RESEARCH PROTOCOL:

HIPSTAR: **H**ip fracture **I**nformation **P**rofiling, **S**urveillance and **T**reatment **A**cross epidemiological **R**egistries

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1. List of Abbreviations

ASA	American Society of Anesthetists
CDM	Common Data Model
EHDEN	European Health Data & Evidence Network
EHR	Electronic health record
EMR	Electronic Medical Record
FFN	Fragility Fracture Network
ICMJE	International Committee of Medical Journal Editors
IM	Intramedullary
IMI	Innovative Medicines Initiative
IRS	Internal repair using screws
NHFD	National Hip Fracture Database
OHDSI	Observational Health Data Science and Informatics
OMOP	Observational Medical Outcomes Partnership
RWD	Real-world data
RWHN	Real-World Healthcare Navigator
SHS	Sliding hip screw
THR	Total hip replacement

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Authorship will also include those who meaningfully contribute to study design, analysis, and interpretation of results during the Fragility Fracture Network (FFN) Congress: Hip Fracture Studyathon on October 3, 2023, and subsequently contribute to the drafting of the work for publication, approving the final version of the study. The definition of a contribution will align with the International Committee of Medical Journal Editors (ICMJE) authorship guidelines which must be satisfied for authorship eligibility The Responsible Parties involved in this protocol take accountability for the overarching protocol, package development, providing assistance to sites running the analysis and ensuring site-specific governance is adhered to in all publications generated from this protocol.

2.2 Sponsor

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3. Abstract

In this study we will characterise the patient population sustaining hip fractures, identifying trends in incidence and outcomes.

4. Amendments and Updates

Number	Date	Section of study protocol	Amendment or update	Reason

5. Rationale and Background

The burden of hip fracture as a health issue is both profound and far-reaching with substantial impact on overall quality of life and economic impact, prompting significant global efforts aimed at improving morbidity and mortality rates associated with this debilitating injury. (Braithwaite et al. 2003) An instrumental development in this endeavour is the establishment of hip fracture registries, which have not only facilitated the collection of rich data but have also complemented routinely gathered information. (Werner et al. 2022; Johansen et al. 2017) These registries provide invaluable insights into patient cohorts and outcomes linked to hip fractures, shedding light on critical aspects of care. Concurrently, large-scale clinical trials have analysed the surgical management of hip fractures, promoting the use of real world data in generating evidence to guide practice. prompting the exploration of real-world applications through real-wor. (Fixation using Alternative Implants f...) One of the challenges, however, are the differences between the registries regarding the underlying structures and semantic mapping, especially in comparison to routinely collected data. Recent advancements in data science have ushered in the era of federated network analyses, allowing for direct comparisons across diverse datasets. A common data model (CDM) can harmonise healthcare data across multiple data sets and provide a mechanism to allow the conduct of multi-database, international studies. (Gini et al. 2016) The European Health Data and Evidence

Network (EHDEN) project (https://www.ehden.eu/) is an international project supported by the Innovative Medicines Initiative (IMI) that standardises healthcare data to the Observational Medical Outcomes Partnership Common Data Model (OMOP CDM). Through utilising this novel approach, there is the potential to pinpoint sources of bias and confounding, which might remain hidden when confined to single-population studies. Furthermore, the international dimension of hip fracture registries serves as a compelling avenue for discerning global trends in care and outcomes.

6. Objective

The primary objective of this study is to describe the baseline demographic and clinical characteristics of individuals sustaining a hip fracture across a network of real-world databases, including the occurrence of adverse outcomes following surgery. This will be explored overall and if sufficient sample size, to also examine treatments and outcomes by sex, age, and surgical subtype.

7. Methods

7.1 Data sources

The study will be conducted using hip fracture data from real world data sources that have been mapped to the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM) in collaboration with the European Health Data and Evidence Network (EHDEN). The OMOP CDM (https://github.com/OHDSI/CommonDataModel/wiki)(Overhage et al. 2012) is an open-source, common data model maintained by the Observational Health Data Sciences and Informatics (OHDSI) community. It includes a standard representation of health care experiences (such as information related to drug utilisation and condition occurrence), as well as common vocabularies for coding clinical concepts, and enables consistent application of analyses across multiple disparate data sources.(Voss et al. 2015) Table 1 details the local country-specific datasets that were converted into the OMOP CDM for this project. This list may be expanded as additional hip fracture databases are converted to the OMOP CDM.

Table 1. Data sources formatted to the OMOP CDM

Data source	Source population	Sample size	Data type	Longitudinal history
NHFD (England and Wales)	All patients sustaining a hip fracture in England and Wales	~65,000 patients a year	*Prospectively collected clinical data across the FFN minimum common dataset, additional data to characterise a series of key performance indicators and and to drive financial incentivisation through NHS England's 'best practice tariff'*	*2012-2022*
Irish Hip Fracture Database	All patients over 60 years old sustaining hip fracture in Ireland	3700 cases a year	*Prospectively collected clinical data across the FFN minimum common dataset, additional data to characterise a series of key performance indicators and to drive financial*	*Five years 2017-2021*

			incentivisation through The Irish Hip Fracture Standards.	
Danish Multidisciplinary Hip Fracture Database	All patients over 65 years of age sustaining hip fracture in Denmark	7000 cases per year since 2004	*Prospectively collected patient and surgery relevant clinical data, including data on in-hospital key performance quality indicators, reoperations and vital status*	*Nationwide data from 2004-2022. Comorbidity history 10 years prior hip fracture surgery*
Norwegian Hip Fracture Register / NOREPOS	Hip fracture surgeries in hospitals in Norway	Approximately 8500 primary surgeries and 800 reoperations per year	*Reported by orthopedic surgeons through questionnaires, including type of fracture and surgery, ASA score, cognitive status etc. The data is individually linked to data from national registries, including filled prescriptions in outpatient pharmacies and deaths recorded in the Norwegian Cause of Death Registry.*	*2005 onwards*
Spain/ RNFC	Patients presenting with hip fracture in 100 participating hospitals	~60 000 per year	*Prospectively collected clinical data across the FFN minimum common dataset*	*2017 to present*
Australia and New Zealand/ ANZHR	People aged 50 years and over with a hip fracture admitted to a participating hospital in Australia	~50,000 per year	*Prospectively collected clinical data across the FFN minimum common dataset*	*2016 to present*

7.2 Study design

The study is an observational retrospective cohort study based on routinely-collected health care data which has been mapped to the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM). Cohorts of individuals who sustained a hip fracture will be identified using a primary diagnosis that qualifies the individual for entry into the country-level hip fracture registry or dataset. Characteristics of these individuals at their index date will be identified. Treatments and outcomes of these individuals after their index date will be described. Index date is defined in each cohort as either the date of hip fracture procedure or diagnosis depending on their target cohort definition.

7.3 Target cohort

7.3.1 Primary analysis

The study will consist of four main cohorts that will provide information on how persons qualify for entry into the hip fracture registry in comparison to a routinely collected datasource. As such, we will use multiple target cohorts to understand entry patterns as a sensitivity analysis:

Target Cohort #1: Comprehensive Entry (ALL Events Qualifies for Entry to Registry)
Persons in the comprehensive entry target cohort for all hip fractures will have at least one of the following:

- Have a record of a procedure occurrence of surgery for hip fracture OR
- Have a record of a condition occurrence of hip fracture

Entry events will be limited to the earliest event.
The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Target Cohort #2: Primary Surgical Entry (FIRST Surgical Event Qualifies for Entry to Registry)
Persons in the primary surgical entry target cohort for all hip fractures will have at least one of the following:

- Have a record of a procedure occurrence of FIRST surgery for hip fracture

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Target Cohort #3: Any Surgical Entry (ANY Surgical Event Qualifies for Entry to Registry)
Persons in the any surgical event target cohort for all hip fractures will have at least one of the following:

- Have a record of a procedure occurrence of surgery for hip fracture

Entry events will be limited to all events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Target Cohort #4: Any Condition Entry (ANY Condition Entry to Registry)
Persons in the any condition entry target cohort for all hip fractures will have at least one of the following:

- Have a record of a condition occurrence of hip fracture

Entry events will be limited to the earliest event. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Target Cohort #5: Restrictive Entry (Requires both Condition AND Procedure for Entry to Registry)
Persons in the restrictive entry target cohort for all hip fractures will have at least one of the following:

- Have a record of a procedure occurrence of surgery for hip fracture AND
- Have a record of a condition occurrence of hip fracture

Entry events will be limited to the earliest event.

The cohort will all be identified without any requirement for prior observation time as both condition and procedure occurrence is assumed to be contingent on the qualifying hip fracture event.

7.3.2 Subgroups of Interest (Sub-Cohorts for Stratification)

As part of our analysis, we will create stratifications to evaluate sub-groups of interest. The following section details cohort-specific stratifications that are desired for identifying sub-trends. These cohorts subsume the logic from the Target cohorts provided in section 7.3.1. These groups will only be utilised when the sample size is >=5 at a minimum, if not precluded by a larger required minimum sample size as specified in governance rules.

7.3.2.1 Surgically managed hip fracture cohorts (intervention stratifications)

Subgroup #1: *extramedullary plate*

Persons will qualify for entry into this cohort by having the following:

- Have a record of a procedure occurrence of a first surgery for hip fracture with SHS

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

If possible this cohort will be divided into

Subgroup #1A: sliding device

Persons will qualify for entry into this cohort by having the following:

- *Have a record of a procedure occurrence of a first surgery for hip fracture with SHS*

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #1B: non sliding device

Persons will qualify for entry into this cohort by having the following:

- *Have a record of a procedure occurrence of a first surgery for hip fracture with non-sliding hip screw as part of an extramedullary device.*

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #2: Intramedullary (IM) cohort

Persons will qualify for entry into this cohort by having the following:

- Have a record of a procedure occurrence of a first surgery for hip fracture with IM nail

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #3: Cannulated hip screws cohort

Persons will qualify for entry into this cohort by having the following:

- Have a record of a procedure occurrence of a first surgery for hip fracture with cannulated hip screws

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #4: Total hip replacement (THR) cohort

Persons will qualify for entry into this cohort by having the following:

- Have a record of a procedure occurrence of a first surgery for hip fracture with total hip replacement

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Where possible these cohorts will be divided into

Subgroup #4A: Uncemented total hip replacement (THR) cohort

Persons will qualify for entry into this cohort by having the following:

- Have a record of a procedure occurrence of a first surgery with an uncemented prosthesis where data granularity allows

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #4B: Cemented total hip replacement (THR) cohort

Persons will qualify for entry into this cohort by having the following:

- Have a record of a procedure occurrence of a first surgery for hip fracture with cemented total hip replacement where data granularity allows

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #4C: Hybrid total hip replacement (THR) cohort

Persons will qualify for entry into this cohort by having the following:

- Have a record of a procedure occurrence of a first surgery for hip fracture with hybrid total hip replacement where data granularity allows

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #5: Hemiarthroplasty cohort

Persons will qualify for entry into this cohort by having the following:

- Have a record of a procedure occurrence of a first surgery for hip fracture with hemiarthroplasty (index event)

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #5A: Uncemented Hemiarthroplasty cohort

Persons will qualify for entry into this cohort by having the following:

- Have a record of a procedure occurrence of a first surgery for hip fracture with uncemented hemiarthroplasty (index event)
- Have a record of procedure occurrence of a first surgery within the subgroups of unipolar and bipolar prostheses where data granularity allows

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #5B: Cemented Hemiarthroplasty cohort

Persons will qualify for entry into this cohort by having the following:

- Have a record of a procedure occurrence of a first surgery for hip fracture with cemented hemiarthroplasty (index event)
- Have a record of procedure occurrence of a first surgery within the subgroups of cemented hemiarthroplasty with unipolar and bipolar prostheses where data granularity allows

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #6: Non operative cohorts

As an exploratory element to the work two separate subcohorts to best identify those patients presenting with hip fracture who do not proceed to surgery.

Subgroup #6A: Non Operative cohort

Persons will qualify for entry into this cohort by having the following:

- Have exactly 0 records of a procedure occurrence surgery for hip fracture

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #6B: Non Operative cohort

Persons will qualify for entry into this cohort by having the following:

- Have exactly one records of a procedure occurrence surgery for no

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #7: Other surgery cohort

Persons will qualify for entry into this cohort by having the following:

- Have a record of a procedure occurrence surgery for hip fracture not defined into the subgroups above.

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

7.3.2.1 Pathological cohorts (pathology stratifications)

Subgroup #7: Pathological cohort (All)

Persons will qualify for entry into this cohort by having the following:

- Have a condition occurrence of a pathological fracture

Entry events will be limited to all events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #8: Malignancy cohort

Persons will qualify for entry into this cohort by having the following:

- Have a condition occurrence of a pathological fracture of malignancy

Entry events will be limited to all events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #9: Atypical cohort

Persons will qualify for entry into this cohort by having the following:

- Have a condition occurrence of a pathological fracture of atypical

Entry events will be limited to all events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

7.3.2.3 Post operative intervention cohorts (Rehabilitation stratifications)

Subgroup #10: Early Physician involvement cohort

Persons will qualify for entry into this cohort by having the following:

1. Have a record of procedure occurrence of a first surgery for hip fracture (index event)

AND be restricted to:

2. Have record of an observation with a value of physician involvement any time after and including the date of the index event

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

Subgroup #11: Early post operative mobilisation cohort

Persons will qualify for entry into this cohort by having the following:

1. Have a record of procedure occurrence of a first surgery for hip fracture (index event)

AND be restricted to:

2. Have record of post operative mobilisation on the index date OR day 1 after the date of the index event

Entry events will be limited to earliest events. The cohort will all be identified without any requirement for prior observation time as entry into a hip fracture registry is contingent on the qualifying hip fracture event.

7.4 Additional Stratifications

Each target and subgroup cohort will be analysed in full and stratified on factors based on the following characteristics as reported on the index date (qualification into the hip fracture registry), all stratum are pending meeting minimum reportable cell counts (as specified by data owners) and where possible, includes:

- Sex (Male vs. Female)
- All reportable age groups (reported in 5 or 10 years age groups)
- Disease aetiology
    - American Society of Anesthetists (ASA) grade (all groups will be interesting to report)
    - Cognitive status (coded as yes/no, probably a less reliable variable)
    - Fracture type (all types are of interest to report separately)
    - Intracapsular versus extracapsular fractures
    - Pre-fracture mobility status
    - Pre-fracture residence
- Type of anaesthesia

7.5 Features of interest

At index characteristics (at time of qualification for entry)

Demographics:

- Age: calculated as year of birth at entry into registry
- Sex (as reported)

Disease and treatment aetiology:

- ASA grade
- Cognitive status
- Fracture type
- Pathological fracture
- Pre-fracture mobility
- Pre-fracture residence
- Type of anaesthesia

Post-index characteristics (any time after entry into the registry)

These features will be described where present using all available time post-index.

- Bone protection medication at discharge
- Functional level/mobility at discharge
- Discharge location
- Mortality any time point
- 30 day mortality
- 90 day mortality
- Time to surgery
- Living at home at 3 months
- Living at home at 90 days
- Living at home at 30 days
- Return to pre-fracture residence

- Characteristics are populated based on the availability of data elements across data sources. Individual sources may have different depths of detail and will adhere to minimum cell sizes.

7.6 Analysis: Characterising cohorts

All analyses will be performed using a common R package developed by the Studyathon Data Science Team. The code for this study can be found at https://github.com/BartsBoneJointHealth/HipFractureStudyathon. The study package will consist of a descriptive statistical analysis to identify the target population by stratum specified. Where data are available, additional characteristics related to surgical intervention, rehabilitation type, disease aetiology.

7.7 Logistics of Executing a Federated Analysis

Sites will run the study analysis package locally on their data coded according to OMOP CDM. Only aggregate results will be shared with the study coordinator. Result files will be automatically staged into a ZIP file that can be transmitted using the OhdsiSharing R Library (http://ohdsi.github.io/OhdsiSharing/) or through a site's preferred SFTP client using a site-specific key provisioned by the OHDSI Study Coordinator. Local data stewards are encouraged to review study parameters to ensure minCellCount function follows local governance. At a minimum, it is encouraged to keep this value to >5 to avoid any potential issues with re-identification of patients as performed by check through the data custodian and a secondary check during results consolidation. (Note: covariates are constructed using controlled ontologies from the OMOP standard vocabularies though some labels may be replaced with publication-friendly labels due to space restrictions of the submitting journal.)

8. Minimum Reportable Sample Size

The study package is designed to suppress any analyses which do not meet minimum reportable threshold. This cut point will be determined in coordination with known database characteristics and any country-level specific requirements for reporting minimum cell size.

9. Strengths and Limitations

9.1 Strengths

We are running a multi-country, multi-centre characterisation study to understand baseline covariates, treatments, and outcomes observed in the treatment of hip fracture. This is a robust approach to evaluate morbidity of hip fracture outcomes at scale. The use of a common data model and standard vocabularies ensures interoperability and portability of phenotypes utilised in this analysis. The use of a federated study model will ensure no movement of patient-level data from institutions participating in this analysis. This is critically important to ensure the protection of patient privacy in the secondary use of routinely collected patient data. Data custodians will remain in control of the analysis run on these data and will conduct their own site-based validation processes. This study is a large-scale approach to utilising rich data captured for purpose in hip fracture registry protocols for secondary use in large scale epidemiological research. The findings from this study provide a framework for how hip fracture registries can contribute to expanding our clinical understanding of heterogeneity in global burden of disease.

9.2 Limitations

The OMOP CDM has not been widely validated for use with surgical device epidemiology studies in hip fracture. As such, the conversion of data from local source coding into the OMOP CDM may contribute to a loss of granularity into the classification of surgical intervention utilised by the local clinicians. There may be data elements, such as surgical grade and operative time, that are not collected in hip fracture registry data and/or are not mapped into the OMOP CDM representation of these registriers. Case presentation may vary with respect to calendar time and geographical location.

Concurrent medical conditions may be underestimated as they will be based on the presence of condition reported in the hip fracture registry, with the absence of such a record taken to indicate the absence of a disease. As these are currently not linked to other real-world data (RWD), concurrent conditions will be underreported, and future work should be focussed upon linking registries to additional sources of RWD.

Similarly, medication records indicate that an individual was prescribed or dispensed a particular drug but may only relate to certain drugs collected in the registries. Medication exposures outside of standard of care for hip fracture management may not be captured through these protocols. Future work may be necessary to link other sources of medication data to ensure a holistic understanding of concomitant medication exposures outside of hip fracture care.

The potential for case misclassification of hip fracture is a concern, but less likely due to the disease specific nature of the hip fracture registries.

10. Protection of Human Subjects

The study uses only de-identified data. Confidentiality of patient records will be maintained at all times. Data custodians will remain in full control of executing the analysis and packaging results. There will be no transmission of patient-level data at any time during these analyses. Only aggregate statistics will be captured. Study packages will contain minimum cell count parameters to obscure any cells which fall below allowable reportable limits. All study reports will contain aggregate data only and will not identify individual patients or physicians.

11. Management and Reporting of Adverse Events and Adverse Reactions

This study will provide a descriptive summary of individuals at sustaining a hip fracture and is using only de-identified data. Confidentiality of patient records will be maintained at all times through local processes to de-identify source data. All study reports will contain aggregate data only and will not identify individual patients or physicians.

12. Plans for Disseminating and Communicating Study Results

The results will be used across multiple papers by the target cohorts, by stratification features, and/or by baseline characteristics, treatments, or outcomes. All results will be posted on the OHDSI website (evidence.ohdsi.org) or an EHDEN community equivalent after completion of the study. At least one paper per topic presented in Sections 6 and 7 describing the study and its results will be written and submitted for publication to a peer-reviewed scientific journal. The results will also be presented at the OHDSI in-person events.

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Appendix 1: Working concept sets to be further defined

All Hip Fracture Surgery

OMOP Concept ID	OMOP Concept Name	Notes
40479229	Percutaneous fixation of fracture of neck of femur	Best mapping currently
4343341	Primary open reduction of fracture of neck of femur and open fixation using dynamic hip screw	
46270907	Closed reduction of fracture of proximal femur and internal fixation using bone nail	
4297365	Partial hip replacement by prosthesis	Can also be used in conj with observation to identify if cemented or uncemented
4203771	Total replacement of hip	
37017416	Partial hip replacement with bipolar prosthesis	
4142076	Primary cemented total hip replacement	
4076471	Primary uncemented hemiarthroplasty of hip	Granularity of unipolar vs bipolar hemi currently not possible in OMOP
4150990	Prosthetic hybrid total replacement of hip joint	
4079259	Primary uncemented total hip replacement	

4327115	Operative procedure on hip	
4034297	Arthroplasty - excision	
46270907	Primary closed reduction and internal fixation of proximal femoral fracture with screw/nail and plate device	
4321874	Other nonoperative procedures	Excl descendants
4144424	Primary open reduction and internal fixation of proximal femoral fracture with screw/nail and plate device	Proxy for non-sling screws
4321874	Other nonoperative procedures	Excl descendants

All Hip Fracture Conditions

OMOP Concept ID	OMOP Concept Name	Notes
433856	Fracture of neck of femur	Used alongside observation to add displacement
4133012	Intertrochanteric fracture	
4135748	Subtrochanteric fracture of femur	
4138412	Fracture of proximal end of femur	
46270166	Periprosthetic fracture of hip	Currently not mapped to give greater granularity

Fracture condition subgroups

1. Intracapsular fractures

OMOP Concept ID	OMOP Concept Name	Notes
433856	Fracture of neck of femur	Used along side observation to add displacement

-displaced intracapsular

OMOP Concept ID	OMOP Concept Name	Notes
433856	Fracture of neck of femur	Used along side observation to add displacement
4047514	Fracture with displacement	

-undisplaced intracapsular

OMOP Concept ID	OMOP Concept Name	Notes
433856	Fracture of neck of femur	Used along side observation to add displacement
4139391	Undisplaced fracture	

2. Extracapsular fractures

OMOP Concept ID	OMOP Concept Name	Notes

4133012	Intertrochanteric fracture	Further granularity not currently possible
4135748	Subtrochanteric fracture of femur	
4138412	Fracture of proximal end of femur	

- **Intertrochanteric**

OMOP Concept ID	OMOP Concept Name	Notes
4133012	Intertrochanteric fracture	Further granularity not currently possible in network study

- **Subtrochanteric**

OMOP Concept ID	OMOP Concept Name	Notes
4135748	Subtrochanteric fracture of femur	

Extramedullary devices: Sliding hip screw (SHS)

OMOP Concept ID	OMOP Concept Name	Notes
4343341	Primary open reduction of fracture of neck of femur and open fixation using dynamic hip screw	Used to incorporate all sliding hip screws

Extramedullary devices: Non-sliding hip screw (SHS)

OMOP Concept ID	OMOP Concept Name	Notes
4144424	Primary open reduction and internal fixation of proximal femoral fracture with screw/nail and plate device	Proxy for non sliding hip screw in CDM currently to allow for innovation in plate and screw devices

Intramedullary (IM) nail

OMOP Concept ID	OMOP Concept Name	Notes
46270907	Closed reduction of fracture of proximal femur and internal fixation using bone nail	

Cannulated hip screws

OMOP ConceptId	OMOP Concept Name	Notes
40479229	Percutaneous fixation of fracture of neck of femur	Best current proxy for cannulated screws

Total hip replacement (THR)

OMOP Concept ID	OMOP Concept Name	Notes
4203771	Total replacement of hip	
4150990	Prosthetic hybrid total replacement of hip joint	

4079259	Primary uncemented total hip replacement	
4142076	Primary cemented total hip replacement	

-cemented total hip replacement

OMOP Concept ID	OMOP Concept Name	Notes
4142076	Primary cemented total hip replacement	

-uncemented total hip replacement

OMOP Concept ID	OMOP Concept Name	Notes
4079259	Primary uncemented total hip replacement	

-hybrid total hip replacement

OMOP Concept ID	OMOP Concept Name	Notes
4150990	Prosthetic hybrid total replacement of hip joint	

Hemiarthroplasty

OMOP Concept ID	OMOP Concept Name	Notes
4297365	Partial hip replacement by prosthesis	

37017416	Partial hip replacement with bipolar prosthesis	

Hemiarthroplasty subgroups
-cemented hemiarthroplasty

OMOP Concept ID	OMOP Concept Name	Notes
4297365	Partial hip replacement by prosthesis	unipolar implied in this study design but not included in term- limitation in current CDM
37017416	Partial hip replacement with bipolar prosthesis	
4106323	Cemented component fixation	Used in combination with procedure terms as method of identifying fixation

-uncemented hemiarthroplasty

OMOP Concept ID	OMOP Concept Name	Notes
4076471	Primary uncemented hemiarthroplasty of hip	unipolar implied but not included in term
37017416	Partial hip replacement with bipolar prosthesis	
4119646	Uncemented component fixation	Used in combination with procedure terms as method of identifying fixation

Non-operatively managed hip fracture

OMOP Concept ID	OMOP Concept Name	Notes
4321874	Other nonoperative procedures	Excl descendants

Pathological fracture

OMOP Concept Id	OMOP Concept Name	Notes
45772710	Pathological fracture of proximal femur due to neoplastic disease	
45766906	Pathological fracture of proximal end of femur	
45766906	Pathological fracture of proximal end of femur	Ayptical linked using FACT_RELATIONSHIP to Observation for 'Adverse reaction caused by bisphosphonate'

Pathological fracture subgroup -Malignancy

OMOP ConceptId	OMOP Concept Name	Notes
45772710	Pathological fracture of proximal femur due to neoplastic disease	

Pathological fracture subgroup -Atypical

OMOP ConceptId	OMOP Concept Name	Notes
45766906	Pathological fracture of proximal end of femur	Linked using fact_relationship

Physician involvement

OMOP ConceptId	OMOP Concept Name	Notes
4125679	Seen by physician	
4140767	Seen by care of the elderly physician	

Post Operative Mobilisation

OMOP ConceptId	OMOP Concept Name	Source Table	Source Field	Source Value	Notes