TITLE PAGE

WHAT IS COMPREHENSIVE GERIATRIC ASSESSMENT (CGA)? AN UMBRELLA REVIEW.

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**INTRODUCTION**

Older people admitted for acute inpatient hospital care are at high risk of adverse events, long stays, readmission and long term care use. There is considerable evidence on assessment and co-ordination of care for older patients with complex needs using Comprehensive Geriatric Assessment (CGA) [[[1]](#endnote-1),[[2]](#endnote-2),[[3]](#endnote-3)]. However there is continued uncertainty about how to identify those who will benefit most and deliver the service that they need, wherever they are in the hospital [[[4]](#endnote-4),[[5]](#endnote-5)], and the most appropriate, cost-effective form of CGA for different settings.

**OBJECTIVES**

We aimed to provide an overview of existing systematic literature reviews. The principle objectives of this “umbrella” [[[6]](#endnote-6),[[7]](#endnote-7)] review were to define (i), characteristics of the main beneficiaries of CGA, ii) key elements of CGA, iii) principal outcome measures and to summarise iv) evidence on the cost-effectiveness of models of delivery of CGA and v) highlight gaps and weaknesses in the evidence base, across relevant inpatient clinical areas.

**METHODS**

We used the Joanna Briggs Institute Umbrella review method. The review protocol is published [[[8]](#endnote-8)].

***Inclusion criteria:*** We included systematic reviews and meta-analyses which included randomised and other controlled evaluations and case studies and described the provision of CGA in patients over 65 years old in hospital. We included reviews in which CGA was compared to usual inpatient care, or CGA / usual care in an alternative setting.

***Selection of reviews:*** Five of the authors (PM, SPC, SGP, HR, KP) worked in pairs to review titles and abstracts and then the full text papers for selection which required agreement of both reviewers. Disagreements were arbitrated by another reviewer.

***Data sources and search strategy:*** Four databases were searched: Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews and Effects (DARE), MEDLINE and EMBASE (for an example search strategy, see appendix**).**

***Search restrictions:*** We limited the search to reviews published from 2005 to February 2017. Searches were restricted by the level of evidence (systematic review and meta-analysis, or other evidence syntheses), and in English.

***Methodological quality*:** Methodological quality / biasrisk was recorded using the Joanna Briggs Institute critical appraisal checklist for Systematic Reviews and Research Syntheses [[[9]](#endnote-9)] (see appendix).

***Data collection and extraction:*** Data was extracted from the included reviews (not the primary studies included in the reviews) using the standardised JBI data extraction tool. Reviewers discussed and piloted its use. Separate evidence tables were created for the definitions and key elements of CGA, the setting and staff, the key participants, outcome measures and costs, then used to produce summary tables and develop a narrative overview of the evidence.

**RESULTS**

We screened 1010 titles and evaluated 419 abstracts for eligibility, 143 full articles were reviewed for relevance and 24 included in a final quality and relevance check. Thirteen reviews, reported in 15 papers [1, 2, 3,[[10]](#endnote-10), [[11]](#endnote-11), [[12]](#endnote-12), [[13]](#endnote-13), [[14]](#endnote-14), [[15]](#endnote-15), [[16]](#endnote-16), [[17]](#endnote-17), [[18]](#endnote-18), [[19]](#endnote-19), [[20]](#endnote-20), [[21]](#endnote-21)] were selected for review. The most recently conducted trial included in the reviews was reported in 2014, all other trials were reported between 1983 and 2012. The PRISMA flow chart is available in an appendix.

**Overlap of review evidence**: Ninety five original articles were cited 166 times. 26 original articles were cited more than once (a table of citation counts for these articles is included as an appendix). The most highly cited articles included Landefield 1995 [[[22]](#endnote-22)], Asplund 2000 [[[23]](#endnote-23)] (7 citations each) and Counsell 2000 [[[24]](#endnote-24)] (6 citations). Removing all except one of the reviews [2, 13] which cited these three most highly cited papers did not significantly affect our conclusions with regard to the population characteristics, intervention definition, settings and comparisons and clinical outcomes. Some health economics detail was lost in this sensitivity analysis.

***Population:*** All of the reviews included participants over 65 years of age. Minimum age for inclusion varied from 55+ years to 75+ years (table 1). . In most studies frailty was not explicitly identified as a characteristic of CGA recipients, however one review [23], (which included the majority of the most highly cited trials) attempted to stratify trials by frailty. Some reviews included the presence of a specific diagnosis, such as cancer or hip fracture (table 1).

***Intervention:***  The most widely used definition of CGA was: “a multidimensional, multidisciplinary process which identifies medical, social and functional needs, and the development of an integrated / co-ordinated care plan to meet those needs.” Dimensions of CGA reported consistently included Medical/Physical Psychological/Psychiatry, Socio-economic, Function, and Nutritional assessment (Table 1)

***Settings and comparisons:***

The bulk of the reviews used essentially the same body of literature extending back to 1983 to examine some aspect of CGA in the hospital setting. Reviews citing literature which was predominantly outside of this highly cited core included a review of interface care [12], gerontologically informed nursing assessment and referral [14], and multidisciplinary team interventions [21]

***Outcomes:*** The main clinical outcomes included mortality (12/13 reviews), activities of daily living (13/13), cognitive functioning (9/13) and dependency (6/13). Key operational outcomes were length of stay (11/13) and readmissions (12/13). “Destinational” outcomes included living at home (7/13) and institutionalisation (11/13). Resource use and costs were considered in 4 reviews. Patient related outcomes (such as health related quality of life, wellbeing or participation) were not usually reported.

***Health economic synthesis:*** Relatively few studies look at costs. None took a broader view to include direct costs (staff and resources), subsequent costs (such as community health and social care costs), costs to patients and wider society. Further, the multiple intervention configurations which (broadly) deliver CGA, were mostly not standardised. One exception was the review by Fox et al. (2012) [16]. After removal of one outlier study the result of meta-analysis demonstrated that the costs of acute geriatric unit care were significantly less than those of usual care (weighted mean difference was =$245.80, 95%CI = $446.23 -$45.38; P =.02) [16]. Two studies [1, 2] concluded that many of the hospital based services showed a reduction in costs associated with CGA. In a review of trials of various ACE model components, there was little cost evidence available to differentiate and compare relative effectiveness between components of the ACE model.

**DISCUSSION**

These reviews concerned the provision of comprehensive geriatric assessment in older patients who were hospital inpatients. The main target group in this context were older people with acute illness.

There was a degree of consistency between the reviews on the definition of CGA which importantly includes both assessment of needs in multiple domains, and the development of a plan to meet those needs. The most consistently reported assessment domains were medical, psychological, social and functional

The settings included dedicated inpatient wards, but also services which delivered CGA across the hospital, at the interface between acute and community care, and by nurse led and multidisciplinary teams.

Death, disability and institutionalisation were the key outcomes for recipients and reduced length of stay and readmissions were the key operational goals.

The impact of frailty as a determinant of CGA outcome was not widely examined in these reviews. The one review that attempted this concluded that for frail patients, ward based CGA may reduce institutionalisation rates.

Notably, despite CGA being a patient centred process, few studies have examined the role of patient reported outcome measures (PROMs). PROMs measure outcomes that are important to the patient such as health or quality of life and the use of PROMs may lead to CGA being re-focussed on patient’s priorities.

There has only been limited economic evaluation which suggests that CGA may save on hospital costs.

The main strength of and umbrella review is provide a broad overview in a specific topic area. The corresponding weakness may be a paucity of detail relevant to a particular service or context. Such detail is available in the primary reviews and trials that are included in the overview. While largely of good methodological quality by standard critical appraisal criteria (see appendix), most of the included reviews did not include a robust assessment of sources of bias. Further, while it has been suggested that umbrella review methodology may reduce the bias associated with excluding non-English language articles, it is not completely eliminated and remains a concern [[[25]](#endnote-25)].

More work needs to be done on targeting and identifying beneficiaries of CGA. Further trials are justified and should be stratified by frailty, use patient related outcome measures and collect sufficient economic data to determine cost effectiveness. Such trials will need careful process evaluations embedded within them in line with current research frameworks for the evaluation of complex interventions [[[26]](#endnote-26),[[27]](#endnote-27)].

**CONCLUSIONS**

As elements of CGA become increasingly embedded in general hospital care, with the development of new and emerging settings and services [[[28]](#endnote-28)], this review highlights a degree of consistency in definition, essential content, key target group and outcomes of CGA. We hope that this can be used to inform the development of hospital wide services by developing evidence based implementations and incorporating them into multi-dimensional assessment processes, which include competence in common clinical syndromes (falls, confusion, immobility, continence), multi-professional co-ordination and management.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 1. CGA description and definition and components, participants and types of admissions** | | | | | | | | | | | | | |
|  | **First Author and publication year** | | | | | | | | | | | | |
|  | Bazta’n 2009 [1] | Conroy 2011 [10] | Deschodt 2013 [3] | Ellis 2011a [2]  Ellis 2011b [11] | Fealy 2009 [12] | Fox 2012 [13]  Fox 2013 [14] | Kammerlander 2010 [15] | Linertova 2011 [16] | Tremblay 2012 [17] | Van Craen 2010 [18] | Hickman et al 2015 [19] | Ekdahl et al 2015 [20] | Pilotto et al 2017 [21] |
| **CGA Definition** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Multidimensional Multidisciplinary process – identifies medical, social and functional needs |  | ⚫ | ⚫ | ⚫ |  |  |  |  | ⚫ | ⚫ |  | ⚫ | ⚫ |
| Acute inpatient setting in which multidimensional assessment and management takes place | ⚫ |  |  |  |  | ⚫ |  |  |  |  |  | ⚫ | ⚫ |
| Consistent with a multidisciplinary approach |  |  |  |  |  |  | ⚫ | ⚫ |  |  |  |  |  |
| No clear explicit definition |  |  |  |  | ⚫ |  | ⚫ | ⚫ |  |  | ⚫ |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **CGA Description** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Provision of CGA in a dedicated acute patient environment | ⚫ |  |  |  |  | ⚫ |  |  |  |  |  |  |  |
| A specialised team working on a specialised ward, such as inpatient Geriatric Evaluation and Management Unit |  |  |  | ⚫ |  |  |  |  |  |  |  |  |  |
| Descriptions of complex care collaborations involving multidimensional assessment and management |  |  |  | ⚫ |  |  |  |  |  |  |  |  |  |
| * including both inpatient and outpatient components |  |  |  |  |  |  |  | ⚫ |  |  |  |  |  |
| * at the interface between hospital and community care |  | ⚫ |  |  |  |  |  |  |  |  |  |  |  |
| * a hospital inpatient consultant team |  |  | ⚫ |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Components of CGA** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Medical / Physical assessment | ⚫ |  |  | ⚫ |  | ⚫ | ⚫ |  |  | ⚫ | ⚫ | ⚫ |  |
| Psychological / Psychiatry assessment |  |  |  | ⚫ |  | ⚫ |  | ⚫ |  | ⚫ | ⚫ | ⚫ |  |
| Socio-economic assessment |  |  |  | ⚫ |  | ⚫ |  |  |  | ⚫ | ⚫ |  |  |
| Function assessment |  |  | ⚫ | ⚫ |  | ⚫ | ⚫ |  | ⚫ | ⚫ | ⚫ | ⚫ |  |
| Nutritional assessment |  |  |  |  |  | ⚫ |  | ⚫ |  | ⚫ |  |  |  |
| Mobility and falls assessment |  | ⚫ | ⚫ |  |  |  |  |  |  |  |  |  |  |
| Care planning |  |  |  | ⚫ |  |  |  |  |  |  |  |  |  |
| Goal setting |  |  |  |  |  | ⚫ |  |  |  |  |  |  |  |
| Treatment / rehabilitation |  |  |  | ⚫ |  | ⚫ |  |  |  |  |  |  |  |
| Discharge planning |  |  |  |  |  | ⚫ |  |  |  |  |  |  |  |
| Follow up |  |  |  | ⚫ |  |  |  |  |  | ⚫ |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Participants** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Older person |  |  |  |  |  |  |  |  | ⚫ | ⚫ |  |  |  |
| Frail older person |  | ⚫ | ⚫ | ⚫ |  |  |  |  |  |  |  |  |  |
| Frail elderly person |  |  |  | ⚫ |  |  |  |  |  |  |  |  |  |
| Age specified: |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 55+ |  |  |  |  |  |  | ⚫ |  |  |  |  |  |  |
| 60+ |  |  | ⚫ |  | ⚫ |  |  |  |  | ⚫ | ⚫ |  |  |
| 65+ | ⚫ | ⚫ |  | ⚫ |  | ⚫ |  |  |  | ⚫ | ⚫ | ⚫ |  |
| 70+ |  |  |  |  |  |  |  |  | ⚫ |  |  |  |  |
| 75+ |  |  |  |  |  |  |  | ⚫ |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Type of Admission** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Emergency | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ |  |  | ⚫ | ⚫ | ⚫ | ⚫ |
| Excluded condition specific interventions | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ |  |  |  |
| Inclusion of specific conditions |  |  |  |  |  |  |  |  |  |  |  |  |  |
| - acute illness or injury |  |  |  |  |  | ⚫ |  |  |  |  |  |  |  |
| - cancer |  |  |  |  |  |  |  |  | ⚫ |  |  |  |  |
| - hip fracture |  |  |  |  |  |  | ⚫ |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 2. Outcomes described in reviews of CGA for hospital inpatients** | | | | | | | | | | | | | |
|  | **First author and publication year** | | | | | | | | | | | | |
|  | Bazta’n 2009 | Conroy 2011 | Deschodt 2013 | Ellis 2011a  Ellis 2011b | Fealy 2009 | Fox 2012  Fox 2013 | Kammerlander 2010 | Linertova 2011 | Tremblay 2012 | Van Craen 2010 | Hickman et al 2015 | Ekdahl et al 2015 | Pilotto et al 2017 |
| **Clinical outcomes** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Mortality (includes composite outcome “death or dependence | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ |  | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ |
| Activities of Daily Living (ADL) | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ |  |  | ⚫ | ⚫ | ⚫ | ⚫ |
| Cognitive functioning (including delirium) |  | ⚫ |  | ⚫ | ⚫ | ⚫ |  |  |  |  | ⚫ | ⚫ | ⚫ |
| Dependency |  |  |  | ⚫ | ⚫ | ⚫ |  |  |  | ⚫ |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Other Psychosocial Outcomes** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Health status |  | ⚫ |  |  |  |  |  |  |  |  |  |  |  |
| Quality of life |  | ⚫ |  |  |  |  |  |  |  |  |  | ⚫ |  |
| Satisfaction |  | ⚫ |  |  |  |  |  |  |  |  |  |  |  |
| Carer strain / burden |  | ⚫ |  |  |  |  |  |  |  |  |  | ⚫ |  |
| Falls |  |  |  |  |  | ⚫ |  |  |  |  | ⚫ |  |  |
| Delirium |  |  |  |  |  | ⚫ |  |  |  |  |  |  | ⚫ |
| Iatrogenic / other complications of hospitalisation |  |  |  |  |  | ⚫ | ⚫ |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Operational outcomes** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Length of stay | ⚫ |  | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ |  |  | ⚫ | ⚫ |  | ⚫ |
| Readmission | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ | ⚫ |  | ⚫ |  | ⚫ | ⚫ | ⚫ | ⚫ |
| ED visits |  |  |  |  |  |  | ⚫ |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Destinational Outcomes** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Living at home | ⚫ |  |  | ⚫ | ⚫ | ⚫ |  |  |  | ⚫ | ⚫ | ⚫ | ⚫ |
| Institutionalisation | ⚫ | ⚫ |  | ⚫ | ⚫ | ⚫ |  |  |  | ⚫ | ⚫ | ⚫ | ⚫ |
| Poor discharge destination |  |  |  |  |  |  |  | ⚫ |  |  |  |  |  |
| Discharge destination |  |  |  |  |  | ⚫ |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Economic outcomes** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Resource use | ⚫ |  |  | ⚫ |  | ⚫ |  |  |  |  |  |  |  |
| Costs | ⚫ | ⚫ |  | ⚫ |  | ⚫ |  |  |  |  |  |  |  |

**SUPPLEMENTARY MATERIAL**

APPENDIX – Medline search strategy

|  |  |
| --- | --- |
|  |  |
| 1. | acute care.mp. |
| 2. | (sub-acute care or subacute care).mp. |
| 3. | (post-acute care or postacute care).mp. |
| 4. | (acute adj3 (bed or beds)).mp. |
| 5. | (inpatient care or "in patient care").mp. |
| 6. | acute medical unit$1.mp. |
| 7. | acute assessment unit$1.mp. |
| 8. | acute medical assessment unit$1.mp. |
| 9. | Acute Disease/ |
| 10. | (emergency adj (department\* or room$1 or ward$1)).mp. |
| 11. | exp Emergency Service, Hospital/ |
| 12. | Emergencies/ |
| 13. | "accident and emergency".mp. |
| 14. | (emergenc$ adj4 (admit$ or admission$)).mp. |
| 15. | intermediate care.mp. |
| 16. | integrated care.mp. |
| 17. | (care adj2 continuum).mp. |
| 18. | progressive care.mp. |
| 19. | or/1-18 |
| 20. | Frail Elderly/ or frail.mp. |
| 21. | geriatric assessment.mp. or Geriatric Assessment/ |
| 22. | Health Services for the Aged/ |
| 23. | (geriatric unit\* or specialist geriatric or acute geriatric).mp. |
| 24. | ((elder\* or older or geriatric\* or aged) adj3 (unit\* or specialist\* or ward\*)).mp. |
| 25. | (acute care adj3 elderly).mp. |
| 26. | geriatric\* acute care.mp. |
| 27. | (comprehensive geriatric assessment or CGA).mp. |
| 28. | ("geriatric evaluation and management" or gem).mp. |
| 29. | ((self care or selfcare) adj (ward\* or unit\*)).mp. |
| 30. | intensive home care.mp. |
| 31. | (rehabilitation adj (ward\* or unit\*)).mp. |
| 32. | (special adj (ward\* or unit\*)).mp. |
| 33. | or/20-32 |
| 34. | Needs assessment/ |
| 35. | Risk assessment/ |
| 36. | exp Diagnostic services/ |
| 37. | \*"Health services needs and demands"/ |
| 38. | exp Health services/ |
| 39. | exp "Delivery of health care"/ |
| 40. | exp "Outcome and process assessment (health care)"/ |
| 41. | single assessment process.mp. |
| 42. | (function\* adj2 assess\*).mp. |
| 43. | exp Rehabilitation/ |
| 44. | rehabilitat\*.mp. |
| 45. | exp Physical Therapy Modalities/ |
| 46. | physiotherap\*.mp. |
| 47. | physical therap\*.mp. |
| 48. | occupational therap\*.mp. |
| 49. | OT.mp. |
| 50. | or/34-49 |
| 51. | geriatrics/ |
| 52. | 50 and 51 |
| 53. | (geriatric adj2 consultation).mp. |
| 54. | (geriatric adj2 evaluation).mp. |
| 55. | 33 or 52 or 53 or 54 |
| 56. | activities of daily living.mp. or "Activities of Daily Living"/ |
| 57. | cost$1.mp. or exp "Costs and Cost Analysis"/ |
| 58. | cost benefit.mp. or exp Cost-Benefit Analysis/ |
| 59. | cost effectiveness.mp. |
| 60. | mortality.mp. or exp Mortality/ |
| 61. | health status.mp. or exp Health Status/ |
| 62. | length of stay.mp. or "Length of Stay"/ |
| 63. | LOS.mp. |
| 64. | discharge.mp. or Patient Discharge/ |
| 65. | Patient Readmission/ or readmission$.mp. |
| 66. | (admission$ adj3 hospital$).mp. |
| 67. | ((Readmission$ or Re admission$) adj3 hospital$).mp. |
| 68. | ((Readmit$ adj3 hospital$) or (Re admit$ adj3 hospital$)).mp. |
| 69. | ((avoid$ adj3 admission$) or (avoid$ adj3 readmission$)).mp. |
| 70. | (bed block$ or bedblock$).mp. |
| 71. | ("use" adj3 (bed or beds)).mp. |
| 72. | (bed adj3 occupancy).mp. |
| 73. | quality of life.mp. or exp "Quality of Life"/ |
| 74. | satisfaction.mp. or Personal Satisfaction/ |
| 75. | carer strain.mp. |
| 76. | carer burden.mp. |
| 77. | Caregivers/px [Psychology] |
| 78. | fall$1.mp. |
| 79. | Accidental Falls/ |
| 80. | (delirium or delirious).mp. |
| 81. | (confusion or confused).mp. |
| 82. | exp Confusion/ |
| 83. | decubitus ulcer\*.mp. |
| 84. | (pressure sore\* or pressure ulcer\*).mp. |
| 85. | (bedsore\* or bed sore\*).mp. |
| 86. | Pressure Ulcer/ |
| 87. | functional status.mp. |
| 88. | function\*.mp. |
| 89. | (cognit\* or affect\*).mp. |
| 90. | exp Cognition/ |
| 91. | exp Affect/ |
| 92. | exp Cognition Disorders/ |
| 93. | (reduct\* adj2 (medication\* or drug\* or medicine\*)).mp. |
| 94. | ((reduc\* or difficulty\*) adj2 (mobility or ambulat$)).mp. |
| 95. | Mobility Limitation/ |
| 96. | exp Urination Disorder/ |
| 97. | exp Urinary Tract Infections/ |
| 98. | (urinary tract\* adj3 (catheter\* or infect\* or complicat\*)).mp. |
| 99. | exp Urinary Catheterization/ |
| 100. | UTI.mp. |
| 101. | LUTS.mp. |
| 102. | ((reduc\* or decreas\*) adj2 (nurs\* or hospital\*)).mp. |
| 103. | "hospital at home".mp. |
| 104. | "hospital in the home".mp. |
| 105. | or/56-104 |
| 106. | 19 and 55 and 105 |
| 107. | limit 106 to (english language and yr="2010 - 2015") |
| 108. | limit 107 to (meta analysis or systematic reviews) |

APPENDIX. Umbrella Review Flow Diagram

Abstracts excluded   
(n = 276)

Abstracts screened   
(n =419)

Titles excluded   
(n = 591)

Titles screened   
(n =1010)

Records after duplicates removed   
(n =1010 )

Additional records identified through other sources   
(n =1)

Records identified through database searching   
(n = 1132)

Identification

Screening

Full-text articles excluded   
(n = 119)

Full-text articles assessed for eligibility   
(n = 143­­)

**Eligibility**

Articles included in final quality and relevance screen   
(n = 24)

Articles excluded   
(n = 12)

Articles included in final data extraction   
(n =15)

Included

***PRISMA flowchart detailing identification and selection of research syntheses***

***for inclusion in the JBI Umbrella Review.***

APPENDIX : Results of critical appraisal tool for included reviews:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Questions (Answer Y = yes, U = unclear) | Bazta’n 2009 | Conroy 2011 | Deschodt 2013 | Ellis 2011a  Ellis 2011b | Fealy et al 2009 | Fox et a 2012 | Fox et al 2013 | Kammerlander 2010 | Linertova 2011 | Tremblay et al 2012 | Van Craen et al 2010 | Hickman et al 2015 | Ekdahl et al 2015 | Pilotto et al 2017 |
| 1 | Is the review question clearly and explicitly stated? | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** |
| 2 | Were the inclusion criteria appropriate for the review question? | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **N Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** |
| 3 | Was the search strategy appropriate? | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **U U** | **Y U** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** |
| 4 | Were the sources and resources used to search for studies adequate? | **Y Y** | **Y Y** | **N Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y U** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y U** |
| 5 | Were the criteria for appraising studies appropriate? | **Y Y** | **Y Y** | **Y Y** | **U Y** | **Y Y** | **Y Y** | **U U** | **N U** | **U Y** | **Y Y** | **Y Y** | **U U** | **Y Y** | **U U** |
| 6 | Was critical appraisal conducted by two or more reviewers independently? | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **U U** | **Y Y** | **Y Y** | **Y Y** | **Y U** | **Y Y** | **U U** |
| 7 | Were there methods to minimize errors in data extraction? | **U U** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **U N** | **Y Y** | **Y Y** | **Y U** | **Y Y** | **U U** |
| 8 | Were the methods used to combine studies appropriate? | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **U U** | **Y Y** | **Y Y** | **Y Y** | **U U** |
| 9 | Was the likelihood of publication bias assessed? | **N Y** | **Y Y** | **Y Y** | **Y Y** | **N Y** | **U U** | **Y Y** | **U U** | **U N** | **U U** | **U N** | **U U** | **Y Y** | **U U** |
| 10 | Were recommendations for policy and/or practice supported by the reported data? | **Y U** | **Y Y** | **U Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y U** | **Y Y** | **N U** | **Y NA** | **Y Y** | **U Y** | **Y Y** |
| 11 | Were the specific directives for new research appropriate? | **Y Y** | **Y Y** | **Y Y** | **NA Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **U Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** | **Y Y** |
| 12 | Final Relevance Check: Is the main focus of this systematic review: - CGA(C)/Inpatient hospital care (I) both (B)? | **I I** | **B B** | **B B** | **B B** | **B B** | **I I** | **B B** | **B B** | **I I** | **B B** | **B B** | **B B** | **B B** | **B B** |
| Numerical scores (Number of Yes answers out of 11 – average of the 2 reviewers scores) | | **9** | **11** | **10** | **10** | **10.5** | **10** | **9** | **6** | **8** | **8** | **9.5** | **8** | **10.5** | **5.5** |
|  | | | | | | | | | | | | | | | |

APPENDIX. Source trials/evaluations which were cited twice or more.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Cited articles** | **First author and publication year** | | | | | | | | | | | | | **Citation**  **Count** |
| Conroy 2011 | Fealy 2009 | Pilotto 2017 | Ekdahl 2015 | Ellis 2011a , 2011b | Linertova 2011 | Van Craen 2010 | Fox 2012, 2013 | Bazta’n 2009 | Deschodt 2013 | Tremblay 2012 | Kammerlander 2010 | Hickman 2015 |
| Landefield 1995 |  |  | ⚫ |  |  |  |  |  |  |  |  |  |  | 7 |
| Asplund 2000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 7 |
| Counsell 2000 |  |  |  |  |  |  |  |  |  |  |  |  |  | 6 |
| Collard 1985 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 |
| Cohen 2002 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 |
| Harris 1991 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 |
| Thomas 1993 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 |
| Reuben 1995 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 |
| Fretwell 1990 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| Applegate 1990 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| Rubentein 1984 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| Saltvedt 2002 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| McVey 1989 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| Naughton 1994 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| Kircher 2007 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| Winograd 1993 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| Barnes 2012 |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 |
| Stenvall 2007 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |
| Nicholaus 1999 ESD |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |
| Powell 1990 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |
| Hogan 1987 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |
| Nicholaus 1999 Ward |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |
| Trappes Lomax 2006 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |
| Shyu 2008 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |
| Vidan 2005 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |
| Shyu 2005 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |

\* Articles citing literature outside of this highly cited core included a review of interface care [Conroy 2011](Close 1999, Close 1999, McCusker 2003, Mion 2003, Caplan 2004, Davison 2005), gerontologically informed nursing assessment and referral [Fealy 2009] (McCusker 2003, Mion 2003, Caplan 2004, Miller 1996, Gagnon 1999, McCusker 2001, Guttman 2004, Basic 2005., Hegney 2006), and multidisciplinary team interventions [Hickman 2015]( Huang 2005, Vidan 2005, Pitkälä 2006, Legrain 2011, Couirntey 2012b, Courtney 2012a, Dalleur 2014).

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