Bone & Joint Open

Supplementary Material

Table i. Electronic database search strategy and results (date of search 25/04/23).

No.	Database	Records
1.	Ovid MEDLINE	8,991
2.	Ovid Embase	12,200
3.	Ovid EMCARE	6,637
4.	Ovid Global Health	732
5.	EBSCOhost CINAHL	5,096
6.	Cochrane Database of Systematic Reviews	1
7.	Cochrane Central Register of Controlled Trials	646
8.	Scopus	8,680
9.	Web of Science (Core Collection)	9,892
10.	WHO Global Index Medicus	369
11.	CRD NHS Economic Evaluations Database	27
12.	INAHTA Health Technology Assessment database	10
	Total	53,281
	Total after deduplication (Bramer method)	24,448

Details of search strategies used in each of the 12 databases:

1. Database: Medline (Ovid MEDLINE Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE® Daily and Ovid MEDLINE) 1946 to present

Search Strategy:

1 exp Quality Indicators, Health Care/(24762)

2 Quality Improvement/(32257)

3 ("performance indicator*" or "health system performance" or "hospital performance" or "performance measurement*" or "health metric*" or "quality indicator*" or "quality of health care" or "quality control" or "quality improvement" or "performance data").ti,ab,kw. (138046)

4 ("performance metric*" or "performance improvement*" or "quality assurance" or "quality measur*" or "quality standards").ti,ab,kw. (57633)

5 1 or 2 or 3 or 4 (217979)

6 exp Fractures, Bone/ (206951)

7 (fracture* or "broken bone*").ti,ab,kw. (304160)

8 6 or 7 (348665)

9 exp "Wounds and Injuries"/ (1003048)

10 (trauma or injury or injuries).ti,ab,kw. (1092148)

11 9 or 10 (1709645)

12 5 and 8 and 11 (1334)

13 8 or 11 (1810038)

14 5 and 13 (9337)

15 ("case series" or "case reports").ti,ab. (162872)

16 14 not 15 (9259)

17 exp animals/ not humans/ (5116054)

18 16 not 17 (8991)

2. Database: Embase 1974 to present

Search Strategy:

1 total quality management/ (89786)

2 ("performance indicator*" or "health system performance" or "hospital performance" or "performance measurement*" or "health metric*" or "quality indicator*" or "quality of health care" or "quality control" or "quality improvement" or "performance data").ti,ab,kw. (213737)

3 ("performance metric*" or "performance improvement*" or "quality assurance" or "quality measur*" or "quality standards").ti,ab,kw. (85299)

4 1 or 2 or 3 (318158)

5 exp fracture/ (350382)

6 (fracture* or "broken bone*").ti,ab,kw. (363355)

7 injury/ (350782)

8 (trauma or injury or injuries).ti,ab,kw. (1450224)

9 5 or 6 or 7 or 8 (1880586)

10 4 and 9 (12714)

11 ("case series" or "case reports").ti,ab. (238199)

12 10 not 11 (12611)

13 exp animal/ not human/ (5308420)

14 12 not 13 (12200)

3. Database: Ovid Emcare <1995 to 2023 Week 16>

Search Strategy:

1 health care quality/ or quality control/ (117393)

2 ("performance indicator*" or "health system performance" or "hospital performance" or "performance measurement*" or "health metric*" or "quality indicator*" or "quality of health care" or "quality control" or "quality improvement" or "performance data").ti,ab. (54727)

3 ("performance metric*" or "performance improvement*" or "quality assurance" or "quality measur*" or "quality standards").ti,ab. (22904)

4 1 or 2 or 3 (168765)

5 fracture/ (42524)

6 (fracture* or "broken bone*").ti,ab. (131975)

7 injury/ (108785)

8 (trauma or injury or injuries).ti,ab. (393565)

9 5 or 6 or 7 or 8 (499545)

10 4 and 9 (6750)

11 ("case series" or "case reports").ti,ab. (56400)

12 10 not 11 (6671)

13 exp animal/ not human/ (286559)

14 12 not 13 (6637)

4. Database: Global Health <1973 to 2023 Week 16>

Search Strategy:

1 quality controls/ (19394)

2 ("performance indicator*" or "health system performance" or "hospital performance" or "performance measurement*" or "health metric*" or "quality indicator*" or "quality of health care" or "quality control" or "quality improvement" or "performance data").ti,ab. (28834)

3 ("performance metric*" or "performance improvement*" or "quality assurance" or "quality measur*" or "quality standards").ti,ab. (10322)

4 1 or 2 or 3 (45590)

5 exp fractures/ (10515)

6 (fracture* or "broken bone*").ti,ab. (16398)

7 trauma/ (38843)

8 (trauma or injury or injuries).ti,ab. (100480)

9 5 or 6 or 7 or 8 (117960)

10 4 and 9 (732)

5. Database: EBSCOhost CINAHL

Search Strategy:

S1 (MH "Clinical Indicators") (13,205)

S2 (MH "Quality Improvement+") (75,415)

S3 TI ("performance indicator*" or "health system performance" or "hospital performance" or

"performance measurement*" or "health metric*" or "quality indicator*" or "quality of health care" or

"quality control" or "quality improvement" or "performance data") OR AB ("performance indicator*" or

"health system performance" or "hospital performance" or "performance measurement*" or

"health metric*" or "quality indicator*" or "quality of health care" or "quality control" or

"quality improvement" or "performance data") (45,158)

S4 TI ("performance metric*" or "performance improvement*" or "quality assurance" or "quality measur*"

or "quality standards") OR AB ("performance metric*" or "performance improvement*" or

"quality assurance" or "quality measur*" or "quality standards") (18,092)

S5 S1 OR S2 OR S3 OR S4 (123,807)

S6 (MH "Fractures+") (67,502)

S7 TI (fracture* or "broken bone*") OR AB (fracture* or "broken bone*") (85,911)

S8 (MH "Trauma+") (21,937)

S9 TI (trauma or injury or injuries) OR AB (trauma or injury or injuries) (307,512)

S10 S6 OR S7 OR S8 OR S9 (383,843)

S11 S5 AND S10 (5,108)

S12 (MH "Animals+") (103,321)

S13 (MH "Human") (2,643,278)

S14 (MH "Animals+") NOT (MH "Human") (93,900)

S15 S11 NOT S14 (5,096)

6. Cochrane Database of Systematic Reviews; Issue 4 of 12, April 2023 (retrieved only 1 record) &

7. Cochrane Central Register of Controlled Trials; Issue 4 of 12, April 2023

Search Strategy:

#1 MeSH descriptor: [Quality Indicators, Health Care] explode all trees (812)

#2 MeSH descriptor: [Quality Improvement] explode all trees (1016)

#3 ("performance indicator*" or "health system performance" or "hospital performance" or

"performance measurement*" or "health metric*" or "quality indicator*" or "quality of health care" or

"quality control" or "quality improvement" or "performance data"):ti,ab,kw (9264)

#4 ("performance metric*" or "performance improvement*" or "quality assurance" or "quality measur*"

or "quality standards"):ti,ab,kw (2570)

#5 #1 or #2 or #3 or #4 (11686)

#6 MeSH descriptor: [Fractures, Bone] explode all trees (8166)

#7 (fracture* or "broken bone*"):ti,ab,kw (27553)

#8 MeSH descriptor: [Wounds and Injuries] explode all trees (34224)

#9 (trauma or injury or injuries):ti,ab,kw (82503)

#10 #6 or #7 or #8 or #9 (111159)

#11 #5 and #10 (649)

Tuesday, April 25, 2023 11:59:34 AM

8. SCOPUS

Search Strategy:

(((TITLE ("performance indicator*" OR "health system performance" OR "hospital performance" OR "performance measurement*" OR "health metric*" OR "quality indicator*" OR "quality of health care" OR "quality control" OR "quality improvement" OR "performance data" OR "performance metric*" OR "performance improvement*" OR "quality assurance" OR "quality measur*" OR "quality standards") OR ABS ("performance indicator*" OR "health system performance" OR "hospital performance" OR "performance measurement*" OR "health metric*" OR "quality indicator*" OR "quality of health care" OR "quality control" OR "quality improvement" OR "performance data" OR "performance metric*" OR "performance improvement*" OR "quality assurance" OR "quality measur*" OR "quality standards"))) AND ((TITLE (fracture* OR "broken bone*" OR trauma OR injury OR injuries) OR ABS (fracture* OR "broken bone*" OR trauma OR injury OR injuries)))) AND NOT ((TITLE ("case series" OR "case reports") OR ABS ("case series" OR "case reports"))) AND (EXCLUDE (EXACTKEYWORD , "Nonhuman") OR EXCLUDE (EXACTKEYWORD , "Animals") OR EXCLUDE (EXACTKEYWORD , "Animal") OR EXCLUDE (EXACTKEYWORD , "Animal Experiment") OR EXCLUDE (EXACTKEYWORD , "Animal Model"))

9. Web of Science Core Collection

Search Strategy:

Topic: "performance indicator*" OR "health system performance" OR "hospital performance" OR "performance measurement*" OR "health metric*" OR "quality indicator*" OR "quality of health care" OR "quality control" OR "quality improvement" OR "performance data" OR "performance metric*" OR "performance improvement*" OR "quality assurance" OR "quality measur*" OR "quality standards"

AND

Topic: fracture* or "broken bone*" or trauma or injury or injuries

NOT Research Areas: Zoology or Veterinary Sciences

10. WHO Global Index Medicus

Search Strategy:

(tw:("performance indicator*" OR "health system performance" OR "hospital performance" OR "performance measurement*" OR "health metric*" OR "quality indicator*" OR "quality of health care" OR "quality control" OR "quality improvement" OR "performance data" OR "performance metric*" OR "performance improvement*" OR "quality assurance" OR "quality measur*" OR "quality standards")) AND (tw:(fracture* OR "broken bone*" OR trauma OR injury OR injuries))

11. University of York Centre for Reviews and Dissemination NHS Economic Evaluations Database

Search Strategy:

((performance indicator* OR health system performance OR hospital performance OR performance measurement* OR health metric* OR quality indicator* OR quality of health care OR quality control OR quality improvement OR performance data OR performance metric* OR performance improvement* OR quality assurance OR quality measur* OR quality standards) AND (fracture* OR "broken bone*" OR trauma OR injury OR injuries)) and ((Economic evaluation:ZDT and Bibliographic:ZPS) OR (Economic evaluation:ZDT and Abstract:ZPS)) IN NHSEED

12. International HTA Database

Search Strategy:

All: ("performance indicator*" OR "health system performance" OR "hospital performance" OR "performance measurement*" OR "health metric*" OR "quality indicator*" OR "quality of health care" OR "quality control" OR "quality improvement" OR "performance data" OR "performance metric*" OR "performance improvement*" OR "quality assurance" OR "quality measur*" OR "quality standards") AND (fracture* OR "broken bone*" OR trauma OR injury OR injuries)

Inclusion Criteria	Exclusion Criteria
• Experimental (RCTs, non-RCTs quasi) and observational (cohort or cross-sectional) studies assessing Table ii. Performance indicators or quality standards in hip fracture care. • Mixed methods and qualitative studies if available and provide greater understanding of quality standards. • Studies that measured outcomes of hip care quality indicators from patient records and self-reports • Studies measuring quality of hip trauma care or health system performance in the delivery of trauma care in hospital or similar settings; to patients with hip fractures. • Any method used by the hospital or health system to measure quality standards or health system performance in trauma care of patients with hip fractures • Adult patients aged 40 years and above with fragility hip fractures	• Non-human studies • Studies in non-hip fracture patients • Studies in patients who are less than 40 years old • Studies in high energy /impact hip fracture patients • Quantitative studies not measuring quality indicators of hip care • Dissertations, reports, non-systematic review articles, abstracts, proceedings letters, commentaries and opinions

Table iii. Experimental studies investigating performance indicators in hip fracture care.

Author, year, country of study	No of study sites	Study design	Study period	Number of participants	Gender (M/F)	Age	Fracture type	Performance / proxy performance indicators investigated	Study quality assessment score (out of 5)
Kimmel 2016 (1) Australia	Single-trauma centre in Melbourne	Randomised Control trial Intervention group: intensive physiotherapy three times daily Control group: usual care physiotherapy daily	03/2014 to 01/2015	92	33 / 59	81.3 (±8.25)	Hip fracture (subcapital, intertrochanteric)	Functional status assessment ASA score MMSE score Residential status Funding source (private, Medicare, transport accident commission) Anaesthetic type (general, spinal) Length of surgery Hospital duration Time to mobilisation (to sit in bed, walk 3 metres) Discharge destination In hospital complications Readmission within 6 months QoL scores (GOS-E, EQ-5D, SF-12) Pain assessment and management	4
Panella 2018 (2) 3 European countries (Belgium, Italy and Portugal	26 hospitals across Belgium, Italy and Portugal	Cluster randomized controlled trial (The European Quality of Care Pathways study) Care pathway Intervention group: 15 hospitals & Control group: 11 hospitals	Belgium: 10/2010 to 01/2012 and Italy & Portugal: 01/2013 to 05/2014. Patients were followed up on 30th day and at 6 months post-surgery.	514	109 / 395 Unknown: 10	81.29 (±7.3) (range: 65 to 103)	Hip fracture (displaced proximal femur, intra and extracapsular fractures)	1) Process Indicators Analgesia use (pre & post-surgery) Mobility status (– pre fracture, preop, 30 day & 6 months post discharge) Hip Xray (preop) Cognitive status (preop & at start of mobilisation) Adequate pain assessment (pre & post op) Falls assessment (pre fracture) Haemoglobin (preop) Antibiotic prophylaxis (peri & post op) Time to surgery (within 24 hours after admission) Pressure ulcers assessment & risk management (post op)	2

								Mobilization (within 24-48 hours in patients who can walk before fracture) Referral to osteoporosis clinic Assessment of nutritional status (post op) Referral to geriatric clinic in patients >75 years (post op) Assessment of fluid balance (post op) Social worker visit (during hospitalization) Medication prescription (at discharge) Facilitate smooth discharge to destination <u>2) Hospital level factors</u> Teaching status Number of beds (>600) Number of proximal femur facture patients each year (>300) Clinical staff type <u>3) Patient level factors</u> Charlson Comorbidity Index Dementia ASA score Functional status (pre fracture & 30 day & 6 months post discharge) ~~Residential status (pre fracture)~~ <u>4) Patient outcomes</u> Mortality (30day & 6 month) Readmission (30day & 6 month) Hospital duration Discharge destination (30 day & 6 months post discharge) EQ5D (30-day post discharge) SF36 (30-day after discharge)	

Mittal 2018 (3) Singapore	Single hospital	Non-randomized historical controlled before after intervention (ValuedCare Hip fracture program) study	01/01/2013 to 31/12/2013 and 01/12/2014 to 30/11/2015	680	208 / 472	80.73 (±7.7) (range: 65-102)	Hip fracture (no further details)	Ethnicity ~~Pre fracture residence~~ ~~Pre fracture mobility~~ Comorbidities Mortality (in patient, post discharge 30 days and 12 months) Complications (acute hospital inpatient) Readmissions Time to surgery (within 48 h from time of decision to admit) Hospital duration	3
Niemeijer 2013 (4) Netherlands	Single centre	Non-randomized controlled, retrospective and prospective before after intervention (clinical pathway) study	2006 to 2007 and 11/2008 to 01/2009 and 07/2009 to 12/2010	332	105 / 227	78.87 ±9.58	Hip fracture (no further details)	Department of admissions (Trauma/ortho) ASA score Time to surgery Duration of surgery Discharge destination Hospital duration (before after intervention) Costs	2
Viveros-García 2021 (5) (Spanish) Mexico	Single tertiary referral centre for government workers	Quasi-experimental, retrospective and prospective study	04/2017 to 03/2019	83	26 / 62	77.4 (± 9.67)	Hip fracture (Displaced & non-displaced intracapsular, transtrochanteric, subtrochanteric)	Mobility (pre fracture) Osteoporosis treatment (pre fracture & at discharge) Functional status (pre fracture) Fragility fracture history Comorbidities Complications Delirium Pressure ulcers Mortality (in hospital) Hospital duration Time to surgery (<48 h) Time to mobilisation Adherence to NICE guidelines	1
Saez Lopez 2015 a (6) Spain	Single centre	Quasi-experimental, retrospective & prospective before after intervention (clinical pathway) study	2010 to 2013 (exact dates NR)	412	85 / 327	86.73 (±5.83)	Hip fracture (Pertrochanteric, Intracapsular, subtrochanteric)	~~Residential status (pre fracture)~~ Mobility (pre fracture) Activities of daily living Comorbidities Charlson comorbidity index Dementia ~~Previous Hip fracture~~ ASA score	1

								Anaesthetic technique (spinal) Thromboprophylaxis Pain assessment Antibiotic prophylaxis Anaemia Delirium Nutritional risk assessment Pressure ulcers Time to mobilisation Osteoporosis Treatment Complications Infections Mortality Time to surgery Discharge destination Functional status	

Table iv. Mixed methods studies investigating performance indicators in hip fracture care.

Author, year, country of study	No of study sites	Study design	Study period	Number of participants	Gender (M/F)	Age	Fracture type	Performance / proxy performance indicators investigated	Study quality assessment score (out of 5)
Schroeder 2023 (11) Israel	2 large academic medical centers in Israel.	Qualitative – semi structured interviews and focus groups Patient-reported outcomes (following Hip fracture) that are meaningful to the patient were measured using Short-Form 36 Questionnaire	06/2021 to 12/2021	15	3 / 12	≥ 70	Hip fracture (no further details)	Qualitative (Quotes from patients) Patient's experience of health care / rehabilitation outcomes following Hip fracture Themes (3) and categories (14) 1) Uniqueness a) identify needs post Hip fracture b) Ageism, old age, falls, and fractures 2) Physical needs a) Physical functioning b) Independence c) Therapy d) Rehabilitation/training 3) Roles (physical, social, emotional) a) Physical role (bodily pain & vitality) b) Social role c) Emotional role (fear of falls and uncertain future)	3
Southwell 2022 (12) UK	Single ward of an acute hospital in London, UK	Qualitative – In depth semi structured interviews. Thematic analysis approach. Interpretation as per Bury's biographical disruption	NR	15	8 / 7	≥ 60 years	Hip fracture (intra and extracapsular)	**Note:** Seven physiotherapy standards for Hip fracture were launched by UK Chartered Society of Physiotherapy after national audit report indicated marked variation in Hip fracture rehabilitation in older adults. The 1st four	3

		theoretical framework. All analyses completed in NVivo (Version 11).						standards focus on starting rehabilitation in acute hospital setting on the day of or day after surgery and the frequency /duration of rehabilitation in the 1st seven days and in the subsequent weeks until the goals are achieved. Qualitative (Quotes from patients) Patient's perceptions of early rehabilitation and recovery after Hip fracture, as a complement to the UK standards for acute physiotherapy after hip fracture Themes (5) 1) importance of self-determination 2) reliance on professional support 3) importance of meaningful feedback 4) anxiety about the future 5) reliance on social capital	
Asplin 2021 (13) Sweden	Single – patients recruited from three wards in the geriatric unit of Sahlgrenska University Hospital, Molndal, Sweden	Qualitative – semi structured interviews content analysis according to Graneheim and Lundman	04/2016 to 09/2016	19	6 / 13	82.3 (±8.1)	Hip fracture (cervical and trochanteric)	Qualitative (Quotes from patients) Patient's experience of their recovery after Hip fracture surgery and the use of Traffic Light System- Basic ADL in their rehabilitation process Categories (2) 1) Being seen as a person'	3

								sub-categories (3) a) Interaction gives trust and security b) Information is key to understanding c) Encouragement is essential to promote activity 2) and 'Striving for Independence' sub-categories (4) a) Accepting the situation whilst trying to remain positive b) The greener the better, but it's up to me c) Ask me, I have goals d) Uncertainties concerning future	
Volkmer 2021 (14) UK	Multi - orthopaedic wards at seven hospitals across England and Wales	Qualitative – one-to-one and semi-structured telephone interview. Thematic analysis Normalisation Process Theory	NR	Physiotherapists: 21	2 / 19	NR	Hip fracture (no further details)	Qualitative (Quotes from Physiotherapists) Physiotherapists' perceptions of mechanisms to explain observed variation in early postoperative practice after hip fracture surgery demonstrated in a national audit. Themes (4) 1) Achieving protocolised and personalised care 2) patient and carer engagement 3) multidisciplinary team engagement across the care continuum 4) strategies for service improvement	3

Jensen 2020 (15) Denmark	Single -university hospital in southern Denmark	Qualitative – 3 focus groups Habermasian lifeworld theoretical approach Content analysis	10/2016 to 12/2016	Mixed group of health professionals*: 16 (*doctor in chief, leading orthopaedic doctor, nurses, endocrinologist, geriatricians, researchers, external observers, social and healthcare assistants, physiotherapists)	NR	NR	Hip fracture (no further details)	Qualitative (Quotes from Health professionals) HP experiences of Hip fracture pathway Themes (2) 1) Systematised pathways and clinical guidelines are inevitable 2) How to counteract patients' lack of information.	2
Segevall 2019 (16) Sweden	Single - orthopaedic unit at a hospital in rural Sweden	Qualitative – semi structured interviews Phenomenological content analysis	10/2016 to 06/2017	13	6 / 7	Median: 74 (range: 66 – 98)	Hip fracture (no further details)	Qualitative (Quotes from patients) Rural older people's experiences of recovering after hip fracture surgery. Themes (4) 1) an unexpected life-altering event 2) preparing to return home 3) needing adjustment and support at home 4) struggling to manage at home.	2
Bruun-Olsen 2018 (17) Norway	Single hospital nearby Oslo	Qualitative – semi structured interviews with open ended questions phenomenological approach	NR	8	2 / 6	Range: 69–91	Hip fracture (no further details)	Qualitative (Quotes from patients) Patient's experience of the recovery process following Hip fracture Themes (3) 1) Feeling vulnerable Sub themes (2) a) Feeling of subservience	2

								b) Feeling of gloominess and hopelessness 2) A span between self-reliance and dependency Sub themes (3) a) The gap between expectations and reality b) Recovery as self-reliance c) Recovery as dependent on actions from others 3) Disrupted from a normal life Sub themes (2) a) Less independence and mobility b) The impact of age	
Ivarsson 2018 (18) Sweden	Single orthopaedic department at a university hospital in south Sweden	Qualitative – semi structured open ended interviews Critical incident technique approach	NR	14	6 / 8	73.5 (±4.5)	Hip fracture (no further details)	Qualitative (Quotes from patients) Experiences of pre- and in-hospital care in patients with hip fractures Theme (1) Oscillating between being satisfied and enduring a new demanding situation Categories (5) a) Pain and pain management b) Feeling fear and satisfaction in perioperative care c) Experiencing continuity in care d) Considering information	2

								e) Feeling encouragement and assistance	
Gesar 2017 (19) Sweden	Multi - five orthopaedic wards at three hospitals, one university hospital and two central hospitals, in three county councils in Sweden	Qualitative - Semi-structured interviews Explorative inductive Data analysed using manifest inductive content analysis	08/2013 to 12/2013	30	3 / 27	82.5 (range: 65–97)	Hip fracture (no further details)	Qualitative (Quotes from patients) Patient's experience of health care / rehabilitation outcomes following Hip fracture Themes (1) To end up in a new situation with or without control Categories (3) 1) Belief in recovery, nothing will be altered Subcategories (2) a) No problem, I will manage this b) unexpected event, determination will be needed 2) Adapting to a new situation in hospital Subcategories (2) a) Need for appraisal b) Context as a negative influence 3) An unpredictable future Subcategories (2) a) When and how to recover b) Uncertainty	3
Jensen 2017 (20) Denmark	Multi Patients from two wards at Odense University Hospital Health professionals from 3 hospitals	Qualitative – semi structured interviews and field observations phenomenological and Reflective Lifeworld Research approach	06/2015 to 12/2015	29 (Patients:10, relatives:4 and health professionals*:15) (*physiotherapists, nurses, geriatrician, physicians,	Patients: 2 / 8 Relatives: 2 / 2 HP's: NR	Patients: 78.8	Hip fracture (no further details)	Qualitative (Quotes from patients and HPs) Experiences of Hip fracture patients and HPs on hip fracture pathway. Patient experiences - Categories (4)	2

		Phenomenon: "hip fracture pathway with short time stay in hospital (STSH)"		healthcare workers and PhD student)				a) pre-conceived notions b) importance of autonomy c) "master in my own house" d) will and zest for life Health professional experiences - Categories (4) a) Self-care and empowerment b) Cross sectional collaboration c) Preparing for discharge	
Christie 2015 (21) UK	NR	Collaborative inquiry (underpinned by critical theory and concept of life-world) Qualitative – data collected during eight two-hour action Meetings. Patients and carers - participated in semi structured interviews to tell their stories of the journey from injury through to getting home. Clinical leaders reflected on excerpts from these stories and identified their learning	NR	Clinical leaders*: 16 Patients: 3 Carers: 2 (*From different disciplines and were knowledgeable in the field of hip fracture care and were in a position to influence others)	NR	Clinical leaders: NR Patients:>65 Carers: >18	Hip fracture (no further details)	<u>Qualitative</u> (Quotes only from Clinical leaders) Multidisciplinary collaborative approach to evidence-based, person-centred hip fracture care. Themes (4) 1) What it was like 2) overcoming the risks together 3) thinking differently 4) enhanced experience	1
Griffiths 2015 (22)	Single major trauma centre in West Midlands, UK	Qualitative – semi structured interviews (19 interviews with patients only	02/2012 to 08/2012	31	11 / 20	81.5 ± 9.2, (range 61–96)	Hip fracture (no further details)	<u>Qualitative</u> (Quotes from patients) experience of recovery from hip fracture at two	3

UK		14 with the carer only 8 with patient/carer dyads) 10 participants were interviewed twice. Thematic analysis						time points—4 weeks and 4 months postoperative hip fixation Themes (7) 1) Mobility (within 24 h post-surgery) 2) valued day-to-day activities 3) self-care 4) pain 5) mental well-being 6) fear of falling 7) leg shortening.	
Olsson 2007 (23) Sweden	Single - a geriatric/orthopaedic ward at a Swedish hospital	Qualitative – semi structured interviews Phenomenographic analysis	NR	13	2 / 11	Median: 81 years (range:71–93)	Hip fracture (no further details)	Qualitative (Quotes from patients) Hip fracture patients' own perceptions of their situation and views of their responsibility in the rehabilitation process. Common traits seen in patients (3) 1) Lacked awareness 2) were shocked by the Hip fracture accident/event 3) Had a strong desire to recuperate Variations in need for information (3) 1) The Autonomous - who knew what they wanted after discharge 2) The Modest – who gave the impression of being vulnerable and dependent on others and they expressed themselves cautiously 3) The Heedless – who appeared to view their situation with some	2

								detachment, almost as if it did not really concern them.	
Archibald 2003 (24) UK	Single hospital	Qualitative – In-depth, open-ended unstructured interviews Phenomenological methodology, grounded theory approach	Spring 2001	5	1 / 4	> 65 years	Hip fracture (no further details)	Qualitative (Quotes from patients) Patient's experience of health care / rehabilitation outcomes following Hip fracture Themes (4) 1) the injury experience, 2) the pain experience, 3) the recovery experience (involved the surgery, beginning the struggle of recovery, and regaining independence) 4) the disability experience (involved the disability itself, depending on others, and being housebound).	2

Table v. Qualitative studies investigating performance indicators in hip fracture care.

Author, year, country of study	No of study sites	Study design	Study period	Number of participants	Gender (M/F)	Age	Fracture type	Performance / proxy performance indicators investigated	Study quality assessment score (out of 5)
Schroeder 2023 (11) Israel	2 large academic medical centres in Israel.	Qualitative – semi structured interviews and focus groups Patient-reported outcomes (following Hip fracture) that are meaningful to the patient were measured using Short-Form 36 Questionnaire	06/2021 to 12/2021	15	3 / 12	≥ 70	Hip fracture (no further details)	Qualitative (Quotes from patients) Patient's experience of health care/rehabilitation outcomes following Hip fracture Themes (3) and categories (14) 1) Uniqueness a) identify needs post Hip fracture b) Ageism, old age, falls, and fractures 2) Physical needs a) Physical functioning b) Independence c) Therapy d) Rehabilitation/training 3) Roles (physical, social, emotional) a) Physical role (bodily pain & vitality) b) Social role c) Emotional role (fear of falls and uncertain future)	3
Southwell 2022 (12) UK	Single ward of an acute hospital in London, UK	Qualitative – In depth semi structured interviews. Thematic analysis approach. Interpretation as per Bury's biographical	NR	15	8 / 7	≥ 60 years	Hip fracture (intra and extracapsular)	**Note:** Seven physiotherapy standards for Hip fracture were launched by UK Chartered Society of Physiotherapy after national audit report indicated marked variation in Hip fracture rehabilitation in older	3

		disruption theoretical framework. All analyses completed in NVivo (Version 11).						adults. The 1st four standards focus on starting rehabilitation in acute hospital setting on the day of or day after surgery and the frequency /duration of rehabilitation in the 1st seven days and in the subsequent weeks until the goals are achieved. Qualitative (Quotes from patients) Patient's perceptions of early rehabilitation and recovery after Hip fracture, as a complement to the UK standards for acute physiotherapy after hip fracture Themes (5) 1) importance of self-determination 2) reliance on professional support 3) importance of meaningful feedback 4) anxiety about the future 5) reliance on social capital	
Asplin 2021 (13) Sweden	Single – patients recruited from three wards in the geriatric unit of Sahlgrenska University Hospital, Molndal, Sweden	Qualitative – semi structured interviews content analysis according to Graneheim and Lundman	04/2016 to 09/2016	19	6 / 13	82.3 (±8.1)	Hip fracture (cervical and trochanteric)	Qualitative (Quotes from patients) Patient's experience of their recovery after Hip fracture surgery and the use of Traffic Light System- Basic ADL in their rehabilitation process Categories (2)	3

								1) Being seen as a person' sub-categories (3) a) Interaction gives trust and security b) Information is key to understanding c) Encouragement is essential to promote activity 2) and 'Striving for Independence' sub-categories (4) a) Accepting the situation whilst trying to remain positive b) The greener the better, but it's up to me c) Ask me, I have goals d) Uncertainties concerning future	
Volkmer 2021 (14) UK	Multi - orthopaedic wards at seven hospitals across England and Wales	Qualitative – one-to-one and semi-structured telephone interview. Thematic analysis Normalisation Process Theory	NR	Physiotherapists: 21	2 / 19	NR	Hip fracture (no further details)	<u>Qualitative</u> (Quotes from Physiotherapists) Physiotherapists' perceptions of mechanisms to explain observed variation in early postoperative practice after hip fracture surgery demonstrated in a national audit. Themes (4) 1) Achieving protocolised and personalised care 2) patient and carer engagement 3) multidisciplinary team engagement across the care continuum 4) strategies for service improvement	3

Jensen 2020 (15) Denmark	Single -university hospital in southern Denmark	Qualitative – 3 focus groups Habermasian lifeworld theoretical approach Content analysis	10/2016 to 12/2016	Mixed group of health professionals*: 16 (*doctor in chief, leading orthopaedic doctor, nurses, endocrinologist, geriatricians, researchers, external observers, social and healthcare assistants, physiotherapists)	NR	NR	Hip fracture (no further details)	Qualitative (Quotes from Health professionals) HP experiences of Hip fracture pathway Themes (2) 1) Systematised pathways and clinical guidelines are inevitable 2) How to counteract patients' lack of information.	2
Segevall 2019 (16) Sweden	Single - orthopaedic unit at a hospital in rural Sweden	Qualitative – semi structured interviews Phenomenological content analysis	10/2016 to 06/2017	13	6 / 7	Median: 74 (range: 66 – 98)	Hip fracture (no further details)	Qualitative (Quotes from patients) Rural older people's experiences of recovering after hip fracture surgery. Themes (4) 1) an unexpected life-altering event 2) preparing to return home 3) needing adjustment and support at home 4) struggling to manage at home.	2
Bruun-Olsen 2018 (17) Norway	Single hospital nearby Oslo	Qualitative – semi structured interviews with open ended questions phenomenological approach	NR	8	2 / 6	Range: 69–91	Hip fracture (no further details)	Qualitative (Quotes from patients) Patient's experience of the recovery process following Hip fracture Themes (3) 1) Feeling vulnerable Sub themes (2) a) Feeling of subservience	2

								b) Feeling of gloominess and hopelessness 2) A span between self-reliance and dependency Sub themes (3) a) The gap between expectations and reality b) Recovery as self-reliance c) Recovery as dependent on actions from others 3) Disrupted from a normal life Sub themes (2) a) Less independence and mobility b) The impact of age	
Ivarsson 2018 (18) Sweden	Single orthopaedic department at a university hospital in south Sweden	Qualitative – semi structured open ended interviews Critical incident technique approach	NR	14	6 / 8	73.5 (±4.5)	Hip fracture (no further details)	Qualitative (Quotes from patients) Experiences of pre- and in-hospital care in patients with hip fractures Theme (1) Oscillating between being satisfied and enduring a new demanding situation Categories (5) a) Pain and pain management b) Feeling fear and satisfaction in perioperative care c) Experiencing continuity in care d) Considering information	2

								e) Feeling encouragement and assistance	
Gesar 2017 (19) Sweden	Multi - five orthopaedic wards at three hospitals, one university hospital and two central hospitals, in three county councils in Sweden	Qualitative - Semi-structured interviews Explorative inductive Data analysed using manifest inductive content analysis	08/2013 to 12/2013	30	3 / 27	82.5 (range: 65–97)	Hip fracture (no further details)	Qualitative (Quotes from patients) Patient's experience of health care / rehabilitation outcomes following Hip fracture Themes (1) To end up in a new situation with or without control Categories (3) 1) Belief in recovery, nothing will be altered Subcategories (2) a) No problem, I will manage this b) unexpected event, determination will be needed 2) Adapting to a new situation in hospital Subcategories (2) a) Need for appraisal b) Context as a negative influence 3) An unpredictable future Subcategories (2) a) When and how to recover b) Uncertainty	3
Jensen 2017 (20) Denmark	Multi Patients from two wards at Odense University Hospital Health professionals from 3 hospitals	Qualitative – semi structured interviews and field observations phenomenological and Reflective Lifeworld Research approach	06/2015 to 12/2015	29 (Patients:10, relatives:4 and health professionals*:15) (*physiotherapists, nurses, geriatrician, physicians,	Patients: 2 / 8 Relatives: 2 / 2 HP's: NR	Patients: 78.8	Hip fracture (no further details)	Qualitative (Quotes from patients and HPs) Experiences of Hip fracture patients and HPs on hip fracture pathway. Patient experiences - Categories (4)	2

		Phenomenon: "hip fracture pathway with short time stay in hospital (STSH)"		healthcare workers and PhD student)				a) pre-conceived notions b) importance of autonomy c) "master in my own house" d) will and zest for life Health professional experiences - Categories (4) a) Self-care and empowerment b) Cross sectional collaboration c) Preparing for discharge	
Christie 2015 (21) UK	NR	Collaborative inquiry (underpinned by critical theory and concept of life-world) Qualitative – data collected during eight two-hour action Meetings. Patients and carers - participated in semi structured interviews to tell their stories of the journey from injury through to getting home. Clinical leaders reflected on excerpts from these stories and identified their learning	NR	Clinical leaders*: 16 Patients: 3 Carers: 2 (*From different disciplines and were knowledgeable in the field of hip fracture care and were in a position to influence others)	NR	Clinical leaders: NR Patients:>65 Carers: >18	Hip fracture (no further details)	<u>Qualitative</u> (Quotes only from Clinical leaders) Multidisciplinary collaborative approach to evidence-based, person-centred hip fracture care. Themes (4) 1) What it was like 2) overcoming the risks together 3) thinking differently 4) enhanced experience	1
Griffiths 2015 (22)	Single major trauma centre in West Midlands, UK	Qualitative – semi structured interviews (19 interviews with patients only	02/2012 to 08/2012	31	11 / 20	81.5 ± 9.2, (range 61–96)	Hip fracture (no further details)	<u>Qualitative</u> (Quotes from patients) experience of recovery from hip fracture at two	3

UK		14 with the carer only 8 with patient/carer dyads) 10 participants were interviewed twice. Thematic analysis						time points—4 weeks and 4 months postoperative hip fixation Themes (7) 1) Mobility (within 24 h post-surgery) 2) valued day-to-day activities 3) self-care 4) pain 5) mental well-being 6) fear of falling 7) leg shortening.	
Olsson 2007 (23) Sweden	Single - a geriatric/orthopaedic ward at a Swedish hospital	Qualitative – semi structured interviews Phenomenographic analysis	NR	13	2 / 11	Median: 81 years (range:71–93)	Hip fracture (no further details)	Qualitative (Quotes from patients) Hip fracture patients' own perceptions of their situation and views of their responsibility in the rehabilitation process. Common traits seen in patients (3) 1) Lacked awareness 2) were shocked by the Hip fracture accident/event 3) Had a strong desire to recuperate Variations in need for information (3) 1) The Autonomous - who knew what they wanted after discharge 2) The Modest – who gave the impression of being vulnerable and dependent on others and they expressed themselves cautiously 3) The Heedless – who appeared to view their situation with some	2

								detachment, almost as if it did not really concern them.	
Archibald 2003 (24) UK	Single hospital	Qualitative – In-depth, open-ended unstructured interviews Phenomenological methodology, grounded theory approach	Spring 2001	5	1 / 4	> 65 years	Hip fracture (no further details)	Qualitative (Quotes from patients) Patient's experience of health care / rehabilitation outcomes following Hip fracture Themes (4) 1) the injury experience, 2) the pain experience, 3) the recovery experience (involved the surgery, beginning the struggle of recovery, and regaining independence) 4) the disability experience (involved the disability itself, depending on others, and being housebound).	2

Table vi. Prospective and/or retrospective before/after intervention cohort studies investigating performance indicators in hip fracture care.

Author, year, country of study	No of study sites	Study design	Study period	Number of participants	Gender (M/F)	Age	Fracture type	Performance / proxy performance indicators investigated	Study quality assessment score (out of 5)
Crozier-Shaw 2022 (25) Ireland	Single hospital	Retrospective before after intervention (introduction of messaging service MedxNote) study	04/2017 to 12/2017 and 04/2018 to 12/2018	243	NR	NR	Hip fracture (no further details)	Time to orthopaedic ward (within 4 h of arrival) Time to surgery (within 48 h from admission)	2
Esper 2022 (26) USA	Single hospital.	Retrospective before after intervention (preoperative transthoracic echocardiogram TTE protocol) study	09/2015 to 06/2021	968	305 / 663	79.90 (± 10.21)	Hip fracture [AO/OTA fracture classifications: 31A, 31B, 32(A-C)]	Ethnicity Injury score Ambulatory status Charlson comorbidity index Glasgow coma score Preoperative transthoracic echocardiogram Time to surgery Hospital duration Complications Comorbidities Mortality (in patient & within 30 days)	4
Lian 2022 (27) Norway	Single hospital	Retrospective before after intervention (six-item improvement programme) study	01/2012 to 12/2015	475	143 / 332	83.35 (±8.25)	Hip fracture (Only dislocated femoral neck fracture for hemiarthroplasty)	ASA score Medication prescriptions Comorbidities Alcohol and smoking ~~Residential status~~ Time to surgery Operating time Complications Reoperations Mortality (postoperative)	3
Matharu 2022 a (28) UK	Single hospital	Retrospective before after intervention (Trust implemented service changes) study	2012 and 2019 (exact dates NR)	1,096	NR	"Older people" (no further details)	Hip fracture (no further details)	Mortality (undefined at 30 days) Hospital duration Reoperations Pressure sores (during acute hospital admission) Time to mobilization (Day 1 of surgery) Best Practice Tarriff achieved	1
Rutenberg 2022	Single centre	Retrospective before after intervention (prophylactic pre-	01/01/2011 to 30/06/2016	904	294 / 610	82.5 (±7.15)	Hip fracture (proximal femoral pertrochanteric, intra &	Mobility (pre fracture) ~~Cohabitation status (pre fracture)~~ Charlson comorbidity index Comorbidity assessment	3

(29) Israel		surgical antibiotic treatment quality indicator) study	01/01/2014 to 30/06/2016				extracapsular fractures)	Antibiotic prophylaxis Mortality (in hospital & at undefined 1 year mortality) Time to surgery (< 48 h post admission) Hospital department (ortho/geriatric/medicine/other) Hospital duration Complications (in hospital & at undefined 1 year) Delirium Pressure sores Readmissions	
Anthony 2021 (30) UK	Single large district general hospital split over three sites	Retrospective before after intervention (anaesthetic 'hot week') study	2017 to 2018 (exact dates NR)	1,044	312 / 732	82.05	Hip fracture (no further details)	Time to surgery (within 36 hours of admission) Reasons for surgery delay Time to mobilisation Hospital duration Mortality Perioperative orthogeriatric assessment Falls assessment Bone health assessment Pre op AMT Delirium Assessment	2
Rozenfeld 2021 (31) Israel	Israel's National Trauma Registry	Retrospective before after intervention (Performance indicator early Hip fracture surgery) study	2010 to 2016 (exact dates NR)	17,504	5,384 / 12,120	≥65	Hip fracture (ICD-9-CM 820)	Charlson co-morbidity index Time to surgery (<48 h from hospitalisation) Mortality (in hospital & undefined l year mortality)	3
Rubenstein 2021 (32) USA	Single centre	Retrospective before after intervention (the resident quality improvement initiative) study	01/07/ 2015 to 30/06/2017 and 01/07/2018 to 30/06/2019	96	26 / 70	74.6 (±10.55)	Hip fracture (femoral neck, peritrochanteric, intertrochanteric and subtrochanteric)	BMI Charlson comorbidity index Time to surgery (within 24 hours of admission) Hospital duration Discharge destination Readmissions (within undefined 30 days)	2
Valsamis 2021 (33) UK	Single Level 1 Major Trauma Centre	Retrospective before after intervention (dedicated hip fracture unit) study	04/2011 to 06/2015 and 07/2015 to 09/2016	2,777	NR	NR	Hip fracture (Proximal femoral fragility fractures)	Time to surgery Hospital duration Mortality	2
Wang 2021	Single hospital	Retrospective before after	01/2016 to 06/2020	204	48 / 156	Median: 78.7	Hip fracture (fragility,	Barthel Index (daily living) Charlson comorbidity index	3

(34) China		intervention (advanced nursing care) study				(IQR 74.5 – 82.6)	intertrochanteric, femoral neck)	ASA score Time to surgery (from admission) Exercises (within 24 h after surgery) Complications (postoperative) Pressure ulcers/injuries Delirium UTI / pulmonary infection DVT Pain assessment (on day 2 after surgery) Mobility assessment (in hospital, at 3 & 6 month follow up post-surgery) Hospital duration Mortality assessment (in hospital, at 3 & 6 month follow up) Refracture assessment (at 3 & 6 month follow up) QoL assessment (at 3 & 6 month follow up)	
Snowdon 2020 (35) Australia	Two acute hospitals in Melbourne, Australia	Prospective controlled before after intervention (Direct supervision of physiotherapists) study design	02/2017 to 05/2017 and 06/2017 to 09/2017	290	24 / 266	82 (range 22–99)	Hip fracture (intra capsular, intertrochanteric, subtrochanteric)	Charlson comorbidity index Cognitive impairment Pre fracture mobility ~~Pre fracture residential status~~ Complications post-surgery Time to mobilisation (<24 h of surgery) Functional independence Hospital duration Falls assessment 30-day readmission Discharge destination Mobility status Analgesia Mortality	3
van Voorden 2020 (36) Netherlands	Dutch Nationwide Trauma Registry	Retrospective before after the Dutch Hip Fracture Audit	2015 and 2017 (exact dates NR)	3,808	1,115 / 2,693	81.8 (±8.9)	Hip fracture (femoral neck, trochanteric Intertrochanteric)	ASA score ICU duration Discharge destination Functional status Hospital department duration Mortality (in hospital & 30 day) Hospital trauma level Hospital duration Time to surgery	3
Baroni 2019 (37) Italy	Single centre	Prospective and retrospective before after intervention (geriatric co-	01/09/2011 to 31/08/2012	430	107 / 323	83.6 (±7.23)	Hip fracture (Medial, Lateral, Sub-trochanteric)	Time to surgery (days & < 48 hrs from admission) Duration of hospitalisation Mortality (in hospital and at 1 year) In hospital complications	3

		management or consultation v/s ortho care) observational study with 2 parallel arms						Medications at admission Anti-fracture drug prescription at discharge Geriatric/orthopaedic/orthogeriatric consultations Perioperative orthogeriatric assessment Falls assessment Coexisting diseases Charlson comorbidity score ASA score	
Jackson 2019 (38) USA	Single hospital group (with 3 individual hospitals)	Retrospective before after intervention (Hip fracture care program at each of the 3 hospitals) study	01/2011 to 12/2016	2,895	841 / 2054	82.8 (±7.6)	Hip fracture (Femoral neck, Peritrochanteric, other including intracapsular, intertrochanteric, midcervical)	Admission status Type of health insurance Time to theatre (from admission & ER) Duration of hospitalisation Costs Discharge destination (to skilled nursing facility or other than home)	4
Metcalfe 2019 (39) UK	Hospital data of England (HES APC) & Scotland (SMR)	Interrupted time series study before and after the introduction of a) NHFD from January 2007; b) Hip Fracture BPT from April 2010; and c) the combined effect of the NHFD/BPT intervention	01/01/2000 to 31/12/2006 01/01/2007 to 30/04/2010 01/05/2010 to 01/02/2018	1,154,454	285,844 / 868,610	>60	Hip fracture (neck of femur, pertrochanteric, subtrochanteric fractures)	Multiple deprivation index Charlson Comorbidity Index Time to theatre (early i.e. <2 days) Mortality (undefined 30, 60, 90, and 365-day) Readmission (undefined at 30, 60, and 90-day) Hospital duration	4
R P Murphy 2019 (40) Ireland	Single hospital	Retrospective before after intervention (introduction of the orthogeriatric service) study	08/2017 to 02/2018 and 08/2018 to 02/2019	285	NR	80.7	Hip fracture (no further details)	Hospital duration (on ortho ward) Adherence to Irish Hip Fracture standards of care (IHFS) Admission to an orthopaedic ward within 4 hours of first presentation or directly to the theatre from the ED within 4 hours Time to surgery (within 48 hours of first presentation and within normal working hours) Developed pressure ulcers following admission Geriatric review at any point during admission Bone health assessment Falls assessment Rehab admissions	2

								Discharge destination	
Sermon 2019 (41) Belgium	Single centre	Retrospective before after intervention (early surgery) study	01/2011 to 12/2013 and 06/2014 to 05/2017 With 6 month follow up	1,561	443 / 1,118	83.5 (IQR 77 – 88)	Hip fracture (femoral neck, trochanteric)	ASA score Time to surgery (within next calendar day) Hospital duration date and time of hospital admission ICU admission & duration Mortality (undefined 30 day & 6 month) Readmission (within 90 days of discharge)	3
Wallace 2019 (42) USA	Single Level I regional trauma centre in Nassau County, New York	Retrospective before after intervention (multidisciplinary hip fracture care pathway) study	01/01/2014 to 31/10/2014 and 01/11/2014 to 30/04/2016	271	93 / 178	83.18 (±8.24)	Hip fracture (Intracapsular, Intertrochanteric, subtrochanteric)	Race Injury severity score ~~Injury mechanism~~ Glasgow Coma Scale Discharge destination ED duration ICU duration Hospital duration Time to surgery (<24 h) Complications Comorbidities Mortality	4
Walton 2019 (43) UK	Single hospital	Retrospective before after intervention (dedicated hip fracture unit) study	01/04/2011 to 30/06/2015 and 01/07/2015 to 16/09/2016	2,777	782 / 1,995	83.2 (± 9.1)	Hip fracture (proximal femur, intracapsular, intertrochanteric, subtrochanteric)	ASA grade Mortality (30, 120 & 365 day) Hospital duration Time to surgery (from admission) Discharge destination	3
Liu 2017 (44) Hong Kong	Clinical data from the Hospital Authority of Hong Kong	Retrospective before after intervention (Performance indicator formulated by the hospital Authority) study	01/2000 to 12/2011	43,830	12,821 / 31,009	82 (range: 65-112)	Acute Hip fracture (ICD-9-CM diagnosis codes 820.8, 820.09, 820.02, 820.03, 820.20, and 820.22)	Time to surgery (defined early, delayed, late from time of admission) Mortality (undefined 30-day, 1 year and long-term mortality) Survival	3
Middleton 2017 (45) UK	UK NHFD	Retrospective before after intervention (integrated orthogeriatric hip fracture pathway) study	01/07/2009 to 30/06/2011 01/07/2011 to 30/06/2013	1,869	448 /1,421	84.5 (range: 57–104)	Hip fracture (extracapsular fracture)	AMTS ASA Mobility assessment Time to orthogeriatric assessment Time to surgery Hospital duration Mortality (undefined 30 day)	4
Oakley 2017	Single hospital	Retrospective before after intervention	04/2008 to 04/2010 and	2,541	642 / 1,899	Median 84	Hip fracture (neck of femur)	AMT score (pre & post op) The Nottingham Hip Fracture Score Hospital duration	3

(46) UK		(introduction of BPT) study	04/2012 to 04/2014			(range 77 - 89)		Time to admission to theatre Time to surgery Residential status (pre fracture Comorbidities ~~Cohabitation status (pre fracture)~~ Mobility status (pre fracture) MDT admission protocol MDT-guided rehabilitation Orthogeriatric review (within 72 hours s of admission) Falls assessment Bone protection assessment Survival Causes in delay to surgery of over 36 hours Hospital duration Mortality (in hospital and 30 days)	
Pajulammi 2017 (47) Finland	Single hospital	Prospective before after intervention (implementation and development of an orthogeriatric hip fracture program) study	09/2007 to 12/2015	1,644	426 / 1,218	Median: 84 (IQR: 78-88) (range 65-105	Hip fracture (no further details)	ASA score (pre fracture) Dementia (pre fracture) Mobility (pre fracture) Residential status (pre fracture) Time to surgery (<24 h, 24-47 h, > 47 h from admission) IUC removed during acute hospitalization Comprehensive Geriatric assessment	3
Hamed 2016 (48) USA	Single hospital	Prospective before after intervention (managed care critical pathway tool) study	N/R	102	52 /50	79 (range 63-93)	Hip fracture (femoral neck and intertrochanteric fractures)	Ambulatory status (rehab within 24h post op) Residential /living status (preinjury / post discharge) Mortality rate (up to 1 year post surgery) Complications Duration of hospitalisation Readmissions Reoperations Quality of care	2
Metcalfe 2016 a (49) UK	United Kingdom National Hip Fracture Database (UK NHFD)	Retrospective before after (Major Trauma Centre designation) study	01/04/2010 to 31/12/2013	289,466	77,866 / 211,600	82.8 (±8.4)	Hip fracture (Proximal femur fractures)	Premorbid mobility Residential status (pre fracture & after discharge) Time to ward Time to geriatrician review Time to operation Hospital duration Pressure sores Mortality (in hospital) Reoperations (within 30 days)	4

Soong 2016 (50) Canada	Single centre	Retrospective before after intervention (integrated medical-surgical co-management incorporating continuous improvement methodology) study	01/01/2009 to 31/12/2010 and 01/01/2012 to 31/12/2013	571	169 / 402	79.75 (±13.35)	Hip fracture (femoral neck, intertrochanteric & subtrochanteric)	Charlson comorbidity index Comorbidities Dementia ADL score ~~Residential status (pre admission)~~ Discharge destination Hospital duration Cost Time to surgery (from admission) Mortality Readmission (within 30 days of index admission) Osteoporotic treatment	3
Fleury 2015 (51) Switzerland	Single hospital	Prospective before after intervention (clinical pathway) study	01/03/2011 to 31/12/2013 and 2009 to 2013 (for LoS analysis)	669	148 / 521	83.47	Hip fracture (proximal femur)	Delirium assessment (on day 3 post surgery) Pneumonia assessment Nutritional assessments (at discharge) Time to surgery (within 24 & 48 h) Duration of hospitalisation Discharge destination	2
Neuburger 2015 (52) England	National database of hospital episodes data	Retrospective before after intervention (the BOA/BGS NHFD Initiative) study	01/01/2003 to 31/12/2011	471,590	157,506 / 314,084	82.5	Hip fracture (neck of femur, pertrochanteric, subtrochanteric fractures)	Prompt admission to orthopaedic care Surgery within 48 h Rate of surgery Rate of early surgery (on the day or day after admission to hospital) Prevention of pressure ulcers Access to acute orthogeriatric care Assessment for bone protection therapy Falls assessment Mortality (30, 90 & 365 day)	4
Britton 2014 (53) UK	Single hospital	Retrospective before after intervention (implementation of designated daily and Sunday trauma lists) study	08/2009 to 07/2010 and 11/2010 to 02/2011	442 (Post-intervention:NR)	NR	NR	Hip fracture (femoral neck fractures)	Time to surgery (within 36 hours of admission) Orthogeriatric assessments (within 72 hours of admission)	1
Khan 2014 (54) UK	Single hospital	Retrospective before after intervention (BPT 2010 & 2011) study	01/12/2008 to 31/05/2011	516	118 / 398	Median 84 (range: 60-100)	Hip fracture (neck of femur, intracapsular & extracapsular)	Time to surgery < 36 h Admitted under joined geriatric/orthopaedic care Using an agreed multidisciplinary protocol Assessed by a geriatrician < 72 h Postoperative multi-professional rehabilitation team	3

								Fracture prevention assessments (falls/bone health) ASA grade Hospital duration (including trauma unit) Mortality (at undefined 30 & 365 days) Cause of 365-day mortality Costs	
Kommer 2014 (55) UK	Single hospital	Retrospective before after intervention (2 differing consultant on-call systems) study	2010 to 2011 (exact dates NR)	93	NR	≥65	H Hip fracture F (intracapsular and extracapsular)	Time to theatre	2
Colais 2013 (56) Italy	Multiple acute care hospitals, Lazio region, Italy	Retrospective before after intervention (pay-for-performance act 2009) study	07/2008 to 06/2009 and 07/2010 to 06/2011	12,433	2586 / 9847	82.95 (± 7.15)	Hip fracture (ICD-9-CM diagnosis codes 820.0–820.9 in any position)	Hospital payment type Time to surgery (within 48 hours) Comorbidities	4
Collinge 2013 (57) USA	Single level 2 trauma centre / community hospital	Retrospective before after intervention (Hip fracture program) study	07/2008 to 04/2009 05/2009 to 02/2010 03/2010 to 12/2010	657	173 / 484	80.9 (range 60 - 102)	Hip fracture (femoral neck, peritrochanteric, Subtrochanteric)	Time from admission to medical clearance Time from medical clearance to surgery Time from admission to surgery Comorbidities Duration of hospitalisation Mortality (in hospital, within 30- & 365-days post-admission) Cause of death Costs	4
Khan 2013 b (58) UK	Single hospital	Retrospective before after intervention (BPT 2010 & 2011) study	04/2010 to 04/2012	873	NR	>65	Hip fracture (fragility, neck of femur fractures)	Admitted under joint geriatric/orthopaedic care Using an agreed multidisciplinary protocol Time to surgery (within 36 h) Geriatric review (within 72 hour) Bone health assessment Falls risk assessment Post op multidisciplinary rehabilitation team BPT achievement Duration of hospitalisation Mortality (at undefined 30 day)	3
Ciaschi 2011 (59)	Five public hospitals in the Lazio Region, Italy	Prospective single group before after intervention (a)	04/2006 to 10/2006 and	176	NR	NR	Hip fracture (no further details)	Timing of evaluation in the emergency room Time to surgery (within 48 hours) Antibiotic prophylaxis	1

Italy		Hospital Clinical Pathway b) preparatory phase; and c) educational intervention on site) study No follow up study post implementation of educational intervention in Oct 2007	04/2007 to 10/2007					Thrombolytic prophylaxis Time to mobility and of physiotherapy Duration of hospitalisation	
Yousri 2011 (60) UK	Single hospital	Retrospective before after intervention ("LEAN thinking" pathway) study	09/2005 to 08/2006 and 09/2006 to 08/2007	608	171 / 435	81.4 (range 22-105)	Hip fracture (neck of femur)	Mortality (overall & 30 day) Door to theatre time (≤24 h & > 48 h) Admission to trauma ward Hospital duration	3
Merle 2009 (61) France	Three hospitals in Northwestern France	Prospective before after intervention (review and discussion of comparative performance results by three teams followed by implementation of quality improvement as deemed necessary by each team) study. Mixed methods study but only quantitative data reported in this paper	03/2003 to 09/2003 and 04/2004 to 12/2004	856	172 / 684	83.8 (±7.8)	Hip fracture (no further details)	Functional status (Parker score) Activity of daily living (Katz score) Residential status (pre & post fracture) Time to follow-up (≤3 months post-surgery) Time to surgery Time between surgery and completing surgery record Height / weight and albuminemia recorded in ortho chart Nutritional status /supplement ordered assessment (in ortho ward) Time to discharge Time between discharge from orthopaedic ward and completion of orthopaedic hospitalization record Time between admission and request of a place in a rehabilitation facility Time to rehab Time between discharge from rehabilitation ward and completion of rehabilitation hospitalization record Time to mobilisation (1st getting up) Delay between surgery and first getting up Physio intervention	2

								Patient satisfaction with information. hospital care, pain management Pain management Osteoporotic assessment and/or treatment Falls prevention Pressure sores occurrence Length of post op orthopaedic stay Mortality Readmissions	
Hommel 2008 (62) Sweden	Single university Hospital in Lund, Sweden.	Prospective before after intervention ("a new evidence based clinical pathway") study	01/04/2003 to 31/03/2004	420	132 / 288	80.5 (±10.65)	Hip fracture (femoral neck, intracapsular, trochanteric, subtrochanteric, cervical)	Time to surgery (<24 h, >24h) Reason for surgery delay ASA score ~~Residential status~~ Length of hospital stay Total institutionalised days Reoperations Mortality (at discharge, at 4 and 12 months after fracture	2
Jensen 2007 (63) (Danish) Denmark	Single hospital	Prospective before after intervention (optimisation of the reception procedure, which included nurse-prescribed X-ray examination and opioid-free analgesia) study	01/9/2002 to 21/01/2003 and 01/01/2004 to 22/07/2004	267	NR	80.5	Hip fracture (no further details)	Time to admission Time in ED Time to surgery	1
Guryel 2004 (64) UK	Single - The Princess Royal district general hospital	Retrospective before after intervention (introduction of NCEPOD echocardiography recommendations) study	02/2001 to 03/2001 and 02/2002 to 03/2003	60	14 / 46	82 (range 68 – 93)	Hip fracture (neck of femur)	Time to surgery (≤24h, 24-48h, 3-5days, 6-10 days, >10 days) Reasons for surgery delay Comorbidities Pre-operative echocardiography	1
Hommel 2003 (65) Sweden	Single - University Hospital, Lund, Sweden	Retrospective before after intervention (introduction of audit and other quality improvements) study	01/09/1998 to 31/12/1998 and 01/09/1999 to 31/12/1999 and	483	124 / 359	80.1 (± 10.6)	Hip fracture (no further details)	Time to surgery (<12h, <24h, >24h from admission) Pressure ulcer risk assessment Pain relief	1

			01/09/2000 to 31/12/2000						
Freeman 2002 (66) UK	East Anglian multi-site audit of hip fracture	Prospective comparative/before after intervention ("strategy to change" due to 1992 audit) cohort study	1992 (exact dates NR) and 07/01/1997 to 31/10/1997	1,478	303 / 1175	81.45 (±9.26)	Hip fracture (Intra and extracapsular fractures)	Residential status (pre fracture & at discharge) Functional status (pre fracture & at discharge) Basic ADL score Standardised risk assessment (for pressure sores on admission to orthopaedic ward) Prophylactic anticoagulation Prophylactic antibiotics Time to surgery (within 48 h of admission) Time to mobilisation (within 48 hrs of surgery) Orthogeriatric assessment Pain assessment Pressure ulcers assessment Discharge destination Complications Mortality (in hospital, at 30- & 90-days post fracture)	3

Table vii. Prospective cohort studies investigating performance indicators in hip fracture care.

Author, year, country of study	No of study sites	Study design	Study period	Number of participants	Gender (M/F)	Age	Fracture type	Performance / proxy performance indicators investigated	Study quality assessment score (out of 5)
Yang 2023 (67) Taiwan	Single centre	Prospective cohort study	11/2017 to 03/2021	318	97 / 221	80.23 (±9.29)	Hip fracture (Femoral neck, pertrochanteric)	SPMSQ score (Short portable mental status questionnaire) ~~Handgrip strength~~ Charlson comorbidity index score Surgical delay Surgery duration Barthel Index EQ-5D-3L	2
Matharu 2022 b (68) UK	Multi – Hip fracture patients aged 60 years and over from England, Wales and Northern Ireland with records in the National Hip Fracture Database.	Prospective cohort study	01/01/2018 to 31/12/2019	124,960	36,524 / 88,436	82.7 (±8.6)	Hip fracture (intra and extracapsular, others)	Residential status ASA physical status Preinjury mobility AMT score Time to surgery (within 36 h of admission) Nerve block before surgery Delirium assessment Time to mobilisation (within 24 h of surgery Hospital duration Discharge destination Mortality (30 day)	4
Wurdemann 2022 a (69) Netherlands	Seven hospitals	Prospective cohort study	01/01/2018 to 31/12/2019	4,904	1,585 / 3,310	79.87 (±11.80)	Hip fracture (displaced/undisplaced femoral neck, trochanteric AO-A1-3 and sub trochanteric)	~~Residential status (pre fracture)~~ Mobility assessment (pre fracture) KATZ6-ADL score ASA score Dementia Osteoporosis assessment Risk of malnutrition Medication (use of >5 medications) Delirium assessment Parker mobility score Oral Anticoagulant Hospital duration Reasons for prolonged duration	3

								Time to surgery (> 48 h after presentation to ED) Reasons for delayed surgery Number & type of clinicians involved Complications Mortality (in hospital, 30, 90 days and 1year) Anaemia Reoperations Functional status	
Do 2021 (70) Australia	32 Australian public hospitals	Prospective and retrospective multimethod cohort study	01/09/2014 to 28/02/2015 and 07/2016 to 08/2017 and 01/01/2018 to 31/12/2018	716 patient medical records and 857 patients from orthopaedic public hospital wards 23 leading hip fracture clinicians	190 / 526 (NR for all cohorts)	82.8 ±8.1 (NR for all cohorts)	Hip fracture (no further details)	<u>Data from medical records of 716 patients</u> Initial pain score (within 30 min of arrival to the hospital) Analgesia or nerve blocks (within 30 min of arrival unless patient declined) Pain reassessed (within 60 min of arrival) Orthopaedic team notified (within 60 min of patient arrival to the hospital) Time to surgery (within 48 h of arrival to the hospital) Prophylactic antibiotic treatment (within 60 min prior to surgical incision) Prophylactic thrombolytic treatment (within 48 h of arrival to the hospital) Surgery performed with the aim of allowing patient to fully weight bear without restriction in the immediate post-operative period Time to mobilization (started day after surgery unless contraindicated or patient declined) Patient offered a dedicated mobilization session to regain function at least once per day until discharge	2

								Falls assessment (at discharge) Bone protection medication (at discharge) <u>Clinicians' perception of indicator performance against actual performance</u> Average time between arrival and initial pain assessment (<30, 31-60, 61-90,>90 mins) Average time between arrival and administration of pain relief (<10, 11-30, 31-60,>60 mins) Average time between arrival and second pain assessment (<10, 11-30, 31-60,>60 mins) Average time between arrival and orthopaedic team notification (<30, 31-60, 61-90,>90 mins) Average time between arrival and surgery (<24, 25-48, 49-72, 73 h, 1 week) Patient received prophylactic antibiotic treatment within 60 min prior to surgical incision (≥75% of the time, 26-75% of the time, not often 1-25%, never 0%) Patient received prophylactic thrombolytic treatment within 48 h of arrival (≥75% of the time, 26-75% of the time, not often 1-25%, never 0%) Surgery performed with the aim of allowing patient to fully weight bear without restriction in the immediate post-operative period (≥75% of the time,	

								26-75% of the time, not often 1-25%, never 0%) Mobilization started day after surgery (≥75% of the time, 26-75% of the time, not often 1-25%, never 0%) Dedicated mobilization session to regain function at least once per day until discharge (yes/no) A specialist falls assessment from a trained clinician (yes/no) Bone protection medication for secondary fracture prevention (yes/no) <u>Association between indicator adherence and clinician measures and Patient Measures of Safety (PMOS) sub-scale measures</u> Teamwork Safety climate Leadership Patient Measures of Safety (PMOS) Communication & teamwork Organization and care planning Access to resources Ward type and layout Information flow Roles and responsibilities Staff training Equipment (design and function) Delays Aggregate PMOS score	
Gandossi 2021	Single - Orthogeriatric Unit (OGU) at	Prospective cohort study	01/10/2011 to 15/03/2019	988	250 / 738	Median: 84.9 (IQR range: 80.6-89.2)	Hip fracture (Intracapsular, Inter and sub-trochanteric)	ASA score Time to surgery (within 48 h)	2

(71) Italy	S. Gerardo University Hospital, Monza, Italy							Post op delirium Functional status at discharge Hospital duration Frailty index Anaesthesia mode	
Griffin 2021 (72) UK	Multicentre cohort study conducted in 20 acute UK NHS hospitals	Prospective cohort study	05/2014 to 04/2017	7,391	NR	83 (± 8.5)	Hip fracture (no further details)	Time to surgery (within 36 h of admission to ED) Joint ortho geriatric care Use of agreed MDT protocol Geriatric assessment (within 72 h of admission) Geriatrician directed MDT rehab Bone health and falls risk assessment Cognitive (delirium) assessments (pre and post-surgery) AMTS score ASA Mobility status Residential status BPT attainment Health-related quality of life (EQ-5D) Mortality (at 4 months post-injury)	3
Said 2021 (73) Australia	Single - Australian tertiary health service	Prospective cohort study	05/05/2016 to 08/09/2016	100	34 / 66	84 (range: 78-88)	Hip fracture (no further details)	New mobility score ~~Previous living status~~ Dementia assessment Delirium assessment Other injuries Time to surgery from ED admission Weight bearing status Complications (within 48 h of surgery) Time to mobilisation (within 48 h of surgery) Hospital duration Discharge destination	3
Xiang 2021 (74) China	Multicentre – patients from nine study centres in China	Prospective cohort study	04/2015 to 04/2017	284	86 / 198	80.7 (± 7.6)	Hip fracture (unstable intertrochanteric fractures - AO/OTA 31-A2 or 31-A3)	CharIson Comorbidity Index EQ5D / EQ VAS scores Time to mobilisation [Early – transferring from	2

								bed to a sitting chair within 2 days after surgery, standing up with both feet on the ground within 4 (±2) days after surgery, and walking with or without aids within 5 (±2) days after surgery] Weight bearing status Hospital duration Complications	
Trinh 2018 (75) Australia	Single hospital	Prospective cohort study	2014 to 2015	493	161 / 332	NR	Hip fracture (intracapsular, extracapsular)	ASA score Transferred patient Day & time of admission Geriatrician assessment Received nerve block Time to surgery (< 48 h of admission) Seen by physiotherapist (< 24 h) Received refracture prevention medications Hospital duration Readmission (within 28 days of discharge) Mortality (within 28 days of admission)	3
Lizaur-Utrilla 2016 (76) Spain	Single hospital	Prospective cohort study	01/2012 to 12/2014	628	162 / 466	83.5 (range: 61-102)	Hip fracture (trochanteric, cervical)	Time of admission ASA score Charlson index Residential status Dementia Daily living activities Mobility status (at admission) Comorbidities (at admission) Time to surgery (≤2 days v/s ≥2 days) Mortality (in hospital, post-surgery and within 1 year of surgery) Predictors of 1 year mortality	4

Buecking 2015 (77) Germany	Single - acute care trauma department of the university hospital in Marburg, Germany	Prospective cohort study	01/04/2009 to 30/09/2011	392	108 / 284	81 (±8.0)	Hip fracture (femoral neck, trochanteric, subtrochanteric)	ASA score Pre fracture Barthel index Charlson Comorbidity Index Mini-mental status examination (MMSE) Geriatric Depression Score (GDS) Time to surgery (within 24 h) Duration of surgery Time to mobilisation (within 48 h of surgery)	2
Dubljanin-Raspopovi 2013 (78) Serbia	Single clinic for orthopaedic surgery and traumatology, Clinical center, Serbia	Prospective cohort study	NR	96	25 / 71	78.31(±7.45)	Hip fracture (femoral neck, intertrochanteric)	MMSE Preop FIM ASA score Anaesthesia type Time to mobilisation (≤48, >48 h)	2
Sivakumar 2013 (79) Australia	Single hospital	Prospective cohort study	01/11/2010 to 31/10/2011	322	92 / 230	82.3 (±9.9) (range 48-103)	Hip fracture (intracapsular and extracapsular)	Comorbidities Osteoporosis Cognitive impairment Residential status (pre fracture) Mobility status (pre fracture) Time to theatre (post admission) Time to mobilization (post-operative) Discharge destination Complications Delirium Revision surgery Pressure areas In patient falls ICU admission Readmissions Mortality (inpatient)	3
Barone 2009 (80) Italy	Single -Ortho-geriatric unit in an acute care hospital in Italy	Prospective cohort study	11/2005 to 01/2007	469	103 / 366	84.6 (±7.03)	Hip fracture (osteoporotic fracture of proximal femur)	Residential status ASA score Time to surgery (d) Hospital duration Preholiday surgery Barthel Index Katz Index Cognitive impairment	2

								Discharge destination Weight bearing status Time to mobilisation Medical burden Severity of illness	
Foss 2008 (81) Denmark	Single - Hvidovre University Hospital	Prospective cohort study	09/2002 to 07/2004	487	126 / 361	82 (range 75–88)	Hip fracture (medial, pertrochanteric, Subtrochanteric)	Time to surgery (within 24h of admission) Time to mobilisation (day 1, 2, 3 postop) Mobilisation (walking independently, with human assistance, unable to walk, hours out of bed) Nutritional status (anaemia) Pre fracture functional status ASA classification Comorbidities Length of hospital stay 30-day mortality	3
Siu 2006 a (82) USA	Four hospitals in the New York	Prospective cohort study	1997 to1998	532	96 / 436	Median: 83	Hip fracture (intertrochanteric, femoral neck displaced and nondisplaced)	Residential status Dementia Functional Independence Measure RAND comorbidity score Abnormal clinical findings Anaesthesia approach Pain assessment Urinary catheter Time to surgery from arrival Time to mobilisation from surgery Mortality at 6 months	2
Siu 2006 b (83) USA	Four hospitals in the New York metropolitan area	Prospective cohort study	1997 to1998	554	102 / 452	82 (±8.7)	Hip fracture (intertrochanteric, femoral neck displaced and nondisplaced)	Time to surgery from admission (≤24, >24, ≤48, >48, (≤72, >72 h) Abnormal clinical risk assessment (minimally or markedly abnormal findings) Anticoagulation (timing and regimen) Antibiotic prophylaxis Urinary catheter removal (postop day 1, 2,3)	3

								Mobilisation to or beyond chair (within first 3 postop days) Physical therapy (within first 3 postop days) Pain assessment and relief Preadmission residence Pre-fracture locomotion Functional status (FIM scale) Dementia Comorbidity score QoL Readmission Mortality Use of restraints Duration of hospitalisation	
Foss 2005 (84) Denmark	Single - Hvidovre University Hospital, Copenhagen, Denmark	Prospective cohort study	09/2002 to 07/2003	300	79 / 221	83 (range: 73 – 87)	Hip fracture (Cervical, pertrochanteric, subtrochanteric)	Mobility score Dementia Residential status ASA grade Time to admission Time to surgery Reasons for surgery delay Pre and post op analgesia Anaesthesia type Antibiotic prophylaxis Discharge destination Length of hospital stay Mortality (in hospital, 30 day) Complications	2
Moran 2005 (85) UK	Single hospital	Prospective cohort study	08/05/1999 to 07/05/2003	2,903	684 / 2219	80 (range 17 to 103)	Hip fracture (femoral neck)	Time to surgery (day1 to 10 post admission) Medical comorbidities Mortality (30-day, 90-day, 1 year) Complications	1
Heikkinen 2004 (86) Finland	Six Finnish hospitals	Prospective cohort study	08/1997 to 02/2001	1,179	334 /845	78.9 (range 50.3 to 102.4)	Hip fracture (basi, displaced and nondisplaced cervical, trochanteric and subtrochanteric)	Residential status (pre fractures, at discharge and 4 month follow up) Walking ability (pre fractures, at discharge and 4 month follow up) ASA grade Time to surgery Duration of hospitalisation	4

								Pain assessment (at 4 month follow up) Mortality (at 4 and 12 months) Reoperations Centre effect	
Orosz 2004 (87) USA	Four hospitals in the New York metropolitan area.	Prospective cohort study	07/1997 to 12/1999	1178	229 / 949	82	Hip fracture (femoral neck)	Delirium Residential status FIM locomotion score Comorbidities Time to surgery (≤24h, >24h) Mobility assessment Pain assessment Postop complications Length of hospital stay Mortality	2
Pemrod 2004 (88) USA	Four hospitals in the New York City area	Prospective, multisite observational study	08/1997 to 08/1998	443	80 / 363	81.4 (± 8.7) (range 53 to 101)	Hip fracture (femoral displaced and nondisplaced, intertrochanteric)	Residential status (pre fracture, at discharge and at 2 and 6 month follow up) Locomotion (FIM score): pre fracture, in hospital and at 2- and 6-months post fracture Mobilisation ("early physical therapy"-sessions between day of surgery and POD3, "Late PT" -therapy sessions from POD4 to 4 weeks and from 4 weeks to 8 weeks post admission and length of therapy program POD4 to 8 weeks) Time to surgery (<24h of admission) Comorbidity score (RAND) Acute Physiology and Chronic Health Evaluation Severity score Dementia New impairments at discharge Readmissions (before 2 months and between 2- and 6-months post fracture)	2

								Duration of hospitalisation Mortality	
Elliott 2003 (89) Ireland	Multiple - Belfast City and Royal Victoria hospitals	Prospective cohort study	01/11/1997 to 31/10/1999	1780	415 /1365	≥ 65 years	Hip fracture (neck of femur)	~~Marital status~~ Townsend deprivation score Barthel score Mental test score ASA score Time to surgery (<1d, 1- <3d, 3- <5d, 5- <10d, >10d) Mortality	2
Todd 1995 (90) UK	Eight hospitals in East Anglia	Prospective cohort study/ audit	NR	580	114 / 466	80.3 (± 10.4) (range 78.6 to 81.5)	Hip fracture (intra and extracapsular)	Residential status ADL score Clinical problems at admission Anaesthesia (general) Prophylactic antibiotics Anticoagulant prophylaxis Time to surgery (<24h, >24h of admission) Who conducted surgery (senior registrar or consultant) Time to mobilisation (day 1, 2, 3 post op) Length of hospital stay Complications Pressure ulcer risk assessment Revision surgery Mortality at 90 days	1
Zuckerman 1995 (91) USA	Single hospital	Prospective cohort study	01/01/1988 to 31/12/1990	367	76 / 291	≥ 65 years	Hip fracture (femoral neck, intertrochanteric)	Time to surgery (early – within 2 calendar days and delayed – after ≤ 3 calendar days from admission to the hospital) Preexisting medical conditions ASA grade Complications Mortality (within first year of fracture)	3
Parker 1992 (92) UK	Single centre (Peterborough District Hospital)	Prospective cohort study	NR	468	80 / 388	81	Hip fracture (proximal femoral fractures)	Time to surgery from injury: early (<24h, 24 – 47h) late (48 -72h, >72h) Time to surgery from admission: early (<24h, 24 – 47h) late (48 -72h, >72h)	1

								Mobility score Mental test score ASA grade ~~Pre fracture residential status~~ Pressure ulcer risk assessment Delirium/Confusional state Complications (infections and DVT) Mortality (at 30 days and 1 year)	
Davis 1988 (93) UK	The Sunderland General Hospital and Dryburn Hospital, Durham	Prospective cohort study	06/1983 to 05/1985	230	40 / 190	80.6 (±9.9)	Hip fracture (intertrochanteric)	Mental test score Mobility (pre fracture and postop) Time to surgery (<48h, 48-96h, >96h) Complications (wound, UTI and chest infections) Mortality Pressure ulcer risk assessment	1

Table viii. Retrospective cohort studies investigating performance indicators in hip fracture care.

Author, year, country of study	No of study sites	Study design	Study period	Number of participants	Gender (M/F)	Age	Fracture type	Performance/proxy performance indicators investigated	Study quality assessment score (out of 5)
Parola 2023 (94) USA	Single hospital	Retrospective cohort study	01/10/2014 to 01/03/2020	1,538	465 / 1073	81 (±10)	Hip fracture (femoral neck, intertrochanteric, or periprosthetic)	Insurance type Race (White v/s non white) Deprivation index BMI Charlson comorbidity Index STTGMA trauma risk score Mortality (in patient, 30 day & 1 year) Time to surgery (from hospital presentation to surgery) Complications ICU admission Discharge destination (home, skilled nursing home, Acute rehab facility)	3
Walsh 2023 (95) Ireland	16 hospitals from the Irish Hip Fracture Database (IHFD)	Retrospective cohort study	01/2016 to 12/2020	14,951	4,425 / 10,526	80.6 (±8.8)	Hip fracture (intracapsular, extracapsular)	ASA grade Time to surgery Anaesthesia type Mobility (pre fracture) Transfer from other hospital Presentation time/day Medical assessment (pre op) Treated by (consultant anaesthetist) Surgical seniority involved in treatment Hospital level factors	3
Colais 2022 (96) Italy	National Outcomes Evaluation Programme (PNE), Italy	Retrospective cohort study	2010 to 2020 (exact dates NR)	74,323	NR	> 65 years	Hip fracture (no further details)	Time to Surgery (within 48 hours of fracture) Geographic variation	2

Condorhuaman-Alvarado 2022 (97) Spain	Spanish National Hip Fracture Registry	Retrospective cohort study	01/2017 to 05/2017 and 01/2019 to 12/2019	10,711	2550 / 8,161	87 (±5.6) [range:75-106]	Hip fracture (fragility, intra/extracapsular)	Time to surgery (within 48 h) Time to mobilization (first postoperative day) Anti-osteoporotic medication prescription (at pre-fracture & at discharge), Calcium supplements prescription (pre-fracture & at discharge) Vitamin D supplements prescription (pre-fracture & at discharge) Functional status (pre-fracture) Pressure ulcers (during hospitalization) Independent mobility (at 30 days) Mortality (in hospital and at 30 days post-surgery) Readmission (at 30-day post fracture) Reoperation (at 30 days post fracture) Destination (at discharge & at 30-day post discharge)	4
Denis 2022 (98) Canada	Single hospital	Retrospective cohort study	NR	109	35 / 72	80.1 (±9.6)	Hip fracture (proximal femoral fractures)	Time to surgery (< 24 & 48 hours) ASA Score Charlson Comorbidity Index Emergency Triage Priority Patients on oral anticoagulant Duration of hospitalisation Discharge location Mortality	3
Fisher 2022 a (99) USA	Single centre	Retrospective cohort study	01/10/2014 to 01/03/2020	1,044	313 / 731	80.2(±10.8)	Hip fracture (AO/OTA 31A, 31B, 32A-C)	Body mass index Charlson Comorbidity Index Ambulatory status STTGMA score Time to surgery	4

								Duration of hospitalisation Mortality (in patient & at 1 year) Complications Comorbidities Discharge destination Readmission (30- & 90-days post-surgery) Weight bearing assessment Ambulation distance (at admission & on days 1 to 5 after surgery)	
Goubar 2022 (100) UK	UK Physiotherapy Hip Fracture Sprint Audit data linked to hospital records	Retrospective cohort study	01/05/2017 to 30/06/2017	5,177	1,395 / 3,782	Median: 84 (IQR: 78–89)	Hip fracture (intracapsular, intertrochanteric, subtrochanteric)	Ethnicity Deprivation index ASA grade Charlson Comorbidity Index Ambulation assessment (pre fracture and post-surgery) Day of admission Duration of hospitalisation Time to surgery (within 36 h) Time to mobilisation Type and duration of physiotherapy ~~Residential status (pre fracture)~~ Anaesthesia type Hospital Frailty Index	3
Neumann 2022 (101) (German) Germany	Multiple clinics in North Rhine-Westphalia	Retrospective cohort study	2007 to 2008 and 2017 to 2018 (exact dates NR)	61,249	17,362 / 46,879	82.5	Hip fracture (proximal femoral, pertrochanteric fractures)	Hospital duration (pre & post-surgery) Time to surgery (from Hosp admission) Year / period of surgery Day of admission Comorbidities Surgery duration Complications (general & surgical) Infections Mortality (in patient)	4
Siow 2022	Single centre	Retrospective cohort study	2018 to 07/2021	1,678	NR	NR but repot that they	Hip fracture (neck of femur,	Time to admission Time to anaesthesia	1

(102) Singapore						included a small proportion of younger patients (<60 years) who did not have an orthogeriatric review due to an age cut-off but still suffered complex issues and uncontrolled pain	intertrochanteric or subtrochanteric fractures)	Anaesthesia consults (<24 h) Patients seen (within 48, 72 h) Time to surgery (< 48h from ED registration to start of surgery) Critical care review and ICU admission Mortality (within 10 days of operation, in hospital mortality, 6-month and 12-month) Hospital duration	
Walsh 2022 (103) Ireland and Denmark	National (Irish and Danish) Hip fracture databases	Retrospective cohort study	Ireland: 01/01/2017 to 31/12/2020 and Denmark: 01/01/2016 to 31/12/2017	25,828 [Ireland (n=12,904), Denmark (n=12,924)]	7,892 / 17,936	Median: 82.5 (IQR 76–89)	Hip fracture (intracapsular, intertrochanteric or subtrochanteric)	~~Residential status (pre fracture)~~ Mobility (pre fracture) Comorbidity level Mobility (at discharge) Nutritional risk assessment Time to surgery (< 36 h) Time to mobilisation (< 24 h of surgery) Falls risk assessment Bone health assessment Hospital duration (> 7 days) Mortality (7, 14-day mortality)	4
Wurdemann 2022 b (104) Netherlands	National Dutch Hip Fracture Audit (DHFA)	Retrospective (Audit) cohort study	01/01/2016 to 31/12/2020	60,202	20,107 / 40,095	Median: 82 (IQR 73 – 88)	Hip fracture (dislocated/un-dislocated femoral neck, trochanteric AO-A1-3 and sub trochanteric)	Living setting (pre fracture & at 3 month follow up) Mobility score (pre fracture & at 3 month follow up) KATZ6-ADL (pre fracture & at 3 month follow up) Dementia Osteoporosis assessment Malnutrition scores in hospital Specialty of clinician involved	3

								ED ward duration Operation date and time ASA score Anaesthesia type Geriatric assessment Complications (at admission) Mortality (in hospital, at 3 months & 1 year) Consultations (at admission, at 3 months post discharge) Reoperation (within 3 months) Time to surgery (< 48 h) Orthogeriatric co-management (in ≥70-year-old)	
Farrow 2021 (105) UK	UK National Hip Fracture Audit Database (NHFD)	Retrospective cohort study	01/01/2018 to 31/12/2018	66,578	NR	NR	Hip fracture (no further details)	Time to surgery Duration of hospitalisation (acute and overall) Mortality (30 days) Discharge to original residence (within 120 days) Proportion of patients who met the Best Practice Tariff	4
Goubar 2021 (106) UK	UK National Hip Fracture Database (NHFD)	Retrospective cohort study	01/01/2014 to 31/12/2016	126,897	34,933 / 91,962	Median: 84 (IQR: 77 to 89)	Hip fracture (intracapsular, intertrochanteric, subtrochanteric)	Ethnicity Deprivation index Ambulation assessment (pre fracture and post-surgery) Day of admission Year of surgery Hospital volume ASA grade Comorbidities Dementia assessment ~~Residential status (pre fracture)~~ Time to mobilisation Mortality (at 30 days from fracture)	3
Hassan 2021 (107)	Single – tertiary care referral private	Retrospective cohort (nested	01/2010 to 12/2018	911	Cases: 25 / 23	≥50	Hip fracture (Neck of Femur,	Time to surgery (within 48 h, >48 h from ED)	3

Pakistan	university hospital	case control) study		(Cases: 48, control: 863)	Control: 327 / 536		intertrochanteric, subtrochanteric)	~~Mechanism of injury (low, high energy fall)~~ Anaesthesia type (GA, regional) Procedure type (elective, emergency) Charlson Comorbidity Index Ambulation status at discharge (FWB, NWB) Mortality ICU admissions	
Haslam-Larmer 2021 b (108) Canada	Single - large tertiary care centre located in Toronto, Ontario.	Retrospective cohort study	01/04/2016 to 31/03/2017	77	22 / 55	85.3 (± 8.7)	Hip fracture (Femoral head/neck, trochanteric)	~~Pre fracture residence~~ Functional status Dementia / delirium assessment Anaesthetic approach Time to mobilisation (within 24 h of surgery)	3
Kristensen 2021 (109) Denmark	DMHFR	Retrospective cohort study	2007 to 2016 (exact dates NR)	60,275	16,780 / 43,495	>65	Hip fracture (femoral fractures (ICD-10 codes: medial (S720), pertro- chanteric (S721) or subtrochanteric (S722))	Pain assessment Time to mobilisation (<24 h postoperatively) Nutrition risk assessment Anti-osteoporotic medication Fall prevention Rehabilitation (post discharge) Functional level assessment (at admission & at discharge) Time to surgery (< 24 & <36 hrs) Preoperative optimisation Charlson comorbidity index ~~Education~~ ~~Family income~~ ~~Migration status~~ ~~Cohabiting status~~ ~~Employment status~~ ~~Residential status~~ Type of municipality Patient-related healthcare disparities (best/worst of patients)	4

Lieten 2021 (110) Belgium	Single hospital	Retrospective cohort study	2014 to 2017 (exact dates NR)	840	240 / 600	80.6 (±12.2)	Hip fracture (sub capital, per-sub trochanteric)	~~Residential status (preadmission)~~ Time to admission Time to surgery (< 24 v/s > 24 hours after admission) Hospital duration (admission to discharge) Mortality (inpatient & at the end of data collection from the date of surgery) 4-year survival (from discharge & date/year of surgery) Complications Reasons for delayed surgery	3
Shah 2021 (111) UK	National Hip Fracture Database	Retrospective cohort study	01/01/2017 to 31/12/2017	68, 977	20,179 / 48,798	82.7 (range: 60–109)	Hip fracture (intracapsular, intertrochanteric, subtrochanteric)	Time to surgery (<36 h of presentation) Variation in day and time of presentation ASA grade Preinjury mobility	3
Sheehan 2021 (112) UK	Data from UK National Hip Fracture Database	Retrospective cohort study	01/01/2014 to 31/12/2016	133,319	36,316 / 97,001	84 (range: 77–89)	Hip fracture (Intracapsular, Intertrochanteric, Subtrochanteric)	Ethnicity Deprivation index Pre fracture ambulation Time to surgery (within 36 h of admission) ASA grade Comorbidities ~~Pre fracture residence~~ Dementia assessment Delirium assessment Mortality Time to mobilisation (within 36-h of surgery) ~~Pre fracture ambulation~~	3
Voeten 2021 (113) Netherlands	Five hospitals participating in the Dutch Hip Fracture Audit (DHFA)	Retrospective cohort study	01/01/2018 to 31/12/2018	1,351	426 / 943	84 (± 7.1)	Hip fracture (dislocated & non dislocated femoral neck fractures, intertrochanteric AO – A1-3 and subtrochanteric)	ASA score Dementia Katz-6 Activities of daily living (ADL) Living situation Nutrition assessment Time to surgery (surgery within 24 h) Orthogeriatric management (during admission)	4

								Operation by an orthopaedic trauma certified surgeon Complications Mortality (in hospital) Hospital duration	
Walsh 2021 (114) Ireland	16 Irish hospitals participating in the Irish Hip Fracture Standards/ database (IHFS/D)	Retrospective (Audit) cohort study	01/01/2013 to 31/12/2018	17,983	5,395 / 12,588	≥60	Hip fracture (due to injury (ICD-10-AM S72.00 to S72.2) or. displaced/undisplaced, intracapsular, intertrochanteric or subtrochanteric. fractures)	~~Residential status (pre fracture)~~ ASA grade Discharge destination Trauma type Previous fracture history Comorbidity (pre op) Anaesthesia type Time to surgery (< 48 h) Reason for surgery delay beyond 48 h Time to mobilisation (on day or day after surgery) Mobility initiation (by physiotherapist) Reoperation (within 30 days) Adherence to Irish hip fracture standards Assessed by a geriatrician Bone health assessment Falls assessment Functional mobility (pre op) Cumulative ambulatory score (post op weight bearing) Hospital duration Mortality (in hospital)	3
Cohen-Kadosh 2020 (115) Israel	Administrative data from orthopaedic wards of 20 acute care hospitals	Retrospective cohort study	NR	2,500	NR	NR	Hip fracture (femoral neck, intracapsular and extracapsular fractures)	Pre-op Charlson comorbidity score Time to surgery (< 48 & >48 hours) Use of drain (for 1 day) Wound infection (within 365 days post-surgery) Mortality (within 365 days post-surgery)	1
Farrow 2020	SHFA national database	Retrospective cohort study	01/2014 to 04/2018	15,351	3,670 / 11,681	≥50	Hip fracture (no further details)	"Big 6" (analgesia, early warning score, pressure	4

(116) Scotland								area assessment, fluid assessment, bloods taken, cognitive assessment) completed in ED Time in ED (>4 hours) All inpatient assessment bundle (completed within 24 h) Fasting from oral fluids (for >4 hours) Repeated fasting Time to surgery (>36 h from admission) Comprehensive geriatric assessment (performed within 3 days of admission) Time to mobilisation (>24 hrs) Physiotherapy assessment (performed after second postoperative day) Occupational therapy review (performed after third postoperative day) Duration of hospitalisation	
Ferrara 2020 (117) Italy	Gruppo Italiano di Ortogeriatria (GIOG) database with data from 14 hospitals	Retrospective cohort study	01/02/2016 to 31/07/2018	3,017	694 /2323	86 (median) IQR (80-90)	Hip fracture (Intracapsular, Inter-trochanteric, Sub-trochanteric and other)	Pre-surgery cognitive assessment Time to surgery (≤48 h from fracture) Protein supplementation (day after surgery) Removal of urinary catheter (day after surgery) Delirium assessment (day after surgery) Physiotherapy (day after surgery) Skin lesions assessment (at discharge) Duration of hospitalisation Bone protection (at discharge)	1

								Discharge destination (to rehabilitation)	
Kristensen 2020 (118) Denmark	DMHFR	Retrospective cohort study	2006 to 2018 (exact dates NR)	86,561	24,844 / 61,717	Median 84	Hip fracture (femoral neck, pertrochanteric, subtrochanteric)	Pain assessment Time to mobilisation (<24 h postoperatively) Nutrition risk assessment Anti-osteoporotic medication Fall prevention Rehabilitation (post discharge) Functional level assessment (at admission) Surgical delay (2006 to 2015: < 24 hrs from admission time, 2016 to 2018: < 24 hrs from arrival time) Time to surgery (< 24, 24-48, >48 hrs) Preoperative optimisation Mortailty (30 days from surgery date) Reoperation (alloplastic, osteosynthesis or deep infection within 2 years of surgery) Readmissions (within 30 days after discharge) Residential status ASA score Charlson comorbidity index (2010 onwards) BMI (2010 onwards) Alcohol intake (2006 to 2009) Smoking habits (2006 to 2009)	4
Maxwell and Mirza 2020 (119) USA	US national hip fracture NSQIP PUF database	Retrospective cohort study	2016 to 2017 (exact dates NR)	19,896	6,107 / 13,789	Median:82 (IQR:69-89)	Hip fracture (femoral neck, intertrochanteric & subtrochanteric, other)	Admission year Time to admission (>48 hours prior to surgery) Ethnicity Smoking status Comorbidities Pre fracture medication use	4

								Functional status Delirium assessment (preop) Blood transfusion (preop) Renal failure (preop) Coagulopathy (preop) ASA physical status Complications Emergency surgery Standardised Hip fracture program participation Mortality (undefined 30 day) Hospital duration (postop) Bone protection prescription DVT prophylaxis prescription Time to mobilisation (weightbearing on postop day 1) Residential status (at 30 days)	
Nayar 2020 (120) USA	National Surgical Quality Improvement Program database (NSQIP)	Retrospective cohort study	01/2011 to 12/2017	58,456	16, 363 / 42,093	84 (IQR: 77 – 89)	Hip fracture (femoral neck, intertrochanteric, peritrochanteric, or subtrochanteric)	Ethnicity Time to surgery (from hospital presentation) Charlson comorbidity index Complications (perioperative) Mortality (perioperative)	4
Aprato 2019 (121) Italy	Two level I trauma centres	Retrospective cohort study	01/01/2017 to 31/12/2017	660	235 / 423	84 (range 78.8–88.0)	Hip fracture (femur fracture, basicervical, subtrochanteric, pertrochanteric, subcapital and transcervical)	Time to surgery (early: within 48 h or delayed:(>48 h) Time to mobilisation (Physio start/1st walking day) Duration of hospitalisation Mortality (in hospital)	3
Asanuma 2019 (122) Japan	12 acute care hospitals	Retrospective cohort study	2005 to 2015 (exact dates NR)	1,247	259 / 988	Mainly ≥ 65 97 (7.8%) < 64 years	Hip fracture (femoral neck, trochanteric)	Time to mobilisation (rehab at admission, pre-operative, daily/weekend & self-exercise) Comorbidities	3

								Functional status Duration of hospitalisation	
Beaupre 2019 (123) Canada	Discharge Abstract Database (DAD), the National Ambulatory Care Reporting System (NACRS) and the Alberta province Patient Registry	Retrospective cohort study	01/04/2008 to 31/03/2015	11,996	3584 / 8412	79.6 (± 11.2)	Hip fracture (international Classification of Disease Version 10 (diagnosis codes [ICD10-CA] S720, S721, S722)	Time to surgery (<24, 24-36, 36-48 and ≥48 hours) Mortality (at 30- and 90-days post-fracture) Charlson comorbidity score Interaction between time to surgery and age	4
Condorhuaman-Alvarado 2019 (124) Spain	The Spanish National Hip Fracture Registry or Registro Nacional de Fractura de Cadera RNFC)	Retrospective cohort study	01/2017 to 05/2017	3,071	NR	NR	Hip fracture (no further details)	Time to surgery (within 48 h) Time to mobilization (first postoperative day) Anti-osteoporotic medication prescription (at discharge), Calcium supplements prescription (at discharge) Vitamin D supplements prescription (at discharge) Pressure ulcers (during hospitalization) Independent mobility (at 30 days)	1
Kristensen 2019 b (125) Denmark	DMHFR	Retrospective cohort study	01/03/2010 to 31/11/2013	20,458	5899 / 14559	>65	Hip fracture (including medial, pertrochanteric or subtrochanteric femoral fractures)	Residential status BMI Charlson Comorbidity Index Setting & volume (orthopaedic v/s orthogeriatric units) Ethnicity Mortality (30 days from admission) Costs (from day of admission to 1-year follow-up)	4

								Pain assessment (at admission & at 1 year follow up) Time to mobilisation (<24 h postoperatively) Mobility assessment (at admission, and at 1 year follow up) Rehabilitation programme (at admission, and at 1 year follow up) Anti-osteoporotic medication (at admission, and at 1 year follow up) Fall prevention (at admission, and at 1 year follow up) Outpatient services costs Bed day costs Therapy Further treatment costs Further diagnostic costs Surgery & anaesthesia costs Radiology costs	
Whitaker 2019 (126) UK	Single trauma unit in UK	Retrospective cohort study	04/2011 to 12/2015	1,354	NR	83.15 (range 60.1 – 102.5)	Hip fracture (neck of femur)	Residential status (pre fracture & at 1 year follow up) Mobility status (pre fracture & at 1 year follow up) ASA grade Mortality (at 1 year follow up) Time to surgery (<36h to the start of anaesthesia from arrival to ED or from diagnosis if in patient) Time to Orthogeriatric review (<72h of admission) AMTS assessment (pre & post op) Bone protection Falls assessment	3

Cuesta-Peredo 2018 (127) Spain	Single hospital	Retrospective cohort study	01/01/2012 to 31/12/2016	1,571	408 / 1163	84.15 (± 6.28)	Hip fracture (Intracapsular, extracapsular, other)	Time to surgery Comorbidities Charlson score Delirium assessment ER admissions Adverse events Infections Duration of hospitalisation Mortality Costs	3
Farrow 2018 (128) Scotland	Scottish National Hip Fracture Audit (SHFA) database	Retrospective cohort study	01/2014 to 09/2014	1,162	315 / 847	≥50	Hip fracture (no further details)	Time in ED (< 2 hours) Analgesia offered in the ED "Big-6" bundle (analgesia, vital signs, fluid optimization, laboratory blood tests, cognition assessment, and pressure area assessment completed in ED) Inpatient assessment bundle (falls risk, nutrition, cognition, and pressure area assessment completed within 24 hours) Comprehensive geriatric assessment (within 48 hours) Fasting from food (for ≤10 hours) Fasting from fluids (for ≤4 hours) Time to surgery (within 48 hours if medically fit) No routine urinary catheterization Physiotherapy input (by first postoperative day) Occupational therapy (input by third postoperative day) Duration of hospitalisation	4

								Discharge planning (commenced within 48 hours of admission) Discharge destination Mortality (at 30 and 120 days postadmission) ~~Residence prior to admission~~	
Kempenaers 2018 (129) Belgium	Single centre	Retrospective cohort study	01/01/2009 to 01/07/2017	2,573	783 / 1790	Median: 82 (IQR:74–87)	Hip fracture (Acute (AO/OTA type 31 hip fracture)	ASA score Time to surgery (with 12, 12 to ≤ 24, 24 ≤ 36, 36 ≤48, 48 ≤72 and >72 h) Duration of hospitalisation Mortality (undefined 30 and 90 days) Readmissions Healthcare costs	4
Sobolev 2017 (130) Canada	Canadian Institute for Health Information database containing data of all Canadian hospitals, except for the province of Quebec.	Retrospective cohort study	01/01/2004 to 31/12/2012	153,917	40,934 / 112,965	≥65	Hip fracture (transcervical, petrochanteric, subtrochanteric)	Comorbidities ~~Preadmission residence~~ Admission time (working hours, after hours, weekend) Year of surgical treatment Transfer history Time to surgery (within first or next day) Hospital type (teaching, community) Hospital case volume Hospital duration 30-day mortality post-surgery	2
Kristensen 2016 & 2017 (131, 132) Denmark	DMHFR	Retrospective cohort study	01/03/2010 to 31/11/2013	25,354	7288 /18066	>65	Hip fracture (including medial, pertrochanteric or subtrochanteric femoral fractures)	Residential status BMI Charlson Comorbidity Index Time to surgery (undefined <24, 24-48, >48 hrs) Setting & volume (orthopaedic v/s orthogeriatric units) Pain assessment Time to mobilisation (<24 h postoperatively)	4

								Mobility assessment (at admission & at discharge) Post discharge rehabilitation programme Anti-osteoporotic medication Fall prevention Mortality (30 days from admission) Hospital duration Readmission (within 30 days of discharge)	
Ferguson 2016 (133) Scotland	Scottish Hip Fracture Audit & MSK Hip Fracture Audit	Retrospective cohort study	2003 to 2008 and 4 months in 2013	31,400	7783 / 23,617	80	Hip fracture (no further details)	Residential status (pre fracture and 30 days post discharge) Pre fracture mobility ASA grade (at admission) Duration of A&E stay Time to Theatre (within 48 h) Duration of hospitalisation Discharge destination (from acute/ortho care) Mortality (30- & 120-days post discharge)	3
Kristensen 2016 a (134) Denmark	Public hospitals in Denmark - DMHFR	Retrospective cohort study	01/03/2010 to 30/11/2011	11,461	3271 / 8190	>65	Hip fracture (femoral neck, pertrochanteric and subtrochanteric)	~~Residential status (pre fracture)~~ BMI Charlson Comorbidity Index Pain assessment Time to mobilisation (<24 h postoperatively) Mobility assessment Post discharge rehabilitation programme Anti-osteoporotic medication Fall prevention Mortality (30 days from admission)	4

								Quality of in-hospital care (orthopaedic v/s orthogeriatric units)	
Kristensen 2016 b (135) Denmark	Data from DMHFR linked with data from Danish National Registries	Retrospective cohort study	01/03/2010 to 30/11/2013	25,305	7,269 / 18,036	>65	Hip fracture (femoral neck, pertrochanteric and subtrochanteric fractures)	BMI Charlson comorbidity index ~~Marital status~~ Residential status Domicile region (in Denmark) Admission year Hospital region Unit type (ortho/geriatric) Unit volume Day of admission Pain assessment Early mobilisation Basic mobility assessment (at admission & at discharge) Rehab plan conducted Osteoporotic prophylaxis Falls assessment Received all relevant processes of care Surgical delay (>48 hrs from time to admission) Mortality (within 30 days of admission)	4
Metcalfe 2016 b (136) USA	Multicentre (all acute hospitals in California)	Retrospective cohort study	2007 to 2011 (exact dates NR)	91,401	25,750 / 65,206	81.7 (± 8.3)	Hip fracture (neck of femur)	~~Ethnicity~~ Payment source Day of admission Charlson Index Annual hospital case volume Hospital bed size Trauma centre level Setting (rural/urban) Hospital type (teaching, non-teaching) Time to theatre Hospital duration Discharge destination Mortality (In hospital) Post op complications Readmissions (within 30 days of discharge)	4

Neufeld 2016 (137) Canada	American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) hospitals	Retrospective cohort study	01/01/2005 to 31/12/2013	26,066	7,346 / 18,707	≥60	Hip fracture (femoral neck, peritrochanteric, intertrochanteric, subtrochanteric fractures)	Ethnicity BMI ASA score Comorbidities Functional health status Time to surgery (within 36 hours or on post-admission day 0 or 1) Mortality (in hospital & at 30 days postop) Complications (post op) Met NICE benchmark Hospital duration	4
Buja 2015 (138) Italy	Administrative data collected in the Veneto Region	Retrospective cohort study	01/2012 to 12/2012	5,643	1.276 / 4.367	82.7 (range 65-100)	Hip fracture (ICD-9-CM codes 820.0–820.9)	Time to surgery (within 48 hours) Social determinants	4
Colais 2015 (139) Italy	Hospital Information System (HIS) in Italy	Retrospective cohort study	01/01/2007 to 31/12/2012	359,529	78357 / 281152	65-100	Hip fracture (ICD-9-CM diagnosis codes 820.0–820.9 in any position)	Time to surgery (within 48 hours) Comorbidities Mortality (within 6- & 12-months post-surgery)	4
Dinamarca-Montecinos 2015 (140) (Spanish) Chile	Single hospital	Retrospective cohort study	01/01/2010 to 31/12/2012	647	154 / 493	80.8	Hip fracture (femur neck, pertrochanteric and subtrochanteric)	Time to surgery Mortality (in hospital & at 1 year) Comorbidities Seasonality of fracture occurrence Duration of hospitalisation Anti-osteoporotic medication Other medication	2
Hawkes 2015 (141) UK	Single hospital	Retrospective cohort study	05/2012 to 04/2013 and 01/2014 to 06/2014	541	NR	≥ 65	Hip fracture (fragility neck of femur)	Time to theatre (< 36 h of admission) Day, time & month of admission Time to orthogeriatric assessment (<72 h of admission) MDT assessment Falls assessment Bone protection medication review AMMT assessment (pre & post-surgery)	2

								BPT uplift award assessment Hospital duration	
Desai 2014 (142) Canada	Single Level 1 trauma centre	Retrospective cohort study	2005 to 2012 (exact dates NR)	890	240 / 650	≥60	Hip fracture (proximal femur, femoral neck, intertrochanteric, subtrochanteric)	Time to transfer/admission Time to surgery Comorbidities Readmission Complications Duration of hospitalisation Mortality (in hospital)	4
Kristensen 2014 (143) Denmark	individual-level record link data from 3 nationwide Danish medical registries	Retrospective cohort study	01/03/2010 to 30/11/2011	12,065	3436 / 8629	≥65	Hip fracture (femoral neck, pertrochanteric and subtrochanteric)	~~Residential status (pre fracture)~~ BMI Charlson Comorbidity Index Hospital duration Hospital patient volume Pain assessment Time to mobilisation (<24 h postoperatively) Mobility assessment Post discharge rehabilitation program Anti-osteoporotic medication Fall prevention Mortality (30 days from admission) Quality of in-hospital care (orthopaedic v/s orthogeriatric units)	3
Khan 2013 a (144) UK	Single hospital	Retrospective cohort study	12/2008 to 05/2011	663	175 /488	82 (range 65–100)	Hip fracture (neck of femur fractures)	ASA Diagnostic interval = diagnostic delay Admission interval Admission delay Surgical interval Surgical delay Operated within 36 h Mortality (at undefined 90 days)	2
Uzoigwe 2013 (145) UK	Single centre	Retrospective cohort study	02/2008 to 05/2011	2,056 (includes 94 non-operated patients)	572 / 1484	81 (range 21 - 105)	Hip fracture (neck of femur fractures - a fracture occurring anywhere between the	ASA score Surgery type Residential status Discharge destination Mortality	3

							base of the head of the femur and 5 cm below the lesser trochanter, consistent with BOA/BGS definitions)	Time to surgery (< 12, <24, <36, <48, <60, <72h after admission) Fracture in hospital v/s at home *TTS effect & outcome compared with 8 other studies Hospital duration	
Patel 2013 (146) England	Single centre	Retrospective cohort study	07/2009 to 07/2010	372	104 / 268	85 (range 33–101)	Hip fracture (intracapsular and extracapsular fractures)	Time to surgery < 36 h Admitted under joint geriatric/orthopaedic care Using an agreed multidisciplinary protocol Assessed by a geriatrician < 72 h Postoperative multi-professional rehabilitation team Fracture prevention assessments (falls/bone health)	4
Jakma 2012 (147) Netherlands	Single hospital	Retrospective cohort study	01/2003 to 12/2006	941	285 / 856	80 (range 14 - 101)	Hip fracture (no further details)	Time to surgery (within 24 hr after admission) reoperations Mortality (at 1 year after surgery)	4
Kumar 2012 (148) UK	Single hospital.	Retrospective cohort study	08/2009 to 02/2011	146	36 / 110	77 (± 10.5)	Hip fracture (neck of femur)	ASA score Preop care (ECG, chest X-ray, analgesia in ED) IV fluids (within 6 hrs) Pressure care assessment Preop orthogeriatric review Time to surgery (< 24, 24-48, >48 hrs) Mortality (undefined within 30 days) Hospital duration	2
Pérez Verdún 2012 (149)	Single hospital	Retrospective cohort study	16/09/2009 to 22/09/2010	77	24 / 53	80.79 (± 7.60) (range 64-98)	Hip fracture (no further details)	Cognitive assessment (pre fracture) Language impairment Usual medical treatment Hospital duration (pre & post intervention)	1

(Spanish) Spain								Initial/diagnostic assessments Time to surgery Time to mobilisation / physiotherapy Hospital physio days Hospital Care Satisfaction Survey Functional assessments Mortality (in hospitals and 6 months from hospital admission) Mobility assessments Discharge destinations	
Koren-Hakim 2012 (150) Israel	Single hospital	Retrospective cohort study	11/2007 to 10/2009	215	61 / 154	83.5 (±6.09) (range 66 - 104)	Hip fracture (pertrochanteric, sub-capital and subtrochanteric fractures)	~~Residential status (pre fracture)~~ Charlson Comorbidity Index Cumulative illness rating scale for geriatrics Comorbidities assessment BMI Nutritional risk assessment Discharge destination Time to operation Hospital duration Complications Readmissions (within 6 months) Mortality (in hospital & up to 36 months) Functional ability assessment Cognitive assessments	2
Taylor 2012 (151) UK	Single urban UK hospital	Retrospective cohort study	05/2010 to 07/2010	185	53 / 132	81.3	Hip fracture (neck of femur)	Pain assessment and management (analgesia - time and type) Medical assessment Time spent in ED, before transfer to a ward (<2h, <4h) Dementia Pressure-ulcer risk-assessment	2

Fergus 2011 (152) New Zealand	Single - Auckland City Hospital	Retrospective cohort study	01/04/2007 to 31/08/2007	115	26 / 89	85 (range 67–100)	Hip fracture (intra and extracapsular)	Comorbidity assessment ASA scores Time from fracture to admission (<24h from injury) Time from admission to surgery (<24 h, 24–48 h, 49–72 h, >72 h) Length of hospital stay Mortality Post op complications Living situation (preinjury and at discharge) Mobility (at admission and at discharge) Activities of daily living (ADLs) DVT prophylaxis Osteoporosis assessment and treatment Discharge destination	2
Egerod 2010 (153) Denmark	National multi centre audit of hospital charts from each hospital treating ≥ 50 hip fracture patients per year	Retrospective cohort study	08/2007 to 01/2008	594	166 / 428	Median 83 (range 39-103)	Hip fracture (diagnostic admission codes: S72.0, S72.1, and S72.2)	Time to surgery Intra operative anaesthesia Pain management Nutrition assessment Time to mobilisation/physical activity (day of surgery or next day) Post op function assessment Delirium assessment Duration of hospitalisation Discharge protocol Discharge location Mortality	3
Lefaivre 2009 (154) Canada	Single centre - Vancouver General Hospital	Retrospective cohort study	1998 to 2001	607	125 / 482	83.3 (range 66 - 111)	Hip fracture (femoral neck, intertrochanteric, subtrochanteric)	Time to surgery (< 24 hrs, 24 to 48 hrs, > 48 hrs) Comorbidities Duration of hospitalisation Complications	2

								Pressure sores assessment Mortality	
Nielsen 2009 (155) Denmark	Data from the Danish National Indicator Project	Retrospective cohort study	16/08/2005 to 15/08/2006	6,266	1640 / 4626	Median: 83.2 (range 65.0 - 107.8)	Hip fracture (medial, pertrochanteric, subtrochanteric femur fracture)	~~Cohabiting status~~ Alcohol intake Smoking status ASA score Charlson comorbidity index score Mortality (30-day post admission with Hip fracture, post discharge) Nutritional risk assessments (within 2 days after admission) Pain assessment (during mobilization) ADL assessment (pre fracture and pre discharge) Anti osteoporotic treatment Relationship between quality-of-care criteria and mortality	3
SooHoo 2009 (156) USA	Single hospital	Retrospective before after intervention (RAND Quality Indicators for the Surgical Care of Patients With Hip Fracture) study	1998 to 2003 (exact dates NR)	111	27 / 84	79 (±10.11) (range 50-99)	Hip fracture (no further details)	Time to surgery (undefined <36 hours) Hospital duration Osteoporosis Race Diagnostic and medical assessments (within 1 day of admission) Antibiotic prophylaxis (on day of surgery) Rehab (post op day 1) Thromboembolic prophylaxis (on admission to the hospital) Pressure sore assessment & management (at risk patients)	3
Youde 2009 (157)	All acute hospital trusts admitting orthopaedic	Retrospective national clinical audit of falls and	10/2006 to 12/2006 (but restricted	3,184	629 / 2555	Median 83	Hip fracture (fragility neck of femur)	Ethnicity Presentation to the A&E (same day as fall)	3

UK	trauma cases and all primary care trusts (PCTs) in England	bone health for older people	to those alive at 04/2007)					Residential status (at presentation to A&E) Day & hour of presentation to A&E Time in A&E (≤120, 121-240, >240 mins) Preop medical review by specialist Time to preop analgesia Time to theatre from registration Time to surgery from admission Hospital duration (from registration to discharge) Past medical history assessment Cognitive function/impairment assessment (pre and post op) Assessment of cognitive function (pre& post operative) Medication status (preoperative) cardiac murmurs present (preoperative) Renal function (preoperative) Oxygen saturation on room air (preoperative) Risk assessed for pressure ulcers Thromboprophylaxis Mobilization (<24 hours post op) Physiotherapy (<72 hours post op) Discharge destination	
Verbeek 2008 (158) The Netherlands	Single level-1 trauma hospital	Retrospective cohort study	NR	192	45 / 147	80.4 (SEM 0.77)	Hip fracture (intra and extracapsular)	Time to surgery: Early: < 24 h, late ≥3 days from admission) ~~Preinjury residence~~ ASA grade Post op complications Lenth of hospital stay Discharge destination	2

								Mortality (in hospital, at 1 year)	
Novack 2007 (159) Israel	Seven large, general hospitals of Clalit Health Services organization throughout Israel	Retrospective cohort study	2001 to 2005.	4633 (includes 818 non operated patients)	1264 / 3369	82.3 (± 7.4)	Hip fracture (neck of femur)	Time to surgery (<2, 2-4, >4 days from admission) Charlson index Dementia Co morbidities Hospital stay Readmission within 1 month of initial admission Mortality (in hospital, within 1 and 12 months)	2
Pillay 2007 (160) (Dutch) Netherlands	Single University medical center, Utrecht	Retrospective cohort study	01/01/2000 to 31/12/2003	217	49 / 168	80.7	Hip fracture (intracapsular fracture)	ASA score Functional status (pre fracture) Delirium (on admission) Dementia Comorbidities Mortality (during admission, at 3 months, 1 year, and 3 years after discharge) hospital duration	4
Majumdar 2006 (161) Canada	Regional hospitals in Northern and Central Alberta, Canada	Retrospective cohort study	03/1994 to 02/2000	3981 (includes 117 non-operated patients)	1143 / 2838	Median:82 (IQR: 75-87)	Hip fracture (Femoral neck, intertrochanteric, subtrochanteric, subcapital)	Pre fracture comorbidities Mortality risk score Time to surgery (<24h, 24-48h, >48h after admission)	3
Gdalevich 2004 (162) Israel	Single regional Medical center	Retrospective cohort study	01/01/1995 to 31/12/1997	651	159 / 492	≥60	Hip fracture (Intra and extra capsular)	Time to surgery (24 h periods i.e. <24h, 24–48h, >48h etc after fracture) Marital status Pre-existing medical conditions ASA score Mortality Mobility pre and post-surgery Complications Mental health post injury	2
Lawrence 2004 (163) UK	Single - University Hospital Nottingham	Retrospective cohort study	2003	100 (includes 4 non surgery patients)	23 / 77	83 years (range 62-96)	Hip fracture (intra-capsular, extra-capsular and subtrochanteric)	Length of hospital stay Operative time Time to surgery (1-4 days)	2

								Reasons for surgery delay Costs	
Weller 2004 (164) Canada	Multiple hospitals in Ontario, Canada	Retrospective cohort study	01/04/1993 to 31/03/1999	57315	14383 / 42932	80.5 (± 9.3)	Hip fracture (neck of femur)	Time to surgery (1 day, 2 days, 3 to 7 days) Hospital status Charlson -Deyo comorbidity index Mortality (in hospital, 3-, 6- and 12-months post-surgery) Length of hospital stay Complications	2
Grimes 2002 (165) USA	20 hospitals located in four metropolitan areas (New Brunswick - New Jersey; San Antonio - Texas; Philadelphia - Pennsylvania and Richmond - Virginia)	Retrospective cohort study	01/01/1983 to 31/12/1999	8383	1751 / 6632	80.4 (± 8.6) (range 60 to 106 years)	Hip fracture (Femoral neck, intertrochanteric, subtrochanteric, other)	Time to surgery (<24h, >24-48h, >48-72h, >72-96h, >96h after admission) Medical history / medical conditions Charlson Comorbidity Index Sickness at admission scale for 30-day mortality ASA class Prior hip fracture ~~Preadmission residence (home, retirement home, nursing facility)~~ Admission year (1981-1987, 1988-1994) Insurance type Race Preop blood transfusion Postop morbidity Mortality (in hospital, 30 day and long term) Pressure ulcer risk assessment	2
Hoenig 1997 (166) USA	284 randomly selected hospitals from 30 areas in 5 states	Retrospective cohort study	1981 to 1982 and 1985 to 1986	1880	423 / 1457	≥ 65 years	Hip fracture (trochanteric, femoral neck, or other)	~~Pre fracture residential status~~ Ambulation (any v/s bed rest, out of bed to chair during the first 25 post op days) Hospital duration Return to community (return home or to a	2

								retirement but not skilled nursing home) Time to surgery (early - within first 2 days of hospitalization v/s late)) PT/OT frequency (High: > 5 sessions per week v/s low) Comorbidities Complications Mortality (30 and 60 days) Race (Black v/s white)	
Rogers 1995 (167) USA	Medical Center Hospital of Vermont Trauma Registry	Retrospective cohort study	1987 to 1992	82	16 / 66	82.37 (± 7.6)	Hip fracture (isolated femoral head, femoral neck, intertrochanteric, or subtrochanteric)	Time to surgery: early (<24h), intermediate (24-72h) and late (>72h) Mortality Complications Length of hospital stay	1
Bredahl 1992 (168) Denmark	Single (the Department of Orthopaedic Surgery of Aalborg Hospital)	Retrospective cohort study	01/1983 to 12/1988	778	213 / 565	Median: 79 years (range 16-102 years)	Hip fracture (femoral neck or trochanteric)	Time to surgery (<12h, >12h of admission) Mortality Post op complications Hospital stay	2
Dolk 1990 (169) Sweden	Single hospital	Retrospective cohort study	1985 (no further details)	274	72 / 202	78 years	Hip fracture (femoral neck or trochanteric)	~~Pre fracture residential status~~ Time to surgery (from day 0,1,2,3 or ≥4 of fracture) Time to surgery (from day 0,1,2,3 or later of admission) Reasons for delay in admissions and surgery Mortality Hospital stay	1
Davidson and Bodey 1986 (170) UK	Single - Mount Vernon Hospital, Northwood, Middlesex	Retrospective cohort study	1981 to 1982	155	25 / 130	80.8 (range: 53 - 102)	Hip fracture (sub capital and trochanteric)	Time to hospital admission after fracture Time to surgery after admission Who performed surgery (consultant, registrar) Previous illnesses / comorbidities Previous Hip fracture Dementia Post op complications	1

								Mortality Antibiotic prophylaxis Anticoagulant prophylaxis Length of hospital stay	

Table ix. Cross-sectional surveys investigating performance indicators in hip fracture care.

Author, year, country of study	No of study sites	Study design	Study period	Number of participants	Gender (M/F)	Age	Fracture type	Performance / proxy performance indicators investigated	Study quality assessment score (out of 5)
Tabu 2023 (171) 5 LMICs in South Asia (Nepal and Sri Lanka) and Southeast Asia (Malaysia, Thailand & Philippines)	Multiple sites across 5 countries	Survey	04/2020 to 11/2020	98 (Healthcare professionals and managers)	NR	NR	Hip fracture (intracapsular, /extracapsular and subtrochanteric)	Time to hospital Time to ward Time to surgery (from admission) Hospital (acute) duration Cognitive function (pre-op) Delirium (pre & peri op) Pain (post op) Nutritional status (peri-operative) Pressure sores (peri op) Falls risk (peri op) Bone health (peri op) Mortality Mobility Residential status Complications Health related QoL	3
MacDonald 2018 (172) 7 countries (Canada, USA, Australia, New Zealand, Denmark, Sweden, and Ireland)	35 acute care hospitals across 7 countries	Survey (quantitative results of qualitative, unstructured survey)	01/06/2016 to 31/08/2016	Professionals from 35 hospitals across 7 countries completed survey/audit of nursing quality care indicators for older adults with fragility hip fractures	NR	NR	Hip fracture (no further details)	Hospital type (teaching v/s non-teaching) Time to surgery (undefined <24, <36, <48 hours) Time and frequency of mobilization Nutrition assessment Catheter associated infection prevention Pain management Delirium assessment Pneumonia prevention Constipation prevention VTE prevention Pressure injury prevention Care transition/prepare for home Bone health Staff education	3

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Table x. Prospective cohort studies investigating performance indicators in hip fracture care.

No.	Indicator/proxy indicator
1.	Admission department
2.	Admission interval
3.	Admission status
4.	Day of admission (weekend, holiday, weekday)
5.	Timing of evaluation in Emergency department/room (ED/ER)
6.	Multi-disciplinary team (MDT) admission protocol
7.	Intensive care unit (ICU) admission
8.	ICU duration
9.	ED/ER duration
10.	Length of hospital stay
11.	Acute hospital duration
12.	Reason for long hospital duration
13.	Total institution days
14.	Time from admission to medical clearance
15.	Time between admission and rehab facility request
16.	Transfer history
17.	Fracture in hospital
18.	Inpatient falls
19.	Time to ortho geriatric review
20.	Ortho team notified
21.	Time between arrival and orthopaedic team notification
22.	MDT guided rehab
23.	Critical care review
24.	Geriatric assessment
25.	Joint orthogeriatric care
26.	Ortho geriatric co-management
27.	Ortho geriatric review
28.	Pre op medical review by specialist
29.	Use of restraint
30.	Refracture assessment
31.	Fracture prevention
32.	Antifracture prescription
33.	Bone health assessment
34.	Bone protection medication for secondary fracture prevention
35.	Calcium prescription
36.	Medication
37.	Nerve block administered
38.	Nutritional supplement ordered
39.	Osteoporosis assessment
40.	Protein supplementation
41.	Vitamin D prescription
42.	Usual medical treatment
43.	Deep vein thrombosis/ venous thromboembolism prophylaxis
44.	Prophylactic thrombolytic treatment within 48 hours of arrival
45.	Anaesthesia type
46.	Blood transfusion
47.	Catheter insertion
48.	Catheter associated infection
49.	Intra operative anaesthesia

50.	Intravenous fluids
51.	Pulmonary infection
52.	Urinary tract infection
53.	Ulcers
54.	Use of drain
55.	Wound infection
56.	Infection
57.	Adverse events
58.	Complications
59.	Constipation
60.	Pneumonia assessment
61.	Pneumonia prevention
62.	Time to pre op analgesia
63.	Pain management
64.	Pain reassessment
65.	Pain score
66.	Time between arrival and initial pain assessment
67.	Time between arrival and administration of pain relief
68.	Time between arrival and second pain assessment
69.	Time and year of surgery
70.	Door to theatre time
71.	Elective or emergency surgery
72.	Length of surgery
73.	Operation by ortho-trauma surgeon
74.	Rate of surgery
75.	Surgery delay
76.	Surgical interval
77.	Time between time to surgery and completing surgery record
78.	Time from admission to surgery
79.	Time from medical clearance to surgery
80.	Time to surgery
81.	Time to theatre
82.	Time between arrival and surgery
83.	Surgery performed with the aim of allowing patient to fully weight bear without restriction in the immediate post-operative period
84.	Mobility pre fracture
85.	Mobilization started day after surgery
86.	Delay between surgery and first getting up
87.	Independent mobility
88.	Locomotion
89.	Mobility started by physiotherapist
90.	Occupational therapy review
91.	Physical (early) therapy
92.	Physiotherapy type and frequency
93.	Physiotherapy assessment
94.	Physiotherapy/occupational therapy frequency
95.	Time to mobilisation
96.	Type and duration of physio
97.	Weight bearing status
98.	Dedicated mobilization session to regain function at least once per day until discharge
99.	Time to rehab

100.	Time between discharge and completion of records
101.	Time between discharge from rehab and completion of rehab records
102.	Time to follow up
103.	New impairments at discharge
104.	Care transition
105.	Discharge destination
106.	Discharge planning
107.	Rehab admission
108.	Rehab plan conducted
109.	Return to community
110.	Patient satisfaction
111.	Quality of life
112.	Quality of care
113.	Abnormal clinical findings
114.	Activities of daily living
115.	Acute Physiology and Chronic Health Evaluation Severity score
116.	Albuminemia
117.	Records of alcohol & smoking consumption
118.	Abbreviated Mental Test (AMT)
119.	Anaemia
120.	Antibiotics prophylaxis
121.	Prophylactic antibiotic treatment within 60 min prior to surgical incision
122.	The American Society of Anaesthesiologists (ASA score)
123.	Barthel index
124.	Body mass index (BMI)
125.	Cardiac murmurs
126.	Charlson Comorbidity Index
127.	Clinical problems at admission
128.	Cognitive assessments
129.	Cohabitation status
130.	Comorbidities
131.	Cumulative ambulatory score
132.	Cumulative illness rating scale
133.	X-ray
134.	Delirium
135.	Dementia
136.	Deprivation index
137.	Diagnostic interval
138.	EQ5D assessment
139.	Exercise/mobility
140.	Falls assessment
141.	A specialist falls assessment from a trained clinician
142.	Fragility fracture history
143.	Frailty index
144.	Pre-fracture medication
145.	Season of fracture
146.	Fasting
147.	Repeated fasting
148.	RAND comorbidity score
149.	Severity of illness

150.	Fluid balance
151.	Functional independence
152.	Functional status
153.	Glasgow coma score
154.	Haemoglobin
155.	Hand grip strength
156.	Height & weight
157.	Initial diagnostic assessment
158.	Injury mechanism
159.	Injury score
160.	KATZ 6 Index/score
161.	Language impairment
162.	Mental health
163.	The Mini-Mental Status Exam (MMSE)
164.	Pre op electrocardiogram (ECG)
165.	Preop care
166.	Preop optimisation
167.	Pressure areas
168.	Previous HF
169.	Preexisting medical conditions
170.	Skin lesion
171.	SPMSQ score (Short portable mental status questionnaire)
172.	Nottingham HF score
173.	Nutrition assessment
174.	O2 saturation
175.	Other injuries
176.	Parker mobility score
177.	Patient related healthcare disparities
178.	Renal failure
179.	Renal function
180.	Transthoracic ECG
181.	Trauma risk score
182.	Records of race /ethnicity
183.	Living setting
184.	Marital status
185.	Education
186.	Residential status
187.	Social determinants
188.	Townsend deprivation
189.	Employment status
190.	Family income
191.	Geographic variation
192.	Geographical region
193.	Domicile region
194.	Migration status
195.	Municipality type
196.	Staff education
197.	Specialty of clinician involved
198.	Setting and volume of ortho unit
199.	Setting -urban/rural
200.	Social worker involvement

201.	Consultations
202.	Clinical staff type
203.	Number and type of clinicians
204.	Surgical seniority involved in treatment
205.	Treated by consultant anaesthetist
206.	Who conducted surgery
207.	Clinician and patient safety
208.	Annual hospital case volume
209.	Hospital department
210.	Hospital factors
211.	Hospital frailty index
212.	Hospital payment type
213.	Hospital physio days
214.	Hospital trauma level
215.	Hospital status
216.	Centre /hospital effect
217.	Therapy costs
218.	Surgery and anaesthesia cost
219.	Radiology cost
220.	Outpatient services cost
221.	Costs
222.	Bed and day cost
223.	Further diagnostic cost
224.	Records of further treatment cost
225.	Healthcare cost
226.	Health insurance
227.	Insurance type
228.	Medical burden
229.	Payment source
230.	Readmission
231.	Reoperation
232.	Revision surgery
233.	Survival
234.	4-year survival
235.	Cause of death
236.	Mortality
237.	Adherence to Irish HF standards
238.	“Big 6” compliance
239.	Best Practice Tarriff compliance
240.	Adherence to National institute for health and care excellence (NICE) guideline/standards
241.	Standardised HF program participation

Table xi. Summary of themes from qualitative evidence from patients and healthcare professionals.

Patients	Healthcare professionals	Common themes
Environment factors	Environment factors	Cultural
Psychological and physiological factors	Psychological and physiological factors	Attitudes
Mismatch of expectations	Mismatch of expectations	Beliefs
Factors affecting early mobility (external to patient)	Factors affecting early mobility (external to patient)	Perceptions
Factors affecting early mobility (unique to person)	Factors affecting early mobility (unique to person)	Psychological
Patient's pre-fracture functional status	Healthcare provider perceptions	Physiological
Patients' cognitive status	Healthcare providers attitudes and behaviours	Service provision
Medical unpredictability	Preconceived notions held by healthcare providers and patients	Care pathway
Pre-conceived notions	Self-care and empowerment	Health risk
Importance of autonomy	Cross sectional collaboration	Capability
"Master in my own house"	Preparing for discharge	Opportunity
Will and zest for life	Staff cultural Issues causing delay to hip fracture patient progress through the pathway	Motivation
Uniqueness	Persuasion in hip fracture patients' care pathways	Behaviour
Physical needs	Modelling	Education
Roles (physical, social, emotional)	Enablement	Training
Identify needs post hip fracture	Education & training	Information provision
Ageism, old age, falls & fractures	Environmental restructuring	Environmental
Physical functioning	COM behaviour change	Restructuring
Independence	Communication/marketing	Patient engagement
Therapy	Guidelines	MDT engagement
Rehabilitation/training	Service provision	Clarity of MDT roles
Physical role	Environmental / social planning	Mismatch of expectations
Bodily pain	Regulation	Patient empowerment
Vitality	Intervention functions	Patient autonomy
Social role	Service provision	Mobilization risk factors
Emotional role (fear of falls, uncertain future, moods, guilt and sadness)	Enablement	External factors
Importance of self-determination	Modelling	Unique to person
Reliance on professional support	Environmental restructuring	Preparing for discharge
Importance of meaningful feedback	Education and training	
Anxiety about the future	Audit nursing and treatment routines	
Reliance on social capital	Fast track care of hip fracture patients	
Being seen as a person		
Striving for Independence		
Interaction gives trust and security		

Information is key to understanding Encouragement is essential to promote activity Accepting the situation whilst trying to remain positive The greener the better, but it's up to me Ask me, I have goals Uncertainties concerning future An unexpected life-altering event Preparing to return home Needing adjustment and support at home Struggling to manage at home. Feeling vulnerable A span between self-reliance and dependency Disruption from normal life Feeling of subservience Feeling of gloominess and hopelessness The gap between expectations and reality Recovery as self-reliance Recovery as dependent on actions from others Less independence and mobility The impact of age Oscillating between being satisfied and enduring a new demanding situation Pain and pain management Feeling fear and satisfaction in perioperative care Experiencing continuity in care Considering information Feeling encouragement and assistance To end up in a new situation with or without control Belief in recovery, nothing will be altered No problem, I will manage this unexpected event, determination will be needed Adapting to a new situation in hospital Need for appraisal Context as a negative influence An unpredictable future When and how to recover Uncertainty	Identify risk factors Develop pressure prevention program in orthopaedic wards Achieving protocolised and personalised care Patient and carer engagement Multidisciplinary team engagement across the care continuum Strategies for service improvement Systematised pathways and clinical guidelines are inevitable How to counteract patients' lack of information Objective world (e.g. knowledge) Social world (rules/norms of social interactions, patient expectations, health related decisions) Subjective world (intentions, thoughts, emotions and wishes) What it was like Overcoming the risks together Thinking differently Enhanced experience	

Mobility (within 24 h post surgery) Valued day-to-day activities Self-care Pain Mental well-being Fear of falling Leg shortening. Common patient traits Variations in need for information Lacked awareness were shocked by the hip fracture accident/event Had a strong desire to recuperate The 'Autonomous' who knew what they wanted after discharge The 'Modest' who gave the impression of being vulnerable and dependent on others and they expressed themselves cautiously The 'Heedless' who appeared to view their situation with some detachment, almost as if it did not really concern them The injury experience, The pain experience, The recovery experience The disability experience Storytelling, recalling the experience of the injury itself Coping with the pain. Involved the operation, beginning the struggle of recovery, and regaining independence. The disability itself, depending on others, and being housebound		

Purple: Suggest call for new performance indicators; Green: personal factors; Blue: Part of care pathway; Yellow: Injury related factors; Grey: Similar themes.