







BMJ Open Configurations and outcomes of acute hospital care for frail and older patients with moderate to major trauma: a systematic review

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ABSTRACT

Objective To systematically review research on acute hospital care for frail or older adults experiencing moderate to major trauma.

Setting Electronic databases (Medline, Embase, ASSIA, CINAHL Plus, SCOPUS, PsycINFO, EconLit, The Cochrane Library) were searched using index and key words, and reference lists and related articles hand-searched.

Included articles Peer-reviewed articles of any study design, published in English, 1999–2020 inclusive, referring to models of care for frail and/or older people in the acute hospital phase of care following traumatic injury defined as either moderate or major (mean or median Injury Severity Score ≥ 9). Excluded articles reported no empirical findings, were abstracts or literature reviews, or referred to frailty screening alone.

Methods Screening abstracts and full text, and completing data extractions and quality assessments using QualSyst was a blinded parallel process. A narrative synthesis, grouped by intervention type, was undertaken.

Outcome measures Any outcomes reported for patients, staff or care system.

Results 17 603 references were identified and 518 read in full; 22 were included—frailty and major trauma ($n=0$), frailty and moderate trauma ($n=1$), older people and major trauma ($n=8$), moderate or major trauma ($n=7$) Or moderate trauma ($n=6$). Studies were observational, heterogeneous in intervention and with variable methodological quality.

Specific attention given to the care of older and/or frail people with moderate to major trauma in the North American context resulted in improvements to in-hospital processes and clinical outcomes, but highlights a relative paucity of evidence, particularly in relation to the first 48 hours post-injury.

Conclusions This systematic review supports the need for, and further research into an intervention to address the care of frail and/or older patients with major trauma, and for the careful definition of age and frailty in relation to moderate or major trauma.

International Prospective Register of Systematic Reviews (PROSPERO) CRD42016032895.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This review has taken a comprehensive approach to including both those classified as frail as well as those who are older in recognition that definitions vary and frailty has not always been routinely assessed.
- ⇒ Widening our approach to capture both moderate and major trauma, according to classifications of severity of impact on a younger population, allows us to indicate where a more inclusive approach may have benefits for older people.
- ⇒ The review was strengthened by following international guidelines for the conduct of reviews and established tools for the quality assessment of the included studies.
- ⇒ The review's limitations include its broad definitions and therefore the heterogeneity of the included studies' populations and outcomes, as well as of quality.

The original protocol for the review can be found in online supplemental file 1.

INTRODUCTION

As the population ages, so does the proportion of older people affected by major trauma. In the UK, registry data show the incidence of major trauma in those over 75 years old doubled in a 9-year period, and nearly 150 000 people were affected from 2012 to 2017.^{1,2} Older patients with trauma frequently experience medical comorbidities, cognitive deficits and polypharmacy, and have a higher level of morbidity and mortality than younger patients.^{3–5} These poorer outcomes are associated with the physiological and biological changes of ageing that lead to a reduced ability to tolerate injury.^{6,7}

Deficiencies in care of the older patients with trauma have been reported in the



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literature, including under-recognition of injury severity, delays to imaging and missed identification of injuries.⁸⁻¹¹ This has led to the development of specific quality standards and education programmes to address the differing needs of older patients with trauma.¹²⁻¹⁴ In the UK, the National Institute for Health and Care Excellence recommend that there are acute specialist services for older patients with trauma but recognise the challenge in identifying aspects of service configuration that impact on patient outcomes.¹⁵

Older people are a heterogeneous group and it is not just chronological age that impacts on outcomes. There is increasing evidence that frailty, a long-term condition characterised by accumulative deficits in physiological, physical and mental function, rather than age impacts on outcomes in major trauma.^{16 17} Frailty status is offered as a way of further categorising older patients who could benefit from targeted interventions following major trauma. In England, the introduction of a quality measure leading to a payment subsidy for patients with major trauma aged 65 years or over who have a frailty assessment within 72 hours of admission has recently been introduced.¹⁸ Early assessment of frailty in patients with major trauma in the emergency department (ED) is possible but not yet reflected in the clinical guidance.¹⁹ Frailty-specific models of care for geriatric fracture and patients with mild trauma have been shown to improve length of hospital stay, readmission rates and independence.^{20 21}

It is not clear which components of major trauma care specifically focused on frail or older patients are associated with improved outcomes, or precisely where the 'cut point' for defining trauma as 'major' in older and/or frail people should be, although a new definition taking account of differential impact of trauma has recently emerged.²² While recognising that age and frailty are not directly correlated, trauma providers who do not use formal frailty screening in older people with trauma are reported to commonly include age in their determinations of frailty and to show limited consensus around definitions.²³ In this context, we therefore asked the following review question, specifically designed to capture the breadth of definitions related to age/frailty and trauma/major trauma: what is the configuration and impact of current models of care for frail or older patients presenting with moderate to severe trauma in hospital?

METHODS

This systematic review was designed and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA),^{24 25} and registered with the International Prospective Register of Systematic Reviews (PROSPERO), CRD42016032895.²⁶

Patient and public involvement

There was no direct patient and public involvement in this systematic review. The review question was derived

however during conduct of a study of feasibility and accuracy of ED frailty identification in older patients with trauma: a prospective multicentre study, during which the patient and public involvement activities highlighted the importance of the subject.¹⁹

Eligibility criteria

The eligibility criteria underpinning the broader terms utilised in the review question are defined in detail as follows.

Inclusion

1. Population: patients with major (ISS >15) or moderate (ISS ≥9 and ≤15) trauma who are older and/or present with frailty.²⁷ 'Major trauma' was defined as serious and often multiple injuries where there is a strong possibility of death or disability.²² Classically major trauma includes those classed as having severe injuries determined by an Injury Severity Score (ISS) above 15 but due to the disproportionate impact of trauma on older patients we elected after conducting initial screening to also include moderate trauma (ISS ≥9).²² Definitional variation was anticipated due to the relatively recent introduction of the term 'frail' in emergency care trauma and the conflation of age >70 with frailty.^{23 27} Frailty or being older was therefore defined according to the criteria set in each paper.
2. Intervention: configuration of acute care for older and/or frail patients presenting to hospital after moderate to major trauma. We defined 'hospitals' as a facility capable of receiving patients with traumatic injuries; and 'configuration' to include any type of care specific to the frail or older status of the patient. These definitions result in a broad review, with the evidence for the subgroups within our definitions presented separately.
3. Comparison: Any or none.
4. Outcomes: prevalence and type of acute care model; and any outcomes reported for patients, staff or care system. 'Impact' was any outcomes for the patient, staff or care system.
5. Study design: Any that allowed measurement in a primary study.

Studies were grouped for synthesis according to their intervention.

Exclusion criteria

Articles were additionally excluded if they were not published in the English language, reported on injuries with a mean or median ISS (or calculated estimated mean ISS from grouped data) of <9 or presented no information on ISS, reported no empirical findings, were published as an abstract or were literature reviews.

Information sources

The electronic databases Medline, Embase, Applied Social Sciences Index and Abstracts, CINAHL Plus, SCOPUS V.4, PsycINFO, EconLit and The Cochrane Library were searched from the beginning of January 1999 to end December 2020, with the initial 20-year

period (1999–2019) selected following scoping that suggested that most papers on the topic were published in the 2010s but with some earlier work in the 2000s. During the review conduct process we elected to add the year 2020 in order to update.²⁸

The search strategies were developed initially utilising the topic knowledge of the team and scoping papers to produce a set of terms for each of the elements of the eligibility criteria, mapping these to the index terms of the different databases,²⁸ and utilising these index terms as additional key words in the databases without indexing.

No language or publication status restrictions were imposed at this stage; see online supplemental file 2 for the search strategies for all information sources.

In addition, we used ‘lateral searching’ techniques²⁹ - we checked reference lists of systematic reviews identified at the abstract screening stage and papers selected for inclusion after full-text reading, and used the Scopus ‘Cited by’ and the Pubmed ‘Related articles’ functions.

Selection process

Relevant studies were selected using title and abstract screening, followed by full-text screening, by author pairs (MH with PM, STK, DB or LG) screening independently in parallel, with disagreements resolved in discussion, against the eligibility criteria. Articles excluded at full-text screening are listed in online supplemental file 3.

Data collection process and data items

Author pairs independently extracted the general characteristics of studies and results into a spreadsheet and the lead author conducted a consistency check across all for level of detail of data extracted. The data items collected were author and year of publication, aim, study design and methods, study setting (country, section of acute care), intervention/model of care/pathway, comparison (if any), participants (population and sample), mean or median ISS, outcomes and their effect measures and key findings against outcome. Where ISS was presented as a range, the study team calculated an estimate mean ISS based on a mid-point assumption in grouped ISS data and the sample numbers. A summary of the data extracted on characteristics and outcomes is found in the online supplemental data files (characteristics and outcomes).

Study risk of bias assessment

Author pairs independently appraised study quality using the QualSyst checklists for quantitative and qualitative studies,³⁰ with any disagreement moderated by MH. Scoring cut points were not employed to decide on inclusion or exclusion²⁸; rather the differences in scores on the risk of bias assessment were utilised in the synthesis, accounting for heterogeneity in study paradigms, methods and results.³⁰

Synthesis methods

Heterogeneity of the interventions and outcomes investigated in the included studies precluded meta-analysis. Therefore, narrative synthesis was undertaken³¹ and

conducted against guidance: developing a theory of how, why and for whom the intervention works; developing a preliminary synthesis of findings; exploring relationships; and assessing the robustness of the synthesis³² through a process of discussion and tabulation of the outcomes, initially against population subgroups and then against the intervention groups, and taking into account the limitations of lower quality evidence during synthesis.³³

RESULTS

Search results

The search strategy identified 17603 references, from which we selected 518 for full-text review. Of these, 85 described major or moderate trauma, and 22 of these were included for data collection, quality appraisal and data analysis; see [figure 1](#) PRISMA flow diagram.

The included evidence is summarised below in three subsections: characteristics of included studies, methodological quality, and synthesis of findings.

Characteristics of included studies

Four population descriptor groups were constructed (see [figure 2](#)). Only one study was found that specifically explored configurations and/or outcomes of interventions for frail patients with moderate trauma.³⁴ The remainder of the studies included major (ISS >15)^{34–45} or moderate through to major (ISS ≥9) trauma^{46–54 55} in populations defined by their authors as ‘older’, with or without a version of a frailty assessment being part of the intervention. Studies included classifications of ‘older’ at differing starting ages, ranging from 55 to 70 years.

The publication years ranged from 2002³⁵ to 2019³⁴; all but two were from 2011 onwards. All were conducted in North America and were in single localities, either one hospital or facilities within one or two administrative regions. Included studies were all observational in design.

No two studies presented precisely the same intervention, though five distinct intervention groups were identified (see online supplemental data characteristics and outcomes).

Injury severity in the samples varied widely.

Outcome measures varied across studies, although there were groupings around quality-assured processes of geriatric-specific care and around hospital (eg, length of stay and cost) and patient (eg, mortality) outcomes.

Online supplemental data characteristics present the characteristics for each study, chronologically within each intervention group.

Methodological quality

The studies were of variable methodological quality. The mean quality score was 75.2% (SD 14.6), median 76.1%, minimum 45.8%,⁴⁸ maximum 95.5%,³⁷ IQR 25 (64.5 to 89.2). The full quality scores are shown [table 1](#); all but one studies⁴⁸ were judged as being below the ‘relatively liberal’ cut point for suggested inclusion in reviews and 12 studies to be above the ‘relatively conservative’ cut point of 75%

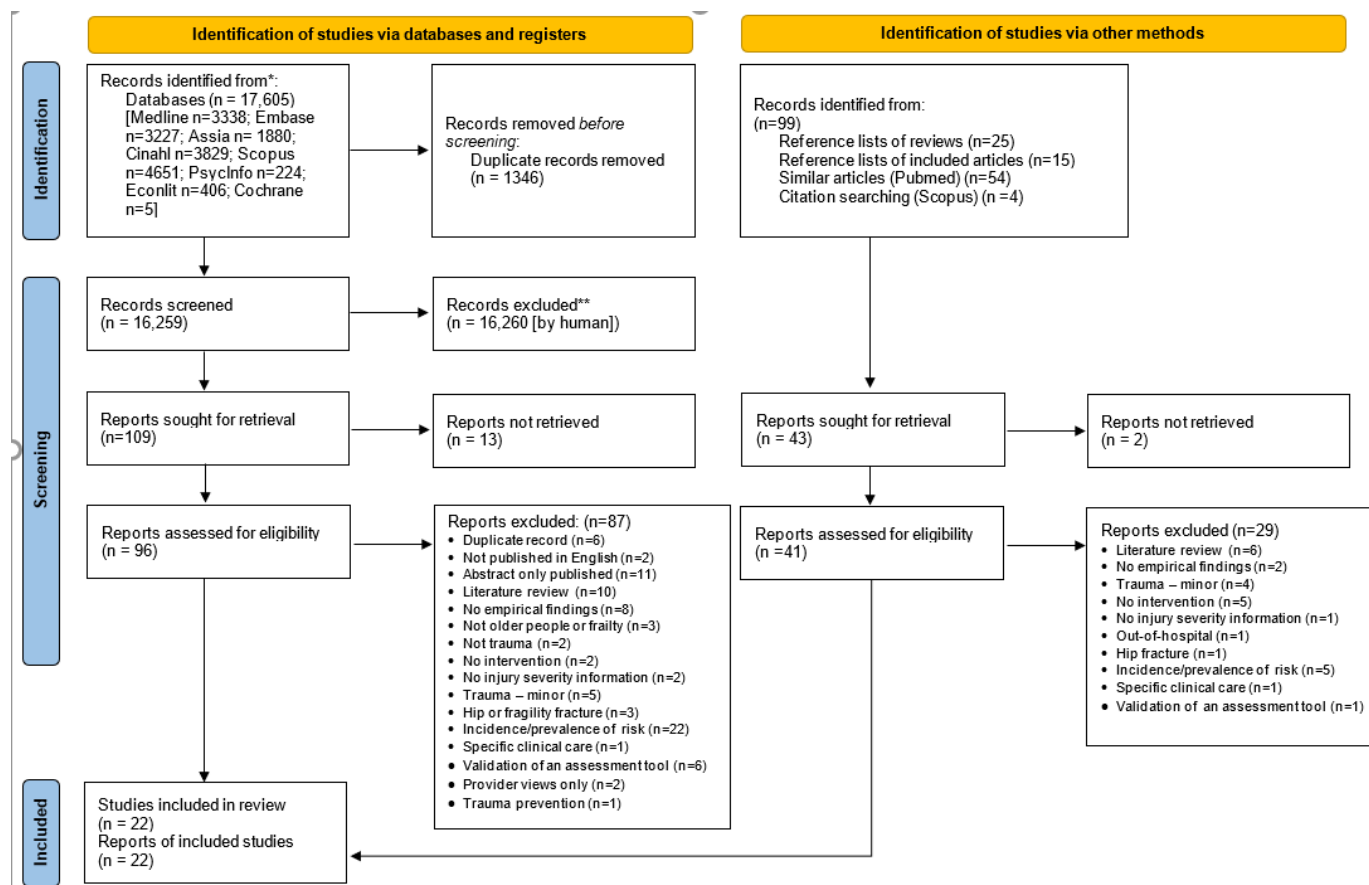


Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram.

raised as examples of potential cut point by the authors of the QualSys tools.³⁰ The most important methodological issues were uncontrolled comparison, lack of statistical adjustment for patient characteristics and underpowered or not discussed statistical power, according to the definitions of the quality assessment tool used.³⁰

Narrative synthesis according to intervention group

The studies are presented in the five 'intervention' groupings: frailty pathways, geriatric consultation, geriatric specific care, palliative care and triage to trauma service provision.

Frailty pathways

One paper was identified specifically regarding the patient with frail trauma; this did not include patients with injuries defined as major trauma. Bryant *et al* evaluated preimplementation and postimplementation of interdisciplinary care pathways for frail moderately injured patients with trauma admitted to the trauma service.³⁴ Patients were screened with the FRAIL scale²⁰ and specific frailty interventions/pathways of care indicated by the assessment included hospital specialist consults, family engagement, palliative care, social work and rehabilitation input. Early identification of frailty and focused care pathways were associated with significant reductions in adjusted risks of delirium and readmission, although the study self-reports being underpowered.³⁴

Geriatric trauma consultation

The seven studies categorised as 'geriatric consultation' delivered this within different time frames after admission (24 or 72 hours) and points in the patient's journey (ED, ward, intensive care unit (ICU)), but were otherwise similar in design and intervention, looking before and after the introduction of a system of geriatric-specific assessment and care planning. The studies measuring care processes focused on identified and/or treated 'geriatric-specific' issues. Varying outcomes are reported: documentation of delirium as unchanged⁵² or improved³⁸; presence of delirium reduced⁴⁰; no change in falls or use of physical restraint⁴⁰; reduced subspecialty consultant requests to internal medicine^{41 53} and psychiatry⁵³; and unchanged trauma quality indicators or quality outcome scores.^{38 41 53}

Outcomes included length of stay, discharge disposition, readmission and mortality. Length of stay in ICU and in-hospital was reported to be longer after geriatric consultation in the ICU,⁴⁸ but not significantly different for all, based on age criteria.^{41 52 53} ICU re-admission rate was reduced significantly.⁵² Discharge disposition showed fewer patients⁴⁸ or similar numbers⁴¹ returning home, similar numbers^{41 48} or fewer to long-term or higher level care.^{40 51} Deaths were reported to be fewer in patients who had received geriatric consultation in one study,⁴⁸ but not in others for in-hospital mortality^{40 52 53} or at 30 days

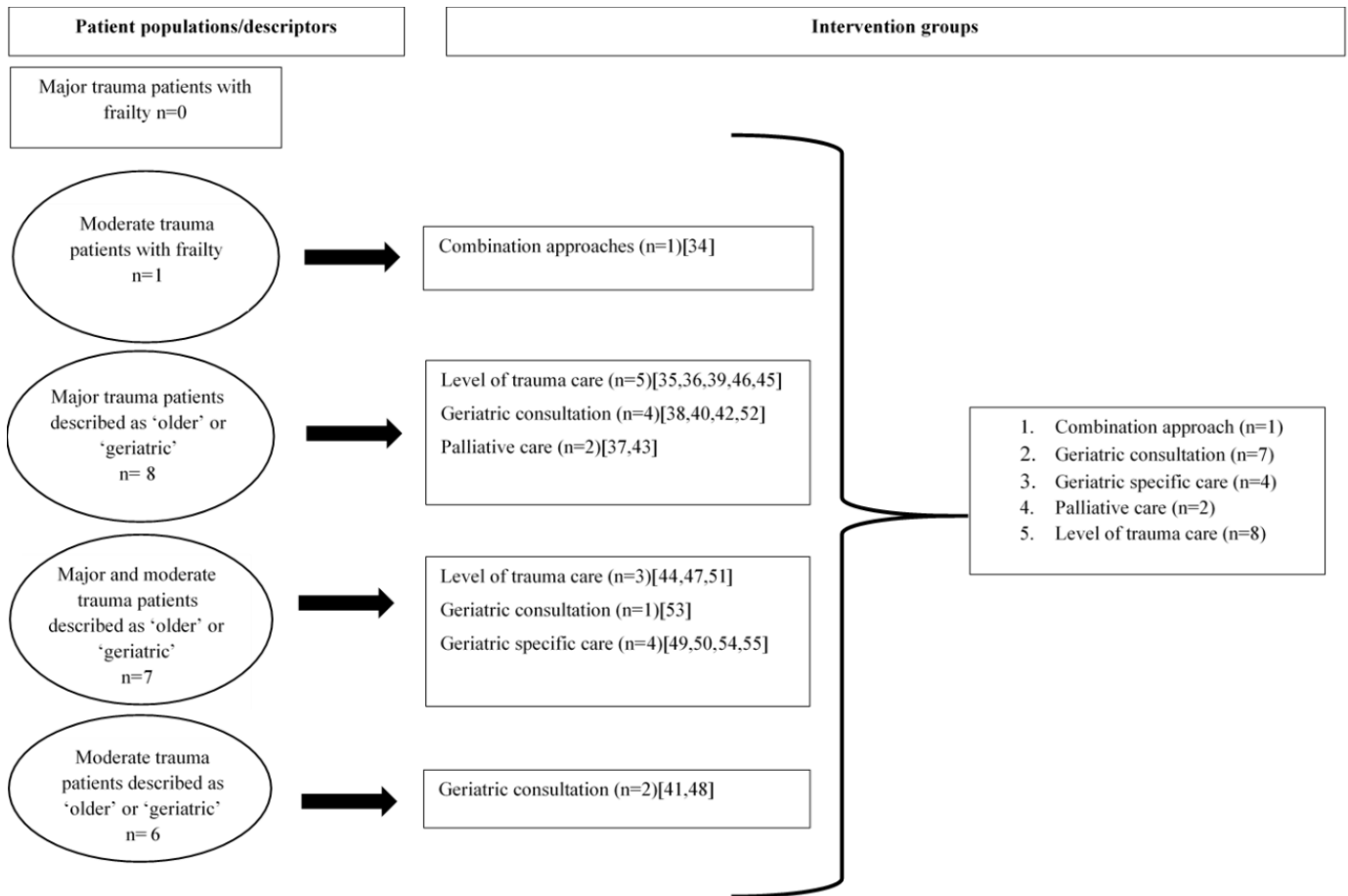


Figure 2 Patient populations/descriptors and intervention groups in included articles.

postdischarge.⁴² Hospital readmission at any measured time point was also unchanged.^{41 52 53}

Min *et al*³⁸ presented a high-quality observational study, using powered intention-to-treat analysis, and parallel data abstraction with inter-rater reliability tested. However, the remainder of the studies in this group utilised univariate analyses between cohorts, with no explanation of statistical power and no adjustment for potential confounding.^{40-42 53} This, coupled with the variation in the geriatric trauma consultation services provided and within the patient groups included, in predominantly uncontrolled observational studies, makes comparison difficult across the varied results.

Geriatric-specific care

Four studies evaluated multidisciplinary approaches where institutes or protocols had been implemented to care for the older patient with moderate trauma (see table 1 for ISS descriptors). These sets of interventions were mixed but broadly similar, containing, variously, elements such as protocols for multidisciplinary geriatric-specific input^{49 50 55} (in one case including geriatric consultation alongside investigation and ICU admission guidance),⁴⁹ a number of protocols for ICU care⁵⁰ or for anticoagulation and trauma alert.⁵⁵

These studies reported no mortality difference associated with a geriatric protocol^{49 50 53} and were not

associated with changes to documented guideline-specific care across hospitals.⁴⁷ However, after adjusting for injury severity, reduced mortality rates for the geriatric protocol in combination with a trauma alert for patients on anti-coagulant therapy were reported.⁴⁷ Descriptively, length of stay in the ED and hospital overall were reduced.⁵⁰ The methodologically stronger studies used larger samples and statistically adjusted analyses.^{50 55} Authors interpreted their positive results from retrospective observational studies cautiously in light of their limitations, despite larger samples and statistically adjusted analyses,^{50 55} even where intervention phase data were collected prospectively.⁵⁵

In qualitative inquiry, Saillant *et al*⁵⁵ reported open-ended survey responses indicating the characteristics perceived to be important to improving geriatric trauma outcomes as multidisciplinary care to include geriatrician input and recognising the distinctness of the cohort.

Palliative care

Of the two studies included, one presented the 'before and after' of the implementation of a palliative care consultation for patients with geriatric trauma,⁴³ and one compared the end of life processes (including a palliative care consultation and pathway) for patients with traumatic brain injury.³⁷ Both studies report statistically significant improvements against their own measures, particularly in



Table 1 Quality appraisal³⁰ of individual studies (in alphabetical order)

First author, year	Question / objective described	Study design evident and appropriate	Method of group selection described and appropriate	Subject characteristics sufficiently described?	Random allocation described (if applicable)	Blinding of investigators reported (if applicable)	Blinding of subjects reported (if reported)	Outcome and measure(s) well defined and robust to	Sample size appropriate	Analytic methods justified and appropriate	Some estimate of variance is reported for the main results	Controlled for confounding	Results reported in sufficient detail	Conclusions supported by the results	Total possible sum	Total possible sum %	
Bradburn <i>et al</i> 2018 ⁵⁴	2	2	2	2	n/a	0	n/a	2	1	2	2	2	2	1	19	24	79.167
Bradburn <i>et al</i> 2012 ⁴⁹	2	2	1	2	n/a	2	n/a	2	1	2	2	2	2	1	20	22	90.909
Bryant <i>et al</i> 2019 ⁵⁴	2	2	2	2	n/a	0	n/a	2	1	2	2	2	2	1	20	22	90.909
Cortez 2018 ⁴¹	2	2	2	2	n/a	0	n/a	1	1	1	2	1	1	1	16	24	66.667
Demetriadou <i>et al</i> 2002 ³⁵	2	2	2	2	n/a	0	n/a	2	0	1	2	1	2	1	17	24	70.833
Fallon <i>et al</i> 2006 ⁴⁸	2	1	1	2	n/a	0	n/a	2	0	1	0	0	1	1	11	24	45.833
Fredrickson <i>et al</i> 2011 ⁵⁴	2	2	2	2	n/a	0	n/a	2	2	2	2	2	2	2	22	24	91.667
Kupensky <i>et al</i> 2015 ⁴³	2	2	1	2	n/a	0	n/a	2	0	2	0	0	2	1	14	24	58.333
Lenertowicz <i>et al</i> 2012 ⁴	2	2	2	2	n/a	0	n/a	2	1	2	0	0	2	2	17	24	70.833
Lilley <i>et al</i> 2016 ³⁷	2	2	2	2	n/a	0	n/a	2	1	2	0	0	1	1	15	24	62.5
Melton <i>et al</i> 2002 ⁴⁷	2	2	2	2	n/a	0	n/a	2	0	2	2	2	2	2	20	22	90.909
Min <i>et al</i> 2015 ³⁸	2	2	2	2	n/a	0	n/a	2	2	2	2	2	2	2	22	24	91.667
Olufajo <i>et al</i> 2016 ⁵²	2	2	2	2	n/a	0	n/a	2	1	2	0	0	2	1	16	24	66.667
Rogers <i>et al</i> 2012 ³⁶	2	2	2	0	n/a	0	n/a	2	0	2	2	2	2	1	17	22	77.273
Sahr <i>et al</i> 2013 ⁴⁴	2	1	2	2	n/a	0	n/a	2	0	1	2	0	1	0	13	22	59.091
Saillart <i>et al</i> 2017 ⁵⁵	2	2	2	1	n/a	0	n/a	2	1	2	1	2	1	2	18	24	75
Scheetz <i>et al</i> 2018 ⁴⁶	2	2	2	0	n/a	0	n/a	2	0	2	0	0	0	2	12	22	54.545
Southerland <i>et al</i> 2017 ⁵³	2	2	2	2	n/a	0	n/a	2	0	2	2	1	2	2	21	24	87.5
St John <i>et al</i> 2016 ⁴⁵	2	2	2	2	n/a	0	n/a	2	1	2	2	2	2	2	21	22	95.455
Staudenmayer <i>et al</i> 2013 ³⁹	2	2	2	2	n/a	0	n/a	2	1	2	2	2	2	2	21	24	87.5
Wong <i>et al</i> 2017 ⁴²	2	1	1	2	n/a	0	n/a	1	0	2	0	0	2	2	13	22	59.091
Zafar <i>et al</i> 2015 ⁵¹	2	2	2	2	n/a	0	n/a	2	0	2	2	1	2	1	18	22	81.818

relation to the documentation of advanced care planning and family discussion,^{37 43} with more people discharged to home or hospice.³⁷ Neither of these studies, however, justified their sample size or controlled for confounding in their analyses, despite describing differences in the age or ISS of their ‘intervention’ and ‘control’ groups.

Triage to trauma service provision

Eight retrospective studies considered the impact of delivering care for older patients with trauma managed in differing levels of service provision, in three subsets: level of trauma centre, proportion of older patients with trauma managed by the trauma centre and trauma team activation.

Comparing trauma centres with non-trauma centres

Three studies evaluated care delivered at trauma centres in comparison to non-trauma centres, with mortality as the primary outcome. One study used unadjusted analysis to report no difference in mortality in those aged over 55 cared for at a trauma or non-trauma centre⁴⁶; however, the two studies which used adjusted predictive models reported reduced mortality rates in trauma centres in patients aged over 80,⁴⁷ and those aged over 55.³⁹

Comparing trauma centres seeing different proportions of older patients with trauma

In a different comparison, Zafar *et al*⁵¹ reported benefits for older patients managed in high-volume centres, with lower risk-adjusted mortality rates in centres seeing a higher proportion of those aged 65 and over compared with those with a lower proportion of older patients with trauma.

Notwithstanding that none of the papers comparing trauma centres (sections ‘Comparing trauma centres with non-trauma centres’ and ‘Comparing trauma centres seeing different proportions of older patients with trauma’) achieved blinding among investigators in retrospective analyses of routinely collected data and the absence of information about sample size power in all (though accepting the large sample sizes), we see evidence of different impacts of trauma facility on outcomes.

Trauma team activation within the receiving hospital

Within the four papers on trauma team activation, all looked at an extension to current activation criteria, focused on broadening to include older people with a lesser injury (eg, rib fracture⁴⁴) than would ordinarily trigger an activation, or all persons with trauma above certain age limits (eg, 65⁴⁵ or 70³⁵ years) or using a risk tool.³⁶ Two studies measured length of stay, adverse events and mortality outcomes before and after the institutional change in trauma team activation criteria,^{35 44} one compared the outcomes for younger and older patients⁴⁵ and the other compared mortality associated with correct and undertriage.³⁶ Extended activation criteria³⁵ and ‘correct’ triage³⁶ were associated with improved outcomes including reduced mortality^{35 36}; reduced length of stay in

ICU and overall⁴⁴; and, descriptively, reduced permanent disability.³⁵

These positive reports of the impact of essentially lowered thresholds for trauma are considered in the context of study quality. None of these studies explained their sample size and only St John *et al* adjusted their analyses for confounders, reporting that trauma team activation was not associated with a reduced relative risk of death in older people when compared with younger patients.⁴⁵ Even in this more robust analysis, the authors suggest that their sample size was not large enough. All of the studies are appraised to at least partially over-reach on their conclusions.

DISCUSSION

The systematic search for evidence relating to configuration and impact of care for older patients with or without classified frailty suffering moderate to major trauma yielded a large potential pool of studies, of which we included 22 for synthesis. None of the included studies specifically addressed the needs of the older person with frailty experiencing major trauma as defined by ISS >15. In summary, the included studies were all observational, mostly retrospective in design, comparing processes and/or outcomes of acute hospital care following an intervention against a ‘control’ of a preceding period of time. Studies ranged in quality, with concerns particular to little consideration of confounding by age and injury severity, and to statistical power. All studies were from North America.

The included studies reported on a range of interventions aiming to improve care and outcomes for the frail or older patient presenting with trauma: trauma centre use^{39 46 47 51}; lower thresholds for trauma team activation^{35 36 44 45}; geriatric consultation^{38 40–42 52 53} or palliative care consultation^{37 43} early in the patient’s care pathway; other geriatric specific care processes^{49 50 54 55}; and combinations of the above in frailty-specific interventions.³⁴

The synthesised literature suggests that what is currently known in terms of configurations that improve the outcomes for older patients with moderate and major trauma are as follows: some improvements to geriatric-specific care processes and to patient and service outcomes were associated with the above interventions, but these improvements were not universal in the included studies. The highest-quality papers suggest reduced mortality associated with trauma centre use,³⁹ particularly if that trauma centre sees a high proportion of older patients,⁴⁷ with trauma team activation for all aged over 65⁴⁵ and with geriatric care protocols.^{46 49 53} They also point to reduced length of stay with ICU protocol⁵⁰ and reduced readmission with frailty-specific pathways,³⁴ as well as improved delirium and mobility care with daily geriatrician visits to trauma surgical patients.³⁸ Overall, however, the evidence is not strong—there are no groups of studies reporting the same interventions or results, and there are limitations in study design.

This review raises three key discussion points in relation to what is already known: the absence of studies specific to frailty pathways in patients with major trauma and one in moderate trauma, the definition of major trauma in frail and/or older patients and measuring the impact of interventions containing multiple elements of care. These require further research.

The number of studies closely related to our particular review question is indicative that adverse outcomes for older people presenting with trauma are being addressed. The interventions of many of these studies—providing a higher than usual level of trauma care and/or the involvement of the multidisciplinary team, particularly what many of the papers refer to as ‘geriatric’ consultation—also highlights a recognition that this is unlikely to be an issue that can be solved by either the ED or the medical or surgical inpatient teams alone. Given the relatively low age limits of inclusion to the reviewed studies, frailty in the whole of each study sample cannot be assumed. However, the frailty-specific study³⁴ appears in the most recent years of our review period, coinciding with professional guidance on this population, colloquially referred to as ‘silver trauma’.²⁷ The quantitative ‘frailty’ study we located included patients with relatively low ISSs³⁴ and, notwithstanding the impact of lower severity trauma on older adults, there remains a gap in the literature.

These points—and our own difficulties drawing a clear line through the cut-off point in both injury severity and age or frailty for this review—highlight the problematic area of the definition of major trauma in those who are frail and/or older.

The studies included also highlight issues with measuring impact in interventions with multiple components. In such interventions, causality and effect size are difficult to determine and it is possible that a number of interacting interventions might each contribute to an overall beneficial outcome, or that a single intervention might be impactful. We argue that the limitations of many of our included studies make it difficult to be definitive about beneficial effect, and randomised controlled trial evidence of such complex interventions is desirable.

This review itself has a number of limitations. We excluded all papers where the primary focus was on hip fracture or other single fragility fracture alone; however, the poor definition of presenting conditions may mean we did not include some appropriate studies. Likewise, including studies of both frail and older people risks conflating two different groups; we have presented the literature on these groups separately but note that frailty assessment is a relatively recent addition to acute care, and the populations of the studies including a more general older sample are also likely to include those with frailty. We also present a narrative synthesis³¹; while meta-analysis is not indicated with diverse non-randomised study types,⁵⁶ and we have extracted data items consistently, the analysis remains limited, specifically in not conducting sensitivity analyses, and not having formally

assessed the risk of bias due to reporting bias, or certainty in the body of evidence.

We conclude that the body of evidence, while heterogeneous and of moderate quality, gives an indication that some interventions focused on the specific care needs of frail and/or older patients with trauma (trauma centres seeing a high proportion of older patients, geriatric or frailty-specific care protocols and daily geriatrician visits) have positive impact on care processes and some outcomes based on the examples of different approaches from the North American context. Despite the complexities of major trauma and of frailty interventions alike, overall this systematic review supports the need for the development and prospective, well-powered evaluation of a novel intervention, building from the elements showing promise in this review, to intervene as early as possible in the pathway of those attending the ED with significant injury sustained in those rendered vulnerable by frailty and/or extremes of age.

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Configurations and outcomes of acute hospital care for frail and older patients with moderate to major trauma: a systematic mixed studies review

PROTOCOL

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PROJECT TITLE

Configurations and outcomes of acute hospital care for frail and older patients with moderate to major trauma: a systematic mixed studies review

1. BACKGROUND

Older people, particularly those aged 75 and older are increasingly sustaining major traumatic injury [1,2], with falls being the commonest cause [3,4]. International evidence suggests there are two groups of patients within this – those functioning well physically prior to the injury, and those who are frail. Frailty can be assessed using one of a number of tools,⁵ but international scoping review evidence suggests only 14% were screened for frailty during the Emergency Department (ED) period [4]. Frailty, however, has been shown to be significantly associated with increased length of hospital stay [6,7], post-operative complications⁶ and mortality in trauma [8,9], in part independently of the confounders of age, sex, race, comorbidities and disabilities [10]. Current research funded by the Burdett Trust and led by Professor Jarman is assessing the feasibility of early nurse-led frailty assessment in the Emergency Department (ED). The literature review undertaken for the development of that protocol identified that frailty screening is only recommended as part of a comprehensive geriatric assessment at a later stage in the patient's journey [5], although there is some evidence of improved outcomes for those who have early frailty screening and expedited care via a specialist pathway [11]. The literature however has not been reviewed systematically and we are keen to find out if there is more than this scant evidence on frailty assessment of the major trauma patient in the ED and the strength of evidence for the impact of frailty assessment in the acute phase of care specifically. We also wish to investigate what other aspects of the configuration of acute hospital care for frail major trauma patients exist, and what the outcomes of these are. Alongside new guidance in the NHS Long Term Plan [12] that hospitals with a major ED will provide an acute frailty service for at least 70 hours per week, working towards achieving clinical frailty assessment within 30 minutes of arrival, a systematic review is considered justified.

This review has been designed to meet the criteria of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Protocols (PRISMA-P) 2015 statement [13].

2. REVIEW OBJECTIVES AND QUESTIONS

The objective for the review is:

To appraise and synthesise the published literature on the configuration and outcomes of acute hospital care for frail and older patients with moderate to major trauma.

The review investigates the following overall review question:

What is the configuration and outcome of acute hospital care for frail major trauma patients?

The review will also include the following sub-questions, to be addressed as the weight of evidence allows:

- What models of care for frail and older patients with moderate to major trauma are described in the literature?
- What evidence is there that outcomes are related to different configurations of hospital care for frail and older patients with moderate to major trauma?
- What evidence is there for outcome being dependent upon how early assessment of frailty is undertaken in the patient's journey?
- What gaps appear in the existing evidence?

As this review question contains broad terms, these have been defined at the outset, as follows:

- Major trauma: Major trauma describes serious and often multiple injuries where there is a strong possibility of death or disability [14]. Seriously injured adults and children are often defined as having suffered from major trauma if they have an Injury Severity Score (ISS) >15. However, as ISS is not determined until after full diagnostic assessment, we will define major trauma patients to include 'candidate major trauma patients', that is those as those attending a Major Trauma Centre or Trauma Unit, as well as those defined by their injuries being moderate, i.e. (ISS ≥ 9 and ≤ 15).
- Acute hospital care: By acute hospital care we mean a care provided in a facility with a receiving ED designated as a Major Trauma Centre or Trauma Unit
- Frail / frailty: There is no universal definition of frailty, but it is regarded as a condition characterised by a cumulative decline of physiological resilience across a number of body systems [15-17].
- Older: we will use the age definitions of the included papers where they refer to their population as 'older'.

- Configuration: Configuration has been taken in its definition as a particular arrangement of parts or components, in this context meaning arrangement of care for frail major trauma patients. It will include concepts such as processes of care, pathways, assessment or screening.
- Outcome: Outcome will be defined broadly to include prevalence and type of outcome measurements associated with the configuration of acute hospital care for the frail major trauma patient.

3. METHODS

3.1 Scoping review

A preliminary assessment of potentially relevant literature and its size for review was carried out via a scoping search using Medline to identify papers relevant to the study's objectives [18]. The 'scoping' search yielded 4,407 articles (see table 1). Although this search was clearly limited by its use of just one database, it was indicative that a body of literature was available for review and that a search strategy that aimed to be inclusive identified a potentially large number of studies for review.

The scoping also suggests that studies of diverse designs may be included and that a mixed studies review, addressing a complex review question [19] is desirable in order to combine the strengths of any quantitative and qualitative research identified [20].

Table 1: Scoping search using Medline – 16/03/2019

#	Query	Results
S42	S37 AND S41	4,892
S41	S38 OR S39 OR S40	236,719
S40	(MH "Hospitalization") OR "hospitalisation"	139,966
S39	(MH "Inpatients")	93,708
S38	(MH "Secondary Care") OR "secondary care"	8,769
S37	S6 AND S11 AND S36	146,927
S36	S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35	10,075,130
S35	(MH "Death") OR "death"	885,790
S34	(MH "Mortality") OR "mortality" OR (MH "Hospital Mortality")	1,285,598
S33	(MH "Continuity of Patient Care") OR "continuity"	68,038
S32	(MH "Length of Stay") OR "length of stay"	151,409
S31	(MH "Costs and Cost Analysis") OR (MH "Health Care Costs") OR (MH "Direct Service Costs") OR "cost"	646,411
S30	(MH "Program Evaluation") OR "appropriate*"	755,141
S29	"timeliness"	5,841
S28	(MH "Health Care Quality, Access, and Evaluation") OR (MH "Health Services Accessibility") OR "access"	498,080
S27	"effect"	3,441,442
S26	"effectiveness"	543,814
S25	(MH "Quality of Life") OR (MH "Quality of Health Care") OR (MH "Quality-Adjusted Life Years") OR (MH "Health Care Quality, Access, and Evaluation")	404,917

FRAIL T2_SYSTEMATIC REVIEW_Protocol_UPDATE_20201230_Clean

S24	(MH "Economics") OR (MH "Value of Life") OR (MH "Cost-Benefit Analysis") OR "economic"	374,922
S23	"productivity"	68,438
S22	(MH "Efficiency") OR "efficiency" OR (MH "Efficiency, Organizational")	448,858
S21	(MH "Personhood") OR "dignity"	15,781
S20	(MH "Empathy") OR "compassion"	33,002
S19	"perception OR view OR rates OR rating OR audit OR effect OR influence OR review OR outcome OR performance OR quality"	41,411
S18	"perception OR view OR rates OR rating OR audit OR effect OR influence OR review OR outcome OR performance OR quality"	41,411
S17	"experience"	813,122
S16	(MH "Patient Satisfaction") OR "satisfaction"	307,595
S15	(MH "Patient Acceptance of Health Care") OR "Acceptability"	81,738
S14	(MH "Geriatric Assessment") OR "geriatric assessment"	37,316
S13	(MH "Health Impact Assessment") OR "impact"	1,094,378
S12	(MH "Treatment Outcome+") OR (MH "Patient Outcome Assessment+") OR (MH "Adverse Outcome Pathways") OR (MH "Outcome Assessment (Health Care)") OR (MH "Patient Reported Outcome Measures") OR (MH "Outcome and Process Assessment (Health Care)") OR (MH "Critical Care Outcomes") OR "Outcome"	1,980,029
S11	S7 OR S8 OR S9 OR S10	5,857,457
S10	(MH "Geriatrics") OR (MH "Geriatric Assessment") OR ""Older adult" or elderly or geriatric* or "older people*" or ag?ng"	68,266
S9	(MH "Aged") OR "aged" OR (MH "Health Services for the Aged") OR (MH "Aged, 80 and over")	5,826,174
S8	(MH "Frail Elderly") OR "frail*"	37,531
S7	(MH "Frailty") OR "frailty"	16,650

FRAIL T2_SYSTEMATIC REVIEW_Protocol_UPDATE_20201230_Clean

S6	S1 OR S2 OR S3 OR S4 OR S5	1,416,675
S5	"trauma*"	568,118
S4	""major trauma""	8,670
S3	(MH "Advanced Trauma Life Support Care")	209
S2	(MH "Multiple Trauma") OR "multiple trauma" OR (MH "Craniocerebral Trauma") OR (MH "Trauma Centers") OR (MH "Fractures, Multiple") OR (MH "Trauma Severity Indices")	64,083
S1	(MH "Wounds and Injuries+") OR "Wounds and Injuries" OR (MH "Wounds, Nonpenetrating+") OR (MH "Degloving Injuries") OR (MH "Wounds, Stab") OR (MH "Wounds, Penetrating") OR (MH "Wounds, Gunshot") OR (MH "Brain Injuries") OR (MH "Thoracic Injuries")	1,114,560

3.2 Inclusion and exclusion criteria

The scoping exercise and research team discussion was used to draft inclusion and exclusion criteria for this systematic review, as follows:

3.2.1 Inclusion criteria

Peer-reviewed papers will be included if they meet the following criteria:

- *Population*: Frail and older patients with moderate to major trauma in the research studies included (definitions and point of assessment may vary)
- *Intervention*: Configuration of acute hospital care for frail and older patients with moderate to major trauma
- *Comparison*: Any comparison group or none
- *Study design*: Any study design that allows description of configurations of acute care for frail and older patients with moderate to major trauma and/or measurement of outcomes of such configurations in a primary study (including papers meeting our inclusion criteria from within reviews identified in the search strategy).
- *Outcomes*: These outcomes will be fully defined by what has been measured in studies that meet the above intervention inclusion criterion, but scoping suggests these are likely, but not exclusively, to include morbidity and mortality, adverse events, quality of life, length of stay, cost and patient or carer experience.

3.2.2 Exclusion criteria

Peer-reviewed papers will be excluded if they meet the following criteria:

- Studies where the average ISS measure presented is below nine, where the ISS is presented in groups from which an average cannot be estimated, or where the ISS is not stated.
- Studies reporting on patients with isolated hip fracture
- Studies where older people are not distinguished within an 'all adults' group
- Studies reporting incidence or prevalence only of trauma or an in-hospital process or outcome
- Studies focussed on prevention of trauma, including falls in older people, either outside or inside of hospital
- Studies assessing the validity or reliability of an assessment tool only
- Studies reporting treatment of a specific medical condition or treatment in trauma patients e.g. antibiotics for cellulitis

- Reviews (NB papers from the reference lists will be screened)
- Papers that do not report empirical findings
- Papers published only in abstract form
- Studies that present their results for frail and older patients with moderate to major trauma in an amalgamated form with another population
- Papers published before 1999 (i.e. older than 20 years).

3.3 Search strategy

The search strategy and terms for the review will be guided by a systematic approach to the research questions.

We will conduct our searches using the following data sources:

- MEDLINE (Final search – see Appendix 1)
- EMBASE
- Applied Social Sciences Index and Abstracts (ASSIA)
- CINAHL Plus
- SCOPUS –V.4
- PsycInfo
- Social Policy and Practice (Ovid)
- EconLit (EBSCO)
- The Cochrane Library

In addition the following additional ‘lateral searching’ techniques will also be used for papers included in the review following the full text selection process:

- checking reference lists
- using the ‘Cited by’ option on Scopus, and the ‘Related articles’ option on PubMed, as recommended in searching for studies of complex interventions [21]
- contacting leading researchers and expert practitioners in the field (defined as the authors of the papers included in the full text included articles and their reference lists) to help identify any other empirical research published in peer-reviewed journals they know of that we have not identified through our search strategy.

3.4 Methods for study selection

3.4.1 Selection for full text reading from abstracts

The results of the electronic search will be downloaded into an Excel spreadsheet. Article duplicates will be removed. Relevant reviews will be selected according to eligibility criteria using a two-step screening process: 1) Title and abstract screening; and 2) full-text screening.

Two reviewers in parallel will review titles and abstracts of all the articles resulted to ascertain their eligibility. Disagreements will be resolved by peer discussion and a third view from the project lead or other research team members if required.

3.4.2 Selection for inclusion after full text reading

All the full-texts of the potentially relevant citations will be examined in parallel by two reviewers to analyse whether they meet all the inclusion criteria. Disagreements will be resolved by peer discussion and a third view from the project lead (MH/HJ) if required.

Each paper that is included in the review will then be read to carry out an assessment of the risk of bias/assessment of quality, and data extraction, as described below.

3.5 Assessment of quality of the studies

We will follow guidance in the assessment of quality appropriate to the study's design and we anticipate quantitative, qualitative and mixed methods papers to be included. As a general principle we will assess quality by the potential sources of bias and credibility of the discussion and conclusions as suggested by the results. For quantitative research, quality will be assessed by "the extent to which a study's design, conduct, and analysis have minimized selection, measurement, and confounding biases....." [22, 23] For qualitative research, emphasis will be placed on integrity, transparency and transferability [24 25].

Following the Centre for Reviews and Dissemination guidance [18], we will take a systematic approach to the assessment of quality of the included studies, using a published checklist that does not focus on producing a composite score of quality, rather is explicit about assessing the components of a study that determine quality.

We have selected to use the following assessment tools:

- QualSyst [26], that provides two sets of questions, one for qualitative and one for quantitative studies, the latter of which can be applied to quantitative studies of any design and aims to

distinguish studies of higher quality by design. As scoring systems are seen to be problematic in systematic reviews [18] we will not use Kmet's summary score [26] to inform the selection of a minimum threshold of quality of studies selected for inclusion in the review, rather for the following purpose: "differences in the scores within study designs, and across research paradigms, should prove useful when synthesizing information and exploring the heterogeneity of study results." [26: p10]

- the Mixed Methods Appraisal Tool (MMAT) [27], that allows reviewers to concomitantly assess the methodological quality of studies with diverse designs [28]. The tool has undergone content validity checks and continues to undergo reliability checks. While improvement in relation to some aspects have been recommended, it has been confirmed to be an efficient tool [20].

3.6 Data extraction

Two review authors will independently extract data from the studies using a predefined data extraction form. Discrepancies will be resolved through discussion. The data extraction forms will provide information on:

- General characteristics of studies: author, year, setting (including country and health care system), theoretical framing, authors' aims/ research question(s);
- Descriptive characteristics: study design; population, sample, recruitment, outcome measures
- Results: key findings / results,
- Limitations: noted by authors and reviewers
- Conclusions: noted by authors
- Reviewer(s)' notes.

If necessary, we will seek additional information from the study authors.

3.7 Approaches for data synthesis

Overall, data will be analysed qualitatively to identify broad conclusions across the included studies. Within this, however, we will consider separating the narrative about quantitative, qualitative and mixed methods studies, should that be appropriate to the presentation of impact, according to populations, samples, settings, interventions and outcome measures. For the quantitative results we will carry out an assessment of the potential for undertaking a meta-analysis once papers for review have been finalised and data extraction completed. Qualitative and quantitative evidence will be treated equally in this review, and presented as a thematic meta-synthesis [29].

This narrative synthesis will be conducted against the four elements in guidance on the conduct of narrative synthesis in systematic reviews [30,31]:

- developing a theory of how the intervention works, why and for whom (considering whether a causal chain linking the intervention to the outcomes of interest has emerged in the quantitative studies or developing a theory of the elements that contribute to an aspect of frailty assessment or intervention impact from qualitative studies);
- developing a preliminary synthesis of findings of included studies (using tabulation and grouping against individual outcome measures (e.g. length of stay or mortality) if the number of papers allows this, or against the generic impact groupings of effectiveness, efficiency, appropriateness, acceptability, access and equity [32] where heterogeneity of detailed outcome measures is found);
- exploring relationships within and between studies (using conceptual mapping and visual representations of relationships between study characteristics and outcomes);
- assessing the robustness of the synthesis (through formal quality assessment as well as reflection).

The concepts of ‘signal’ and ‘noise’ will be used here to ensure the weight of evidence is systematically and transparently considered in this process. [33]

3.7 Review Panel

The study lead will review progress and check adherence to the review protocol at three points: completion of searches, completion of the selection of articles for inclusion, completion of data extraction. At each of these stages the study lead (HJ) will be sent a summary of the processes and outcomes of decisions made by the review team and will discuss any issues and offer general guidance on progressing the review with the review lead (MH).

4. REPORTING

We will register the reviews on PROSPERO and will also seek to publish the review of interventions in an open access, peer reviewed journal.

We will adhere to the PRISMA guidelines for reporting [34].

5. PROJECT TIMETABLE

The project is scheduled to complete the review with its updated searches to December 2020, in spring 2021.

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APPENDIX 1: MEDLINE (Final search)

<input type="checkbox"/>	S36 S4 AND S8 AND S22 AND S26 AND S34	Limiters - Published Date: 19990101-20191231 Search modes - Boolean/Phrase	View Results (2,876) View Details Edit
<input type="checkbox"/>	S35 S4 AND S8 AND S22 AND S26 AND S34	Search modes - Boolean/Phrase	View Results (3,097) View Details Edit
<input type="checkbox"/>	S34 S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33	Search modes - Boolean/Phrase	View Results (2,468,263) View Details Edit
<input type="checkbox"/>	S33 "pathway"	Search modes - Boolean/Phrase	View Results (637,326) View Details Edit
<input type="checkbox"/>	S32 "assessment*" OR "screening**"	Search modes - Boolean/Phrase	View Results (13,779) View Details Edit
<input type="checkbox"/>	S31 (MH "Symptom Assessment")	Search modes - Boolean/Phrase	View Results (3,648) View Details Edit
<input type="checkbox"/>	S30 (MH "Needs Assessment")	Search modes - Boolean/Phrase	View Results (28,363) View Details Edit
<input type="checkbox"/>	S29 (MH "Episode of Care")	Search modes - Boolean/Phrase	View Results (1,700) View Details Edit
<input type="checkbox"/>	S28 (MH "Models, Organizational")	Search modes - Boolean/Phrase	View Results (18,344) View Details Edit
<input type="checkbox"/>	S27 (MH "Patient Care Management") OR "patient ADJ3 care ADJ3 management"	Search modes - Boolean/Phrase	View Results (3,563) View Details Edit
<input type="checkbox"/>	S26 S23 OR S24 OR S25	Search modes - Boolean/Phrase	View Results (190,180) View Details Edit
<input type="checkbox"/>	S25 (MH "Hospitalization")	Search modes - Boolean/Phrase	View Results (98,096) View Details Edit
<input type="checkbox"/>	S24 (MH "Inpatients") OR "inpatient**"	Search modes - Boolean/Phrase	View Results (106,740) View Details Edit
<input type="checkbox"/>	S23 (MH "Secondary Care") OR "secondary ADJ3 care"	Search modes - Boolean/Phrase	View Results (474) View Details Edit
<input type="checkbox"/>	S22 S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16	Search modes - Boolean/Phrase	View Results (17,295,856) View Details Edit

	OR S17 OR S18 OR S19 OR S20 OR S21		
<input type="checkbox"/>	S21 (MH "Epidemiology") OR "morbidity"	Search modes - Boolean/Phrase	View Results (383,907) View Details Edit
<input type="checkbox"/>	S20 (MH "Death") or "death"	Search modes - Boolean/Phrase	View Results (840,804) View Details Edit
<input type="checkbox"/>	S19 (MH "Mortality") OR "mortality"	Search modes - Boolean/Phrase	View Results (1,059,732) View Details Edit
<input type="checkbox"/>	S18 (MH "Continuity of Patient Care") OR "continuity"	Search modes - Boolean/Phrase	View Results (46,956) View Details Edit
<input type="checkbox"/>	S17 (MH "Length of Stay") OR "length ADJ3 stay"	Search modes - Boolean/Phrase	View Results (81,094) View Details Edit
<input type="checkbox"/>	S16 (MH "Economics+") OR "economic"	Search modes - Boolean/Phrase	View Results (916,679) View Details Edit
<input type="checkbox"/>	S15 (MH "Personhood") OR "dignity"	Search modes - Boolean/Phrase	View Results (9,870) View Details Edit
<input type="checkbox"/>	S14 (MH "Patient Satisfaction") OR "satisf"	Search modes - Boolean/Phrase	View Results (365,662) View Details Edit
<input type="checkbox"/>	S13 (MH "Efficiency") OR "efficiency" OR "timeliness"	Search modes - Boolean/Phrase	View Results (444,728) View Details Edit
<input type="checkbox"/>	S12 (MH "Evaluation Studies as Topic+") OR "appropriate" OR "effect" OR "perception" OR "view" OR "experience" OR "rate" OR "rating" OR "audit" OR "influence" OR "review" OR "outcome" OR "performance" OR "quality" OR "impact" OR "productivity"	Search modes - Boolean/Phrase	View Results (0) View Details Edit
<input type="checkbox"/>	S11 (MH "Health Care Quality, Access, and Evaluation+") OR "access"	Search modes - Boolean/Phrase	View Results (163,903) View Details Edit
<input type="checkbox"/>	S10 (MH "Quality of Health Care+")	Search modes - Boolean/Phrase	View Results (6,478,009) View Details Edit
<input type="checkbox"/>	S9 (MH "Health Impact Assessment") OR (MH "Adverse Outcome Pathways")	Search modes - Boolean/Phrase	View Results (605) View Details Edit
<input type="checkbox"/>	S8 S5 OR S6 OR S7	Search modes - Boolean/Phrase	View Results (5,283,289) View Details Edit

	S7 (MH "Geriatrics") OR (MH "Geriatric Assessment") OR "geriatric*"	Search modes - Boolean/Phrase	View Results (148,527) View Details Edit
	S6 (MH "Aged+") OR "aged" OR (MH "Health Services for the Aged") OR "older" OR "elder*" OR "ag\$ng"	Search modes - Boolean/Phrase	View Results (9,566) View Details Edit
	S5 (MH "Frailty") OR "frail*"	Search modes - Boolean/Phrase	View Results (24,778) View Details Edit
	S4 S1 OR S2 OR S3	Search modes - Boolean/Phrase	View Results (1,958,162) View Details Edit
	S3 (MH "Emergency Treatment+") OR "emergency ADJ3 (medic* OR servic* OR ward* OR department OR room)" OR (MH "Trauma Centers")	Search modes - Boolean/Phrase	View Results (122,114) View Details Edit
	S2 (MH "Multiple Trauma") OR "trauma*"	Search modes - Boolean/Phrase	View Results (447,905) View Details Edit
	S1 (MH "Wounds and Injuries+") OR "wound*" OR "injur*" OR "fracture*"	Search modes - Boolean/Phrase	View Results (163,050) View Details Ed

Searches conducted on databases at 5/5/19 and at 21/12/2020 (search terms unchanged; date limiters set to 2019-2020 or May 2019-December 2020, according to the conventions of each database)











ASSIA









[\(MAINSUBJECT.EXACT.EXPLODE\("Lesions"\) OR MAINSUBJECT.EXACT.EXPLODE\("Injuries"\) OR MAINSUBJECT.EXACT\("Prevalent fractures"\) OR MAINSUBJECT.EXACT\("Fractures"\) OR MAINSUBJECT.EXACT\("Fractured femurs"\) OR MAINSUBJECT.EXACT\("Fractured hips"\) OR MAINSUBJECT.EXACT\("Fractured"\) OR MAINSUBJECT.EXACT\("Trauma surgery"\) OR MAINSUBJECT.EXACT\("Traumatic brain injury"\) OR MAINSUBJECT.EXACT\("Physical trauma"\) OR MAINSUBJECT.EXACT\("Accident and emergency departments"\) OR injur* OR wound* OR fracture* OR trauma\) AND \(MAINSUBJECT.EXACT.EXPLODE\("Frail"\) OR frail* OR older OR elder* OR MAINSUBJECT.EXACT\("Geriatricians"\) OR MAINSUBJECT.EXACT\("Geriatric assessment teams"\) OR MAINSUBJECT.EXACT.EXPLODE\("Geriatric assessment"\) OR MAINSUBJECT.EXACT\("Geriatric medicine"\) OR geriatric*\) AND \(MAINSUBJECT.EXACT\("Quality of care"\) OR MAINSUBJECT.EXACT\("Quality of service"\) OR MAINSUBJECT.EXACT\("Quality adjusted life years"\) OR MAINSUBJECT.EXACT\("Quality of life"\) OR MAINSUBJECT.EXACT.EXPLODE\("Outcomes"\) OR outcome* OR MAINSUBJECT.EXACT.EXPLODE\("Patient satisfaction"\) OR satisf* OR MAINSUBJECT.EXACT.EXPLODE\("Efficiency"\) OR efficien* OR MAINSUBJECT.EXACT.EXPLODE\("Clinical effectiveness"\) OR MAINSUBJECT.EXACT.EXPLODE\("Cost effective analysis"\) OR MAINSUBJECT.EXACT.EXPLODE\("Medical effectiveness research"\) OR MAINSUBJECT.EXACT.EXPLODE\("Effectiveness"\) OR MAINSUBJECT.EXACT.EXPLODE\("Cost effectiveness"\) OR effective* OR MAINSUBJECT.EXACT.EXPLODE\("Accessibility"\) OR accessib* OR MAINSUBJECT.EXACT.EXPLODE\("Evaluation"\) OR perception* OR "appropriate*" OR "perception*" OR "view*" OR "experience*" OR "rate*" OR "rating*" OR "audit*" OR "influence*" OR "review*" OR "performance*" OR "impact*" OR "productiv*" OR timeliness OR MAINSUBJECT.EXACT\("Length of stay"\) OR \(length of stay\) OR MAINSUBJECT.EXACT.EXPLODE\("Continuity"\) OR continuity OR MAINSUBJECT.EXACT.EXPLODE\("Death"\) OR death* OR mortalit* OR MAINSUBJECT.EXACT\("Morbidity"\) OR morbidit*\) AND \(MAINSUBJECT.EXACT.EXPLODE\("Hospitalized"\) OR MAINSUBJECT.EXACT.EXPLODE\("Hospitalization"\) OR hospitali?ation OR \(secondary care\) OR inpatient*\) AND \(MAINSUBJECT.EXACT.EXPLODE\("Critical pathways"\) OR MAINSUBJECT.EXACT.EXPLODE\("Integrated care pathways"\) OR MAINSUBJECT.EXACT.EXPLODE\("Clinical pathways"\) OR pathway* OR MAINSUBJECT.EXACT.EXPLODE\("Assessment"\) OR assess* OR MAINSUBJECT.EXACT.EXPLODE\("Models"\) OR \(patient care management\) OR MAINSUBJECT.EXACT.EXPLODE\("Screening"\) OR screening\) NOT \(psycholog* OR posttrauma* OR post-trauma* OR stress\) AND pd\(20190501-20201231\)](#)











Limited by:






Date: From 01 May 2019 to 31 December 2020





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	S3 5	S4 AND S8 AND S22 AND S26 AND S34	Limiters - Published Date: 20190501- 20201231 Search modes - Boolean/Phr ase	View Results  (301) View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL Plus
	S3 4	S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33	Search modes - Boolean/Phr ase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S3 3	"pathway"	Search modes - Boolean/Phr ase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S3 2	"assessment*" OR "screening*"	Search modes - Boolean/Phr ase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S3 1	(MH "Symptom Assessment")	Search modes -	Rerun  View Details






			Boolean/Phrase	Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S30	(MH "Needs Assessment")	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S29	(MH "Episode of Care")	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S28	(MH "Models, Organizational")	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S27	(MH "Patient Care Management") OR "patient ADJ3 care ADJ3 management"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE


	S2 6	S23 OR S24 OR S25	Search modes - Boolean/Phr ase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S2 5	(MH "Hospitalizatio n")	Search modes - Boolean/Phr ase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S2 4	(MH "Inpatients") OR "inpatient*"	Search modes - Boolean/Phr ase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S2 3	(MH "Secondary Care") OR "secondary ADJ3 care"	Search modes - Boolean/Phr ase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S2 2	S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR	Search modes - Boolean/Phr ase	Rerun  View Details Edit

		S19 OR S20 OR S21		Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S21	(MH "Epidemiology") OR "morbidity*"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S20	(MH "Death") or "death*"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S19	(MH "Mortality") OR "mortality*"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S18	(MH "Continuity of Patient Care") OR "continuity"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S17	(MH "Length of Stay") OR	Search modes -	Rerun 

		"length ADJ3 stay"	Boolean/Phrase	View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S1 6	(MH "Economics+") OR "economic*"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S1 5	(MH "Personhood") OR "dignity"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S1 4	(MH "Patient Satisfaction") OR "satisf*"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S1 3	(MH "Efficiency") OR "efficienc*" OR "timeliness"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE

	S1 2	(MH "Evaluation Studies as Topic+") OR "appropriate*" OR "effect*" OR "perception*" OR "view*" OR "experience*" OR "rate*" OR "rating*" OR "audit*" OR "influence*" OR "review*" OR "outcome*" OR ""performanc e*" OR "qualit*" OR ""impact*" OR "productiv*"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S1 1	(MH "Health Care Quality, Access, and Evaluation+") OR "access*"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
	S1 0	(MH "Quality of Health Care+")	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE

<input type="checkbox"/>	S9	(MH "Health Impact Assessment") OR (MH "Adverse Outcome Pathways")	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S8	S5 OR S6 OR S7	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S7	(MH "Geriatrics") OR (MH "Geriatric Assessment") OR "geriatric*"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S6	(MH "Aged+") OR "aged" OR (MH "Health Services for the Aged") OR "older" OR "elder*" OR "ag\$ng"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S5	(MH "Frailty") OR "frail*"	Search modes - Boolean/Phrase	Rerun  View Details Edit

				Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input checked="" type="checkbox"/>	S4	S1 OR S2 OR S3	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S3	(MH "Emergency Treatment+") OR "emergency ADJ3 (medic* OR servic* OR ward* OR department OR room") OR (MH "Trauma Centers")	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input checked="" type="checkbox"/>	S2	(MH "Multiple Trauma") OR "trauma*"	Search modes - Boolean/Phrase	Rerun  View Details Edit Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE
<input type="checkbox"/>	S1	(MH "Wounds and Injuries+") OR "wound*" OR "injur*" OR "fracture*"	Search modes - Boolean/Phrase	Rerun  View Details Edit

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+										
-	+	#1	MeSH descriptor: [Frail Elderly] explode all trees	MeSH					719	
-	+	#2	MeSH descriptor: [Frailty] explode all trees	MeSH					128	
-	+	#3	#1 OR #2	Limits					802	
-	+	#4	MeSH descriptor: [Wounds and Injuries] explode all trees	MeSH					25625	
-	+	#5	#3 AND #4	Limits					0	
			with Publication Year from 2019 to 2020, with Cochrane Library publication date from May 2019 to Dec 2020, in Trials							
-	+	#6	Type a search term or use the S or MeSH buttons to compose	S	MeSH	Limits			N/A	

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Search History

#	Query	Limiters/Expanders	Last Run Via	Results	Action
S1	(injury OR injuries OR accident* OR trauma OR fracture* OR emergency) AND (frailty OR frail OR older OR ag\$ng OR elder*)	Limiters - Published Date: 20190501-20201231 Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - EconLit	49	Edit

EMBASE

#	Searches	Results
1	exp injuries/ or exp head injuries/ or exp spinal cord injuries/ or exp wounds/	27342
2	exp emergency treatment/	0
3	fracture.mp.	2591
4	injur*.mp.	96106
5	exp geriatric patients/ or exp geriatrics/ or exp "aged (attitudes toward)"/ or exp aging/ or exp geriatric assessment/ or exp geriatric psychiatry/ or exp geriatric psychotherapy/ or exp gerontology/ or exp geropsychology/ or exp physiological aging/	104790
6	impairment.mp.	125125
7	exp frail elderly/ or exp aged/ or exp frailty/	2557
8	geriatric.mp. or exp geriatrics/	39668
9	elderly care/ or aging/ or elder*.mp.	120086
10	exp treatment outcome/ or exp clinical outcome/ or exp critical care outcome/ or exp outcome assessment/ or exp outcomes research/ or exp patient-reported outcome/	124553
11	exp patient satisfaction/	5665
12	"quality of life"/	41721
13	exp health care economics/ or exp "costs and cost analysis"/ or exp health care costs/	43472
14	exp health care utilization/	16172
15	exp "quality of services"/ or exp "quality of care"/	19755
16	evaluation/ or exp clinical audits/ or exp program evaluation/ or exp treatment effectiveness evaluation/ or exp measurement/	491192
17	timeliness.mp.	1129

	18 appropriateness.mp.	9930
	19 length of stay.mp. or exp Treatment Duration/	16724
	20 "length of stay"/	4069
	21 continuity.mp.	17560
	22 mortality.mp. or exp "Death and Dying"/	64848
	23 morbidity.mp. or exp MORBIDITY/	27803
	24 exp hospitalization/	23156
	25 hospitalisation.mp.	1840
	26 exp hospital admission/	5421
	27 hospital discharge/	2342
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	29 exp treatment planning/ or exp case management/ or exp needs assessment/ or exp treatment guidelines/	23298
	30 exp clinical pathway/	0
	31 pathway.mp.	41878
	32 exp best practices/ or exp evidence based practice/ or exp professional standards/ or exp "quality of services"/	38354
	33 guideline.mp. or practice guideline/	6511
	34 exp screening/	32500
	35 1 or 2 or 3 or 4	99326
	36 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23	791866
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	38 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23	791866

 39	24 or 25 or 26 or 27 or 28	50385
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 49	injur*.mp.	96106
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 52	exp frail elderly/ or exp aged/ or exp frailty/	2557
 53	geriatric.mp. or exp geriatrics/	39668
 54	older.mp.	162314
 55	elderly care/ or aging/ or elder*.mp.	120086
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 57	exp patient satisfaction/	5665
 58	"quality of life"/	41721

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69 administration/ or exp health care costs/ or exp health care delivery/ or exp health care services/	232733
60 exp health care utilization/	16172
61 exp "quality of services"/ or exp "quality of care"/	19755
62 evaluation/ or exp clinical audits/ or exp program evaluation/ or exp treatment effectiveness evaluation/ or exp measurement/	491192
63 timeliness.mp.	1129
64 appropriateness.mp.	9930
65 length of stay.mp. or exp Treatment Duration/	16724
66 "length of stay"/	4069
67 continuity.mp.	17560
68 mortality.mp. or exp "Death and Dying"/	64848
69 morbidity.mp. or exp MORBIDITY/	27803
70 exp hospitalization/	23156
71 hospitalisation.mp.	1840
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77 pathway.mp.	41878

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Medline

#	Query	Limiters/Expanders	Last Run Via	Results	Action
S35	S4 AND S8 AND S22 AND S26 AND S34	Limiters - Published Date: 20190501- 20201231 Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	462	Edit S35
S34	S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S34
S33	"pathway"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S33
S32	"assessment*" OR "screening*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S32
S31	(MH "Symptom Assessment")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S31
S30	(MH "Needs Assessment")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S30

S29	(MH "Episode of Care")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S29
S28	(MH "Models, Organizational")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S28
S27	(MH "Patient Care Management") OR "patient ADJ3 care ADJ3 management"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S27
S26	S23 OR S24 OR S25	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S26
S25	(MH "Hospitalization")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S25
S24	(MH "Inpatients") OR "inpatient*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S24
S23	(MH "Secondary Care") OR "secondary ADJ3 care"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S23

S22	S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S22
S21	(MH "Epidemiology") OR "morbidit*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S21
S20	(MH "Death") or "death*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S20
S19	(MH "Mortality") OR "mortalit*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S19
S18	(MH "Continuity of Patient Care") OR "continuity"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S18
S17	(MH "Length of Stay") OR "length ADJ3 stay"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S17
S16	(MH "Economics+") OR "economic*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S16

S15	(MH "Personhood") OR "dignity"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S15
S14	(MH "Patient Satisfaction") OR "satisf*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S14
S13	(MH "Efficiency") OR "efficienc*" OR "timeliness"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S13
S12	(MH "Evaluation Studies as Topic+") OR "appropriate*" OR "effect*" OR "perception*" OR "view*" OR "experience*" OR "rate*" OR "rating*" OR "audit*" OR "influence*" OR "review*" OR "outcome*" OR "performance*" OR "qualit*" OR "impact*" OR "productiv*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S12
S11	(MH "Health Care Quality, Access, and Evaluation+") OR "access*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S11









S10	(MH "Quality of Health Care+")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S10
S9	(MH "Health Impact Assessment") OR (MH "Adverse Outcome Pathways")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S9
S8	S5 OR S6 OR S7	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S8
S7	(MH "Geriatrics") OR (MH "Geriatric Assessment") OR "geriatric*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S7
S6	(MH "Aged+") OR "aged" OR (MH "Health Services for the Aged") OR "older" OR "elder*" OR "ag\$ng"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S6
S5	(MH "Frailty") OR "frail*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S5
S4	S1 OR S2 OR S3	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen -	Display	Edit S4

			Advanced Search Database - MEDLINE		
S3	(MH "Emergency Treatment+") OR "emergency ADJ3 (medic* OR servic* OR ward* OR department OR room") OR (MH "Trauma Centers")	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S3
S2	(MH "Multiple Trauma") OR "trauma*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S2
S1	(MH "Wounds and Injuries+") OR "wound*" OR "injur*" OR "fracture*"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - MEDLINE	Display	Edit S1

PsycInfo

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<input type="checkbox"/>	7	exp frail elderly/ or exp aged/ or exp frailty/	2557	Advanced
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<input type="checkbox"/>	9	elderly care/ or aging/ or elder*.mp.	120086	Advanced
<input type="checkbox"/>	10	exp treatment outcome/ or exp clinical outcome/ or exp critical care outcome/ or exp outcome assessment/ or exp outcomes research/ or exp patient-reported outcome/	124553	Advanced
<input type="checkbox"/>	11	exp patient satisfaction/	5665	Advanced
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	17	timeliness.mp.	1129	Advanced
	18	appropriateness.mp.	9930	Advanced
	19	length of stay.mp. or exp Treatment Duration/	16724	Advanced
	20	"length of stay"/	4069	Advanced
	21	continuity.mp.	17560	Advanced
	22	mortality.mp. or exp "Death and Dying"/	64848	Advanced
	23	morbidity.mp. or exp MORBIDITY/	27803	Advanced
	24	exp hospitalization/	23156	Advanced
	25	hospitalisation.mp.	1840	Advanced
	26	exp hospital admission/	5421	Advanced
	27	hospital discharge/	2342	Advanced
	28	inpatient.mp. or exp hospital patient/	31496	Advanced
	29	exp treatment planning/ or exp case management/ or exp needs assessment/ or exp treatment guidelines/	23298	Advanced
	30	exp clinical pathway/	0	Advanced
	31	pathway.mp.	41878	Advanced
	32	exp best practices/ or exp evidence based practice/ or exp professional standards/ or exp "quality of services"/	38354	Advanced
	33	guideline.mp. or practice guideline/	6511	Advanced
	34	exp screening/	32500	Advanced
	35	1 or 2 or 3 or 4	99326	Advanced
	36	10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23	791866	Advanced
	37	5 or 6 or 7 or 8 or 9	262996	Advanced

	38 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23	791866	Advanced
	39 24 or 25 or 26 or 27 or 28	50385	Advanced
	40 29 or 30 or 31 or 32 or 33 or 34	137463	Advanced
	41 35 and 37	11079	Advanced
	42 36 and 41	2959	Advanced
	43 39 and 42	214	Advanced
	44 40 and 43	13	Advanced
	45 44 and 1999:2019.(sa_year).	13	Advanced

SCOPUS

(TITLE-ABS-KEY (trauma OR injury OR accident) AND TITLE-ABS-KEY (frail OR older OR elder) AND TITLE-ABS-KEY (hospitali?ation OR "secondary care" OR inpatient) AND TITLE-ABS-KEY (outcome* OR effect* OR access* OR impact OR productiv* OR satisf* OR efficienc* OR "quality of life" OR economic OR "length of stay" OR mortality OR death OR morbidity) AND TITLE-ABS-KEY (pathway OR assessment OR screening OR "care plan" OR "organisation of care") AND NOT TITLE-ABS-KEY ("post traumatic" OR stress OR psychol*)) AND PUBYEAR > 2018 AND PUBYEAR < 2021

Supplementary file 3: Articles excluded at full-text reading, with reason

Reference of article excluded after full-text reading	Reason for exclusion
Konda SR, Lott A, Saleh H, Gales J, Egol KA. Use of the STTGMA Tool to Risk Stratify 1-Year Functional Outcomes and Mortality in Geriatric Trauma Patients. <i>J Orthop Trauma</i> . 2018 Sep;32(9):461-466. doi: 10.1097/BOT.0000000000001242.	duplicate
Maxwell CA. Trauma in the geriatric population. <i>Crit Care Nurs Clin North Am</i> . 2015 Jun;27(2):183-97. doi: 10.1016/j.cnc.2015.02.006. Epub 2015 Mar 20. PMID: 25981722.	duplicate
Gronewold J, Dahlmann C, Jäger M, Hermann DM. Identification of hospitalized elderly patients at risk for adverse in-hospital outcomes in a university orthopedics and trauma surgery environment. <i>PLoS One</i> . 2017 Nov 10;12(11):e0187801. doi: 10.1371/journal.pone.0187801. PMID: 29125861; PMCID: PMC5695284.	duplicate
Karlekar MB, Maxwell CA, Dietrich MS, Miller RS. Creating New Opportunities to Educate Families on the Impact of Frailty and Cognitive Impairment in a Trauma Intensive Care Unit: Results of a Quality Improvement Project. <i>J Palliat Med</i> . 2017 Feb;20(2):193-196. doi: 10.1089/jpm.2016.0244. Epub 2016 Dec 19. PMID: 27992236.	duplicate
Wiles LL, Day MD. Delta Alert: Expanding Gerotrauma Criteria to Improve Patient Outcomes: A 2-Year Study. <i>J Trauma Nurs</i> . 2018 May/June;25(3):159-164. doi: 10.1097/JTN.0000000000000371. PMID: 29742626.	duplicate
Devore S, Parli SE, Oyler DR, Bernard A. Comprehensive Geriatric Assessment for Trauma: Operationalizing the Trauma Quality Improvement Program Directive. <i>J Trauma Nurs</i> . 2016 Nov/Dec;23(6):337-342. doi: 10.1097/JTN.0000000000000244. PMID: 27828887.	duplicate
Ong T, Sahota O, Gladman JRF. 91 Is there a role for an orthogeriatric model of care in the management of vertebral fragility fractures in hospital Age and Ageing, Volume 48, Issue Supplement_1, February 2019, Pages i24–i25, https://doi.org/10.1093/ageing/afy200.08	Exc_abstract only
Deschodt M, Van Grootven B, Flamaing J, Milisen K. Systematic Review of the Effect of Ward-Based Ortho-Geriatric Co-Management on Functional Status, Length of Stay, Readmissions and Costs. Vol. 64, Wiley, 2016.	Exc_abstract only
Viera-Ortiz L, Munet MD, Nieves-Plaza CBS, Mariely, MS. Palliative Care Consultation and EOL Care In Trauma Patients: A Descriptive Study (GP798) <i>Journal of Pain and Symptom Management</i> ; 2020, 60:303.	Exc_abstract only
Walsh C, McCullagh R, O'Connor K, Higgins A, O'Callaghan D, Timmons S. 234 An Evaluation of Two Frailty Intervention Therapy Team's (FITT) in the Emergency Department Pilot Services, Age and Ageing, Volume 48, Issue Supplement_3, September 2019, Pages iii17–iii65, https://doi.org/10.1093/ageing/afz103.141	Exc_abstract only
Bourke R, Rice C, McMahon G, Cunningham C, Kenny R-A, Briggs R. 304 ED-FASU: A Novel 'Front Door' Multidisciplinary Service Assessing Patients with Falls and Syncope in the Emergency Department. Age and Ageing, Volume 48, Issue Supplement_3, September 2019, Pages iii17–iii65, https://doi.org/10.1093/ageing/afz103.195	Exc_abstract only

<p>O'Caoimh R. 296 Risk-prediction in the Emergency Department: Comparing the Accuracy of Short Frailty Screens to Identify Adverse Healthcare Outcomes among Older Adults, Age and Ageing, Volume 48, Issue Supplement 3, September 2019, Pages iii17–iii65, https://doi.org/10.1093/ageing/afz103.188</p>	Exc_abstract only
<p>Fitzpatrick D, Heywood S, O'Mahony C, Gallagher P. 238 Bridging the Gap: Expanding and Improving the Role of the Integrated Care Team in a Level 4 Hospital, Age and Ageing, Volume 48, Issue Supplement 3, September 2019, Pages iii17–iii65, https://doi.org/10.1093/ageing/afz103.142</p>	Exc_abstract only
<p>Adedokun C, McNamara R, O'Herlihy N. 152 Implementation of Older Persons Rapid Assessment Hub (OPRAH) in the Emergency Department (ED), Age and Ageing, Volume 48, Issue Supplement 3, September 2019, Pages iii17–iii65, https://doi.org/10.1093/ageing/afz103.89</p>	Exc_abstract only
<p>Tulsi D, Pillay L, Ogunjembola I, Farelly A, McGlynn J, Doherty J, Donnelly T. 78 Comparing the Management of Frailty between a Rapid Access Frailty Team and General Medical Teams at a Level Three Hospital, Age and Ageing, Volume 48, Issue Supplement 3, September 2019, Pages iii17–iii65, https://doi.org/10.1093/ageing/afz103.43</p>	Exc_abstract only
<p>Lawrence, K. Creating an innovative approach: Transforming expectations for the timing of Goals of Care conversations in trauma intensive care units. Canadian Association of Critical Care Nurses' Dynamics of Critical Care Conference 2019, September 16-18, 2019, Halifax, Nova Scotia. Canadian Journal of Critical Care Nursing 2020 xxxxxx</p>	Exc_abstract only
<p>Mahmood R, Negasan C, Manzoor A, Enwere P, Arnada-Martinez A, Walters H, Yeong K, Lisk R. 33 Improving Mortality with An Integrated Model of Care for Cervical Spine Fracture in Patients Over 75 Years Old, Age and Ageing, Volume 49, Issue Supplement 1, February 2020, Pages i1–i8, https://doi.org/10.1093/ageing/afz183.33</p>	Exc_abstract only
<p>Meagher AD, Lin A, Mandell SP, Bulger E, Newgard C. A Comparison of Scoring Systems for Predicting Short- and Long-term Survival After Trauma in Older Adults. Acad Emerg Med. 2019 Jun;26(6):621-630. doi: 10.1111/acem.13727. Epub 2019 Apr 3. PMID: 30884022.</p>	Exc_assessing the validity or reliability of an assessment tool only
<p>Morris RS, Milia D, Glover J, Napolitano LM, Chen B, Lindemann E, Hemmila MR, Stein D, Kummerfeld E, Chipman J, Tignanelli CJ. Predictors of elderly mortality after trauma: A novel outcome score. J Trauma Acute Care Surg. 2020 Mar;88(3):416-424. doi: 10.1097/TA.0000000000002569. PMID: 31895331.</p>	Exc_assessing the validity or reliability of an assessment tool only
<p>Mudge AM, McRae P, Hubbard RE, Peel NM, Lim WK, Barnett AG, Inouye SK. Hospital-Associated Complications of Older People: A Proposed Multicomponent Outcome for Acute Care. J Am Geriatr Soc. 2019 Feb;67(2):352-356. doi: 10.1111/jgs.15662. Epub 2018 Nov 13. PMID: 30423197; PMCID: PMC6367036.</p>	Exc_assessing the validity or reliability of an assessment tool only
<p>Osterhoff G, Noser J, Held U, Werner CML, Pape HC, Dietrich M. Early Operative Versus Nonoperative Treatment of Fragility Fractures of the Pelvis: A Propensity-Matched Multicenter Study. J Orthop Trauma. 2019 Nov;33(11):e410-e415. doi: 10.1097/BOT.0000000000001584. PMID: 31633644.</p>	Exc_fragility fracture

Joseph B, Pandit V, Rhee P, et al. Predicting hospital discharge disposition in geriatric trauma patients: is frailty the answer? <i>J Trauma Acute Care Surg.</i> 2014;76:196e200.	EXC_Frailty as a predictor
Adams AL, Schiff MA, Koepsell TD, Rivara FP, Leroux BG, Becker TM, Hedges JR. Physician consultation, multidisciplinary care, and 1-year mortality in Medicare recipients hospitalized with hip and lower extremity injuries. <i>J Am Geriatr Soc.</i> 2010 Oct;58(10):1835-42. doi: 10.1111/j.1532-5415.2010.03087.x. PMID: 20929461.	EXC_Hip fracture
Chong C, Christou J, Fitzpatrick K, Wee R, Lim WK. Description of an orthopedic-geriatric model of care in Australia with 3 years data. <i>Geriatr Gerontol Int.</i> 2008 Jun;8(2):86-92. doi: 10.1111/j.1447-0594.2008.00453.x. PMID: 18713160.	EXC_hip fracture
Cameron I, Crotty M, Currie C, Finnegan T, Gillespie L, Gillespie W, Handoll H, Kurrle S, Madhok R, Murray G, Quinn K, Torgerson D. Geriatric rehabilitation following fractures in older people: a systematic review. <i>Health Technol Assess.</i> 2000;4(2):i-iv, 1-111. PMID: 10702905.	EXC_Hip fracture
Prestmo A, Saltvedt I, Helbostad JL, Taraldsen K, Thingstad P, Lydersen S, Sletvold O. Who benefits from orthogeriatric treatment? Results from the Trondheim hip-fracture trial. <i>BMC Geriatr.</i> 2016;16:49.	EXC_hip fracture
Barros de Queiroz, Samia Mara; Reis Coutinho, Daisy Teresinha; César de Almeida, Paulo; Cavalcante Guedes, Maria Vilani; Célia de Freitas, Maria. Clinical conditions of elderly who are victims of muscle-skeletal trauma. <i>Ciência Cuidado e Saúde;</i> 2017, 15:530 DOI:10.4025/cienccuidsaude.v15i3.28482	EXC_Incidemce of risk
Konda SR, Lott A, Saleh H, Gales J, Egol KA. Use of the STTGMA Tool to Risk Stratify 1-Year Functional Outcomes and Mortality in Geriatric Trauma Patients. <i>J Orthop Trauma.</i> 2018 Sep;32(9):461-466. doi: 10.1097/BOT.0000000000001242. PMID: 29905625.	Exc_incidence of risk
Kaplan SJ, Pham TN, Arbabi S, Gross JA, Damodarasamy M, Bentov I, Taitsman LA, Mitchell SH, Reed MJ. Association of Radiologic Indicators of Frailty With 1-Year Mortality in Older Trauma Patients: Opportunistic Screening for Sarcopenia and Osteopenia. <i>JAMA Surg.</i> 2017 Feb 15;152(2):e164604. doi: 10.1001/jamasurg.2016.4604. Epub 2017 Feb 15. PMID: 28030710.	Exc_incidence of problem
Rege RM, Runner RP, Staley CA, Vu CCL, Arora SS, Schenker ML. Frailty predicts mortality and complications in chronologically young patients with traumatic orthopaedic injuries. <i>Injury.</i> 2018 Dec;49(12):2234-2238. doi: 10.1016/j.injury.2018.08.017. Epub 2018 Aug 22. PMID: 30274754.	Exc_incidence of risk
Kirkman MA, Jenks T, Bouamra O, Edwards A, Yates D, Wilson MH. Increased mortality associated with cerebral contusions following trauma in the elderly: bad patients or bad management? <i>J Neurotrauma.</i> 2013 Aug 15;30(16):1385-90. doi: 10.1089/neu.2013.2881. Epub 2013 Jul 17. PMID: 23441674.	Exc_incidence of risk
Gronewold J, Dahlmann C, Jäger M, Hermann DM. Identification of hospitalized elderly patients at risk for adverse in-hospital outcomes in a university orthopedics and trauma surgery environment. <i>PLoS One.</i> 2017 Nov 10;12(11):e0187801. doi: 10.1371/journal.pone.0187801. PMID: 29125861; PMCID: PMC5695284.	EXC_Incidemce of risk
Jankowski K, Bryden DC. Using a CriSTAL scoring system to identify pre-morbid conditions associated with a poor outcome after admission to intensive care in people 70 years or older. <i>J Intensive Care Soc.</i> 2019 Aug;20(3):231-236. doi: 10.1177/1751143718804678. Epub 2018 Oct 9. PMID: 31447916; PMCID: PMC6693104.	Exc_incidence of risk

Hsia RY, Wang E, Saynina O, et al. Factors associated with trauma center use for elderly patients with trauma: a statewide analysis, 1999-2008. <i>Arch Surg.</i> 2011;146:585–592	EXC_Incidence of risk
Scheetz LJ. Trauma center versus non-trauma center admissions in adult trauma victims by age and gender. <i>Prehosp Emerg Care.</i> 2004;8:268–272	EXC_incidence of risk
Lukin W, Greenslade JH, Chu K, Lang J, Brown AF. Triage of older major trauma patients in the emergency department: an observational study. <i>Emerg Med J.</i> Apr; 2015 32(4):281–286.	EXC_incidence of risk
Davis JS, Allan BJ, Sobowale O, Ivascu F, Orion K, Schulman CI. Evaluation of a new elderly trauma triage algorithm . <i>Southern Medical Journal</i> , 2012;105 (9), 447 – 451 . doi:10.1097/SMJ.0b013e318261f6f4	EXC_Incidence of risk
Scheetz L. Effectiveness of prehospital trauma guidelines for identification of major trauma in elderly motor vehicle crash victims. <i>Journal of Emergency Nursing</i> 2003;29 (2), 109 – 115 .	EXC_incidence of risk
McKevitt EC, Calvert E, Ng A, Simons RK, Kirkpatrick AW, Appleton L, Brown DR. Geriatric trauma: resource use and patient outcomes. <i>Can J Surg.</i> 2003 Jun;46(3):211-5. PMID: 12812248; PMCID: PMC3211738.	Exc_incidence or prevalence only
Joseph B, Orouji Jokar T, Hassan A, Azim A, Mohler MJ, Kulvatunyou N, Siddiqi S, Phelan H, Fain M, Rhee P. Redefining the association between old age and poor outcomes after trauma: The impact of frailty syndrome. <i>J Trauma Acute Care Surg.</i> 2017 Mar;82(3):575-581. doi: 10.1097/TA.0000000000001329. PMID: 28225741.	Exc_incidence or prevalence only
Scheetz LJ. Injury patterns, severity and outcomes among older adults who sustained brain injury following a same level fall: a retrospective analysis. <i>Int Emerg Nurs.</i> 2015 Apr;23(2):162-7. doi: 10.1016/j.ienj.2014.09.003. Epub 2014 Sep 17. PMID: 25281285.	Exc_incidence or prevalence only
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Meagher AD, Lin A, Mandell SP, Bulger E, Newgard C. A Comparison of Scoring Systems for Predicting Short- and Long-term Survival After Trauma in Older Adults. <i>Acad Emerg Med.</i> 2019 Jun;26(6):621-630. doi: 10.1111/acem.13727. Epub 2019 Apr 3. PMID: 30884022.	Exc_incidence or prevalence only
Curtis E, Romanowski K, Sen S, Hill A, Cocanour C. Frailty score on admission predicts mortality and discharge disposition in elderly trauma patients over the age of 65 y. <i>J Surg Res.</i> 2018 Oct;230:13-19. doi: 10.1016/j.jss.2018.04.017. Epub 2018 May 12. PMID: 30100028.	Exc_incidence or prevalence only
Brown K, Cameron ID, Keay L, Coxon K, Ivers R. Functioning and health-related quality of life following injury in older people: a systematic review. <i>Inj Prev.</i> 2017 Dec;23(6):403-411. doi: 10.1136/injuryprev-2016-042192. Epub 2017 Jan 10. PMID: 28073948.	Exc_incidence or prevalence only
Teo DB, Wong HC, Yeo AW, Lai YW, Choo EL, Merchant RA. Characteristics of fall-related traumatic brain injury in older adults. <i>Intern Med J.</i> 2018 Sep;48(9):1048-1055. doi: 10.1111/imj.13794. PMID: 29573078.	Exc_incidence or prevalence only
Bala M, Kashuk JL, Willner D, Kaluzhni D, Bdolah-Abram T, Almogly G. Looking beyond discharge: clinical variables at trauma admission predict long term survival in the older severely injured patient. <i>World J Emerg Surg.</i> 2014 Jan 23;9(1):10. doi: 10.1186/1749-7922-9-10. PMID: 24450423; PMCID: PMC3933040.	Exc_incidence or prevalence only

Min L, Burruss S, Morley E, Mody L, Hiatt JR, Cryer H, Ha JK, Tillou A. A simple clinical risk nomogram to predict mortality-associated geriatric complications in severely injured geriatric patients. <i>J Trauma Acute Care Surg.</i> 2013 Apr;74(4):1125-32. doi: 10.1097/TA.0b013e31828273a0. PMID: 23511155; PMCID: PMC3693577.	Exc_incidence or prevalence only
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Wiles LL, Day MD, Harris L. Delta Alerts: Changing Outcomes in Geriatric Trauma. <i>J Trauma Nurs.</i> 2016 Jul-Aug;23(4):189-93. doi: 10.1097/JTN.0000000000000215. PMID: 27414140.	EXC_minor injury
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Engelhardt KE, Reuter Q, Liu J, et al. Frailty screening and a frailty pathway decrease length of stay, loss of independence, and 30-day readmission rates in frail, geriatric trauma and emergency general surgery patients. <i>J Trauma Acute Care Surg</i> 2018;85:167e173.	EXC_minor trauma
Konda SR, Lott A, Saleh H, Lyon T, Egol KA. Using Trauma Triage Score to Risk Stratify Inpatient Triage, Hospital Quality Measures, and Cost in Middle-Aged and Geriatric Orthopaedic Trauma Patients. <i>J Orthop Trauma.</i> 2019 May 31; . Epub 2019 May 31.	EXC_Minor trauma
Wiles LL, Day MD, Harris L. Delta Alerts: Changing Outcomes in Geriatric Trauma. <i>J Trauma Nurs.</i> 2016 Jul-Aug; 23(4):189-93.	EXC_Minor trauma
Donatelli NS, Gregorowicz J, Somes J. Extended ED stay of the older adult results in poor patient outcome. <i>J Emerg Nurs.</i> 2013 May; 39(3):268-72. Epub 2013 Mar 19.	EXC_no empirical data
Palliative care in the trauma ICU. O'Connell K, Maier R. <i>Curr Opin Crit Care.</i> 2016 Dec; 22(6):584-590.	EXC_no empirical data
Joyce MF, Balonov K, Azocar RJ. Critical care and trauma considerations in the geriatric patient. <i>Int Anesthesiol Clin.</i> 2014 Fall;52(4):95-108. doi: 10.1097/AIA.000000000000027. PMID: 25268867.	Exc_no empirical findings
Stanford P, Booth N, Suckley J, Twelvetree T, Thomas D. Assessment of injury severity in patients with major trauma. <i>Nurs Stand.</i> 2016 Aug 3;30(49):54-63. doi: 10.7748/ns.2016.e10342. PMID: 27484568.	Exc_no empirical findings

Cutugno CL. The 'graying' of trauma care: addressing traumatic injury in older adults. <i>Am J Nurs</i> . 2011 Nov;111(11):40-8; quiz 49-50. doi: 10.1097/01.NAJ.0000407300.77350.03. PMID: 22005051.	Exc_no empirical findings
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Perracini MR, Kristensen MT, Cunningham C, Sherrington C. Physiotherapy following fragility fractures. <i>Injury</i> . 2018 Aug;49(8):1413-1417. doi: 10.1016/j.injury.2018.06.026. Epub 2018 Jun 21. PMID: 29958686.	Exc_no empirical findings
Stein DM, Kozar RA, Livingston DH, Luchette F, Adams SD, Agrawal V, Arbabi S, Ballou J, Barraco RD, Bernard AC, Biffi WL, Bosarge PL, Brasel KJ, Cooper Z, Efron PA, Fakhry SM, Hartline CA, Hwang F, Joseph BA, Kurek SJ, Moore FA, Mosenthal AC, Pathak AS, Truitt MS, Yelon JA; AAST Geriatric Trauma/ACS Committee. Geriatric traumatic brain injury-What we know and what we don't. <i>J Trauma Acute Care Surg</i> . 2018 Oct;85(4):788-798. doi: 10.1097/TA.0000000000001910. PMID: 30256343.	Exc_no empirical findings
Sadarangani T, Squires A. Frailty as a predictive factor in geriatric trauma patient outcomes. <i>Journal of Clinical Outcomes Management</i> . 2014 Sep 1;21(9):396-397.	Exc_no empirical findings
Beedham W, Peck G, Richardson SE, Tsang K, Fertleman M, Shipway DJ. Head injury in the elderly - an overview for the physician. <i>Clin Med (Lond)</i> . 2019 Mar;19(2):177-184. doi: 10.7861/clinmedicine.19-2-177. PMID: 30872306; PMCID: PMC6454360.	Exc_no empirical findings
Evaluation of a virtual geriatric trauma institute. Katrancha ED, Zipf J. <i>J Trauma Nurs</i> . 2014 Nov-Dec; 21(6):278-81.	EXC_no injury severity
Hart T, Fann JR, Chervoneva I, Juengst SB, Rosenthal JA, Krellman JW, Dreer LE, Kroenke K. Prevalence, Risk Factors, and Correlates of Anxiety at 1 Year After Moderate to Severe Traumatic Brain Injury. <i>Arch Phys Med Rehabil</i> . 2016 May;97(5):701-7. doi: 10.1016/j.apmr.2015.08.436. Epub 2015 Dec 18. PMID: 26707456.	Exc_no intervention
Maxwell CA, Miller RS, Dietrich MS, Mion LC, Minnick A. The aging of America: a comprehensive look at over 25,000 geriatric trauma admissions to United States hospitals. <i>Am Surg</i> . 2015;81(6):630-636.	Exc_no intervention
Mann NC, Cahn RM, Mullins RJ, Brand DM, Jurkovich GJ. Survival among injured geriatric patients during construction of a statewide trauma system. <i>J Trauma</i> . 2001;50(6):1111-1116.	EXC_no intervention
Demetriades D, Sava J, Alo K, et al.: Old age as a criterion for trauma team activation. <i>J Trauma</i> 2001, 51:754-756.	EXC_no intervention
Jacobs DG, Plaisier BR, Barie PS, et al. Practice management guidelines for geriatric trauma: the EAST Practice Management Guidelines Work Group. <i>J Trauma</i> 2003;54:391-416.	EXC_no intervention
Demetriades D, Sava J, Alo K, Newton E, Velmahos GC, Murray JA, Belzberg H, Asensio JA, Berne TV. Old age as a criterion for trauma team activation. <i>J Trauma</i> . 2001 Oct; 51(4):754-6; discussion 756-7.	EXC_no intervention
Devore S, Parli SE, Oyler DR, Bernard A. Comprehensive Geriatric Assessment for Trauma: Operationalizing the Trauma Quality Improvement Program Directive. <i>J Trauma Nurs</i> . 2016 Nov/Dec;23(6):337-342. doi: 10.1097/JTN.0000000000000244. PMID: 27828887.	EXC_no ISS data

Brown KL, Ashcraft AS. Comfort or Care: Why Do We Have to Choose? Implementing a Geriatric Trauma Palliative Care Program. <i>J Trauma Nurs.</i> 2019 Jan/Feb;26(1):2-9. doi: 10.1097/JTN.0000000000000410. PMID: 30624375.	EXC_no ISS detail
Farhat I, Moore L, Porgo TV, Patton MP, Tardif PA, Truchon C, Berthelot S, Stelfox HT, Gabbe BJ, Lauzier F, Turgeon AF, Clément J. Resource use for older people hospitalised due to injury in a Canadian integrated trauma system: a retrospective multicenter cohort study. <i>Age Ageing.</i> 2019 Nov 1;48(6):867-874. doi: 10.1093/ageing/afz097. PMID: 31437268; PMCID: PMC6814085.	Exc_no model of care
Hendricks A, Basrai M, Gonzalez Granda A, Stollhoff L, Müller AD, Nüssler A, Liener U, Bischoff SC. Implementation of Clinical Nutrition Guidelines in Centres for Geriatric Trauma Patients - Investigation in Two Clinics on a Sample Basis. [German] <i>Aktuelle Ernährungsmedizin</i> 2018; 43(04): 272-283	EXC_not English
Baztán Cortés JJ, Martínez Zujeros S, Garmendia Prieto B, Pérez Morillo P, Martínez Cervantes Y, Resino Luis C, Román Belmonte JM, Gómez Pavón J, Pallardo Rodil B, Socorro García A. Repercusión de un sistema centralizado de ingresos sobre la eficacia y eficiencia de una unidad geriátrica de recuperación funcional [Impact of a centralised hospital admission system on the efficacy and efficiency of a geriatric functional recovery unit]. <i>Rev Esp Geriatr Gerontol.</i> 2020 Jan-Feb;55(1):18-24. Spanish. doi: 10.1016/j.regg.2019.08.008. Epub 2019 Oct 5. PMID: 31594677.	Exc_not in english
Lott A, Haglin J, Saleh H, Hall J, Egol KA, Konda SR. Using a Validated Middle-Age and Geriatric Risk Tool to Identify Early (<48 Hours) Hospital Mortality and Associated Cost of Care. <i>J Orthop Trauma.</i> 2018 Jul;32(7):349-353. doi: 10.1097/BOT.0000000000001187. PMID: 29738400.	Exc_not major trauma
Caitriona C, Mark MG, Elaine H, Claire G, Michelle F, Persson UM, Sherrington C, Blake C. Management of hospitalised osteoporotic vertebral fractures. <i>Arch Osteoporos.</i> 2020 Feb 20;15(1):14. doi: 10.1007/s11657-020-0687-x. PMID: 32078057.	Exc_not major trauma
Scheetz LJ. Differences in survival, length of stay, and discharge disposition of older trauma patients admitted to trauma centers and nontrauma center hospitals. <i>J Nurs Scholarsh.</i> 2005;37(4):361-6. doi: 10.1111/j.1547-5069.2005.00062.x. PMID: 16396410.	Exc_not major trauma
Calsolaro V, Antognoli R, Pasqualetti G, Okoye C, Aquilini F, Cristofano M, Briani S, Monzani F. 30-Day Potentially Preventable Hospital Readmissions In Older Patients: Clinical Phenotype And Health Care Related Risk Factors. <i>Clin Interv Aging.</i> 2019 Nov 5;14:1851-1858. doi: 10.2147/CIA.S208572. PMID: 31806943; PMCID: PMC6842315.	Exc_not major trauma
Lockhart C. Implementation of an evidence based geriatric guideline on a military trauma ICU. Report Uniformed Services University. https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/PB2017102330.xhtml	Exc_not trauma
Mogul AS, Cline DM, Gabbard J, Bryant C. Missed Opportunities: Integrating Palliative Care into the Emergency Department for Older Adults Presenting as Level I Triage Priority from Long-Term Care Facilities. <i>J Emerg Med.</i> 2019 Feb;56(2):145-152. doi: 10.1016/j.jemermed.2018.10.020. Epub 2018 Dec 6. PMID: 30527561.	Exc_not trauma
Ichwan B, Darbha S, Shah MN, et al. Geriatric-specific triage criteria are more sensitive than standard adult criteria in identifying need for trauma center care in injured older adults. <i>Ann Emerg Med.</i> Jan; 2015 65(1):92-100. e103. [PubMed: 24908590]	EXC_prehospital care

Murphy TE, Baker DI, Leo-Summers LS, Allore HG, Tinetti ME. Association between treatment or usual care region and hospitalization for fall-related traumatic brain injury in the Connecticut Collaboration for Fall Prevention. <i>J Am Geriatr Soc</i> . 2013 Oct;61(10):1763-7. doi: 10.1111/jgs.12462. Epub 2013 Sep 19. PMID: 24083593; PMCID: PMC3801219.	Exc_prevention of trauma
Shoultz TH, Moore M, Reed MJ, Kaplan SJ, Bentov I, Hough C, Taitsman LA, Mitchell SH, So GE, Arbabi S, Phelan H, Pham T. Trauma Providers' Perceptions of Frailty Assessment: A Mixed-Methods Analysis of Knowledge, Attitudes, and Beliefs. <i>South Med J</i> . 2019 Mar;112(3):159-163. doi: 10.14423/SMJ.0000000000000948. PMID: 30830229.	EXC_Provider views
Maxwell CA. Availability of selected Institute of Medicine recommendations for geriatric care in hospitals providing care to injured older adults. <i>Geriatr Nurs</i> . 2014 Mar-Apr;35(2 Suppl):S27-31. doi: 10.1016/j.gerinurse.2014.02.017. PMID: 24702716.	EXC_providers of all trauma
Robalino S, Nyakang'o SB, Beyer FR, Fox C, Allan LM. Effectiveness of interventions aimed at improving physical and psychological outcomes of fall-related injuries in people with dementia: a narrative systematic review. <i>Syst Rev</i> . 2018 Feb 20;7(1):31. doi: 10.1186/s13643-018-0697-6. PMID: 29463292; PMCID: PMC5819703.	EXC_Review
McDonald VS, Thompson KA, Lewis PR, Sise CB, Sise MJ, Shackford SR. Frailty in trauma: A systematic review of the surgical literature for clinical assessment tools. <i>J Trauma Acute Care Surg</i> . 2016 May;80(5):824-34. doi: 10.1097/TA.0000000000000981. PMID: 26881488.	EXC_Review
Gardner RC, Dams-O'Connor K, Morrissey MR, Manley GT. Geriatric Traumatic Brain Injury: Epidemiology, Outcomes, Knowledge Gaps, and Future Directions. <i>J Neurotrauma</i> . 2018 Apr 1;35(7):889-906. doi: 10.1089/neu.2017.5371. Epub 2018 Feb 15. PMID: 29212411; PMCID: PMC5865621.	EXC_Review
Switzer JA, Gammon SR. High-energy skeletal trauma in the elderly. <i>J Bone Joint Surg Am</i> . 2012 Dec 5;94(23):2195-204. doi: 10.2106/JBJS.K.01166. PMID: 23224390.	EXC_Review
Jacobs DG. Special considerations in geriatric injury. <i>Curr Opin Crit Care</i> . 2003 Dec;9(6):535-9. doi: 10.1097/00075198-200312000-00012. PMID: 14639075.	EXC_Review
Ong T, Kantachuvesiri P, Sahota O, Gladman JRF. Characteristics and outcomes of hospitalised patients with vertebral fragility fractures: a systematic review. <i>Age Ageing</i> . 2018 Jan 1;47(1):17-25. doi: 10.1093/ageing/afx079. PMID: 29253103; PMCID: PMC5860524.	EXC_Review
Buecking B, Timmesfeld N, Riem S, Bliemel C, Hartwig E, Friess T, Liener U, Ruchholtz S, Eschbach D. Early orthogeriatric treatment of trauma in the elderly: a systematic review and metaanalysis. <i>Dtsch Arztebl Int</i> . 2013 Apr;110(15):255-62. doi: 10.3238/arztebl.2013.0255. Epub 2013 Apr 12. PMID: 23667392; PMCID: PMC3647136.	Exc_Review
Komadina R, Wendt KW, Holzer G, Kocjan T. Outcome parameters in orthogeriatric co-management - a mini-review. <i>Wien Klin Wochenschr</i> . 2016 Dec;128(Suppl 7):492-496. doi: 10.1007/s00508-016-1118-2. Epub 2016 Nov 17. PMID: 27858179.	EXC_Review

Aziz HA, Lunde J, Barraco R, Como JJ, Cooper Z, Hayward T 3rd, Hwang F, Lottenberg L, Mentzer C, Mosenthal A, Mukherjee K, Nash J, Robinson B, Staudenmayer K, Wright R, Yon J, Crandall M. Evidence-based review of trauma center care and routine palliative care processes for geriatric trauma patients; A collaboration from the American Association for the Surgery of Trauma Patient Assessment Committee, the American Association for the Surgery of Trauma Geriatric Trauma Committee, and the Eastern Association for the Surgery of Trauma Guidelines Committee. <i>J Trauma Acute Care Surg.</i> 2019 Apr;86(4):737-743. doi: 10.1097/TA.0000000000002155. PMID: 30531333.	EXC_Review
Birchley G, Jones K, Huxtable R, Dixon J, Kitzinger J, Clare L. Dying well with reduced agency: a scoping review and thematic synthesis of the decision-making process in dementia, traumatic brain injury and frailty. <i>BMC Med Ethics.</i> 2016 Jul 27;17(1):46. doi: 10.1186/s12910-016-0129-x. PMID: 27461340; PMCID: PMC4962460.	EXC_Review
Bachmann S, Finger C, Huss A, Egger M, Stuck AE, Clough KM. Inpatient rehabilitation specifically designed for geriatric patients: systematic review and meta-analysis of randomized controlled trials. <i>BMJ.</i> 2010;340:1718.	EXC_Review
Calland JF, Ingraham AM, Martin N, Marshall GT, Schulman CI, Stapleton T, Barraco R. Evaluation and management of geriatric trauma: an Eastern Association for the Surgery of Trauma practice management guideline. <i>J Trauma Acute Care Surg.</i> 2012;73(5 Suppl 4):S345-S350.	EXC_Review
American College of Surgeons Trauma Quality Improvement Project Geriatric Trauma Management Guidelines. 2012. Available at: https://www.facs.org/~media/files/quality%20programs/trauma/tqip/geriatric%20guide%20tqip.ashx Accessed October 2018. Retrieved on 23.07.10 from https://www.facs.org/~media/files/quality-programs/trauma/tqip/geriatric_guidelines.ashx?la=en	EXC_Review
Apostolo J, Cooke R, Bobrowicz-Campos E, et al. Predicting risk and outcomes for frail older adults: an umbrella review of frailty screening tools. <i>JBIM Database System Rev Implement Rep</i> 2017;15:1154e1208.	EXC_Review
Stevens CL, Torke AM. Geriatric Trauma: A Clinical and Ethical Review. <i>J Trauma Nurs.</i> 2016 Jan-Feb; 23(1):36-41; quiz E3-4.	EXC_Review
Callaway DW, Wolfe R. Geriatric trauma. <i>Emerg Med Clin North Am.</i> 2007 Aug; 25(3):837-60, x.	EXC_Review
Liu H, Shang N, Chhetri JK, Liu L, Guo W, Li P, Guo S, Ma L. A Frailty Screening Questionnaire (FSQ) to Rapidly Predict Negative Health Outcomes of Older Adults in Emergency Care Settings. <i>J Nutr Health Aging.</i> 2020;24(6):627-633. doi: 10.1007/s12603-020-1374-8. PMID: 32510116.	Exc_specific care (inc frailty assessment)
Scalea TM, Simon HM, Duncan AO, et al. Geriatric blunt multiple trauma: improved survival with early invasive monitoring. <i>J Trauma</i> 1990;30:129-34.	EXC_specific clinical care
Wu J, Faux SG, Estell J, Wilson S, Harris I, Poulos CJ, Klein L. Early rehabilitation after hospital admission for road trauma using an in-reach multidisciplinary team: a randomised controlled trial. <i>Clin Rehabil.</i> 2017 Sep;31(9):1189-1200. doi: 10.1177/0269215517694462. Epub 2017 Feb 1. PMID: 28786337.	Exc_trauma but not frailty/older people/geriatrics

Lamontagne ME, Bayley MT, Marshall S, Kua A, Marier-Deschênes P, Allaire AS, Schmouth ME, Kagan C, Truchon C, Swaine B. Assessment of Users' Needs and Expectations Toward Clinical Practice Guidelines to Support the Rehabilitation of Adults With Moderate to Severe Traumatic Brain Injury. <i>J Head Trauma Rehabil.</i> 2018 Sep/Oct;33(5):288-295. doi: 10.1097/HTR.0000000000000429. PMID: 30188458.	Exc_trauma but not frailty/older people/geriatrics
Joseph, B., Pandit, V., Zangbar, B., Kulvatunyou, N., Tang, A., O'Keefe, T., ...Rhee, P. (2014). Validating trauma-specific frailty index for geriatric trauma patients: A prospective analysis. <i>Journal of the American College of Surgeons</i> , 219(1), 10–17. doi: 10.1016/j.jamcollsurg.2014.03.020	EXC_Validity of tool
Zhao FZ, Wolf SE, Nakonezny PA, Minhajuddin A, Rhodes RL, Paulk ME, Phelan HA. Estimating Geriatric Mortality after Injury Using Age, Injury Severity, and Performance of a Transfusion: The Geriatric Trauma Outcome Score. <i>J Palliat Med.</i> 2015 Aug;18(8):677-81. doi: 10.1089/jpm.2015.0027. Epub 2015 May 14. PMID: 25974408; PMCID: PMC4522950.	Exc_validity or reliability of a tool only
Toosizadeh N, Joseph B, Heusser MR, Orouji Jokar T, Mohler J, Phelan HA, Najafi B. Assessing Upper-Extremity Motion: An Innovative, Objective Method to Identify Frailty in Older Bed-Bound Trauma Patients. <i>J Am Coll Surg.</i> 2016 Aug;223(2):240-8. doi: 10.1016/j.jamcollsurg.2016.03.030. Epub 2016 May 4. PMID: 27155751; PMCID: PMC4961594.	Exc_validity or reliability of a tool only
Konda SR, Lott A, Saleh H, Schubl S, Chan J, Egol KA. How Does Frailty Factor Into Mortality Risk Assessment of a Middle-Aged and Geriatric Trauma Population? <i>Geriatr Orthop Surg Rehabil.</i> 2017 Dec;8(4):225-230. doi: 10.1177/2151458517735202. Epub 2017 Oct 25. PMID: 29318084; PMCID: PMC5755843.	Exc_validity or reliability of a tool only

Characteristics of the included studies

First author, year	Population grouping	Aim(s)	Study design and methods	Study setting (country, section of acute care [e.g. ED])	Intervention / model of care/ pathway	Comparison	Participants (population and sample, including numbers)	Injury Severity Score (ISS)	Outcome measures collected
1. FRAILTY PATHWAYS n=1 study									
Bryant, 2019[34]	Moderate trauma patients with frailty	To determine if an interdisciplinary care pathway for frail geriatric trauma patients improved in-hospital mortality, complications, and 30-day readmissions.	Retrospective cohort study	USA, urban level 1 trauma centre	Frailty Identification and Care Pathway including (1) education, (2) frailty screening (3) early initiation of geriatric-focused care processes	Pre-implementation (April 2015 to March 2016), and one year post-implementation (October 2016 to September 2017)	n=269 trauma patients aged 65+; pre-implementation n= 125 pre-frail or frail patients, post-implementation n=190 screened as frail.	Mean (SD) ISS pre-11.46 (5.96), post 11.78 (6.18)	Delirium; major complications; in-hospital mortality; 30-day readmission
2. GERIATRIC TRAUMA CONSULTATION ALONE IN OLDER PEOPLE n=7 studies									
Fallon, 2006[48]	Moderate trauma patients described as 'older' or 'geriatric'	To evaluate the impact of a Geriatric Trauma Consultation Service	Retrospective cohort study, using prospectively collected medical record and trauma registry data	USA, level I trauma centre	Mandatory geriatric consult (assessment and advise on treatment and management) at ICU stage of care, provided by a geriatric trauma team (GTT) composed of geriatricians and an advance practice nurse (APN) =SEEN group, 2004 onwards	Not seen by the geriatric consult service = UNSEEN group, 2004 onwards	n=285 trauma admissions age 65 and older; n=114 (40%) seen by the GTT,	ISS median 9.8; n=171 unseent, ISS median 9.1	Physician adherence to the consultation team's recommendations; Overall length of stay (LOS) and LOS on ICU; discharge disposition; types of issues addressed by GTT recommendations; mortality and cause of death

Lenartowicz, 2012[40]	Major trauma patients described as 'older' or 'geriatric'	To describe and evaluate an inpatient geriatric trauma consultation service (GTCS)	Before and after case series comparison on clinical outcomes pre and post implementation of GTCS	Canada; Level I trauma centre	Patients referred to a Geriatric Trauma Consultation Service (GTCS) : advanced practice nurse specialist in geriatrics and a geriatrician undertaking a comprehensive geriatric assessment within 72h of admission	Pre-GTCS (March 2005-August 2007) and post-GTCS (September 2007-March 2010)	n=238 pre-GTCS and n=248 post-GTCS patients ≥ 60 years (excluding patients who died on arrival and within ED).	Mean ISS 22 pre-GTCS and 24.7 post-GTCS	Rate of geriatric consultation; recommendation adherence rate; geriatric-specific in hospital complications; trauma quality indicators; sub-speciality consultation requests; length of stay; mortality; discharges to long term care
Min, 2015[38]	Major trauma patients described as 'older' or 'geriatric'	To evaluate degree of quality improvement in geriatric care of older patients with acute trauma in hospital impacted by a geriatric consultation intervention	"Pre-post" observational study, using intention to treat, medical record review	USA, level 1 academic trauma centre	Geriatric faculty and a rotating geriatric medicine fellow, with a typical practice of daily visits until resolution of geriatric medical and disposition issues for all trauma patients aged 65 years and older requiring hospital admission. From December 2007	The medical centre's usual care, which included the option of requesting a general medical or geriatric consultation, admitted between December 2006 and November 2007	n=147 patients age 65 years or older admitted to the trauma service, with length of stay >24 hours: n=71 in the control group, (retrospectively identified) and n=76 in the intervention group, (prospectively identified), sequentially admitted patients,	Control group mean (SD) ISS 14.3 (9.28); intervention groups mean (SD) ISS 15.3 (9.98).	Quality of Care (QOC) score (aggregated from 33 Assessing the Care of Vulnerable Elders 'ACOVE-3' quality indicators categorised by subtype: geriatric condition-based care versus non-geriatric care, delirium care (vs all other care), and care to promote mobility (vs all other care)
Olufajo, 2016[52]	Major trauma patients described as	To evaluate the implementation of mandatory geriatric consults for all trauma	Prospective and retrospective observational study, using chart review	USA, level 1 trauma centre	Geriatric consult protocol (October 2013 through September 2014). delivered by a geriatrician within	Trauma patients admitted before activation of the protocol (June 2011	n=406 patients; n=215 in the pre-intervention group and n=191 in the	Mean [SD] Injury Severity Score was similar in both groups	In-hospital mortality, 30-day mortality (within 30 days of discharge), ICU readmission

	'older' or 'geriatric'	patients 70 years or older.			24 hours of admission (weekdays) or at the beginning of the next week following weekend admission for all trauma patients aged 70 years and older identified prospectively	through June 2012) who would have been eligible for geriatric consults	post-intervention group.	(14.29 [7.6] vs 13.56 [8.7]).	(within the incident hospitalisation), 30-day readmission (within 30 days of hospital discharge), and hospital length of stay.
Southerland 2017[53]	Moderate trauma patients described as 'older' or 'geriatric'	To examine the effectiveness of implementing a geriatric consultation model of care, called the GeriTrauma collaboration	Retrospective chart review, using the institutional Trauma databank and electronic medical record system	USA, level 1 trauma centre	Trauma physician and care providers' education; geriatric consultation triggers; geriatric consultation usually within 24 hours of admission, with follow-up until resolution or discharge. Implemented in July 2014. Pre-implementation period July 2013 to December 2013.	Post-implementation period July 2014 to December 2014	n=245 of 391 charts included for adults 65+ years old admitted to the trauma service with inpatient stay >24 hours); n=48 pre-implementation and n=197 post implementation.	Mean [SD] ISS 9.5 [8.1]; geri trauma 8.7 [1.7], trauma 10.1 [9.7], p 0.83.	Consultation rates; ICU length of stay; initial documentation; proportion of accomplished TQIP Geriatric Trauma quality indicators; discharge quality indicators – length of stay, inpatient survival, discharge to higher care need environment; 90-day hospital readmissions
Wong, 2017[42]	Major trauma patients described as 'older' or 'geriatric'	To describe the sustainability and process improvements of an inpatient geriatric trauma consultation service	Prospective cohort using medical record and trauma registry review of implementation and	Canada; level 1 trauma centre	Sustainability interventions based on workflow assessment, staff interviews and survey to identify gaps in the geriatric trauma consultation	Implementation (pre-sustainability interventions) phase; Sept 2007 - Mar 2010	Patients aged 65 years and older admitted to the trauma service (not dead on arrival or died in the ED); Implementation phase n=246 patients;	Implementation phase mean (SD) ISS 24.7 (14.1) and Sustainability phase mean (SD) ISS 24.1 (11.5);	Percentage of patients who received a comprehensive geriatric assessment; Reasons for no assessment by the geriatric trauma consultation

			sustainability phases		service (advanced practice nurse in geriatrics, geriatrician, resident physician within 72 hours of admission): July to Dec 2013		Sustainability phase n=138 (n=77 with prospective data collection)		service; Geriatric-specific in hospital complications and trauma quality indicators; Discharge destination; Frequency of geriatric issues addressed by the geriatric trauma consultation service, mean number of issues per participant and number of recommendations made; Trauma team adherence rate to recommendations
Cortez, 2018[41]	Moderate trauma patients described as 'older' or 'geriatric'	To assess the impact of implementation of a geriatric trauma protocol (GTP) based on American College of Surgeons recommendations to improve patient outcomes	Quasi-experimental non-equivalent group design, using patient chart review	USA, level II trauma centre	Implementation involved 1) training for surgical residents on a Geriatric Trauma Protocol (GTP). 2) GTP including ISAR screening to geriatric consultation; medication review, toxicology screen, assessment for hypoperfusion, review of comorbidities, geriatrician referral if appropriate, involvement of family members, consideration of	Three months pre-intervention, during 2016	n=117; all patients 65+ years old who were admitted to the hospital as a trauma case; n=77	Pre-intervention mean [SD] ISS 7.16 [6.1], and n=40 post-intervention mean ISS 10.75 [7.4].	Length of stay, discharge destination, mortality, medical complications, processes of care

					palliative care, consideration of delirium, early mobilisation. Eight weeks post-intervention during 2016				
3. GERIATRIC-SPECIFIC CARE (including geriatric consultation in some cases) n=4 studies									
Bradburn, 2012[49]	Moderate trauma patients described as 'older' or 'geriatric'	To evaluate the effectiveness of a high risk geriatric protocol	Cross-sectional retrospective analysis	USA, Level II trauma centre	Geriatric Protocol (GP): multidisciplinary process for patients who are ≥ 65 with a specific high-risk injury, one or more medical history indicator, and one or more assessment indicator are placed on the geriatric protocol, including pre-specified immediate investigations and treatment, ICU admission and geriatric consult. Implemented 2007. Partial (geriatric consult or patient on the guideline) and Both (geriatric consult and patient on the guideline) 2007-2010.	Patients not receiving geriatric consult nor the guideline. 2000-2007	n=4,534 patients aged ≥ 65 . n=3,902 were included in analysis due to missing covariates. n=2,887 patients did not receive the geriatric protocol; n=1,015 patients received geriatric protocol (n=609 partial elements, n=406 both elements).	ISS Low (1-9) 52.7%, moderate (10-16) 23.1%, severe (17-25) 15.5%, most severe (>25) 8.7	In-hospital mortality
Frederikson, 2013[50]	Moderate trauma patients described as	To assess the impact of the implementation of four patient care protocols in the critical care	Retrospective pre-test/post-test study, and a post-protocol implementation, with regression	USA, level 1 trauma centre and trauma ICU	Four patient care protocols: <ul style="list-style-type: none">Ventilator-associated	Pre-protocol period January 1, 2004 to December 31, 2006	All elderly patients (aged >65 years) with trauma, excluding patients who died within 48 hours of	Pre-protocol mean [SD] ISS 9.93 [7.65] and post-protocol phase	ICU length of stay; Hospital length of stay; ED discharge location

	'older' or 'geriatric'	environment within an elderly trauma population	discontinuity design		<p>pneumonia prevention</p> <ul style="list-style-type: none"> • Rib fracture • Massive blood transfusion • Anticoagulation <p>Post-implementation January 1, 2007 to December 31, 2009</p>		admission for regression analyses. n=902 pre-protocol and n=1156 post-phase	mean ISS 10.25 [7.24]	
Saillant, 2017[55]	Moderate trauma patients described as 'older' or 'geriatric'	To determine which evidence-based geriatric protocols were correlated with decreased mortality	Cross-sectional observational study, using a survey and data from a state-wide trauma database	USA, level I and II trauma centres in one state	<p>Survey administered by trained interviewers using a standardised script: description of geriatrics-specific trauma care at each centre, survey date unspecified.</p> <p>Trauma database data 2011 to 2013.</p>	n/a	n=26 out of 27 eligible trauma centres participated (n=13 level I, n=13 level II; n=24 teaching hospitals). Risk-adjusted mortality data available for n=101,477 patients aged 65 and over	n/a trauma centre respondents	Definition of an older adult; adoption of TQIP guidelines; risk-adjusted mortality
Bradburn, 2018[54]	Moderate trauma patients described as 'older' or 'geriatric'	To analyse trends in geriatric outcomes with consideration of the impact of a high-risk geriatric protocol (HRGP), and the anticoagulation and trauma alert (ACT).	Longitudinal cohort study, using retrospective data from a prospectively maintained trauma registry	USA, level II trauma centre	<p>Two practice management guidelines (PMGs) were implemented for the elderly trauma population: 1) a high-risk geriatric protocol (HRGP) (Bradburn, 2012), implemented February 2006 – Phase 2; and 2) anticoagulation and trauma (ACT) alert, implemented March 2012 – Phase 3.</p>	Baseline control period January 2000 to January 2006 – Phase 1	<p>n=8,471 geriatric patients (age ≥ 65) admitted with a blunt injury, not burns or DNR.</p> <p>Phase 1 n=1,879 patients ; Phase 2 n=3,393</p> <p>Phase 3: n=3,199</p>	<p>Phase 1: ISS mean 12.0 [SD 9.15],</p> <p>Phase 2: ISS mean 11.1[SD 8.29],</p> <p>Phase 3: ISS mean 9.4 [SD 7.32]</p>	Mortality; complications

4. PALLIATIVE CARE CONSULTATION n=2 studies									
Kupensky, 2015[43]	Major trauma patients described as 'older' or 'geriatric'	To evaluate the impact of Palliative Medicine Consultation (PMC) on geriatric trauma patients' outcomes	Retrospective, descriptive study, using data from a medical records and the Trauma Registry	USA, Level I trauma centre	Patients who received a PMC after implementation of an institutional practice management guideline requiring PMC on or before post-trauma day two in surgical ICU was implemented; study period July 2013 to November 2014.	Patients who did not receive a PMC after implementation of an institutional practice management guideline requiring PMC on or before post-trauma day two in surgical ICU was implemented; study period July 2013 to November 2014.	n=202 patients aged 65 years or older, admitted to trauma services in the surgical ICU, and alive 24 hours post hospital admission.	Average ISS 17.86 (range: 0-57).	Palliative care consultation; evidence of symptom management; advance care goals length of stay in surgical ICU and total in hospital; discharge disposition
Lilley, 2016[37]	Major trauma patients described as 'older' or 'geriatric'	To study processes associated with complex end-of-life decision making in geriatric patients (≥65 years) admitted with severe traumatic brain injury	Retrospective review of cases	USA, Level I Trauma Centre	Institutional practice management guideline requiring palliative medicine consultation on or before post-trauma day 2 In 'Responders' (GCS > 8 at 72 hours) between January 1, 2011 and December 31, 2014	Institutional practice management guideline requiring palliative medicine consultation on or before post-trauma day 2 'Non-responders' (GCS ≤ 8 at 72 hours) between January 1, 2011 and December 31, 2014	n=90 patients, aged 65 years and older, who were admitted at the centre with TBI and severe neurologic impairment (defined as initial GCS < 8)	Median (IQR) ISS 25 (16-26).	End of life decision making

5. INTERVENTIONS RELATED TO THE TRIAGE OF OLDER PATIENTS WITH TRAUMA n=8 studies									
5a. TRAUMA CENTRES VERSUS OTHER PROVIDERS, OR LEVELS/TYPES OF TRAUMA CENTRES n=3 studies									
Meldon, 2002[47]	Moderate trauma patients described as 'older' or 'geriatric'	To and examine the association between trauma centre verification and hospital mortality in very elderly trauma patients (>80 years)	Retrospective cohort study, using countywide trauma registry data	USA, all Level I and II trauma centres, and acute care hospitals in one county	Trauma centre care	Non-trauma centre care	n=451 patients (level I TC n=38, level II TC n=191, AC n=); >80 years with traumatic injury (not #NOF)	ISS median (IQR): Level I TC 13 (4-25); Level II TC 5 (4-9); AC 4 (4-9)	Hospital mortality
Staudenmayer, 2013[39]	Major trauma patients described as 'older' or 'geriatric'	To determine the current state of triage practice and the associated outcomes for severely injured elderly patients triaged to a level I or II trauma centre with those admitted to a non-trauma centre	Retrospective cohort study using a population-based database	USA; emergency services translational research network in two states	Admission to a level I or II trauma centre following an injury call placed to 911	Admission to a non-trauma centre	n=6,015 patients aged 55 years or older, had presented through the emergency medical systems and been transported to acute care hospitals. n=244 patients with	Injury Severity Score >15. Non-trauma centres ISS less often >15 (2.2% vs 6.7%, p<0.01).	60-day mortality; length of stay; in-hospital costs
Scheetz, 2018[46]	Major trauma patients described as 'older' or 'geriatric'	To conduct a comparative analysis of complications and mortality among severely brain-injured older adults treated at trauma centres and non-trauma centres	Secondary analysis of 2014 data from the Healthcare Cost and utilization Project New York State Inpatient Discharge data	USA: single state	Admission to trauma centre	Admission to a non-trauma centre	n= 7138 patient records of patients age 55 years and older with a primary diagnosis of brain injury and initial admission to an acute care hospital; n=1,737.	Injury Severity Score of >15 (n=143 trauma centre and n=1,594 non-trauma centre). Patients median (IQR) new injury severity score to non-trauma centre = 25 (18-27), to trauma centre = 22 (18-27), p<0.001	Sixteen specified complications; mortality (in-hospital death)
5b. TRAUMA CENTRES MANAGING A HIGHER PROPORTION OF OLDER TRAUMA PATIENTS n=1 study									

Zafar 2015[51]	Moderate trauma patients described as 'older' or 'geriatric'	To determine if older trauma patients have better outcomes at centres that manage a higher proportion of older trauma patients	Retrospective cohort observational study, using the National Trauma Data Bank	USA, level I and II trauma centres with at least 500 trauma visits per year	Trauma centres with greater than 50% of older trauma patients, admission years 2007 to 2011	All centres categorised into six groups based on proportions of older trauma patients: less than 10%, 10% to 20%, 20% to 30%, 30% to 40%, 40% to 50%, admission years 2007 to 2011	n=444,038 patients with age >65 years, from 295 Level 1 and Level 2 trauma centres.	ISS: 0-8, 33.2% 9-15, 41.2% 16-24, 13.9% 25-75, 7.9% <i>(study team-estimated mean ISS 13.8, based on mid-point assumption in grouped ISS data)</i>	Mortality, risk-adjusted mortality ratio (RAMR)
5c. TRAUMA TEAM ACTIVATION WITHIN THE RECEIVING HOSPITAL n=4 studies									
Demetriades, 2002 [35]	Major trauma patients described as 'older' or 'geriatric'	To assess the effect of a modified trauma team activation (TTA) policy on mortality and hospital charges	Retrospective study, using trauma-registry data over an 8.5 years period to compare outcomes pre- and post-introduction of the new TTA criteria	USA (Southern California), level 1 academic trauma centre	Trauma team activation (TTA) to include age 70+ as a criterion, and a protocol on early intensive monitoring and resuscitation and early surgical intensive care unit admission, initiated from March 2000 to August 2001	Time period prior to new TTA policy, January 1993 to February 2000	n=335 patients age 70+ years	ISS>15, admitted at the site between January 1993 and August 2001. Pre-intervention n=260 patients, mean ISS 25 [SD 10]; post-intervention group n=76 patients mean ISS 24 [SD 7].	Survival/mortality, functional status on discharge, hospital charges
Rogers, 2012[36]	Moderate trauma patients described as	To investigate outcomes of under-triage of	Retrospective analysis of trauma registry data	USA, trauma department of one acute hospital	Three levels of trauma team response: two Trauma Team Activations	Did not undergo a trauma team activation (defined as	n=3,902 patients aged 65 and over with full data on ISS, Glasgow-Coma score	ISS >15	Mortality according to under-triage, adjusted mortality, complications,

	'older' or 'geriatric'	older trauma patients			(Code T and Trauma Alert), both with a 10-minute response and trauma team consultation, with a 45 minute response. 2000 to 2010	under-triage if ISS >15)	(GCS), occurrence of complications, Revised Trauma Score (RTS), level of Trauma Team Activation (TTA), and/or discharge status.		coumadin use, mechanism of injury
Sahr, 2013[44]	Moderate trauma patients described as 'older' or 'geriatric'	To assess the efficacy of the implementation of a rib fracture protocol among elderly trauma patients	Retrospective cohort study, method not described	USA; level 1 trauma 2000 to 2016 centre	Emergency Department Rib Fracture Protocol Post protocol (2009-2010)	Treatment according to emergency physician discretion Pre-protocol implementation (2007 to 2008):	n=148 trauma patients 65 years of age and older admitted with at least one rib fracture (n= 81 pre-protocol and n=67 post-protocol); n=30 <3 fractured ribs	Mean [SD] ISS 11.50 [7.20] and n=51 three or more fractured ribs mean [SD] ISS 18.63 [12.44]	Hospital length of stay; ICU length of stay
St John, 2016[45]	Major trauma patients described as 'older' or 'geriatric'	To investigate the role of trauma team activation in outcomes of elderly trauma patients	Cohort and case-control study collecting data from a registry maintained on all admitted trauma patients in a single centre.	USA, level 1 trauma centre with a 4-state catchment area	Trauma team activation against injury, mechanism, physiologic variables or required treatment guidelines for a full or modified activation for patients aged 65 years and older January 1, 2011 and December 31, 2012.	Trauma team activation in those aged less than 65 years between January 1, 2011 and December 31, 2012.	n=10,033 patients >= 18 years of age (n=2,099 aged 65 and over) with complete data on critical variables of trauma team activation and hospital admissions admitted	Mean (SD) ISS: Received TTA 22.2 (14.6); no TTA Mean ISS (SD) 12.6 (10.3)	Effectiveness of trauma team activation by age: adverse outcomes, factors associated with poor outcomes

Outcomes of the included studies

First author, year	Outcome measures collected	Results	
1. FRAILTY PATHWAYS n=1 study			
Bryant 2019 [34]	Delirium	21.6% pre implementation vs 12.5% post implementation (odds ratio [OR] 0.44, 95% CI 0.22 to 0.88); post intervention absolute risk reduction 9.1%	
	Major complications	28% vs. 28.47%	
	In-hospital mortality	7.2% vs. 4.17%; post intervention absolute risk reduction 3.0%	
	30-day re-admission	9.6% vs. 2.78% (OR 0.25, 95% CI 0.07 to 0.84); post intervention absolute risk reduction 6.8%	
2. GERIATRIC CONSULTATION n= 7 studies			
Fallon, 2006 [48]	Length of stay (median [unit unspecified, days assumed])	Geriatric seen group 7.3, unseen group 3.0, p = 0.001	
	Length of stay on ICU (median [unit unspecified, days assumed])	Geriatric seen group 3.3, unseen group 1.4, p=0.001	
	Discharge disposition, including death	home	SEEN group n=32, 28% vs UNSEEN n=68, 40%, p=0.001
		rehabilitation	SEEN group n=66, 58% vs UNSEEN n=54, 32%, non-significant
		nursing care home	SEEN group n=6, 5% vs UNSEEN n=7, 4%, non-significant
		coroner (i.e. died)	SEEN n=5, 4% vs UNSEEN n=31, 18%, p=0.001
		other	SEEN group n=4, 4% vs UNSEEN n=2, 1%, non-significant
	Types of issues addressed by GTT recommendations	Pain (59%), pain control (42%), rehabilitation (49%), delirium (36%), hypertension (33%), dementia (26%), adverse drugs decreased (20%), depression/anxiety (20%), diabetes (19%), constipation (19%), advance care planning (15%), alcohol issues (14%)	
Physician adherence to one of more GTT recommendations	91%		
Lenartowicz, 2012 [40]	Rate of comprehensive geriatric assessment	Pre intervention 3.8% versus post-intervention 59.4%	
	Recommendation adherence rate	93.2%	
	Geriatric-specific in hospital complications (falls, delirium, physical restraint use) and trauma quality indicators (decubitus ulcer, deep vein thrombosis, pulmonary embolus, myocardial infarction, pneumonia, cardiac arrest, missed injuries)	Falls 2.0% pre, 0.8% post, p 0.72 Delirium 50.5% pre and 40.9% post, p = 0.05 Physical restraint 52.5% pre, 50.3% post, p 0.65 Trauma quality indicators: No statistically significant differences	

	Sub-specialty consultation requests			Pre-GTCS n=31, post-GTCS group n=18, p=0.04 to internal medicine Pre-GTCS n=31, post-GTCS group n=18, p=0.02 to psychiatry
	In-hospital mortality (excluding first 48 hours)			Pre GTCS 12.3%, post-GTCS 14.6%, p 0.47
	Discharges to long term care			6.5% pre-GTCS vs 1.7% post-GTCS, p=0.03
Min, 2015 [38]	Overall Quality of Care (QOC) score (33 Assessing the Care of Vulnerable Elders 'ACOVE-3' quality indicators in the hospital care set for appropriateness of care)			Unadjusted control group 76.5% vs geriatric consultation 73.2; p < 0.05 Adjusted for patient-level confounders, no difference (2.8 percentage-point difference; p = 0.08).
	Geriatric condition-based care (e.g. delirium screening)			Unadjusted: geriatric consultation 74%, control 68.3%. Adjusted 5.0 percentage point difference (95% CI, 1.2-9.2)
	Delirium care			Unadjusted: geriatric consultation 63.9%, control 55.0. Adjusted 8.4 percentage point difference (95% CI, 0.5-16.4)
	Mobility care			Unadjusted: geriatric consultation 80.0%, control 74.0. Adjusted 4.7 percentage point difference (95% CI, -1.7-11.3)
	Screening or prevention			Unadjusted: geriatric consultation 88.6%, control 83.2. Adjusted 6.1 percentage point difference (95% CI, 1.2-11.2)
	Care process: diagnosis quality indicators			Unadjusted: geriatric consultation 70.5%, control 68.5. Adjusted 2.1 percentage point difference (95% CI, -5.7-9.9)
	Care process: treatment quality indicators			Unadjusted: geriatric consultation 86.3%, control 86.4. Adjusted 0.3 percentage point difference (95% CI, -5.3-6.0)
	Care process: follow-up and continuity quality indicators			Unadjusted: geriatric consultation 62.4%, control 58.8. Adjusted 1.8 percentage point difference (95% CI, -4.5-8.6)
Olufajo, 2016 [52]	Geriatric consult			3.26% pre intervention, 100.0% post intervention, p<0.01
	Documentation of delirium			31.2% pre intervention, 38.2% post intervention, p= 0.14
	DNR/DNI code status			10.2% pre intervention, 38.2% post intervention, p<0.01
	Referral for formal cognitive evaluation			2.3% pre intervention, 14.2% post intervention, p<0.01
	In-hospital mortality			9.30% pre intervention, 5.24% post intervention, p= 0.12
	30-day mortality (within 30 days of discharge)			11.63% pre intervention, 5.24% post intervention, p= 0.12
	ICU readmission (within the incident hospitalisation)			8.26% pre intervention, 1.96% post intervention, p= 0.06
	30-day readmission (within 30 days of hospital discharge)			16.92% pre intervention, 14.92% post intervention, p= 0.60
	Hospital length of stay			6.41 pre intervention, 5.95 post intervention, p= 0.90
Southerland 2017 [53]	Geriatrics consultation			Pre-implementation 2.0%, post-implementation 47.7% (40.7-54.7%), p < 0.01
	ICU length of stay (days)			Pre-implementation 6.8 (2.4-11.2), post-implementation 5.5 (4.1-7.0), p 0.49 Geri Trauma group 4.70 [2.9-6.5]; Trauma group 6.00% [3.9-8.2], p<0.39
	Proportion of accomplished TQIP	Compliance in initial documentation	Initial code status	Pre-implementation 87.5% (78.1-96.9), post-implementation 91.4% (87.4-95.3), p 0.04 Geri Trauma group 97.9% [95.0-100]; Trauma group 85.4%, p<0.01

	Geriatric Trauma quality indicators	Home medication list	Pre-implementation 8.4 (6.9-10.0), post-implementation 9.0 (8.2-9.8), p 0.50 Geri Trauma group 91.5% [85.8-97.1]; Trauma group 76.7% [68.5-84.9], p<0.01
		Home number medications	Pre-implementation 89.6% (80.9-98.2), post-implementation 83.8% (78.6-88.9), p 0.51 Geri trauma 9.3 [8.2-10.4], trauma 8.7% [7.6-9.8], p=0.48
		Pre-injury level of care (community or skilled facility)	Pre-implementation 87.5% (78.1-96.9), post-implementation 83.8% (78.6-88.9), p 0.78 Geri trauma 90.4% [84.5-96.4]; trauma 77.7% [69.6-85.7], p=0.02
	Inpatient quality measures	Goals of care discussion	Pre-implementation 10.4% (1.8-19.1), post-implementation 11.7% (7.2-16.2), p 0.77 Geri trauma 5.3% [0.8-9.9]; trauma 17.5% [10.1-24.8], p<0.01
		Bowel regimen given	Pre-implementation 81.3% (70.2-92.3), post-implementation 74.6% (68.5-80.7), p 0.17 Geri trauma 78.7% [70.4-87.0]; trauma 70.9% [62.1-79.6], p=0.19
		Delirium screening	Pre-implementation 33.3% (20.0-46.7), post-implementation 38.6% (31.8-45.4), p 0.50 Geri Trauma 45.7% [35.7-55.8], trauma 32.0% [23.0-41.1], p=0.05
		Delirium diagnosed	Pre-implementation 6.6% (3.1-21.9), post-implementation 24.9% (18.8-30.9), p 0.07 Geri Trauma 36.2% [26.5-45.9], trauma 14.6% [7.8-21.4], p<0.01
		Benzodiazepines given	Pre-implementation 39.6% (25.7-53.4), post-implementation 34.5% (27.9-41.2), p 0.51 Geri trauma 28.7% [19.6-37.9]; trauma 39.8% [30.4-49.3], p=0.10
		Physical therapy consult	Pre-implementation 79.2% (67.7-90.7), post-implementation 81.2% (75.8-86.7), p 0.75 Geri Trauma 95.7% [91.7-99.8], trauma 68.0% [58.9-77.0], p<0.01
		Surgery required	Pre-implementation 27.1% (14.5-39.7), post-implementation 20.8% (15.1-26.5), p 0.35 Geri trauma 20.2% [12.1-28.3]; trauma 21.4% [13.4-29.3], p=0.84
		Discharge number of medications	Pre-implementation 11.0 (9.3-12.6), post-implementation 11.5(10.6-12.3), p 0.68 Geri trauma 11.9 [10.8-13.0]; trauma 11.1 [9.7-12.4], p=0.37
		Change in medications (median)	Pre-implementation +2.5 (1.4-3.6), post-implementation +2.8(2.1-3.5), p 0.62 Geri trauma 2.80 [2.0-3.5]; trauma 2.90 [1.8-4.0], p=0.89

		Discharge quality measures	Length of stay (days)	Pre-implementation 8.0 (5.0-10.9), post-implementation 5.6 (4.7-6.5), p 0.05 Geri trauma 6.0 [4.7-7.3]; trauma 5.2 [3.9-6.6], p=0.42
			Inpatient survival	Pre-implementation 100% (n/a), post-implementation 91.4% (87.4-93.5), p 0.04 Geri Trauma 95.7% [90.0-99.7], trauma 87.4% [81.0-93.8], p=0.03
			Discharged to higher level of care	Pre-implementation 33.3% (20.0-46.7), post-implementation 23.9% (18.8-30.9), p 0.02 Geri Trauma 51.2% [40.5-61.9], trauma 24.0% [14.3-33.7], p<0.01
			90 day readmissions	Pre-implementation 16.7% (6.1-27.2), post-implementation 13.2% (8.5-19.7), p 0.53 Geri Trauma 13.3% [6.3-20.4], trauma 15.5% [8.1-23.0], p=0.74
Wong, 2017 [42]	Percentage of patients aged 65 or older admitted to the trauma service who received a comprehensive geriatric assessment			89.9% (124/138) in the sustainability phase versus 59.4% in the implementation phase (p<0.001)
	Reasons for no assessment by the geriatric trauma consultation service			Patient died (n=9), discharged (n=1) or transferred (n=1) within 72 hour of admission; imminent withdrawal of treatment or death anticipated (n=1).
	Geriatric-specific in-hospital complications (falls, delirium, physical restraint use) and trauma quality indicators (decubitus ulcer, thromboembolism, myocardial infarction, pneumonia, cardiac arrest and missed injuries)			Implementation vs. sustainability phase: falls 1.5% v.3.9%; delirium 40.9% v. 53.3; physical restraint use 50.3 v. 49.4%; decubitus ulcer 4.4 v. 10.4%; deep vein thrombosis 0.5 v. 6.5%; myocardial infarction 2.0 v. 0%; pneumonia 18.2 v. 23.4%
	Discharge destination			1.4% discharged to a nursing home; 1.7% in the implementation phase
	Frequency of geriatric issues addressed by the geriatric trauma consultation service, mean number of issues per participant and number of recommendations made (sustainability phase only)			Mobilisation 55, continence 53, pain 51, discharge planning 43, medication reconciliation 39, sensory impairment 14, mood disorder 6, nutrition 4, restraint 4, decubitus ulcer 3. Frequency of geriatric issues addressed; delirium 67, Mean number per participant implementation phase 4.3 issues, sustainability phase 4.7 issues. At least 1 recommendation made in 73/76 patients
	Trauma team adherence rate to recommendations			Implementation phase 93.2%; sustainability phase 88.2%.
Cortez, 2018 [41]	Length of stay (mean [SD] days)			Pre-intervention 6.58 [8.0] vs. post-intervention 5.03 [3.8], p 0.532
	Discharge destination	Home		Pre-intervention n=26 (33.8%) vs post-intervention n=16 (40%), p=0.505
		Subacute rehabilitation		Pre-intervention n=35 (45.5%) vs post-intervention n=15 (37.5%), p=0.409
	Death			Pre-intervention n=5 (6.5%) vs post-intervention n=3 (7.5%), p=0.838
	Medical complications			Pre-intervention 15.6% vs post-intervention 22.5%, p=0.355
	Acute readmission			Pre-intervention n=10 (13%) vs post-intervention n=5 (12.5%), p=0.940;
	Readmission			Pre-intervention n=1 (1.3%) vs post-intervention n=0, p=0.469
	Processes	Admitted to orthopaedics		Pre-intervention n=26 (33.8%) vs post-intervention n=9 (22.5%), p=0.207
Admitted to medicine			Pre-intervention n=24 (31.2%) vs post-intervention n=3 (7.5%), p=0.004	
Anticoagulant given			Pre-intervention n=25 (32.5%) vs post-intervention n=14 (35.0%); p=0.783	

		EtOH screen performed	Pre-intervention n=19 (24.7%) vs post-intervention n=20 (50%); p=0.006
		Family meeting	Pre-intervention n=7 (9.1%) vs post-intervention n=6 (15%), p=0.335
		Family involved	Pre-intervention n=51 (66.2%) vs post-intervention n=34 (85%), p=0.31
		Geriatric consult	Pre-intervention n=5 (6.5%) vs post-intervention n=9 (22.5%), p=0.011
		Palliative care consult	Pre-intervention n=2 (2.6%) vs post-intervention n=2 (5%), p=0.498
		Medicine consult	Pre-intervention n=17 (22.1%) vs post-intervention n=2 (5%), p=0.018
		Physical therapy consult	Pre-intervention n=54 (70.1%) vs post-intervention n=28 (70%), p=0.988
		Social work consult	Pre-intervention n=57 (74%) vs post-intervention n=28 (70%), p=0.643
		Identification of Seniors At Risk completed	Pre-intervention n=71(92.2%) vs post-intervention n=33(82.5%), p=0.113
4. GERIATRIC-SPECIFIC CARE (including geriatric consultation in some cases) n=4 studies			
Bradburn, 2012 [49]	In-hospital mortality	Unadjusted	Not receiving the geriatric protocol 6.2% (referent); partial protocol 7.6% OR 1.23, 95% CIs 0.88-1.72; both parts of protocol 7.1%, OR 1.16, 95% CIs 0.77-1.74
		Adjusted (trauma alert status, ISS, age group, RTS, pre-existing conditions)	Partial protocol OR 0.96, 95% CIs 0.66-1.42, p=0.854; both parts of protocol OR 0.63, 95% CIs 0.39-0.99, p=0.046.
Frederikson, 2013 [50]	ICU length of stay (mean [SD] days)		Pre-protocol 3.75 [4.77]; post-protocol 3.56 [4.54], non-significant (value not stated)
	Hospital length of stay (mean [SD] days)		Pre-protocol 6.11 [16.74] to post-protocol phase 4.20 [2.18], t (934) = 4.071; p < 0.01.
	Variables that predict LOS within each time period (of age, sex, Injury Severity Score, systolic and diastolic blood pressures at admission, primary medical insurance, injury category):		Pre-protocol adjusted R ² .03, SE 17.07; post-protocol R ² .118, SE 4.36
	ED discharge location	Home	Pre-protocol 2.44%; post-protocol 1.82%, p > .05
		Another acute care facility	Pre-protocol 0.22%; post-protocol 0.26%, p > .05

		Floor	Pre-protocol 67.29%; post-protocol 68.08%, $p > .05$
		ICU/CCU	Pre-protocol 10.42%; post-protocol 11.68%, $p > .05$
		OR	Pre-protocol 10.09%; post-protocol 10.38%, $p > .05$
		23 hour observation	Pre-protocol 2.55%; post-protocol 6.75%, $z(2, 035) = 4.273, p \leq .05$
		Other or unknown	Pre-protocol 6.43%; post-protocol 0.00%, $p \leq .05$
Saillant, 2017 [55]	Definition of an older adult		Age ≥ 65 years of age at 77 % of the surveyed centres
	Adoption of Trauma Quality Improvement guidelines		Rates of individual process adoption ranged: 4% (geriatric unit) to 85% (routine discussion of code status on admission) including high frequency of involvement of primary care (58 %) and palliative care providers (58 %); only one centre incorporated all of the guidelines.
	Association of summed score for best practice processes with risk adjusted mortality outlier status (observed to expected mortality ratios), adjusted for age, injury severity, comorbidities, admission physiology, mechanism of injury, and transfer status		Low outlier status: 8 (IQR 7–10.5) Medium outlier status: 7 (IQR 5–9) High outlier status 8 (IQR 6–14), $p = 0.50$
Bradburn, 2018 [54]	Mortality	Unadjusted	Baseline $n=136$ (7.24%), high-risk geriatric protocol (HRGP) $n=208$ (6.13%), HRGP + anticoagulation and trauma Alert (ACT) $n=128$ (4.0%)
		Adjusted (age, ISS, GCS, RTS)	Baseline (referent), HRGP OR 1.01, 95% CIs 0.74-1.38, $p=0.942$; HRGP + ACT Alert OR 0.67, 95% CIs 0.47-0.94, $p=0.021$
	Complications -occurrence of one or more specific complications: ARDS, acute respiratory failure, pneumonia, embolus, myocardial infarction, acute renal failure, progression of neurologic insult, CVA/stroke, sepsis.	Unadjusted	Baseline $n=23$ (1.28%), HRGP $n=52$ (1.57%), HRGP + ACT Alert $n=51$ (1.64%)
		Adjusted (age, ISS, GCS, RTS)	Baseline (referent), HRGP OR 1.37, 95% CIs 0.80-2.32, $p=0.248$; HRGP + ACT Alert OR 1.53, 95% CIs 0.89-2.61, $p=0.120$
5. PALLIATIVE CARE $n= 2$ studies			

Kupensky 2015 [43]	Palliative medicine consultation (PMC), mean time from admission to PMC 2.91 days		48.0% (97/202) overall
	Symptom management (evidence of management of pain, constipation, nausea/vomiting, and anxiety/agitation)		PMC 3.65 of 4 symptoms vs. no PMC 3.47; p=.023
	Advance care goals	Evidence of an advance directive discussion	Overall 50.5% (102/202); PMC 93.1% vs. no PMC 6.9%; p<.001
		Update or change in code status	Overall 28.7% (58/202); PMC 84.5% vs. no PMC 15.5%; p<.001
	Length of stay in surgical ICU (days)		PMC m=6.40 vs. no PMC m=11.81; p = 001
	Length of stay in the hospital (days)		PMC m=7.92 vs. no PMC m=13.11; p = 001
	Discharge disposition	Home or rehab	PMC 17.5% vs. no PMC 49.5%; p<.001
		Skilled nursing facility or long-term acute care facility	PMC 47.4% vs. no PMC 43.8%; p<.001
Death or hospice		PMC 35.1% vs. no PMC 6.7%; p<.001	
Lilley, 2016 [37]	End-of-life decision making processes documented	Family meeting	Recorded for 43 (93%) of the 46 patients who had life-sustaining treatments withdrawn or withheld and for 38 (72%) who had changes in their initial code status. Non-responders 79% vs responders 25%; p < 0.001
		Palliative care consultation	Non-responders 13.8% vs. responders 3.1%; p 0.13
		Final code status at discharge of death	Full code status: Non-responders 31% vs responders 75% Do not resuscitate/Do not intubate: Non-responders 17.2% vs responders 15.6% Comfort measures only: Non-responders 51.7% vs responders 9.4% p < 0.001.
1. INTERVENTIONS RELATED TO THE TRIAGE OF OLDER PATIENTS WITH TRAUMA			
5a. TRAUMA CENTRES VERSUS OTHER PROVIDERS, OR LEVELS/TYPES OF TRAUMA CENTRES n=3 studies			

Meldon 2002 [47]	Crude hospital mortality		Trauma centre I 24% (n=9), trauma centre II 5.2% (n=10), acute care 9.9% (n=22)
	Adjusted difference in hospital mortality (adjusted for age, gender, initial CGS, ISS)		Acute setting associated with mortality OR 3.2; 95% CI 1.1-9.5
	Hospital mortality by ISS group	0-10	Trauma centre dead n=4 (2%) vs. acute care n=5 (3%), p 1.00
		11-15	Trauma centre dead n=2 (11) vs. acute care n=3 (43%), p 0.113
		16-20	Trauma centre dead n=4 (29%) vs. acute care n=1 (6%), p 0.157
		21-45	Trauma centre dead n=8 (44%) vs. acute care n=12 (92%), p 0.008
46-75		Trauma centre dead n=1 (100%) vs. acute care n=1 (100%), n/a	
Staudenmayer, 2013 [39]	60 day mortality (unadjusted)		Non-trauma centres 9.0% vs trauma centres 5.7%, p < 0.001
	Length of stay (median days)		Non-trauma centres 4.0 days vs trauma centres 3.0 days, p < 0.001
	In-hospital per patient costs (median USD)		Non-trauma centres \$9,642 vs trauma centres \$17,875, p < 0.001
	60 day mortality in patients with an Injury Severity Score of >15 (adjusted for age, sex, mechanism of injury and physiology [prehospital systolic blood pressure, heart rate and Glasgow Coma Scale])		Non-trauma centre 16.3% vs trauma centre 17.1%; OR 1.87, 95% CI 0.50, 6.95
	In patient total costs (median) in patients with an Injury Severity Score of >15 (adjusted for age, Injury Severity Score, sex, mechanism of injury, physiologic variables and having a procedure)		Non-trauma centre care \$48,682 vs trauma centre care \$71,621, p = .03
Scheetz, 2018 [46]	Sixteen specified complications		398 (22.9%) patients experienced 693 complications; Seven complications had a frequency <10 in both groups, with no further analysis. Of the nine complications with larger numbers, seven showed statistically unadjusted non-significant differences. Two showed a higher rate amongst patients treated at the trauma centre: adult respiratory distress syndrome 6.8% non-trauma centre versus 21.0% trauma centre (p <.001, effect size 0.146) and clostridium difficile infection 1.1% non-trauma centre vs. 3.5% trauma centre (p .044, effect size 0.018)
5b. TRAUMA CENTRES MANAGING A HIGHER PROPORTION OF OLDER TRAUMA PATIENTS n=1 study			
Zafar, 2015 [51]	Risk-adjusted in-hospital mortality rate (variables in the model included grouped age, sex, race/ethnicity, comorbidities, hypotension, GCS score, ISS, mechanism of injury, heart rate, and a need of ventilator)	Proportion of trauma patients in the older age group <10%	7.3%
		Proportion of trauma patients in the older age group 10-20%	7.0%

	support and were adjusted for hospital characteristics and interfacility differences)	Proportion of trauma patients in the older age group 20-30%	7.1%
		Proportion of trauma patients in the older age group 30-40%	6.5%
		Proportion of trauma patients in the older age group 40-50%	6.1%
		Proportion of trauma patients in the older age group >50%	5.6% Older patients were 34% less likely to die than those presenting at the lowest-proportion centres (OR 0.66; 95% CI 0.54-0.81)
5c. TRAUMA TEAM ACTIVATION WITHIN THE RECEIVING HOSPITAL n=4 studies			
Demetriades 2002 [35]	Mortality		Pre-intervention 53.8% vs post-intervention 34.2%, p=0.003; RR 1.57, 95%CI 1.13-2.19.
	Incidence of permanent disability		Pre-intervention 16.7% vs. post-intervention 12.0%; p=0.49, RR 1.39, 95%CI 0.59-3.25.
	Duration of ICU stay (mean days)		Pre-intervention 4.5 vs post-intervention 5.2, p=0.61
	Duration of hospital stay (mean days)		Pre-intervention 10.7 vs. post-intervention 10.2, p=0.77
	Hospital charges (USD)		Pre-intervention 64,249 vs. post-intervention USD 49,644p=0.20
Rogers, 2012 [36]	Predictors of mortality (unadjusted)		Under-triage mortality 12.9% (n=87) vs. correctly triaged 5.8% (n=220); OR 2.41; 95% CI 1.85–3.14; P < 0.001 (P < 0.001)
	Predictors of mortality (adjusted for trauma score, GCS, 1+ complications, and Coumadin use)		Under-triage (mortality 12.9% (n=87) OR 1.98; 95%CI 1.41–2.78; P < 0.001. AUC 0.78
Sahr, 2013 [44]	Hospital length of stay		Decrease (unspecified) F = 7.820, p=.006.
	Hospital length of stay (mean [SD]) by number of ribs fractured	<3 fractures	Pre-protocol 4.77 [3.93]; post-protocol 4.93 [9.83]
		Three or more fractured ribs	Pre-protocol 10.24 [13.59]; post-protocol 8.74 [3.33]
		ANOVA	F = 4.254, p=.042
	ICU length of stay (mean [SD]) by number of ribs fractured	<3 fractures	Pre-protocol 0.54 [1.24]; post-protocol 1.90 [2.33]
Three or more		Pre-protocol 3.67 [7.30]; post-protocol 4.72 [6.97]	

		fractured ribs	
		ANOVA	F = 4.959; p = .028
St John, 2016 [45]	Effectiveness of trauma team activation by age (adjusted relative risk of poor outcomes defined as death during hospital admission or discharge to a skilled nursing facility)		Elderly 0.80 (95% CI 0.53-1.20) versus non-elderly 0.49 (95% CI 0.26-0.91) p = 0.024