

## Supplementary material: Nordic hip fracture registries - comparisons toward a minimal common and standardized Nordic Hip Fracture Dataset (Nordic-HFD)

**Supplement Table S1.** Variables that are available in all 4 registries, with underlying variable definitions and data points.

|                              | DMHFR                                                                                                                                                                     | NHFR                                                                                                                                                                                                                                                                                                                        | SFR                                                                                                                                                                                                                                                                                                                                                   | RIKSHÖFT                                                                                                                                                                                          |
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| <b>Baseline</b>              |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                   |
| <b>Age at fracture</b>       | Years                                                                                                                                                                     | Years                                                                                                                                                                                                                                                                                                                       | Years                                                                                                                                                                                                                                                                                                                                                 | Years                                                                                                                                                                                             |
| <b>Sex</b>                   | Male/Female                                                                                                                                                               | Male/Female                                                                                                                                                                                                                                                                                                                 | Male/Female                                                                                                                                                                                                                                                                                                                                           | Male/Female                                                                                                                                                                                       |
| <b>Fracture diagnosis</b>    | ICD-10 codes:<br>* S72.0: (femoral neck).<br>* S72.1: pertrochanteric.<br>* S72.2: subtrochanteric.                                                                       | Based on Garden and AO/OTA classification:<br>* non-displaced femoral neck (Garden I–II).<br>* displaced femoral neck (Garden III–IV),<br>* Baso cervical.<br>* 2-fragment pertrochanteric (AO/OTA A1).<br>* multi-fragment pertrochanteric (AO/OTA A2).<br>* intertrochanteric (AO/OTA A3).<br>* subtrochanteric fracture. | ICD-10 codes:<br>* S72.00: closed femoral neck.<br>* S72.01: open femoral neck.<br>* S72.10: closed pertrochanteric.<br>* S72.11: open pertrochanteric.<br>* S72.20: closed subtrochanteric.<br>* S72.21: open subtrochanteric.<br>Additionally classified according to AO/OTA (A1–3, B1–3).<br><br>Periprosthetic fractures according to UCS-systems | * non-displaced femoral neck (Garden I–II).<br>* displaced femoral neck (Garden III–IV).<br>* basocervical.<br>* 2-fragment trochanteric.<br>* multi-fragment trochanteric.<br>* subtrochanteric. |
| <b>Pathological fracture</b> | ICD-10 code:<br>* M84.4 pathological fracture.                                                                                                                            | * non-pathological fracture.<br>* pathological fracture.<br>* uncertain.                                                                                                                                                                                                                                                    | ICD-10 code:<br>* M84.4 pathological fracture.                                                                                                                                                                                                                                                                                                        | * non-pathological fracture.<br>* metastatic fracture.<br>* benign bone tumor.<br>* primary malign bone tumor.<br>* Paget.<br>* other.                                                            |
| <b>Fracture displacement</b> | Supplementary diagnostic codes added to fracture codes S72.0–S72.2:<br>* ZDS01: displaced fracture.<br>* ZDS02: non-displaced fracture.<br>* ZDS03: unknown displacement. | Femoral neck fractures classified as undisplaced (Garden 1+2) or displaced (Garden 3-4). From 2021: Posterior tilt (< or > 20 degrees) are registered for Garden 1+2 fractures.                                                                                                                                             | Classified according to AO/OTA (A1–3, B1–3).                                                                                                                                                                                                                                                                                                          | Additional question, marked “yes” for either non-dislocated or dislocated.                                                                                                                        |
| <b>Laterality</b>            | * right side.<br>* left side.                                                                                                                                             | * right side.<br>* left side.                                                                                                                                                                                                                                                                                               | * right side.<br>* left side.                                                                                                                                                                                                                                                                                                                         | * right side.<br>* left side.                                                                                                                                                                     |

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|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                    | * missing information.                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                               |
| <b>American Society of Anesthesiologists score</b> | Available from Danish Anesthesiologic Database                                                                                                                                                                                                                                                                                                | Available from fracture register                                                                                                                                                                                                                                                                                                                                                                                                                                           | Available from Swedish Perioperative Register                                                                                                                                                                                                                                                                 | Available from fracture register                                                                                                                                                                                                                                                              |
| <b>Surgery</b>                                     |                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                               |
| <b>Primary surgical method</b>                     | Procedure codes:<br>* KNFB0–99: primary insertion of hip arthroplasty.<br>* KNFJ4–9: fracture treatment of femur (osteosynthesis).<br>* KNFG0–99: resection arthroplasty of the hip joint.<br>* KNFK19: resection or excision of bone in femur.<br>These codes are grouped into main categories (e.g. osteosynthesis, hemiarthroplasty, THA). | * 2 screws or pins.<br>* 3 screws or pins,<br>* bipolar hemiarthroplasty.<br>* unipolar hemiarthroplasty.<br>* sliding hip screw and plate.<br>* sliding hip screw with trochanteric support plate.<br>* short intramedullary nail without distal locking.<br>* short intramedullary nail with distal locking.<br>* long intramedullary nail without distal locking.<br>* long intramedullary nail with distal locking.<br>* other procedure.<br>* total hip arthroplasty. | Procedure codes:<br>* NFB09–99: primary insertion of hip arthroplasty.<br>* NFJ09–99: fracture treatment of femur.<br>* NFG09–99: resection arthroplasty in the hip joint.<br>* NFK19: resection or excision of femoral bone.<br>* TNF39.0: Non-operative treatment.<br>* TNX40: Traction without anesthesia. | * one screw, pin or nail.<br>* 2 screws, pins or nails.<br>* 3 screws, pins or nails.<br>* screw, pin or nail with side-plate.<br>* intramedullary nail.<br>* hemiarthroplasty (half/bipolar).<br>* total hip arthroplasty.<br>* conservative (non-surgical) treatment.<br>* other treatment. |
| <b>Date of primary surgery</b>                     | * Date and time                                                                                                                                                                                                                                                                                                                               | * Date and time                                                                                                                                                                                                                                                                                                                                                                                                                                                            | * Date and time                                                                                                                                                                                                                                                                                               | * Date and time                                                                                                                                                                                                                                                                               |
| <b>Time to surgery</b>                             | Calculated from exact date and time of hospital admission and surgery, available from the National Patient Registry.                                                                                                                                                                                                                          | Counted from time of fracture as following.<br>* 0–6 hours.<br>* >6–12 hours.<br>* >12–24 hours.<br>* >24–48 hours.<br>* > 48 hours.<br>Since 2023 also time from admission available                                                                                                                                                                                                                                                                                      | Available as continuous variable (hours & minutes) from time of X-ray to start of surgical procedure. Reported as proportions of hip fracture patients ≥20 years operated:<br>* within 24 hours of X-ray diagnosis.<br>* within 36 hours of X-ray diagnosis.                                                  | Recorded both as exact time from admission to surgery and as 2 categories:<br>* operation within 24 hours.<br>* operation within 36 hours.                                                                                                                                                    |
| <b>Mortality</b>                                   | Date of death at any time after surgery obtained from national registries; used to calculate postoperative mortality.                                                                                                                                                                                                                         | Date of death at any time after surgery obtained from national population register; used to calculate post-operative mortality.                                                                                                                                                                                                                                                                                                                                            | Date of death at any time after fracture obtained from national registries; used to calculate post fracture mortality.                                                                                                                                                                                        | Registered as mortality after 4 month and 12 months. Post operative                                                                                                                                                                                                                           |

DMHFR = Danish Multidisciplinary Hip Fracture Registry, NHFR = Norwegian Hip Fracture Register, SFR = Swedish Fracture Registry.

**Supplement Table S2:** Variables that are available in 3 out of the 4 registries, with underlying variable definitions and data points.

|                                          | DMHFR                                                                                                                                                                                                                                                                                                  | NHFR                                                                                                                                                                                                                               | SFR | RIKSHÖFT                                                                                                                                                                                                                                                                                                          |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Baseline</b>                          |                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                    |     |                                                                                                                                                                                                                                                                                                                   |
| <b>Pre-fracture cognitive impairment</b> | Derived from diagnostic codes and a cognitive assessment code (ZZ5061). Results coded as:<br>* ZRPB00: cognitive impairment.<br>* ZRPB01: not cognitively impaired.<br>* ZRPB02: unknown cognitive status.                                                                                             | * Yes.<br>* No.<br>* Uncertain.                                                                                                                                                                                                    | -   | * No cognitive impairment.<br>* Suspected dementia/confusion.<br>* Diagnosed with dementia.                                                                                                                                                                                                                       |
| <b>Pre-fracture cohabitation</b>         | Derived from diagnostic code ZZ8050 with additional codes:<br>* ZRSB01: living in own home.<br>* ZRSB01A: living in own home affiliated to an institution.<br>* ZRSB02: homeless.<br>* ZRSB04: living in residential care facility/nursing home.<br>* ZRSB09: no information available.                | * living in own home.<br>* living in institution.<br>* from acute care (other hospital ward).<br>* staying at rehabilitation facility.<br>* other.                                                                                 | -   | * living in own home.<br>* living in residential care facility.<br>* living in own home at a residential care facility.<br>* staying at rehabilitation facility.<br>* from acute department.<br>* other.                                                                                                          |
| <b>Pre-fracture mobility</b>             | Cumulated Ambulation Score (CAS).<br>Score 1-6 and unknown.<br>Include assessment of: Getting in and out of bed, sit-to-stand-to-sit from a chair, indoor walking.<br>Each activity is assessed on scale from 0-2 (0 = Not able, 1 = Able to with assistance, 2 = Able to safely, without assistance). | Scale 1-6:<br>* Freely mobile without aids.<br>* Mobile outdoor with one aid.<br>* Mobile outdoor with 2 aids or frame.<br>* Some indoor mobility, but never goes outdoor without help.<br>* No functional mobility.<br>* Unknown. | -   | 2 separate 1–5 scales.<br><br>Walking:<br>* Walked outdoors alone.<br>* Walked outdoors only with company.<br>* Walked indoors alone but not outdoors.<br>* Walked outdoors only with company.<br>* Unable to walk.<br><br>Mobility aid:<br>* No walking aids.<br>* One cane.<br>* 2 canes.<br>* Rollator walker. |

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|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                       | * Wheelchair or never left bed.                                                          |
| <b>Pre-fracture anti-coagulants</b> | Available from the National Prescription Registry.                                                                                                                                                                                                                                                                                                                                                                                     | 3 main outcomes<br>* Yes<br>* No.<br>* Unknown.<br>Medication type also recorded.                                                                                                                                                                                                                                                                        | -                                                                                                                                                                                     | Recorded as yes/no to use of anticoagulant medication. Type since 2015                   |
| <b>Surgery</b>                      |                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                       |                                                                                          |
| <b>Reoperation</b>                  | From procedure codes: KNFU0-99 combined with<br>* NFB0-99: Primary prosthetic replacement of hip joint.<br>* NFC0-99: Secondary prosthetic replacement of hip joint.<br>* NFW00-69: Reoperation on hip or thigh.<br>* NFG09: excision arthroplasty of hip joint<br>* NFU0-99: Removal of implants and external fixation devices from hip and femur.<br>* NFS0-99: Operation for infection of tendon, joints and bone of hip and thigh. | * Removal of implant.<br>* Girdlestone.<br>* Bipolar hemiarthroplasty.<br>* Unipolar hemiarthroplasty.<br>* Infection debridement.<br>* Closed reduction of dislocated. arthroplasty.<br>* Open reduction of dislocated. arthroplasty.<br>* Exchange caput / bipolar head.<br>* Other.<br>* THA information available from NAR                           | Registered but completeness unknown. Information exchanged with Swedish Arthroplasty Register on arthroplasty procedures on fracture patients, and fractures on arthroplasty patients | Registered but completeness unknown. Not validated against the National Patient Register |
| <b>Date of reoperation</b>          | * Date and time                                                                                                                                                                                                                                                                                                                                                                                                                        | * Date and time                                                                                                                                                                                                                                                                                                                                          | * Date and time                                                                                                                                                                       | -                                                                                        |
| <b>Cause of reoperation</b>         | Available from the National Patient Registry using diagnostic codes, indicating causes such as:<br>infection, dislocation, pseudoarthrosis, mechanical arthroplasty complication, bleeding, wound rupture, new fracture etc.                                                                                                                                                                                                           | * osteosynthesis failure,<br>* non-union.<br>* avascular necrosis of the femoral head.<br>* local pain due to prominent osteosynthesis material.<br>* malunion.<br>* prolonged wound drainage.<br>* superficial wound infection.<br>* deep wound infection.<br>* hematoma,<br>* dislocation of hemiarthroplasty.<br>* Cutout of osteosynthesis material. | Registered with detailed description (patient symptoms, infection, hardware failure, nonunion etc)                                                                                    | -                                                                                        |

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|                                  |                                                                                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>* peri-implant fracture.</li> <li>* loosening of hemiarthroplasty.</li> <li>* other.</li> <li>* THA information available from NAR</li> </ul> |                                  |                                                                                                                                                                                               |
| <b>Non-surgical treatment</b>    | Available from the National Patient Registry                                                                                                                                                                                                                                                                            | -                                                                                                                                                                                    | Available from fracture registry | Available from fracture registry                                                                                                                                                              |
| <b>Duration of surgery</b>       | Exact time available                                                                                                                                                                                                                                                                                                    | Exact time available                                                                                                                                                                 |                                  | Exact time available                                                                                                                                                                          |
| <b>Post-surgery</b>              |                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                      |                                  |                                                                                                                                                                                               |
| <b>Discharge destination</b>     | Derived from code ZZ8050 with discharge destination codes:<br>* ZRSB01: own home.<br>* ZRSB01A: own home affiliated to an institution.<br>* ZRSB02: homeless.<br>* ZRSB04: residential care facility/nursing home.<br>* ZRSB09: no information.<br>These are often grouped as home, institution, rehabilitation, other. | <ul style="list-style-type: none"> <li>* Own home.</li> <li>* Institution.</li> <li>* Other hospital or department.</li> <li>* Rehabilitation facility.</li> <li>* Other.</li> </ul> | -                                | At 4 month:<br>* own home.<br>* residential care facility.<br>* own home at residential care facility.<br>* rehabilitation facility.<br>* acute/emergency department.<br>* other.<br>* death. |
| <b>Early mobilization</b>        | Exact date and time of first postoperative mobilization are registered, allowing calculation of time from surgery to first mobilization.                                                                                                                                                                                | <ul style="list-style-type: none"> <li>* not mobilized on postoperative day 1.</li> <li>* mobilized on postoperative day 1.</li> <li>* unknown</li> </ul>                            | -                                | Exact number of days from surgery to first mobilization is recorded.                                                                                                                          |
| <b>Osteoporosis prevention</b>   | Available from fracture registry and the National Prescription Registry                                                                                                                                                                                                                                                 | Information on type of osteoporosis prevention.<br>For each type of medication:<br>* not given.<br>* Initiated.<br>* continued.<br>* unknown                                         | -                                | Information on type of osteoporosis prevention.<br>For each type of medication, information available on start and duration of treatment.                                                     |
| <b>Complications</b>             |                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                      |                                  |                                                                                                                                                                                               |
| <b>Pressure ulcer/de-cubitus</b> | Available through ICD-10 code from the National Patient Registry:<br>* DL89: Pressure ulcer during or after admission.                                                                                                                                                                                                  | During admission:<br>* Yes.<br>* No.                                                                                                                                                 | -                                | During admission:<br>* No pressure ulcer.<br>* Category 1: Persistent discoloration.<br>* Category 2: Epithelial damage with blisters, crack or abrasion of the skin.                         |

Kommenterad [MH1]: during the hospital stay I suppose otherwise difficult

|                                |                                                                                                                                                                                                                           |                                                                                                                                                   |   |                                                                                                                                          |
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|                                |                                                                                                                                                                                                                           |                                                                                                                                                   |   | * Category 3: Full-thickness skin defect without deep wound cavity.<br>* Category 4: Full-thickness skin defect with deep wound cavity.  |
| <b>Urinary tract infection</b> | Available through ICD-10 code from the National Patient Registry: N08.0, N10, N11, N12, N13.6, N15.1, N15.9, N16.0, N28.8D–F, N29.0, N29.1, N30, N33.0, N34.0, N34.1, N39.0, etc., covering UTI during or after admission | During admission:<br>* Yes.<br>* No.                                                                                                              | - | During admission:<br>* Yes.<br>* No.                                                                                                     |
| <b>Pneumonia</b>               | Available through ICD-10 code from the National Patient Registry: DSJ12–J18 for pneumonia, during or after admission.                                                                                                     | During admission:<br>* Yes.<br>* No.                                                                                                              | - | During admission:<br>* Yes.<br>* No.                                                                                                     |
| <b>Acute kidney injury</b>     | Available from the National Laboratory Registry. Can be calculated according to various definitions.                                                                                                                      | Acute kidney injury is defined as: increase in serum creatinine by at least 50% or by 50 µmol/L from baseline.<br>Recorded as:<br>* yes.<br>* no. | - | Acute kidney injury is defined as: increase of serum-Urea or Creatinine from initial reference point.<br>Recorded as:<br>* yes.<br>* no. |
| <b>Thrombosis</b>              | Available through ICD-10 code from the National Patient Registry:<br>* D180.1-3.<br>* D126.<br>Either during or after admission.                                                                                          | During admission:<br>* Yes.<br>* No.                                                                                                              | - | During admission:<br>* Yes.<br>* No.                                                                                                     |
| <b>Cardiovascular event</b>    | Available through ICD-10 code from the National Patient Registry:<br>* D121,<br>* D163-64,<br>* DG45.9,<br>Either during or after admission.                                                                              | During admission. Defined as myocardial infarction or stroke:<br>* yes.<br>* no                                                                   | - | During admission:<br>* Yes.<br>* No.                                                                                                     |
| <b>Delirium</b>                | Available through ICD-10 code from the National Patient Registry:<br>* DR410: confusion.                                                                                                                                  | During admission. Delirium must be evaluated by 4AT or CAM:                                                                                       | - | During admission:<br>* yes,<br>* no.                                                                                                     |

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|                               | * DF05: delirium (not caused by alcohol or psychoactive substances).<br>* DF11: mental disorder or behavioral disorder caused by opioids. Either during or after admission. | * yes,<br>* no                                                                                                                                             |                                                                                             |                                                                |
| <b>PROM</b>                   |                                                                                                                                                                             |                                                                                                                                                            |                                                                                             |                                                                |
| <b>Baseline and follow-up</b> | -                                                                                                                                                                           | PROM evaluated at 4 times via EQ5D and HOOS-12.<br>* At baseline.<br>* At 4 months post surgery.<br>* At 1 year post surgery.<br>* At 3 year post surgery. | PROM evaluated at 2 times via EQ5D and SMFA.<br>* At baseline.<br>* At 1 year post surgery. | PROM evaluated once via EQ5D.<br>* At 4 months post surgery ** |

DMHFR = Danish Multidisciplinary Hip Fracture Registry, NHFR = Norwegian Hip Fracture Register, SFR = Swedish Fracture Registry, NAR = Norwegian Arthroplasty Registry, THA = Total Hip Arthroplasty

\*\* coverage and completeness uncertain