

New Horizons in Comprehensive Geriatric Assessment

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ABSTRACT

In this article we discuss the emergence of new models for delivery of comprehensive geriatric assessment (CGA) in the acute hospital setting.

CGA is the core technology of Geriatric Medicine and for hospital inpatients it improves key outcomes such as survival, time spent at home, and institutionalisation. Traditionally It is delivered by specialised multi-disciplinary teams, often in dedicated wards, but in recent years has begun to be taken up and developed quite early in the admission process (at the “front door”), across traditional ward boundaries and in specialty settings such as surgical and pre-operative care, and oncology.

We have scanned recent literature, including observational studies of service evaluations, and service descriptions presented as abstracts of conference presentations to provide an overview of an emerging landscape of innovation and development in CGA services for hospital inpatients.

INTRODUCTION

Comprehensive Geriatric Assessment (CGA) is defined as “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.” [1].

The origins of CGA can be traced to the foundational literature of the specialty of Geriatric Medicine in the UK in the 1940s [2]. Subsequent development was reported in randomised controlled trials (RCTs) in the 1980s and in meta analyses reported in the 1990s and maintained until the present day [1, 3, 4].

This “Technology of Geriatrics” is no longer new [5] and it has acquired the status among geriatricians of proven, effective, and an essential component of the assessment and management for older patients in hospital and community settings.

CGA is usually delivered by a multidisciplinary team, sometimes working in a specific ward environment, but often as part of a mobile or peripatetic consultation service [1]. CGA Teams may use specific assessment tools and protocols to aid the assessment process, and usually meet regularly to discuss and co-ordinate the assessment and (crucially) the associated treatment goals and management plans [1].

When compared to “usual care” in randomised controlled trials in hospital settings, CGA has been shown to have positive effects on key personal and operational outcomes. The CGA process

increases the likelihood of being alive and living at home, avoiding institutionalisation, death and deterioration [1], in relation to an episode of inpatient hospital care.

The participants in the trials that established the effectiveness of CGA were mostly older people, defined by the norms of the era and location in which the trials were performed. Some may find it surprising that participants in these trials could be as young as 50, with the majority of participants being described as in the “60+” and “65+” age ranges [6].

CGA for hospital inpatients

As a consequence of demographic change and improved health in old age, older people are becoming the predominant users of inpatient hospital services. Older people admitted to hospital are at high risk of complications and adverse outcomes. These patients often have complex needs, with multiple co-morbidities and present with characteristic clinical syndromes associated with frailty including frailty itself, falls, loss of mobility, confusion and incontinence [7, 8, 9, 10, 11]

There is considerable evidence on how to assess and co-ordinate care for patients with these clinical problems using CGA. The principles of CGA have been applied in the development of specialised inpatient settings for a variety of clinical problems which are common in old age [1, 12, 13,]. For example many hospitals have specific ward based services which provide in-hospital CGA, often referred to in the literature as “Geriatric Evaluation and Management Units”. These are ward based service in which a multidisciplinary team provides a multidimensional assessment and develops a management plan in collaboration with the patient and carers, which incorporates rehabilitation, discharge planning and co-ordination and follow up in a package which is personalised for the individual. This model is also seen in specialised care environments, such as Orthogeriatric and Stroke Units, the models for which grew out of the principles of comprehensive assessment and multidisciplinary care that underpin the CGA process [14, 15].

However, outside of these specialised clinical areas, CGA has been less available and understood in the wider hospital setting. This may relate to uncertainty about how to identify and target suitable recipients. The clinical trials which showed the effectiveness of the process did not always stratify participants with respect to detail which would be considered important today – like the presence or absence of specific clinical syndromes, or the presence or severity of frailty. Moreover they were not focused on identifying solutions applicable to the whole hospital [16], for example by providing CGA at the front door [17, 18], or the most appropriate and cost-effective forms of delivery for different settings.

So while a compelling argument can be made for the effectiveness of CGA [1, 19], the question of its potential beyond specialised inpatient services remains open.

Population ageing is progressing, so that older people are becoming the majority consumers of inpatient hospital services. In this context there is a clear need for the hospital of the future to provide services structured around the needs of patients [20]. Any coherent vision of a hospital fit for the future must of course include making hospitals “good places for old people” [21, 22].

It is possible that optimisation of inpatient care could include the provision of CGA by hospital inpatient services so that all hospital in-patients with the potential to benefit from the process would receive timely and effective CGA to shape the clinical decision making process so that it meets their complex needs. For those undergoing elective surgery, CGA might be incorporated into the pre-operative care pathway [23, 24] to ensure that decision-making around the procedure itself, as well as post-operative rehabilitation, might be optimised in a way that might improve outcomes, minimise length of stay, and facilitate recovery

To achieve a vision of timely and effective use of CGA on a hospital wide basis will require the development of new and innovative service models.

Current evidence and practice

There is emerging evidence that new and innovative service models are indeed developing. Many hospitals are now responding to the needs of their older patients with services that deliver CGA in ways that have not previously been commonplace, and (as a consequence) have not yet been extensively evaluated. For example, a recent benchmarking survey conducted in the UK in 49 services in acute settings [25] showed that 34% of trusts had developed enhanced teams with geriatricians working in the Emergency Department and 42% of trusts had developed frailty units. In short and intermediate term hospital-based assessment units, about half were using CGA, with 25-44% having a dedicated geriatric team. In this survey it was found that recognised assessment tools and pathways for frailty were present in most (59%) of the local health and social care economies.

Emerging models of care

This article draws on 2 sources of literature review conducted as part of a NIHR funded research project on Hospital Wide CGA (26). We carried out an umbrella review (of existing systematic reviews) on how best to deliver CGA on a hospital wide basis. The protocol for the review is published [27] and its findings are presented elsewhere [6]. This umbrella review identified 15 relevant existing literature reviews and their component randomised controlled trials, published between 2005 and the end of 2016.

To provide information about the development of new and emerging service models of relevance to clinical practice, the search strategies used in the umbrella review were used to retrieve recent trials and other study types, published in journal articles or presented as abstracts at international meetings. These searches were performed in Medline, Embase and CENTRAL, the Cochrane Trials Register and included reports published up until the end of 2015.

The studies that we found were mostly observational in nature and many of them are only currently published in abstract form. They included descriptive evaluations of new types of services and emerging evidence of new service models some of which are, as yet, barely evaluated. The examples of new and emerging models for the delivery of CGA which were uncovered by this process are categorised and shown in Table 1.

Here we will expand and discuss each of the emerging service types outlined in the table.

Ward based acute care

Features of the Acute Care for Elders (ACE) unit, the acute geriatric ward, and the acute frailty unit appear very similar, in that they deliver CGA in a dedicated environment, in an acute care setting. The ACE unit concept is the most thoroughly evaluated in randomised controlled trials and has been the subject of meta-analysis [28]. Recent ACE unit evaluations have focused on specific aspects, such as evaluating a delirium protocol in the ACE unit setting, or health economic analysis of existing trials (see table 2). Ward based systems to deliver CGA in acute care are therefore not an entirely new concept. However the concept is being refined and developed to deliver CGA very close to the point of presentation of acute care need, including providing CGA in acute medical units, and in relation to ward based high dependency care.

Ward based acute care evaluations have reported positive outcomes such as reduced length of stay, reduced costs, reduced incidence of delirium, reduced mortality and reduced readmissions. Though some studies suggested improved functional status at discharge, this was not observed at longer term follow up

ED based acute care

Delivering CGA close to the point of presentation with acute illness, in the emergency department itself has been an area of intense interest in recent years. This can be achieved in a number of ways, essentially by enhancing the Emergency Department (ED) team and sometimes the environment, to provide CGA. Team enhancements include placing specially trained nursing staff (Advanced Nurse Practitioners) in the ED to identify and assess older people, bringing the older peoples medicine team into the assessment process either during or after an ED attendance and embedding a CGA

service and the associated multidisciplinary team in the ED, with or without the creation of a dedicated physical environment for patients requiring CGA in the ED setting.

Studies have indicated ED based CGA may reduce admission to acute wards and to ICU, increase referrals to Palliative and hospice care, increase patient satisfaction, and slow the decrease in functional status.

TABLE 1. New and emerging models of hospital wide CGA services identified in recently reported journal articles and conference abstracts.

PRACTICE EXAMPLES AND SETTING	JOURNAL ARTICLES	CONFERENCE ABSTRACTS *
<i>Ward based acute care</i>		
ACE unit (and components) Acute Geriatric Ward Acute medical unit for older people Ward based care programme CGA in acute medical units Daily board round High dependency care Delirium assessment CGA plus dental health assessment	Barnes 2012 [29] Allen 2011 [30] Flood 2013 [31] Ahmed 20 [32] Garcholou 2012 [34] Gregersen 2012 [33] Garacholou 2012 [34]	Allison 2011, Gausvik 2015,Dang 2012, Flood 2011 Butler 2012 Hoogerduijn 2012 Conroy 2011 Isom 2013 Greco 2013 Alonso Bouzon 2011 Burkardt 2014
<i>Interventions based in the Emergency Department</i>		
ANP in ED Enhanced ED team Risk screening + focused CGA Frailty (or ACE) unit in proximity to ED CGA in ED/ assessment / decision units Medicine for Older People team review (ED admissions) Geriatrician led admission avoidance service	Aldeen 2014 [35] Argento 2014 [36] Grudzen 2015 [37] Foo 2014 [38] Conroy 2014 [39] Ellis 2012 [40] Conroy 2014 [39] Clift 2012 [41]	Argento 2011, Argento 2013 Adams 2013, Ellis 2011 Beirne 2012, Carey 2011a, Carey 2011b, Clift 2013, Hughes 2014, Fernandez 2014, Beirne 2012 Byrne 2013, Byrne 2014 Jones 2012
<i>Services across ward boundaries</i>		
Mobile ACE unit Medical floor based interdisciplinary team Geriatric consultation teams	Farber 2011 [42] Hung 2013 [43] Yoo 2014 [44] Yoo 2013 [45]	Hung 2011 Deschodt 2014, Dewhurst 2013
<i>Surgical / perioperative care</i>		
Pre op surgical care protocols. Risk report / order set.	Cronin 2011 [46]	
Hospital wide complex intervention with surgical focus.	Bakker2014 [47]	
ACE unit for acute medical/surgical ward	Krall 2015 [48]	
Audit against NCEPOD standards		Garbharran 2012
Geriatric consultation team in hip fracture patients		Deschodt 2011
<i>CGA in Oncology</i>		
Use of screening tools (risk profiling)		Kenis 2013, Exterman 2011
* Full citations for conference abstracts are available the appendix		

Services that function across ward boundaries

These are mobile services which incorporate the principles of comprehensive geriatric assessment but deliver them to patients who are not on dedicated wards for older inpatients, and are developments of already well established concepts – the ACE unit, and the Inpatient Geriatric Consultation Team. These teams however attempt to overcome the key limitation of peripatetic geriatric assessment care (the tendency not to implement the recommendations arising from the comprehensive assessment process), by delivering care directly on wards which do not normally provide such care.

There are a few recent descriptions of mobile CGA services, which have suggested reduced length of stay, reduction of costs, and reduction in adverse events.

Surgical / perioperative care

Introduction of CGA into surgical care has been described through the use of pre-operative protocols [46], the introduction of a hospital wide complex intervention to deliver CGA [47], and by including surgical patients in an ACE unit service [48], delivering CGA for older patients requiring abdominal surgery and the use of a multidisciplinary geriatric consultation team for older hip fracture patients. Reported effects included improved function and reduction in delirium, falls and pressure sores.

CGA in Oncology units

While it was observed some time ago that a CGA framework can identify additional problems not picked up in routine oncology consultation [49], there are as yet few reports of rigorous evaluations. Observational studies have reported the use of risk screening in geriatric oncology and the provision of CGA by geriatrician liaison as a means of modifying tolerance to chemotherapy in an oncology service with promising results [50], providing support for the notion of developing and sustaining such services for older people with cancer.

DISCUSSION

Our starting point for this review was an understanding that the value of CGA for older people in hospital is established and that new forms of delivery in new settings are developing - leading to the notion of “Hospital wide” CGA [16]. This concept embraces the idea that all patients who may benefit from CGA in hospital should be able to receive it, and that this may require new forms of delivery in previously under-explored settings.

CGA is core technology for geriatric medicine. Hospital wide delivery is an important development in the evolution of services to meet the needs of older people. Existing evidence from trials and reviews establishes the effectiveness of CGA but not the optimum target population (in any detail). The evidence tends to favour ward based, over consultation services, and there is widespread belief [51] that CGA is likely to be of most benefit as a component of assessment and care programmes for older people with frailty. Emerging evidence from NHS Benchmarking shows that some services are developing to deliver CGA across the hospital [25]. Existing systematic reviews and emerging evidence from recent observational studies and service descriptions supports the notion that hospital wide approaches to the delivery of CGA for those who may benefit are beginning not only to be developed, but evaluated in multiple locations and settings.

The most active area of development relates to acute medical care. Much of the attention focuses on the acute / hyper-acute setting – the emergency department, decision unit, acute frailty unit – services which are at the interface between the hospital and the community at the “admission” end of the hospital inpatient journey. These developments use in-reach, but also build upon and extend the concepts of Geriatric Evaluation and Management Units and the ACE Unit and extend the reach of CGA services to the entry services of the hospital (Emergency departments) and temporally into the first few hours of a hospital admission or assessment.

These front door services are complemented within the hospital setting by services which extend the concept of a “Geriatric Consultation Service”, providing mobile teams which can assess and implement CGA outputs, working across the usual boundaries of ward based care.

The notion of extending the success of CGA services in surgical settings is well represented in the literature, which is also beginning to contain descriptions of the potential impact of using CGA in oncology services as well.

The logistical difficulties posed in implementing CGA into new settings such as emergency departments and surgery or oncology services should not be under-estimated. In addition the weakness of the evidence surrounding the relative effectiveness of liaison type services, suggests that further development and careful evaluation is required before models are implemented at scale. For example some of the current models being tested in surgery or oncology involve geriatricians and team members being added into existing cancer or surgery services. This approach may well turn out to be effective, but will place an additional burden upon stretched budgets, so in addition to evaluation of clinical effectiveness, cost –effectiveness studies are needed before widespread implementation.

Interventions utilising CGA are by definition complex. It brings together multiple elements of assessment which can affect health outcome to facilitate clinical decision making. Such models may be among the most challenging to evaluate in randomised controlled trials. It is possible to develop, evaluate and study such interventions with scientific rigour, and there are authoritative guidelines on how to do this [52]. The gold standard for evidence of cost-effectiveness remains the RCT with health economic analysis [53]. To reach the point where such a RCT is possible requires several iterations of modelling, service specification, development implementation and evaluation before a new service can be trialled against the previous gold standard or “usual” care.

One of the challenges of evaluating CGA services in acute hospital care is ensuring that account is taken of a full range of relevant outcomes. These may be of clinical importance (such as functional health status or duration of inpatient stay), important to the users of acute care services and their carers (such as patient reported outcomes or carer strain), relevant to the service providers and commissioners (such as resource use and cost effectiveness). Further the design of trials and evaluations needs to strike important balances between (for example) short term versus longer term outcomes, and between operational outcomes (such as length of stay and readmission rates) and personal outcomes such as health status.

Benchmarking shows that there is pace and enthusiasm for developing innovative services [25], which can result in widespread implementation of new forms of CGA delivery and targeting , running ahead of the literature evidence of effectiveness and cost effectiveness. This implies that local units which are implementing exciting new service innovations need to be supported so that they are able to assess and report their own impacts and adapt their services accordingly.

In conclusion: Hospital Wide CGA is an emerging concept with a strong evidence base for the effectiveness of the core intervention, but a weaker evidence base about effective targeting of the intervention, with an emerging landscape of models of delivery. A case for the development of tools to assist in the delivery of CGA on a hospital wide basis can be made. Clinicians and managers should consider embedding high quality evaluation and seeking support for high quality research designs when introducing new models for the delivery and targeting of CGA in hospital inpatient care. Further RCTs in which CGA is explicitly targeted (by patient characteristics, or by specific service type) would be justifiable.

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Table 2. Journal articles describing emerging service models delivering inpatient CGA on a hospital wide basis.

Study *	Participants	Intervention	Design	Outcomes	Comments
Ward based acute care					
Barnes 2012.	ACE unit trial data revisited. > 70 yrs. admitted for > 2 days	ACE unit	RCT with economic analysis	Primary: Reduced LOS, Reduced costs. Secondary: No change in functional status, re-admission rates unchanged	No power calculation, how they measured functional decline, Old data 1997 ACE unit cost effective
Allen 2011	ACE unit patients	Implementing a delirium protocol within an established ACE unit	QI project. Before and after comparison	Data collection methods not really described. Reduced incidence of delirium 8.8 vs 7.2 post intervention, Reduced LOS for patients who developed delirium (7.6 to 4.0 days), Decreased mortality (23% vs 9.5%) reduced re-admissions	Data collection methods not described, Data analysis not described. This is mainly a description of a service rather than an analysis
Flood 2013	Patients aged 70 years or older under the care of a hospitalist in an ACE unit, or usual care	ACE unit patient compared with hospitalist care	Observational Cohort	Adjusted cost ratios revealed significant cost savings for patients with low (0.82; 95% CI, 0.72-0.94) or moderate (0.74; 95% CI, 0.62-0.89) Case Mix Index (CMI) but not for high CMI scores (1.13; 95% CI, 0.93-1.37). 30 day readmission reduced in ACE patients (7.9% vs 12.8%; P = .02).	Statistical analysis described. ACE unit cost effective
Gharacholou 2012	Heart failure, frailty (frailty criteria described) including; stroke, dementia, unplanned admissions dependency, prolonged bed rest	CGA in a GEM for heart failure for frail patients	Subgroup analysis of patients with Heart Failure that were enrolled into the GEM RCT	From parent trial Survival and HRQOL. This analysis also included Primary: SF-36 score as a measure of functional status from original trial with a follow up phone call to the HF subset 6-12 months post randomisation. Patients in intervention group has less functional decline at discharge. This was not observed at 6 or 12 months	Statistical analysis is described. Baseline characteristics of subset are described, both groups were similar. There were no detrimental effects in the GEM group when compared to UC Short term benefits only (not long term)
Gregerson 2012	80+ years acutely admitted to hospital	CGA vs G(i)M . GEMU similar to ACE	Observational comparison	Patients in the CGA group were older and had more co-morbidity but had similar LOS and reduced 30 mortality when compared to general medical department patients	Large retrospective cohort study with sub group analysis.
Ahmed 2012	Frail Elderly' admitted to ACE unit verses usual care, Ave age 81, 50% <incontinent	ACE unit	Observational Cohort	Reduced Ave LOS, Reduced Costs, Reduced Re-admission, Increased patient satisfaction, Unit complied with all hospital safety standards	Patients defined by "frailty" but frailty not measured. Patients admitted from multiple sources, entry criteria were not described

Study *	Participants	Intervention	Design	Outcomes	Comments
Interventions based in the Emergency Department					
Grudzen 2015	65+ ISAR score >2, attended ED	ED based around APNs GEDI-WISE programme	Observational	ICU admission rates from ED in patients 65+ reduced, Palliative care and Hospice referrals increased. Reduced ICU use	Statistical analysis described. Multiple interventions going on at the same time due to the GEDI-WISE programme, difficult to separate this intervention from others that were ongoing.
Foo 2014	Patients over 65 years, risk stratified and planned for discharge	Nurse led ED Risk screening + focused geriatric assessment / usual care	Quasi experimental (pseudo RCT)	Primary: Deterioration in functional status was slower in the intervention group. No change between the groups in secondary outcomes	Fu 12 months. Power calculation was completed. High amount of refusals and failures to recruit in the intervention group
Conroy 2014	85 + years attending ED	ED CGA	Observational Cohort	Primary: Reduction in admissions 69.6 to 61.2%. Secondary: readmission rates reduced 26 vs 19.9%	Power calculation given. Paper benefits from Large sample size. Established that it is possible to deliver CGA in ED environments
Cliff 2012	Patients were referred by the ED team	ED (outreach and support team)	Observational	Increased patient satisfaction with care.	Paper largely descriptive. Largely a service description. No discernible sampling or quantitative research methods
Aldeen 2014	Patients with ISAR score >2, or at the request of ED physicians	ED-Specialist geriatric nurse liaison	Observational Cohort Data collection method and sources not stated.	Conversion rate: 3% reduction in admissions to hospital (44.9 vs 60%)	Patient demographics not described in detail
Argento 2014	Age >65 with triage risk screening >2 plus patients whose physician requested a review. Ave age 86	ED- Advanced practice nurses GEMS	Observational	Increased DNACPR, 85% had medicine reconciliation, Goals of care decisions made in 95% Increased patient satisfaction, 6% increase in patients using the hospital. Operational outcomes, including time in ED said to be improved	Readmission rated not recorded.
Ellis 2014	>65 years with functional or cognitive impairment, geriatric clinical syndrome or from a care home	ACE unit in ED	Observational Cohort/service evaluation. Before and after design	Primary: Increased rates of D/C directly from ED. Secondary: no statistically significant differences in secondary outcomes	Statistical analysis described and justified. Data collection performed by independent researcher. Median LOS also reported
Blakemore 2012	Frail older people with non-life threatening conditions	ED-Emergency Frailty unit	Observational	ED discharge increased by 37% 7+30 day re-admissions down 1/3	Paper also described a culture change within the ED as a result of having the unit, and collaborative working. See Conroy 2014

Study *	Participants	Intervention	Design	Outcomes	Comments
Services provided across ward boundaries					
Faber 2011	Are fully described 80+, 46 % Cog impaired ETC	MACE unit (Mobile ACE service) vs ACE vs Usual care	Observational Cohort, retrospective with propensity score matching	Reduced LOS (5.8 vs 7.9 days, P<0.001) in MACE Cohort, no difference in mortality 7-30 or 90 day readmission rates. Costs lower in MACE cohort (\$10315 vs \$15636, p<0.001)	Large sample size, 2 year study
Hung 2013	75+ admitted to MACE units with matched controls receiving usual care in G(I)M wards. Inclusion and exclusion criteria are described. Baseline Characteristics are also described	MACE unit vs usual care	Observational Matched cohort	Adverse events reduced 17% to 9.5%, LOS reduced 0.8 days, Re-admission at 30 days and functional status at 30 days were not significantly different between the two groups	Statistical analysis described and justified. Mace more efficient, slightly safer, same outcomes
Yoo 2014	65+ admitted to medical ward. Inclusion and exclusion criteria described. Patient characteristics given in a table	Mobile CGA (IDT daily geriatric assessment. IDT 45 min x 3/week)	Observational Cohort	Reduced LOS by 0.7 days. Delirium and 30 day readmission the same	Power calculation given, Statistical analysis described. Patients excluded if their care was not compliant 80% of the time. Not much impact
Cronin 2011	65+ years undergoing vascular/general surgical procedures. Some basic demographics are recorded	Pre op surgical care protocols. Risk report and order set	Quality improvement Programme (Pre and post intervention) Observational cohort	>85s conversion rate	Largely an intervention description. .Methods not described, no idea what the 'Order set" consisted of. Small sample size 63 patients. Small sample showed feasibility
Surgical / perioperative care					
Bakker 2014	70+ years, identified as Frail, admitted for longer 48 hours	Hospital wide complex intervention with focus on surgical patients.	Observational Cohort (Pre and post intervention), plus mixed methods process evaluation	Primary: Delirium reduced by from 11% to 10% Cognitive decline reduced from 15% to 12 %. Secondary: Unplanned readmissions increased, ADI 3 months better in intervention group, reduced caregiver burden in intervention group	Frailty screening based on clinical judgement. Statistical analysis described and justified. Level to which intervention components implemented was variable. Evaluated during learning/introduction. Limited effects observed
Krall 2012	65+, MCI or dementia, delirium risk, stroke. Exclusion criteria described	ACE unit for acute medical/surgical ward	observational retrospective cohort	Functional status either neutral or improved on D/C. Reduction in falls, pressure sores Reduced ave LOS 3.18 vs 3.9 days	No description other than average ages given for the usual care group. ACE unit had better outcomes

References

- 1 Ellis, G., M. Whitehead, D. O'Neill, P. Langhorne and D. Robinson (2011a). "Comprehensive geriatric assessment for older adults admitted to hospital." Cochrane Library DOI (DOI: 10.1002/14651858.CD006211.pub2.).
- 2 Warren MW. Care of the Chronic Sick. *The Lancet* 1946; (6406):841-3.
- 3 Rubenstein LZ, Josephson KR, Wieland DG, English PA, Sayre JA, Kane RL. Effectiveness of a geriatric evaluation unit. *N Engl J Med* 1984;311:1664-70.
- 4 Stuck AE, Siu AL, Wieland GD, Adams J, Rubenstein LZ. Comprehensive geriatric assessment: a meta-analysis of controlled trials. *Lancet*. 1993;342(8878):1032-6.
- 5 Epstein AM, Hall JA, Besdine R, Edward C, Feldstein M, McNeil B, Rowe JW. The Emergence of Geriatric Assessment Units: The "New Technology of Geriatrics". *Ann Intern Med*. 1987;106(2):299-303.
- 6 McCue P, McCleod A, Conroy S, Roberts HC, Kennedy S. How best to deliver Comprehensive Geriatric Assessment (CGA) hospital: an umbrella review. *European Geriatric Medicine* 2016;7(s1):S100
- 7 Rockwood K, Stadnyk K, MacKnight C, McDowell I, Hebert R, Hogan DB. A brief clinical instrument to classify frailty in elderly people. *Lancet* 1999; 353: 205–6.
- 8 Inouye SK, Studenski S, Tinetti ME, Kuchel GA. Geriatric Syndromes: Clinical, Research and Policy Implications of a Core Geriatric Concept. *Journal of the American Geriatrics Society*. 2007;55(5):780-791.
- 9 Wou F, Gladman JR, Bradshaw L, et al. The predictive properties of frailty-rating scales in the acute medical unit. *Age Ageing* 2013;42(6):776-81.
- 10 Edmans J, Bradshaw L, Gladman JRF, et al. The Identification of Seniors at Risk (ISAR) score to predict clinical outcomes and health service costs in older people discharged from UK acute medical units. *AGE AND AGEING* 2013;42(6):747-53.
- 11 Goldberg SE, Whittamore KH, Harwood RH, et al. The prevalence of mental health problems among older adults admitted as an emergency to a general hospital. *Age and Ageing* 2012;41(1):80-86.
- 12 Baztan, J. J., F. M. Suarez-Garcia, J. Lopez-Arrieta, L. Rodriguez-Manas and F. Rodriguez-Artalejo (2009). "Effectiveness of acute geriatric units on functional decline, living at home, and case fatality among older patients admitted to hospital for acute medical disorders: meta-analysis." *Bmj* 338: b50.
- 13 Deschodt, M., J. Flamaing, P. Haentjens, S. Boonen and K. Milisen (2013). "Impact of geriatric consultation teams on clinical outcome in acute hospitals: a systematic review and meta-analysis." *BMC Med* 11: 48.
- 14 Langhorne P, Williams B, Gilchrist W, Howie K. Do stroke units save lives? *Lancet* 1993;342:395-8.
- 15 Association BO. The Care of Patients with Fragility Fracture. London: British Orthopaedic Association, 2007.
- 16 Bakker FC, Robben SHM, Olde Rikkert MGM. Effects of hospital-wide interventions to improve care for frail older inpatients: a systematic review. *BMJ Quality & Safety* 2011;20(8):680-91.
- 17 Graf, C. E., S. V. Giannelli, F. R. Herrmann, F. P. Sarasin, J. P. Michel, D. Zekry and T. Chevalley (2012). "Can we improve the detection of old patients at higher risk for readmission after an emergency department visit?" *J Am Geriatr Soc* 60(7): 1372-1373.
- 18 Carpenter, C. R., M. S. Avidan, T. Wildes, S. Stark, S. A. Fowler and A. X. Lo (2014). "Predicting geriatric falls following an episode of emergency department care: a systematic review." *Academic Emergency Medicine* 21(10): 1069-1082.
- 19 Ellis G, Whitehead MA, Robinson D, et al. Comprehensive geriatric assessment for older adults admitted to hospital: meta-analysis of randomised controlled trials. *BMJ* 2011;343.
- 20 Royal College of Physicians. Future hospital: Caring for medical patients. Secondary Future hospital: Caring for medical patients 2013. <http://www.rcplondon.ac.uk/projects/future-hospital-commission>.
- 21 McMurdo M E T. Make hospitals good for older people. *BMJ* 2013;346:f867; doi:<https://doi.org/10.1136/bmj.f867>.
- 22 Conroy SP, Turpin S. New horizons: urgent care for older people with frailty. *Age Ageing* 2016;45(5):577-84.
- 23 Partridge J S L, Harari D, Martin F C, Dhesi J K. The impact of pre-operative comprehensive geriatric assessment on postoperative outcomes in older patients undergoing scheduled surgery: a systematic review. *Anaesthesia* 2014, 69 (Suppl. 1), 8–16.
- 24 Partridge JSL, Harari D, Martin FC, et al. Randomized clinical trial of comprehensive geriatric assessment and optimization in vascular surgery. *British Journal of Surgery* 2017:n/a-n/a.
- 25 NHS Benchmarking Network. Older people's care in acute settings - National Report. March 2017.
- 26 <https://njl-admin.nihr.ac.uk/document/download/2007743>. Accessed 30th April 2017.

- 27 McCue P, Parker S, Conroy S, Bardsley M, Roberts H, Kennedy S. How best to deliver Comprehensive Geriatric Assessment (CGA) on a hospital wide basis: an umbrella review. PROSPERO 2015:CRD42015019159 Available from: http://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42015019159
- 28 Fox MT, Persaud M, Maimets I, et al. Effectiveness of Acute Geriatric Unit Care Using Acute Care for Elders Components: A Systematic Review and Meta-Analysis. *Journal of the American Geriatrics Society* 2012;60(12):2237-45.
- 29 Barnes DE, Palmer RM, Kresevic DM, Fortinsky RH, Kowal J, Chren MM, et al. Acute care for elders units produced shorter hospital stays at lower cost while maintaining patients' functional status. *Health Affairs (Project Hope)* 2012;31(6):1227-1236. <http://doi.org/10.1377/hlthaff.2012.0142>.
- 30 Allen, K. R.; Fosnight, S. M.; Wilford, R.; Benedict, L. M.; Sabo, A.; Holder, C.; Jackovitz, D. S.; Germano, S. A.; Gleespen, L.; Baum, E.; Wilber, S. T.; Hazelett, S. Implementation of a system-wide quality improvement project to prevent delirium in hospitalized patients. *Journal of clinical outcomes management* 2011;18(6):253-258.
- 31 Flood KL, MacLennan PA, McGrew D, Green D, Dodd C, Brown CJ. Effects of an acute care for elders unit on costs and 30-day readmissions. *JAMA Internal Medicine*. 2013;173:981-7.
- 32 Ahmed N, Taylor K, McDaniel Y, Dyer CB. The role of an acute care for the elderly unit in achieving hospital quality indicators while caring for frail hospitalized elders. *Population Health management* 2012;15(4):236-240. doi:10.1089/pop.2011.005
- 33 Gregersen M, Pedersen AB, Damsgaard EM. Comprehensive geriatric assessment increases 30-day survival in the aged acute medical inpatients. *Danish medical journal*. 2012;59(6):1-6.
- 34 Gharacholou SM, Sloane R, Cohen HJ, Schmader KE. Geriatric inpatient units in the care of hospitalized frail adults with a history of heart failure. *International Journal of Gerontology*. 2012;6:112-6.
- 35 Aldeen AZ, Courtney DM, Lindquist LA, Dresden SM, Gravenor SJ. Geriatric Emergency Department Innovations: Preliminary Data for the Geriatric Nurse Liaison Model. *Journal of the American Geriatrics Society*. 2014;62(9):1781-5.
- 36 Argento V, Calder G, Ferrigno R, Skudlarska B. Geriatric emergency medicine service: a novel approach to an emerging trend. *Connecticut medicine*. 2014;78(6):339-43.
- 37 Grudzen C, Richardson LD, Bauml KM, Winkel G, Davila C, Ng K, et al. Redesigned geriatric emergency care may have helped reduce admissions of older adults to intensive care units. *Health Affairs*. 2015;34:788-95.
- 38 Foo CL, Siu VW, Ang H, Phuah MW, Ooi CK. Risk stratification and rapid geriatric screening in an emergency department - a quasi-randomised controlled trial. *BMC geriatrics*. 2014;14:98.
- 39 Conroy SP, Ansari K, Williams M, Laithwaite E, Teasdale B, Dawson J, et al. A controlled evaluation of comprehensive geriatric assessment in the emergency department: The 'Emergency Frailty Unit'. *Age and Ageing*. 2014;43:109-14
- 40 Ellis G, Jamieson CA, Alcorn M, Devlin V. An Acute Care for Elders (ACE) unit in the emergency department. *European Geriatric Medicine*. 2012;3:261-3.
- 41 Clift EL. Innovative ED older persons' care: a report on an initiative developed in Southampton Hospital ED. *International Emergency Nursing*. 2012;20(4):201-6.
- 42 Farber JI, Korc-Grodzicki B, Du Q, Leipzig RM, Siu AL. Operational and quality outcomes of a mobile acute care for the elderly service. *Journal of Hospital Medicine* 2011;6(6):358-363.
- 43 Hung WW, Ross JS, Farber J, Siu AL. Evaluation of the mobile acute care of the elderly (MACE) service. *JAMA Internal Medicine*. 2013;173:990-6.
- 44 Yoo JW, Seol H, Kim SJ, Yang JM, Ryu WS, Min TD, et al. Effects of hospitalist-directed interdisciplinary medicine floor service on hospital outcomes for seniors with acute medical illness. *Geriatrics and Gerontology International*. 2014;14:71-7.
- 45 Yoo JW, Kim S, Seol H, Kim SJ, Yang JM, Ryu WS, et al. Effects of an internal medicine floor interdisciplinary team on hospital and clinical outcomes of seniors with acute medical illness. *Geriatrics & gerontology international*. 2013;13:942-8.
- 46 Cronin J, Livhits M, Mercado C, Chen F, Foster N, Chandler C, et al. Quality improvement pilot program for vulnerable elderly surgical patients. *American Surgeon*. 2011;77:1305-8.

- 47 Bakker, F. C.; Persoon, A.; Bredie, S. J. H.; Van Haren-Willems, J.; Leferink, V. J.; Noyez, L.; Schoon, Y.; Olde Rikkert, M. G. M. The CareWell in Hospital program to improve the quality of care for frail elderly inpatients: Results of a before-After study with focus on surgical patients. *Am J Surg* 2014;208(5):735-746.
- 48 Krall E, Close J, Parker J, Sudak M, Lampert S, Colonnelli K. Innovation pilot study: acute care for elderly unit--promoting patient-centric care. *Herd*. 2012;5:90-6.
- 49 Extermann M, Aapro M, Bernabei R, Cohen HJ, Droz JP, Lichtman S, Mor V, Monfardini S, Repetto L, Sørbye L, Topinkova E. Use of comprehensive geriatric assessment in older cancer patients: recommendations from the task force on CGA of the International Society of Geriatric Oncology (SIOG). *Crit Rev Oncol Hematol*. 2005;55(3):241-52.
- 50 Kalsi T, Babic-Illman G, Ross PJ, Maisey NR, Hughes S, Fields P, Martin FC, Wang Y, Harari D. The impact of comprehensive geriatric assessment interventions on tolerance to chemotherapy in older people. *British Journal of Cancer* (2015) 112, 1435–1444. doi:10.1038/bjc.2015.120.
- 51 Turner G, Clegg A. Best practice guidelines for the management of frailty: a British Geriatrics Society, Age UK and Royal College of General Practitioners report. *Age and Ageing* 2014;43:744–747.
- 52 P. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, and Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ* 2008;337:a1655 doi: 10.1136/bmj.a1655
- 53 Petrou S, Gray A. Economic evaluation alongside randomised controlled trials : design, conduct, analysis, and reporting. *BMJ* 2011;342:d1548. (doi: 10.1136/bmj.d1548)