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Orthogeriatric model of care for hip fracture care

Evidence check

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Evidence check question

What are the key features, effectiveness, opportunities and challenges in the orthogeriatric model of care?

Summary

Orthogeriatric models of care comprise a multidisciplinary approach to care, involving the systemic/ongoing involvement or leading role of a geriatrician or a specialised orthogeriatrician in the management of older people requiring orthopaedic surgery, particularly patients with hip fracture.

There is evidence that orthogeriatric models of care lead to improved outcomes in terms of mortality, complications, functional outcomes, medication management and cost-effectiveness compared with an alternative 'usual care' model in which geriatric consultation is only provided 'as needed' and at the request of the surgeon.

While findings from individual studies vary, in terms of hospital length of stay, time to surgery and readmission rates, they indicate favourable or similar outcomes to such a version of 'usual care'.

Overall, the evidence supports the implementation of an orthogeriatric model of care, given the potential for improved patient, health service and quality of care outcomes.

Because of heterogenicity in orthogeriatric models of care being evaluated and compared in the included studies, and inconsistent reporting on outcomes, a conclusion as to which orthogeriatric model is superior to others cannot be drawn.

In-brief

Eight systematic reviews published since 2012 and 20 comparative/evaluative studies published since August 2020 were included. Majority of studies involved geriatric hip fracture patients.

Orthogeriatric models of care

Four main types of orthogeriatric models of care were described in the included studies:

- Orthopaedic surgeon-led model: the patient is admitted to the orthopaedic ward under the orthopaedic surgeon; the geriatrician provides consult on a routine and ongoing basis.[1]
- Shared orthogeriatric model: the patient is admitted to a ward under the co-management of both the surgeon and the geriatrician. [1] A variation of this model includes admitting patients to the orthopaedic ward immediately after surgery with a daily consult from a geriatrician; after removal of sutures/staples, transfer to internal medicine or geriatric wards with a routine consult with an orthopaedic surgeon.[2]
- Geriatrician-led model: the patient is admitted to the geriatric medical ward under the geriatrician; the orthopaedic surgeon provides consult on a routine and ongoing basis.[1]
- Dedicated orthogeriatrician-led model: employment of a dedicated orthogeriatrician in an orthopaedic department.[3, 4]

Effectiveness

- **Mortality**:
    - In-hospital mortality: one recent meta-analysis reported a 28% lower risk of in-hospital mortality for hip fracture patients in an orthogeriatric care model compared with in 'usual care'. [1] Integrated care model (shared care) alone resulted in a 35% reduction in the risk of in-hospital mortality compared with 'usual care'. Other systematic reviews and individual studies reported a favourable outcome in the orthogeriatric care model groups. [5-9] There were few or no differences between the various types of orthogeriatric models of care, with one study reporting slightly better mortality outcomes with the shared care model. [6] There were mixed findings across studies, some reporting no difference to 'usual care'. [2, 10-12] One cross-sectional study of 3,972 geriatric patients (mean age = 83.5 years) reported a significant reduction in mortality among patients >90 years old over a 10-year period, with an annual percentage change of -7.1 (95% CI [-12.6, -1.3], p=0.024). [8]
    - One-year mortality: A meta-analysis published in 2021 reported an overall 14% lower risk of one-year mortality for hip fracture patients in an orthogeriatric care model compared with standard orthopaedic care (relative rate=0.86, 95% CI [0.78, 0.97], p<0.01).
        - Integrated care model versus 'usual care': eight studies with a total of 8,865 patients; relative rate 0.87, 95% CI [0.75, 1.01], p=0.01. [1]
        - Geriatric consultant service: three studies with a total of 1,037 patients; relative rate=0.65, 95% CI [0.31-1.38], p=0.27. [1]
        - Geriatric ward: three studies with a total of 9,937 patients; relative rate = 0.95, 95% CI [0.68, 1.32], p=0.40. [1]
        - In one meta-analysis, orthogeriatric ward model of care had better outcomes in reducing long-term mortality (odds ratio 0.62, 95% CI [0.48,0.80], p=0.0002) compared with shared care by orthopaedists and geriatrician or geriatric advice in an orthopaedic ward. [6]
        - A systematic review published in 2014 reported a reduced relative risk of one-year mortality in favour of orthogeriatric treatment compared with trauma surgery services alone (four studies with a total of 478 patients; relative risk=0.79, 95% CI [0.57, 1.10], p = 0.17) but this did not reach statistical significance.[13] Several

individual studies reported a significantly reduced mortality rate compared with in 'usual care'.[14]

- **Complication rate**: There is relatively consistent evidence of reduced incidence rates of medical and/or surgical complications in orthogeriatric models of care compared with in 'usual care', irrespective of the model investigated, although a minority of studies report a non-significant difference.[1] More specifically, compared with 'usual care', orthogeriatric models of care indicated benefit in terms of:
    - Delirium, including subsyndromal delirium: most studies reported a significantly lower relative risk compared with that in 'usual care';[1, 7, 15] one reported no difference.[16]
        - One recent meta-analysis reported a 19% reduction in delirium incidence in orthogeriatric care models compared with 'usual care': 13 studies with a total of 2,000 patients; relative rate=0.81, 95% CI [0.71, 0.92], p=0.19.[1]
        - One study reported no difference between post-operative patients who were cared for by a multidisciplinary team that provided comprehensive geriatric assessments and those that did not (26.3% versus 26.5% respectively, p=0.98).[16]
    - Pressure ulcers: mixed findings with either a significantly lower[1] or similar incidence rate[8]
    - Anaemia/transfusion need: a significantly lower incidence[1, 3]
    - Urinary tract infections: a significantly lower incidence[1]
    - Falls: inconclusive findings across studies. One systematic review reported a significantly lower incidence while the other reported no significant difference[1, 17]
    - Secondary fracture: A retrospective cohort study compared geriatric hip fracture outcomes in two different institutions, one with specialised geriatric trauma protocols and another that used standard care protocols only. They found significantly more secondary fractures occurred in the institution with geriatric protocols than in the one without (1.8% versus 0.0% respectively, p=0.012)[17]
    - While some individual studies reported increased medical complications in the orthogeriatric models, these may be attributable to the improved assessment and surveillance of symptoms in these groups of patients compared to 'usual care' patients.[1]
- **Hospital length of stay**: A meta-analysis published in 2022 and a systematic review reported a significantly reduced length of stay for patients receiving orthogeriatric models of care compared with 'usual care',[1, 9] while two earlier meta-analyses (published in 2014 and 2013, respectively) reported no significant difference.[7, 13] Some individual studies reported a reduction in length of stay since the implementation of orthogeriatric models of care.[2, 4, 8, 11, 18, 19] Others, however, reported an increase in the length of stay or no difference.[10, 12, 14, 16, 20, 21]
- **Time to surgery**: Two systematic review studies reported that although there was evidence of reduced time to surgery with orthogeriatric models of care, the difference compared with 'usual care' was not significant.[1, 7] One systematic review, however, reported significantly reduced time to surgery.[9] Although some individual studies reported no significant difference, one reported a decline in the proportions of patients operated beyond 36 hours in the orthogeriatric care models.[2, 4, 8, 16]
- **Readmission rate**: mixed findings across studies with either favourable or similar outcomes to 'usual care'.[1, 9, 22]
- **Cost-effectiveness**: studies reporting on both the in-hospital costs and all costs at 12-month or 18-month follow-up reported a lower cost compared with those in 'usual care' or cost-effective when taking into consideration the life-years gained.[1, 23, 24]

  - the number of quality-adjusted life-years (QALYs) at 4 and 12 months and disability-adjusted life years (DALYs) were higher for patients receiving orthogeriatric care than 'usual care'.[5, 20, 25, 26]
- **Functional outcomes**: mixed findings across studies with favourable or similar outcomes between the orthogeriatric models of care and 'usual care'.[1, 5, 10, 18, 19] The relative outcomes can be dependent on the time to follow up, measurement scales used, the setting (i.e. nursing home or ambulatory care) and the orthogeriatric models.[1, 2, 5, 7, 10]
  - Activities of daily living (ADL): various measurement scales, including Katz Index of Independence in Activities of Daily Living (ADL),[18, 27] Barthel Index,[25, 28] Nottingham Extended Activities of Daily Living Scale (NEADL)[10] and Basic Activities of Daily Living (B-ADL)[10] were used to measure this outcome.
- **Osteoporosis assessment, diagnosis and medication initiation**: The rate of osteoporosis diagnosis in patients receiving shared orthogeriatric care was higher than in 'usual care'.[17, 19] There is evidence of an increase in initiation of calcium or vitamin D supplements and anti-osteoporotic medication.[17, 21]

Opportunities

The available evidence has identified a number of opportunities to improve orthogeriatric models of care:

- Specified and clear protocols or pathways for orthogeriatric care[12, 29]
- Improved training in geriatric medicine and increasing the number of trained geriatricians to increase the sustainability of orthogeriatric collaboration [7]
- Promotion of shared decision-making between the patients and the clinicians[23, 30]
- Improved communication between clinicians[29]
- Enhanced role of advanced practice nurses in the orthogeriatric models of care[14, 23]
- Environmental restructuring for a dedicated space for procedures or equipment [29]
- Early mobilisation with a team approach and enhanced rehabilitation after surgery[23]
- Evaluation of patient-reported and health service outcomes[29]

Challenges

- Lack of clinical and procedural knowledge and skills about orthogeriatric management or pathways[29]
- Limited geriatric or orthogeriatric ward spaces and shortage of geriatricians or orthogeriatricians[7]
- Limited evidence on the optimal type of orthogeriatric care model[1]
- Lack of supportive structures and paths [29]

Grey literature: recommendations

- In Australia, the Australian and New Zealand Guideline for Hip Fracture Care for adults recommends the orthogeriatric model of care, involving a shared care arrangement between the specialties of orthopaedics and geriatric medicine for people with a hip fracture.[31] The Australian Commission on Safety and Quality in Health Care (ACSQHC) Clinical Care Standard for Hip Fracture recommends that a patient with a hip fracture is offered treatment based on an orthogeriatric model of care. The evidence of orthogeriatric (or alternative physician or medical

practitioner) management during an admitted patient's hip fracture episode of care is listed as an indicator for quality.[32]

- In the United Kingdom, the National Institute for Health and Care (NICE) guidelines for hip fracture management recommend offering patients a ward-based hip fracture programme from admission. The model of care includes orthogeriatric assessment, rapid assessment of fitness for surgery, early goal setting, ongoing multi-disciplinary review and integration with related health services. The program can be based in either an orthogeriatric ward or an orthopaedic ward.
- The American Academy of Orthopaedic Surgeons recently published its clinical practice guidelines for surgical management of hip fractures in older adults. The 16 recommendations include promoting interdisciplinary care for co-management of individuals with hip-fracture.
- In Canada, the Ontario guidelines for management of patients with a hip fracture include best practice recommendations for older people. The three key recommendations include participation of caregivers, education for patients and caregivers, and following the principles of good seniors/geriatric care.

Pre-peer review literature

- Two pre-peer review studies assessed the impact of hospital factors on mortality. One, a systematic review in Brazil, found the preoperative period affects mortality for elderly Brazilian inpatients with hip fractures. The other, a narrative review, found orthogeriatric models of care with comprehensive geriatric assessment improve daily living and decrease long-term mortality.

Background

The Agency for Clinical Innovation had published a clinical practice guide for the orthogeriatric model of care in 2010, outlining key aspects and practical considerations for preoperative care, postoperative management and rehabilitation/discharge planning. The scientific evidence on orthogeriatric models of care has evolved considerably since the release of this practice guidance. The current evidence check aims to provide an overview and summary of the available evidence to date, assess key features and effectiveness, and inform contemporary clinical practice.

Methods

Peer-reviewed articles were identified through PubMed, Google and Google Scholar. The search terms used are outlined in Appendix 1. Grey literature search was conducted using Google and Google Scholar. Because of a large volume of eligible studies published in the last 10 years and availability of existing high-quality systematic review studies, the current evidence check only included review studies published since 2012 and eligible empirical studies published since the latest systematic review.[1]

Limitations

Only review studies published since 2012 and interventional/evaluative studies published since August 2020 presenting quantitative/comparative data were included.

Results

Table 1

Note some of the information has been copied directly from the source material.

Source	Summary
Peer reviewed sources	

Effects of orthogeriatric care models on outcomes of hip fracture patients: a systematic review and meta-analysis
 	
Van Heghe, et al. 2022[1]
	• **Study type**: systematic review and meta-analysis
	• **Inclusion criteria**: randomised controlled trials (RCTs), controlled observational studies, pre/post analyses, as well as other systematic reviews and meta-analyses (as source documents to find primary studies) in English; studies in persons older than 55 years, hospitalised with a recent hip fracture; articles containing a clear description of the orthogeriatric care model and the usual care model
	• **Exclusion criteria**: studies in persons with other fracture types, pathological hip fractures, and high traumatic injuries.
	• **Search date**: August 2020
	• **Results**: 37 studies were included.
	  ○ Length of stay**:** a statistically significant decrease of 1.55 days of length of stay for all orthogeriatric care models combined compared with standard care.
	  ○ Time to surgery: orthogeriatric care reduced time to surgery with 0.23 days (5.52 hours) compared with standard care; however, the result was not significantly significant.
	  ○ In-hospital mortality: a 28% lower risk of in-hospital mortality for hip fracture patients included in an orthogeriatric care model compared with standard care.
	  ○ One-year mortality: orthogeriatric care (all models combined) resulted in a 14% lower risk of one-year mortality compared with standard care.
	  ○ 30-day readmission rate: the overall effect was not significant
	  ○ Functional outcomes: better or similar outcomes compared with standard care
	  ○ Complication rates: most complications occurred numerically less frequent in the intervention groups (orthogeriatric care) than in the control groups (standard of care)
	  ○ Cost-effectiveness: limited data suggest cost-effectiveness
	• **Conclusion**: there is moderate quality evidence that orthogeriatrics reduces length of stay, in-hospital mortality, one-year mortality and delirium in hip fracture patients, and may reduce complications and cost, while the effect on functional outcome is inconsistent. There is currently insufficient evidence to recommend one or the other type of orthogeriatric care model.

Source	Summary
Peer reviewed sources	

Orthogeriatric management: Improvements in outcomes during hospital admission due to hip fracture
 	
Tarazona-Santabalbina, et al. 2021[23]
	• **Study type**: narrative review
	• **Inclusion criteria:** summarises evidence on optimum thromboprophylactic, anaesthetic and analgesic protocol, the assessment and management of cognitive impairment and malnutrition during hospitalisation, patient mobility, postoperative and the efficiency of rehabilitation programs.
	• **Exclusion criteria:** published more than five years ago; language limited to in English, Spanish and French.
	• **Search date:** February 2021
	• **Results**: 133 studies were included. Identified orthogeriatric management of patients with hip fracture included:
	  ○ Geriatric syndromes: declining age and baseline presentation of frailty most important prognostic factors for delirium. cognitive impairment, mood disorders, and depression. Screening for baseline urinary incontinence, and monitoring constipation following surgery associated may benefit outcomes.
	  ○ Malnutrition: studies report a prevalence between 9% and 18%.
	  ○ Sarcopenia: undernutrition, hand-grip strength and skeletal muscle index.
	  ○ Frailty: One study found patients with high frailty score and ASA grade are at a greater risk of infection. REFS significantly predicted function at six months.
	  ○ Pressure sores: One meta-analysis development is associated with diabetes and surgical delays.
	  ○ Polypharmacy: One study found a prevalence between 23% and 75% of patients
	  ○ Perioperative care: Low glomerular filtration rates, anaemia and poor pain management are associated with poor outcomes.
	  ○ Function: Older age, delirium and clinical adverse events are associated with low rate of return to full function.
	  ○ Mortality:
	  ▪ One cohort study (n=2443) found taking beta-blockers before surgery significantly lowered the 90-day mortality (IRR: 0.82, p=0.03) compared with those who did not take them.
	  ▪ Reasons for non-surgical management included independence and severe dementia.
	  ▪ One observational study (n=1,010) found the six-month attributable mortality was due to baseline characteristics (62%), perioperative factors (12%) and severe postoperative complications (12%).

Source	Summary
Peer reviewed sources	
	▪ One Thailand study found one-year mortality of hip fractures was 6.21 times higher than the aged-matched population. ▪ One retrospective study (n=254) found risk factors associated with mortality were age >85 years, male sex, ASA score ≥3, ≥3 comorbidities and CAR ratio ≥2.49. ○ Costs are estimated at $13,331, according to one systematic review. • **Conclusion**: orthogeriatric units have enabled major improvements in the standard of care.
Association of orthogeriatric care models with evaluation and treatment of osteoporosis: a systematic review and meta-analysis Van Camp, et al. 2020[17]	• **Study type**: systematic review and meta-analysis • **Inclusion criteria:** RCTs or controlled observational studies (n=13) summarising the association of different orthogeriatric care models (collaboration between orthogeriatrician and orthopaedic surgeon) for older patients with a hip fracture, compared with usual orthopaedic care, with fall prevention measures, diagnosis and treatment of osteoporosis and future falls and fractures. Number of hip fracture patients = 20,078, median age 75–85 years. • **Exclusion criteria:** studies without a control group, case reports, commentary. • **Search date:** April 2020 • **Results**: ○ MOC 1: Shared care between orthopaedic surgeons and geriatricians ○ MOC 2: Orthopaedic ward with geriatric consult service ○ MOC 3: Geriatric ward with orthopaedic consult service ○ Secondary fractures: differences were non-significant. One study using MOC 1 reported higher refracture rates, though the intervention group had a higher proportion of nursing home resident and higher ASA scores. ○ Fall prevention measures: meta-analysis showed the effect was non-significant (I^2=81%, Chi^2 p=0.02). ○ Calcium or vitamin D supplements and anti-osteoporotic medication: Evidence of an increase of initiation in all MOCs. The OR for MOC 1 was 41, though there was considerable heterogeneity (I^2=96%, Chi^2 p<0.0001). ○ Osteoporosis: diagnosis rates were higher for MOC 1, though was not statistically significant (I^2=70%, Chi^2 p=0.07) • **Conclusion**: orthogeriatric care for hip fracture patients was associated with higher prescription rates of calcium and vitamin D supplements and bisphosphonates and increased awareness regarding the diagnosis of osteoporosis. Inconclusive evidence for fall prevention, falls and refracture rates. High risk of bias in

Source	Summary
Peer reviewed sources	
	all studies apart from one (RCT using MOC 3), and presence of publication bias evident from funnel plot.

Multidisciplinary rehabilitation for older people with hip fractures
Handoll, et al. 2021[5]
	• **Study type**: systematic review
	• **Inclusion criteria:** rehabilitation after hip surgery using a multidisciplinary approach, supervised by a geriatrician, rehabilitation physician or other appropriate physician.
	• **Exclusion criteria:** studies not using a randomised or quasi-randomised trial design, published before 2009
	• **Search date:** October 2020
	• **Results**: 28 studies were included, n=5,351
	  • Inpatient setting, n=20 trials, comparator was 'usual care'
	  ○ 'Poor outcome' (death or deterioration in residential status) at 6–12 months: RR: 0.88, 95% CI: 0.80 to 0.98
	  ○ Type of multidisciplinary intervention: no evidence of a difference between groups.
	  ○ In-hospital mortality: may be reduced (RR 0.77, 95% CI: 0.58, 1.04)
	  ○ Mortality at 4–12 months: may be reduced (RR 0.91, 95% CI: 0.80 to 1.05)
	  ○ Mobility at 6–12 months: may be reduced (RR 0.83, 95% CI: 0.71 to 0.98)
	  ○ Quality of life (one study): marginally better [little confidence]
	  ○ Activities of daily living: mixed findings of some or no difference
	  • Ambulatory setting (three trials, n=377)
	  ○ Death, or move to a higher level of care, or inability to walk, at one year: little to no between-group difference
	  ○ Mortality at 4–12 months (2 studies): little to no difference
	  ○ Independence (one study): little to no difference
	  • Nursing home residents (one study, n=240)
	  ○ Mortality at 4–12 months: no differences
	  ○ Inability to walk at 4–12 months: no differences
	  ○ Differences in quality of life at 4–12 months: no differences
	• **Conclusion**: very low-certain evidence.

Outcomes in multidisciplinary team-based approach in geriatric hip fracture care: a systematic review Patel, et al. 2020[9]	• **Study type**: systematic review • **Inclusion criteria: s**tudies comparing an orthopaedic-led care model versus a coordinated orthogeriatrics care model or a geriatrics-led care model to treat hip fractures with reported outcomes for time to surgery, length of stay, readmission rates and postoperative mortality • **Search date:** November 2017 • **Results**: 17 studies were included. Orthogeriatrics care model or a geriatrics-led care model versus orthopaedic-led care model

Source	Summary
Peer reviewed sources	
	○ Time to surgery: significantly reduced (p=0.045) ○ Length of stay: significantly reduced (p=0.0036) ○ Postoperative mortality: significantly reduced (p=0.0034) ○ Readmission: no difference • **Conclusion**: although a heterogeneous group of studies, the aggregate data from several studies using an orthogeriatrics care model or a geriatrics-led care model trend towards improvements across several clinical and cost-related outcome measures: decreased time to surgery, shorter length of stay, improved postoperative clinical outcomes, decreased mortality and lower cost.
Which is the optimal orthogeriatric care model to prevent mortality of elderly subjects post hip fractures? A systematic review and meta-analysis based on current clinical practice Moyet, et al. 2019[6]	• **Study type**: systematic review and meta-analysis • **Inclusion criteria**: studies on the effect of various orthogeriatric interventions compared to classic intervention, on mortality, for femoral fractures in the elderly. • **Exclusion criteria**: does not meet above PICOS criteria. • **Search date**: 2019. • **Results, by model**: ○ Orthogeriatric ward model: significantly improved mortality (OR 0.62, 95% CI: 0.48 to 0.80) ○ Shared care by orthopaedists and geriatricians' model: no significant differences between groups (OR 1.00, 95% CI: 0.81 to 1.23) ○ Geriatric advice in orthopaedic ward model: no significant differences between groups (OR 0.90, 95% CI: 0.71 to 1.15) ○ Overall implementation of orthogeriatric model: significantly improved mortality (OR 0.85, 95% CI: 0.74 to 0.97) • **Conclusion**: the orthogeriatric ward model has the greatest effect on long-term mortality for elderly inpatients with hip fracture. Any type of orthogeriatric care model resulted in reduced long-term mortality.
Effects of orthogeriatric care models on outcomes of hip fracture patients: a systematic review and meta-analysis Grigoryan, et al. 2014[7]	• **Study type**: systematic review • **Inclusion criteria**: describes a multidisciplinary approach to inpatient hip fracture management involving an orthopaedic surgeon and a geriatrician; have a control group defined as an 'as needed' geriatric or medicine consult at the request of the surgeon. • **Exclusion criteria**: published more than 20 years ago; studies focusing on rehabilitation, post-discharge, not including a geriatrician, or examining other fractures in addition to hip fractures were also excluded.

Source	Summary
Peer reviewed sources	

	• **Search date:** July 2012
	• **Results**: 19 studies were included. Identified multidisciplinary models of care and the differences in outcomes compared with geriatric consult model included:
	  ○ Routine geriatric consultation
	  ▪ In-hospital mortality: significantly reduced
	  ▪ Time to surgery: significantly reduced
	  ▪ Long-term mortality: significantly reduced
	  ▪ Length of stay: no significant difference
	  ▪ Post-op delirium: significantly reduced
	  ▪ Function: significantly improved
	  ○ Geriatric ward
	  ▪ As the studies included were heterogenous, no meta-analysis was performed.
	  ○ Shared care
	  ▪ Length of stay: significantly reduced
	  ▪ In-hospital mortality: no significant difference
	  ▪ Time to surgery: no significant difference
	  ▪ Long-term mortality: no significant difference
	• **Conclusion**: orthopaedic geriatric collaboration improves outcomes for older patients.

Early orthogeriatric treatment of trauma in the elderly: a systematic review and meta-analysis
 	
Beucking, et al. 2013[13]
	• **Study type**: systematic review and meta-analyses
	• **Inclusion criteria**: RCTs comparing orthogeriatric treatment (collaborative treatment by the trauma surgery and geriatric services) of elderly patients with fractures with treatment by the trauma surgery service alone. Five studies met criteria.
	• **Exclusion criteria**: does not meet above PICOS criteria.
	• **Search date:** 2013
	• **Results:**
	  ○ Length of hospital stay: no difference (mean different: –0.06, 95% CI: –3.74 to 3.62)
	  ○ In-hospital mortality: decreased, though not significant, RR 0.66 (95% CI: 0.28 to 1.55)
	  ○ One-year mortality: decreased, though not significant, RR 0.90 (95% CI: 0.57 to 1.10)
	• **Conclusion**: interdisciplinary care led to a decrease in in-hospital mortality and one-year mortality, but these decreases were not statistically significant.

Changes in characteristics and outcomes of patients undergoing surgery for	• **Study type**: Retrospective cohort study • **Setting**: United Kingdom • **Participants**: individuals admitted with hip fractures

Source	Summary
Peer reviewed sources	

hip fractures following the initiation of orthogeriatric service: temporal trend analysis
 	
Fluck, et al. 2021[8]
	• **Model(s) of care:** geriatric medical ward
	  ○ admitted within geriatric ward (orthogeriatric consultant); integrated care model (seven days-a-week ward round led by an orthopaedic surgeon and also including an orthogeriatrician on Monday–Friday).
	• **Comparator**: geriatric medicine consult service.
	• **Results**:
	  ○ Time to surgery: the proportion of patients operated beyond 36 hours fell sharply during the first two years
	  ○ Length of stay: median length of stay declined from over 15 days to around 10 days in 2018-2019; proportion of patients with length of stay >23 days declined rapidly after 2013 after the introduction of integrated model
	  ○ Mortality: a significant decline in mortality among those >90 years old
	  ○ Functional outcomes: there were no significant changes in failure to mobilise within one day of hip surgery.
	  ○ Complications: no significant difference in the rates of pressure ulcers for all age groups combined; significant decline in pressure ulcers among patients under 90 years.
	  ○ Other: new discharge to rehabilitation increase; the proportion of patients newly prescribed with an anti-resorptive agents increased from 61% to 85.3%.
	• **Conclusion:** establishment of an orthogeriatric service had no detrimental impact on mortality and prevalence of pressure ulcers; it improved other clinical and functional outcomes.

Impact of orthogeriatric care management by orthopedic surgeons and physicians on in-hospital clinical outcomes: a difference-in-difference analysis Ogawa, et al. 2022[2]	• **Study type**: retrospective cohort study • **Setting**: Japan • **Participants**: patients with femoral neck fractures and trochanteric fractures; older than 50 years • **Model(s) of care**: integrated care model; n=288 ○ admitted under orthopaedic ward immediately after surgery and daily visit from a geriatrician; after removal of sutures/staples, transfer to internal medicine or geriatric wards; after discharge, follow up by a primary physician who is a geriatrician; orthopaedic consults upon request. • **Comparator**: geriatric consultation model; n=576

Source	Summary
Peer reviewed sources	

	• **Results** (intervention group compared to control/comparator group):
	  ○ Length of hospital stay: significantly improved (decrease)
	  ○ Time to surgery: no significant difference
	  ○ Incidence of in-hospital mortality: no significant difference
	  ○ In-hospital complications: no significant difference
	  ○ Independence of walking function at discharge: no significant difference
	  ○ Discharge to home: no significant difference
	• **Conclusion**: integrated care model significantly reduces the length of stay

Haemoglobin and transfusions in elderly patients with hip fractures: the effect of a dedicated orthogeriatrician
 	
Quaranta, et al. 2021[3]
	• **Study type**: retrospective cohort study
	• **Setting**: Italy
	• **Participants**: elderly patients treated for hip fracture
	• **Model(s) of care**: employment of a dedicated orthogeriatrician in an orthopaedic department; n=198
	• **Comparator**: no orthogeriatrician; n=296
	• **Results** (intervention group compared with control/comparator group):
	  ○ Hb at discharge: significantly improved (increase)
	  ○ Number of transfusions in patients who underwent hemiarthroplasty: significantly improved (reduce)
	• **Conclusion**: the introduction of the orthogeriatrician to an orthopaedic ward for the management of elderly patients treated for hip fracture allows to discharge the patients with higher Hb values, reducing the risk of anemisation and the costs related to possible re-admission.

Orthogeriatric co-management reduces incidence of delirium in hip fracture patients Pollman, et al. 2021[15]	• **Study type**: prospective cohort study • **Setting**: Norway • **Participants**: patients operated for a hip fracture • **Model(s) of care**: integrated care model; n=103 ○ orthogeriatric co-management; patient admitted to the orthopaedic ward; the geriatrician goes rounds together every weekday • **Comparator**: usual care; n=94

Source	Summary
Peer reviewed sources	

	• **Results** (intervention group compared to control/comparator group):
	  ○ subsyndromal delirium (SSD): significantly improved (fewer patients having SSD; 6% versus 13%)
	  ○ delirium: significantly improved (fewer patients having delirium; 35% versus 47%)
	• **Conclusion**: integrated care model reduced the incidence of SSD/delirium in hip fracture patients.

Orthogeriatrics prevents functional decline in hip fracture patients: report from two randomized controlled trials
Dakhil, et al. 2021[10]
	• **Study type**: RCT
	• **Setting**: Norway
	• **Participants**: hip fracture patients
	• **Model(s) of care**: comprehensive orthogeriatric care; n=361
	  ○ Patients treated in the acute geriatric ward both pre- and post-operatively; a team consisting of a geriatrician, nurse, physiotherapist and occupational therapist were responsible for delivering the service.
	• **Comparator**: orthopaedic care; n=365
	• **Results** (compared with control/comparator):
	  ○ Nottingham Extended Activities of Daily Living Scale (NEADL): significantly better outcomes at 4 months and 12 months
	  ○ Basic Activities of Daily Living (B-ADL) function at 4 months: significantly better outcomes at 12 months; significantly better outcomes at 4 months only when excluding patients living at a nursing home at baseline
	  ○ Preoperative waiting time: no difference
	  ○ Length of stay: significantly longer (12.8 versus 9.8 days)
	  ○ In-hospital mortality: no significant difference
	  ○ Number of deaths at 4 months and 12 months after surgery: no significant difference
	• **Conclusion**: admitting hip fracture patients to an orthogeriatric care unit directly from the emergency department had a positive effect on activities of daily living up to 12 months after surgery.

A comprehensive multidisciplinary care pathway for hip fractures	• **Study type**: multicentre prospective controlled trial • **Setting**: The Netherlands • **Participants**: patients aged ≥60 years with a hip fracture

Source	Summary
Peer reviewed sources	

better outcome than usual care?
Flikweert, et al. 2021[18]
	• **Model(s) of care**: a comprehensive care pathway; n=188
	  ○ a collaboration between the departments of traumatology, orthopaedics, geriatrics and anaesthesiology, together with two nursing homes with a geriatric rehabilitation department
	  ○ a dedicated operating room time slot on the morning after admission
	• **Comparator**: usual care (no geriatrician available); n=169
	• **Results** (intervention group compared with control/comparator group):
	  ○ Length of hospital stay: significantly shorter (median 7 versus 10 days)
	  ○ Mortality at six months: no significant difference (15% versus 10%, p=0.17)
	  ○ Rate of return to pre-fracture Katz Index score: no significant difference (56% versus 63%)
	  ○ Return to pre-fracture living situation: no difference (81% versus 81%)
	  ○ Lawton score: no significant difference
	  ○ EQ-5D score: no significant difference
	• **Conclusion**: although short-term advantages are reported, positive effects on longer term functional results could not be proven in our study.

Health-economic evaluation of collaborative orthogeriatric care for patients with a hip fracture in Germany: a retrospective cohort study using health and long-term care insurance claims data
Schulz, et al. 2021[20]
	• **Study type**: retrospective cohort study
	• **Setting**: Germany
	• **Participants**: patients aged ≥80 years, sustained a hip fracture in 2014, and were treated in hospitals
	• **Model(s) of care**: orthogeriatric co-management; n=14,005
	  ○ A complex treatment of early rehabilitation lasting at least 14 days and provided by a multidisciplinary geriatric team that was headed by a geriatrician and made up of physiotherapists, occupational therapists, specifically trained nurses, social workers and additional disciplines, if needed.
	  ○ In patients with hip fracture, this multidisciplinary geriatric treatment usually began within 24 hours after surgery and could be delivered at an orthopaedic or a geriatric ward.
	• **Comparator**: standard care (no intended contact to a geriatric ward); n=10,512
	• **Results** (intervention group compared to control/comparator group):

Source	Summary
Peer reviewed sources	
	○ Costs (in euro; €) ▪ Total (payer perspective): significantly increased (22,255 versus 21,073) ▪ Total (societal perspective): significantly increased (29,203 versus 27,794) ▪ Inpatient: significantly increased (13,509 versus 12,505) ▪ Outpatient: significantly increased (814 versus 785) ▪ medications: significantly increased (1,096 versus 1,057) ▪ Devices/medical appliances: no significant difference (276 versus 275) ▪ Long-term care (payer perspective): no significant difference (6,561 versus 6,452) ▪ Long-term care (payer perspective): significantly increased (13,508 versus 13,172) ▪ Incremental cost-effectiveness ratios (ICER): €52,378.12/ life years gained from payer and €75,703.44/ life years gained from societal perspective ▪ The probability for cost-effectiveness would be 95% if the willingness-to-pay was higher than €82,000/ life years gained from payer, and €95,000/ life years gained from societal perspective. ○ Length of stay: significantly increased (25.97 versus 23.65 days) ○ Life years: significantly higher (0.77 versus 0.74) ○ Quality life years during follow-up: significantly increased (0.51 versus 0.49) • **Conclusion**: survival improved in hospitals providing orthogeriatric co-management. Costs were found to increase, driven by inpatient and long-term care. The cost-effectiveness depends on the willingness-to-pay.
Evaluation of the implementation of multidisciplinary fast-track program for acute geriatric hip fractures at a university hospital in resource-limited settings Sura-Amonrattana, et al. 2021[33]	• **Study type**: retrospective cohort study • **Setting**: Thailand • **Participants**: patients with hip fractures in orthopaedics from 2016 to 2018, exclusion: elective surgery. • **Model(s) of care**: Fast-track orthogeriatric model of care; n=151 ○ Fast-track program: multidisciplinary team, commences upon admission. Acute pain service aims to control pain within 24 hours and customise pain medications. Geriatric team manages patient within 24 hours of admission until discharge. Surgery schedules as quickly as possible, spinal anaesthesia is the preferred method. Aim: all patients in operating room by 72 hours. Operating room is dedicated for hip-fracture patients. Aims include prevention of complications and nutrition counselling.

Source	Summary
Peer reviewed sources	

	• **Comparator**: Pre-implementation of fast-track program; n=151
	• **Results** (intervention group compared with control/comparator group):
	  ○ Incidence of medical complications: no significant differences
	  ○ Time-to-72 hours surgery: significantly improved (80% versus 44%)
	  ○ Length-of-stay: shortened (11 versus 13 days)
	  ○ In-hospital mortality: no significant difference
	  ○ Mortality at month 3, 6, 12 months: no significant difference
	  ○ Function status at day 4, month 3 and month 12: no difference between groups. Discharging to home improved function in both groups.
	• **Conclusion**: the Fast-track program for acute geriatric hip fractures reduced the length of hospital stay and time to surgery.

Mortality in hip fracture patients after implementation of a nurse practitioner-led orthogeriatric care program: results of a 1-year follow-up
 	
van Leendert, et al. 2021[14]
	• **Study type**: retrospective observational cohort
	• **Setting**: The Netherlands
	• **Participants**: patients with hip fracture in a level-1 trauma centre, mean age 77 years
	• **Model(s) of care**: nurse practitioner-led orthogeriatric care program (NPOCP); n=144
	  ○ Conducted by two nurse practitioner, extensively trained by geriatricians, and able to diagnose and manage comorbidities, complications and polypharmacy. Nurse practitioner were rostered on one per week, and performed comprehensive geriatric assessments (CGAs) on weekdays.
	• **Comparator**: usual care; n=156
	• **Results** (intervention group compared with control/comparator group):
	  ○ Mortality: significantly lowered at 3 months (9% versus 24%) and 12 months (14% versus 34%).
	  ○ Length of stay: not significant (7 days in NPOCP versus 9 days in usual care (UC) p=0.08)
	  ○ Location of hospital discharge: higher proportion were discharged home (40% versus 28%)
	• **Conclusion**: NPOCP associated with reduced mortality.

After hours surgery for elderly hip fracture patients: how safe is it? Yeo, et al. 2020[34]	• **Study type**: retrospective observational study • **Setting**: Singapore • **Participants**: patients with hip fracture aged >60 years who had surgery, admitted to a tertiary centre from 2011 to 2013 • **Model(s) of care**: surgery during usual office hours; n=693 ○ surgery start time 8am–5pm on weekdays, or 8am–12pm Saturdays • **Comparator**: after hours operation; n=210 (all other hours)

Source	Summary
Peer reviewed sources	

	• **Results** (intervention group compared to control/comparator group):
	  ○ Safety of after-hours hip fracture surgery: no significant differences
	  ○ Related complications: no significant differences
	  ○ Time-to-surgery: after-hours group had a greater proportion of surgery within 24 hours of admission (12% versus 7% for office hours)
	• **Conclusion**: there was no evidence that after-hours surgery increased complication rates.

Impact of an orthogeriatric collaborative care model for older adults with hip fracture in a community hospital setting
Lee, et al. 2021[16]
	• **Study type**: retrospective observational cohort
	• **Setting**: Canada
	• **Participants**: patients with hip fracture aged ≥65 years admitted to a community hospital between 2015 and 2017.
	• **Model(s) of care**: orthogeriatric collaborative care model; n=117
	  ○ Specific focus on geriatric principles of care
	• **Comparator**: pre-intervention; n=95
	• **Results** (intervention group compared with control/comparator group):
	  ○ Postoperative delirium: no improvement (26% in both groups)
	  ○ Length of stay: no improvement (7 days in both groups)
	  ○ Time to surgery: unchanged
	• **Conclusion**: there were no improvements in delirium or length of stay.

Impact of orthogeriatric management on the average length of stay of patients aged over seventy five years admitted to hospital after hip fractures
Marcheix, et al. 2021[11]
	• **Study type**: retrospective cohort study
	• **Setting**: France
	• **Participants**: patients aged >75 years (n=534) admitted to hospital with a hip fracture
	• **Model(s) of care**: treated in an orthogeriatric unit (n=288)
	  ○ Orthopaedic trauma unit supervised by a geriatrician. Includes systematic pre-operative evaluation of all patients aged >75 years with a hip fracture, and is the site of post-operative care
	• **Comparator**: traditional orthopaedic care (246)
	• **Results** (intervention group compared to control/comparator group):
	  ○ Length of stay: significantly improved in patients treated in an orthogeriatric unit [median Length of stay 9 days versus 10 days]
	  ○ Postoperative outcomes: no significant differences between groups for mortality, surgical delay, discharge destination or the rate of secondary fracture after 6 months.
	• **Conclusion**: treatment in an orthogeriatric unit reduced length of stay.

Source	Summary
Peer reviewed sources	

Different approaches towards geriatric trauma care for hip fracture patients: an inter-hospital comparison
 	
Kusen, et al. 2021[12]
	• **Study type**: retrospective cohort at two sites
	• **Setting**: The Netherlands
	• **Participants**: patients aged ≥70 years with a hip fracture and surgical treatment between 2014 and 2015.
	• **Model(s) of care**: multidisciplinary geriatric care pathway (GCP) (hospital I) n=513
	  ○ Standard geriatric trauma consult service and a specialised, combined geriatric and traumatology ward. Emergency department, ward and operating theatre doctors and nurses have specified protocols enabling standard treatment for geriatrics. CGA performed upon admission on weekdays. On weekends, consultation with a geriatrician was available. Daily visits by trauma surgeon and geriatrician. Surgery preferably performed during office hours, with time slots reserved. Specialised 'transfer' nurse involved for discharge options.
	• **Comparator**: extensive standard care (hospital II) n=385
	  ○ No geriatric pathways. Consult performed by a nurse with attention to delirium. No specialised ward. Transfer nurse was involved for the discharge.
	• **Results** (intervention group compared to control/comparator group):
	  ○ Mortality: no significant differences between groups
	  ○ Morbidity: no significant differences in 30-day rate
	  ○ Length of stay: no significant differences
	  ○ Secondary surgical interventions: no significant differences
	• **Conclusion**: this study found no significant differences between hospitals. Future studies should focus on clarifying which factors in geriatric care models contribute most to improved outcomes and which are most cost effective.

In-hospital clinical outcomes in patients with fragility fractures of the lumbar spine, thoracic spine, and pelvic ring: a comparison of data before and after certification as a DGU(Â®) Geriatric Trauma Centre Laubach, et al. 2021[21]	• **Study type**: observational single-centre cohort study • **Setting**: Germany • **Participants**: patients aged >70 years, with a lumbar spine, thoracic spine, pelvic ring fragility fracture • **Model(s) of care**: orthogeriatric co-management (OGCM) provided by the implementation of a Geriatric Trauma Centre (GTC) n=108 (2017–18) ○ Routine consultation with a geriatrician in interdisciplinary ward wound twice weekly. Cases discussed once per week at an interdisciplinary team conference, and patient-specific treatment plans are defined. Representatives from nursing, OT, physiotherapy and cases management are actively involved in this process as well as throughout hospital stay. Individual risk profile is built using Identification of Seniors at

Source	Summary
Peer reviewed sources	
	Risk Screening (ISAR screening) at admission. Score of ≥2 indicated recommendation for OGCM. • **Comparator**: pre-GTC cohort (2012–13) (n=111) • **Results** (intervention group compared with control/comparator group): ○ Length of stay: reduced in intervention group, although was not statistically significant (7 days versus 9 days, p=0.08) ○ Mortality: No significant difference between groups. ○ New in-hospital findings and diagnoses: urinary tract infection (UTI) incidence increased in the intervention group (35% versus 16%, p=0.001); delirium diagnoses also increased (13% versus 6%, p=0.09) ○ Necessity of deviation from initial management plan: comparable between groups (ACDiT score ≥1). ○ Non-surgical treatment: no difference in the incidence. • **Conclusion**: there was a decrease in the length of stay, although this was not significant. The incidence of UTI increased in the GTC group. The study had five-year washout period between cohorts, which may affect exchangeability of groups. The intervention group also had an older median age (82 versus 80, p=0.02), and used vitamin K antagonists or direct oral anticoagulants more frequently (21% versus 11%).
Changes in characteristics and outcomes of patients undergoing surgery for hip fractures following the initiation of orthogeriatric service: temporal trend analysis Fluck, et al. 2021[8]	• **Study type**: observational cohort study • **Setting**: England • **Participants**: patients undergoing hip fracture surgery at single-centre (n=3,972) • **Models of care**: ○ Orthogeriatric care in a geriatric ward (2010–2013) ▪ Orthopaedic surgeon acting as a consultative specialist, while orthogeriatrician was responsible for patient care. Consultant ward rounds twice weekly. ○ Additional supportive discharge set up to reduce length of stay ○ COW model (2016 onwards): daily ward rounds led by Consultant Of the Week (COW). Shared care model involving seven days a week of ward rounds led by both orthopaedic surgeon as well as orthogeriatrician on Monday–Friday. Both specialists work closely with multidisciplinary team, including social service workers. Meetings held before ward rounds with the whole team. • **Comparator**: prior to 2010, led by the orthopaedic team. • **Results/temporal trends** (temporal trends): ○ Peri-operative outcomes: first intervention significantly reduced proportion of patients waiting for surgery beyond 36 hours (-54%)

Source	Summary
Peer reviewed sources	
	○ Mortality: no significant differences between interventions overall. Stratified for age, those aged over 90 years had improved outcomes in pressure ulcers and mortality. ○ Length of stay: reduced significantly after discharge intervention in 2013 (-24% annually) ○ Discharge destination: increasing trend in the proportions of patients returning to rehabilitation (+8.4% annually) • **Conclusion**: orthogeriatric service was associated with increase in the proportion of patients undergoing surgery within 36 hours, and surgery in higher risk adults and a decline in prolonged length of stay and an increase discharge to rehabilitation.
Impact of an orthogeriatrician on length of stay of elderly patient with hip fracture Aletto, et al. 2020[4]	• **Study type**: observational cohort study, single-centre • **Setting**: Italy • **Participants**: patients aged ≥60 years with a hip fracture (n=352) • **Model(s) of care**: geriatric care model with orthogeriatrician ○ Upon admission into orthopaedic department, patient is assessed by orthogeriatrician and orthopaedic surgeon. Daily ward round with orthopaedic surgeon, orthogeriatrician and staff nurse. • **Comparator**: pre-introduction of orthogeriatrician (2018) ○ As above, without the geriatrician • **Results** (intervention group compared to control/comparator group): ○ Length of stay: significantly reduced (11 versus 12, p<0.01) ○ Days from the admission to surgery: no difference (2 days) ○ Days from surgery to discharge: significant reduction (9 versus 10 days, p<0.01) • **Conclusion**: integration of orthogeriatric care reduced length of stay and hospitalisation time following surgery. The study did not allow for a washout period between interventions, which may be a limitation of the study.
Patient characteristics, treatment outcomes and rehabilitation practices for patients admitted with hip fractures using multiple data set analysis Warhurst, et al. 2020[19]	• **Study type**: retrospective cohort study • **Setting**: New Zealand • **Participants**: patients aged ≥65 years with a hip fracture admitted to Christchurch hospital (n=282) • **Models of care**: ○ Aged residential care (ARC) residents discharged from acute orthopaedics (n=45) ○ Not ARC residents discharged from acute orthopaedics (n=92) ○ Discharged from orthopaedics rehabilitation (n=185) ○ Discharged from general geriatric rehabilitation (n=93) • **Results** (intervention group compared to control/comparator group):

Source	Summary
Peer reviewed sources	
	○ 30-day mortality: higher in the general geriatric rehabilitation group (3% versus 1% for all other groups) ○ 180-day mortality: 7% in the orthogeriatric rehabilitation group and 8% in the general rehabilitation group. ○ Length of stay: reduced in orthogeriatric compared with general rehabilitation (13 versus 20 days) ○ Osteoporosis treatment was higher in the orthogeriatric group than in general rehabilitation group (88% versus 62%) ○ Discharge destination: higher rates of discharge to home in orthogeriatric group (70% versus 43%) ○ Function: similar between groups • **Conclusion**: mortality was highest in ARC residents discharged from acute orthopaedics.
Introduction of the orthogeriatric co-management model increases the quality of care: a pilot study Lieten, et al. 2020[22]	• **Study type**: retrospective single-centre observational study • **Setting**: Belgium • **Participants**: geriatric patients aged ≥75 years admitted to an orthopaedic trauma ward) • **Model(s) of care**: orthogeriatric co-management (OG-CM) model, (n=132) ○ Geriatrician on an orthopaedic ward and integrated care. Shared management of patient by geriatrician and orthopaedic surgeon from admission to discharge. • **Comparator**: traditional orthopaedic care model (n=119) • **Results** (intervention group compared with control/comparator group): ○ Quality of care: [significantly improved or favourable outcome/no significant difference/significantly deteriorated, increased or reduced] ○ Readmissions: significantly lowered after intervention (0.31 versus 0.89 per patient) ○ Mortality: no significant difference in in-hospital or 30-day mortality. ○ Costs: increased with intervention group, this was not significant. ○ Length of stay: unchanged • **Conclusion**: intervention group had increased diagnoses, less readmissions, unchanged mortality rate and unchanged length of stay.
Cost-effectiveness of a multidisciplinary co-management program for the older hip fracture patients in Beijing	• **Study type**: a Markov microsimulation model • **Setting**: China • **Participants**: inpatients with hip fracture • **Model(s) of care**: multidisciplinary co-management program

Source	Summary
Peer reviewed sources	
Peng, et al. 2020[24]	○ Involved orthopaedic surgeons, geriatricians, emergency physicians, anaesthesiologists and physio-therapists, with standardised emergency department and preoperative assessments and treatments, admission to a specialist orthogeriatric ward, early surgery and early discharge. • **Comparator**: simulated in line with the pre-intervention group • **Results:** ○ Cost: intervention increased the cost of management ($13,309 versus $11,975 for conventional group) ○ QALYs: increased for the intervention group (2.45 years versus 2.38 years for the conventional group) ○ First-year mortality: lowered for the intervention group (16.1%, versus 17.8% for the conventional group) • **Conclusion**: The multidisciplinary co-management program for patients with hip fracture can be a cost-effective solution in the Chinese population.
Development of an early activation hip fracture care bundle and implementation strategy to improve adherence to the National Hip Fracture Clinical Care Standard Curtis, et al. 2021[29]	• **Study type**: evaluation of the implementation of and adherence to a new care framework. • **Setting**: Wollongong hospital, NSW, Australia. • **Participants**: multidisciplinary staff in a regional trauma centre. • **Care bundle**: Early Activation Hip Fracture Care Bundle (eHIP) ○ eHIP bundle: 7 interventions addressing the 7 standards of ACSQHC Hip Fracture care. ○ Development: collaboration between clinicians, managers, NSW Agency for Clinical Innovation (ACI) and consumers. ○ Review: departmental meetings identified local barriers to compliance. • **Results**: ○ 83 barriers to the implementation of the bundle were identified. ○ Barriers were categorised according to the Theoretical Domains Framework and linked to specific strategies guided by the Behaviour Change Wheel and Behaviour Change Technique Taxonomy. ○ To overcome barriers: techniques included ○ formal policy that outlines eHIP roles ○ video promotion ○ pager group ○ fascia iliaca block enabling ○ eMR modifications ○ face-to-face reinforcement and modelling ○ communication and prompts ○ environmental restructuring.

Source	Summary
Peer reviewed sources	
	• **Conclusion**: behaviour change theory resulted in a codesigned strategy to overcome staff and organisational barriers to the implementation of the care bundle.

Guideline for the management of hip fractures 2020
 	
Griffiths, et al. 2020[35]
	• Updated guideline by the Association of Anaesthetists (UK).
	• Multidisciplinary Working Party updated the 2011 guidelines for peri-operative management of people with hip fracture.
	• Changes to the recommendations relate to analgesia, medicolegal practice, risk assessment, bone cement implantation syndrome and regional review networks.
	• Orthogeriatric assessment is highlighted as a reason for significant progress in hip fracture management in the UK. Orthogeriatric care can inform the below topics, noted as important updates in the guidelines:
	  ○ Anaesthesia
	  ○ Rehabilitation
	  ○ Considerations in liberty protection
	  ○ Reasons in delaying surgery
	  ○ Postoperative discharge destination

Table 2

Note some of the information has been copied directly from the source material.

Source	Summary
Grey literature	

Australian and New Zealand guideline for hip fracture care: improving outcomes in hip fracture management of adults
 	
Australian & New Zealand Hip Fracture Registry, Sept 2014[31]
	• Australian guidelines for patients with hip fracture
	• The more advanced model of care, the 'orthogeriatric model of care', involves a shared care arrangement of hip fracture patients between the specialties of orthopaedics and geriatric medicine.
	• The guidelines state patients can be offered a formal, acute orthogeriatric service from admission, that includes:
	  ○ regular orthogeriatrician assessment
	  ○ rapid optimisation of fitness for surgery
	  ○ early identification of individual goals
	  ○ early identification of most appropriate service to deliver rehabilitation
	  ○ continued, coordinated, orthogeriatric and multidisciplinary review and discharge planning liaison or integration with related services.
	• If a hip fracture complicates or precipitates a terminal illness, the multidisciplinary team can consider the role of surgery as part of a

Source	Summary
Grey literature	

	palliative care approach that minimises pain, establishes patients' own priorities for rehabilitation, and considers patients' wishes about their end-of-life care.
	• Healthcare professionals can deliver care that minimises the patient's risk of delirium and maximises their independence.
	• Nutritional status can be assessed early in the hospital stay and reassessed during the course of the admission.
	• Early supported discharge can be considered provided the patient:
	  ○ is medically stable, and
	  ○ has the mental ability to participate in continued rehabilitation, and
	  ○ is able to transfer and mobilise short distances, and
	  ○ has not yet achieved their full rehabilitation potential, as discussed with the patient, carer and family.
	• Patients admitted from residential aged care facilities can still be included in rehabilitation programmes in the community or hospital.

Hip fracture care clinical care standard Australian Commission on Safety and Quality in Health Care, Health Quality & Safety Commission New Zealand, Sept 2016[32]	• Australia and New Zealand Clinical Care Standards for Hip Fracture. • Quality statement 3: Orthogeriatric model of care ○ A patient with a hip fracture can be offered treatment based on an orthogeriatric model of care. • Indicator for Quality statement 3 includes evidence of orthogeriatric (or alternative physician or medical practitioner) management during an admitted patient's hip fracture episode of care.

Acute Hip Fracture Management Model of Care
 	
Government of South Australia, Aug 2016[36]
	• South Australian model of care incorporated two current Australian overarching standards and guidelines in place (ANZ guide for Hip Fracture Care, ACSQHC Clinical Care Standards) as well as specific South Australian requirements and considerations to provide best practice care to all older South Australians.
	• Includes Orthogeriatric Fracture Centre (OFC): providing multi-disciplinary trauma care for when an orthogeriatric patient presents with an orthopaedic fracture.
	• Model of care:
	  ○ A patient with a hip fracture will be directed to a specialist
	  ○ The patient will receive timely and effective pain management
	  ○ The patient will be treated under an orthogeriatric shared model of care
	  ○ The patient will receive appropriate surgical management in a timely manner
	  ○ The patient will be supported with early mobilisation

Source	Summary
Grey literature	
	○ The patient will have a personalised discharge plan completed with ongoing support ○ The patient and/or carer receive regular consultation with all care providers ○ Aboriginal or Torres Strait Islander patients will receive culturally appropriate and respectful care ○ SA Health will measure and deliver best clinical practice.
Management of hip fractures in older adults evidence-based clinical practice guideline American Academy of Orthopaedic Surgeons, Mar 2021[37]	• Clinical practice guideline providing a summary of recommendations based off the strength of evidence at the time of publication. • The recommendations include interdisciplinary care programs. ○ Interdisciplinary care refers to programs that involve providers from multiple disciplines working together to co-manage individuals with hip fracture. This may include geriatric and orthopaedic providers, and nursing, dietary, and rehabilitation providers such as occupational and physical therapists.
The management of hip fracture in adults The National Institute for Health and Care Excellence, UK, 2011[38]	• UK guidelines for hip fracture management in adults. • Guidelines were reviewed in 2019, with an updated version currently being revised. • From admission, patients can be offered a formal, acute, orthogeriatric or orthopaedic ward-based Hip Fracture Programme that includes: ○ orthogeriatric assessment ○ rapid optimisation of fitness for surgery ○ early identification of individual goals for multidisciplinary rehabilitation to recover mobility and independence, and to facilitate return to pre-fracture residence and long term wellbeing ○ continued, coordinated, orthogeriatric and multidisciplinary review ○ liaison or integration with related services, particularly mental health, falls prevention, bone health, primary care and social services ○ clinical and service governance responsibility for all stages of the pathway of care and rehabilitation, including those delivered in the community.
Quality-based procedures clinical handbook for hip fracture	• Ontario local government recommendations for hip fracture patients. • For inpatients requiring orthogeriatric care, recommendations include: ○ caregivers should be encouraged to stay and participate ○ appropriate education should be provided to patient and caregivers

Source	Summary
Grey literature	
Health Care Ontario, 2013[39]	○ all care should follow principles of good seniors/geriatric care.
Incidence and associated factors of elderly mortality following hip fracture in Brazil: a systematic review and meta-analysis Peterle, et al. Feb 2022[40]	• Pre-peer review systematic review and meta-analyses (PRISMA study). • Country: Brazil • Population: elderly Brazilian inpatients with hip fractures • Participants: n=25 studies, 3,949 patients (67% women) mostly 70-80 years old. • Findings: ○ Hospital mortality: 10.2% ○ 90-day mortality: 9.7% ○ Six-month mortality: 24.8% ○ One-year mortality: 21.9% • Factors most related to mortality: ○ Demographic (male) ○ Clinical conditions (high pre-operative risk, comorbidities) ○ Hospital factors. The factors most related with mortality included: preoperative period, and infections. • Conclusion: Identification of predictors of hip fracture mortality allows for early intervention and planning to allow for health systems to adapt.

Appendix

PubMed search terms

Search 1 (178 hits on 9 December 2021)

((((((("femoral*"[Title/Abstract] OR "femur*"[Title/Abstract]) AND (head[Title/Abstract] or neck[Title/Abstract] or proximal[Title/Abstract]) AND (fracture*[Title/Abstract])) OR (("hip"[Title/Abstract] OR "femur*"[Title/Abstract] OR "femoral*"[Title/Abstract] OR "trochant*"[Title/Abstract] OR "pertrochant*"[Title/Abstract] OR "intertrochant*"[Title/Abstract] OR "subtrochant*"[Title/Abstract] OR "intracapsular*"[Title/Abstract] OR "extracapsular*"[Title/Abstract]) AND "fracture*"[Title/Abstract])) OR ("Femoral Fractures"[MeSH Terms])) AND ("models, organizational"[MeSH Terms] OR "organizational innovation"[MeSH Terms] OR "patient centered care/organization and administration"[MeSH Terms] OR "delivery of health care, integrated"[MeSH Terms] OR "model of care"[Title/Abstract] OR "models of care"[Title/Abstract] OR "care model*"[Title/Abstract] OR "care delivery model*"[Title/Abstract] OR "organisation of"[Title/Abstract] OR "organisational model*"[Title/Abstract] OR "organisation model*"[Title/Abstract] OR "organization of"[Title/Abstract] OR "organizational model*"[Title/Abstract] OR "organization model*"[Title/Abstract] OR "healthcare delivery model*"[Title/Abstract] OR "integrated care"[Title/Abstract] OR "integrated model*"[Title/Abstract] OR "multidisciplinary"[Title/Abstract] OR "integrated"[Title/Abstract] OR "model"[Title] OR "shared care"[Title/Abstract] OR "clinical pathway"[Title/Abstract])) AND ("geriatr*"[Title/Abstract] OR "geriatrics"[MeSH Terms])) AND (("2010/01/01"[Date - Publication] : "3000"[Date - Publication])) Filters: Humans, English

Search 2 (322 hits on 9 December 2021)

(orthogeriatr*[Title/Abstract]) AND (("2010/01/01"[Date - Publication] : "3000"[Date - Publication])) Filters: Humans, English

Google search terms

Key search terms included “geriatric care”, “orthogeriatric models of care”, “acute geriatric care” and “acute orthogeriatric care”.

The medRxiv database was searched using the following key terms: “care”, “model”, “geriatric medicine” and “orthopaedics”.

Inclusion and exclusion criteria

Inclusion	Exclusion
• Published in English • Published since 2010 • Population: Orthogeriatric patients • Intervention: Organisational model of care, including: ○ Workforce-based (e.g. integrated care, multidisciplinary care teams, nurse-led care, geriatric-led model consultative versus admitting)	• Not in English • Published before 2010 • Studies that do not meet **PICOS** criteria • Letters, comments, editorials, study protocols, conference abstracts

Inclusion	Exclusion
○ Institutional or organisation-based (e.g. a dedicated unit, integrated care) ○ Where the care is delivered (e.g. primary care, care-in-the-home, specialist care in hospital) ○ Mode-based (e.g. telemedicine/virtual delivery of care versus face-to-face) • **C**omparison: different models of care • **O**utcomes: key features, effectiveness (patient outcomes, provider outcomes, health system outcomes), identified opportunities and challenges ○ Outcomes specific to rural, regional and urban areas • **S**tudy types: ○ Review studies (to capture empirical studies) with systematic search strategy and methods ○ Randomised or non-randomised clinical trials, before and after studies, time series studies ○ Retrospective chart review studies ○ Evaluative studies with quantitative or qualitative assessment of outcomes with or without a comparison group • Grey literature such as guidelines and consensus statements	

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