Which performance indicators are used globally for evaluating healthcare in patients with a hip fracture?

A mixed methods systematic review

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Aims

Performance indicators are increasingly used to evaluate the quality of healthcare provided to patients with a hip fracture. The aim of this review was to map the variety of performance indicators used around the world and how they are defined.

Methods

We present a mixed methods systematic review of literature on the use of performance indicators in hip fracture care. Evidence was searched through 12 electronic databases and other sources. A Mixed Methods Appraisal Tool was used to assess methodological quality of studies meeting the inclusion criteria. A protocol for a suite of related systematic reviews was registered at PROSPERO (CRD42023417515).

Results

A total 24,634 articles were reviewed, of which 171 met the criteria of the review. Included studies were heterogenous in design and came from varied healthcare systems in 34 different countries. Most studies were conducted in high-income countries in Europe (n = 118), followed by North America (n = 33), Asia (n = 21), Australia (n = 10), and South America (n = 2). The highest number of studies in one country came from the UK (n = 45). Only seven of the 171 studies (< 2,000 participants) were conducted across ten low- and middle-income countries (LMICs). There was variation in the performance indicators reported from different healthcare systems, and indicators were often undefined or ambiguously defined. For example, there were multiple definitions of 'early' in terms of surgery, different or missing definitions of 'mobilization', and variety in what was included in an 'orthogeriatric assessment' in hip fracture care. However, several performance indicators appeared commonly, including time to surgery (n = 142/171; 83%), orthogeriatric review (n = 30; 17%), early mobilization after surgery (n = 58; 34%), and bone health assessment (n = 41; 24%). Qualitative studies (n = 18), mainly from high-income countries and India, provided evidence on the experiences of 192 patients and 138 healthcare professionals with regard to the use of performance indicators in clinical care and rehabilitation pathways. Themes included the importance of education and training in parallel with the introduction of performance indicators, clarity of roles with the clinical team, and the need for restructuring or integration of care pathways.

Conclusion

This review identified a large number of performance indicators related to the delivery of healthcare for patients with a hip fracture. However, their definitions and thresholds varied across studies and countries. Evidence from LMICs is sparse. Both qualitative and quantitative evidence indicates that there remains a pressing need for further research into the use and

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standardization of performance indicators in hip fracture care and their influence on patient outcomes and economic costs.

Take home message

- Hip fracture care is marked by significant variability in the performance indicators used and how they are defined which makes meaningful comparisons across healthcare systems challenging.
- Although healthcare professionals acknowledge the importance of data collection, there is limited evidence on the actual impact of these indicators on patient outcomes and healthcare costs, with even less known about the experiences of those involved in managing them.
- Standardization of terminology and definitions is essential to enable evidence synthesis, alongside further research into their use, particularly in low- and middle-income settings.

Introduction

Hip fracture is a common, serious, and costly public health issue.[1] The incidence rates are currently highest in North America and Europe, but the global incidence is expected to double over the next 20 to 30 years due to the growing proportion of older people in many regions of the world.[2] Hip fractures have serious consequences for patients. Of hip fracture patients in the UK, 25% die within a year and survivors have a reduction in their health-related quality of life, similar to having a stroke.[3] The outlook is likely to be even worse for people in low- and middle-income countries (LMICs) with fewer resources to support recovery and long-term care.[4] The annual costs of care for patients with hip fracture in the USA, the UK, and nine Asian countries are estimated at USA$12 trillion,[5] USA$3 trillion, and USA$15 billion, respectively.[6]

Hip fracture care typically requires input from multiple specialties at different points of the patient 'journey'. To inform this process, several countries have developed clinical practice guidelines and regional or national audits to optimize the delivery of appropriate hip fracture care. These guidelines and audit datasets often include performance indicators, sometimes referred to as 'best practice quality standards'. Performance indicators were introduced to improve patient health outcomes by quantifying aspects of care delivery that are associated with improved recovery after a hip fracture.[7] However, the use of performance indicators, and the different types of performance indicator used in different healthcare settings, is not clearly described in the literature.

The aim of this review was to identify performance indicators used in the care of patients with hip fracture in different healthcare systems around the world. We also explored how performance indicators are defined in clinical practice and how they are used by healthcare professionals and policy makers.

Methods

We performed a mixed-methods systematic review of evidence on performance indicators used globally for evaluating healthcare in patients with hip fractures. This review is part of a suite of systematic reviews evaluating healthcare of patients with fractures (registered at the International Prospective Register for Systematic Reviews (PROSPERO).[8] The review is reported according to the PRISMA statement,[9] and the Enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) statement.[10]

Search strategy

A comprehensive search strategy without age, period, or language restrictions was iteratively derived with input from information specialist and hip fracture experts (Supplementary Table i). Overall, 12 bibliographic databases were searched for studies published from database inception to 25 April 2023: MEDLINE; Embase; EMCARE; Ovid Global Health; the Cumulative Index to Nursing and Allied Health Literature (CINAHL); the Cochrane Database of Systematic Reviews; Cochrane Central Register of Controlled Trials; Scopus; Web of Science; World Health Organization (WHO) Global Index Medicus; Centre for Reviews and Dissemination (CRD) NHS Economic Evaluations Database (to 31 March 2015); and the International Network of Agencies for Health Technology Assessment (INAHTA) Health Technology Database.

The search involved using relevant index terms and free-text terms, synonyms, and phrases in the title and abstract fields for relevant papers on performance indicators, quality indicators, health care/quality improvement AND fractures, trauma, injuries or injury, in order to meet the aims of the protocol.

All references were exported into EndNote v. 20 reference manager (Clarivate, USA), and duplicates were removed using the Bramer method.[11] Snowballing, websites, personal databases, and citations were searched for additional records.

Study selection

To ensure high level of agreement between reviewers and to minimize any reviewer-related biases, a subset of articles was piloted for independent double review among all authors (AT, JM, MC, MP, SG, VMP) at each stage of the review process (i.e. title and abstract screening, data extraction, and quality assessment) and results were compared. Titles and abstracts were then independently screened by AT, MP, and VMP using EndNote v. 20 (Clarivate). Articles appearing to meet this review's inclusion criteria (Supplementary Table ii) were retrieved for full text review and details of these studies were recorded in pre-piloted spreadsheets with reasons for excluding studies. Foreign language papers were translated using Microsoft (USA)/Google translator (Google, USA) and native speakers were contacted if anything was unclear. Uncertainty about inclusion criteria and disagreements were resolved by discussion among all authors.

Quality assessment

The Mixed Methods Appraisal Tool (MMAT) v. 2018[12] was used to assess the methodological quality of included studies. All authors were trained to use the tool and a sample of studies were piloted for quality assessment. Two reviewers (AT, VMP) independently assessed the quality of all included studies. Any disagreement between the reviewers over the risk of bias of an

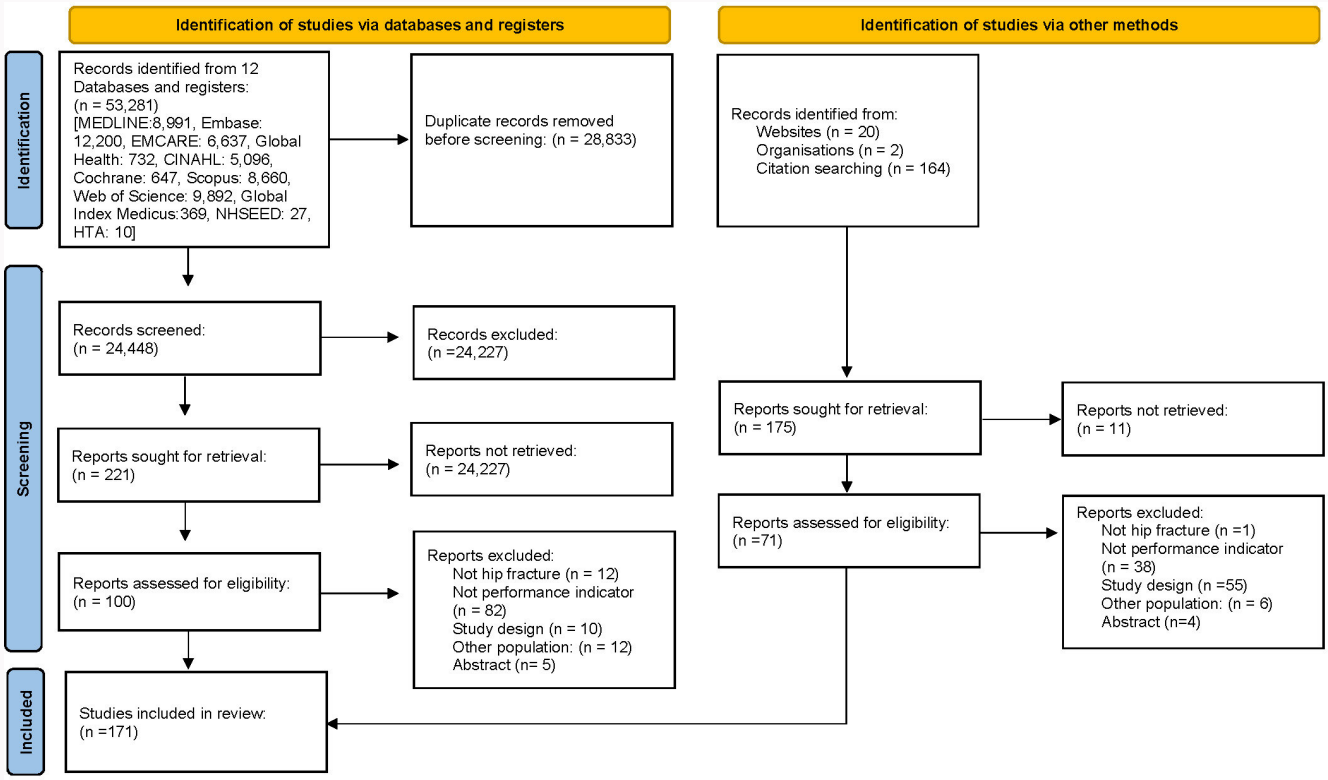


Fig. 1
PRISMA flow diagram of the systematic search for evidence on performance indicators used globally for evaluating hip fracture care. CINAHL, the Cumulative Index to Nursing and Allied Health Literature; HTA, Health Technology Assessment; NHSEED, NHS Economic Evaluations Database.

included study, was resolved by discussion at team meetings. The quality assessment stage underpinned the context of the synthesized findings and was not used to exclude studies.

Data extraction and analyses

Two reviewers (AT, VMP) independently extracted data of relevant studies into a pre-piloted study design specific spreadsheet. For quality assurance, all studies meeting the inclusion criteria were double reviewed by a second reviewer to ensure agreement and consistency in data extraction and reporting. Additionally, to minimize reviewer related bias, the evidence tables of included studies were further double reviewed and analyzed by AT, MC, and VMP.

Data synthesis

The heterogeneity between quantitative studies, in terms of study designs and study periods, precluded meta-analysis. A narrative synthesis of quantitative and qualitative data was therefore undertaken.

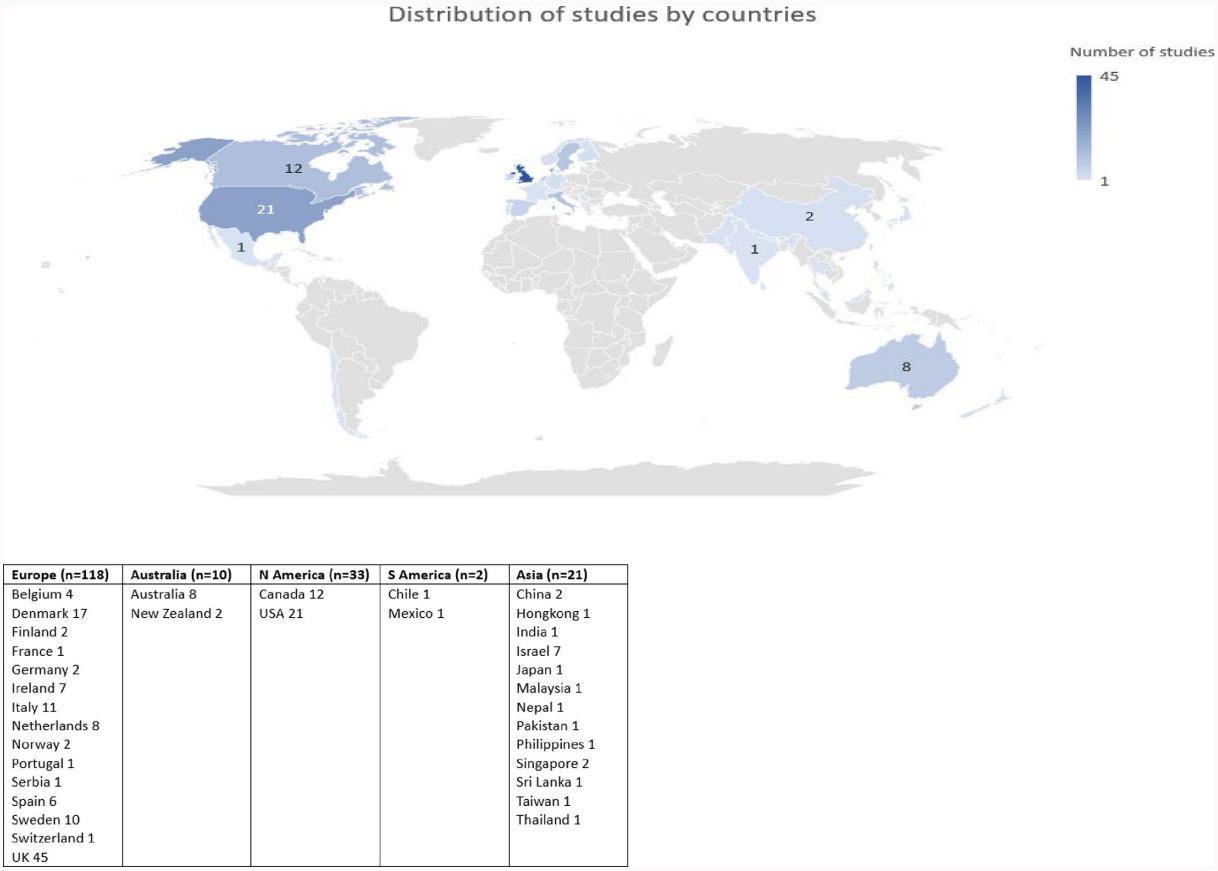
Extracted qualitative and quantitative data were analyzed and synthesized by one reviewer (VMP) and mapped by country of study, study period, and study design. Evidence was synthesized on the variety of performance indicators used around the world and how they are defined. Additionally, qualitative evidence from patients and healthcare professionals was summarized by ET, JM, MC, and VMP. Finally, summaries of the qualitative and quantitative data were integrated by ET, MC, and VMP using 'the parallel results convergent design synthesis'.[13]

Results

A total of 24,448 articles were identified from searching 12 electronic databases in April 2023. These were screened, and 221 full text articles were reviewed (including 12 other language papers). Full texts of 175 additional studies were identified from reference lists and other sources and were also reviewed. A total of 171 studies met the inclusion criteria. A PRISMA flow diagram summarizes the literature search strategy in Figure 1.

The articles were heterogenous in terms of health systems, study designs, study periods, performance indicators, and performance indicator definitions (Supplementary Tables iii to ix for summary of extracted data and quality assessment). There were two multinational cross sectional surveys,[14,15] two randomized controlled trials,[16,17] two control pre- and post-intervention studies,[18,19] two quasi-experimental,[20,21] four mixed methods,[22–25] 14 qualitative studies,[26–39] 27 prospective cohort studies,[40–66] 42 mixed prospective and retrospective pre/post intervention studies,[67–108] and 76 retrospective cohort studies,[109–185] which provided evidence on the performance indicators of hip fracture care in 34 countries. The retrospective study design and other limitations had an impact on the methodological quality of included studies with 23% studies being of high quality, while 63% and 14% studies were of intermediate and low quality, respectively.

The study period was not reported in 13 included studies. However, it appears that all included studies were conducted between years 1981 and 2021 and subsequently published between years 1986 and 2023. Of these 171 studies, 63% were published in recent years between years 2015 and



Europe (n=118)	Australia (n=10)	N America (n=33)	S America (n=2)	Asia (n=21)
Belgium 4	Australia 8	Canada 12	Chile 1	China 2
Denmark 17	New Zealand 2	USA 21	Mexico 1	Hongkong 1
Finland 2				India 1
France 1				Israel 7
Germany 2				Japan 1
Ireland 7				Malaysia 1
Italy 11				Nepal 1
Netherlands 8				Pakistan 1
Norway 2				Philippines 1
Portugal 1				Singapore 2
Serbia 1				Sri Lanka 1
Spain 6				Taiwan 1
Sweden 10				Thailand 1
Switzerland 1				
UK 45				

Fig. 2
Mapping evidence by countries in which the studies were originally conducted.

2023. Only 32% studies were published between 2001 and 2014 and around 5% studies were published between 1986 and 2000.

Evidence collected was mainly from high-income countries in North America (n = 33), Europe (n = 118 with 45 studies from the UK), Australia (n = 10), South America (n = 2), and Asia (n = 21) (Figure 2). Evidence from LMICs was limited with only seven out of 171 studies reporting evidence from ten LMICs (Mexico, India, China, Serbia, Pakistan, Nepal, Sri Lanka, Malaysia, Thailand, and Philippines).[14,20,22,51,53,76,164]

Two studies did not report the total number of participants from each of the three (Belgium, Italy, and Portugal),[16] and seven (Canada, USA, Australia, New Zealand, Denmark, Sweden, and Ireland)[15] countries represented.

Overall, in Asia, studies were conducted in 13 countries with a total of 75,659 participants. Studies from Australia and New Zealand had > 2,195 participants, while studies in Europe were conducted in 15 countries and had > 3,456,765 participants, although most of the participants (2,525,926) were from the UK. Finally, North America (Canada and USA) had > 446,412 participants, and two countries from South America – Chile and Mexico – had 647 and 83 participants, respectively.

Performance indicators used globally in hip fracture care and how they are defined

Across the 171 articles, 241 performance indicators were described. Supplementary Table x lists performance indicators/proxy performance indicators. However, the performance indicators were often undefined or variably defined in the different articles. The 12 most commonly reported performance indicators are shown in Table I. Time to hospital admission (42 articles (24.6%)) is variably defined as time from fall/injury to arrival in the emergency department (ED)/diagnosis/admission to the hospital. Review by a physician specializing in care of older patients was reported by 30 studies (17.5%). However, the target time for the review was often unreported and, where reported, ranged from ≤ 48 to ≤ 72 hours. The clinician performing the review was also described inconsistently, ranging from geriatrician, orthogeriatric to orthopaedic surgeon. Time to surgical intervention was reported in 142/171 (83%) articles but there was variation in the target time (< 12 hours to > ten days) and start point for the timing, ranging from arrival in the ED through decision to admit, to admission to the hospital ward. Time to mobilization after surgery was reported as a performance indicator in 58 (34%) articles; however, there was substantial variation in how, when, and by whom mobilization was initiated postoperatively. Other commonly reported performance indicators were: bone health assessment was reported in 41 studies (24%), pain assessment in 31 (18%), anaesthesia risk assessment in 16 (9.4%), antibiotic prophylaxis assessment in 11 (6.4%), thrombolytic prophylaxis assessment in 15 (8.77%), medication prescription assessment in 20 (11.7%), cognitive impairment assessment was reported by 29 (17%) studies, and a return to home risk assessment in 69/171 (40.3%).

Table I. Summary of quantitative studies investigating performance indicators in hip fracture care of older patients.

Performance indicator	Studies exploring each indicator*	Performance indicators mostly undefined or with multiple definitions
Prompt admission to a surgical ward from the emergency department	4,8,9†,25,29,36,38,40,41,42,46, 49,52,57,59,60,63,75,76,84,95,98, 101,102,104,106,110,115,118,120, 127,128,130,132,140,141,143,150, 151,156,169,170‡	• Time to transfer or present patient to ED (from fall) or admit to acute ortho care • Time in ED/emergency triage priority (< 2 to 4 hrs) • Time from hospital admission to medical clearance • New or transferred patient admission (door to hospital/ward/ortho/ geriatric/ medicine/ED/trauma/theatre/other department) • Day/date/time to ortho/trauma/ward admission • Admission to hospital (within 24 hrs of fracture/arrival) • Admission within four hrs of first presentation or directly to theatre from ED within four hrs • Admission delays due to diagnostic interval • Admission due to fractures in hospital vs home
Prompt review by a physician specializing in care of older patients	2,5§,30,37,40,45,46,47,49,52, 53,54,58,66,72,75,77,95,102,104, 112,113,115,126,128,140,145,147,149,156	• 'Comprehensive' geriatric/geriatrician review/'Critical care review'/Cumulative illness rating scale-geriatric • Joint geriatric/orthopaedic care/geriatrician directed MDT rehab • Orthogeriatric assessment in patients > 75 yrs within 48 to 72 hrs of admission. • MDT co-managed/Use of agreed MDT protocol • Care review done by other healthcare professionals • Access to acute orthogeriatric care/geriatric depression score ***Additionally, several studies also reported assessments on** a.Medical/medication history/diagnostics b.Frailty index/physical/functional status (Parker mobility score, ADL, ASA, KATZ6, Barthel index, etc.) c.Quality of life (GOS-E, EQ-5D, EQ-VAS, SF-12/36, etc.) d.Nutritional risk e.Falls risk assessment/falls prevention f.Pressure ulcer care/risk assessment
Bone health assessment	2,5§,6,30,34¶,37,40,46,50,52,54, 58,61,69,70,72,75,79,97,103,104,109, 113,116,117,118,124,125,126,131, 133,134,139,140, 142,145,151, 154,155,170‡,171	• Bone health/refracture risk/osteoporosis assessment
Early surgical intervention	2,3,4,5§,6,7,8,9†,10,25,26,27,29,30,31, 32,33,34¶,36,37,38,39,40,41,42,43,44, 45,46,47,49,50,51,52,53,54,55,56,57,58,59, 60,61, 62,63,64,65,66,67,68,69,70,71,72,73, 75,76,77,79,80,81,82,83,84,85,86,87,88,89,90, 91,92,93,94,95,96,97,98,99,100,101,102, 103,104,105,107**,109,110,111,112,113,114,115, 116,117,118, 119,120,121,123,124,126,127,128, 129,130,131,132,134,135,136,137,138,139, 140,141,143,144,145,146,147,148,149,151, 152,153,155,156,157,158,160,161,162,163, 164,165,166,167,168,169,170‡,171	• Time from medical clearance to surgery • Time to surgery/theatre/start of anaesthesia/within normal working hours/pre-holiday surgery • Surgery within 12/ ≤ 24/24 to 48/36/48/ > 48/ ≤ 72/ > 72/96/ > 96 hrs, next/2 calendar day/3 to 5 days/6 to 10 days/> 10 days (from decision to admit/ presentation/hospital registration/arrival to ED/admission (to hospital/ward/ from diagnosis if inpatient)/early/delayed/late (from time of admission) • Emergency/elective surgery • Time from door to theatre (≤ 24 hrs and > 48 hrs) *** Additionally, some studies also assessed**: a.Reasons for delay in surgery, year/period of surgery b.Duration/length of surgery, operating time and day, surgery type c.Time between surgery and completing surgery record
Early mobilization after surgery	1,2,5§,6,7,28,30,34¶,35,48,50,54,58,59, 61,66,68,70,73,74¶,77, 78††,79,80,81, 82,83,88,90,97,99,100,103,106,107,108, 109,111,113,115,116,117,118,121,122,124, 125,128,131,133,134,142,148,152,155,156, 165,171	• Mobility/ambulatory/weightbearing status i.e. ability to walk/independent mobility (postoperative/at or after discharge) • Ambulation/mobilization (on postop day 1, 2, 3, 4, 5), mobility related activities (sedentary, sitting, upright standing, upright stepping, walking) • Time to mobilization/rehab/to sit in bed, to or beyond chair, walk 3 m/ weightbearing activities/first getting up/exercises (within 24 to 48 hrs postoperatively, in patients who can walk before fracture)/delay between surgery and first getting up)/within 48 hrs of admission • Time between admission and request of a place in a rehabilitation facility • Physiotherapy (< 24 hrs/day after postop), occupational therapy (< 36 hrs postop), rehab programme (in hospital or at discharge)
Pain assessment	1,2,6,34¶,35,61,65,66,68,70,75, 82,83,84,87,109,115,117,125,128, 131,133,134,142,147,150,152,154, 156,170‡,171	• Pain assessment/analgesia management/nerve block prescription
Anaesthesia risk assessment	1,6,9†,71,78††,82,84,90,95,100, 102,104,107**,108,113,152	• Anaesthesia type (general, regional, spinal), time of administration, who prescribed anaesthesia

(*Continued*)

(*Continued*)

Performance indicator	Studies exploring each indicator*	Performance indicators mostly undefined or with multiple definitions
Antibiotic prophylaxis assessment	2,6,29,59,66,70,83,84,90,155,169	• Timing of antibiotic prescriptions
Thrombolytic prophylaxis assessment	6,34¶,59,66,69,70,83,90,98,118, 151,155,156,169,171	• Thrombolytic/coagulopathy prophylaxis
Medication prescription assessment	2,5§,6,27,37,69,70,75,97,109,117,118, 124,125,131,133,134,139,142,156	• Polypharmacy/medication (including anti porosis) prescription
Cognitive impairment assessment	1,2,7,26,30,35,42,45,46,67,68,72,77, 78††,79,80,89,92,93,115,116,126,128, 140,148,149,156,161,170‡	• Cognitive status assessments (via AMTS/Glasgow coma/MMSE/SPMSQ score)
	2,6,7,47,50,69,73,76,82,83,84,88,104,106,108, 111,112,150,158, 159,169	• Dementia assessment
	5§,6,7,29,30,34¶,51,68,69,71,72,73,79,87,92, 108,111,116,118, 127,152,159,170‡,171	• Delirium assessment *** Additionally, several studies also assessed** a.Other comorbidities (via Charlson/RAND comorbidity/chronic health evaluation score etc) b.Hospital (various wards) duration
Return to home risk assessments	1,2,3,4,6,7,27,29,32,34¶,35,36, 38,40,42,43,46,47,48,49,50,51, 61,62,66,67,68,71,72,73,76,79, 80,83,84,86,87,88,94,97,98,99, 103,104,105,109,112,113,116,117, 118,122,125,126,128,131,132,134, 135,144,148,149,151,152,154,156, 157,165,171	• Pre/post fracture living, cohabitation, residential status, discharge destination • Care transition/prepare for home/discharge planning/protocol (commenced within 48 hours of admission)/facilitate smooth discharge to destination • Social worker visit (during hospitalization) • Provision of adequate explanation/information about home medication prescription • Arrangement of extra support to patients who need when going home • Functional independence (FIM score), rehabilitation arrangements

*Study number as per Supplementary Tables iii to ix.
†India.
‡Nepal, Sri Lanka, Malaysia, Thailand, and Philippines.
§Mexico.
¶China.
**Pakistan.
††Serbia
ADLs, activities of daily living; AMTS, Abbreviated Mental Test Score; ASA, American Society of Anesthesiologists; ED, emergency department; EQ-VAS, EuroQol-visual analogue scale; FIM, Functional Independence Measure; GOS-E, Glasgow Outcome Scale - Extended; MDT, multidisciplinary team; MMSE, Mini-Mental State Examination; SF-12, 12-Item Short Form Health Survey; SF-36, 36-Item Short Form Health Survey; SPMSQ, Short Portable Mental Status Questionnaire.

Synthesis of qualitative evidence

There were 18 studies mainly from developed countries and India that reported qualitative data from approximately 330 participants (range 5 to 31) (192 patients and 138 healthcare professionals regarding their experiences on performance indicator use in hip fracture clinical care and rehabilitation pathways; Table II). Four mixed methods studies provided evidence from healthcare professionals in Australia,[23] Canada,[24] India,[22] and Sweden[25] (Supplementary Table iv). Two of the studies did not specify the number of healthcare professional participants.[22,23] Additionally, 14 qualitative studies conducted between 2001 to 2021 mainly from Europe – Sweden (n = 5), Denmark (n = 2), Norway (n = 1), and the UK (n = 5) – and Israel (n = 1), provided healthcare professional or patient perceptions on aspects of clinical care and rehabilitation pathways related to acute care performance indicators (Supplementary Table v). Six of these studies had only healthcare professional participants,[22,23,25,29,30,36] two had both patients and healthcare professional participants,[24,35] and ten studies had only patient participants. Only four studies indicated the participation of carers/relatives/family members, but their details or experiences were not clearly described. The qualitative studies generally did not define specific performance indicators but asked more general questions about patient and staff experience of aspects of care related to performance indicators.

The qualitative studies were of poor (61%) or intermediate (39%) methodological quality. They were heterogenous in terms of study aims, types of healthcare professionals interviewed, timing of data collection from patients in relation to the hip fracture which could introduce recall bias, theoretical models/frameworks and content analyses. Furthermore, the nomenclature used in different studies made integration challenging, with different researchers using terms such

Table II. Summary of qualitative studies investigating performance indicators in hip fracture care of older patients.

Study ID, country, Study period	Study aim	Population	Study design	Analyses method (theory/ framework/model used)	Themes/subthemes	Categories/subcategories
Haslam-Larmer et al (Canada) Study period: 2019[24]	To identify factors influencing participation in early mobility activities after hip fracture surgery	Hip fracture Patients: 19 Family members: NR Healthcare professionals: 10 (Physiotherapists, occupational therapists, therapy assistants, and registered nurses)	Part of mixed method study. Qualitative method: Face to face semi structured interviews The Healthcare professionals interview questions based on Theoretical Domains Framework The patient & family member questions were grounded in the COM behaviour change model	Theoretical Domains Framework Capability, Opportunity, Motivation, Behaviour (COM-B) change model	Patients • Patient's pre-fracture functional status • Patients' cognitive status • Medical unpredictability Healthcare professionals • Healthcare provider perceptions • Healthcare providers attitudes and behaviours • Preconceived notions held by healthcare providers and patients Patients and Healthcare professionals • Environment factors • Psychological and physiological factors • Mismatch of expectations	Patients and Healthcare professionals Factors affecting early mobility: • external to patient • unique to person
Jensen et al (Denmark) Study period: 2015[30]	To describe experiences of the hip fracture pathway.	Hip fracture Patients:10 Relatives: 4 (daughter, husband, wife) Health professionals*:15 (*physiotherapists, nurses, geriatrician, physicians, healthcare workers and PhD student)	Qualitative – semi structured interviews and field observations to gain a broader and richer description and to clarify if the patients feel empowered and able to perform selfcare after short time stay in hospital.	Phenomenological and Reflective Lifeworld Research approach Phenomenon: 'hip fracture pathway with short time stay in hospital (STSH)'	NR	Patient • Pre-conceived notions • Importance of autonomy • 'Master in my own house' • Will and zest for life Health professional • Self-care and empowerment • Cross sectional collaboration • Preparing for discharge
Mow et al (Australia) Study period: unclear, sometime between 2013 to 2015[23]	To identify processes that could be clarified and streamlined, with the agreement of relevant stakeholders, in the creation of a new hip fracture pathway	Clinical staff: NR (Anaesthetists, radiographer, ortho surgeon, ortho registrar, medical registrar, physician, allied HP, theatre nurse)	Part of mixed method study. Qualitative method: Unclear	Smart simplicity model (to drive progress toward the common goal by cooperative process restructuring, allowing staff involved in the processes to explore jointly the approaches that were best supported by evidence)	Clinical staff • Cultural issues causing delay to hip fracture patient progress through the pathway	NR
Rath et al (India) Study period: 2014 to 2015[22]	To document current practices, barriers and facilitators to adopting best practice guidelines and consequently make recommendations for improving the management of older adults with hip fracture	Healthcare professionals*: NR (*Involved in pre to postop hip fracture care and included clinical leads, residents, and nurses from orthopaedics, anaesthesia, geriatrics, medicine, and physiotherapy depts)	Part of mixed method study. Qualitative method: open ended question interviews and focus group discussions to obtain information on existing care pathways within their hospital setting and potential barriers and facilitators to adopting best practices	Behaviour change wheel framework COM model	Healthcare professionals • Persuasion in hip fracture patients' care pathways • Modelling • Enablement • Education & training • Environmental restructuring	Healthcare professionals • COM behaviour change • Communication/ marketing • Guidelines • Service provision • Environmental/social planning • Regulation
Gunningberg et al (Sweden) Study period: 2000[25]	To investigate possible changes in nursing and treatment routines in pressure ulcer risk	Multiprofessional group*: 6 (*Ortho surgeon, nurses & technicians from ED, operation theatre, and ortho ward)	Part of mixed method study. Qualitative method: focus group interviews to investigate possible changes in nursing and treatment routines	Framework of the Plan-Do-Study-Act model & VIPS model based on four key concepts (wellbeing, respect for integrity, prevention, and safety)	Multiprofessional staff • Intervention functions • Service provision • Enablement • Modelling • Environmental restructuring • Education and training	Multiprofessional staff • Audit nursing and treatment routines • Fast track care of hip fracture patients • Identify risk factors • Develop pressure prevention programme in orthopaedic wards
Volkmer et al (UK) Study period: NR[29]	To explore physiotherapists' perceptions of mechanisms to explain observed variation in early postoperative practice after hip fracture surgery demonstrated in a national audit.	Physiotherapists: 21	Qualitative – one-to-one and semi-structured telephone interview. Open-ended questions about their experiences working with hip fracture patients; their views on potential reasons for reported variation in physiotherapy after hip fracture; the types of patients they treat, the structure of their service, the role of other healthcare professionals, patients and informal/formal carers in early recovery after hip fracture	Normalization Process Theory	Physiotherapists • Achieving protocolised and personalized care • Patient and carer engagement • Multidisciplinary team engagement across the care continuum • Strategies for service improvement	NR

(*Continued*)

(*Continued*)

Study ID, country, Study period	Study aim	Population	Study design	Analyses method (theory/ framework/model used)	Themes/subthemes	Categories/subcategories
Jensen et al (Denmark) Study period: 2016[30]	To use a Habermasian lens to illuminate health professionals' perspective of the gap between what the system provides, and patients' needs and wishes, with a view to supporting patient empowerment.	Mixed group of health professionals*: 16 (*doctor in chief, leading orthopaedic doctor, nurses, endocrinologist, geriatricians, researchers, external observers, social and healthcare assistants, physiotherapists)	Qualitative – three focus groups Open-ended questions which allowed participants to freely discuss their thoughts, perceptions and ideas on hip fracture care and generated follow-up questions	Habermas' theoretical framework	Health professionals • Systematized pathways and clinical guidelines are inevitable • How to counteract patients' lack of information	Health professionals • Objective world (e.g. knowledge) • Social world (rules/ norms of social interactions, patient expectations, health related decisions) • Subjective world (intentions, thoughts, emotions and wishes)
Christie et al (UK) Study period: NR[36]	To explore a multidisciplinary collaborative approach to implementing evidence-based, person-centred hip fracture care.	Clinical leaders*: 16 (*From different disciplines and were knowledgeable in the field of hip fracture care and were in a position to influence others)	Qualitative – data collected during eight two-hour action meetings	Collaborative inquiry approach (underpinned by the combination of critical theory and Habermas' concept of lifeworld, Mezirow' action orientated approach to learning from experience and Rogers' humanistic psychology of person-centred practice)	Clinical leaders • What it was like • Overcoming the risks together • Thinking differently • Enhanced experience	NR
Schroeder et al (Israel) Study period: 2021[26]	To understand the perspective of the patient's experience of rehabilitation following hip fracture	Hip fracture Patients: 15	Qualitative method: Open-ended questions semi-structured interviews and focus groups via video conference and telephone Questions were about the physical, emotional, personal goals of rehabilitation as well as the participant's view of optimal timing for administration of the SF36 questionnaire.	SF-36 model (used SF-36 questionnaire for patient reported outcome measurements) The Lincoln and Guba Framework	Patients • Uniqueness • Physical needs • Roles (physical, social, emotional)	Patients • Identify needs post hip fracture • Ageism, old age, falls & fractures • Physical functioning • Independence • Therapy • Rehabilitation/training • Physical role • Bodily pain • Vitality • Social role • Emotional role (fear of falls, uncertain future, moods, guilt and sadness)
Southwell et al (UK) UK Study period: NR[27]	To explore older adult's perceptions of early rehabilitation and recovery after hip fracture, as a complement to the UK standards for acute physiotherapy after hip fracture.	Hip fracture patients: 15	Qualitative – In-depth semi-structured interviews with three open-ended questions on starting rehabilitation, rehabilitation activities and benefits, and challenges of rehabilitation for recovery).	Bury's biographical disruption theoretical framework.	Patients • Importance of self-determination • Reliance on professional support • Importance of meaningful feedback • Anxiety about the future • Reliance on social capital	NR
Asplin et al (Sweden) Study period: 2016[28]	To explore patients' experiences during inpatient rehabilitation after hip fracture surgery and the use of Traffic Light System -Basic ADL in their rehabilitation process	Hip fracture patients:19	Qualitative – semi-structured interviews with questions on experiences of recovery and participation in their rehabilitation process including the use of TLS-BasicADL	Content analysis using Graneheim and Lundman method	Patients • Being seen as a person • Striving for Independence	Patients • Interaction gives trust and security • Information is key to understanding • Encouragement is essential to promote activity • Accepting the situation while trying to remain positive • The greener the better, but it's up to me • Ask me, I have goals • Uncertainties concerning future
Segevall et al (Sweden) Study period: 2016 to 2017[31]	To describe rural older people's experiences of recovering after hip fracture surgery	Hip fracture patients: 13	Qualitative –individual semi-structured interviews, according to Kvale and Brinkman method. Participants were asked to talk about the fall, how they perceived their hospital stay, and how their life now compares with how it was prior to the fall.	Phenomenological content analysis using Catanzaro procedure.	Patients • An unexpected life-altering event • Preparing to return home • Needing adjustment and support at home • Struggling to manage at home.	NR
Bruun-Olsen et al (Norway) Study period: NR[32]	To explore how elderly patients with hip fracture enrolled in an ongoing RCT have experienced their recovery process	Hip fracture patients: 8	Qualitative – semi-structured interviews with open-ended questions on the issues related to their experiences of barriers and facilitators of the different	Phenomenological approach	Patients • Feeling vulnerable • A span between self-reliance and dependency • Disruption from normal life	Patients • Feeling of subservience • Feeling of gloominess and hopelessness

(*Continued*)

(*Continued*)

Study ID, country, Study period	Study aim	Population	Study design	Analyses method (theory/ framework/model used)	Themes/subthemes	Categories/subcategories
			stages in the recovery process			
Ivarsson et al (Sweden) Study period: NR[33]	To elucidate perceived situations of significance experienced by patients with hip fracture during the prehospital- and in-hospital care.	Hip fracture patients: 8	Qualitative – semi-structured interviews with open-ended questions on their experiences as hip fracture patients	Critical incident technique approach	Patients • Oscillating between being satisfied and enduring a new demanding situation	Patients • Pain and pain management • Feeling fear and satisfaction in perioperative care • Experiencing continuity in care • Considering information • Feeling encouragement and assistance

Gesar et al (Sweden)
Study period: 2013[34]
	To explore healthy older patients' perception of their own capacity to regain pre-fracture function in the acute phase (the first two to five days) after hip fracture surgery	Hip fracture patients: 30	Qualitative - Semi-structured interviews with open-ended questions to describe their hip fracture experiences and the possibilities of regaining functions and recovery after hip surgery.	Explorative inductive qualitative design.
				Data analyzed using manifest inductive content analysis
					Patients
					• To end up in a new situation with or without control
						Patients
						• 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

Griffiths et al (UK) Study period: 2012[37]	To explore what patients consider important when evaluating their recovery from hip fracture and to consider how these priorities could be used in the evaluation of the quality of hip fracture services.	Hip fracture Patients: 31	Qualitative – semi-structured interviews to explore with patients and, where appropriate, their carers, what they consider to be important outcomes and to explore variation across this patient group.	NR	Patients • Mobility (within 24 hrs post surgery) • Valued day-to-day activities • Self-care • Pain • Mental wellbeing • Fear of falling • Leg shortening.	NR
Olsson et al (Sweden) Study period: NR[38]	The aim of this study was to describe the hip fracture patients' own perceptions of their situation and views of their responsibility in the rehabilitation process.	Hip fracture Patients: 13	Qualitative – semi-structured interview questions, related to the informants' perception of the transitional properties,	Phenomenographic analysis	Patients • Common patient traits • Variations in need for information	Patients • 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)
Archibald et al (UK) Study period: 2001[39]	This study was conducted to explore the experiences of individuals who had suffered a hip fracture to inform nursing practice.	Hip fracture Patients: 5	In-depth, open-ended, unstructured interviews	Phenomenological methodology, grounded theory approach	Patients • The injury experience, • The pain experience, • The recovery experience • The disability experience	Patients • Storytelling, recalling the experience of the injury itself • Coping with the pain • Involved the operation, beginning the struggle of recovery, and

(*Continued*)

(*Continued*)

Study ID, country, Study period	Study aim	Population	Study design	Analyses method (theory/ framework/model used)	Themes/subthemes	Categories/subcategories

*Study number as per Supplementary Tables iv and v.
ADLs, activities of daily living; COM, capability, opportunity, and motivation; HP, healthcare professional; N/R, not reported; RCT, randomized controlled trial; TLS, traffic light system.

as 'themes', 'sub themes', 'categories', and 'sub-categories' interchangeably across papers. This heterogeneity makes synthesis of the qualitative data challenging.

Nevertheless, we grouped 'themes' under headings: personal factors, injury related factors, care pathway factors, and areas indicting the need for new or different performance indicators (Supplementary Table xi). Several studies identified the need for education/training/guidance to raise awareness of the importance of performance indicators in hip fractures care. Other cross-cutting themes included the need for clarity of roles within the clinical team, the need for restructuring or integration of care pathways linked to performance indicators and the requirement for regulation of data and processes.

Although lived experience of hip fracture was the focus for many of the qualitative studies involving patients, the participants identified several themes relevant to the use of performance indicators. These studies report that the interpretation of healthcare performance was influenced by personal/social attitudes, including beliefs, perceptions, and fears. With regard to medical/hospital care, themes including the need for teamwork/multidisciplinary care, a supportive environment and information about patient progress in their recovery, with particular regard to information about rehabilitation. The patients expressed a desire to be kept informed about progression on the care pathway, as it related to their care in particular. These themes suggest the potential need for more patient-centred performance indicators, to address the complexity of patient needs and contextual elements such as trust, humanistic approach, multi morbidity, frailty, and psychosocial care, within care pathways. For example, regarding their expectations of meeting performance indicator targets, one patient quoted, "It is very important to ask patients what they want from the treatment, what the patient's expectations are from the treatment, even though we are older women".[26] With regards to early mobilization one patient stated, "I thought I probably could have done more, but I didn't know how much I should do, I left it to them".[24]

Analyses of the qualitative data from eight studies involving healthcare professionals revealed several themes which could be subdivided at individual/personal, patient, and hospital/environmental levels. The healthcare professionals sought and found empowerment through the use of, and reporting of, performance indicators in hip fracture care. They felt able to use performance indicators to drive organizational restructuring and optimize multi-disciplinary team roles, as well as improving individual patient care. They also identified the need for training to change behaviour and achieve specific performance indicator targets. Healthcare professionals also expressed some concerns regarding the use of performance indicators in hip fracture care. These included suboptimal engagement of stakeholders, particularly patients and healthcare professionals, in the choice of performance indicators and the design of the clinical pathway. Leading to, for example, a lack of obvious links between performance indicators and patient-centred outcomes such as quality of care.

A common theme in both patient and healthcare professional interviews was the mismatch of expectations between patients and their carers and the clinical staff looking after them. This could lead to very different interpretations of data pertaining to performance indicators in the context of hip fracture. This mismatch was influenced by cultural attitudes to hip fracture and personal beliefs, for example the belief that older patients with hip fracture were less important than other trauma patients and therefore of a lower priority for urgent care. Other common themes included: the importance of psychological factors and motivation, assessments of general health risk, falls risk, discharge planning, and the provision of information to patients (Supplementary Table xi).

Discussion

This mixed methods review summarizes the peer reviewed literature and provides a holistic overview on the use of performance indicators in hip fracture care. A total of 171 studies were conducted between the years 1981 and 2021 across 34 countries. Of these studies, 63% were published within the last eight years or so (between 2015 and 2023). Studies were heterogenous in design, health systems studied, and study periods.

There was considerable variation in the performance indicators used for hip fracture care and, where performance indicators were defined, considerable variation in the definitions used. This variation makes it difficult to compare and contrast the performance of healthcare centres and systems, both within a single country and between countries. Of the 241 performance indicators described, 'time to surgery' was mostly commonly used (83% of included studies). Other commonly used indicators were 'time to mobilization post-surgery', 'orthogeriatric assessment', and 'bone health assessment'. Performance indicators related to acute care predominated, with very little attention given to post-acute care and rehabilitation.

The experiences of patients and healthcare professionals with regards to the use of performance indicators was generally poorly documented. However, common themes emerging from qualitative studies included the need for education/training/guidance on the use of performance indicators to facilitate positive behavioural and organizational

change, and the need to link performance indicators to demonstrable improvements in patient-centred outcomes.

Performance indicators are increasingly collected as part of national hip fracture registries/audits. Some healthcare systems have gone further, linking healthcare funding to performance indicators such as 'best practice tariffs' or 'pay for performance' initiatives but data on the benefits of such schemes, in terms of patient outcomes and healthcare costs, are limited.[7,186]

This review is not without limitations. The variable terminology used in describing performance indicators – quality standards, quality indicators, performance indicators, performance metrics, etc – made it difficult to develop a comprehensive search strategy. We attempted to mitigate this using 'snowballing' methods, which included conducting an extensive review of reference lists from retrieved studies and by searching the associated grey literature. However, it is still possible that our search strategy missed relevant studies. The heterogeneity in the use of and definition of performance indicators for hip fracture care, precluded numerical synthesis of data from different studies, and hence the review is limited to a narrative summary.

In conclusion, the use of performance indictors to manage hip fracture care is increasing in healthcare systems around the world. Healthcare professionals clearly see value in collecting these data. However, there is great variation in the performance indicators used, and how these performance indicators are defined. While it is important that performance indicators are relevant to the healthcare system in which they are used, standardization of the terminology and definitions of the commonly used performance indicators in hip fracture care would facilitate evidence synthesis and comparisons both within and between healthcare systems. Evidence with regard to stakeholder experiences in the collection and management of performance indicators is lacking.

There remains a pressing need for further research into the use and standardization of performance indicators in hip fracture care and their influence on patient outcomes and economic costs. More robust studies are also required into the barriers and facilitators for the use of performance indicators, in different healthcare systems and in different countries. The use of performance indicators for hip fracture care in low- and middle-income settings is currently poorly documented.

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Supplementary material

Tables showing: a) the search strategy; b) inclusion and exclusion criteria; c) summary of extracted data and quality assessment of various study designs (experimental, mixed methods, qualitative, before/after intervention, prospective/retrospective cohort studies and cross-sectional surveys); d) performance indicators/proxy performance indicators investigated via prospective cohort studies; and e) summary of themes from qualitative evidence from patients and healthcare professionals.

References

1. **Johnell O**, **Kanis JA**. An estimate of the worldwide prevalence, mortality and disability associated with hip fracture. *Osteoporos Int*. 2004;15(11): 897–902.
2. **Sing C-W**, **Lin T-C**, **Bartholomew S**, **et al**. Global epidemiology of hip fractures: secular trends in incidence rate, post-fracture treatment, and all-cause mortality. *J Bone Miner Res*. 2023;38(8):1064–1075.
3. **Griffin XL**, **Parsons N**, **Achten J**, **Fernandez M**, **Costa ML**. Recovery of health-related quality of life in a United Kingdom hip fracture population. *Bone Joint J*. 2015;97-B(3):372–382.
4. **Armstrong E**, **Harvey LA**, **Payne NL**, **et al**. Do we understand each other when we develop and implement hip fracture models of care? A systematic review with narrative synthesis. *BMJ Open Qual*. 2023; 12(Suppl 2):e002273.
5. **Cheung C-L**, **Ang SB**, **Chadha M**, **et al**. An updated hip fracture projection in Asia: the Asian federation of Osteoporosis societies study. *Osteoporos Sarcopenia*. 2018;4(1):16–21.
6. **Cooper CF**. *International Osteoporosis Foundation Compendium of Osteoporosis*. 2nd Edition., 2019. https://www.osteoporosis.foundation/educational-hub/files/iof-compendium-osteoporosis-2nd-edition
7. **Voeten SC**, **Krijnen P**, **Voeten DM**, **Hegeman JH**, **Wouters M**, **Schipper IB**. Quality indicators for hip fracture care, a systematic review. *Osteoporos Int*. 2018;29(9):1963–1985.
8. **Mazarello Paes V**, **Masters J**, **Graham S**, **Harriss E**, **Costa M**. PROSPERO 2023 CRD42023417515. https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42023417515 (date last accessed 4 February 2025).
9. **Page MJ**, **McKenzie JE**, **Bossuyt PM**, **et al**. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021; 372:n71.
10. **Tong A**, **Flemming K**, **McInnes E**, **Oliver S**, **Craig J**. Enhancing transparency in reporting the synthesis of qualitative research: ENTREQ. *BMC Med Res Methodol*. 2012;12:181.
11. **Bramer WM**, **Giustini D**, **de Jonge GB**, **Holland L**, **Bekhuis T**. De-duplication of database search results for systematic reviews in EndNote. *J Med Libr Assoc*. 2016;104(3):240–243.
12. **Hong QN**, **Fàbregues S**, **Bartlett G**, **et al**. The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. *EFI*. 2018;34(4):285–291.
13. **Hong QN**, **Pluye P**, **Bujold M**, **Wassef M**. Convergent and sequential synthesis designs: implications for conducting and reporting systematic reviews of qualitative and quantitative evidence. *Syst Rev*. 2017;6(1):61.
14. **Tabu I**, **Goh EL**, **Appelbe D**, **et al**. Service availability and readiness for hip fracture care in low- and middle-income countries in South and Southeast Asia. *Bone Jt Open*. 2023;4(9):676–681.
15. **MacDonald V**, **Maher AB**, **Mainz H**, **et al**. Developing and testing an international audit of nursing quality indicators for older adults with fragility hip fracture. *Orthop Nurs*. 2018;37(2):115–121.
16. **Panella M**, **Seys D**, **Sermeus W**, **et al**. Minimal impact of a care pathway for geriatric hip fracture patients. *Injury*. 2018;49(8):1581–1586.
17. **Kimmel LA**, **Liew SM**, **Sayer JM**, **Holland AE**. HIP4Hips (High Intensity Physiotherapy for Hip fractures in the acute hospital setting): a randomised controlled trial. *Med J Aust*. 2016;205(2):73–78.

18. **Mittal C**, **Lee HCD**, **Goh KS**, **et al**. ValuedCare program: a population health model for the delivery of evidence-based care across care continuum for hip fracture patients in Eastern Singapore. *J Orthop Surg Res*. 2018;13(1):129.
19. **Niemeijer GC**, **Flikweert E**, **Trip A**, **et al**. The usefulness of lean six sigma to the development of a clinical pathway for hip fractures. *J Eval Clin Pract*. 2013;19(5):909–914.
20. **Viveros-García JC**, **Guillermo-Nuncio EA**, **Nieto-Sandoval HR**, **Baldenebro-Lugo LS**. Quality indicators in hip fracture care after the implementation of an orthogeriatrics team. *Acta Ortop Mex*. 2021;35(2): 181–187.
21. **Saez Lopez P**, **Sanchez Hernandez N**, **Paniagua Tejo S**, **Valverde Garcia JA**, **Montero Diaz M**, **Alonso Garcia N**, **et al**. Clinical pathway for hip fracture patients] Utilidad de una via clinica en el manejo del anciano con fractura de cadera. *Rev Esp Geriatr Gerontol*. 2015;50(4):161–167.
22. **Rath S**, **Yadav L**, **Tewari A**, **et al**. Management of older adults with hip fractures in India: a mixed methods study of current practice, barriers and facilitators, with recommendations to improve care pathways. *Arch Osteoporos*. 2017;12(1):55.
23. **Mow TC**, **Lukeis J**, **Sutherland AG**. The benefits of streamlined hip fracture management in a regional hospital. *Geriatr Orthop Surg Rehabil*. 2017;8(2):99–103.
24. **Haslam-Larmer L**, **Donnelly C**, **Auais M**, **Woo K**, **DePaul V**. Early mobility after fragility hip fracture: a mixed methods embedded case study. *BMC Geriatr*. 2021;21(1):181.
25. **Gunningberg L**, **Lindholm C**, **Carlsson M**, **Sjödén PO**. Reduced incidence of pressure ulcers in patients with hip fractures: a 2-year follow-up of quality indicators. *Int J Qual Health Care*. 2001;13(5):399–407.
26. **Schroeder HS**, **Israeli A**, **Liebergall MI**, **et al**. The suitability of measuring patient-reported outcomes in older adults following a hip fracture using the short-form 36 questionnaire: a qualitative description approach. *Inquiry*. 2023;60:469580231171819.
27. **Southwell J**, **Potter C**, **Wyatt D**, **Sadler E**, **Sheehan KJ**. Older adults' perceptions of early rehabilitation and recovery after hip fracture surgery: a UK qualitative study. *Disabil Rehabil*. 2022;44(6):940–947.
28. **Asplin G**, **Carlsson G**, **Fagevik Olsén M**, **Zidén L**. See me, teach me, guide me, but it's up to me! Patients' experiences of recovery during the acute phase after hip fracture. *Eur J Physiother*. 2021;23(3):135–143.
29. **Volkmer B**, **Sadler E**, **Lambe K**, **et al**. Orthopaedic physiotherapists' perceptions of mechanisms for observed variation in the implementation of physiotherapy practices in the early postoperative phase after hip fracture: a UK qualitative study. *Age Ageing*. 2021;50(6):1961–1970.
30. **Jensen CM**, **Santy-Tomlinson J**, **Overgaard S**, **et al**. Empowerment of whom? The gap between what the system provides and patient needs in hip fracture management: a healthcare professionals' lifeworld perspective. *Int J Orthop Trauma Nurs*. 2020;38:100778.
31. **Segevall C**, **Söderberg S**, **Björkman Randström K**. The journey toward taking the day for granted again: the experiences of rural older people's recovery from hip fracture surgery. *Orthop Nurs*. 2019;38(6):359–366.
32. **Bruun-Olsen V**, **Bergland A**, **Heiberg KE**. "I struggle to count my blessings": recovery after hip fracture from the patients' perspective. *BMC Geriatr*. 2018;18(1):18.
33. **Ivarsson B**, **Hommel A**, **Sandberg M**, **Sjöstrand D**, **Johansson A**. The experiences of pre- and in-hospital care in patients with hip fractures: a study based on critical incidents. *Int J Orthop Trauma Nurs*. 2018;30:8–13.
34. **Gesar B**, **Hommel A**, **Hedin H**, **Bååth C**. Older patients' perception of their own capacity to regain pre-fracture function after hip fracture surgery - an explorative qualitative study. *Int J Orthop Trauma Nurs*. 2017;24:50–58.
35. **Jensen CM**, **Smith AC**, **Overgaard S**, **Wiil UK**, **Clemensen J**. "If only had I known": a qualitative study investigating a treatment of patients with a hip fracture with short time stay in hospital. *Int J Qual Stud Health Well-being*. 2017;12(1):1307061.
36. **Christie J**, **Macmillan M**, **Currie C**, **Matthews-Smith G**. Improving the experience of hip fracture care: a multidisciplinary collaborative approach to implementing evidence-based, person-centred practice. *Int J Orthop Trauma Nurs*. 2015;19(1):24–35.
37. **Griffiths F**, **Mason V**, **Boardman F**, **et al**. Evaluating recovery following hip fracture: a qualitative interview study of what is important to patients. *BMJ Open*. 2015;5(1):e005406.
38. **Olsson LE**, **Nyström AE**, **Karlsson J**, **Ekman I**. Admitted with a hip fracture: patient perceptions of rehabilitation. *J Clin Nurs*. 2007;16(5):853–859.
39. **Archibald G**. Patients' experiences of hip fracture. *J Adv Nurs*. 2003;44(4): 385–392.
40. **Yang TI**, **Kuo YJ**, **Huang SW**, **Chen YP**. Minimal short-term decline in functional performance and quality of life predicts better long-term outcomes for both in older taiwanese adults after hip fracture surgery: a prospective study. *J Orthop Surg Res*. 2023;18(1):791.
41. **Würdemann FS**, **Voeten SC**, **Wilschut JA**, **Schipper IB**, **Hegeman JH**. Data-driven development of the nationwide hip fracture registry in the Netherlands. *Arch Osteoporos*. 2022;18(1):2.
42. **Do VQ**, **Mitchell R**, **Clay-Williams R**, **et al**. Safety climate, leadership and patient views associated with hip fracture care quality and clinician perceptions of hip fracture care performance. *Int J Qual Health Care*. 2021;33(4):mzab152.
43. **Griffin XL**, **Achten J**, **Parsons N**, **Costa ML**, **On behalf of the WHiTE collaborators**. Does performance-based remuneration improve outcomes in the treatment of hip fracture? *Bone Joint J*. 2021;103-B(5): 881–887.
44. **Trinh LTT**, **Achat H**, **Loh SM**, **Pascoe R**, **Asarreh H**, **Stubbs J**. Meeting management standards and improvement in clinical outcomes among patients with hip fractures. *J Healthc Qual*. 2018;40(6):336–343.
45. **Lizaur-Utrilla A**, **Martinez-Mendez D**, **Collados-Maestre I**, **Miralles-Muñoz FA**, **Marco-Gomez L**, **Lopez-Prats FA**. Early surgery within 2 days for hip fracture is not reliable as healthcare quality indicator. *Injury*. 2016;47(7):1530–1535.
46. **Sivakumar BS**, **McDermott LM**, **Bell JJ**, **Pulle CR**, **Jayamaha S**, **Ottley MC**. Dedicated hip fracture service: implementing a novel model of care. *ANZ J Surg*. 2013;83(7–8):559–563.
47. **Heikkinen T**, **Willig R**, **Hänninen A**, **et al**. Hip fractures in Finland--a comparison of patient characteristics and outcomes in six hospitals. *Scand J Surg*. 2004;93(3):234–240.
48. **Matharu GS**, **Shah A**, **Hawley S**, **et al**. The influence of mode of anaesthesia on perioperative outcomes in people with hip fracture: a prospective cohort study from the National Hip Fracture Database for England, Wales and Northern Ireland. *BMC Med*. 2022;20(1):319.
49. **Gandossi CM**, **Zambon A**, **Oliveri G**, **et al**. Frailty, post-operative delirium and functional status at discharge in patients with hip fracture. *Int J Geriatr Psychiatry*. 2021;36(10):1524–1530.
50. **Said CM**, **Delahunt M**, **Ciavarella V**, **et al**. Factors impacting early mobilization following hip fracture: an observational study. *J Geriatr Phys Ther*. 2021;44(2):88–93.
51. **Xiang Z**, **Chen Z**, **Wang P**, **et al**. The effect of early mobilization on functional outcomes after hip surgery in the Chinese population - A multicenter prospective cohort study. *J Orthop Surg (Hong Kong)*. 2021;29(3):23094990211058902.
52. **Buecking B**, **Bohl K**, **Eschbach D**, **et al**. Factors influencing the progress of mobilization in hip fracture patients during the early postsurgical period?-A prospective observational study. *Arch Gerontol Geriatr*. 2015; 60(3):457–463.
53. **Dubljanin-Raspopović E**, **Marković-Denić L**, **Ivković K**, **et al**. The impact of postoperative pain on early ambulation after hip fracture. *Acta Chir Iugosl*. 2013;60(1):61–64.
54. **Barone A**, **Giusti A**, **Pizzonia M**, **et al**. Factors associated with an immediate weight-bearing and early ambulation program for older adults after hip fracture repair. *Arch Phys Med Rehabil*. 2009;90(9):1495–1498.
55. **Foss NB**, **Kristensen MT**, **Kehlet H**. Anaemia impedes functional mobility after hip fracture surgery. *Age Ageing*. 2008;37(2):173–178.
56. **Siu AL**, **Penrod JD**, **Boockvar KS**, **Koval K**, **Strauss E**, **Morrison RS**. Early ambulation after hip fracture: effects on function and mortality. *Arch Intern Med*. 2006;166(7):766–771.
57. **Siu AL**, **Boockvar KS**, **Penrod JD**, **et al**. Effect of inpatient quality of care on functional outcomes in patients with hip fracture. *Med Care*. 2006; 44(9):862–869.
58. **Foss NB**, **Kehlet H**. Mortality analysis in hip fracture patients: implications for design of future outcome trials. *Br J Anaesth*. 2005;94(1):24–29.
59. **Moran CG**, **Wenn RT**, **Sikand M**, **Taylor AM**. Early mortality after hip fracture: is delay before surgery important? *J Bone Joint Surg Am*. 2005; 87(3):483–489.

60. **Orosz GM**, **Magaziner J**, **Hannan EL**, **et al**. Association of timing of surgery for hip fracture and patient outcomes. *JAMA*. 2004;291(14):1738–1743.
61. **Penrod JD**, **Boockvar KS**, **Litke A**, **et al**. Physical therapy and mobility 2 and 6 months after hip fracture. *J Am Geriatr Soc*. 2004;52(7):1114–1120.
62. **Elliott J**, **Beringer T**, **Kee F**, **Marsh D**, **Willis C**, **Stevenson M**. Predicting survival after treatment for fracture of the proximal femur and the effect of delays to surgery. *J Clin Epidemiol*. 2003;56(8):788–795.
63. **Todd CJ**, **Freeman CJ**, **Camilleri-Ferrante C**, **et al**. Differences in mortality after fracture of hip: the east Anglian audit. *BMJ*. 1995; 310(6984):904–908.
64. **Zuckerman JD**, **Skovron ML**, **Koval KJ**, **Aharonoff G**, **Frankel VH**. Postoperative complications and mortality associated with operative delay in older patients who have a fracture of the hip. *J Bone Joint Surg Am*. 1995;77(10):1551–1556.
65. **Parker MJ**, **Pryor GA**. The timing of surgery for proximal femoral fractures. *J Bone Joint Surg Br*. 1992;74(2):203–205.
66. **Davis TR**, **Sher JL**, **Porter BB**, **Checketts RG**. The timing of surgery for intertrochanteric femoral fractures. *Injury*. 1988;19(4):244–246.
67. **Crozier-Shaw G**, **Hughes AJ**, **Cashman J**, **Synnott K**. Instant messaging apps and data protection: combining to improve hip fracture care? *Ir J Med Sci*. 2022;191(2):765–769.
68. **Esper G**, **Anil U**, **Konda S**, **Furgiuele D**, **Zaretsky J**, **Egol K**. Standardized preoperative pathways determining preoperative echocardiogram usage continue to improve hip fracture quality. *Geriatr Orthop Surg Rehabil*. 2022;13:21514593221094730.
69. **Lian T**, **Brandrud A**, **Mariero L**, **Nordsletten L**, **Figved W**. 60% Reduction of reoperations and complications for elderly patients with hip fracture through the implementation of a six-item improvement programme. *BMJ Open Qual*. 2022;11(3):e001848.
70. **Matharu GS**, **Whitehouse MR**, **Harding K**, **Kelly M**, **Walsh K**. Trauma care in older people: charting a path from outlier to excellence. *Age Ageing*. 2022;51(8):afac163.
71. **Frenkel Rutenberg T**, **Aizer A**, **Levi A**, **et al**. Antibiotic prophylaxis as a quality of care indicator: does it help in the fight against surgical site infections following fragility hip fractures? *Arch Orthop Trauma Surg*. 2022;142(2):239–245.
72. **Anthony C**, **Malaj M**, **Lokanathan P**, **Murgatroyd J**, **O'Connor P**. Crossing quartiles: Improving time to theatre for patients with hip fractures in a large UK district general hospital; A quality improvement report. *Injury*. 2021;52(11):3415–3419.
73. **Rozenfeld M**, **Bodas M**, **Shani M**, **et al**. Introduction of hospital quality measures may lead to a temporary decrease in patient outcomes. *Public Health*. 2021;200:71–76.
74. **Rubenstein W**, **Barry J**, **Rogers S**, **Grace TR**, **Tay B**, **Ward D**. Reducing time to surgery for hip fragility fracture patients: a resident quality improvement initiative. *J Healthc Qual*. 2021;43(5):e77–e83.
75. **Valsamis EM**, **Husband H**, **Burchette D**, **Milošević M**, **Bakota B**. Modelling the effect of a dedicated hip fracture unit on patient outcomes using segmented robust linear regression techniques. *Injury*. 2021;52 Suppl 5:S3–S6.
76. **Wang M**, **Liang H**, **Cui L**. Clinical practice of best practice nursing care standards for older adults with fragility hip fracture: a propensity score matched analysis. *Appl Nurs Res*. 2021;62:151491.
77. **van Voorden TAJ**, **den Hartog D**, **Soesman NMR**, **et al**. Effect of the Dutch Hip Fracture Audit implementation on mortality, length of hospital stay and time until surgery in elderly hip fracture patients; a multi-center cohort study. *Injury*. 2020;51(4):1038–1044.
78. **Baroni M**, **Serra R**, **Boccardi V**, **et al**. The orthogeriatric comanagement improves clinical outcomes of hip fracture in older adults. *Osteoporos Int*. 2019;30(4):907–916.
79. **Jackson K**, **Bachhuber M**, **Bowden D**, **Etter K**, **Tong C**. Comprehensive hip fracture care program: successive implementation in 3 hospitals. *Geriatr Orthop Surg Rehabil*. 2019;10:2151459319846057.
80. **Metcalfe D**, **Zogg CK**, **Judge A**, **et al**. Pay for performance and hip fracture outcomes: an interrupted time series and difference-in-differences analysis in England and Scotland. *Bone Joint J*. 2019;101-B(8): 1015–1023.
81. **Murphy RP**, **Reddin C**, **Murphy EP**, **Waters R**, **Murphy CG**, **Canavan M**. Key service improvements after the introduction of an integrated orthogeriatric service. *Geriatr Orthop Surg Rehabil*. 2019;-10:2151459319893898.
82. **Sermon A**, **Rochus I**, **Smeets B**, **et al**. The implementation of a clinical pathway enhancing early surgery for geriatric hip fractures: how to maintain a success story? *Eur J Trauma Emerg Surg*. 2019;45(2):199–205.
83. **Wallace R**, **Angus LDG**, **Munnangi S**, **Shukry S**, **DiGiacomo JC**, **Ruotolo C**. Improved outcomes following implementation of a multidisciplinary care pathway for elderly hip fractures. *Aging Clin Exp Res*. 2019;31(2):273–278.
84. **Walton TJ**, **Bellringer SF**, **Edmondson M**, **Stott P**, **Rogers BA**. Does a dedicated hip fracture unit improve clinical outcomes? A five-year case series. *ANNALS*. 2019;101(3):215–519.
85. **Liu SK**, **Ho AW**, **Wong SH**, **Department of Orthopaedics and Traumatology, Princess Margaret Hospital, Laichikok, Hong Kong**. Early surgery for Hong Kong Chinese elderly patients with hip fracture reduces short-term and long-term mortality. *Hong Kong Med J*. 2017; 23(4):374–380.
86. **Middleton M**, **Wan B**, **da Assunção R**. Improving hip fracture outcomes with integrated orthogeriatric care: a comparison between two accepted orthogeriatric models. *Age Ageing*. 2017;46(3):465–470.
87. **Oakley B**, **Nightingale J**, **Moran CG**, **Moppett IK**. Does achieving the best practice tariff improve outcomes in hip fracture patients? An observational cohort study. *BMJ Open*. 2017;7(2):e014190.
88. **Pajulammi HM**, **Pihlajamäki HK**, **Luukkaala TH**, **Jousmäki JJ**, **Nuotio MS**. Association of comprehensive geriatric assessment with quality-related care practices during implementation and development of an orthogeriatric hip fracture program. *Eur Geriatr Med*. 2017;8(5–6):424–429.
89. **Yazdanshenas H**, **Washington ER IV**, **Shamie AN**, **Madadi F**, **Washington ER III**. Senior managed care system for hip fracture in the United States. *Clin Orthop Surg*. 2016;8(1):19–28.
90. **Metcalfe D**, **Gabbe BJ**, **Perry DC**, **et al**. Quality of care for patients with a fracture of the hip in major trauma centres. *Bone Joint J*. 2016;98-B(3): 414–419.
91. **Soong C**, **Cram P**, **Chezar K**, **et al**. Impact of an integrated hip fracture inpatient program on length of stay and costs. *J Orthop Trauma*. 2016; 30(12):647–652.
92. **Fleury N**, **Chevalley F**, **Rubli E**, **Coti P**, **Farron A**, **Jolles BM**. Efficiency of the lausanne clinical pathway for proximal femoral fractures. *Front Surg*. 2015;2:5.
93. **Neuburger J**, **Currie C**, **Wakeman R**, **et al**. The impact of a national clinician-led audit initiative on care and mortality after hip fracture in england. *Med Care*. 2015;53(8):686–691.
94. **Britton E**, **Nash W**. The new neck of femur fracture target: experience in a district general hospital. *Int J Health Care Qual Assur*. 2014;27(1):36–43.
95. **Khan SK**, **Shirley MDF**, **Glennie C**, **Fearon PV**, **Deehan DJ**. Achieving best practice tariff may not reflect improved survival after hip fracture treatment. *Clin Interv Aging*. 2014;9:2097–2102.
96. **Kommer M**, **Gokaraju K**, **Singh S**. Changing the consultant on calls from a daily to weekly rotation system reduces time to theater for patients with hip fracture to improve quality of care: a retrospective study of 2 cohorts of patients presenting with hip fracture. *Geriatr Orthop Surg Rehabil*. 2014;5(2):69–72.
97. **Colais P**, **Pinnarelli L**, **Fusco D**, **Davoli M**, **Braga M**, **Perucci CA**. The impact of a pay-for-performance system on timing to hip fracture surgery: experience from the Lazio Region (Italy). *BMC Health Serv Res*. 2013;13:393.
98. **Collinge CA**, **McWilliam-Ross K**, **Beltran MJ**, **Weaver T**. Measures of clinical outcome before, during, and after implementation of a comprehensive geriatric hip fracture program: is there a learning curve? *J Orthop Trauma*. 2013;27(12):672–676.
99. **Khan SK**, **Weusten A**, **Bonczek S**, **Tate A**, **Port A**. The best practice tariff helps improve management of neck of femur fractures: a completed audit loop. *Br J Hosp Med*. 2013;74(11):644–647.
100. **Ciaschi A**, **Caprara A**, **Gillespie F**, **Furnari G**, **Mamede S**. Changing doctors' behaviours: an educational program to disseminate a new clinical pathway for the hospital management of hip fractures in elderly patients in the Lazio Region, Italy. *J Eval Clin Pract*. 2011;17(4):811–818.
101. **Yousri TA**, **Khan Z**, **Chakrabarti D**, **Fernandes R**, **Wahab K**. Lean thinking: can it improve the outcome of fracture neck of femur patients in a district general hospital? *Injury*. 2011;42(11):1234–1237.
102. **Merle V**, **Moret L**, **Pidhorz L**, **et al**. Does comparison of performance lead to better care? A pilot observational study in patients admitted for hip fracture in three French public hospitals. *Int J Qual Health Care*. 2009;21(5):321–329.

103. **Jensen PS**, **Holm M**, **Christensen FT**, **Foss NB**, **Kehlet H**. Fast-tracking admission from emergency room to orthopaedic ward in hip fracture patients. *Opt modt proc for hoftefrakturpat*. 2007;169(9):808–812.
104. **Freeman C**, **Todd C**, **Camilleri-Ferrante C**, **et al**. Quality improvement for patients with hip fracture: experience from a multi-site audit. *Qual Saf Health Care*. 2002;11(3):239–245.
105. **Snowdon DA**, **Leggat SG**, **Harding KE**, **et al**. Direct supervision of physiotherapists improves compliance with clinical practice guidelines for patients with hip fracture: a controlled before-and-after study. *Disabil Rehabil*. 2020;42(26):3825–3832.
106. **Hommel A**, **Ulander K**, **Bjorkelund KB**, **Norrman PO**, **Wingstrand H**, **Thorngren KG**. Influence of optimised treatment of people with hip fracture on time to operation, length of hospital stay, reoperations and mortality within 1 year. *Injury*. 2008;39(10):1164–1174.
107. **Guryel E**, **Redfern DJ**, **Ricketts DM**. Balancing priorities in the management of hip fractures: guidelines versus resources. *Ann R Coll Surg Engl*. 2004;86(3):171–173.
108. **Hommel A**, **Ulander K**, **Thorngren K**. Improvements in pain relief, handling time and pressure ulcers through internal audits of hip fracture patients. *Scand J Caring Sci*. 2003;17(1):78–83.
109. **Parola R**, **Neal WH**, **Konda SR**, **Ganta A**, **Egol KA**. No differences between white and non-white patients in terms of care quality metrics, complications, and death after hip fracture surgery when standardized care pathways are used. *Clin Orthop Relat Res*. 2023;481(2):324–335.
110. **Walsh ME**, **Blake C**, **Walsh CD**, **Brent L**, **Sorensen J**. Patient and hospital-level factors associated with time to surgery after hip fracture in Ireland: Analysis of national audit data 2016-2020. *Injury*. - 2023;S0020-1383(23)00371-6.
111. **Colais P**, **Pinnarelli L**, **Mataloni F**, **et al**. The national outcomes evaluation programme in Italy: the impact of publication of health indicators. *Int J Environ Res Public Health*. 2022;19(18):11685.
112. **Condorhuamán-Alvarado PY**, **Pareja-Sierra T**, **Muñoz-Pascual A**, **et al**. Improving hip fracture care in Spain: evolution of quality indicators in the Spanish National Hip Fracture Registry. *Arch Osteoporos*. 2022; 17(1):54.
113. **Denis A**, **Montreuil J**, **Reindl R**, **Berry GK**, **Harvey EJ**, **Bernstein M**. Time-to-Incision for Hip Fractures in a Canadian Level-1 Trauma Centre: Are We Respecting the Guidelines? *Can Geriatr J*. 2022;25(1):57–65.
114. **Fisher ND**, **Parola R**, **Bi AS**, **Konda SR**, **Egol KA**. Ambulation on hip fracture postoperative day 1: a marker for better outcomes following hip fracture surgery in patients 55 years or older. *HIP Int*. 2023;33(4):779–788.
115. **Goubar A**, **Ayis S**, **Beaupre L**, **et al**. The impact of the frequency, duration and type of physiotherapy on discharge after hip fracture surgery: a secondary analysis of UK national linked audit data. *Osteoporos Int*. 2022;33(4):839–850.
116. **Neumann CJ**, **Schulze-Raestrup U**, **Müller-Mai CM**, **Smektala R**. Development of the inpatient quality of care of surgically treated patients with a proximal femoral fracture in North Rhine-Westphalia: Analysis of 61,249 treatment courses based on data from external inpatient quality assurance. *Unfallchir (Heidelb)*. 2022;125(8):634–646.
117. **Siow WS**, **Tay L**, **Mah CL**. Quality improvement initiative: how the setting up of an anaesthesia consultant-led perioperative outreach service addressed anaesthesia-specific issues to improve anaesthesia consult and surgery timings for hip fracture patients. *BMJ Open Qual*. 2022;11(3):e001738.
118. **Walsh ME**, **Sorensen J**, **Blake C**, **Johnsen SP**, **Kristensen PK**. Geographic variation in hip fracture surgery rate, care quality and outcomes: a comparison between national registries in Ireland and Denmark. *Arch Osteoporos*. 2022;17(1):128.
119. **Würdemann FS**, **Krijnen P**, **van Zwet EW**, **et al**. Trends in data quality and quality indicators 5 years after implementation of the Dutch Hip Fracture Audit. *Eur J Trauma Emerg Surg*. 2022;48(6):4783–4796.
120. **Farrow L**, **Hall AJ**, **Ablett AD**, **Johansen A**, **Myint PK**. The influence of hospital-level variables on hip fracture outcomes. *Bone Joint J*. 2021;103-B(10):1627–1632.
121. **Goubar A**, **Martin FC**, **Potter C**, **et al**. The 30-day survival and recovery after hip fracture by timing of mobilization and dementia: a UK database study. *Bone Joint J*. 2021;103-B(7):1317–1324.
122. **Kristensen PK**, **Falstie-Jensen AM**, **Madsen M**, **Johnsen SP**. Patient-related healthcare disparities in the quality of acute hip fracture care: a 10-year nationwide population-based cohort study. *BMJ OPEN*. 2021; 11(12):e051424.
123. **Lieten S**, **Herrtwich A**, **Bravenboer B**, **Scheerlinck T**, **Van Laere S**, **Vanlauwe J**. Analysis of the effects of a delay of surgery in patients with hip fractures: outcome and causes. *Osteoporos Int*. 2021;32(11):2235–2245.
124. **Voeten SC**, **Wouters MWJM**, **Würdemann FS**, **et al**. Textbook process as a composite quality indicator for in-hospital hip fracture care. *Arch Osteoporos*. 2021;16(1):63.
125. **Walsh ME**, **Ferris H**, **Coughlan T**, **et al**. Trends in hip fracture care in the Republic of Ireland from 2013 to 2018: results from the Irish Hip Fracture Database. *Osteoporos Int*. 2021;32(4):727–736.
126. **Cohen-Kadosh S**, **Sinuany-Stern Z**. Hip fracture surgery efficiency in Israeli hospitals via a network data envelopment analysis. *Cent Eur J Oper Res*. 2020;28(1):251–277.
127. **Farrow L**, **Hall A**, **Aucott L**, **Holt G**, **Myint PK**. Does quality of care in hip fracture vary by day of admission? *Arch Osteoporos*. 2020;15(1):52.
128. **Ferrara MC**, **Andreano A**, **Tassistro E**. Three-year National report from the Gruppo Italiano di Ortogeriatria (GIOG) in the management of hip-fractured patients. *Aging Clin Exp Res*. 2020;32(7):1245–1253.
129. **Kristensen PK**, **Röck ND**, **Christensen HC**, **Pedersen AB**. The Danish multidisciplinary hip fracture registry 13-year results from a population-based cohort of hip fracture patients. *Clin Epidemiol*. 2020;12:9–21.
130. **Maxwell BG**, **Mirza A**. Medical comanagement of hip fracture patients is not associated with superior perioperative outcomes: a propensity score-matched retrospective cohort analysis of the national surgical quality improvement project. *J Hosp Med*. 2020;15(8):468–474.
131. **Nayar SK**, **Marrache M**, **Ali I**, **et al**. Racial disparity in time to surgery and complications for hip fracture patients. *Clin Orthop Surg*. 2020;12(4): 430–434.
132. **Aprato A**, **Casiraghi A**, **Pesenti G**, **et al**. 48 h for femur fracture treatment: are we choosing the wrong quality index? *J Orthop Traumatol*. 2019;20(1):11.
133. **Asanuma D**, **Momosaki R**. Characteristics of rehabilitation services in high-FIM efficiency hospitals after hip fracture. *J Med Invest*. 2019;66(3.4): 324–327.
134. **Beaupre LA**, **Khong H**, **Smith C**, **et al**. The impact of time to surgery after hip fracture on mortality at 30- and 90-days: Does a single benchmark apply to all? *Injury*. 2019;50(4):950–955.
135. **Condorhuamán-Alvarado PY**, **Pareja-Sierra T**, **Muñoz-Pascual A**, **et al**. First proposal of quality indicators and standards and recommendations to improve the healthcare in the Spanish National Registry of Hip Fracture. *Rev Esp Geriatr Gerontol*. 2019;54(5):257–264.
136. **Kristensen PK**, **Søgaard R**, **Thillemann TM**, **Søballe K**, **Johnsen SP**. High quality of care did not imply increased hospital spending-nationwide cohort study among hip fracture patients. *Int J Qual Health Care*. 2019;31(7):22–29.
137. **Whitaker SR**, **Nisar S**, **Scally AJ**, **Radcliffe GS**. Does achieving the "Best Practice Tariff" criteria for fractured neck of femur patients improve one year outcomes? *Injury*. 2019;50(7):1358–1363.
138. **Cuesta-Peredo D**, **Tarazona-Santabalbina FJ**, **Borras-Mañez C**, **Belenguer-Varea A**, **Avellana-Zaragoza JA**, **Arteaga-Moreno F**. Estimate of the costs caused by adverse effects in hospitalised patients due to hip fracture: design of the study and preliminary results. *Geriatrics (Basel)*. 2018;3(1):7.
139. **Farrow L**, **Hall A**, **Wood AD**, **et al**. Quality of care in hip fracture patients: the relationship between adherence to national standards and improved outcomes. *J Bone Joint Surg Am*. 2018;100(9):751–757.
140. **Kempenaers K**, **Van Calster B**, **Vandoren C**, **et al**. Are the current guidelines for surgical delay in hip fractures too rigid? A single center assessment of mortality and economics. *Injury*. 2018;49(6):1169–1175.
141. **Kristensen PK**, **Johnsen SP**, **Mor A**, **Thillemann TM**, **Pedersen AB**. Is the higher mortality among men with hip fracture explained by sex-related differences in quality of in-hospital care? A population-based cohort study. *Age Ageing*. 2017;46(2):193–199.
142. **Ferguson KB**, **Halai M**, **Winter A**. National audits of hip fractures: are yearly audits required? *Injury*. 2016;47(2):439–443.
143. **Kristensen PK**, **Thillemann TM**, **Søballe K**, **Johnsen SP**. Can improved quality of care explain the success of orthogeriatric units? A population-based cohort study. *Age Ageing*. 2016;45(1):66–71.
144. **Kristiansen NS**, **Kristensen PK**, **Nørgård BM**, **Mainz J**, **Johnsen SP**. Off-hours admission and quality of hip fracture care: a nationwide cohort study of performance measures and 30-day mortality. *Int J Qual Health Care*. 2016;28(3):324–331.

145. **Metcalfe D**, **Salim A**, **Olufajo O**, **et al**. Hospital case volume and outcomes for proximal femoral fractures in the USA: an observational study. *BMJ Open*. 2016;6(4):e010743.
146. **Neufeld ME**, **O'Hara NN**, **Zhan M**, **et al**. Timing of hip fracture surgery and 30-day outcomes. *Orthopedics*. 2016;39(6):361–368.
147. **Buja A**, **Canavese D**, **Furlan P**, **Lago L**, **Saia M**, **Baldo V**. Are hospital process quality indicators influenced by socio-demographic health determinants. *Eur J Public Health*. 2015;25(5):759–765.
148. **Colais P**, **Di Martino M**, **Fusco D**, **Perucci CA**, **Davoli M**. The effect of early surgery after hip fracture on 1-year mortality. *BMC Geriatr*. 2015; 15:141.
149. **Dinamarca-Montecinos JL**, **Améstica-Lazcano G**, **Rubio-Herrera R**, **Carrasco-Buvinic A**, **Vásquez A**. Hip fracture. Experience in 647 Chilean patients aged 60 years or more. *Rev Med Chil*. 2015;143(12):1552–1559.
150. **Hawkes D**, **Baxter J**, **Bailey C**, **et al**. Improving the care of patients with a hip fracture: a quality improvement report. *BMJ Qual Saf*. 2015;24(8): 532–538.
151. **Desai SJ**, **Patel J**, **Abdo H**, **Lawendy A-R**, **Sanders D**. A comparison of surgical delays in directly admitted versus transferred patients with hip fractures: opportunities for improvement? *Can J Surg*. 2014;57(1):40–43.
152. **Khan SK**, **Jameson SS**, **Avery PJ**, **Gray AC**, **Deehan DJ**. Does the timing of presentation of neck of femur fractures affect the outcome of surgical intervention. *Eur J Emerg Med*. 2013;20(3):178–181.
153. **Uzoigwe CE**, **Burnand HGF**, **Cheesman CL**, **Aghedo DO**, **Faizi M**, **Middleton RG**. Early and ultra-early surgery in hip fracture patients improves survival. *Injury*. 2013;44(6):726–729.
154. **Jakma TSC**, **Vijfhuize S**, **Vegt PA**, **Plaisier PW**, **Oostenbroek RJ**, **Punt BJ**. Hip fracture surgery and performance indicators: an analysis of 941 patients operated in a large teaching hospital. *Eur J Trauma Emerg Surg*. 2012;38(1):49–52.
155. **Kumar G**. Protocol-guided hip fracture management reduces length of hospital stay. *Br J Hosp Med*. 2012;73(11):645–648.
156. **Perez Verdun MA**, **Sanchez-Cantalejo Ramirez E**, **Tirado Reyes M**. Quality indicators in the integrated care process of hip. *Fracture in the elderly RehabilitacionFract in the elderly Rehabil*. 2012;46(4):287–294.
157. **Koren-Hakim T**, **Weiss A**, **Hershkovitz A**, **et al**. The relationship between nutritional status of hip fracture operated elderly patients and their functioning, comorbidity and outcome. *Clin Nutr*. 2012;31(6):917–921.
158. **Egerod I**, **Rud K**, **Specht K**, **et al**. Room for improvement in the treatment of hip fractures in Denmark. *Dan Med Bull*. 2010;57(12):A4199.
159. **Nielsen KA**, **Jensen NC**, **Jensen CM**, **et al**. Quality of care and 30 day mortality among patients with hip fractures: a nationwide cohort study. *BMC Health Serv Res*. 2009;9(1):186.
160. **SooHoo NF**, **Correa B**, **Pandarinath R**. Pitfalls of using performance measures to evaluate the quality of hip fracture care. *Orthopedics*. 2009;32(2):84–89.
161. **Youde J**, **Husk J**, **Lowe D**, **Grant R**, **Potter J**, **Martin F**. The national clinical audit of falls and bone health: the clinical management of hip fracture patients. *Injury*. 2009;40(11):1226–1230.
162. **Pillay J**, **Wouden JC**, **Leenen LPH**. Retrospective application of the performance indicator "hip fracture: operate within 24 hours" in 217 patients treated at the university medical centre utrecht in 2000-2003: reduction in postoperative pneumonia but not mortality. *Ned Tijdschr Geneeskd*. 2007;151(17):967–970.
163. **Patel NK**, **Sarraf KM**, **Joseph S**, **Lee C**, **Middleton FR**. Implementing the national hip fracture database: an audit of care. *Injury*. 2013;44(12): 1934–1939.
164. **Hasan O**, **Mazhar L**, **Rabbani U**, **Rabbani A**, **Mahmood F**, **Noordin S**. Does early surgery prevent Postoperative ICU admission after surgery for the fracture of the hip. Nested case control study of 911 patients. *Ann Med Surg (Lond)*. 2021;61:35–40.
165. **Haslam-Larmer L**, **Auais M**, **Donnelly C**, **Woo K**, **DePaul V**. A health care record review of early mobility activities after fragility hip fracture: Utilizing the French systematic method to inform future interventions. *Int J Orthop Trauma Nurs*. 2021;42:100846.
166. **Sheehan KJ**, **Goubar A**, **Martin FC**, **et al**. Discharge after hip fracture surgery in relation to mobilisation timing by patient characteristics: linked secondary analysis of the UK National Hip Fracture Database. *BMC Geriatr*. 2021;21(1):694.
167. **Shah A**, **Matharu GS**, **Inman D**, **Fagan E**, **Johansen A**, **Judge A**. Variation in timely surgery for hip fracture by day and time of presentation: a nationwide prospective cohort study from the National Hip Fracture Database for England, Wales and Northern Ireland. *BMJ Qual Saf*. 2021;30(7):559–566.
168. **Sobolev B**, **Guy P**, **Sheehan KJ**, **et al**. Hospital mortality after hip fracture surgery in relation to length of stay by care delivery factors: a database study. *Medicine (Baltimore)*. 2017;96(16):e6683.
169. **Kristensen PK**, **Thillemann TM**, **Johnsen SP**. Is bigger always better? A nationwide study of hip fracture unit volume, 30-day mortality, quality of in-hospital care, and length of hospital stay. *Med Care*. 2014;52(12):1023–1029.
170. **Taylor R**, **Nairn S**. Audit of standards of practice in suspected hip fracture. *Int Emerg Nurs*. 2012;20(4):236–242.
171. **Fergus L**, **Cutfield G**, **Harris R**. Auckland city hospital's ortho-geriatric service: an audit of patients aged over 65 with fractured neck of femur. *N Z Med J*. 2011;124(1337):40–54.
172. **Lefaivre KA**, **Macadam SA**, **Davidson DJ**, **Gandhi R**, **Chan H**, **Broekhuyse HM**. Length of stay, mortality, morbidity and delay to surgery in hip fractures. *J Bone Joint Surg Br*. 2009;91(7):922–927.
173. **Verbeek DO**, **Ponsen KJ**, **Goslings JC**, **Heetveld MJ**. Effect of surgical delay on outcome in hip fracture patients: a retrospective multivariate analysis of 192 patients. *Int Orthop*. 2008;32(1):13–18.
174. **Novack V**, **Jotkowitz A**, **Etzion O**, **Porath A**. Does delay in surgery after hip fracture lead to worse outcomes? A multicenter survey. *Int J Qual Health Care*. 2007;19(3):170–176.
175. **Majumdar SR**, **Beaupre LA**, **Johnston DWC**, **Dick DA**, **Cinats JG**, **Jiang HX**. Lack of association between mortality and timing of surgical fixation in elderly patients with hip fracture: results of a retrospective population-based cohort study. *Med Care*. 2006;44(6):552–559.
176. **Gdalevich M**, **Cohen D**, **Yosef D**, **Tauber C**. Morbidity and mortality after hip fracture: the impact of operative delay. *Arch Orthop Trauma Surg*. 2004;124(5):334–340.
177. **Lawrence TM**, **White CT**, **Wenn R**, **Moran CG**. The current hospital costs of treating hip fractures. *Injury*. 2005;36(1):88–91.
178. **Weller I**, **Wai EK**, **Jaglal S**, **Kreder HJ**. The effect of hospital type and surgical delay on mortality after surgery for hip fracture. *J Bone Joint Surg Br*. 2005;87(3):361–366.
179. **Grimes JP**, **Gregory PM**, **Noveck H**, **Butler MS**, **Carson JL**. The effects of time-to-surgery on mortality and morbidity in patients following hip fracture. *Am J Med*. 2002;112(9):702–709.
180. **Hoenig H**, **Rubenstein LV**, **Sloane R**, **Horner R**, **Kahn K**. What is the role of timing in the surgical and rehabilitative care of community-dwelling older persons with acute hip fracture? *Arch Intern Med*. 1997;157(5):513–520.
181. **Rogers FB**, **Shackford SR**, **Keller MS**. Early fixation reduces morbidity and mortality in elderly patients with hip fractures from low-impact falls. *J Trauma Inj Infect Crit Care*. 1995;39(2):261–265.
182. **Bredahl C**, **Nyholm B**, **Hindsholm KB**, **Mortensen JS**, **Olesen AS**. Mortality after hip fracture: results of operation within 12 h of admission. *Injury*. 1992;23(2):83–86.
183. **Dolk T**. Operation in hip fracture patients--analysis of the time factor. *Injury*. 1990;21(6):369–372.
184. **Davidson TI**, **Bodey WN**. Factors influencing survival following fractures of the upper end of the femur. *Injury*. 1986;17(1):12–14.
185. **Kristensen PK**, **Thillemann TM**, **Søballe K**, **Johnsen SP**. Are process performance measures associated with clinical outcomes among patients with hip fractures? A population-based cohort study. *Int J Qual Health Care*. 2016;28(6):698–708.
186. **Werner M**, **Macke C**, **Gogol M**, **Krettek C**, **Liodakis E**. Differences in hip fracture care in Europe: a systematic review of recent annual reports of hip fracture registries. *Eur J Trauma Emerg Surg*. 2022;48(3):1625–1638.

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Data sharing

All data generated or analyzed during this study are included in the published article and/or in the supplementary material.

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