CHAPTER 2

Comprehensive Geriatric Assessment

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OBJECTIVE

To learn the meaning of comprehensive geriatric assessment (CGA), its domains and commonly used assessment instruments, as well as its application in clinical programmes.

KEY POINTS

- CGA is a diagnostic process of getting to know an elderly individual in all dimensions; it is the cornerstone of geriatric medicine.
- Key domains in the assessment of elderly patients include physical health, functional capacity, mental function, socioeconomic resources, and environmental resources.
- Useful information can be acquired from both elderly patients and their family / friend / caregiver.
- When caring for a frail old person with multiple illnesses, multiple medications and complex needs, we have to ask the right questions. Instead of asking just where they should go and who is responsible, we should work together and ask who are they, and how we can help satisfy their needs.
- Dual sensory impairment in vision and hearing is associated with cognitive and functional decline and increased mortality.
- To identify early cognitive impairment, a combination of patient-based and informant-based screens are the most appropriate approach.

2.1 Introduction

The simultaneous presence of multiple interacting problems (physical, psychological, and social) and the unmet needs of a frail elderly patient require an assessment more complex than that provided by a routine medical diagnosis. Comprehensive geriatric assessment (CGA) is a multidimensional interdisciplinary diagnostic process intended to determine a frail elderly person's medical, psychosocial, and functional capabilities, and problems and aid in the development of a coordinated and integrated plan for management and long-term follow-up.[1] CGA forms the basis of a frail elderly person's treatment and rehabilitation plan. The goals are to reduce pain, improve function, delay death, and ultimately improve quality of life. In contrast to high technology, CGA emphasises high touch. It extends beyond the patient to the individual, from diagnosis to assessment, and from treatment to management. CGA, coupled with multidisciplinary care, has become the cornerstone of geriatric medicine and geriatric care systems.

2.2 Evidence of the Effectiveness of CGA

Early pioneers of geriatric medicine such as Marjory Warren and Lionel Cosin introduced the concept of CGA in the 1930s on the basis of faith and optimism. Today, CGA programmes have evolved and been the subject of scientific scrutiny in the era of evidence-based medicine. Since the late 1970s, controlled trials have evaluated the effectiveness of CGA with consequent publications of positive results in the 1980s.[2] A 1993 meta-analysis by Stuck et al[3] of 28 controlled trials of CGA programmes that involved hospital units, hospital consultation teams, in-home assessment services, outpatient assessment services, and hospital-home assessment programmes demonstrated the benefit of CGA in terms of reduced mortality risk, improved likelihood of living at home, reduced hospital readmissions, greater chance of cognitive improvement, and greater chance of physical function improvement. Since then, major international conferences have been held to discuss this new concept of CGA,[4] and further controlled studies and meta-analyses have confirmed the favourable outcomes.[5-10]

2.3 Complications and Costs of CGA

Although beneficial, there are concerns about CGA. Complications can occur when it is overused or abused. An example is delirium as a result of fragmented and duplicate assessment by different

professions.[11] CGA should be performed in the clinical setting with due regard to the patient's tolerance and well-being with appropriate clinical interpretation of the assessment results. Another concern, notably from hospital management, is the costs associated with the involvement of multiple disciplines. Wieland[12] reviewed 19 randomised controlled trials that reported the cost endpoints in CGA, and concluded that CGA was cost-efficient (less cost for same outcome or same cost for better outcome) for the majority, and cost-effective for a few. A related issue is not to invest in programmes that are not effective. It is therefore important to observe the organisational elements of CGA that are associated with effective programmes, as concluded from previous meta-analysis and reviews of CGA (Table 2.1).[2,12]

CGA programmes can fail if they target individuals who are too healthy to derive benefit or if they fail to identify the frail. To be effective, assessment must be linked with management, called Geriatric Evaluation and Management in the US. Returning elderly patient to a previous care environment may not be feasible if iatrogenic problems are identified during assessment. The three essential components of an effective CGA programme are therefore:

- identifying or targeting a frail elderly individual;
- assessment of the individual and consequent recommendations for care; and
- implementation of the recommendations by a geriatrician and / or interdisciplinary team

2.4 CGA Programmes

2.4.1 CGA within the Hospital

In-patient CGA programmes have been developed for both the acute and the post-acute setting. An acute care for the elderly unit is designed to cater for the special needs of acutely ill elderly inpatients, combining CGA with interventions such as interdisciplinary care for geriatric syndromes in an age-friendly environment, as well as discharge planning and support. CGA programmes in the post-acute environment focus on the continuation of post-acute care and rehabilitation of elderly inpatients by an interdisciplinary team. The interdisciplinary team conference is crucial to the success of an inpatient CGA programme. Meta-analyses have demonstrated the effectiveness of such programmes in both the acute and post-acute rehabilitation setting.[5-7] A 2011 Cochrane meta-analysis of 22 trials involving 10315 participants in six countries concluded that inpatient CGA programmes increased a patient's likelihood of being alive and resident in their own home following an emergency admission to hospital, especially if they were cared for on a ward that performed CGA, and were also associated with a potential cost reduction compared with general medical care.[8]

Table 2.1 Organisational elements of comprehensive geriatric assessment associated with effective programmes[2,12]

- Targeting the frail
- Interdisciplinary team structure
- Comprehensive / multidimensional geriatric assessment
- Management with clinical control of treatments and care
- Long-term follow-up

2.4.2 CGA and the Hospital-home Transition

CGA that targets elderly patients at high risk of recurrent heart failure after hospital discharge, combined with post-discharge follow-up at the hospital and at home has been shown to reduce hospital readmissions, improve quality of life, and reduce net cost.[9,13]

2.4.3 CGA in the Community

In Hong Kong, CGA in the community is performed by geriatric day hospitals (GDHs) and community geriatric assessment teams (CGATs). Stroke patients are the major users of GDHs. Physical function in terms of self-care, mobility, and household function has been shown to improve following discharge from a GDH.[14] CGATs were established in Hong Kong in 1994 to enhance and preserve the health and quality of life of elderly persons in the community by timely assessment and appropriate management. At its inception, CGAT services included assessment prior to admission to subvented care homes or hospitals, outreach geriatric clinics for care homes, hospital discharge support services, and geriatric home care. The effectiveness of CGAT in supporting frail elders in the community is evidenced by the lower hospital utilisation by care homes with CGAT support in terms of accident and emergency (A&E) department attendance, total hospital admissions, and total hospital bed-days, with relative reductions of 24%, 24%, and 43%, respectively (Figure 2.1).[15]

2.4.4 CGA at the Hospital Interface: Gate-keeping Versus Goal-keeping in Caring for the Frail Old

For the frail old with multiple problems, the question is often asked, "where should s/he go, whose responsibility is this?" In a time of rationing and rationalisation, modern healthcare tends to answer with gate-keeping that is primarily resource-driven, leaving less room for goal-keeping that is needs-led (Figure 2.2a). This was aptly described by the Canadian geriatrician, Professor Kenneth Rockwood,[16] "Modern health care needs to reconcile itself to complex patients. There are many wrong ways to address this, each of which has the following

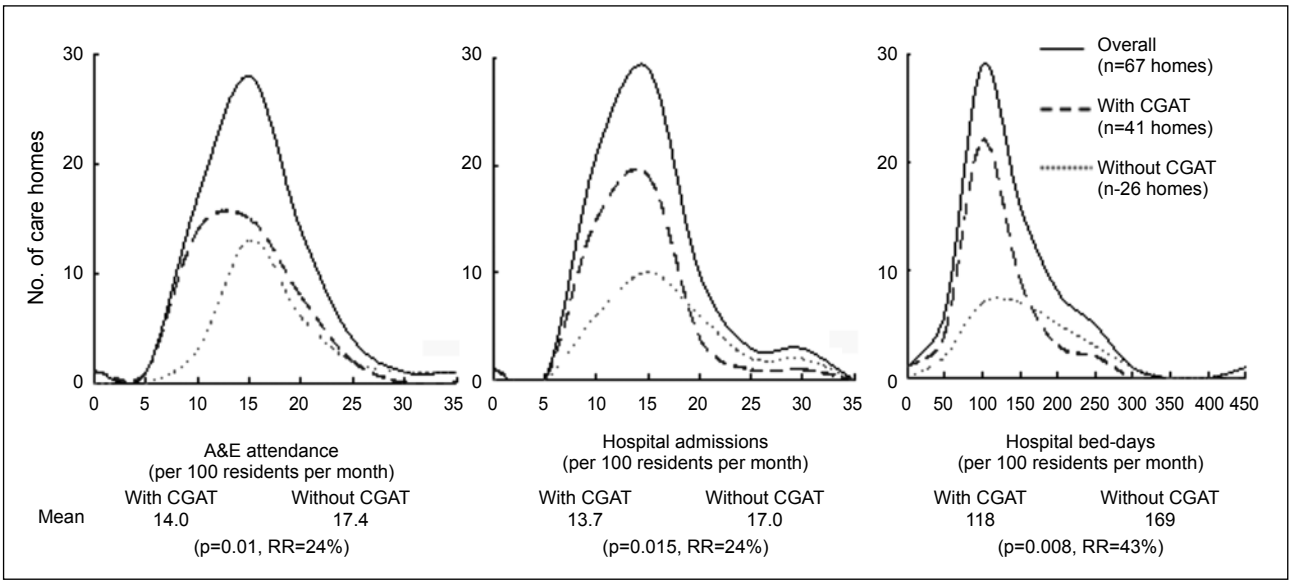


Figure 2.1 Effectiveness of community geriatric assessment team (CGAT) in reducing hospital utilisation by care home residents, based on survey data (November 2004 to January 2005) for Princess Margaret Hospital from Hospital Authority, Hong Kong[15]
Abbreviations: A&E = accident and emergency department; RR = relative risk

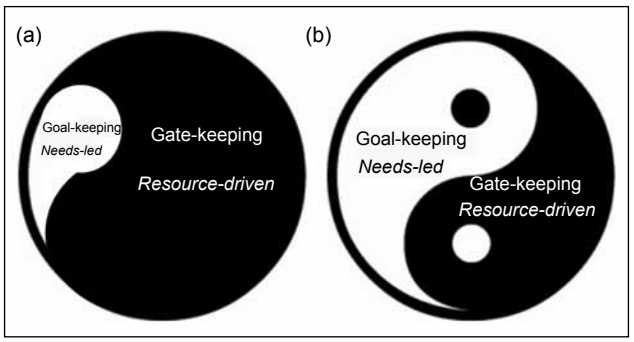


Figure 2.2 (a) Gate-keeping and goal-keeping dichotomy and (b) their harmonisation through comprehensive geriatric assessment

in common: instead of getting to grips with how service is provided, they want the frail old people to go away, to some more appropriate place."

Nevertheless there is evidence that with CGA and effective organisational elements mentioned above, goal-keeping can be harmonised with gate-keeping, whereby goal-keeping can lead to gate-keeping with a reduction in resource utilisation, and gate-keeping can result in goal-keeping with attention to the needs of elders (Figure 2.2b). Evidence to support such cost-effective CGA programmes has been shown in a number of settings. First, CGA prior to entry into a care home has enabled detection of treatable previously undiagnosed illnesses, improved physical function, alleviation of the need for care home placement, and reduced total health and social costs.[17,18] As of 2014, 6.1% of elders aged >65 years in Hong Kong were resident in a care home. Timely introduction of specialist assessment prior to care home entry locally may help to reduce this relatively high institutional rate with important implications for quality and costs of elderly healthcare. Second, the benefit of CGA has been shown at A&E departments. Attention has been drawn to the problems of A&E in managing frail elders.[19,20] Studies of CGA at A&E have shown enhanced function and reduced use of care homes without increased cost.[21-23] Studies of patients who present to A&E following fall also highlight the importance of CGA in this area, with reduced serious injury and subsequent bed-day utilisation.[24-26] Third, it has been shown that CGA reduces serious adverse drug reactions while reducing suboptimal prescribing.[27] Inappropriate medication and adverse drug reactions are important causes of hospital admission of elders.[28,29] Thus CGA that targets polypharmacy can be both goal-keeping in improving the medical care of elders and gate-keeping in reducing iatrogenic hospitalisations.

2.5 CGA Domains and Instruments

The World Health Organization and the British Geriatrics Society have recommended the following domains for comprehensive assessment of elderly patients: physical health; functional capacity; mental function; social resources; economic resources; and environmental resources.[30,31] A number of validated instruments for geriatric assessment have been developed and published since the 1960s on these various domains (Table 2.2[32-91]).

Table 2.2 Domains and instruments of comprehensive geriatric assessment[32-91]

Domain	Instrument / test
Physical health	
Vision	Snellen Visual Acuity Test, visual function assessment instruments[32-36], Melbourne Edge Test,[37] visual field, Albert's line cancellation test for visual neglect[38,39]
Hearing	Screening Version of Hearing Handicap Inventory for the Elderly (HHIE-S),[40-42] Whispered voice test[43]
Swallowing	Water swallow test[44,45] (see Chapter 43)
Nutrition	Mini Nutritional Assessment (MNA)[46,47] [see Chapter 30], Simplified Nutritional Assessment Questionnaire (SNAQ)[48]
Medication	GerontoNet ADR risk score,[49] Medication appropriateness index,[50] Morisky 8-item medication adherence scale[51] (see Chapter 15)
Comorbid conditions and disease severity	Charlson Comorbidity Index,[52] Cumulative Illness Rating Scale–Geriatrics (CIRS-G)[53,54]
Functional capacity	
Basic activities of daily living (ADL)	Katz index, Barthel index, Functional independence measure (FIM) (see Chapter 4)
Instrumental activities of daily living (IADL)	Lawton's IADL[55]
Balance and mobility	Get-up and go,[56] Timed Up & Go,[57] Berg Balance Scale,[58] Functional Reach Test[59] (see Chapter 20)
Frailty	"FRAIL" Questionnaire Screening Tool,[60] Canadian Study of Health and Aging Clinical Frailty Scale[61,62]
Sarcopenia	SARC-F screen for sarcopenia[63]
Mental function	
Cognition	Clock drawing test,[64-66] Executive clock drawing task (CLOX),[67-69] Mini-Cog,[70] Saint Louis University Mental Status (SLUMS) examination,[71] Rapid Cognitive Screen (RCS)[72] Mini-Mental State Examination (MMSE),[73] Chinese version of the Mini-Mental State Examination (CMMSE)[74,75] Abbreviated Mental Test (AMT)[76,77] Addenbrooke's Cognitive Examination Revised (ACE-R)[78] Montreal Cognitive Assessment (MoCA)[79-83] Ascertain Dementia 8 (AD8),[84,85] Chinese AD8 (cAD8)[86] Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE)[87]
Confusion	Confusion assessment method (CAM)[88] (see Chapter 24)
Mood / anxiety / fears	Geriatric Depression Scale (GDS)[89] (see Chapter 25)
Socioeconomic resources	Social network and support checklist (see Chapter 16) Eligibility for care resources / disability allowances
Environmental resources	Checklist for positive environment (age-friendly,[90] supportive [therapeutic, prosthetic], accessible, adaptable, comfortable, safe[91]), negative environment (iatrogenic, barriers, hazards), transport facilities, accessibility to local resources

The Royal College of Physicians and the British Geriatrics Society have recommended standardised assessment scales for use in geriatric practice to facilitate 75-plus screening, clinical and research communication, and case-mix comparison: the Barthel ADL index, the Abbreviated Mental Test (AMT) score, the Geriatric Depression Scale, the Philadelphia Geriatric Center Morale Scale, and a social support checklist.[92]

Over the years, CGA has evolved from a selection of single-domain, individually validated measures (the 'first generation' of assessment instruments) to the 'second generation' omni-comprehensive assessment instruments developed for a specific healthcare environment (e.g. Minimum Data Set–Nursing Home) in the 1990s to the 'third generation' of standardised communication system in transitional care in the 2000s based on a common set of standardised assessment items in addition to a limited number of setting-specific items, e.g. interRAI HC (home care), interRAI LTCF (long-term care facility), and interRAI AC (acute care).[93,94] The third-generation instruments share core elements of information and are intended for elderly patients in all healthcare environments and to improve information transfer in transitional care. These instruments use the same philosophy of assessment to facilitate clinical communication both between different caregiving professionals and across acute, post-acute, and long-term care settings. They aim to enhance interdisciplinary care planning and continuity of care with effective use of information technology.[93]

2.6 Visual Assessment

Assessment of vision is especially important in old age because impairment is common, strongly associated with falls and fractures, adversely affects communication and medication handling; and yet is often remediable through surgery or prescription of spectacles.

Assessment of vision begins with taking a history: questions about function (can you feed yourself? dress? handle / inject medication? read? watch television? cook? sew? shopping? drive?); use of aids (spectacles and why? magnifying glass?); accident, falls, and near-falls (bump to one side?); and risk factors (diabetes, stroke, hypertension, steroid, smoking, alcohol). Examination includes response to hand shaking, test of newspaper reading, inspecting spectacles, visual acuity and contrast sensitivity testing, fundoscopy, visual field examination, and tests of perceptual neglect.

Visual acuity is the ability to see detail at a distance. This is recorded as a Snellen fraction when the person being assessed reads down the Snellen chart of a series of letters or letters and numbers that reduce in size from the top to the bottom. The Snellen fraction records the ability to identify a letter of a certain size at a specified distance. The first number or numerator of the Snellen fraction is the testing distance (standard is 20 feet or 6 m). During the visual acuity test, one eye is covered and the vision of each eye is recorded separately, as well as both eyes together. When the person is unable to correctly identify more than half the letters on a line, the previous line will be recorded as the visual acuity. The second number or denominator of the Snellen fraction represents the distance that the average eye can see the letters on a certain line of the eye chart. A Snellen fraction of 20/40 or its metric equivalent 6/12 means that the eye being tested can see at 20 feet (6 m) the smallest letter that can be seen by the average eye at 40 feet (12 m). Visual acuity worse than 20/400 or 6/120 is recorded as count fingers (at a certain number of feet), hand motion (at a certain number of feet), light perception, or no light perception.

Impaired vision is considered present when the level of vision is below that which the individual requires for his or her everyday tasks. A common cut-off point is binocular visual acuity of 6/12 or 6/18 as used in the Medical Research Council study. Legal blindness is taken as 6/60. The common causes of impaired vision are refractive errors, cataract, glaucoma, macular degeneration, and stroke.

Visual function assessment instruments have been developed to measure a patient's vision capability that may not be reflected by testing visual acuity alone.[32] These consist of questions to assess visual perception (activity limitation, near vision, intermediate vision, and distance vision), sensory adaptation (light / dark adaptation, visual search, colour discrimination, and glare disability), peripheral vision, depth perception, social functioning, role limitations, dependency, and mental health. Chinese versions of such visual function assessment instruments that deal with daily vision-dependent activities and associated everyday problems relevant to Chinese culture have been developed and used.[33-36]

Edges in the environment, such as steps and pavement, are naturally occurring visual stimuli of functional significance. An impaired ability to perceive edges will disadvantage elderly persons, especially those with slow reaction times, muscle weakness, or reduced peripheral sensation, and increase their fall risk.[95] Edge contrast sensitivity can be assessed by the Melbourne Edge Test that contains 20 circular test patches of 25 mm diameter, with a series of edges of reducing contrast and variable orientation.[37]

Visual field is assessed by confrontation and perimetry. Visual field loss is present in 1 in every 20 community-dwelling elderly people, increased in incidence 5-fold between 55-80 years of age, and is associated with impaired daily functioning and fall risk.[96,97] Glaucoma, stroke, cataract, and age-related macula degeneration are common causes of visual field loss in old age.[52,53,98]

Perceptual neglect or hemi-neglect is a defect in the detection, orientation, or response to stimuli (visual, auditory, or tactile) from spatial regions on the side contralateral to the side of cerebral damage, and the deficit cannot be attributable to malfunction in more basic sensory or motor systems. Perceptual neglect has been found in 49% of non-dominant hemisphere strokes and 25% of dominant hemisphere strokes in the early stages.[32] It can readily be diagnosed from the characteristic sitting posture of slumping to one side diagonally, leaving behind an exposed triangle ('inverted triangle sign') on the back of the chair, with the trunk and head rotated away from the side of weakness, and conjugate eye deviation away from the side of weakness (Plate 2.1). Visual neglect can be assessed by the Albert's line cancellation test,[38,39] in which the patient is asked to cross out lines ruled on a sheet of paper; the central line being crossed by the examiner as a demonstration (see Learning Manual). The Albert's test score is the percentage of lines left uncrossed and is an important prognostic factor in determining both mortality and functional recovery from stroke.[32] Patients with hemi-neglect are prone to fall and injuries on the side of neglect and may ignore half a plateful of food (Plate 2.1). Caregivers need to be taught to recognise and appreciate the consequences and distress for patients with this perceptual deficit.

2.7 Hearing Assessment

Assessment of hearing in old age is important because impairment is common and disabling; it adversely affects communication; impairs physical, cognitive, and social function; is associated with mood disturbances and behaviour disorders; and

yet often can be improved by amplification, use of appropriate hearing aids, and aural rehabilitation (see Chapter 28).

Assessment of hearing starts with taking a history: questions about function (hear door / telephone bell? hear telephone conversation? visit friends? accused of turning radio / television up too loud? accused of being stupid?); use of aids (hearing aids / amplifiers?); and risk factors (chronic noise exposure, diabetes, hypertension, ototoxic drugs, alcohol). The Screening Version of Hearing Handicap Inventory for the Elderly (HHIE-S)[40,41] is a validated self-administered 10-item questionnaire designed to detect emotional and social problems associated with impaired hearing (Table 2.3). A HHIE-S score of >8 has a sensitivity of 72%, specificity of 77%, positive predictive value of 58%, and negative predictive value of 86% for detecting impaired hearing in elderly persons. With a HHIE-S score of >24, the corresponding values become 41%, 92%, 67%, and 78%.[41] The HHIE-S has been translated and adapted for other languages, including Chinese[42] (Table 2.3).

Examination includes screening hearing tests, otoscopy to identify impacted ear wax, eardrum perforation or other abnormalities, and audiometry. Tuning fork tests are used to distinguish conductive from sensorineural hearing loss. Vision should also be assessed since hearing and vision impairment often coexist in elderly persons. Loss of visual clues in a hearing-impaired elderly person will further impair speech, and dual sensory impairment is associated with cognitive and functional decline and increased mortality.[99,100]

A simple hearing test is the whispered voice test.[43] A tester stands behind (to prevent lip reading) and to the side of the seated patient, at arm's length (0.6 m) from the patient's non-test ear that is masked by gently occluding and rubbing the external auditory canal, and whispers sets of three random numbers (e.g. 6, 1, 9). The patient is asked to repeat the sequence. If the patient cannot repeat back over 50%

Table 2.3 Screening Version of the Hearing Handicap Inventory for the Elderly (HHIE-S)[40,41] and its Chinese translation[42]

Question	Score*
1. [E] Does a hearing problem cause you to feel embarrassed when you meet new people? 聽力問題使您在遇見陌生人時感到窘迫嗎？	
2. [E] Does a hearing problem cause you to feel frustrated when talking to members of your family? 聽力問題使您在與家人交談時感到沮喪嗎？	
3. [S] Do you have difficulty hearing when someone speaks in a whisper? 有人跟您細聲說話時是否會感到費勁？	
4. [E] Do you feel handicapped by a hearing problem? 聽力問題會使您感到障礙或不方便嗎？	
5. [S] Does a hearing problem cause you difficulty when visiting friends, relatives or neighbours? 聽力問題會使您在拜訪親朋好友時遇到困難嗎？	
6. [S] Does a hearing problem cause you to attend religious services less often than you would like? 聽力問題會使您參加活動的次數比以前少嗎？	
7. [E] Does a hearing problem cause you to have arguments with your family? 聽力問題會導致您與家人爭吵嗎?	
8. [S] Does a hearing problem cause you difficulty when listening to television or radio? 聽力問題會使您在看電視或聽廣播時感到困難嗎？	
9. [E] Do you feel that any difficulty with your hearing limits or hampers your personal or social life? 您是否感到聽力問題影響您個人或社會生活？	
10. [S] Does a hearing problem cause you difficulty when in a restaurant with relatives or friends? 聽力問題使您在餐館與親友交談時遇到困難嗎？	
Total score:	

Abbreviations: [E] = emotional handicap question（情緒問題）; [S] = social handicap question（情景問題）
* Scores (range, 0-40): 0 = "no（不是）" response; 2 = "sometimes（有時）"; 4 = "yes（是）"

of the test items over a minimum of two sets, s/he is assumed to have hearing impairment that requires further audiometric assessment.

An audioscope is an instrument that serves as both an otoscope and simplified audiometer. It delivers pure tone frequencies at 20, 25, and 40 decibels at 500, 1000, 2000, and 4000 Hz. Critical frequencies for speech reception are 500, 1000, 2000, 3000 Hz. In the American Speech-Language-Hearing Association guidelines, 25 dB is the standard screening level used for adults. To use the audioscope, the tester selects the largest ear speculum needed to achieve a seal within the external auditory canal, obtains a clear view of the tympanic membrane, and removes any impacted ear wax before testing. The tonal sequence is then initiated with the patient indicating by raising a finger that s/he has heard the tone. The tester records whether the tone is heard at each frequency for each ear. When tested in the physicians' offices and a hearing centre, the sensitivity of the audioscope was 94% in both locations, while its specificity was 90% in the hearing centre and 72% in the physicians' offices.[41] A better test accuracy was obtained when the HHIE-S test was combined with an audioscope test.[41]

2.8 Cognitive Assessment

Cognitive impairment occurs along a continuum from ageing-related cognitive decline to mild cognitive impairment (MCI) with intact daily function to dementia that affects daily function. Cognitive impairment is a geriatric giant with significant impact on the patient, their family and friends, and clinicians. Early detection of impaired cognition allows for diagnosis, appropriate treatment, and support. Cognitive assessment is commonly used to screen for cognitive impairment; obtain differential diagnoses of its cause; rate its severity; monitor change; and make decisions about competency, management, and placement.

With a view towards better care from geriatricians for patients with cognitive impairment, the British Geriatrics Society produced a consensus document in 2005 that recommended use of Mini-Mental State Examination (MMSE)[73] and an executive clock drawing task (CLOX1)[67] as the two initial screening tests in a cognitive screening algorithm.[101] Patients with abnormalities in either one of these tests were further evaluated by two additional cognitive tests: the Confusion Assessment Method[88] and the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE)[87] to screen for delirium and dementia, respectively.

In recognition of the importance of the maintenance of cognitive or brain health to both the individual and society, the International Association of Gerontology and Geriatrics and its Global Aging Research Network convened an expert consensus panel in 2015 and published a consensus paper that recommended a combination of validated, brief (3-7 mins) patient-based and informant-based screens as the most appropriate approach to the identification of early cognitive impairment.[102]

2.8.1 Clock Drawing Test

The clock drawing test (CDT) is a simple and quick test designed originally as a measure of visuospatial ability and attention in hemi-neglect patients, and to screen for constructional apraxia.[103] The CDT is now also recognised as a test for executive and other cognitive functions.[64] The test requires the patient to draw a clock face on a piece of paper with or without the arms set at a specified time. The CDT is commonly used together with the MMSE. These two cognitive tests are complementary to each other, with the CDT more suited for screening executive and visuo-constructional functions, and the MMSE more suited for orientation, memory, and language functions.[64,104] There are many versions of the CDT that differ in instruction, scoring, and ease of use. Despite the different scoring protocols, study has shown that they all correlate well with the severity of global cognitive impairment, although particular scoring methods may be better suited to assess vascular dementia than Alzheimer's disease and vice versa.[74] A comprehensive review of the multiple clock drawing scoring systems revealed that no CDT was consistently superior in terms of predictive validity for dementia screening, and concluded that a qualitative assessment of 'normal' versus 'abnormal' by 'eyeballing' the clocks may be sufficient for use of CDT as a dementia screening instrument in a primary / general medicine / community setting.[105] A CDT adapted for use among elderly Chinese in Hong Kong has been designed (fill inside a pre-drawn circle of 2.5" diameter the numbers of a clock face with arms indicating the 3 o'clock position) and proved to be a valid measure to screen for dementia, even for illiterate individuals traditionally thought to be non-compliant with tests that required writing or drawing.[65,66]

The CLOX designed by Royall et al[67] is used to elicit executive impairment and discriminate it from non-executive constructional failure (Table 2.4). The CLOX is divided into an unprompted drawing task (with specified time of 1:45) that is sensitive to executive control (CLOX1) and a copied version that is not (CLOX2). Points are awarded based on the answers to a set of 15 questions (e.g. does the figure resemble a clock?). Maximum scores for both the drawing task (CLOX 1) and the copying task (CLOX 2) are 15 points each. A lower score indicates

Table 2.4 The executive clock drawing task (CLOX)[67] and its Chinese translation[68]

Executive clock drawing task (CLOX1 and CLOX2)

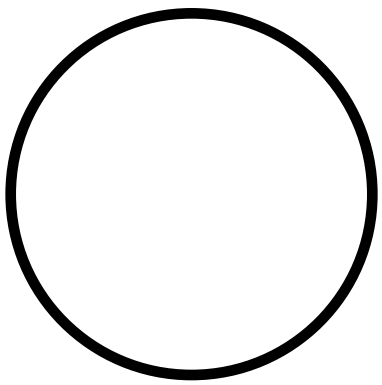
STEP 1 (CLOX1 unprompted executive clock drawing task):
Turn this form over on a light-coloured surface so that the circle below is visible. Have the patient draw a clock on the back. Instruct him / her to "請你畫一個鐘，顯示1:45。將手臂和數目字放在面上邊，以至連一個細路都識睇。" "draw me a clock that says 1:45. Set the hands and numbers on the face so that a child could read them." Repeat the instructions until they are clearly understood. Once the subject begins to draw, no further assistance is allowed. Score this clock in the CLOX1 column.

STEP 2 (CLOX2 non-executive clock copying task):
Return to this side and let the subject observe you draw a clock in the circle below. Place 12, 6, 3, and 9 first. Set the hands again to "1:45". Make the hands into arrows. Invite the subject to copy your clock in the lower right corner. Score this clock (CLOX 2).

	Organisational element	**CLOX1**	**CLOX2**
Q1	Does figure resemble a clock?	Q1=1 point	Q1=1 point
Q2	Outer circle present?	Q2=1 point	Q2=1 point
Q3	Diameter >1 inch?	Q3=1 point	Q3=1 point
Q4	All numbers inside the circle?	Q4=1 point	Q4=1 point
Q5	12, 6, 3 and 9 placed first?	Q5=1 point	Q5=1 point
Q6	Spacing intact? (symmetry on either side of the 12-6 axis?) If yes, skip next.	Q6=2 point	Q6=2 point
Q7	If spacing errors are present, are there signs of correction or erasure?	Q7=1 point	Q7=1 point
Q8	Only Arabic numerals?	Q8=1 point	Q8=1 point
Q9	Only numbers 1-12 among the Arabic numerals?	Q9=1 point	Q9=1 point
Q10	Sequence 1-12 intact? No omissions or intrusions	Q10=1 point	Q10=1 point
Q11	Only two hands present?	Q11=1 point	Q11=1 point
Q12	All hands represented as arrows?	Q12=1 point	Q12=1 point
Q13	Hour hand between 1 and 2 o'clock?	Q13=1 point	Q13=1 point
Q14	Minute hand longer than hour?	Q14=1 point	Q14=1 point
Q15	None of the following: (1) hand pointing to 4 or 5 o'clock? (2) '1:45' present? (3) intrusions from 'hand' or 'face' present? (4) any letters, words or pictures? (5) any intrusion from circle below?	Q15=1 point	Q15=1 point
	Total	/ 15	/ 15

For Caucasians, CLOX1 score of <10 indicates executive dysfunction ± constructional dyspraxia, CLOX2 score of <12 indicates constructional / visuospatial dyspraxia (Royall 1998[67])

For Chinese in Hong Kong, CLOX1 score of <7 (1 standard deviation below mean) or CLOX2 score of <11 (1 standard deviation below mean) indicates cognitive dysfunction (Wong 2004[68])



impairment, with a cut-off score of 10/15 for the drawing task and 12/15 for the copying task. The CLOX has been translated into Chinese (Table 2.4) and was found to correlate strongly with MMSE when tested among elderly Chinese in Hong Kong, although performance depended on education with a lower cut-off score of 7/15 and 11/15 for CLOX1 and CLOX2, respectively among Chinese subjects.[68] Nonetheless when the Chinese version of CLOX was tested in Chinese elderly patients with subcortical ischaemic vascular disease against more formal executive measures than that used by Royall et al,[67] it performed poorly as a screening test for executive dysfunction.[68] A study of the same Chinese version of CLOX among Singaporean Chinese, however, supported CLOX as a valid cognitive screen with adequate psychometric properties, and its use as an adjunct in differentiating Alzheimer's disease from dementia with a vascular element, in which deficits in executive control function are more prominent.[69]

The CDT has been incorporated as a component of other cognitive screening tests, e.g. Mini-Cog,[70] Saint Louis University Mental Status examination (http://aging.slu.edu/index.php?page=multi-language-slums),[71] and Rapid Cognitive Screen.[72] The Mini-Cog was developed as a brief 5-point cognitive test to discriminate dementia from non-dementia among multilingual elderly persons with diverse educational status by combining a delayed three-item recall (0-3 points) with a clock drawing test (0 or 2 points) as recall distractor.[70] A score of 0-2 indicated a positive screen for dementia.

2.8.2 MMSE

The MMSE was first described by Folstein et al in 1975 as a "practical method for grading the cognitive state".[73] It was called "mini" because it "concentrates only on the cognitive aspects of mental functions, and excludes questions concerning mood, abnormal mental experiences and the form of thinking." The MMSE consists of 19 tests of 11 domains covering orientation to time and place (10 points), registration of three words (3 points), attention or calculation tested by serial sevens or spelling (5 points), recall of three words (3 points), verbal and written language including naming, repetition, comprehension (8 points), and visual construction (1 point). Folstein et al[73] suggested a cut-off score of ≤23 (out of a maximum score of 30) for the presence of dementia in persons with at least 8 years of education. Numerous other cut-offs have been calculated from receiver operating characteristic curve analysis of specific populations together with adjustments for age and education.[106] The norms declined with advancing age, especially for less educated women. Given any age and gender, the norms were higher for individuals with a higher education level.[106]

A meta-analysis of 34 dementia studies and five MCI studies was conducted to evaluate the accuracy and clinical utility of MMSE as a cognitive test in high and low prevalence settings (Table 2.5).[107] The study concluded that MMSE has some value both in specialist and non-specialist settings but in two different capacities. In specialist settings such as memory clinics it was reasonably effective in identifying dementia but could not be relied upon alone if a result was negative (patient scored above threshold) and should not be used alone for diagnosing MCI. Conversely, in non-specialist settings such as primary care, the only value of the MMSE was in excluding dementia in someone worried about their memory, while a positive result (scoring under threshold) could be explained mostly by non-dementia conditions.[107] MMSE cannot serve as a substitute for systematic evaluation that includes history taking, examination, and laboratory tests.

The MMSE is affected by educational background, language and communication disorders, and sensory loss. Limitations of the MMSE include its non-linearity, a floor effect in advanced dementia (a score of 0 does not mean an absolute absence of cognition), a ceiling effect in very mild disease (a score of 30 does not always mean normal cognitive function), and a lack of sensitivity for frontal / executive or visuospatial functions. The pentagon task of the MMSE does not assess executive function as it simply requires the patient to copy the image.[108] Thus MMSE may have a limited ability to detect early stage of dementia with executive dysfunction, e.g. vascular dementia.[108] The MMSE has been standardised with clear guidance for its administration, scoring and time allowed for each of the components, with resultant reduction in inter-rater variability and administration time.[109]

A Cantonese version of MMSE has been validated

Table 2.5 Accuracy of the Mini-Mental State Examination as a cognitive test for dementia in various prevalence settings[107]

Setting	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
Memory clinic	79.8	81.3	86.3	73.0
Mixed specialist hospital	71.1	95.6	94.2	76.4
Non-clinical community	85.1	85.5	34.5	98.5
Primary care	78.4	87.8	53.6	95.7

as an instrument to detect cognitive impairment in a local Chinese population in Hong Kong; a cut-off score of 19-20 is recommended as an indication for further evaluation of cognitive impairment[74]; further studies suggested that the optimal cut-off point was ≤18 for illiterate subjects, ≤20 for those with 1-2 years of schooling, and ≤22 for those with >2 years of schooling.[75]

The second edition of the MMSE (MMSE-2) was developed in 2012 under the copyright of the Psychological Assessment Resources (http://www.minimental.com/), with a 30-point standard version equivalent to the original MMSE; a 16-point brief version for rapid cognitive screening; and a 90-point expanded version enhanced with two new tasks (story memory and processing speed) to increase sensitivity for milder forms of cognitive impairment, including subcortical dementia. A simplified Chinese translation of MMSE-2 is available.

2.8.3 AMT

Based on a study in 21 geriatric departments in the UK sponsored by the Royal College of Physicians of London, Hodkinson[76] shortened the Blessed, Tomlinson, and Roth's mental test[110] from 26 questions to 10. He noted that the AMT gave comparable results to the full mental test and could replace it where the test was used to recognise cognitive impairment due to delirium or dementia.[76] The shorter test also achieved far more consistent cooperation by patients being tested. Validation study of the AMT in the UK recommended a cut-off score of 8 (<8 suggesting abnormal cognitive function) with a sensitivity of 91% and specificity of 75%.[111] A modified local Chinese version of AMT (Table 2.6), which was validated in a local Chinese population, is commonly used in Hong Kong.[77] The cut-off of 6 yielded a sensitivity of 96% and specificity of 94% in differentiating normal versus abnormal cognitive function (e.g. delirium, dementia) in local elderly patients.[77] The lower AMT cut-off of 6 for the local Chinese population has been attributed to a lower education level.

2.8.4 Montreal Cognitive Assessment

The Montreal Cognitive Assessment (MoCA) is a cognitive test of 10 items covering the domains of short-term memory, visuospatial skills, executive function, phonemic verbal fluency, abstraction, attention, concentration and working memory, language function, and time orientation (http://www.mocatest.org). Its final English version is a 1-page 30-point screening test, with a cut-off score of <26 considered abnormal and 1 point added for persons educated ≤12 years.[79] Compared with the MMSE, the MoCA is significantly better for detecting MCI, with a sensitivity and specificity of 90% and 87%, respectively.[79] Validated Chinese versions with adjusted cut-offs for use in Hong Kong,[80,81] Taiwan,[82] and China[83] are available. In the Cantonese Chinese version[81] of MoCA, with 2-point added for illiterate and 1-point for persons educated 1-6 years, a cut-off of <22/23 has a sensitivity of 78% and specificity of 73% in detecting amnestic MCI, while a cut-off of 19/20 has a sensitivity of 94% and specificity of 92% in detecting Alzheimer's dementia. In the original 2009 Hong Kong MoCA (HK-MoCA),[80] with 1-point added for persons educated ≤6 years, a cut-off of 21/22 has a sensitivity of 73% and specificity of 75% in differentiating patients with cerebral small vessel disease (the most common cause of vascular cognitive impairment) from controls. The HK-MoCA was subsequently updated to the 2015 version with age and education corrected normative data of total score of MoCA (http://www.mocatest.org/wp-content/uploads/2015/03/HK-MoCA_20151030.pdf). Cognitive impairment is determined when the score ≤ age and education corrected percentile cut-offs at 7th and 2nd percentiles for MCI and dementia, respectively. A brief version of HK-MOCA, the Hong Kong version of Montreal Cognitive Assessment — 5-minute protocol (HK-MoCA 5-min), is available for cognitive screening via telephone.

2.8.5 Informant-based Cognitive Assessment

In contrast to patient-based mental status tests that

Table 2.6 Abbreviated Mental Test (Hong Kong version)[77]

Question	Score
Age (± 5 years)	0/1
Time (to the nearest hour, or am, pm, night)	0/1
(Ask to memorise address for recall at the end of the test: 42 Shanghai Street)	
Year (± 1 year)	0/1
Place name	0/1
Recognition of two persons (doctor, nurse)	0/1
Date of birth (date and month)	0/1
Date of Mid-Autumn festival	0/1
Name of present Chief Executive of the Hong Kong Special Administrative Region or Chinese leader	0/1
Count from 20 to 1 backwards	0/1
Recall address: 42 Shanghai Street	0/1

directly assess the patient's performance, informant-based cognitive assessment indirectly assesses the patient by gathering information about everyday behaviour and activities from informants (family or friends). The strengths of this approach are: change in functioning and time course of decline can be assessed; less influenced by education and premorbid intelligence; less artificial and reflects capacity in a natural setting; applicable even when the patient is non-communicable or uncooperative.[112] A weakness is that the indirect assessment is more influenced by reporting factors such as bias in interpretation of the patient's behaviour; informants' motivation to provide information; and the quality of the relationship between the informant and the patient.[112]

The Ascertain Dementia 8 (AD8) is a brief (3-min administration time) informant-based cognitive screening tool with eight questions that assess change in memory, temporal orientation, judgement, and function (Table 2.7).[84,85] An AD8 score of ≥2 in a memory clinic setting (dementia prevalence 89%) has a sensitivity of 92%, specificity of 46%, positive predictive value of 93%, and negative predictive value of 43% for detecting dementia even at a very mild stage. The AD8 has been translated into Chinese in Taiwan and validated.[86] At a cut-off of 2, the Chinese AD8 has a sensitivity of 97.6%, specificity of 78.1%, positive likelihood ratio of 4.5, and negative likelihood ratio of 0.03 in detecting dementia.[86]

The IQCODE is a self-administered tool that comprises 26 items completed by an informant familiar with the patient. The informant rates the patient's cognitive function as better or worse than 10 years ago based on a 5-point scale.[87] The short form of IQCODE contains 16 items and takes 10-15 minutes to complete. IQCODE is scored by adding up the score for each question and then dividing by the number of questions, 26 for the long IQCODE and 16 for the short IQCODE. The result is a score that ranges from 1-5; a score of 3 means 'no change', 4 'a bit worse', and 5 'much worse'. Balancing sensitivity and specificity for screening for dementia, the cut-off for the long IQCODE is 3.27/3.30, while the cut-off for the short IQCODE is 3.31/3.38. The IQCODE has been translated into other languages, including Chinese (http://crahw.anu.edu.au/risk-assessment-tools/informant-questionnaire-cognitive-decline-elderly.)

Table 2.7 Ascertain Dementia 8 (AD8) questions asked of informants[84,85] and its Chinese version[86]*

AD8	Chinese AD8	Cognitive abilities asked
Instructions to informant: "Remember, 'Yes, a change' indicates that you think there has been a change in the last few years caused by cognitive (thinking and memory) problems."	填表説明：若您以前無下列問題，但在過去幾年中有以下的『改變』，請勾選；若無或不確定，請繼續下一題。一共有八題。	
1. Problems with judgement (e.g. falls for scams, bad financial decisions, buys gifts inappropriate for recipient)	判斷力上的困難：例如落入圈套或騙局、財路上不好的決定、買了對受禮者不合宜的禮物。	Judgement
2. Reduced interest in hobbies / activities	對活動和嗜好的興趣降低。	Function
3. Repeats questions, stories, or statements	重複相同問題、故事和陳述。	Memory
4. Trouble learning how to use a tool, appliance, or gadget (e.g. VCR, computer, microwave, remote control)	在學習如何使用工具、設備和小器具上有困難。例如：電視、音響、冷氣機、洗衣機、熱水爐（器）、微波爐、遙控器。	Function
5. Forgets correct month or year	忘記正確的月份和年份。	Temporal orientation
6. Difficulty handling complicated financial affairs (e.g. balancing checkbook, income taxes, paying bills)	處理複雜的財物上有困難。例如：個人或家庭的收支平衡、所得税、繳費單。	Judgment
7. Difficulty remembering appointments	記住約會的時間有困難。	Memory
8. Consistent problems with thinking and / or memory	有持續的思考和記憶方面的問題。	Memory

* The above AD8 questions are asked of an informant. Items endorsed as "Yes, a change" are summed to yield the total AD8 score

Table 2.8 Clinical Frailty Scale[62]

1. Very fit — robust, active, energetic, well-motivated and fit; these people commonly exercise regularly and are in the fittest group for their age. Self-rate health as 'excellent'
2. Well — without active disease, but less fit than people in category 1
3. Well, with treated comorbid disease — disease symptoms are well controlled compared with those in category 4
4. Apparently vulnerable — although not frankly dependent, these people commonly complain of being 'slowed up' or have disease symptoms or self-rate health as "fair", at best. If cognitively impaired, do not meet dementia criteria
5. Mildly frail — with limited dependence on others for instrumental activities of daily living
6. Moderately frail — help is needed with both instrumental and non-instrumental activities of daily living
7. Severely frail — completely dependent on others for the activities of daily living
8. Terminally ill

Table 2.9 The "FRAIL" Questionnaire Screening Tool[60]

≥3 = Frailty; 1 or 2 = pre-frail
Fatigue: Are you fatigued?
Resistance: Cannot walk up one flight of stairs?
Aerobic: Cannot walk one block?
Illnesses: Do you have more than five illnesses?
Loss of weight: Have you lost more than 5% of your weight in the past 6 months?

Table 2.10 SARC-F Screen for Sarcopenia[63]

Component	Question	Scoring*
Strength	How much difficulty do you have in lifting and carrying 10 pounds?	None = 0 Some = 1 A lot or unable = 2
Assistance in walking	How much difficulty do you have walking across a room?	None = 0 Some = 1 A lot, use aids, or unable = 2
Rise from a chair	How much difficulty do you have transferring from a chair or bed?	None = 0 Some = 1 A lot or unable without help = 2
Climb stairs	How much difficulty do you have climbing a flight of 10 steps?	None = 0 Some = 1 A lot or unable = 2
Falls	How many times have you fallen in the past year?	None = 0 1-3 Falls = 1 ≥4 Falls = 2

* Total score of ≥4 is predictive of sarcopenia and poor outcomes

Table 2.11 Simplified Nutritional Assessment Questionnaire[48]*

My appetite is	Food tastes	When I eat	Normally I eat
1. very poor	1. very bad	1. I feel full after eating only a few mouthfuls	1. less than one meal a day
2. poor	2. bad	2. I feel full after eating about a third of a meal	2. one meal a day
3. average	3. average	3. I feel full after eating over half a meal	3. two meals a day
4. good	4. good	4. I feel full after eating most of the meal	4. three meals a day
5. very good	5. very good	5. I hardly ever feel full	5. more than three meals a day

* A score of <14 may identify persons with anorexia and at risk of significant weight loss

2.8.6 Choice of Cognitive Tests

The appropriate choice of a cognitive test depends both on the time available and the purpose of assessment. An ideal cognitive screening tool should be brief and have no copyrighted costs.[102,113] Surveys in the West have shown the MMSE to be the most commonly used. Nonetheless the MMSE takes on average 8 (range, 4-21) minutes to perform and the acquisition of copyright restriction of MMSE by the Psychological Assessment Resources in 2001 has increased the need to identify briefer and effective cognitive tests for use in clinical practice.[113,114] A systematic review and meta-analysis of dementia screening tests up to 2014 evaluated the diagnostic performance of all cognitive tests for the detection of dementia,[114] and concluded that the Mini-Cog test[70] and the Addenbrooke's Cognitive Examination Revised[78] are the best alternative screening tests for dementia, and the MoCA[79] is the best alternative for MCI.[114]

2.9 Geriatric Assessment for Geriatric Syndromes

The Royal College of Physicians advocated early CGA for frail elderly people.[115] Commonly used validated assessment tools for screening frailty in elderly persons include the Canadian Study of Health and Aging (CSHA) Clinical Frailty Scale (Table 2.8)[61,62] and the "FRAIL" Questionnaire Screening Tool (Table 2.9).[60] Clinical Frailty Scale is a measure of frailty based on clinical judgement when interpreting the results of history taking and clinical examination, developed in the CSHA. Each one-category increment of the scale significantly increased the medium-term risks of death (21.2% within 70 months) and entry into an institution (23.9%). Sarcopenia and falls can be identified through the SARC-F questionnaire (Table 2.10).[63] The assessment tools FRAIL (for frailty) and SARC-F (for sarcopenia and falls) have been combined with other screening assessment tools Simplified Nutrition Assessment Questionnaire

for anorexia and undernutrition (Table 2.11)[48] and Rapid Cognitive Screen for cognitive dysfunction[72] into a Rapid Geriatric Assessment (RGA)[116,117] toolkit to quickly screen for the common geriatric syndromes of frailty, sarcopenia and falls, anorexia and undernutrition, and intellectual impairment. The RGA can be completed quickly within 4 minutes, facilitating early recognition of geriatric syndromes, diagnosis of underlying causes, and implementation of intervention and a care plan to reduce disability in elderly persons.[116,117]

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