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Outcome measures utilised in studies evaluating comprehensive geriatric assessment based perioperative medicine services: A scoping review

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Abstract

Background: Integrating Comprehensive Geriatric Assessment (CGA) into the surgical pathway for older adults has been variably achieved. Dissecting this variability, and assessing the effectiveness of CGA-based services, is challenging due to a lack of standardised outcome measures. We report a scoping review of studies evaluating perioperative CGA to describe previously utilised outcome measures.

Objective: To describe outcome measures used to examine the impact of CGA-based perioperative medicine services.

Methods: Using scoping review methodology, we systematically searched published studies examining CGA-based perioperative medicine services in three electronic databases (Embase/MEDLINE/Web of Science), supplemented with relevant reference lists. Verbatim outcome measures were extracted, standardised, and mapped into pre-defined domains adapted from COMET taxonomy. Data are summarised using descriptive statistics.

Results: Seventy-three eligible studies were identified: 27 controlled trials (randomised/ pseudo-randomised/ non-randomised) and 46 observational studies. Forty-five studies (62% of included studies) reported on CGA in patients undergoing emergent orthopaedic/trauma surgery. A median of seven unique outcome measures were identified per study (IQR4-12) with length-of-stay (n=54/73, 74%) and mortality (In-hospital mortality n=31/73, 42%; 1-year mortality n=21/73, 29%; 1-month mortality n=19/73, 26%) reported most commonly. Domain mapping showed frequent reporting of outcomes evaluating healthcare resource utilisation (n=62/73, 85%) and postoperative complications (n=51/73, 70%), with under-representation of patient-reported or quality-of-life metrics (n=6/73, 8%). Additionally, few studies reported on the cost-effectiveness of perioperative CGA (n=8/73, 11%).

Conclusion: Our analysis shows heterogeneity in outcome measures in studies evaluating CGA-based perioperative medicine services. Consensus regarding core outcome measures is required.

Introduction

Comprehensive Geriatric Assessment (CGA) is a multi-component, multidisciplinary intervention for older adults which utilises objective measures to holistically evaluate and optimise the medical, functional, social, and psychological components of an individual's health [1]. This systematic intervention has demonstrated efficacy in improving clinical outcomes for older adults in both the inpatient and outpatient settings [2,3]. Notably, evidence from several previous randomised controlled trials and observational studies supports the incorporation of CGA into perioperative pathways for older surgical patients. This population are at high risk of postoperative geriatric syndromes, decompensation of co-morbid conditions, and functional deconditioning [4-6].

However, CGA is a complex intervention that requires specialist input from multiple healthcare professionals and often longitudinal intervention across several time points [7]. As a result, variation exists in the ability of centres to implement and deliver this intervention in the perioperative setting [8]. There is also variable delivery of perioperative CGA-based services across different surgical specialties [9]. To understand the barriers and enablers to the uptake of CGA-based perioperative services, and evaluate the clinical and cost-effectiveness of these services at scale across surgical subspecialties, multi-centre implementation-effectiveness trials are required.

Studies to address the above questions are hampered by a lack of consensus regarding outcome measures used in evaluating the complex intervention of CGA. Indeed, previous studies assessing CGA-based perioperative services have reported a wide range of outcomes measures [10]. This heterogeneity limits comparison between studies and creates difficulties for centres in selecting metrics to appraise the effectiveness of new perioperative services. The Core Outcome Measures in Effectiveness Trials (COMET) Initiative was established in 2010 to combat this heterogeneity by encouraging the development and utilisation of a Core Outcome Set (COS) for clinical trials [11]. An established COS for general perioperative and anaesthetic care has been published previously [12], but no recommended set of outcome measures for CGA-based perioperative medicine exists. Whilst an umbrella review has explored outcome measures used to evaluate the impact of CGA across healthcare settings [13], the findings were not specific to perioperative medicine.

This scoping review describes outcome measures used by studies evaluating the efficacy of CGA-based perioperative care compared with standard surgical care, maps these outcome measures to perioperative medicine core domains, and forms the first step in the generation of a COS for ongoing evaluation of CGA-based perioperative services. We aim to define a COS that can be used to describe the unique needs of the older surgical population, the holistic nature of CGA and the implementation of CGA-based perioperative services at scale (Figure 1).

Aim and objectives

Aim: To systematically identify and categorise outcome measures used in studies assessing the effectiveness of CGA-based perioperative medicine services for older adults undergoing surgery, when compared to routine perioperative care.

Objectives: To describe the outcome measures used to evaluate CGA-based perioperative services.

To describe the surgical specialties in which CGA-based perioperative services have been evaluated.

Methods

Reporting and registration

The protocol for this scoping review was decided a priori, in concordance with previously published methodology [14,15], and pre-registered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/5S9A8). Deviations from the initial protocol are described in Appendix S1 of the Supplementary Material. This scoping review is additionally reported according to the guidelines provided in the 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR)' checklist as shown in Appendix S2 of the Supplementary Material [16].

Information sources and search strategy

A systematic search of published literature was performed in Embase, MEDLINE, and Web of Science, on 26th April 2023. The search strategy for each database was designed by one author following consultation with a senior library assistant, and subsequently reviewed by two other authors with expertise in the field. An example search strategy from one online database is shown in Appendix S3 of the Supplementary Material. Searches were limited to articles published in English, and to studies published after the year 2000. The reference lists of previously published systematic reviews evaluating CGA-based perioperative medicine services were also reviewed to identify additional studies meeting the eligibility criteria.

Eligibility criteria

Population – older surgical patients: Eligible studies included older adults (aged >/= 65 years old) undergoing elective or emergency surgery. No restriction was imposed on the nature of the surgical procedure studied. The Centre for Perioperative Care delineates the perioperative period from 'the moment of contemplation of surgery until full recovery' [17]. This definition has been utilised throughout this review.

Intervention – CGA-based perioperative medicine

All included studies reported on the provision of perioperative care based on the principles of CGA as outlined by the British Geriatrics Society [1]. Care was delivered by a team involving at least one consultant geriatrician or geriatric medicine specialist nurse, and involved multi-domain assessment with interventions to optimise modifiable risk factors in the preoperative and/or postoperative period. Domains assessed during CGA included at least two of the following: physical, socioeconomic/environmental, functional, mobility/ balance, psychological/mental health, and medication review [1]. Studies evaluating assessments and interventions targeted at a single domain were excluded. Studies utilising CGA as a screening or risk stratification tool to predict postoperative outcomes were also excluded.

Comparator – routine surgical care

We included studies directly comparing CGA-based services with pre-existing, standard care for surgical patients at the home institution. This encompassed studies from institutions where a form of geriatric assessment, or a geriatric liaison service, had already been implemented within the surgical pathway, provided that the study directly compared this 'standard' model to the integration of a new CGA-based perioperative

model. Only those outcome measures included in such studies which directly compared the CGA-based model to routine care were included in the analysis.

Study design

Studies reporting any experimental or quasi-experimental study design with at least 100 participants were eligible for inclusion, including randomised control trials, observational studies (retrospective and prospective) and results published from quality improvement projects. Literature reviews, systematic reviews, meta-analyses, and study protocols were excluded. Additionally, case reports, editorials and conference abstracts were excluded due to difficulties in ensuring fidelity to the principles of CGA. Smaller studies with fewer than 100 participants were also excluded as we sought to capture those outcome metrics which can be measured at a sufficiently large scale within future implementation-effectiveness trials.

A summary of the eligibility criteria for this scoping review is presented in Box 1.

Data screening

A web-based application, Rayyan [18], was used to collate studies, deduplicate (automatic and manual) and record exclusion/ inclusion decisions. Titles and abstracts were screened according to the inclusion/ exclusion criteria by two independent reviewers. Any study accepted by at least one reviewer at this initial screening stage was deemed suitable for progression to the next stage. Full texts of those studies identified by abstract/ title screening were subsequently assessed independently by two reviewers before confirming inclusion. Disagreements between reviewers following full-text review were resolved by discussion between both parties following unblinding.

Data items and extraction

Data extraction from the full texts of eligible studies was performed and collated in a pre-defined Microsoft Excel template (Supplementary File 1). Data points were extracted by one reviewer.

The following variables were extracted from each study:

- Authors.
- Year of publication.
- Study design/ methodology.
- Number of participants.
- Surgical specialty/ type of operation.
- Details of intervention.
- Details of comparator.
- Individual outcomes measures (recorded as close as possible to wording reported in each study without loss of meaning). Only outcome measures directly comparing CGA to standard care were extracted.
- Outcomes measurement tools (if reported).
- Time points for outcome measurement.

Risk of bias assessment

No formal assessment of study quality, or risk of bias, has been performed in keeping with our scoping review methodology, which aims to map, rather than evaluate, the previously published literature on perioperative CGA.

Data synthesis and analysis

Summary descriptive statistics analysing the design and affiliated surgical specialties of included studies are presented. Comparative outcome measures used in eligible studies were extracted verbatim, and subsequently standardised, based on the overarching concept to account for variation in phrasing between studies and allow identification of comparable, unique outcomes [19]. We then clustered our standardised outcome measures into core domains based on an adapted version of the taxonomy proposed by the COMET initiative [20], accounting for the unique features of CGA-based perioperative medicine and caring for older adults. Our categorisation system for these domains is shown in Box 2, which also depicts the associated COMET core areas (death, life impact, adverse events, resource usage). Where a specific outcome measure could be categorised into more than one domain, all applicable domains were assigned to the study.

Descriptive statistics were used to summarise the individual outcome measures and core domains reported in each study. Statistical analyses were performed using SPSS Statistics 29.0.2.0 and GraphPad Prism 10. Narrative synthesis has additionally been used to describe trends in the reporting of particular outcome domains. No formal meta-analysis has been conducted, in keeping with scoping review methodology.

Results

Study characteristics

Our systematic search of three online databases, supplemented with citation searching from three previously published systematic reviews evaluating perioperative CGA, identified a total of 8,436 articles. Following de-duplication, the abstracts of 5,971 articles were screened for inclusion. The results of abstract and full-text screening are detailed in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram in Figure 2, which also shows the reasons for article exclusion. Two-stage screening with independent reviewers resulted in the inclusion of 73 studies in the final analysis, which reported on a total of 65 participant cohorts (eight studies described post-hoc/ follow-up analyses on a previously studied cohort). Table S1 of the Supplementary Material contains a full reference list of included studies.

Date of publication

All included articles were published between 2001-2023. The distribution of publication years is shown in Figure 3a, which highlights the expansion in studies reporting on CGA-based perioperative medicine after 2015. The median year of publication was 2017, with an interquartile range of 2013-2020.

Study methodology

Of the 73 included articles, observational studies were the most common study type identified by our screening strategy (n=46/73, 63%) This included controlled before-and-after/ historically controlled studies (n=23/73, 32%), retrospective and prospective cohort studies (n=19/73, 26%), a case-control study (n=1/73, 1%), and population-level epidemiological studies (n=3/73, 4%). A total of 24 reports on Randomised Controlled Trials (RCT) were identified (33%) with one study describing a pseudo-randomised controlled trial (n=1/73, 1%). Additionally,

two reports of non-randomised controlled trials were included (n=2/73, 3%). This distribution in study methodology is summarised in Figure 3b.

Participant numbers

The included studies had participant numbers ranging from 100 to 266,499 (this outlying large number of participants was included in one article describing a multilevel, multivariable population-based regression model across multiple elective, non-cardiac surgeries). The median number of participants was 279, with an interquartile range of 187-447.

Surgical specialty

As shown in Figure 3c, most identified studies evaluated the integration of CGA-based perioperative services into pathways for older adults undergoing orthopaedic/ trauma surgery (n=47/73, 64%), particularly those undergoing emergency repair of a hip fracture (n=45/73, 62%). 13 studies included participants undergoing upper/ lower gastrointestinal surgery (n=13/73, 18%), of which the majority reported on colorectal surgical procedures. The next most common surgical specialities studied were vascular surgery (n=6/73, 8%) and surgical oncology (n=4/73, 5%), with only single studies reporting on cardiac and urological procedures. Additionally, 1 large population-level study reported across multiple elective, non-cardiac surgical specialities including orthopaedic, vascular, gastrointestinal, hepatobiliary, thoracic and urological surgery.

A full overview of the characteristics of studies included in this analysis is shown in Table S2 of the Supplementary Material.

Reporting of outcome measures

Following the extraction of verbatim outcome measures, individual terms were standardised to allow appropriate comparisons between studies. This homogenisation process resulted in the number of comparative outcome measures per study ranging from one – 30. The median number of unique outcome measures per study was seven (interquartile range four – 12). In total, 165 unique outcomes were identified. The most frequently reported standardised outcomes across studies are shown in Table 1. Common outcome measures included the length of acute admission (n=54/73, 74%), the need for re-admission following discharge (n=33/74, 45%), and death by any cause (n=47/73, 64%). Notably, studies showed heterogeneity in the time points at which mortality was reported (with several studies reporting mortality at multiple time points). In-hospital mortality was reported most frequently (n=31/73, 42%), followed by one-year mortality (n=21/73, 29%) and one-month mortality (n=19/73, 26%).

Conversely, of the 165 individual outcome measures collated from our search, 81 outcomes were reported on only one occasion (within one study). The singular reporting of these outcomes prevents any comparison of such metrics between studies. A complete list of reported outcome measures is shown in Table S3 of the Supplementary Material.

Domain mapping and reporting

Mapping of extracted outcomes onto core domains adapted from COMET taxonomy was performed to better appreciate the patterns of reporting on issues specific to perioperative care of older adults (Box 2; Mortality, Perioperative Optimisation, Geriatric Syndromes, Patient and Family/Carer Reported Outcome Measures, Postoperative Complications/ Morbidity, Inpatient and Outpatient Healthcare Usage, Care Requirements and Hospital Discharge, Economic Evaluation). This domain mapping process is shown for a representative example in Table S4 of the Supplementary Material. The number of studies with outcomes addressing each core domain is shown in Figure 4.

Healthcare resource usage (both during the acute surgical admission and during outpatient care) was commonly reported (n=62/73, 85%). Outcomes in this domain included length of stay (n=54/73, 74%), hospital re-admissions (n=33/74, 45%), time to surgery from presentation (n=22/73, 30%), number of referrals/ assessments by external medical specialties (n=6/73, 8%), intensive care unit admissions (n=6/73, 8%), emergency department attendances following discharge (n=5, 7%), and postoperative inpatient/ bed-based rehabilitation (n=4/73, 5%).

After healthcare resource usage metrics, the next most common domains were postoperative complications/ morbidity (n=51/73, 70%) and mortality (n=47/73, 64%). Many different postoperative complications were prioritised across different studies, including cardiovascular events (e.g., acute coronary syndromes/ arrhythmias/ cardiac failure, n=19/73, 26%), respiratory issues (e.g., infection/ pulmonary congestion/ exacerbation of chronic airways disease, n=18/73, 25%) and renal derangement (acute kidney injury, n=14/73, 19%). Fifteen studies reported a summative total of postoperative complications in addition to specific pathologies.

All included studies delivered multidomain CGA with oversight from a consultant geriatrician or specialist nurse; as a result, measures relating to common postoperative geriatric syndromes and assessment of patient mobility/ cognition/ functional status were commonplace (n=46/73, 63%). Delirium was the most frequently reported geriatric syndrome (n=26/73, 26%), followed by inpatient falls (n=12/73, 16%) and pressure-associated skin damage (n=11/73, 15%). Postoperative mobility and ambulation were reported using a variety of outcome measures. These included the proportion of patients independent in ambulation/ transfers postoperatively (n=5/73, 7%), the requirement for a new walking aid postoperatively (n=3/73, 4%), Timed-Up-And-Go (TUAG, n=2/73, 3%), Short Physical Performance Battery (SPPB, n=3/73, 4%), and the number of days from surgery to ambulation (n=2/73, 3%).

Similarly, the assessment of functional status varied between studies. Several batteries providing quantitation of activities-of-daily-living were reported, including the Instrumental Activities-of-Daily-Living scale (IADL scale, n=4/73, 5%), the Chinese Barthel Index score (CBI score, n=4/73, 5%) and the Katz Activities-of-Daily-Living index (Katz ADL index, n=3/73, 4%). More commonly, studies simply reported whether a patient's requirement for carer support had changed at the point of discharge compared with admission (n=9/73, 12%). Notably, this outcome measure overlapped with another of our core domains focusing on patient care requirements and hospital discharge, a key consideration for hospitalised older adults. This domain was reported in 32 of our 73 included studies (44%) and included additional measures such as the patient's discharge destination after acute hospitalisation (n=26/73, 36%) and the prevalence of delays in discharge from the hospital (n=4/73, 5%).

Cognition was assessed less frequently than mobility and functional status, with the Mini-Mental State Exam (MMSE, n=5/73, 7%), the Clinical Dementia Rating Scale (n=2/73, 3%), the Informant-Questionnaire-on-Cognitive-Decline-in-the-El-

derly (IQCODE, n=1/73, 1%), and the Consortium-to-Establish-a-Registry-for-Alzheimer's-Disease (CERAD) 10-Words-Test (n=1/73, 1%) all reported.

Outcomes examining the role of the geriatric medicine team in perioperative optimisation were reported in 21 of our 73 included studies (29%). These outcomes related to the management of several comorbid medical conditions including osteoporosis (n=5/73, 7%), depression (n=1/73, 1%), anaemia (n=1/73, 1%) and secondary prevention of atherosclerotic disease (n=1/73, 1%). One study also reported on medication rationalisation following geriatric assessment. Shared decision-making discussions were occasionally reported, with a particular focus on the decision to proceed with surgical or non-surgical management (n=5/73, 7%).

The least commonly used outcome domains were patient and caregiver-reported outcome measures (n=6/73, 8%), and economic evaluation (n=8/73, 11%). Of the small number of studies with patient-reported outcome measures (PROMS) and quality-of-life metrics, the SF-36 health survey was most frequently used (n=4/73, 5%) followed by EQ-5D instruments (n=3/73, 4%). Only one study included outcome measures specifically relating to caregivers/ family members (42-Item Agitation Management Self-Efficacy Scale for caregivers/ 17-Item Chinese-Version Caregiver Competence Scale). Of the studies which described the cost-effectiveness of implementing a perioperative CGA service, most reported on the per-patient cost of the inpatient hospital stay (n=5/73, 7%). Quality-adjusted-life-years (QALYs) were also calculated in two studies, with one reporting the incremental net QALY benefit of CGA compared to standard care, and the other describing the difference in mean QALYs relative to the difference in mean cost.

The median number of core outcome domains utilised per study was four (interquartile range three – five).

Box 1: Inclusion and Exclusion Criteria for Screening of Titles, Abstracts and Full Texts.

Inclusion Criteria:

- English language.
- Published after the year 2000 until date of search (26/04/2023).
- Participants underwent a surgical procedure, including adults >/= 65 years old.
- Sample of at least 100 participants.
- Intervention delivered by a team including a consultant geriatrician or geriatric specialist nurse.
- Intervention involved multi-domain assessment and the implementation of targeted interventions in the perioperative period based on the components of CGA.
- Intervention directly compared to routine pre- or post-operative surgical care.
- Studies followed an experimental or quasi-experimental design. (Randomised control trials, Cohort studies, Case-control studies, Case series, Cross-sectional studies, Quality improvement projects).

Exclusion Criteria:

- Case reports/ editorials/ conference abstracts/ study protocols/ systematic reviews/ literature reviews/ meta-analyses.
- Feasibility studies which did not report on the effectiveness of the intervention.
- Outcome results not reported.
- Outcome measures not directly compared with standard care.
- Single domain intervention employed, rather than multi-domain assessment.
- Use of components of CGA only as a screening tool or for risk stratification/ prediction of post-surgical outcomes.

Box 2: Domains for outcome categorisation of studies evaluating CGA-based Perioperative Medicine, adapted from the COMET Initiative taxonomy. The associated COMET core area is shown in italics alongside each proposed domain.

1. Mortality *(Death)*
   - Outcomes relating to patient death during study period.
2. Perioperative Optimisation *(Life Impact)*
   - Outcomes reporting on the identification and development of an optimisation strategy for patient co-morbidities/ general health, including health promotion.
   - Outcomes relating to shared decision-making and advance care planning in the perioperative period.
3. Geriatric Syndromes *(Life Impact)*
   - Outcomes reporting on the prevention, identification and management of key geriatric syndromes including falls, delirium/ cognitive issues, incontinence, pressure ulcers and functional decline.
   - Includes outcomes reporting on mobility, nutrition, and functional status.
4. Patient and Family/ Carer Reported Outcome Measures *(Life Impact)*
   - Outcomes relating to patient and family/ carer quality-of-life, as well as their experiences throughout the perioperative pathway.
5. Postoperative Complications/ Morbidity *(Adverse Events)*
   - Outcomes reporting on the identification and management of common postoperative complications (both medical and surgical).
6. Inpatient and Outpatient Healthcare Usage *(Resource Usage)*
   - Outcomes relating to the impact on hospital pathways/ processes and utilisation of healthcare staff time/ facilities/ consumables.
   - Includes outcomes assessing usage of other services within the hospital (i.e., other medical specialities, allied health professionals etc).
7. Care Requirements and Hospital Discharge *(Resource Usage)*
   - Outcomes reporting on alterations in the patient's living arrangement before and after surgery, or delays in arranging hospital discharge.
8. Economic Evaluation *(Resource Usage)*
   - Outcomes evaluating the costs associated with implementing the intervention.

Table 1: Table showing the most frequently reported outcome measures across included studies, following the standardisation of terminology. Values show the number of studies reporting each metric.

Outcome measure	Frequency (n=73)
Length of stay	54
Mortality	47
In-hospital mortality	31
1-year mortality	21
1-month mortality	19
Hospital re-admission after discharge	33
Complications – delirium	26
Discharge destination after acute hospitalisation	26
Time to surgery	22
Complications – Cardiovascular	19
Complications – Respiratory	18
Complications – Total (undifferentiated)	15
Complications – Renal/Acute Kidney Injury (AKI)	14
Complications – Falls	12
Complications – Urinary Tract Infection (UTI)	11
Complications – Pressure ulcer	11
Complications – Haematological/Anaemia/Bleeding	10
Complications – Venous Thromboembolism (VTE)	10

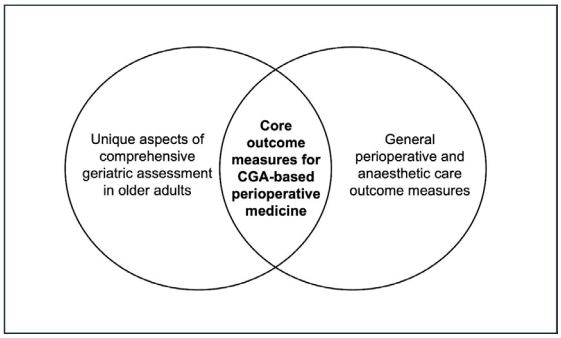

Figure 1: Venn diagram demonstrating the need for a dedicated core outcome set for studies evaluating perioperative Comprehensive Geriatric Assessment (CGA), which integrates the outcome measures used to establish the efficacy of CGA in other healthcare settings [13], with previously published core outcomes for general perioperative/ anaesthetic care [12].

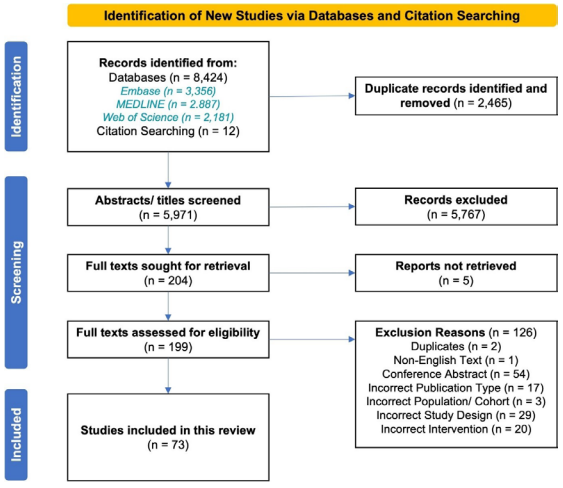

Figure 2: PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram summarising the identification and screening of articles.

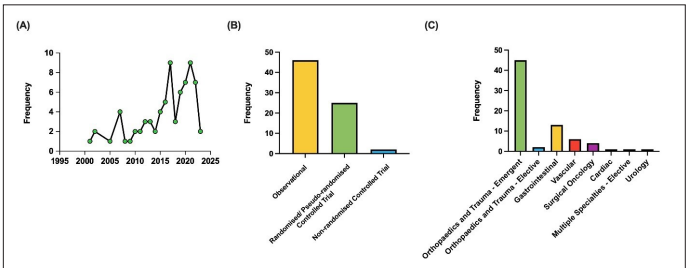

Figure 3: Summary statistics detailing features of eligible studies included in analysis. **(A)** Line graph showing the frequency of studies published in each year between 2001 and 2023 (only studies published before the search date in April 2023 are included). **(B)** Bar graph showing the frequency of controlled clinical trials and observational studies included in the analysis. **(C)** Bar graph showing the frequency of studies reporting on different surgical specialties. Orthopaedic and trauma surgery has been divided according to emergency and elective procedures.

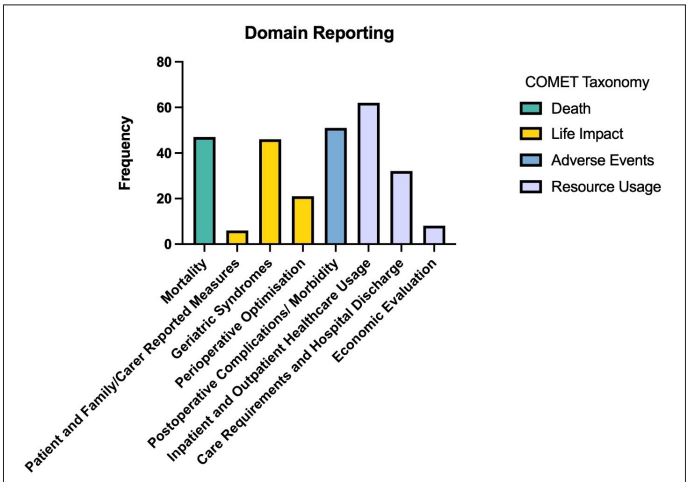

Figure 4: Bar graph showing the reporting frequency of our core outcome domains across included studies. Outcome domains are defined according to our categorisation system described in Box 2. The colour of each bar denotes the associated COMET taxonomy core area for outcome categorisation including death (green), life impact (yellow), adverse events (blue), and resource usage (lilac).

Discussion

We identified 73 studies, reporting on 65 patient cohorts, which have evaluated the effectiveness of integrating multi-domain geriatric assessment into the surgical pathways for older adults undergoing elective and emergency surgery. We have collated the 165 unique outcome measures prioritised by previous research groups, providing an informative overview of those metrics which have historically been deemed most relevant to studies of CGA-based perioperative medicine. Moreover, by mapping these outcomes into core domains, we have identified several important trends in the existing literature. First, the role of geriatric assessment in surgical care has been most widely studied in orthopaedic surgical populations, which is unsurprising given the prevalence of frailty and multi-morbidity in this group of patients [21,22]. While colorectal and vascular surgery patients have also been included in several studies, the relative proportion of studies remains low. Second, patient-reported outcome measures are described infrequently when compared to clinician-reported, quantitative measures. This is despite the reported importance of quality-of-life metrics for both older adults receiving acute care [23,24], and for healthcare staff working within geriatric medicine [25,26]. Similarly, few studies consider the health economics of implementing a new perioperative medicine service, and those that report cost-

effectiveness use disparate reporting measures.

There is also a lack of consensus in the literature regarding the scoring systems that should be used to assess key CGA domains such as mobility, functional status, and cognition. Additionally, reporting on the role of CGA in optimising co-morbid medical issues and the resultant effect on an individual's overall health is often neglected when compared with metrics relating directly to the presenting surgical pathology, such as mortality and in-hospital complications. This may account for some of the difficulties encountered by previous centres in demonstrating the clinical effectiveness of perioperative CGA [8].

This review offers key insights into the heterogeneity which exists in the patient populations and outcome measures used to evaluate CGA-based perioperative medicine services. There are also several limitations to this review. No assessment of study quality was performed, in keeping with our scoping review methodology. Additionally, no synthesis of evidence on the effectiveness of CGA-based services across specialties was conducted. Similarly, this review does not report on variations in how CGA was delivered at different centres, which could be a beneficial output for understanding the divergent ability of hospital services to implement perioperative CGA. Finally, standardisation of study terminology to allow more effective comparisons between studies, and a more succinct synopsis of the published evidence, will have invariably led to the loss of some more subtle distinctions between chosen outcome measures [19].

The results of this scoping review and outcome mapping will inform the development of a standardised core outcome set for international use in studies of perioperative CGA-based services. Establishing this core outcome set will require further input from clinical and academic experts, patients, and the public using a modified Delphi or nominal group technique for iterative refinement.

Conclusion

In summary, this scoping review identifies 73 studies, reporting on 65 patient cohorts, utilising 165 unique outcome measures to evaluate the effectiveness of CGA-based perioperative medicine for older adults. The insights gained from collating and categorising these outcomes will now be refined with input from experts and patient groups to reach an agreed core outcome set. This will promote standardisation and enhance the validity of future studies evaluating the implementation of CGA-based perioperative services.

Declarations

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Conflicts of interest: Authors have no conflicts of interest to declare.

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Appendix S1: Deviations from study protocol.

Protocol	Deviation	Explanation
"Outcomes for the same concept measured at different time points will initially be reported as unique outcomes, however a consolidated list of outcomes including any time point measurement will also be reported"	Individual outcome measure time points not reported (except for mortality).	Given the wide heterogeneity in the time points at which outcome measures were reported, this data was omitted from the final report to allow more meaningful trends in reporting to be identified.
Box 2 – "Life Impact - Optimisation for Surgery"	Wording of core outcome domain adjusted to 'Life Impact - Perioperative Optimisation'.	Clarification of language to ensure post-operative medical optimisation is incorporated within this outcome domain.

Appendix S2: Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist.

Section	Item	Prisma-SCR Checklist Item	Reported On Page #
		TITLE	
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	2
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	2
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	2
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	2-3, Box 1
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	2
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	Supplementary Appendix S3
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	2-3
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	3
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	3
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	N/A
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	3
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	Figure 2
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	3-4, Supplementary Table S1 and S2
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	3-6
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	3-6
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	6-7
Limitations	20	Discuss the limitations of the scoping review process.	7
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	7
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	7

JBI: Joanna Briggs Institute; PRISMA-ScR: Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.
* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.
† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).
‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.
§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).
From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

Appendix S3: Search strategy employed in 3 electronic databases: Embase shown as representative example.

Embase

Ovid EMBASE(R) ALL <1946 to April 25, 2023>

Intervention – Comprehensive Geriatric Assessment

1 exp geriatric assessment/

2 (comprehensive* adj2 geriatric* assess*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]

3 CGA.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]

4 (multicomponent adj2 assess*).mp.

5 (multicomponent adj2 interv*).mp.

6 (multi-component adj2 assess*).mp.

7 (multi-component adj2 interv*).mp.

Population – Older Adults.

8 exp aging/ or exp aged/

9 older people.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]

10 older adult.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]

11 elderly care.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]

12 geriatric*.mp. or exp geriatrics/

Population – Participants undergoing Surgery.

13 exp surgery/

14 surg*.mp.

15 exp preoperative period/ or exp preoperative treatment/ or exp preoperative care/ or preoperative.mp. or exp preoperative monitoring/

16 pre-operati*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]

17 preoperati*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]

18 exp perioperative nursing/ or perioperative.mp. or exp perioperative care/ or exp perioperative period/

19 peri-operati*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]

20 perioperati*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]

21 exp postoperative complication/ or exp postoperative monitoring/ or exp postoperative period/ or exp postoperative cognitive dysfunction/ or exp postoperative delirium/ or exp postoperative care/ or exp postoperative analgesia/

22 post-operati*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]

23 postoperati*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]

24 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23

25 8 or 9 or 10 or 11 or 12

26 1 or 2 or 3 or 4 or 5 or 6 or 7

27 24 and 25 and 26

28 limit 27 to (English language and yr="2000 -Current")

Table S1: Complete list of included studies (n=73) including title, authors, and year of publication.

Article Title	Authors	Year of Publication
Efficacy of an interdisciplinary pathway in a first level trauma center orthopaedic unit: A prospective study of a cohort of elderly patients with hip fractures	G. Bano, M. Dianin, C. Biz, M. Bedogni, A. Alessi, A. Bordignon, et al.	2020
The orthogeriatric comanagement improves clinical outcomes of hip fracture in older adults	M. Baroni, R. Serra, V. Boccardi, S. Ercolani, E. Zengarini, P. Casucci, et al.	2019
Evaluation of a fall-prevention program in older people after femoral neck fracture: a one-year follow-up.	M. Berggren, M. Stenvall, B. Olofsson and Y. Gustafson	2008
Impact of the intervention of a Mobile Geriatric Assessment Team on the diagnosis of significant comorbidities in elderly patients hospitalised after a hip fracture	F. Bloch, C. Kiffel, F. Guilmineau, V. Bellamy, N. Brunetti, C. Patry, et al.	2013
Assessment of a Geriatric Hip Fracture Program: Analysis of Harmful Adverse Events Using the Global Trigger Tool.	Blood, Travis D; Deren, Matthew E; Goodman, Avi D; Hayda, Roman A; Trafton, Peter G;	2019
Evaluation and establishment of a ward-based geriatric liaison service for older urological surgical patients: Proactive care of Older People undergoing Surgery (POPS)-Urology	P. Braude, A. Goodman, T. Elias, G. Babic-Illman, B. Challacombe, D. Harari, et al.	2017
Geriatric fracture program centering age-friendly care associated with lower length of stay and lower direct costs	K. Breda, M. S. Keller, H. Gotanda, A. Beland, K. McKelvey, C. Lin, et al.	2023
Frailty Identification and Care Pathway: An Interdisciplinary Approach to Care for Older Trauma Patients	E. A. Bryant, S. Tulebaev, M. Castillo-Angeles, E. Moberg, S. S. Senglaub, L. O'Mara, et al.	2019
Characteristics and Outcomes of Hip Fracture Patients Hospitalized in an Orthogeriatric Unit Versus an Orthopedic Department: A Retrospective Cohort Study	Y. Bugaevsky, Y. Levy, A. Hershkovitz, I. Ocheretny, A. Nissenholtz, L. Cooper, et al.	2021
Integrated postoperative care model for older colorectal surgery patients improves outcomes and reduces healthcare costs	S. Cizginer, E. G. Prohl, J. F. G. Monteiro, F. Yildiz, R. N. Jones, S. Schechter, et al.	2022
Comparison of 3 Different Perioperative Care Models for Patients With Hip Fractures Within 1 Health Service	L. S. Coventry, A. Nguyen, A. Karahalios, S. Roshan-Zamir and P. Tran	2017
Establishing a perioperative medicine for older people undergoing surgery service for general surgical patients at a district general hospital	R. de Las Casas, C. Meilak, A. Whittle, J. Partridge, J. Adamek, E. Sadler, et al.	2021
Effect of an inpatient geriatric consultation team on functional outcome, mortality, institutionalization, and readmission rate in older adults with hip fracture: a controlled trial	Deschodt, Mieke; Braes, Tom; Broos, Paul; Sermon, An; Boonen, Steven; Flamaing, Johan; Milisen, Koen;	2011
Preventing Delirium in Older Adults with Recent Hip Fracture Through Multidisciplinary Geriatric Consultation	M. Deschodt, T. Braes, J. Flamaing, E. Detroyer, P. Broos, P. Haentjens, et al.	2012
Improved 1-year mortality in elderly patients with a hip fracture following integrated orthogeriatric treatment	E. C. Folbert, J. H. Hegeman, M. Vermeer, E. M. Regtuijt, D. van der Velde, H. J. Ten Duis, et al.	2017
A comparison of treatment setting for elderly patients with hip fracture, is the geriatric ward superior to conventional orthopedic hospitalization?	T. Frenkel Rutenberg, E. Daglan, S. Heller and S. Velkes	2017
Effect of Geriatric Comanagement in Older Patients Undergoing Surgery for Gastrointestinal Cancer: A Retrospective, Before-and-After Study	C. Giannotti, A. Massobrio, L. Carmisciano, A. Signori, A. Napolitano, D. Pertile, et al.	2022
The orthogeriatric unit for acute patients: a new model of care that improves efficiency in the management of patients with hip fracture.	J. I. Gonzalez-Montalvo, T. Alarcon, J. L. Mauleon, E. Gil-Garay, P. Gotor and A. Martin-Vega	2010
Geriatric intervention in elderly patients with hip fracture in an orthopedic ward	M. Gregersen, M. M. Morch, K. Hougaard and E. M. Damsgaard	2012
Proactive care of older people undergoing surgery ('POPS'): designing, embedding, evaluating and funding a comprehensive geriatric assessment service for older elective surgical patients.	Harari, D., Hopper, A., Dhesi, J., Babic-Illman, G., Lockwood, L., & Martin, F.	2007
Outcomes of a Geriatric Liaison Intervention to Prevent the Development of Postoperative Delirium in Frail Elderly Cancer Patients: Report on a Multicentre, Randomized, Controlled Trial	L. Hempenius, J. P. J. Slaets, D. van Asselt, G. H. de Bock, T. Wiggers and B. L. van Leeuwen	2013
Long Term Outcomes of a Geriatric Liaison Intervention in Frail Elderly Cancer Patients	Hempenius, Liesbeth; Slaets, Joris P J; van Asselt, Dieneke; de Bock, Truuske H; Wiggers, Theo; van Leeuwen, Barbara L;	2016
Dedicated orthogeriatric service reduces hip fracture mortality	C. Y. Henderson, E. Shanahan, A. Butler, B. Lenehan, M. O'Connor, D. Lyons, et al.	2017
Evaluation of preoperative geriatric assessment of elderly patients with colorectal carcinoma. A retrospective study	R. Indrakusuma, M. S. Dunker, J. J. Peetoom and W. H. Schreurs	2015
Clinical Outcomes of Perioperative Geriatric Intervention in the Elderly Undergoing Hip Fracture Surgery	Jang, I Y; Lee, Y S; Jung, H W; Chang, J S; Kim, J J; Kim, H J; Lee, E;	2016
Clinical Effectiveness of the Elder-Friendly Approaches to the Surgical Environment Initiative in Emergency General Surgery	R. G. Khadaroo, L. M. Warkentin, A. S. Wagg, R. S. Padwal, F. Clement, X. Wang, et al.	2020
Impact of an orthogeriatric collaborative care model for older adults with hip fracture in a community hospital setting	J. C. Lee, K. Koo, E. K. C. Wong, R. Naqvi and C. L. Wong	2020
An Orthogeriatric Collaborative Intervention Program for Fragility Fractures: A Retrospective Cohort Study	A. H.-C. Leung, T.-P. Lam, W.-H. Cheung, T. Chan, P.-C. Sze, T. Lau, et al.	2011

Postoperative delirium in old patients with femoral neck fracture: a randomized intervention study	M. Lundstrom, B. Olofsson, M. Stenvall, S. Karlsson, L. Nyberg, U. Englund, et al.	2007
Reducing delirium after hip fracture: a randomized trial	E. R. Marcantonio, J. M. Flacker, R. J. Wright and N. M. Resnick	2001
Prospective study of surgical delay for hip fractures: impact of an orthogeriatrician and increased trauma capacity	D. Marsland and C. Chadwick	2010
Establishing a proactive geriatrician led comprehensive geriatric assessment in older emergency surgery patients: Outcomes of a pilot study.	M. C. Mason, A. L. Crees, M. R. Dean and N. Bashir	2018
Association of Integrated Care Coordination With Postsurgical Outcomes in High-Risk Older Adults The Perioperative Optimization of Senior Health (POSH) Initiative	S. R. McDonald, M. T. Heflin, H. E. Whitson, T. O. Dalton, M. E. Lidsky, P. Liu, et al.	2018
Effect of Preoperative Geriatric Evaluation on Outcomes After Elective Surgery: A Population-Based Study	D. I. McIsaac, A. Huang, C. A. Wong, D. N. Wijeysundera, G. L. Bryson and v. W. C	2017
Association of Frailty with 90-Day Postoperative Mortality & Geriatric Comanagement among Older Adults with Cancer	S. McMillan, S. J. Kim, A. L. Tin, R. J. Downey, A. J. Vickers, B. Korc-Grodzicki, et al.	2022
Improving hip fracture outcomes with integrated orthogeriatric care: a comparison between two accepted orthogeriatric models	M. Middleton, B. Wan and R. da Assuncao	2017
Quality of Care Delivered Before versus After A Quality Improvement Intervention for Acute Geriatric Trauma	L. Min, H. Cryer, C.-L. Chan, C. Roth and A. Tillou	2015
Daily Medical Liaison Is Associated with Reduced Length of Stay and Complications in Selected Patients Admitted to a Regional Vascular Surgery Service	E. Mitchell, R. Coary, P. White, E. Farrow, A. Crees, W. Beedham, et al.	2020
Effects of a geriatrician-led hip fracture program: improvements in clinical and economic outcomes	Miura LN; DiPiero AR; Homer LD;	2009
Key Service Improvements After the Introduction of an Integrated Orthogeriatric Service	R. P. Murphy, C. Reddin, E. P. Murphy, R. Waters, C. G. Murphy and M. Canavan	2019
Interdisciplinary inpatient care for elderly people with hip fracture: a randomized controlled trial	G. Naglie, C. Tansey, J. L. Kirkland, D. J. Ogilvie-Harris, A. S. Detsky, E. Etchells, et al.	2002
Effectiveness of Comanagement Model: Geriatric Medicine and Vascular Surgery	S. Natesan, J. Y. Li, K. K. Kyaw, Z. Soh, E. Yong, Q. Hong, et al.	2022
Effects of a perioperative geriatric intervention for older adults with Cancer: A randomized clinical trial	R. D. Nipp, C. L. Qian, H. P. Knight, C. R. Ferrone, H. Kunitake, C. Fernandez-del Castillo, et al.	2022
Preoperative geriatric assessment and tailored interventions in frail older patients with colorectal cancer: a randomized controlled trial	N. Ommundsen, T. B. Wyller, A. Nesbakken, A. O. Bakka, M. S. Jordhoy, E. Skovlund, et al.	2018
Time to Surgery Reduction in Hip Fracture Patients on an Integrated Orthogeriatric Unit: A Comparative Study of Three Healthcare Models	C. Pablos-Hernandez, A. Gonzalez-Ramirez, C. da Casa, M. M. Luis, M. A. Garcia-Iglesias, J. M. Julian-Enriquez, et al.	2020
Association of Preoperative Geriatric Assessment With Length of Stay After Combined Cardiac Surgery	M. Paille, T. Senage, J.-C. Roussel, T. Manigold, M. Piccoli, G. Chapelet, et al.	2021
Association of comprehensive geriatric assessment with quality-related care practices during implementation and development of an orthogeriatric hip fracture program	H. M. Pajulammi, H. K. Pihlajamaki, T. H. Luukkaala, J. J. Jousmaki and M. S. Nuotio	2017
Multimodal prehabilitation before major abdominal surgery: A retrospective study	N. Q. Pang, S. S. He, J. Q. X. Foo, N. H. Y. Koh, T. W. Yuen, M. N. Liew, et al.	2021
Randomized clinical trial of comprehensive geriatric assessment and optimization in vascular surgery	J. S. L. Partridge, D. Harari, F. C. Martin, J. L. Peacock, R. Bell, A. Mohammed, et al.	2017
Preoperative comprehensive geriatric assessment and optimisation prior to elective arterial vascular surgery: a health economic analysis	J. S. L. Partridge, A. Healey, B. Modarai, D. Harari, F. C. Martin and J. K. Dhesi	2021
Perioperative Optimization of Senior Health in Spine Surgery: Impact on Postoperative Delirium	M. N. Pernik, P. R. Deme, M. L. Nguyen, S. G. Aoun, O. Adogwa, K. Hall, et al.	2021
Comprehensive geriatric care for patients with hip fractures: a prospective, randomised, controlled trial	Prestmo A; Hagen G; Sletvold O; Helbostad JL; Thingstad P; Taraldsen K; Lydersen S; Halsteinli V; Saltnes T; Lamb SE; Johnsen LG; Saltvedt I;	2015
Patient reported outcomes in an elder-friendly surgical environment: Prospective, controlled before-after study	B. Saravana-Bawan, L. M. Warkentin, A. Ohinmaa, A. S. Wagg, J. Holroyd-Leduc, R. S. Padwal, et al.	2021
Association of Geriatric Comanagement and 90-Day Postoperative Mortality among Patients Aged 75 Years and Older with Cancer	A. Shahrokni, A. L. Tin, S. Sarraf, K. Alexander, S. Sun, S. J. Kim, et al.	2020
Comprehensive and subacute care interventions improve health-related quality of life for older patients after surgery for hip fracture: A randomised controlled trial	Y. I. L. Shyu, J. Liang, M. Y. Tseng, H. J. Li, C. C. Wu, H. S. Cheng, et al.	2013
Enhanced interdisciplinary care improves self-care ability and decreases emergency department visits for older Taiwanese patients over 2 years after hip-fracture surgery: A randomised controlled trial	Shyu YI; Liang J; Tseng MY; Li HJ; Wu CC; Cheng HS; Chou SW; Chen CY; Yang CT;	2016
A multidisciplinary, multifactorial intervention program reduces postoperative falls and injuries after femoral neck fracture	M. Stenvall, B. Olofsson, M. Lundstrom, U. Englund, B. Borssen, O. Svensson, et al.	2007

Improved performance in activities of daily living and mobility after a multidisciplinary postoperative rehabilitation in older people with femoral neck fracture: a randomized controlled trial with 1-year follow-up	M. Stenvall, B. Olofsson, L. Nyberg, M. Lundstrom and Y. Gustafson	2007
Physical behavior and function early after hip fracture surgery in patients receiving comprehensive geriatric care or orthopedic care--a randomized controlled trial	Taraldsen, Kristin; Sletvold, Olav; Thingstad, Pernille; Saltvedt, Ingvild; Granat, Malcolm H; Lydersen, Stian; Helbostad, Jorunn L;	2014
The long-term effect of being treated in a geriatric ward compared to an orthopaedic ward on six measures of free-living physical behavior 4 and 12 months after a hip fracture - a randomised controlled trial	K. Taraldsen, P. Thingstad, O. Sletvold, I. Saltvedt, S. Lydersen, M. H. Granat, et al.	2015
The long-term effect of comprehensive geriatric care on gait after hip fracture: the Trondheim Hip Fracture Trial--a randomised controlled trial	P. Thingstad, K. Taraldsen, I. Saltvedt, O. Sletvold, B. Vereijken, S. E. Lamb, et al.	2016
A daily multidisciplinary assessment of older adults undergoing elective colorectal cancer surgery is associated with reduced delirium and geriatric syndromes	F. J. Tarazona-Santabalbina, J. Llabata-Broseta, A. Belenguer-Varea, D. Alvarez-Martinez, D. Cuesta-Peredo and J. A. Avellana-Zaragoza	2019
Geriatric Comanagement of Older Vascular Surgery Inpatients Reduces Hospital-Acquired Geriatric Syndromes	J. Thillainadesan, S. J. Aitken, S. R. Monaro, J. S. Cullen, R. Kerdic, S. N. Hilmer, et al.	2022
Care of Older People in Surgery for general surgery: a single centre experience	K. Thu, H. P. T. Nguyen, T. Gogulan, M. Cox, J. Close, C. Norris, et al.	2021
A family care model for older persons with hip-fracture and cognitive impairment: A randomized controlled trial	M. Y. Tseng, C. T. Yang, J. Liang, H. L. Huang, L. M. Kuo, C. C. Wu, et al.	2021
Effects of a diabetes-specific care model for hip fractured older patients with diabetes: A randomized controlled trial	M.-Y. Tseng, J. Liang, J.-S. Wang, C.-T. Yang, C.-C. Wu, H.-S. Cheng, et al.	2019
Functional Recovery of Older Hip-Fracture Patients After Interdisciplinary Intervention Follows Three Distinct Trajectories	M.-Y. Tseng, Y.-I. L. Shyu and J. Liang	2012
Interdisciplinary intervention reduced the risk of being persistently depressive among older patients with hip fracture	M.-Y. Tseng, Y.-I. L. Shyu, J. Liang and W.-C. Tsai	2016
Fewer patients undergo surgery when adding a comprehensive geriatric assessment in older patients with a hip fracture	B. C. van der Zwaard, C. E. Stein, J. E. M. Bootsma, H. J. A. A. van Geffen, C. M. Douw and C. J. P. W. Keijsers	2020
Efficacy of a comprehensive geriatric intervention in older patients hospitalized for hip fracture: a randomized, controlled trial	Vidán M; Serra JA; Moreno C; Riquelme G; Ortiz J;	2005
Optimising Medications in Older Vascular Surgery Patients Through Geriatric Co-management	J. Wang, S. James, S. N. Hilmer, S. J. Aitken, G. Soo, V. Naganathan, et al.	2023
The effect of a pre- and postoperative orthogeriatric service on cognitive function in patients with hip fracture: randomized controlled trial (Oslo Orthogeriatric Trial)	L. O. Watne, A. C. Torbergsen, S. Conroy, K. Engedal, F. Frihagen, G. A. Hjorthaug, et al.	2014
Effectiveness of Perioperative Comprehensive Evaluation of Hip Fracture in the Elderly	Zhu, Tao; Yu, Jun; Ma, Ye; Qin, Yue; Li, Nan; Yang, Haibo;	2022

Table S2: Characteristics of all included studies (n=73), including participant number (n), study methodology, associated surgical specialty, and description of CGA-based intervention.

Title	Participant Number	Methodology	Surgical Specialty	Details of Intervention
Bano et al. 2020	224	Observational	Orthopaedics and Trauma - Emergency	Orthogeriatric interdisciplinary pathway for elderly patients with hip fractures based on CGA. A geriatric medical team was present on the orthopaedic ward during weekdays and visited the patient daily from admission to discharge. Regular meetings between geriatricians and orthopaedic surgeons were organized to discuss and plan clinical choices with continuous communication and collaboration.
Baroni et al. 2019	430	Observational	Orthopaedics and Trauma - Emergency	Orthogeriatric co-management, or geriatric consultation service, based on standardized comprehensive geriatric assessment and multidisciplinary management.
Berggren et al. 2008	199	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Postoperative multi-disciplinary, multifactorial fall prevention program performed by a geriatric team. Staff worked in teams to apply CGA with rehabilitation. Active prevention, detection and treatment of risk factors for falls such as delirium, pain and infections were systematically implemented
Bloch et al. 2013	276	Observational	Orthopaedics and Trauma - Emergency	Post-operative geriatric assessment by MGAT - mobile geriatric assessment team. Teams consisting of an experienced geriatrician and allied health professionals who make an overall assessment of elderly patients from emergency, medical and surgical departments to detect health problems that could compromise their recovery
Blood et al. 2019	540	Observational	Orthopaedics and Trauma - Emergency	Geriatric Hip Fracture Program - Team of orthopaedists as well as geriatricians who regularly evaluated all hip fractures both preoperatively and postoperatively.
Braude et al. 2017	242	Observational	Urology	Structured geriatric team intervention utilising POPS model as previously described (Harari et al. 2007)

Breda et al. 2023	1598	Observational	Orthopaedics and Trauma - Emergency	Patients managed by orthopaedic faculty surgeons and hospitalist groups to deliver care in accordance with the geriatric fracture program (GFP). GFP incorporates multidisciplinary education; evidence-based clinical protocols, including functional pain control; documentation tools; and geriatric-centred goals of care. Relies on 4M framework which uses principles of CGA.
Bryant et al. 2019	269	Observational	Orthopaedics and Trauma - Emergency	Frailty Identification and Care Pathway - Multi-component, multidisciplinary care pathway including comprehensive geriatric assessment by a consulting geriatric team
Bugaevsky et al. 2021	441	Observational	Orthopaedics and Trauma - Emergency	Management in ortho-geriatric unit where all patients undergo CGA by MDT. Patients receive tailor-made treatment plans with consideration of optimal preparation for surgery.
Cizginer et al. 2022	177	Observational	Gastro-intestinal	Optimisation of Senior Care and Recovery (OSCAR) program. Integrated care model that combines geriatrics comanagement with postoperative surgical care. A single geriatrician actively participated in post-surgical management of all colorectal surgery patients. CGA performed within 24hr of surgery followed by daily active care management until discharge.
Coventry et al. 2017	446	Observational	Orthopaedics and Trauma - Emergency	2 interventions included: 1. Geriatric model - patients with neck of femur fractures were admitted in the geriatric unit, which then assumed responsibility for all perioperative medical care needs of the patient, including overnight and weekend cover. 2. Comanaged model - geriatrician-led medical team attended to the medical care of hip fracture patients during routine hours from Monday to Friday.
De Las Casas et al. 2021	100	Observational	Gastro-intestinal	POPS model as previously described (Harari et al. 2007).
Deschodt et al. 2011	171	Non-randomised controlled trial	Orthopaedics and Trauma - Emergency	Multidisciplinary geriatric intervention - CGA, in-depth multidisciplinary evaluation, formal clinical advice and recommendations, and in-hospital follow-up upon request. Recommendations provided by geriatric liaison team, but implemented by surgical team
Deschodt et al. 2012	171	Non-randomised controlled trial	Orthopaedics and Trauma - Emergency	Multidisciplinary geriatric intervention - CGA, in-depth multidisciplinary evaluation, formal clinical advice and recommendations, and in-hospital follow-up upon request. Recommendations provided by geriatric liaison team, but implemented by surgical team.
Folbert et al. 2017	1385	Observational	Orthopaedics and Trauma - Emergency	Integrated orthogeriatric treatment model for elderly patients with a hip fracture at the Geriatric Traumatology Center (CvGT) at Ziekenhuisgroep Twente Almelo-Hengelo. Standardized multidisciplinary approach, clinical pathway, early geriatric co-management and proactive attitude to prevent complications and loss of function.
Frenkel Rutenberg et al. 2017	217	Observational	Orthopaedics and Trauma - Emergency	Admission to a geriatric ward with geriatrician-led care for surgical patients.
Giannotti et al. 2022	207	Observational	Gastro-intestinal	Geriatric co-management for older patients with GI cancer on surgical ward. Involved appointment of a fulltime geriatrician. Included daily geriatrician-led ward rounds, postoperative consultations by same geriatrician, and daily geriatrician-led board rounds.
Gonzalez-Montalvo et al. 2010	224	Pseudo-randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Management on orthogeriatric unit with joint orthopaedic/ geriatric care.
Gregersen et al. 2012	495	Observational	Orthopaedics and Trauma - Emergency	Implementation of geriatric multidisciplinary team on orthopaedic ward consisting of a geriatrician, a physiotherapist and a nurse with geriatric expertise, providing full-time geriatric and orthopaedic care during daytime on weekdays.
Harari et al. 2007	108	Observational	Orthopaedics and Trauma - Elective	The POPS team included a consultant geriatrician, nurse specialist in older people, occupational therapist, physiotherapist, and social worker (only nurse and OT being full-time). Pre-operative broad-domain assessment included Abbreviated Mental Test Score, Geriatric Depression Scale, Barthel Index, Timed Up and Go, 180-degree turn, body mass index, continence screen, orthostatic blood pressure, numeric pain score, and peak expiratory flow rates. Investigation and treatment targeted identified issues, and medical co-morbidities (e.g., hypertension, ischaemic heart disease, COPD, diabetes, anaemia) were optimised according to evidence-based practice. Management plans and goals were agreed with the patient, and disseminated within 48 h to all relevant providers, with patient copy.
Hempenius et al. 2013	260	Randomised Controlled Trial	Surgical Oncology	Multicomponent intervention involving preoperative assessment by a geriatric team and monitoring during hospital stay. Individual care plan developed by consultant geriatrician, and daily assessment by geriatric nurse
Hempenius 2016	227	Randomised Controlled Trial	Surgical Oncology	Multicomponent intervention involving preoperative assessment by a geriatric team and monitoring during hospital stay. Individual care plan developed by consultant geriatrician, and daily assessment by geriatric nurse
Henderson et al. 2017	454	Observational	Orthopaedics and Trauma - Emergency	All patients with a fragility fracture of the femoral neck received a comprehensive geriatric assessment, daily medical involvement of a geriatric team and specialized follow-up assessment of bone and vascular health
Indrakusuma et al. 2015	100	Observational	Gastro-intestinal	Geriatric Daycare Examination - CGA performed following identification of positive ISAR score. Geriatric interventions executed to preoperatively optimise the patient's condition.

Jang et al. 2016	639	Observational	Orthopaedics and Trauma - Emergency	Perioperative geriatric intervention based on results of preoperative CGA. Multi- dimensional interdisciplinary diagnostic process to determine the medical, psychological, and functional abilities of elderly people
Khadaroo et al. 2020	684	Observational	Gastro-intestinal	Elder-Friendly Approaches to the Surgical Environment (EASE) model with integration of a geriatric assessment team (geriatrician and/or geriatric specialist nurse) into the multidisciplinary health care team.
Lee et al. 2020	212	Observational	Orthopaedics and Trauma - Emergency	Orthogeriatric collaborative care model in a community hospital - All eligible patients were referred systematically to the geriatric medicine service for a CGA via a newly designed post- operative order set. Although the orthopaedic surgeon remained the most responsible physician, the geriatrician implemented care recommendations directly under this new orthogeriatric collaborative care model.
Leung et al. 2011	548	Observational	Orthopaedics and Trauma - Emergency	Orthogeriatric Collaborative Clinical Management Program - reviewed by geriatrician and ortho-geriatric specialist nurse within 48hrs of admission. Geriatric reviews were made three times a week after the initial encounter. The aim of geriatric reviews was to optimize patient condition for surgery, and to address previously undiagnosed medical problems and complications that arise during admission
Lundstrom et al. 2007	199	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Patient admitted to geriatric unit specialising in geriatric orthopaedic patients. Applied CGA, management and rehabilitation.
Marcantonio et al. 2001	126	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Underwent geriatrics consultation preoperatively or within 24 hours postoperatively. A geriatrician performed daily visits for the duration of the hospitalization and made targeted recommendations based on a structured protocol.
Marsland et al. 2010	196	Observational	Orthopaedics and Trauma - Emergency	Orthogeriatrician was employed to improve the medical optimisation of patients prior to surgery and to treat any medical complications in the postoperative period. The orthogeriatrician carried out daily ward rounds accompanied by an orthopaedic trauma nurse in order to provide continuity of care and communicated with the junior orthopaedic doctors.
Mason et al. 2018	447	Observational	Gastro-intestinal	CGA delivered by consultant geriatrician or senior registrar
McDonald et al. 2018	226	Observational	Gastro-intestinal	Perioperative Optimization of Senior Health (POSH). Referred patients were seen in the Geriatric Evaluation and Treatment Clinic for interprofessional preoperative evaluation and care coordination. The POSH preoperative assessment team included a geriatrician, geriatric resource nurse, social worker, program administrator, and nurse practitioner from the Preoperative Anaesthesia Testing clinic to complete a comprehensive preoperative geriatric evaluation. Inpatient geriatrics team collaborated with the surgical teams, assisting with the management of medications, chronic medical conditions, pain, and recognition and treatment of common postoperative complications, including delirium.
McIsaac et al. 2017	266,499	Observational	Multiple Specialties - Elective	Outpatient geriatric evaluation in the 4 months before surgery. Combined geriatric consultations and comprehensive geriatric assessments (CGAs).
McMillan et al. 2022	1687	Observational	Surgical Oncology	Preoperative and postoperative geriatric co-management. During geriatric preoperative evaluation, patients complete a geriatric assessment and meet with a registered geriatric nurse or nurse practitioner. Subsequently, a geriatrician evaluates the patient and provides various instructions on managing perioperative medications, engaging in more-vigorous physical activity, and optimizing comorbid conditions before surgery. Concerns and questions are shared with the surgery and anaesthesiology teams via e-mail. In the postoperative period, patients are seen by the Geriatrics Service during their hospital stay.
Middleton et al. 2017	1894	Observational	Orthopaedics and Trauma - Emergency	Fully integrated multidisciplinary hip fracture care pathway on a dedicated orthogeriatric ward.
Min et al. 2015	147	Observational	Orthopaedics and Trauma - Emergency	Clinical partnership between trauma surgery and geriatric medicine, to routinely request formal geriatric consultation for all trauma patients aged 65 and older requiring hospital admission. A typical geriatric consultation during this study included identifying risks unique to older patients early in the hospital course, including cognitive and functional impairment, polypharmacy, and inadequate social support for safe discharge.
Mitchell et al. 2020	375	Observational	Vascular	CGA-derived service intervention as previously described by Partridge et al. 2017
Miura et al. 2009	163	Observational	Orthopaedics and Trauma - Emergency	Hip fracture service (HFS) - interdisciplinary program with geriatrician as primary attending physician. The geriatrician evaluates all admissions to the HFS and coordinates the timing of surgery with the orthopaedic surgeon to achieve the goal of surgical repair within 24 hours after admission.
Murphy et al. 2019	285	Observational	Orthopaedics and Trauma - Emergency	Orthogeriatric Service - All new patients with a hip fracture receive a comprehensive geriatric assessment on admission. There is a constant geriatric medicine presence on the ward and the registrar plays a key role in liaising with the orthopaedic team in addition to biweekly consultant ward rounds and MDT meetings.
Naglie et al. 2002	279	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Postoperative interdisciplinary geriatric care led by consultant geriatrician

Natesan et al. 2022	483	Observational	Vascular	Geriatric comanagement services are characterized by collaboration between geriatric and surgical teams with a focus on preventing geriatric syndromes and complications. An important component of the geriatric comanagement service is the comprehensive geriatric assessment, which identifies underlying risk factors that may not be apparent during preoperative assessments by the surgical team.
Nipp et al. 2022	160	Randomised Controlled Trial	Gastro-intestinal	Perioperative Intervention for Older Patients (PERI-OP) - preoperative outpatient clinic with geriatrician and inpatient postoperative consults using principles of CGA
Ommundsen et al. 2018	122	Randomised Controlled Trial.	Gastro-intestinal	Preoperative geriatric assessment (GA) followed by a tailored intervention based on the results of the GA. No post-operative geriatrician involvement.
Pablos-Hernandez et al. 2020	2741	Observational	Orthopaedics and Trauma - Emergency	Two models used 1. Orthogeriatric unit model - shared responsibility between geriatrics and traumatology in the management of patients with hip fracture. Both are continuously taking care of and evaluating the clinical and functional status of every patient. 2. Geriatric Consultant Model (GCM) - traumatology team leading the healthcare process, and geriatrics intervene at the request of the traumatology team. GCM and OUM patients were both evaluated through comprehensive geriatric assessment.
Paille et al. 2021	407	Observational	Cardiac	CGA performed pre-operatively by geriatrician, proposing preoperative optimization using short-term and longer-term modifications.
Pajulammi et al. 2017	1644	Observational	Orthopaedics and Trauma - Emergency	Hip fracture program on orthopaedic ward with CGA delivered by interdisciplinary geriatrician-led ward rounds. Shared care responsibility. CGA only delivered when geriatrician available.
Pang et al. 2021	591	Observational	Gastro-intestinal	Management and Innovation for Longevity in Elderly Surgical patients (MILES) programme which included assessment by a specialist nurse with training in perioperative geriatric care. A physician specialising in geriatric preoperative assessment reviewed patients with 3 or more comorbidities and frail patients with 2 or more comorbidities. Preoperative optimisation plans, for blood pressure or glucose control for example, were laid out during these consultations. An assessment of frailty was also made, with documentation of the Edmonton Frail Scale, 3-Minute Nutrition Screening (3-MinNS) score,and hand grip strength
Partridge et al. 2017	176	Randomised Controlled Trial	Vascular	POPS preoperative comprehensive geriatric assessment and optimization (Harari et al. 2007).
Partridge et al. 2021	176	Randomised Controlled Trial	Vascular	POPS preoperative comprehensive geriatric assessment and optimization (Harari et al. 2007).
Pernik et al. 2021	324	Observational	Orthopaedics and Trauma - Elective	Perioperative Optimization of Senior Health Program (UTSW POSH) - preoperative CGA within 30 days of scheduled procedure followed by post-operative comanagement with geriatrics consult team
Prestmo et al. 2015	397	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Comprehensive geriatric care before and after operation. Structured, systematic interdisciplinary comprehensive geriatric assessment and care focusing on somatic health (comorbidity management, review of drug regimens, pain, nutrition, elimination, hydration, osteoporosis, and prevention of falls); mental health (depression, delirium); function (mobility, p-ADL and i-ADL) and social situation with early discharge planning.
Sarawana-Bawan et al. 2021	684	Observational	Gastro-intestinal	Elder-Friendly Approaches to the Surgical Environment (EASE) model with integration of a geriatric assessment team (geriatrician and/or geriatric specialist nurse) into the multidisciplinary health care team
Shahrokni et al. 2020	1892	Observational	Surgical Oncology	Geriatric comanagement with preoperative and postoperative care. Preoperative review based on electronic geriatric assessment leading to recommendation of interventions to optimise patient status by geriatric team. All patients seen by the geriatrics service before their operation are followed up after their operation while inpatients, with the geriatrics service in a consultative role.
Shyu et al. 2013	299	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Subacute care model consisted of geriatric consultation, a continuous rehabilitation programme, and early discharge-planning intervention. Comprehensive care model included the components of the subacute care model and health-maintenance interventions to prevent falls, consult on nutrition, and manage depression. Comprehensive geriatric assessment and medical supervision were provided to detect potential clinical problems and decrease delays before surgery. Performed by geriatric specialist nurse with further consultation/ review by consultant geriatrician as needed.
Shyu et al. 2016	299	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Subacute care model consisted of geriatric consultation, a continuous rehabilitation programme, and early discharge-planning intervention. Comprehensive care model included the components of the subacute care model and health-maintenance interventions to prevent falls, consult on nutrition, and manage depression. Comprehensive geriatric assessment and medical supervision were provided to detect potential clinical problems and decrease delays before surgery. Performed by geriatric specialist nurse with further consultation/ review by consultant geriatrician as needed.

Stenvall et al. 2007 (1)	199	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Postoperative care in a geriatric ward with a special intervention program including CGA
Stenvall et al. 2007 (2)	199	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Postoperative care in a geriatric ward with a special intervention program including CGA
Taraldsen et al. 2014	317	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Comprehensive Geriatric Care - patients treated in a geriatric ward receiving comprehensive geriatric assessment
Taraldsen et al. 2015	397	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Comprehensive Geriatric Care - patients treated in a geriatric ward receiving comprehensive geriatric assessment
Taraldsen et al, 2016	397	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Comprehensive Geriatric Care - patients treated in a geriatric ward receiving comprehensive geriatric assessment
Tarazona-Santabalbina et al. 2019	310	Observational	Gastro-intestinal	Multidisciplinary team, which included a surgeon, a geriatrician and a nursing team. The geriatrician performed a CGA and established a care plan accordingly, which was applied and monitored by the same geriatrician.
Thillainadesan et al. 2022	302	Observational	Vascular	Geriatric Comanagement of older Vascular (GeriCO-V) surgery patients. A geriatrician was included as part of the vascular surgery team and proactively performed a comprehensive geriatric assessment including routine medication review for all vascular surgery patients aged 65 years or older
Thu et al. 2021	214	Observational	Gastro-intestinal	Care of Older People in Surgery (COPS) - shared model of care between geriatricians and general surgeon. Provision of CGA to all patients under acute surgical units (ASU).
Tseng et al. 2021	152	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Family-centred care model consisting of geriatric assessment, discharge planning, in-home rehabilitation, and family caregiver-training for dementia care. CGA and medical supervision provided by geriatric consultation team.
Tseng et al. 2019	176	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Diabetes specific care model which included an interdisciplinary care component with CGA provided by geriatrician and geriatric nurse specialist.
Tseng et al. 2012	162	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Interdisciplinary program with geriatric consultation services, a continuous rehabilitation program, and discharge-planning services. Geriatric assessment/consultation was administered by a geriatrician and geriatric nurses during hospitalization, both before and after surgery in order to detect potential medical or functional problems, as well as to decrease delays before surgery. A geriatric nurse conducted a 60-min comprehensive pre- operative assessment and a 30-min postoperative assessment, whereas the geriatrician provided consultation before surgery.
Tseng et al. 2016	153	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Interdisciplinary program with geriatric consultation services, a continuous rehabilitation program, and discharge-planning services. Geriatric assessment/consultation was administered by a geriatrician and geriatric nurses during hospitalization, both before and after surgery in order to detect potential medical or functional problems, as well as to decrease delays before surgery. A geriatric nurse conducted a 60-min comprehensive pre- operative assessment and a 30-min postoperative assessment, whereas the geriatrician provided consultation before surgery.
Van Der Zwaard et al. 2020	430	Observational	Orthopaedics and Trauma - Emergency	Pre-operative CGA by geriatrician to determine psychological, social, and functional status of the patient in addition to the medical status. A treatment plan, and plan for follow-up were tailored for patients during pre-operative CGA using shared decision making involving the geriatrician, the patient, and/or their representatives, or family
Vidan et al. 2005	321	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	The intervention consisted of a complete geriatric evaluation to identify and quantify medical and psychosocial problems and functional capability, to create a comprehensive therapeutic plan. A geriatrician visited the patients daily and was responsible for medical care. Geriatric team also included a rehabilitation specialist and social worker.
Wang et al. 2023	269	Observational	Vascular	Geriatric Comanagement of older Vascular (GeriCO-V) surgery patients. A geriatrician was included as part of the vascular surgery team and proactively performed a comprehensive geriatric assessment including routine medication review for all vascular surgery patients aged 65 years or older.
Watne et al. 2014	329	Randomised Controlled Trial	Orthopaedics and Trauma - Emergency	Treatment in an acute geriatric ward with comprehensive geriatric assessment and daily inter-disciplinary meetings. All team members (geriatrician, nurse, physio- therapist and occupational therapist) were expected to assess patients during their first day on the ward.
Zhu et al. 2022	155	Observational	Orthopaedics and Trauma - Emergency	Comprehensive Evaluation and Intervention Measures for the Elderly. Geriatrician completes a geriatric comprehensive evaluation and records the evaluation form. Corresponding intervention measures undertaken for high-risk patients.

Table S3: Table showing all extracted outcome measures from included studies (n=73) following the standardisation of terminology, including the reporting frequency of each measure (n).

Outcome Measure	Frequency (n)
Length Of Stay	54
Mortality	47
Re-Admissions	33
Complications - Delirium	26
Discharge Destination	26
Time To Surgery	22
Complications - Cardiovascular	19
Complications - Respiratory	18
Complications – Total (undifferentiated)	15
Complications - Renal/ Acute Kidney injury (AKI)	14
Complications - Falls	12
Complications – UTI (Urinary Tract Infection)	11
Complications - Pressure Ulcer	11
Complications - Haematological/ Anaemia/ Bleeding	10
Complications – Venous Thromboembolism (VTE)	10
Complications - Gastrointestinal/ Constipation/ Diarrhoea	9
Functional Status - Level Of Care/ Increased Care Needs	9
Complications - Surgical Site Infection/ Wound Issue	8
Complications - All Infections	8
Requirement for Red Blood Cell (RBC) Transfusion	7
Complications - Urinary Retention/ Genitourinary	7
Complications - Total - Surgical	7
Complications - Stroke/ Neurological	6
Referrals - External Specialty Consultations	6
Transfer To ICU	6
Complications - Major	5
Emergency Department Attendances Post-Discharge	5
Complications - Clavien Dindo Grading	5
Cognitive Assessment - MMSE	5
Complications - Malnutrition	5
Costing - Hospital Stay - Per Patient	5
Decision Making - Surgical Treatment Vs Non-Surgical Treatment	5
Mobility - Independence in Ambulation/ Transfers	5
Treatment Of Comorbidities - Osteoporosis	5
Delayed Discharge	4
Complications - Pain	4
Complications - Total - Medical	4
Functional Status - IADL Score	4
Functional Status - CBI (Chinese Barthel Index)	4
Identification Of Comorbidities	4
Number Of Geriatric Consultations	4
Patients receiving Post-operative Inpatient Rehabilitation	4
Need for Re-Operation	4
Quality-of-life (QoL)/ Patient-Reported Outcomes - SF-36	4
Type Of Operation Performed	3
Mobility - Use Of Walking Aid Postoperative	3
Functional Status - Katz ADL Index	3
Complications - Sleeping Problems	3
Length Of Stay (Emergency Department)	3

Complications - Ileus/ Occlusion	3
Complications - Prolonged Catheterisation	3
Complications - Endocrine	3
Functional Status - ADL Score (Unspecified)	3
Length Of Stay (ICU)	3
Length Of Stay (Rehabilitation Unit)	3
Preoperative Medical/ Geriatric Assessment	3
Referrals - Physiotherapy	3
Time To Geriatric Assessment	3
Mobility – Short Physical Performance Battery (SPPB)	3
Complications - Comprehensive Complication Index	2
Complications - Anastomotic Leakage	2
Complications - Prosthesis Dislocation/ Subluxation	2
Complications - Fluid Balance	2
Referrals - Dieticians	2
Complications - Injuries/Fracture	2
Complications - Other	2
Complications - Total - Geriatric Syndromes	2
Functional Status - Barthel Index	2
Complications - Shock/ SIRS	2
Functional Status - Independence In performing ADLs	2
Mobility - Upright Positioning	2
Quality-of-life (QoL)/ Patient-Reported Outcomes - EQ-5D	2
Mobility – Timed-up-and-go (TUAG)	2
Operative Time	2
Optimisation - Delirium Prevention Strategies	2
Referrals - Social Worker	2
Cognitive Assessment - Clinical Dementia Rating Scale	2
Complications - Depression (GDS)	2
Functional Status – Nottingham Extended ADL Scale (NEADL)	2
Mobility - Days From Surgery To Ambulation	2
Mobility - Prolonged Immobility	2
Optimisation - Falls Assessment	2
Referrals – Occupational Therapy	2
Referrals - Speech-Language Pathologist	2
Incentive Spirometer Volume	1
Time To Medical Clearance	1
Complications - Exposure To Inappropriate Medications - Beers Criteria	1
Complications - Alcohol Withdrawal	1
Quality-of-life (QoL)/ Patient-Reported Outcomes - Visual Analog Scale (EQ-5D)	1
Cognitive Assessment - Informant-Questionnaire-on-Cognitive-Decline-in-the-Elderly (IQCODE)	1
Costing - Difference In Discounted QALYS Per Patient Over 10 Years	1
Costing - Total Hospital Charges	1
Discharge Destination - Composite Measure Of Complicated Discharge including New Care Package, Reablement, Discharge To Bed-Based Rehabilitation, Other Hospital, New Care Home Placement	1
Mobility - Gait Speed	1
Treatment Of Comorbidities - Depression	1
Delay To Adjuvant Chemotherapy Post-Surgery	1
Functional Status – Functional Independence Measure (FIM)S	1
Health Resource Usage - ED Attendances + Outpatient Clinics + Home Care Admissions	1
Administration of Parenteral Iron Therapy	1
Re-Fracture Rate	1

	Complications - Electrolyte Disorder	1
	Length Of Stay (Rehabilitation Unit + Acute Hospitals + Nursing Home)	1
	Premorbid Comorbidity - Depression (GDS)	1
	Referrals - Palliative Care	1
	Time From Surgery To Rehabilitation	1
	Treatment Of Comorbidities - Secondary Prevention Of Atherosclerotic Disease	1
	Cognitive Assessment - CERAD 10 Words Test	1
	Complications - Depression	1
	Complications - Falls Efficacy Scale International Short Form	1
	Complications - Osteosynthesis Failure	1
	Functional Status – Bristol ADL (BADL) Score	1
	Mobility - Cumulated Ambulation Score	1
	Mobility - Physiotherapy Engagement	1
	Mobility – Clinical Outcomes Variables Scale (S-COVS)	1
	Mobility - Sub-Scale Of The NEADL	1
	Nutritional Status - Weight	1
	Quality-of-life (QoL/) Patient Reported Outcomes - Malnutrition Screening Tool	1
	Referrals - Case Management	1
	Referrals - External Specialty Consultations - Transfer To Internal Medicine	1
	Referrals - Psychiatry	1
	Best Practice Adherence - Individual QI Scores	1
	Cancelled Surgery	1
	Caregiver- Reported Outcomes - 17-Item Chinese- Version Caregiver Competence Scale	1
	Caregiver-Reported Outcomes - 42-Item Agitation Management Self Efficacy Scale	1
	Cognitive Assessment - Approved Clock Drawing Test	1
	Complications - Abscess	1
	Complications - Estimated Surgical Blood Loss	1
	Complications - Minor	1
	Complications - Non-Bleeding Complications	1
	Composite Measure - Grading Of Hospital Stay - Severity Grading Defined By Age, Length Of Stay And Defined Comorbidities	1
	Composite Measure - Mortality, Mobility And Level Of Care	1
	Costing - After Discharge - Per Patient	1
	Costing - All Care - Per Patient	1
	Costing - Incremental Net Benefit (INB) Of CGA Compared To Standard Care (QALYS)	1
	Costing - Mean Daily Rate By Treated Cases	1
	Costing - Mean Daily Receipts Linked To Patient's Stay - MDRPS	1
	Costing - Nursing Home Stay - Per Patient	1
	Costing - Other Primary Health And Care Services - Per Patient	1
	Costing - Postoperative Care - Per Patient	1
	Costing - Preoperative Care - Per Patient	1
	Costing – Difference in Mean QALYS relative to Difference in Mean Cost	1
	Costing - Rehabilitation Stay - Per Patient	1
	Functional Status - Red Cross Physical Scale	1
	Identification Of Comorbidities - Comorbidities Listed On Discharge Summary	1
	Identification Of Comorbidities - Dementia	1
	Medical Emergency Team Call	1
	Mobility - Ambulation Distance	1
	Mobility - Gait Characteristics Gaitrite® / 4M Gait Test	1
	Mobility - Quadriceps Strength Of Affected Limb	1
	Mobility - Range Of Motion Of Affected Hip Joint	1
	Mobility - Review Of Physiotherapy Notes	1
	Nutritional Assessment - 18 Item Mini Nutritional Assessment (MNA)	1

	Optimisation - Medication Reconciliation	1
	Optimisation - Mental Status Assessment	1
	Optimisation - Pain Management	1
	Overall Quality-Of-Care (QOC) Score	1
	Patients With Cancer Who Underwent NACT/ Adjuvant Chemotherapy	1
	Place Of Death	1
	Quality-of-life (QoL) / Patient Reported Outcomes - SF-12	1
	Quality-of-life (QoL)/ Patient-Reported Outcomes - Visual Analog Scale	1
	Re-Admissions from Rehabilitation Unit	1
	Study Specific Outcome - Heart Rate Variability	1
	Study Specific Outcome - Probability of Following Non-Depressive, Marginally Depressive Or Persistently Depressive Trajectories Following Hospital Discharge As Determined By Change In Mean GDS Score	1
	Study Specific Outcome - Probability of Poor, Moderate Or Excellent Recovery Trajectory As Determined By Functional Status (Mean CBI Score)	1
	Treatment Of Comorbidities - Anaemia	1

Table S4: Process of domain mapping from individual outcomes shown for a representative study.

Study	Extracted Outcome Measures	Standardised Outcomes Measures	Mapped Outcome Domains
Bano et al. 2020	Length of Stay (days) Time to surgery Patients operated on within 48hr of admission. Post-operative/ in-hospital mortality Mean number of external consultations needed for each patient (mean +/- SD) Percentage of patients who did not require any [external] consultation, n (%) Discharge destination 6-month Hospital readmissions, n (%) 6-month Mortality 6-month Place of residence 6-month ADL score Percentage of patients independent in ambulation at 6 months, n (%)	Length Of Stay Time To Surgery Mortality Referrals - External Specialty Consultations Discharge Destination Re-Admissions Functional Status - Level of Care/ Increased Care Needs Functional Status - ADL Score Mobility - Independence in Ambulation/ Transfers	Inpatient and Outpatient Healthcare Usage Mortality Hospital Discharge and Care Requirements Geriatric Syndromes