

# Report: A survey and evaluation of comprehensive geriatric assessment systems for residential and community aged care

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## Commission and endorsement

In 2023, the Aged Care Industry Information Technology Council (ACIITC) reviewed several research facilities in Australia and identified the Centre for Health Services Research (CHSR) at The University of Queensland, as having the leading experts in aged care health informatics. Additionally, the CHSR is experienced in the use and implementation of online health and data collection tools. Hence, the ACIITC commissioned the CHSR to undertake the Data Standardisation and Assessment Systems for Aged and Community Care research. The ACIITC endorsed the report produced by the CHSR as one of exceptionally high quality, thorough in its investigation and balanced in its findings.

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## Conflict of interest statement

All members of the research team work in a research group led by Professor Len Gray, who is an interRAI fellow and also a Board member of interRAI. Professor Gray declared his conflict of interest during the commission of the project and was actively removed from and held no oversight of the project. Dr Ronald Dendere, Dr Murray Hargrave and Ms Michelle Lang also work on the DHCRC-funded Aged Care Data Compare project which adopted an interRAI assessment system as a minimum dataset and therefore they regularly work with other interRAI fellows based at the University of Queensland. Like Professor Len Gray, these interRAI fellows were also isolated from this project and played no role in its execution.

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## List of abbreviations

ACIITC = Aged Care Industry Information Technology Council

ADL = Activities of daily living

ANACC = Australian National Aged Care Classification

CANE = Camberwell Assessment of Need for the Elderly

CAPs = Clinical Assessment Protocols

CARE = Comprehensive Assessment and Referral Evaluation

CARI = Community Assessment of Risk Instrument

CGA = Comprehensive geriatric assessment

CHAMP = Comprehensive Health Assessment for My Plan

CINAHL = Cumulative Index to Nursing and Allied Health Literature

CPAT = Care Planning Assessment Tool

GDS = Geriatric Depression Scale

interRAI CHA = interRAI Community Health Assessment

interRAI CU = interRAI Check-Up

interRAI HC = interRAI Home Care

interRAI LTCF = interRAI Long-Term Care Facilities

LOINC = Logical Observation Identifiers Names and Codes

LTCCGA = Long-Term Care Comprehensive Geriatric Assessment system

MDS 3.0 RAI = Minimum Dataset 3.0 Resident Assessment Instrument

MeSH = Medical Subject Headings

NSAF = National Screening and Assessment Form

OECD = Organisation for Economic Cooperation and Development

OMFAQ = Older American's resources and services Multidimensional Functional Assessment Questionnaire

PGCMAI = Philadelphia Geriatric Center Multilevel Assessment Instrument

PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses

RAC = residential aged care

RAI = Resident Assessment Instrument

## Executive Summary

The Aged Care Industry Information Technology Council (ACIITC) commissioned the University of Queensland Centre for Health Services Research to survey and evaluate Comprehensive Geriatric Assessment (CGA) systems for residential and community aged care.

Assessment of an older person's needs and capabilities is a fundamental part of health care provision. CGA has become a cornerstone of effective care in multiple settings (residential care, community, hospitals, etc) that aims to deliver better health outcomes. Further, CGAs have been incorporated into assessment *systems*, whereby data collection frameworks are defined, observations/responses are structured, assessments for different use-cases or care settings are harmonised, and decision-support tools (scales, scores, risks) are included. Adoption of standardised CGA systems would enable data flow among the several assessments in the consumer's aged care journey and to fulfill other functions such as quality monitoring and activity-based funding. At the time of writing (August 2023), Australia did not have broad use of CGA systems.

The project aim was to identify and review assessment systems on the international market for potential use in Australian residential aged care (RAC) and community care. We conducted a systematic search of academic and grey literature, and internet resources to identify available systems and gather information pertaining to their design, evaluation, and implementation. We drafted a list of criteria based on literature surveys and, in a focus group discussion, asked a group of expert industry representatives from Australian aged-care provider organisations to validate the list and suggest additional criteria items. We scored the identified systems against these criteria.

We retrieved over 5300 records, of which 716 were reviewed to identify CGA systems and extract data for their evaluation. We identified 15 systems: 5 designed for residential aged care, 7 for community care and 3 designed for multiple settings. Surveying of the expert industry representative group did not identify additional systems.

Evaluation of the 15 systems against the agreed criteria revealed that the Long-Term Care Comprehensive Geriatric Assessment system (LTCCGA) had the lowest aggregate score while the interRAI Home Care (HC) and interRAI Long-Term Care Facilities (LTCF) both had the highest score. Both interRAI systems have additional strengths of being deployed and validated in multiple countries, robust and long-established programs to support implementers (including assessor training), cross-setting compatibility that facilitate information sharing and more software providers supporting their implementation than any other system. Both systems, and the MDS 3.0 RAI

(Minimum dataset 3.0 Resident Assessment Instrument), were the only systems that were assigned codes in an internationally recognised code set (i.e., LOINC).

After a systematic search and an evaluation exercise, we conclude that the interRAI HC and interRAI LTCF are the best candidate CGA systems for potential use in Australian community and RAC, respectively. We propose this study will be valuable for aged care providers and policy makers considering assessment systems and will simplify the process of selecting an assessment system that will standardise comprehensive geriatric assessment and support the multiple data requirements for the sector.

## Introduction

The Comprehensive Geriatric Assessment (CGA) has become an integral component for the care of older people in multiple settings. While there is no formal definition of CGA, the most widely used definition is a 'multidimensional, multidisciplinary process which identifies medical, social, and functional needs, and the development of a coordinated care plan to meet those needs' [1]. Unlike a medical evaluation, CGA is targeted towards frail older people with complex problems. A CGA gives providers a holistic overview of a consumer's medical and health status, their care needs, and helps derive optimal, personalised care plans for short- and long-term care, and for follow-up. Additional features of the CGA that distinguish it from typical medical evaluation include emphases on functional capacity to perform activities of daily living (ADL), physical and social context, quality of life, the use of quantitative assessment scales, and the participation of a multidisciplinary team of healthcare practitioners in the process.

CGA is conducted in different settings and can be customised to elicit information pertinent to those settings. For example, CGA designed for the community care setting may seek information about a person's access to a grocery store, which may not be applicable for a person in long-term care. Research has shown that CGA may be effective at improving health outcomes in the care of older people [1, 2] in a cost-effective manner [3-5]. In long-term care, CGA is associated with lower risk of falls, lower short-term mortality, and improved cognitive and physical functioning [2]. In hospital and other acute care settings, CGA is associated with lower short-term mortality [3, 4], and reduced length of stay [3, 4, 6] and time to surgery [2]. In these settings, CGA also helps reduce the risks of delirium, falls, and pressure injuries, and helps reduce decline in mobility and disability in ADL [2, 7, 8]. Furthermore, CGA reduces the probability of discharge to residential aged care while increasing the probability of discharge to home [2, 4]. For older people in community care, in addition to the benefits seen in other settings, CGA also helps reduce the risk of frailty [9]. The strength of effects varies according to the healthcare setting (hospital, long-term care, home/community care, etc) and the specific clinical conditions of the care recipients [6, 10]. However, in aggregation, evidence suggests high-risk older people with complex problems may benefit from CGA.

A CGA is usually conducted by a core team of diverse healthcare professionals involved in the care of the individual. At a minimum, the core team consists of a medical practitioner (often a geriatrician), a nurse and a social worker, but depending on the setting, specialist doctors and other allied health (e.g., occupational/physiotherapist, dietician, psychologist, etc) may be called on to participate in CGA [11]. While there is wide variation on the components of a CGA, the most common domains addressed by CGA and are considered critical for effective care of older people are physical/medical

health, mental health and psychological status, functional capacity, social support, and environment [1, 12-14].

In residential aged care, where individuals may receive care for extended periods of time, comprehensive assessment is a critical activity that should occur at entry into a facility and be reviewed and revised periodically to underpin both health care and quality of life more broadly. Ideally, assessments should be conducted using a standardised assessment system that includes a framework that specifies the data to be collected, how that data should be recorded, and how observations are scored. A robust assessment system must also include a set of clinical scales and decision support applications that process the data collected during assessment to evaluate risks for common geriatric syndromes and identify problems requiring immediate and/or on-going attention. Such a system provides a critical foundation for the construction of a care plan that attends to day-to-day needs of the older person as well as medium- and long-term outcomes.

The content and configuration of CGA systems are specific to the setting in which they are deployed. Over the years, various assessment systems have been developed for conducting CGA in specific settings. While some organisations have developed assessment systems for off-the-shelf deployment, some aged care providers have opted to take the 'build-your-own' approach. These build-your-own systems usually consist of conglomerations of stand-alone assessment tools for specific areas of geriatric health care (e.g., Geriatric Depression Scale (GDS) for depression, Barthel Index for function, Braden scale for pressure injury risk, etc.) and bespoke items constructed by providers for areas that are not covered by the stand-alone assessment tools. Build-your-own solutions are popular in the Australian aged care sector where providers partner one-on-one with software providers to build customised assessments [15]. As such, clinical and care needs are not described consistently among providers. This reduces the capacity for software vendors to create low-cost decision support tools (at scale), to enable information sharing among care provider organisations, and for the regulator to re-use data for system management functions such as payment and quality monitoring. Other disadvantages of the build-your-own approach are:

- The stand-alone assessment tools deployed are developed in isolation and often there is duplication in the data collected among the tools wherein some data items would be collected multiple times in different formats within each tool.
- Duplication of items increases the data collection burden on both care staff and consumers, and unnecessarily lengthens the duration of assessments.
- The psychometric properties (i.e., reliability and validity) of the bespoke or customised items are not usually evaluated.



- Assessors would require training in multiple assessment tools, be familiar with differing approaches to characterising the same clinical/care concept and must adjust to differing methods for structuring or guiding responses and observations (e.g., prescribed scales for observations versus free text, etc).

Broader adoption and use of standardised CGA systems instead of build-your-own solutions would enable data sharing among the several assessments in the consumer's aged care journey such as the NSAF assessments (National Screening and Assessment Form) and admission assessments, and to fulfill other functions such as quality monitoring and activity-based funding such as the Australian National Aged Care Classification (ANACC).

In this project we review off-the-shelf systems for comprehensive assessment in residential and community aged care that are available pre-built. We focus on systems that:

- Cover a broad range of health and psychosocial care needs, and
- Are publicly available for use (free, purchase or under licence) as a unified assessment package.

We did not seek to identify and evaluate build-your-own or customised CGA assessments due, in part, to the practical difficulties of sourcing each different assessment from provider organisations or software vendors.

## Aim and Objectives

### Aim

The aim of this project was to review assessment systems for residential and community aged care. We envisaged that this would be a valuable resource for aged care providers and policy makers that could simplify the process of selecting an assessment system.

### Objectives

The objectives for the project were to:

1. Compile a comprehensive list of published CGA systems suitable for residential and community aged care and,
2. Evaluate these systems for application in the Australian aged care setting, against a set of criteria pre-determined jointly with industry representatives with clinical or clinical informatics expertise.

## Methodology

### Co-design with Expert Industry Representatives

To ensure that the project would be beneficial to the industry, we adopted a co-design approach through a series of workshops with a panel of expert industry representatives from Australian aged and community care provider organisations to design the study and obtain feedback on results. The panel consisted of the following individuals in various roles across clinical care, IT, and management areas at 10 organisations:

1. ACH Group – Mr Craig Carter
2. Anglicare Southern Queensland – Ms Sue Cooke, Ms Amanda Davies and Mr Barry Mather
3. BaptistCare – Mr Daniel Pettman, Mr Rob Binskin, and Mr Javed Shaikh
4. Calvary Care – Mr Charles Mellino
5. HammondCare – Mr Praneel Anand and Mr Bahara Khoda
6. My Vista – Ms Irene Mooney
7. Ozcare – Ms Lanna Ramsay and Mr Keith Levelle
8. Presbyterian – Mr Peter Newing
9. Regis – Mr Imtiaz Bhayat and Ms Filomena Ciavarella
10. Villa Maria Catholic Homes (VMCH) – Ms Maria Paz

### Search

The search for information occurred in two phases. We adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology [16]. This allowed for a systematic search, which streamlined the process and optimised the chances of finding as much relevant data as possible.

In the first phase, we searched several sources (the internet, grey literature, peer-reviewed academic literature, and other publicly available resources) to identify records describing CGA systems used internationally. We searched academic journal databases: PubMed, Scopus, Web of Science, Cochrane Library, PsycInfo and CINAHL. To begin the search, we developed a set of keywords related to CGA and geriatric assessments. We then conducted an initial, limited exploratory database search to identify further relevant keywords and their associated database-specific index terms (e.g., MeSH terms in PubMed, subject headings in CINAHL etc.). Following that, we searched all the

databases using the combination of the keywords and index terms as the search terms. Index terms identified in specific databases were searched as plain text in other databases.

We similarly developed search terms for internet search using the keywords related to CGA and geriatric assessments. We used these terms as input into Google and Microsoft Bing internet search engines. Additionally, we searched for specific information on the internet using the artificial intelligence chatbots ChatGPT and Microsoft Bing Conversational Experiences (e.g., “What systems are used for conducting comprehensive geriatric assessments?”). We adapted the search terms described above for use in grey literature sources and proceeded to search Google Scholar, [BASE](#) (a search engine for academic web resources including journals, institutional repositories, digital collections etc.) and [WorldCat](#) (a resource for searching records in local and international libraries).

In the second phase of the search, we developed search terms based on keywords related to deployment, validity and reliability, licensing, implementation, and evaluation of CGA systems. We then repeated the process conducted in the first phase by querying the various platforms using the newly developed search terms in combination with the specific assessment systems identified in the first search.

## Evaluation

### Criteria

Based on review of literature, information available about established systems, previous published evaluations of CGA systems [17] and drawing on criteria used for selection and successful implementations of CGA systems in other OECD countries such as France, Belgium, and Iceland [18], the project team compiled a draft list of criteria that characterise a robust CGA system. Using a focus group discussion, a panel of expert industry representatives from Australian aged-care service-provider organisations reviewed and validated the criteria items: the panel unanimously suggested adding terminology coding for assessment systems as a criterion. The final list of items is described below:

**Suitability:** A system must be specifically designed for use in residential aged care (RAC) or community aged care. It is possible that a supplier may build a generic system to conduct CGA in any setting. In such cases, the system design must be validated for potential use in both RAC and community care.

**Language:** A CGA system must be available in a local language. If this is not the case, the system supplier/vendor, not the customer, must translate into a local language prior to the customer purchasing the product. For a system specifically intended for use in Australia, an English version of the system must be available (preferably Australian English).

**Data:** The data elements in an assessment instrument should have robust psychometric properties. That is, individual data elements should be meaningful and relevant to users (face validity), appropriate for the intended use (content validity), be reliable when evaluated by separate assessors (inter-rater reliability) and when used to forecast future events (predictive validity).

**Terminology binding:** A clinical terminology system is a comprehensive set of medical (and health) terms and their associated codes that are designed to uniquely identify and unambiguously describe healthcare concepts in medical software. This criteria item determines if a CGA system or its components (i.e., data elements and outputs of any clinical applications) have been assigned codes in a clinical vocabulary or code system.

**Applications:** A CGA system must have an integrated set of applications that can ingest and analyse the collected data to produce outputs that are designed to aid care provision. There are a range of applications that may be available in a CGA system; those that are necessary are: scales, risk and diagnostic screeners, casemix algorithms, and quality indicators. These applications must be thoroughly tested for validity and demonstrate responsiveness to changes in care. At a minimum, the scope of applications must cover the most common geriatric syndromes (falls, pressure injuries, delirium, incontinence, and functional decline).

**Coverage:** Domains of a CGA are the broad categories of assessment items that are essential in the life and care of older frail people. To evaluate the coverage (i.e., comprehensiveness) of CGA systems, we adopted the list of domains considered in a similar review of CGA systems conducted in New Zealand in 2003 [17] as it agrees well with domains deemed essential in CGA [1, 12-14, 19] and we then added 'consumer preferences' to the list. This aligns with the recent shift towards consumer-centred approach in healthcare and the current Australian aged care quality standards which emphasise consumer dignity and choice [20]. Therefore, a CGA system must cover the following six domains: physical health and medical conditions, mental health and psychological status, functional capacity, social support, environment, and consumer preferences.

**Data burden:** The number of items/observations to be recorded during an assessment must be manageable to assessors and consumers. That is, only essential observations must be included on the assessment instrument, completion of an assessment must be achieved in minimal time and must not present unnecessary burden for an assessor and the consumer. Assessment outcomes must be automatically evaluated by the system and immediately presented to the user upon completion of an assessment.

**Assessor training:** Suppliers of CGA systems must have programs and validated, standardised materials for training assessors to use the systems effectively. Such programs must support continuous training to update assessors' skills and knowledge as assessment systems evolve.

Properly trained assessors are a critical factor for successful implementation of CGA and are essential to ensure consistency and reliability in the collection of high-quality data and interpretation of assessment outcomes.

**Current uptake:** Preferably, a chosen system will be in active use in multiple, diverse jurisdictions – ideally, this means the system is being used across regional or national borders (with all the necessary customisations such as translation to local languages). This characteristic indicates wider acceptability of a system.

**Cross-setting compatibility:** Ideally, a system designed for either RAC or community aged care should share common design features, content and derived applications with systems that are utilised in other settings where CGA is required. In Australia, this could include eligibility assessments (e.g., Aged Care Assessment Team) and programs such as transition care.

**Supplier/vendor support:** Suppliers of CGA systems must have robust structures for technical and material support. This may include websites and/or materials issued during training with clear and up-to-date contact details. Support must also be accessible in a timely manner to minimise the impact of disruptions.

**Ongoing development:** An assessment system must be under active development to keep up with advances in evidence-based medical and health services knowledge. System updates and underpinning evidence must be published publicly.

**Licensing arrangements:** Up-to-date information concerning any costs of adopting an assessment system must be readily and publicly available, preferably on the supplier's website. Adoption costs and pricing structure must cater for varying provider types (i.e., provider size, for profit/non-profit, public/private etc).

**Software support:** Software products implementing an assessment system must be readily available. With software implementation, an assessment system essentially becomes a streamlined clinical decision support tool by enabling data collection on digital devices and automatically funnelling data into the applications and activating triggers in the resulting care plans. Suppliers of CGA systems must make a list of vendors licenced to develop software solutions of their CGA systems publicly available.

## System scores

The records retrieved from both search phases were reviewed to identify CGA systems and extract evidence to evaluate their performance against the criteria described above. Except for 'Coverage', 'Reliability' & 'Validity', a score of 1 was awarded to indicate that a system fulfills a criterion item. Conversely, 0 indicates that a system does not fulfill a criterion or that we did not find publicly

available evidence. The ‘Coverage’ item was scored on a 0-6 scale to indicate the number of domains, out of the six specified in the description of this criterion item, covered by a system. During the extraction of data to accumulate evidence to score the systems on the ‘Data’ criterion, we discovered that evaluations did not follow a uniform approach. Some studies only evaluated the reliability or validity aspects of psychometric properties; others evaluated both. Also, there are different aspects of reliability (i.e., inter-rater or test-retest) and validity (e.g., construct, face, concurrent, content, criterion) – studies investigating the psychometric properties of the systems evaluated any one or any combination of these aspects. Finally, the studies used different measures for reliability and validity (e.g., Kappa statistic, intraclass correlation, and Cronbach’s alpha etc). Furthermore, evaluations were done at data item-, domain- or system-level. Due to this wide range in approaches for evaluating psychometric properties of the systems, we separated the ‘Data’ criterion into ‘Reliability’ and ‘Validity’ components and scored each on a 0–4 scale according to Table 1. For each system, an aggregate was obtained by adding up individual criteria score. This scoring method effectively helped us summarise the information we gathered for each system using a single figure (i.e., the aggregate score) and allow for comparison of overall performance of the systems.

**Table 1: Scores for various levels of evidence of system Reliability and Validity: ‘Mixed’ means results of tests in one or more studies produced positive results but negative results in others.**

<b>Score</b>	<b>Reliability</b>	<b>Validity</b>
0	No evidence of evaluation	No evidence of evaluation
1	One aspect of reliability tested. Results show poor reliability or results are mixed but most show poor reliability.	One aspect of validity tested. Results show poor validity or results are mixed but most show poor validity.
2	One aspect of reliability tested. Results show good reliability or results are mixed but most show good reliability.	One aspect of validity tested. Results show good validity or results are mixed but most show good validity.
3	Multiple aspects of reliability tested. Results show poor reliability or results are mixed but most show poor reliability.	Multiple aspects of validity tested. Results show poor validity or results are mixed but most show poor validity.
4	Multiple aspects of reliability tested. Results show good reliability or results are mixed but most show good reliability.	Multiple aspects of validity tested. Results show good validity or results are mixed but most show good validity.

## Results

### Search and identification of CGA systems

Figure 1 summarises the first phase of the search (i.e., the search to identify CGA systems). The academic journal databases and grey literature sources (Google Scholar, BASE and WorldCat) produced a combined 1702 articles and the web search produced an additional 86 articles plus 249 webpages. After removing duplicates and screening the search results, we reviewed 630 resources (academic journal articles, reports, web pages, and other articles) and identified 15 CGA systems designed for residential (5), community aged care (7) and multiple settings (3). Details of the systems are provided in Table 2. In identifying the systems, we treated jurisdiction-specific versions as variations of an original system and only report on the original system. For example, the Care Planning Assessment Tool (CPAT) has a Japanese version, the J-CPAT, customised for use in Japan. Similarly, other systems such as the Comprehensive Assessment and Referral Evaluation (CARE) have shortened versions (i.e., SHORT-CARE, CORE-CARE) but we only report on the full versions. The interRAI Home Care (interRAI HC), interRAI Long-Term Care Facilities (interRAI LTCF) and Minimum Dataset 3.0 Resident Assessment Instrument (MDS 3.0 RAI) originate from the Resident Assessment Instrument (RAI) which was first developed in the USA [21-23]. The Centers for Medicare and Medicaid Services (CMS) holds the intellectual property (IP) rights to the MDS 3.0 RAI in the USA, the only country where it can be licensed for use [24]. The interRAI consortium holds the IP rights to the interRAI LTCF for use outside the USA as well as global IP rights to the interRAI HC and other systems in its integrated suite which are used extensively across the world and within the USA. It should be noted that large portions of the interRAI LTCF and MDS 3.0 RAI share common assessment items and applications. These are both compatible with other assessment systems in the interRAI integrated suite including the interRAI HC.

The list of 15 identified systems was presented to the expert industry representative group and, in an online survey, the participants were asked if they were aware of any further systems. This survey did not identify any additional systems.

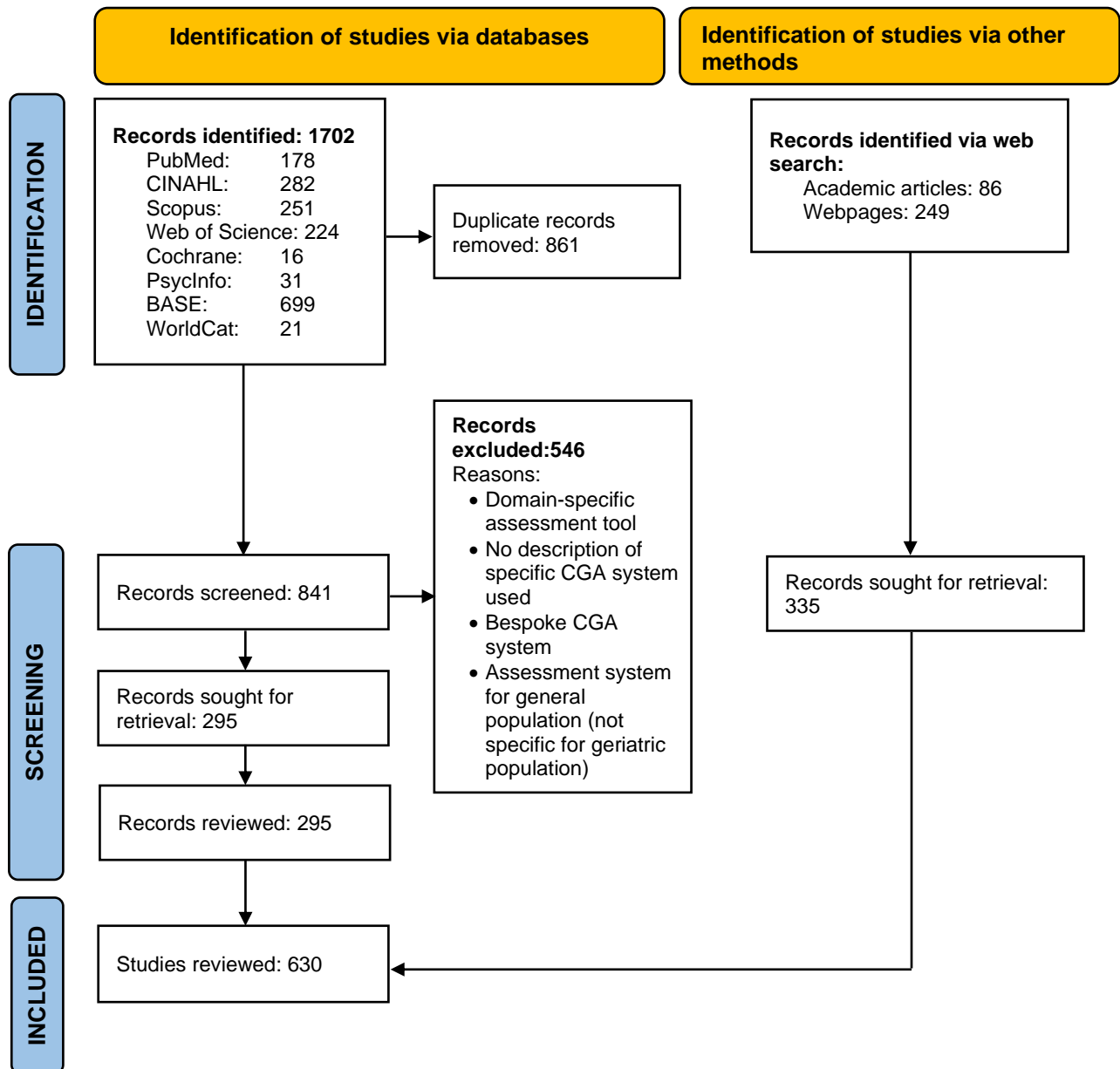


Figure 1. PRISMA flowchart for search and selection of articles for identifying CGA systems

Most of the systems we identified have their origins in only a handful of countries (USA, UK, Australia, and Canada), with only three originating in more than a single jurisdiction. The Comprehensive Assessment and Referral Evaluation (CARE), first published in 1974 [25] is the oldest system we found. The Comprehensive Health Assessment for My Plan (CHAMP), which appears in a journal article published in 2022 is the newest system on our list [26]. With the release of version 1.18.11, the MDS 3.0 RAI has the latest edition of all systems [27]. The CARE is the longest system (1500 items) [28] while the LTCCGA is the shortest (a 1-page, 25-item assessment) [29].



**Table 2: Details of CGA systems identified in the search. Note some of the systems on this list have hyperlinks (indicated by underline) to their webpages: the full weblinks are also provided in Appendix 1.**

CANE = Camberwell Assessment of Need for the Elderly; CARE = Comprehensive Assessment and Referral Evaluation; CARI = Community Assessment of Risk Instrument; CHAMP = Comprehensive health assessment for my plan; interRAI HC = interRAI Home Care; OMFAQ = Older American's Resources and Services Multidimensional Functional Assessment Questionnaire; PGCMAI = Philadelphia Geriatric Center Multilevel Assessment Instrument; CPAT = Care Planning Assessment Tool; interRAI LTCF = interRAI Long-Term Care Facilities; LTCCGA = Long Term Care Comprehensive Geriatric Assessment.

CGA system	Setting	Origin	First published	Latest edition
<a href="#">75+ Health Assessment</a>	Community	Australia	1999	2014
CARE	Community	UK/USA	1974	-
CARI	Community	Ireland/Australia	2015	-
CHAMP	Community	Canada	2022	-
<a href="#">interRAI HC</a>	Community	USA <sup>1</sup>	1994	2021
<a href="#">OMFAQ</a>	Community	USA	1975	1988
<a href="#">PGCMAI</a>	Community	USA	1982	-
<a href="#">CANE</a>	Community / Residential	UK	2000	2021
EasyCare	Community / Residential / Primary care	Europe/USA	1994	2010
CPAT	Residential	Australia	2008	-
<a href="#">interRAI LTCF</a>	Residential	USA <sup>1</sup>	1990	2020
LTCCGA	Residential	Canada	2008	-
<a href="#">Plaisir</a>	Residential	Canada	1983	1994
<a href="#">MDS 3.0 RAI</a> <sup>2</sup>	Residential	USA <sup>1</sup>	1994	2023
<a href="#">ValGraf</a>	Community / Residential	Italy	2004	-

<sup>1</sup> Based on the Resident Assessment Instrument (RAI) first developed in the USA

<sup>2</sup> The MDS 3.0 RAI can only be licensed for use in the USA but its initial edition (Minimum Dataset Resident Assessment Instrument: MDS RAI) could be used outside of the USA.

## Evaluation of CGA systems

After identifying systems used for CGA, a second systematic search, summarised in Figure 2, was conducted to evaluate the systems. The initial database search returned 3281 records, which were reduced to 73 records after title/abstract and full-text screening. Citation and web searches yielded another 44 records after screening. Altogether, 117 records were reviewed to gather evidence for evaluating and scoring the systems. The scores for each system are shown in Table 3. The table was completed using data for the latest version of a CGA system. Where data for the latest system was not (yet) available at the time of writing, possibly due to on-going tests/evaluation, data for the immediately preceding version was reported: Appendix 2 details the data used to evaluate and score the systems.

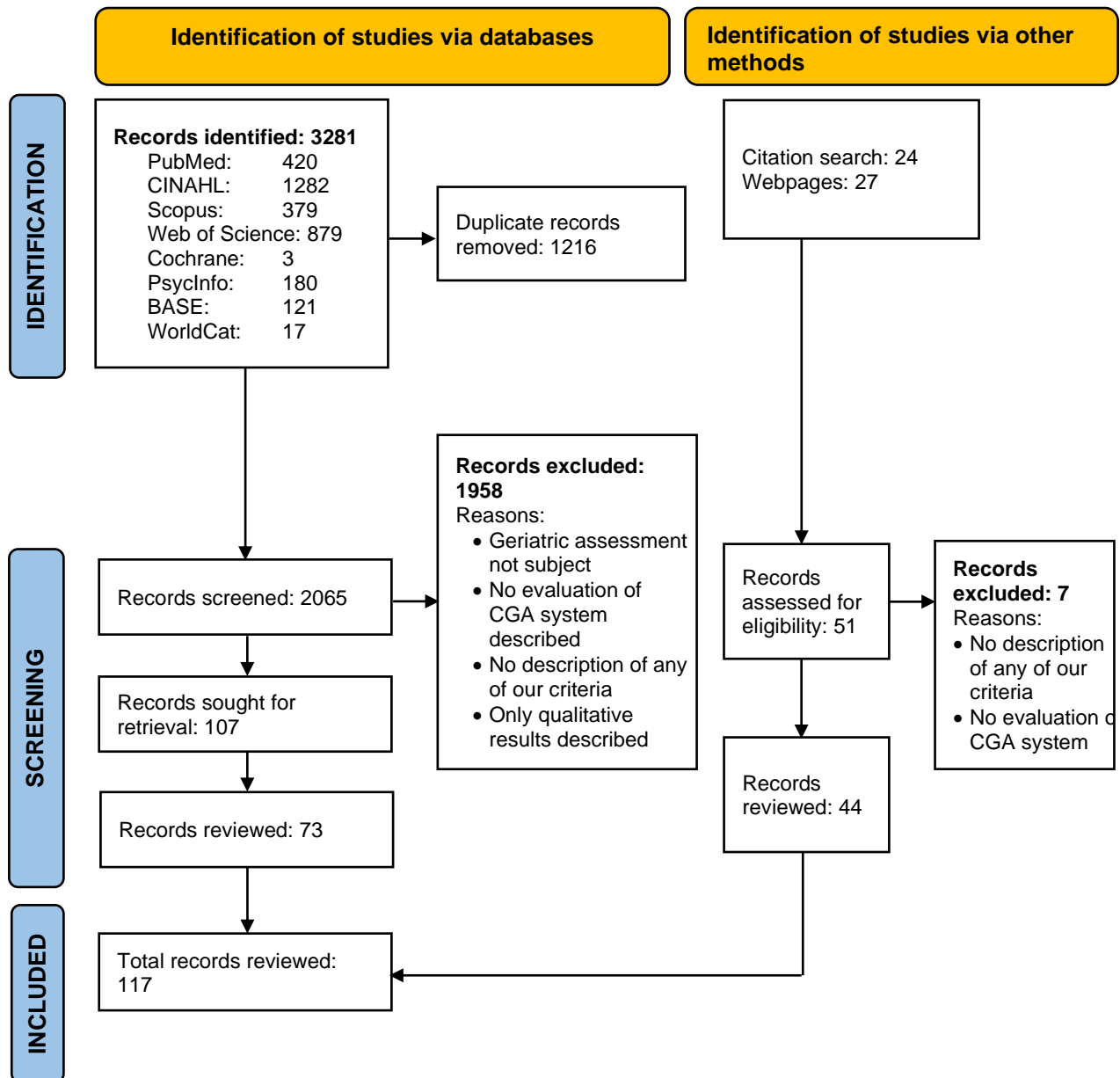


Figure 2: PRISMA flowchart for the search and selection of articles to evaluate CGA systems

**Table 3: Individual scores for each evaluation criterion and aggregate score for the CGA systems.**

*Apps = Applications; Term. = Terminology; Comp. = Compatibility; Org. = Organisational; Ongoing dev. = Ongoing development; Agg. Score = Aggregate score.* Colour codings as follows: NO COLOUR for reliability/validity score = 0, coverage score ≤ 2, aggregate score ≤ 9; **RED** for reliability/validity score = 1, coverage score = 3, aggregate score 10-14; **ORANGE** for reliability/validity score = 2, coverage score = 4, aggregate score 15-19; **YELLOW** for reliability/validity score = 3, coverage score = 5, aggregate score 20-24; **GREEN** for reliability/validity score = 4, coverage score = 6, aggregate score ≥25.

CGA system	Suitability	Language	Data		Apps	Term.	Coverage	Data burden	Assessor	Uptake	Comp.	Org. support	Ongoing dev.	License	Software support	Agg. score
			Reliability	Validity												
75+ Health Assessment	1	1	0	0	0	0	5	0	0	0	1	0	0	1	0	9
CANE	1	1	4	4	0	0	5	1	1	1	1	0	1	1	0	21
CARE	1	1	4	4	1	0	5	0	1	1	1	0	0	0	0	19
CARI	1	1	3	2	1	0	4	1	0	0	0	0	0	0	0	13
CHAMP	1	1	0	0	1	0	4	0	0	0	0	0	1	0	0	8
EasyCare	1	1	4	4	1	0	6	1	0	1	1	0	1	0	1	22
interRAI HC	1	1	4	4	1	1	6	1	1	1	1	1	1	1	1	26
OMFAQ	1	1	3	2	1	0	4	1	1	0	1	1	0	1	0	17
PGCMAI	1	1	4	4	1	0	5	1	0	1	0	1	0	1	0	20
CPAT	1	1	4	2	1	0	4	1	0	0	0	0	0	1	0	15
interRAI LTCF	1	1	4	4	1	1	6	1	1	1	1	1	1	1	1	26
LTCCGA	1	1	0	0	0	0	3	1	0	0	0	0	0	0	0	6
Plaisir	1	1	0	0	1	0	5	1	1	1	0	0	0	0	0	11
MDS 3.0 RAI	1	1	4	4	1	1	6	1	1	0	1	1	1	1	1	25
ValGraf	1	1	2	4	0	0	6	1	0	0	1	0	0	1	0	17

We compiled an aggregate score by simply summing the scores made against each of the criteria. Most of the criteria were scored by presence or absence of evidence (score of 1 or 0, respectively) and we did not attempt to weight any of the individual criterion scores when calculating an aggregate score (see Discussion). Using this system, an aggregate score could range between 0 and 26 (higher is better). In Table 3, we divided the aggregate scores into colour-coded ranges of 5 points for ease of viewing, although no system scored less than 6 so the ranges 0-4 and 5-9 are denoted the same (i.e., No colour). We consider that the aggregate score is open-ended as additional criteria could be considered and/or weighting of criterion scores applied.

The Long-Term Care Comprehensive Geriatric Assessment (LTCCGA) had the lowest aggregate score (6/26) and only scored points for 4 of the 15 criteria items. It was one of only 4 (75+ Health Assessment, CHAMP, LTCCGA, Plaisir) systems with an aggregate score of less than half of the highest score. As a consequence of being in the early stages of development (lack of evaluation evidence; lack of uptake), the CHAMP had a very low aggregate score (8/26). The interRAI HC and interRAI LTFC systems had the highest scores (26/26), fulfilling all the evaluation criteria. In a demonstration of the strength of systems originating from the RAI, the MDS 3.0 RAI had the second highest score and only failed the 'Uptake' criterion due to its availability for use only in the USA. The CANE, EasyCare and PGCMAI were the only other systems with an aggregate score of 20 or higher.

All systems met the 'Suitability' criterion as each system was designed for the specific setting where they are being used: the EasyCare, CANE and ValGraf were the only systems designed for use in multiple settings including community care [30-32]. Interestingly, the ValGraf was the only system to use graphics for descriptive representation of some (but not all) sections on the assessment form. All systems, except the 75+ Health Assessment, CANE, LTCCGA and ValGraf have at least one application that uses data collected during assessment to produce outputs that are designed to aid care provision. Only the interRAI HC, interRAI LTFC and MDS 3.0 RAI met the 'Terminology' criterion by having codes in the [LOINC](#) (Logical Observations Identifiers Names and Codes) code system [33-35].

## Discussion

### “Behind the numbers”

In evaluating the systems, Table 3 only indicates whether we found publicly available evidence of a system meeting a criterion but does not indicate the quality or strength of the evidence. We observed a spectrum of levels of meeting each criterion: the 'Reliability' and 'Validity' of the data items is a good example. Our review showed that psychometric properties could be tested for individual components/items [25, 36], specific domains [37] or the entire system [38]. Moreover, the

psychometric properties were characterised by testing for validity or reliability or, in rare cases, both. To complicate matters further, there are several statistical methods used to test for validity and reliability of observations; and studies did not use a common approach, making it difficult to perform direct comparisons. Despite the numerous ways and dimensions of testing the psychometric properties of assessment systems, our review showed that the RAI-derived systems (interRAI HC, interRAI LTCF and MDS 3.0 RAI) are the most validated: they have been validated in multiple dimensions and jurisdictions (and therefore populations). Although results for psychometric tests were mixed, in most of the studies, these RAI-based systems showed acceptable psychometric properties at a minimum and excellent properties in some cases [18, 38-56]. The 'Application' criterion is another good example where the score indicates the presence (or absence) of applications: some systems only have a single application (e.g., CPAT) while others have multiple (e.g., interRAI LTCF, interRAI HC, EasyCare).

## RAI-based systems

In uncovering the evidence for Table 3, we found that not only are the RAI-based systems the best-performing according to the evaluation criteria, but they likely outperform their alternatives by a notable margin. In addition to being the most validated as described earlier in this section, they have an extensive set of decision-support tools that include clinical assessment protocols (CAPs), risk screeners, outcome scales and quality indicators [57]. Such tools can help providers identify potential risks, predict outcomes, and guide appropriate interventions for preventive care [42]. The interRAI HC and interRAI LTCF share a set of core assessment items and applications. They are designed to be part of a fully integrated suite completed by several setting-specific assessment systems [46]. The interRAI integrated suite of assessment systems includes interRAI Community Health Assessment (interRAI CHA) and interRAI Check-Up (interRAI CU). The interRAI CHA and interRAI CU are abbreviated versions of the full interRAI assessments designed to minimise the assessment process by identifying those who may benefit from a full assessment [58]: as stated earlier, we did not consider shortened versions of assessment systems in this study. interRAI's stated rationale for the integrated suite of systems approach includes facilitation of sharing and exchange of interRAI-configured data [46, 58]; the use of LOINC codes additionally strengthen RAI-based systems by priming them for data exchange and analytics compatible with external health information systems. This integrated suite approach helps minimise data duplication since data collected in one setting can be shared with other settings during transfer of care (e.g., residential facility to acute care) and assessor training is simpler and more efficient as similar systems are used across care settings.

We found evidence that interRAI has robust organisational support for implementers, including an informative website complete with up-to-date contact information and a bibliography of interRAI-

related research [58]. In conducting this review, it was easy to find information on the interRAI website. The interRAI organisation also has training and certification programs for assessors to ensure integrity of interRAI assessments [59-61]. In comparison, we did not find a functioning website for the EasyCare system (the closest competitor to the RAI systems) despite having several web links listed in journal and other research articles.

Another strength of interRAI HC and LTCF systems is the ubiquity of research on the systems and research using the systems. Implementation of interRAI systems, in some cases mandated by governments, in several diverse countries [18] and in several languages indicates broad acceptability of the systems and interRAI's organisational approach. These past and ongoing implementations may also provide blueprints for future users. The main limitation of interRAI systems is that they can be difficult to implement, often requiring culture changes in organisations, IT upgrades and staff training [18]. However, as stated, past implementations can likely provide insights to help simplify the process.

## Other systems

Despite the lack of a website and scarcity of information for the EasyCare system, the system appears to be robust and has global acceptability comparable to that of interRAI systems. It performs well on the "Applications", "Coverage", "Data burden", and "Uptake" criteria, and in many of these criteria it is second only to the RAI-based systems. Although the EasyCare system appears to be very popular in many parts of Europe, the scarcity of contemporary information about the system that would potentially help providers implement the system (e.g., organisational support for implementation, licensing arrangements, assessor training, etc) is a major drawback.

The systems with aggregate scores close to the EasyCare are the CANE, CARE and PGCMAI. The CANE was one of the most popular systems in this review as shown by the number of research articles indexed on PubMed describing the system and the translation into at least 16 languages [62]. The strengths of the CANE are in the design for use in multiple settings including community, acute and residential care [31, 63, 64], extensive evaluations for its psychometric properties where it showed high reliability and mostly acceptable validity, good "Coverage" (covers 5 of the 6 domains described in our "Coverage" criterion), "Uptake" and "Data burden" (designed for completion in under 30 minutes) [31]. The weaknesses of the CANE include the apparent lack of organisational support (we could not find evidence indicating that the developers and copyright holders of the system have support structures to help implementers), software support, and applications, which limit its utility. The CARE has sufficient psychometric properties and several companion applications that include risk screeners for dementia, depression, ADL impairment, service utilisation and death. However, its performance on the "Data burden" criterion is poor, needing an average of about 90 minutes to

complete the full-length assessment. With no available information to indicate any updates to the system since its emergence in 1974, the CARE also performs poorly on the “Organisation support”, “Ongoing development”, “Licensing arrangement” and “Software support” criteria. The PGCMAI has above average psychometric properties and performs well on most criteria - the lack of evidence of compatibility with other settings, training programs for assessors, ongoing development and software support are its prominent weaknesses. Detailed descriptions of all the systems’ evaluations against the criteria are given in Appendix 2.

## Cost implications for adoption

The cost of adopting CGA systems is two-fold: (1) purchasing the rights to use a system (either through a licence or outright purchase) and (2) digital and workforce implementation costs such as software deployments and staff training. While cost was not a criterion in our evaluation, we noted that the systems available for a fee had the highest aggregate scores (MDS 3.0 RAI, interRAI LTCF, interRAI HC, EasyCare). Although the CANE, ValGraf and PGCMAI are available for free and have relatively high aggregate scores, they have shortcomings that make them potentially more inferior to the best-performing, paid-for systems than what the simple numbers in Table 3 indicate. Firstly, these freely available systems have fewer applications than the best-performing systems, which means they have lower decision support capability. Secondly, they do not have organisational and software support, which puts the burden for successfully implementing these systems solely on the user organisation(s): some organisations developing and maintaining assessment systems, such as interRAI, have established protocols for and experience in implementing their systems, and this improves chances of successful implementation. Thus, despite being available for free, there is likely more value in the paid-for systems.

## Comparison with other CGA reviews

Our findings in this study agree with those in previous similar surveys and systematic reviews: that interRAI assessment systems are the industry leaders for comprehensive geriatric assessments [11, 17, 37, 65]. A 2003 New Zealand review of assessment systems for community care showed strengths of the earlier edition of the interRAI HC (i.e., MDS HC) over the CANE, EasyCare and 75+ Health Assessment [17]: New Zealand piloted the system shortly afterwards and eventually adopting and mandating the interRAI suite of assessment for CGA across the country [18]. In Belgium, a 2005 project tested 4 systems and concluded that interRAI systems satisfied the very strict requirements (similar to the criteria in this study) set out by government [65]: the interRAI HC, interRAI LTCF and interRAI Acute Care were piloted at the conclusion of that study, eventually leading to implementation and mandating of interRAI suite of systems [18]. A 2018 review of CGA systems for residential aged care (long-term care) concluded that the interRAI suite of assessment systems was



the most suitable for supporting person-centred care across the continuum of aged care [11]. A recent review of amount and quality of evidence for psychometric properties of CGA systems for residential and community aged care concluded that the interRAI LTCF and interRAI HC were the best performing systems [37].

## Study limitations

Although this study conducted thorough searches of the traditional academic and grey literature, and web sources, its limitation is that it relied on publicly available/published information only. This potentially caused us to miss more “small scale” knowledge (e.g., a single province in Canada that uses a different CGA from the rest of the country). In addition, we did not contact the organisations behind the CGA systems we found, either to share our findings for verification, or to obtain further details. We suggest a follow up study which must deploy surveys to these organisations to help gather more contemporary details about the CGA systems. We also suggest that future studies survey aged care providers, software vendors, regulatory bodies, and other researchers to help uncover more assessment systems that may have more muted public profiles. While our simple scoring method allowed us to summarise and compare the overall performance of the systems against the evaluation criteria using an aggregate, the heterogeneity of the evaluation data meant we had to exercise some judgment (which could be subjective) in determining some scores. However, we attempted to reduce bias by performing dual scoring and we also provide the data used to generate the scores in the appendix.

## Conclusion

In conclusion, this review conducted an extensive online search for systems used for comprehensive geriatric assessments and their related information. We evaluated the systems using a list of criteria items validated by an expert industry representative group. In agreement with similar surveys of CGA systems and other systematic reviews, the evidence in this study suggests that the interRAI HC and interRAI LTCF are the best performing CGA systems for community and residential aged care, respectively. The outcomes of our study will be valuable for aged care providers and policy makers considering assessment systems and will simplify the process of selecting an assessment system.

## Appendix 1: CGA Systems Information Web links

### **75+ Health Assessment:**

[https://www1.health.gov.au/internet/main/publishing.nsf/Content/AA19024A21F2A7EACA257BF0001DAB97/\\$File/Health%20Assessment%20for%20Older%20Persons%20Proforma%20FINAL,%20March%202014.pdf](https://www1.health.gov.au/internet/main/publishing.nsf/Content/AA19024A21F2A7EACA257BF0001DAB97/$File/Health%20Assessment%20for%20Older%20Persons%20Proforma%20FINAL,%20March%202014.pdf)

### **interRAI Home Care**

<https://catalog.interrai.org/category/home-care>

### **OMFAQ**

<https://agingcenter.duke.edu/oars>

### **PGCMAI**

<https://abramsonseniorcare.org/media/1201/lawtons-pgc-multi-level-assessment-instrument.pdf>

### **CANE**

[https://www.cgakit.com/\\_files/ugd/2a1cfa\\_d9564ca2f0ea401183c979624d41ee04.pdf](https://www.cgakit.com/_files/ugd/2a1cfa_d9564ca2f0ea401183c979624d41ee04.pdf)

### **interRAI LTCF**

<https://catalog.interrai.org/category/long-term-care-facilities>

### **Plaisir**

<http://www.erosinfo.com/>

### **MDS 3.0 RAI**

<https://www.cms.gov/medicare/quality/nursing-home-improvement/resident-assessment-instrument-manual>

### **ValGraf**

<https://www.epicentro.iss.it/mentale/pdf/valgraf.pdf>

## Appendix 2: Data informing the evaluation of CGA systems.

CGA system	Suitability	Language	Data		Applications	Terminology	Coverage	Data burden	Assessor	Uptake	Compatibility	Organisational support	Ongoing development	Licensing	Software support
			Reliability	Validity											
75+ Health Assessment	Designed for community care[66]	Developed for Australia [66]	No evidence found	No evidence found	No evidence found	No evidence found	No 'consumer preferences'[67]	Estimates vary widely but interviews can be up to 90 minutes; the entire assessment can be up to 2 - 3 hours[17, 68]	No evidence found.	Uptake is low[69]	Can be used in residential aged care facilities but not in hospital.[66]	No evidence found	No evidence found	Available for free[67]	No evidence found
CANE	Designed for multiple settings[31]	Developed in English[31]	Early tests for reliability showed excellent interrater and test-retest reliability[31], and were consistent in later studies in multiple countries[70-78]	Early tests showed good face, content and construct validity as well as appropriate criterion validity for the 26 items and maintained in later studies[31, 71-74, 76-78]	No evidence found	No evidence found	No 'Consumer preferences'[79]	By design, it can be scored within 30 minutes[31, 79]	Little support for training is available aside from the instructions[79, 80]	Has been translated into ≥16 languages and evaluated in multiple countries.[70-72]	Designed for use in multiple settings including home care, acute care and long-term care[31, 64]	No evidence found	Latest version published in 2021[81]	The assessment form is available for free on a third party website[79]. We could not ascertain whether this is endorsed by the copyright owners of the system.	No evidence found
CARE	Designed for community	Developed in English[25]	Inter & test-retest reliability for items	Various aspects of validity for items and	Has several rules and algorithms to	No evidence found.	No 'Environment' and 'Consumer'	The full CARE assessment has 1500	Training material for assessors	Used in the USA and UK[28, 85]	The CARE is only one component of a suite	No evidence found	No evidence found	No information found	No evidence found

	care[25, 28]		and scales have produced acceptable results [25, 28, 82, 83]	scales have mostly acceptable validity [82, 84]	identify problems. [28]		preferences' [28]	items and needs on average 1.5 hours to complete. But, has abbreviated versions that are designed to reduce burden on assessors (however, these have reduced coverage) [28, 85]	available [28]		of systems to allow compatible evaluations across the care continuum [28]				
CARI	Designed for community care [86]	Developed in English [86]	Item-level inter-rater and test-retest reliability on different measures were mixed [86]	Adequate validity achieved only for the ADL domain but not in the medical and mental state domains [86]	Only has risk screeners for institutionalisation, hospitalisation, and death within a year [86]	No evidence found	Described as having domains: Mental status, ADLs, and medical status [86, 87]. Has Environment item under 'Medical status' making 4 of our 'Coverage' criterion: no 'Social support' and 'Consumer preferences'	Only has 40 items and needs only 5-10 minutes to complete [86]	No evidence found	No evidence found	No evidence found	No evidence found	No evidence found	No information found	No evidence found

CHAMP	Primarily designed for cancer patients in the community[26]	Developed in English[26]	Not yet evaluated[26]	Not yet evaluated[26]	Provides output summary, falls risk and other recommendations[26]	No evidence found	No 'Environment' or 'Consumer preference' domains[26]	No data	No evidence found	No evidence found	No evidence found	No evidence found	Tests of the first edition underway at time of writing[26]	No information found	Electronic version available[26] but we did not find evidence of software support for implementers
CPAT	No definitive data but system has been tested in RAC[88, 89]	Developed in English[88, 89]	Most items have good or excellent reliability. All scales for the 8 domains have excellent reliability. Domain-level inter-rater and test-retest reliability showed very high reliability[88-90]	Most domains showed large effect sizes when compared with criterion scales and in the Australian study, all but one domain showed acceptable validity.[89, 90]	Only one application described: Resident Classification Scale for funding purposes[88]	No evidence found	No 'Environment' or 'Consumer preference' domains[88]	Only has 60 items[88]	No evidence found	No evidence of widespread uptake within and outside Australia	No evidence found	No evidence found	No evidence found	Instrument is available for free[88]	No evidence found
EasyCare	Although the goal for the original system was for primary care[91, 92], it has proven useful in multiple settings[3]	Developed in English[91, 93]	Item-level test-retest reliability is at least adequate[36]. As a diagnostic tool, it showed high levels inter- and test-retest reliability[90, 94-96]	Criterion and construct validity for outcome scales are good; criterion validity for individual items is good[95-97]. Concurrent	Has some outcome scales, calculated from item answers and weighted by consumer and provider views, that provide summary scores for overall independence[93, 97, 100].	No evidence found	Covers all 6 domains[91, 97]	With only 49 items[94, 97], reported average completion times are 39-47 minutes[92, 97]	No evidence found.	Mostly used in Europe but also across the world including in low- and middle-income countries[93, 94, 101]	Can be used in multiple settings[30, 91, 93, 94, 102]	Despite several articles providing links to websites and EasyCare Foundation Ltd[96], we did not find any functioning websites or information	Since initial publishing in 1994, the system has been updated in 1999, 2004 and 2010[94]	No definitive information about adoption costs found. However, we found conflicting data that the system is available for free[96] (without explicit terms of use) and on annual	Electronic version available[94]

	0, 91, 93, 94]			t and convergent validity of the system shows good predictive validity[90, 95, 96, 98, 99]							about the organisation		subscription fee[17]		
interRAI HC	Adapted from the RAI for community care[103, 104]	Developed in English[103, 104]	Overall assessment and most individual items showed high inter-rater reliability in multi-nation studies[46] and single country studies[49, 105]. Items common to other interRAI systems also have high reliability[46, 49]. Outcome scales and screeners have also shown high	Validity of items on the HC is mixed but majority have acceptable validity.[105, 108] Validity of scales is similar: with few scales showing below acceptable validity[52] but most scales and other indices have acceptable validity[45, 106, 109]	Algorithms and applications include Clinical Applications (CAPs), risk screeners, scales, resources utilisation, and quality indicators[57, 110]	The interRAI HC instrument has a LOINC code (individual items do not)[33]	Covers all 6 domains in the 'Coverage' criterion[111]	interRAI systems are designed to minimise data burden, median completion times of the interRAI HC of 40-60 minutes have been reported[49, 112]	interRAI has established training programs with several delivery formats and includes validated materials, processes, and personnel[59, 60, 113, 114]	Used in many countries and jurisdictions, including mandated use in some[18, 115-117]	The interRAI HC is part of an integrated suite of systems for multiple settings and contains a core set of common items and scales available in several other systems.[46, 49]	interRAI has established structures to support implementors of their systems[59, 61]	interRAI has been continuously updating the interRAI HC since its introduction as RAI-HC in 1996[103, 104, 118]	Information available on organisation website[24]	interRAI maintains a publicly available catalogue of vendors licensed to provide software solutions[119]

			reliability[105-107]													
interRAI LTCF	Designed for RAC[58]	Developed in English[23]	Overall assessment and most individual items showed high inter-rater reliability in multi-national studies[46, 120] and single country studies[49]. Items common to other interRAI systems also have high reliability[46, 49]. Scales and screeners have acceptable reliability[49, 106, 121]	Validity of scales is mixed: with few scales showing below acceptable validity[52] but most scales and other indices have acceptable validity[106, 121]	Algorithms and applications include Clinical Assessment Protocols(CAPS), risk screeners, scales, resources utilisation, and quality indicators[57]	The interRAI LTCF instrument has a LOINC code (individual items do not)[34]	Covers all 6 domains in the 'Coverage' criterion [122]	interRAI systems are designed to minimise data burden, median completion times of 40 minutes have been reported[49]	interRAI has established training programs with several delivery formats and includes validated materials, processes, and personnel[59, 60, 113, 114]	Used in many countries and jurisdictions, including mandated use in some[18, 115, 120, 123-126]	The interRAI LTCF is part of an integrated suite of systems for multiple settings and contains a core set of common items and scales available in several other systems.[46, 49, 127]	interRAI has established structures to support implementers of their systems[59, 61]	interRAI has been continuously updating the interRAI LTCF since its introduction as RAI-MDS[122]	Information available on organisation website[24]	interRAI maintains a publicly available catalogue of vendors licensed to provide software solutions[119]	
LTCCGA	Designed for RAC[29]	Developed in English[29]	No evidence found	No evidence found	No evidence found	No evidence found	No 'Social support', 'Environment', and 'Consumer preferences'	Only one page[29]	No evidence found	No evidence of uptake outside Nova Scotia, Canada[29]	No evidence found	No evidence found	No evidence found	No evidence found	Assessment available with published journal paper but no information on rights to use in practice[29]	No evidence found

							domains[29]								
MDS 3.0 RAI	Designed for RAC[21, 23]	Developed in English[23, 27]	Most items have very good or excellent inter- and test-retest reliability[128-130]	Items for specific domains showed good validity and improvement on the MDS 2.0 validity [128] Validity of outcome scales tested across editions of RAI is mixed but most showed acceptable validity[128-150]	Has several outcome scales, screeners, and quality indicators[128, 138]	The MDS 3.0 RAI is fully represented in the LOINC system[35]	Covers all 6 domains in the 'Coverage' criterion [27]	The average and median completion times are both about 1 hour and are about 45% improvement from MDS 2.0[128]	Training materials and support available[151]	Licensed only for use in the USA[24]	Shares items, consistent language and conceptual basis with other systems used in other settings originating from the RAI[22]	The Centers for Medicare and Medicaid Services (CMS) has resources to help implementers in the USA[27]	The MDS has been going through updates since its initial release[21, 27]	Licensable only in the USA[24]	Software support available and CMS holds regular technical information calls for vendors[152] <sup>3</sup>
OMFAQ	Designed for community care[153]	Developed in English[153]	Inter- and test-retest tests for items in the first part of the assessment demonstrated acceptable levels[153, 154].	Validity tests for some scales (Part A) of the system showed good criterion validity[153]	Provides summaries and classifies patients according to functional status and service utilisation[153]	No evidence found	No 'Environment' and 'Consumer preference' domains[153, 154]	Can be completed in an average of 45 minutes[153]	Training manual freely available. Contact details for requesting materials and assistance available[156]	No evidence of uptake outside country of origin (US)	Can be used in residential and community settings[157]	Training manual freely available. Contact details for requesting materials and assistance available[156]	No evidence found	The system and manuals are available for use and free of charge to clinicians and researchers[156]	No evidence found

<sup>3</sup> Note: due to the exclusive availability of the MDS 3.0 RAI in the USA, the web link provided in the reference list for this citation can only be opened by internet users with a US IP address



			Reliability of the 'social resources' scale is very low[155]												
PGCMAI	Designed for community care[158]	Developed in English[159]	For internal consistency tests of scales, results were mixed although mostly good. Similar results obtained in inter- and test-retest tests for rating scales[159, 160]	Internal validity for scales and sub-indices was mixed but mostly good. Small to medium effect sizes reported for criterion validity but large effect sizes for concurrent validity[159]	Summary ratings and screeners are available[159]	No evidence found	Covers 5 of 6 domains in the 'Coverage' criterion: no 'Consumer preferences'[159]	Requires an average of 50 minutes to complete full assessment[159]	No evidence that organisation has a training program. However, instrument manual is freely available.[161]	Mostly used in the USA but also in Sweden[160, 162]	No evidence found	Operating manual freely available. Contact details for enquiries available in the manual[161]	No evidence found that the system is undergoing continuous development	Available for free[161]	No evidence found
<sup>4</sup> Plaisir	Designed for RAC[163]	English version available[163]	No evidence found	No evidence found	Data is entered into a software that calculates the profile of nursing and assistance resources required by the client[163]	No evidence found	Covers 5 of 6 domains in the 'Coverage' criterion: no 'Consumer preferences'[164]	There are 104 variables but there is no data on how long it takes to complete or acceptability by	The org (EROS) has a training program and materials for assessors[165]	Used in Quebec (Canada) but also used in several European countries[166, 167]	No evidence found	No information available. Reference manual free for download on the EROS website[168] but no	Last edition published in 1993[168]. No evidence of ongoing development or later editions	Assessment form and user manual are available for free download on the organisation's website, but we could not find information regarding	Computerised data collection for assessment tool is available[170] but we did not find evidence of software support for implementers

<sup>4</sup> Some of the data used to evaluate this system is drawn from a machine-translation of a website published in French

								assessors. An evaluator can assess 5 to 10 clients per day[164]				details on the terms of use.		terms/conditions of use[168, 169]	
ValGraf	Designed for residential and community care[171]	Developed in Italian but English version is available on request[171]	Reliability for all domains were acceptable or excellent (results originally reported in Italian language)[171]	Construct validity of the entire system was good. Concurrent validity for some domains showed large effect sizes[171]	No evidence found	No evidence found	Covers all 6 domains in the 'Coverage' criterion[32]	Only 99 items for the residential and 124 items for the community care[171]	No evidence found	No evidence of uptake outside Italy	<sup>5</sup> Community care version is adapted by adding relevant items to the residential version.[32, 171]	No evidence found	No evidence found	The English version is available on request free of charge and no fee is required for its use.[171]	No evidence found

<sup>5</sup> Some of the data used for this criterion is drawn from a machine-translation of a webpage published in Italian

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