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Comprehensive Geriatric Assessment

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Practical Issues in Geriatrics

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Comprehensive Geriatric Assessment

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Preface

Population ageing is now a worldwide phenomenon. In 2017, there are an estimated 962 million people aged 60 or over in the world, comprising 13% of the global population. In Europe, population ageing is particularly evident but the rest of the world is following quickly. Socioeconomic development over the past 50 years has been accompanied by large falls in fertility and equally dramatic increases in life expectancy.

These substantial improvements in life expectancy have not resulted in an equal extension of healthy active life. Years spent with long-term medical conditions and with disability are increasing. In general, women are experiencing rather less added healthy years than men, and differences within countries in wealth and opportunities are reflected in differential gain of healthy years.

Sudden death of apparently healthy people is less common. In contrast, a gradual decline of health and functional abilities before death is more common, resulting from the combined impact of multimorbidity and age-related cellular and physiological changes. As a result, the traditional model of medicine based on diagnosis and treatment of single diseases is outmoded. It is unsuitable for most older patients, who are now the majority users of acute hospitals and ambulatory care services.

Common conditions such as dementia, heart disease, stroke, chronic respiratory disorders, diabetes, and musculoskeletal conditions result in impairments across several body systems and it is this combined effect that results in reduced functional abilities. In addition, older people and often also their families bring their own priorities, wisdom, and resilience to the clinical encounter. To provide patient-centred comprehensive clinical care, we need to be aware of all these factors. Diagnosis remains important but is insufficient. Comprehensive geriatric assessment (CGA) is the technology which has developed to meet this challenge.

CGA is a multidimensional, interdisciplinary diagnostic process focused on determining the medical, psychological, and functional capabilities of older people to develop a coordinated and integrated plan for treatment and long-term follow-up.

More than three decades of clinical experience has demonstrated definitively that CGA is indeed the tool of choice to determine and describe the clinical status, biomedical risk profile, capacities, functional abilities, residual skills, psychosocial resources, and prognosis in order to drive a personalized therapeutic care plan of the functionally compromised and frail older individual. It is the essential tool to facilitate clinical decision making.

In this sense CGA may be defined as a cornerstone of modern geriatric care.

Nonetheless, CGA is still underused in the clinical management of the older people, and generally restricted to the specialist clinical areas led by geriatricians. Thus, there is a need to put existing applied health research knowledge into practice with respect to the CGA-based healthcare process used for older people. We believe that an improved flow of knowledge may be an important contributory factor to implement evidence-based practices in CGA.

This book is an extensive and updated collection of information on the clinical and biological rationale, methods, and evidence-based results of the use of CGA both in clinical practice and in research. A large number of experts have been involved as authors of the single chapters in order to give a complete overview taking into account different points of view. Specific topics include why and how to perform CGA at home or in hospital, as well as in post-hospital discharge programmes or as outpatient consultation. Moreover, individual chapters address the clinical usefulness of CGA in specific clinical conditions, with the description of tailored CGA programmes in older patients evaluated for preoperative assessment, admitted to emergency departments and orthogeriatric units, or with organ failure, i.e. heart failure or chronic kidney disease, cancer, or cognitive impairment.

The main aim of the book is to help geriatricians, other specialists, general practitioners, and all healthcare providers who everyday are facing problems and needs of the older subjects, to better understand not only effectiveness but also the feasibility and acceptability and the organizational requirements of the CGA clinical programmes for the older people. Only by tackling clinical practice, management organization, education, and innovation in concert and appropriate proportion we will face up to the new frontiers of healthcare for an ageing population. This will include technology-assisted or self-managed CGA programmes as well as CGA-based predictive tools to improve clinical and management decisions to increase the quality of care and the quality of life of our older patients.

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Comprehensive Geriatric Assessment: An Updated Perspective

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Luigi Ferrucci and Stefania Orini

1.1 Introduction

The declining health and progressive physical and cognitive impairment that accompany aging inspired artists, philosophers, and scientists for unmemorable times. Loss of function was generally considered part of "normal aging," a natural phenomenon that could possibly be described, observed, and interpreted but certainly not stopped or reversed. It was only in the middle of the last century that gerontologists proposed the idea that the development of diseases could be disconnected from aging. A corollary to this concept is that the rate of biological aging is heterogeneous across individuals and while some develop multiple diseases others remain relatively healthy up to the end of life [1]. The possibility to conceptually dissociate chronological and biological aging generated a great deal of enthusiasm and a lot of discussions. Over the last few years, the growth of research aimed at understanding mechanisms that modulate the rate of aging has been impressive, and scientists claimed that once the biology of aging will be finally understood, it may be targeted for intervention that slows down or even reverses aging [2]. In geriatric medicine, the focus of this research has been on the identification of subjects that because of accelerated aging accumulate multi-morbidity [3] have excess risk of physical and cognitive frailty. Initial work in this area recognized that the typical medical approach to diagnosis and treatment based on the recognition and treatment of specific diseases is not effective. It was also recognized that health, functional status, and quality of life of older persons cannot be summarized by the sum of diseases but they are rather affected by behavioral, social, environmental, financial, and political

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factors. In this context, the emergence of a comprehensive geriatric assessment (CGA) as the best approach to the care of older persons was a critical milestone that triggered the geometric expansion of research in clinical geriatrics over the last four decades. The idea that improving medical outcomes and quality of life in older persons requires a multidisciplinary approach that cannot be limited to disease management originated and developed in the UK healthcare system, the first country that formally established the notion of geriatric medicine as a specialty. The operational idea that this complexity could be handled through comprehensive geriatric assessment was proposed by Warren in the late 1930s [4]. The concept of CGA generated some beautiful and important science and had even started to permeate the medical literature and medical practice [5].

1.2 The Explosion of Interest for GCA

The tipping point of the explosion of interest for GCA can be traced back to the publication of the article "Effectiveness of a geriatric evaluation unit. A randomized clinical trial" in the New England Journal of Medicine in 1984 [6]. The principles of CGA had been operationalized few years earlier by the Sepulveda VA Geriatric Evaluation Unit. Larry Rubenstein, the leader of this unit, had defined CGA as a multidimensional interdisciplinary diagnostic process focused on determining a frail older person's medical, psychological, and functional capability in order to develop a coordinated and integrated plan for treatment and long-term follow-up [7]. The novelty of the paper published in 1984 was that beyond the strong face validity of GCA, its effectiveness in improving the health and quality of life of older persons was established in a randomized controlled trial, the highest bar that any clinical intervention should meet before it is implemented in clinical practice. Fueled by this experience, a number of Geriatric Evaluation Units were implemented in the USA and around the world, in many settings and with many different specialty flavors [8]. In spite of this enthusiasm, the full use of CGA remains limited to few experiences, mostly (although not exclusively) in medical research institutions. The reasons for the lack of diffusion of CGA in the medical setting are multiple and complex. Reasons reported in the literature include high cost, departure from the traditional biomedical model, and "ageism" attitude in medical administrators (and perhaps in many physicians). However, the relevance of these obstacles is questionable for some good reasons. Costly medical interventions such as organ transplantations are routinely administered to older persons; the healthcare system is constantly evolving and experimenting new models of care, and, finally, while "ageism" is still present in our society, it is rapidly fading in the biomedical field. Thus, while current models of care cannot address the extraordinary challenges imposed by the expanding number of sick older patients, alternative approaches based on CGA are struggling to permeate the clinical practice. In this introductory chapter, we would like to offer a key hypothesis to understand the reasons for these events and propose a pathway toward wide clinical implementation of CGA.

1.3 The Essence of CGA

Conceptually, the domains assessed by CGA are phenotypic dimensions that we generally recognize as "typical characteristics of aging." Older persons are at higher risk of developing single and multiple diseases, they are likely to experience a certain degree of functional and cognitive status deterioration, they are more likely to report depressive symptoms, and their family, social, and financial conditions are, on average, more problematic. Not everybody develops these losses at the same time, but the large majority of people eventually will. We know, for example, that centenarians tend to maintain exceptional health and functional status up to late in life [9]. There are of course also individuals that in old age are exceptionally functional: they run marathons, teach high-level mathematics, or produce a beautiful art. Wealthy people and those who during life built strong family and social ties remain more resilient to the burden of physical and cognitive frailty [10].

On the other side of the spectrum are individuals with multiple chronic diseases, severe physical and cognitive disability, in poor socioeconomic status, and detached from any family and social connections. Between these two extreme conditions are the bulk of older people who live a "normal life" without interference of major physical or cognitive limitation and a relatively free of illness or symptoms. The relative distribution of health and function, as described above, represents, in fact, a true and meaningful measure of population health, and its heterogeneity is captured extremely well by the CGA because it integrates information on physical health, mental health, functional status, social adaptability, and environmental conditions. This information is essential to develop and implement individualized, supportive care plans aimed at maximizing independence and quality of life [4].

Pilotto et al. recently reviewed the effectiveness of CGA in different healthcare settings and with a focus on how CGA can support decision making for cure especially in uncertain situations [11]. They concluded that the utilization of CGA can identify older persons with complex multi-morbidity and multiple disease or clinical problem that are difficult to handle because of the interference of socioeconomic and mental health constrains and the simple identification of these subjects improve the quality of care. For example, they explored the clinical usefulness of CGA programs in older frail patients who are candidates for surgery [12]; admitted to emergency departments, orthogeriatrics, and rehabilitation units; and affected by cancer or cognitive impairment [13]. This work leaves little doubt that CGA can help clinicians in clinical decision making concerning diagnostics and therapeutics [11]. Interestingly, these authors insist on the need to expand the development of CGA-based prognostic tools for tailoring appropriate interventions and improving clinical outcomes of older adults. They also mention that interventions driven by CGA may reduce the risk of disability and mortality, but they acknowledge that evidence for these outcomes is limited. The field of geriatrics is still mudded by discussion on the best CGA tool, and it appears to be almost impossible to come to a general agreement on some tool that strikes a good compromise between feasibility and completeness. There are, of course, some areas of clinical investigation where CGA yielded outstanding results. By far, the most successful applications use CGA to establish prognosis and to evaluate the risk of interventions where the balance between potential advantages and benefits is critical [14]. For example, the utilization of some form of CGA that is used to evaluate the surgical risk or to evaluate the potential benefit of cancer chemotherapy in older patients has shown substantial benefits compared to more traditional approaches [15, 16].

The summary scores that are derived from CGA allow the stratification of older patients in groups of homogeneous complexity and allow understanding, in surveillance studies, on how interventions initially developed in relatively healthy patients perform when administered to frail older patients.

If CGA captures the "accelerated phenotypic aging," the reliable inference on "true" aging of individual patients and the forecasts on their susceptibility and resilience has tremendous prognostic implications and allows more informed therapeutic decisions. On the other hand, since in most cases our understanding on the underlying cause of this "accelerated aging" condition remains hidden, we can do very little to stop or reverse it. A caveat to this interpretation is that aging is pervasive and, likely, affects many aspects of the human anatomy, physiology, and biology that are not even considered by CGA. In this sense, CGA could be considered a random sample of a larger universe of variables that encompass phenotypic aging but, perhaps, not deep enough to start thinking about effective interventions.

1.4 CGA as a Proxy Measure of Phenotypic Aging

While considering the hypothesis that CGA could be a proxy measure of phenotypic aging, it may be worth bringing this concept to more practical ground. In simple terms, let's imagine a hypothetical person aged 70 years that develops medical and functional problems that the general population develops on average at age 80. We can say that this person is experiencing an accelerated "phenotypical aging" that is revealed by a poor CGA score. Ergo, this individual is at high risk of disability, mortality, and other adverse health outcomes, including increased toxicity from medical interventions. In other words, we could consider that GCA is an index of "phenotypic aging" as opposed to "chronological aging." The concept of phenotypic aging should be relatively familiar since we are all using it when we state that somebody looks "older" or "younger" than the age reported in their driving license. CGA is principally an attempt to bring this perception into solid metrics so that it can be integrated into the care of older persons.

However, does the information about accelerated phenotypic aging help us? Absolutely "yes." As mentioned before, a vast literature has demonstrated that CGA is an extraordinary tool to establish prognosis and forecast the risk associated with medical interventions that have a narrow risk-benefit window. CGA is superior to most prognostic indexes and specialty tools in predicting mortality, surgical complications, and iatrogenesis [11]. By using CGA, clinicians can identify patients that would not benefit from a certain intervention and should be treated with alternative strategies or require extra surveillance and follow-up [16, 17]. An exhaustive inventory of such evidence in the literature is outside the scope of this chapter, and most of it is summarized in the following pages of this book.

1.5 What Is Missing?

Busy clinicians will argue that knowing that certain patients are experiencing accelerated aging may have academic value but may be also frustrating since, at least at this stage, there is little that we can do to slow down the rate of aging. It is difficult to argue against this line of reasoning. Rubenstein's initial evidence was very promising and prompted many clinicians and geriatricians to replicate the experience of the Sepulveda group in multiple countries and settings. Several large and small clinical studies and few randomized controlled trials were conducted with the aim of demonstrating that the CGA approach resulted in better outcomes in terms of disability progression, mortality, quality of life, and other health outcomes that are important for older persons [11]. Studies and systematic reviews have analyzed the different settings where the CGAs are applied with very heterogeneous results. Results of these studies were varied and controversial, and, in spite of serious efforts to explain them, the reason for this variability is still a matter of discussion. A discriminant factor between effective and ineffective trials was the fact that positive results were more likely to be obtained when the same team that was administering the CGA was also managing the intervention. This consideration suggests that more knowledge of all the factors that affect medical and functional status in complex older patients is useful, but the potentials of this knowledge cannot be simply summarized by looking at responses to a standardized questionnaire. In discussing CGA with primary care physicians and other healthcare providers, the initial argument is always about time, cost, or the lack of reimbursement. However, as the conversation progresses, it becomes clear that main objection about using CGA routinely is the relatively lack of solid evidence that the problems discovered through this method can be affected or reversed. As described later, this problem is similar to what is happening with frailty.

Because we have no solid knowledge of the mechanism by which some individuals experience accelerated aging, we lack the tools to address the root of this problem. A growing number of basic and clinician researchers propose that certain diseases and treatment of disease can accelerate the aging process [18]. Some evidence toward this hypothesis exists, for example, for HIV [18].

However, there is wider consensus for the theory that the rate of aging is the underlying driver of disease risk, regardless of the type of disease with the exception perhaps of monogenic conditions. Consistent with this view, Mitnitski and Rockwood conceptualized frailty severity as an accumulation of deficits over time and proposed that the ratio of the number of deficits present over the total number of deficits considered in an individual is a proxy measure of the biological age (or frailty as its proxy) regardless of their nature [19]. However, the large majority of the elements used to construct the risk score are clinical phenotypes, and, therefore, the resulting score could be better qualified as an index of "phenotypic aging." Note that if the phenotypic expression of frailty has no connection with the underlying cause, then the causal pathways to accelerated aging, captured either by the concept of frailty or CGA, reside in a somewhat more basic cellular housekeeping mechanism that becomes dysregulated. It is not surprising that not everybody shares this view, at least not completely. In her monumental effort to define the frailty syndrome, Linda Fried and the Hopkins group postulated that frailty (another metric of accelerated aging) results from a vicious cycle of interacting phenotypes where sarcopenia occupie a central role [20]. The Fried definition of frailty has generated some of the most important research on aging in the last two decades, but, again and similarly to what has happened with CGA, most of this literature has focused on predictive validity and evidence that frailty results from a multisystem dysregulation of various homeostatic mechanisms [21]. The evidence that once frailty is diagnosed interventions can be implemented that substantially modify important outcomes is still missing, and this missing link is probably the most important reason why, similarly to what happened with CGA, the translating of the concept of frailty to clinical practice has been so difficult. Incidentally, Rockwood and collaborators have demonstrated that the Fried frailty definition is one of the many possible definitions of frailty where other alternative phenotypic dimensions are considered and that these alternative definitions have similar validity [22]. Thus, the next, necessary step in geriatric research is to demonstrate that any index of physiologic aging, either CGA or frailty, can lead to interventions that reduces the burden of disease and disability and improves the quality of life in older patients with complex clinical syndromes.

1.6 Biological Aging

At first sight, understanding the primary biological mechanisms that drive aging appears an impossible task, but some recent research suggests otherwise. In 2013, Lopez-Otin and collaborators published a very interesting opinion article that was aimed to identify the hallmarks of aging according to the current knowledge. These authors proposed nine primary mechanisms that can contribute to aging, including genomic instability, telomere attrition, epigenetic alterations, loss of proteostasis, dysregulated nutrient sensing, mitochondrial dysfunction, cellular senescence, stem cell exhaustion, and altered intercellular communication [22]. The following year, a complementary article was published by Brian Kennedy and a group of American scientists who listed seven "pillars" of aging [23]. Although most of the data reported in support of these two landmark papers come from studies in model organisms, they are relevant to this discussion for two major reasons. In both articles, the authors propose the idea that these biological mechanisms give rise to the aging phenotypes and, therefore, represent the bridge between biological and phenotypic aging. Moreover, these two articles have prompted much enthusiasm among researchers and create a translational impetus and growing interest in the concept of "geroscience," defined as "an interdisciplinary field that aims to understand the relationship between aging and age-related diseases." However, the main reason for hope is that these authors have indicated an operational path to start understanding why some people develop "accelerated aging" and are at high risk of disability, premature death, and a cadre of adverse health outcomes that burden the quality of life in old age. The mechanisms identified can be targeted for interventions aimed at shifting the trajectory of phenotypical aging toward "normal aging." We could dream that the rate of phenotypic aging could be even slowed down or reversed but this argument would be better discussed in some other time and place. Certainly, we need more research to understand the aging process in mammalian species, the role of disease in aging, and the role of aging in disease development. We also need more clinical studies to verify whether applying the knowledge and principle of Geroscience to the cure of frail, older persons can improve outcomes and quality of life. Geroscience may be the key to understand the biology underneath older patients with complex and interactive problems as assessed by GCA and bring the clinical science of CGA and frailty beyond stratification of risk and prognosis right in to effective interventions [23, 24]. If CGA is by far the best tool at hand to provide the best possible care to older patients, understanding the biology of aging can create an opportunity for the future.

We propose that progress in the field of clinical geriatrics requires three levels of evaluation (Fig. 1.1). *Chronological age* we know exactly, to the fraction of the second, is a linear function and has zero variance; *it is what it is* for everybody, at least as far as we know. *Phenotypic age* follows very strict rules during development where changes in anatomy and physiology are driven by a powerful genetic program

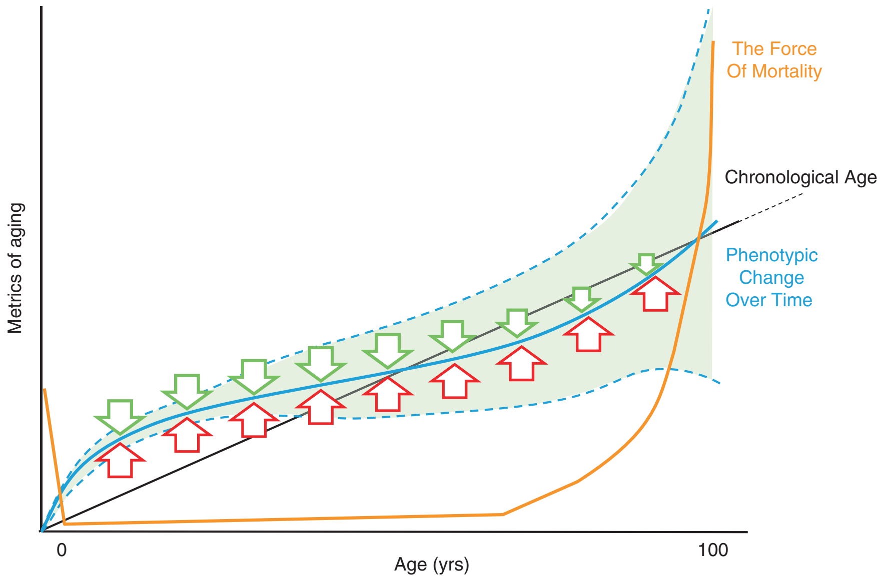

Fig. 1.1 Metrics of aging. Chronologic age is a linear function of time with no heterogeneity across individuals. Phenotypic age is nonlinear: there are massive phenotypic changes during development, followed by relative stability in young and adult, and then, again, there are important changes that occur at old age. The variance in this trajectory (*green area*) is very narrow early in life, possibly caused by the preponderance of a robust genetic plan getting implemented. However, the variance increases with aging because of stochasticity and environmental factors. This is the dimension captured by CGA. Stochastic and environmental factors that could potentially challenge the biological equilibrium required for a healthy life (*red arrows*) are constantly counterbalanced by homeostatic mechanisms (*green arrows*). Such homeostatic mechanisms are the tools of the resiliency and become progressively less effective with aging. The degree of resiliency to destabilizing challenges can be considered a proxy metric of biological aging. Superimposed in *orange* is the force of mortality

getting implemented, and only little variability is allowed. This is so true that if a child is not walking at the age of 12 months, we start suspecting that something is wrong. There may be already aging in this early period, but the events that characterize development are so powerful and robust that aging, if there, remains covered and it is difficult to detect. However, after development, when the genetic control is less strict, the variance of the phenotype increases geometrically, and there may be a substantial discrepancy between chronological and phenotypic age. Such discrepancy is captured well by CGA, which is why CGA is so effective in the identification of older persons at high risk of spiraling into a catastrophic decline that require specific attention, alternative treatment, intensive pre- or post-acute rehabilitation, and active follow-up to improve their outcomes. Underneath the phenotype is *biological age*, which at this stage relies on known biological mechanisms that have been mostly studied in model organisms. At the center of Geroscience is the principle of resilience, the ability that organisms have to deal with stress and challenges and buffer any fluctuation of the homeostatic equilibrium. In a way, "resilience is life in its most pure essence," a purposeful aggregation of bio-macro and micromolecules whose role is to limit the force of entropy that permeate the entire universe and maintain order (life) for as long as possible. Ergo, measures of biological age shall benefit from the information on response characteristics to challenge tests. We shall see whether the promise of Geroscience to make the biology of aging more relevant to the understanding and cure of chronic conditions in older persons pays off. The limited findings that appear in the literature prompt a cautious optimism.

1.7 The Future of CGA

The state of health of CGA is excellent. Healthcare is under pressure to find solutions to provide better care to a growing number of older patients with complex clinical problems, and the shortages of the traditional medical approach in these special patients are becoming overwhelming. There is a rising interest in including those complex patients in RCTs aimed at testing the effectiveness of new drugs or other non-pharmacological interventions in this vulnerable population that, in the end, represent a large bulk of users of those same drugs. CGA as a stratification tool performs incredibly well in this field, although for reasons that are not fully understood. Addressing this lack of mechanistic understanding may be the key to translate the information gathered with GCA into individualized interventions that are more effective than traditional medical approaches to the cure of complex older patients.

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2 The Different Domains of the Comprehensive Geriatric Assessment

Stefano Volpato and Jack M. Guralnik

2.1 Introduction

Identification of older individuals who are frail or at risk of poor health outcomes, followed by appropriate subsequent evaluation and intervention, constitutes a cornerstone of geriatric medicine and quality of care for the ever-growing elderly population. However, in the geriatric population, clinical decision making, including diagnosis, treatment, and outcomes selection, may be particularly challenging. Indeed, older patients are often frail and complex because of the interplay of the multisystemic effects of the aging process with multimorbidity and polytherapy and because of the important contribution of psychological, social, economic, and environmental factors as key determinants of older people's health status (Fig. 2.1). Therefore, the conventional disease-oriented approach may not be suitable; for example, in the presence of multimorbidity, the relationship between a particular disease and the clinical manifestations is often cloudy, and it may be particularly difficult to assess the severity of a specific disease and to assess its impact in terms of functional status and health status. Furthermore, many distressing symptoms, including but not limited to pain, fatigue, sleep disorders and dizziness, may not be attributable to a single specific clinical entity as they are often the consequence of multiple conditions. Finally, compared to younger patients, older patients may have different and heterogeneous preferences and priorities on potential and competing health outcomes and goals such as relief from distressing symptoms, comfort, physical or cognitive function, and increased survival.

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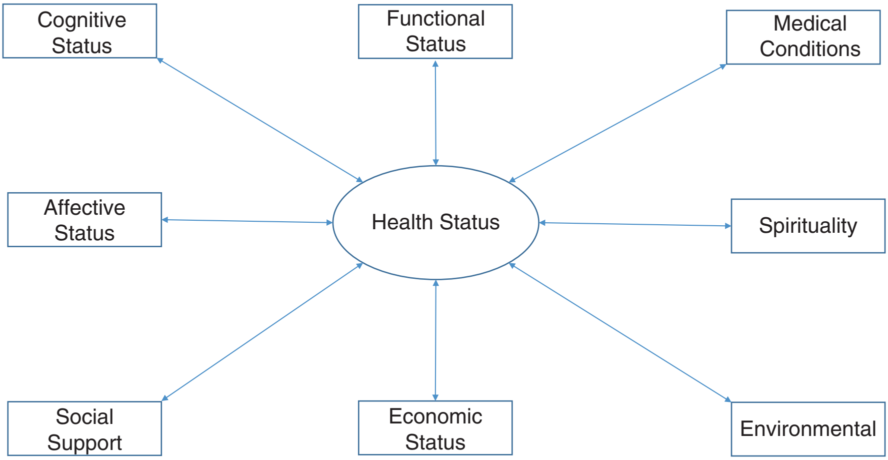

Fig. 2.1 Main determinants of health status of older people

For these reasons, in addition to the traditional medical evaluation, a different multidisciplinary and more holistic approach has been developed. Comprehensive geriatric assessment (CGA) is a multidimensional, diagnostic method elaborated to identify patient's needs, develop a personalized care plan, and improve outcomes of frail older people. Besides detailed data on clinical, functional, and cognitive domains of older patients, CGA provides valuable information on nonmedical domains including economic and socioenvironmental parameters and conditions [1].

Although many different models of care and multiple instruments have been developed and validated over the last 40 years, the majority of CGA tools include similar measurable dimensions, usually grouped into the four domains of *physical health* (including the traditional history, physical examination, laboratory data and problem list, disease-specific severity indicators, and preventive health practices), *functional status* (including basic and instrumental activities of daily living and other functional scales such as mobility or balance and fall risk assessment), *psychological health* (including mainly cognitive and affective status), and *socioenvironmental status* (such as social networks and supports, and environmental safety, adequacy, and needs) [2, 3].

2.2 Physical Health

Comprehensive geriatric assessment does not substitute the traditional clinical workup based on patient's medical history and physical examination, but clinicians need to extend beyond standard evaluation, focusing on a systematic search for specific conditions that are common among older people and might have considerable impact on health status. Indeed, problems like visual and hearing impairment or frequent falling are often overlooked because geriatric patients fail to report these conditions unless specifically inquired about (Table 2.1).

Table 2.1 Selected multidimensional screening instruments according to CGA domain

Domains	Dimensions	Screening instruments	
		Self-report	Performance-based
Physical health	Vision		Snellen chart
	Hearing	Self-reported screening questions	Whispered-voice test
		Hearing handicap inventory for the elderly	Audioscope test
	Multimorbidity		Cumulative illness rating scale
			Charlson comorbidity index
	Polypharmacy	Medication list	Updated Beers criteria
			STOPP and START criteria
	Nutrition	Subjective global assessment	Mini-nutritional assessment
	Balance		SPPB – balance test
			Up and go test
			Performance-oriented mobility assessment
Functional status	Basic activities of daily living	Katz index	
	Instrumental activities of daily living	Barthel index	
	Mobility	Rosow-Breslau scale	Gait speed over 2–6 m
		Mob-H scale	Physical performance test
			Short physical performance battery
			400-m walking test
			6-min walking test
Cognitive status	Cognition		Mini-mental state examination
			Montreal cognitive assessment
			Short portable mental status questionnaire
			Hodkinson abbreviated mental test
			Mini-Cog
	Delirium	Confusion assessment method	
		4-AT	
	Mood	Geriatric depression scale	
		Hamilton rating scale for depression	
		Geriatric anxiety inventory	
		Geriatric anxiety scale	

2.2.1 Vision

One in three adults over the age of 65 years has some form of vision-reducing eye disease, because presbyopia, cataracts, macular degeneration, glaucoma, and diabetic retinopathy all become more prevalent with increasing age [4]. However, many patients do not report symptoms of visual loss, assuming it is a normal part of aging or that nothing can be done about it. Geriatricians can minimize elderly patients' visual loss by screening for age-related eye disease. Intact vision is important to maintain functional independence; for instance, visual acuity is vital to driving and important to properly managing medications and finances. It is important to initially screen for vision problems by asking patients if they wear glasses and whether they have visual problems that interfere with their daily activities. For instance, providers may consider asking patients questions such as: "Do you have trouble recognizing faces? Do you have problems reading a book or the newspaper? Do you have problems watching television? Does your eyesight interfere with any other activities?" A positive response should prompt further assessment of vision [5]. The standard method of screening for visual acuity problems is the Snellen chart. The patient should stand 4.5 m from the chart and read the letters with each eye independently and then both eyes, with eyeglasses if needed. An impairment of 20/50 or worse or a difference of one line or more between eyes should prompt referral to an eye care specialist. However, given the frequency of vision-reducing eye diseases in the aging population, many of which are irreversible if left untreated, it may be prudent to encourage even asymptomatic patients to have annual eye examinations by optometrists or ophthalmologists to screen for these conditions.

2.2.2 Hearing

Presbycusis is the third most common chronic condition in older people, after hypertension and arthritis [6]. Like vision loss, hearing loss can significantly impact functional abilities as well as participation in social activities; furthermore, patients with hearing impairment are at higher risk for cognitive decline [7]. Older patients often do not complain of hearing loss during a usual medical evaluation; thus, healthcare providers must screen patients for hearing loss. Patients should be asked if they feel they have hearing deficit. A positive answer to this simple question has positive likelihood ration of 2.5 for presence of hearing impairment, and therefore these patients should be referred for formal audiologic assessment. Those who reply no should be further investigated with a whispered-voice test, in which the investigator stands 2 feet behind the patient and gently whispers three random numbers or letters while occluding the patient's contralateral auditory canal [8]. Patients that are not able to repeat all three numbers after two tries should be referred for audiological test as well. Alternatively, validated questionnaires, such as the screening version of the hearing handicap inventory for the elderly, accurately identify persons with hearing impairment [9].

2.2.3 Multimorbidity and Polypharmacy

Multimorbidity is usually defined as when an individual has two or more long-term conditions. Studies show that multimorbidity becomes more common as people age; according to a large UK-based study, two-thirds of people aged 65 years or over had multimorbidity, and 47% had three or more conditions [10]. However, although appropriated for epidemiological and research studies, this definition had been considered too broad to be useful in clinical practice, and it has been suggested that defining multimorbidity by simple counts of any kind of diseases and conditions might be not adequate. Indeed, many people may have multimorbidity defined as two or more chronic conditions, but for many, their multimorbidity will present them few problems in their life (e.g., someone with well-controlled hypertension and localized arthritis). In order to weight and assess the severity of multimorbidity, many measurement tools have appeared in the literature, including complex indexes of severity, complications, treatment, and prognosis, such as the cumulative illness rating scale [11] and the Charlson comorbidity index [12]. There are, however, methodological problems affecting the measurement and operational definition of multimorbidity that still limit their utilization in clinical practice.

For many people, multimorbidity matters because it is associated with disability, reduced quality of life, higher mortality, and much greater health services use, including emergency hospital admissions. Furthermore, multimorbidity is associated with polypharmacy, high treatment burden, and also higher rates of adverse drug events [13]. Older people take more medication than any other age groups [14], but despite their role in decreasing morbidity and mortality, medication and particularly polymedication are not risk free. Indeed, age-related physiological change, including, but not limited to, renal function decline and increased permeability of the blood-brain barrier, as well as medication errors, explain the higher risk of adverse drug events of older patients. Serious adverse drug reactions may lead to hospital admission, functional decline, and, eventually, increased mortality [15]. Management of and correct adherence to medications by older patients is often a demanding task requiring good cognitive performance. Older adults may have multiple barriers to correct medication use including visual impairment, cognitive decline, reduced dexterity, and poor health literacy. Medication assessment, including both medication reconciliation and a comprehensive medication review, is therefore a cornerstone of geriatric assessment and patient safety.

The clinician needs to determine what medications the patient is taking and how he or she takes them. For this process, called “medication reconciliation,” multiple pieces of information from the patient, caregiver, and medical record should be gathered. After the medication list is established, the regimen itself must be assessed for safety and appropriateness. Different validated instruments, such as the updated Beers criteria [16] and the STOPP and START criteria [17], may help clinicians to identify both potentially inappropriate medications and the right treatment for a specific patient. Finally, since the likelihood of drug interactions increases with the number of medications taken, complex medication lists should be checked for potential interactions. Many validated software applications are available to help clinicians in this important and difficult task.

2.2.4 Nutritional Status

Maintaining adequate nutrition requires a robust contribution of physical, cognitive, psychological, and social domains. As these domains become impaired with aging, the risk of malnutrition increases in older people. Furthermore, inadequate micronutrient intake is also more common in older persons because several age-related medical conditions may predispose patients to vitamin and mineral deficiencies. Malnutrition can predispose patients to functional decline, falls, fractures, mobility impairments, and several diseases. Thus, the screening and assessment of malnutrition are a crucial part of CGA.

There are four components specific to the geriatric nutritional assessment:

1. Nutritional history performed with a nutritional health checklist
2. A record of a patient's usual food intake based on 24-h dietary recall
3. Physical examination with particular attention to signs associated with inadequate nutrition or overconsumption
4. Select laboratory tests

Many nutrition screening tools are available for malnutrition identification [18]. The subjective global assessment (SGA) [19] is a tool recommended by the American Society for Parenteral and Enteral Nutrition (ASPEN), performed based on patients' medical history and physical examination. It asks participants to record changes in weight, dietary intake, functional capacity, gastrointestinal symptoms, metabolic stress, loss of subcutaneous fat, muscle wasting, and ankle/sacral edema, instead of anthropometric and biochemical tests. A score of C (severely malnourished) is given to patients who have had important fat and muscle loss, a continuous loss of weight, lost 10% of total weight in 6 months, or a significant intake restriction. A score of B (moderately malnourished) is given to patients with loss of 5–10% of total weight in 6 months, with slight loss of fat and muscle and a reduction in mild or moderate intake who may or may not have symptoms. Finally, if there are no symptoms, functional impairment, or weight loss, patients are classified as well nourished (score A). It has the advantage of simple operation, repetitiveness, and no need for any biological assays, but it may be not accurate because the assessment is based on the subjective impression. Furthermore, it may not be suitable for older persons with cognitive impairment and without a reliable caregiver.

The mini-nutritional assessment (MNA) [20] is an elder-specific tool and is extensively validated in nutritional risk screening and nutritional status assessment. It includes 18 questions in four domains: nutritional assessment, subjective assessment, anthropometric assessment, and general assessment. With a total score of 30, scoring ≥24 indicates good nourishment, scoring 17–24 indicates risk of malnutrition, and scoring <17 indicates malnutrition. A simpler version of the MNA, the short-form mini-nutritional assessment (MNA-SF) developed by Rubenstein in 2001, to be further revised by Kaiser et al. [21], has a high correlation with the MNA and is widely used to screen nutritional status of the population. Currently, two versions of MNA-SF are available: MNA-SF-BMI (body mass index) and MNA-SF-CC (calf circumference).

Finally, assessment of alcohol usage should be performed in all patients as part of the nutritional status evaluation. Alcohol intake generally declines in older patients, but older age also changes the ability to metabolize alcohol due to multimorbidity, medications, and changes in liver function and body composition. Thus, older patients may be more sensitive to a negative alcohol effect, particularly in the presence of cognitive decline.

2.2.5 Balance and Falling

Impaired balance in older persons often manifests as falls and fall-related injuries. Approximately one-third of community-living older persons fall at least once per year, with many falling multiple times [22]. Falls are among the leading causes of chronic disability in the elderly which can lead to fractures, soft tissue damage, brain damage, hospitalization, and death. The risk of falling should be assessed by specifically asking the patient about falls and by testing balance, gait, and lower extremity strength. Patients with a history of recurrent falls or fall with injury should receive more detailed assessment beside gait and balance evaluation, including orthostatic blood pressure, vision testing, and medication review [23].

There are many methods and scales for balance and fall risk assessment. Some of them are simple and can be administered also in the physician's office [24]. Balance can be objectively assessed asking the patient to maintain a side-by-side, semi-tandem, and full-tandem position for 10 s [25]. The "up and go" test is a timed assessment of the capability to rise from a chair, walk three meters, turn, walk back, and sit down again on the chair [26]. Patients who need more than 20 s to complete the test are at risk of falling and deserve further investigation. The Tinetti gait and balance instrument is designed to estimate the risk for falls within the following year [27]. This test involves observing as a patient gets up from a chair without using his or her arms, walks 10 ft, turns around, walks back, and returns to a seated position. The patient is asked to complete the gait portion first with the evaluator walking close behind the elder and evaluating gait steppage and drift. The patient is then asked to complete the balance portion with the evaluator again standing close by the patient (toward the right and in front). Nevertheless, it takes about 8–10 min to complete, and it may take too long to be used routinely in a physician's office.

2.3 Functional Status

Measurement of functional status is an essential part of the evaluation of older persons. Patient's capability to perform functional tasks can be considered as a comprehensive measure or the overall impact of age-related impairment and health conditions, including chronic diseases. Furthermore, in older patients, functional status is a powerful prognostic factor and an important indicator of quality of life.

In order to assess functional status in older populations, a variety of tools have been proposed and utilized: some of them belong to self-report measures; others are objective measures. Both self-report and objective measure tools can investigate specific steps of the disablement process; furthermore, there are also more complex tools which combine items related to multiple steps of the disablement process [28]. Self-report measures are based on questionnaires asking how people function in their own environment, in order to evaluate the ability of the individual to remain independent. There are many factors influencing these measures: firstly, the capability of the individual to understand and properly answer the questions of the examiner and properly estimate their own abilities and, secondly, the interaction of the individual with the environment. In fact, different degrees of environmental challenge make it difficult to evaluate the actual physical capabilities of individuals; moreover, a change in the environment over time can modify the reported disability level without any change in the real physical abilities of the individual. Using self-report tools, functional status can be assessed at different levels: basic activities of daily living (BADL), instrumental activities of daily living (IADL), and advanced activities of daily living (AADL). The latter is seldom used in everyday clinical practice.

Basic activities of daily living pertain to self-care tasks including bathing, transferring, dressing, toileting, grooming, and feeding. Conversely, IADL refer to tasks that are needed to live independently in the society such as using the telephone, preparing meals, doing housework, taking medications, shopping, driving and or using public transportation, and handling finances. Advanced activities relate to ability to fulfil societal and community roles.

The Katz index of independence and the Barthel index are the most commonly used for BADL evaluation [29, 30]. The Katz index ranks adequacy of performance in the six functions of bathing, dressing, toileting, transferring, continence, and feeding. Individuals are scored yes/no for independence in each of the six functions. A score of 6 indicates full function, 4 indicates moderate impairment, and 2 or less indicates severe functional impairment. The Barthel index rating scale assesses patient's capability in ten activities (feeding, bathing, grooming, dressing, bowels and bladder continence, toilet use, transferring from bed to chair, mobility, and stairs) assigning a different weight to each activity and a total score ranging from 0 to 100 points, with higher scores indicating better performance.

The Lawton instrumental activities of daily living scale (IADL) is an appropriate instrument to assess independent living skills [31]. These skills are considered more complex than the basic activities of daily living as measured by the Katz and Barthel index of ADLs. The instrument is most useful for identifying how a person is functioning at the present time and to identify improvement or deterioration over time. There are eight domains of function measured with the Lawton IADL scale (using the telephone, shopping, food preparation, housekeeping, laundry, mode of transportation, responsibility for own medications, ability to handle finances). Women are scored on all eight areas of function; historically, for men, the areas of food preparation, housekeeping, and laundering are excluded. Clients are scored according to their highest level of functioning in that category. A summary score ranges from 0 (low function, dependent) to 8 (high function, independent) for women and 0 through 5 for men.

More recently, it has been an emerging interest in assessment of physical function to directly observe the performance of functional tasks. Objective measures of physical function are instruments in which an individual is asked to perform a specific task and is evaluated in an objective, standardized manner using predetermined criteria, which may include counting of repetitions or timing of the activity as appropriate. These tools were developed in response to concerns about the lack of accuracy of self-report measures. Additionally, self-report cannot generally discriminate different functional levels in non-disabled people with higher levels of functioning because of the presence of a ceiling effect in self-report measures. A variety of objective performance tests have been developed for use in different clinical settings. In general, these tools may be categorized according to the domain of functioning, including upper extremity and lower extremity tests. Most objective measures are indicators of functional limitations, but they may be also linked to impairments, or actual disability, and they are useful to stratify individuals according to level of functioning. Examples of these tools include the 4 or 6 m gait speed assessment, the physical performance test [32], and the short physical performance battery (SPPB) [25]. These measures have good psychometric characteristics and predictive value in a variety of settings. In fact, they are often used in cross-national and cross-cultural studies to detect information difficult to obtain using self-reports of disability.

There are three main factors that influence the choice of using one tool instead of another: firstly, the setting, secondly, the clinical conditions of the subject, and, finally, the aims of the assessment. In general, healthy (non-disabled) people can undergo objective measures of physical function such as the SPPB, gait speed alone, or the 400-m walking test or 6-min walk test. This is the best strategy to detect early and subclinical limitation and better stratify the risk of future health outcomes in persons fully independent or with mild-moderate disability. Vice versa, in severely disabled patients, who cannot perform objective tests, self-report will provide physicians reasonable information for short- and middle-term management, whereas objective measures do not add prognostic value. However, it has been suggested that combining self-report information with performance-based measures can provide more refined prognostic information than either method alone [33].

2.4 Psychological Health

2.4.1 Cognitive Status

Major neurocognitive disorders (dementias) are common causes of morbidity, disability, and death in older people; 50–70% of dementia cases are Alzheimer's disease [34]. Minor neurocognitive disorder (mild cognitive impairment) is a known precursor to Alzheimer's disease and other types of dementia. However, both minor and major neurocognitive disorders are often overlooked and attributed to aging rather than being investigated, hampering potential benefits of appropriate treatment and management and dramatically affecting the quality of life of patients and their families and increasing cost for the health systems [35]. For these reasons, the yield of screening for cognitive impairment increases with increasing age.

Many tools have been developed and validated in different populations and clinical setting. The mini-mental state examination (MMSE) is the most commonly used; it is administered in 10–15 min, depending on patients' cooperation, and explores different domains of cognitive functions including orientation, memory, registration, attention, calculation, recall, language, and ability to follow simple commands [36]. Scores on the MMSE range from 0 to 30, with a score of 24 and higher generally considered normal. Lower score indicates more severe impairment. The Montreal cognitive assessment (MoCA) assesses several cognitive domains, including visuospatial abilities, multiple aspects of executive functions, attention, concentration, working memory, and language [37]. Unlike the MMSE, the MoCA includes a clock-drawing test and a test of the executive function known as trail making test-B. Both the MMSE and the MoCA are relatively short, simple, and reliable as a screening test for Alzheimer's disease. In addition, the MoCA measures an important component of dementia that's not measured by the MMSE, namely, executive function. However, both tests are usually too long for routine use in most clinical setting, particularly in acute care wards. Several shorter screening instruments have been therefore validated; examples of such tests include the short portable mental status questionnaire (SPMSQ) [38], the Hodkinson abbreviated mental test score (AMTS) [39], and the Mini-Cog [40]. The SPMSQ includes ten questions related to orientation, personal history, remote memory, and calculation. A final score of three or more errors is indicative of cognitive impairment. This instrument is compact, brief, and easy to use and does not require special material or expertise. Similarly, the AMTS, introduced by Hodkinson in 1972 to quickly assess elderly patients for the possibility of dementia, include ten questions dealing with orientation, remote memory, and calculation. Likewise the SPMSQ, the AMTS takes 3–5 min. Maximum score is 10 and a score of less than 7 suggests cognitive impairment. The Mini-Cog is a 3-min instrument that can increase detection of cognitive impairment in older adults. It can be used effectively after brief training in both healthcare and community settings. It consists of two components, a 3-item recall test for memory and a simply scored clock-drawing test.

None of these shorter tests are validated for the diagnosis of delirium. Among hospitalized patients, cognitive status must be therefore evaluated at admission and periodically over hospital stay because older hospitalized acutely ill patients are at high risk of developing delirium. As a consequence, abnormal findings should be interpreted in the context of change from baseline and upon the clinical picture. There are different validated instruments, including but not limited to the Confusion assessment method [41] and the 4AT method [42], that may help the physician detect delirium in patients with concomitant cognitive decline.

2.4.2 Mood

Although major depression is less common in older people than in the younger population, several complex emotional and psychological problems may affect older patients greatly, impacting the occurrence, development, and clinical course of diseases. Although the presence of depressive symptoms has been associated with functional limitations, cognitive impairment, and increased morbidity, this condition is often overlooked, because older patients might not complain about specific symptoms or because symptoms are interpreted in the context of cognitive impairment or as the consequence of the aging process. The geriatric depression scale (GDS) [43] is a 30-item self-report assessment specially used to identify symptoms of depression in the older population. Two simpler versions of the GDS, GDS-15 and GDS-5 (short versions 15- and 5-item geriatric depression scale), have been developed and validated. The GDS questions are answered “yes” or “no” for depression, reduced activity, irritability, withdrawal, painful thoughts, and negative evaluation of the past, present, and future.

The center for epidemiologic studies depression scale (CES-D) [44] is a short self-report questionnaire with 20 items that reflect depression severity in depressed mood, feelings of guilt and worthlessness, feelings of helplessness and hopelessness, psychomotor retardation, loss of appetite, and sleep disorders, scoring the frequency of occurrence of specific symptoms during the previous week on a four-point scale and scoring ≥16 as CES-D depression. Higher scores indicate more seriousness. The Hamilton rating scale for depression (HRSD) [45] is a multiple-item questionnaire used to provide an indication of depression, which is the most classic and widely used scale to rate the severity and changes of adults’ depression by probing mood, feelings of guilt, suicide ideation, insomnia, agitation or retardation, anxiety, weight loss, and somatic symptoms. A score of 0–7 is considered to be normal. Scores of 20 or higher indicate moderate, severe, or very severe depression and are usually required for entry into a clinical trial.

Anxiety, a condition characterized by feelings of tension, worried thoughts, and physical changes, is also often unrecognized and inadequately treated in the elderly. The importance of assessing anxiety is highlighted further by data suggesting that anxiety is common among older disabled adults and is a significant predictor of progressing disability, cognitive decline, and nursing home placement. Several factors complicate recognition and treatment, including concomitant medical illness, cormorbid depression, overlap with cognitive disorders, and ageism. Although available data from controlled clinical trials are limited for anxiety patients in the geriatric age group, some data and clinical experience indicate that pharmacologic treatments are safe and effective for anxious elderly patients. Many tools are available for screening, but the standardized use of instruments specially developed and validated for the elderly, like the geriatric anxiety inventory (GAI) [46] or the geriatric anxiety scale S (GA) [47], might increase the likelihood of anxiety detection and improve diagnostic accuracy. The geriatric anxiety inventory (GAI) consists of 20 “agree/disagree” items designed to assess typical common anxiety symptoms. The measurements of somatic symptoms with the instrument are limited in order to minimize confusion between symptoms common to anxiety and general medical conditions. The GAI developers created a short form of the geriatric anxiety inventory (GAI-SF) in 2011, which was confirmed to have the same validity and reliability as GAI. In addition, the Diagnostic and Statistical Manual of Mental Disorders (DSM), published by the American Psychiatric Association (APA), can also be used to assess anxiety. The geriatric anxiety scale is a 30-item self-report measure used to assess anxiety symptoms among older adults. Individuals are asked to indicate how often they have experienced each symptom during the last week, answering on a four-point Likert scale ranging from "not at all" (0) to "all the time." Notably, a 10-item short version, called the GAS-10, is available and has strong psychometric properties as a screening instrument in diverse samples of older adults.

2.5 Socioenvironmental Status

While social functioning may not seem to be part of the medical domains, it is a crucial part of the overall health picture in older people. The existence of a strong social support network can frequently be the determining factor of whether the patient can remain at home or needs placement in an institution. In western countries, the social network (spouses, children, and other relatives) provides much of the care for older patients; for example, informal caregiving by family makes up a large portion of the overall costs for patients with cognitive decline [48]. Early identification of problems with social support can help planning and timely development of resource referrals. Assessment of the strength of the social network can provide valuable information about how long the patient will live independently, the needed mechanisms of support to remain independent, and the patient's ability to plan and adapt to environmental challenges. Information on availability of social support and adequate environmental conditions are mandatory to design a personalized plan of care for older patients, particularly for patients with cognitive impairment and/or disability in IADL and BADL. However, even in healthier persons, it is important to know who would be available to help the patients in the case of acute illness.

Ii is important to identify whom the patient would call in an emergency and obtain the contact information. Support networks can be assessed by identifying who the patient believes would provide care for them if they were unable to care for themselves. These questions conveniently follow into a discussion about healthcare proxy decisions and end of life choices, which is crucial for physicians to assess for their patients. Patients should consider these issues during times of stable health when they may have more time to think and discuss them with family members. Ideally, patients should provide written documentation of their choices of healthcare proxy and advanced directives.

Older patients are at risk for home environmental hazards because of impaired mobility, balance, and cognition problems. The CGA team should assess for common home conditions that can be unsafe. Smoke and carbon monoxide detectors can provide advanced warning of life-threatening emergencies and are relatively inexpensive to purchase and operate. Tobacco use in the home can be a risk factor for fires and burns. Simple home environmental changes, including but not limited to grab bars, shower seats, and removal of throw rugs, can prevent falls and the resultant morbidity of falls.

The financial situation of a functionally impaired older adult is important to assess. Older patients may qualify for state benefits, depending upon their social support and income. Older patients occasionally have other benefits such as long-term care insurance that can help in paying for caregivers or for institution fee. Usually, clinicians feel uncomfortable inquiring about the economic condition of their patients, but as an alternative, nurses and welfare workers may collect this important information.

Conclusions

CGA can be performed in a number of setting, including the physician's office, hospital, home, and nursing home, and with varying program types and levels of intensity (such as hospital GEUs, hospital acute care for elderly [ACE] units, hospital consultation teams, outpatient brief screening assessment programs, or intensive in-home assessment and case management programs). The instruments used to assess the different domains of CGA should be selected on the basis of the clinical setting and programs and should be tailored to patients' characteristics. But wherever it is performed, CGA, being the hub of the geriatric care system and serving as a common language, must always include all its fundamental domains.

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The Patient, the Multidisciplinary Team and the Assessment

3

Finbarr C. Martin

3.1 Introduction

Comprehensive geriatric assessment (CGA) has been defined and described in the two previous chapters. Chapters 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 focus on application of CGA in specific clinical circumstances and service settings and discuss the growing evidence that CGA can contribute to better clinical outcomes for patients and improved efficiency for service providers. The complexity of the older patient is matched by the multidimensional scope of the CGA. The level of detail in the assessment varies according to the clinical situation. Standardised assessment tools are usually a feature. Choosing the right tool depends upon the purpose and the tool's measurement properties, and these will be discussed in this chapter.

In its most comprehensive application, CGA includes the formulation of a treatment and care plan, implementation of this plan and then follow-up to monitor progress and adapt the care. The tools and scales used for the assessment are but one component of this process. Additional crucial components include the composition and skills of the clinical team members, the way that the team works together and the ongoing method for coordination or case management. In this chapter the general principles of these aspects are discussed to complement the detailed descriptions of CGA in practice in the later chapters.

3.2 Who Needs CGA?

Patients vary, but in principle there is always a balance between the potential additional benefit that CGA can bring to the clinical encounter and the possible risks and the burden of participating in this complex process. Both benefits and

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risks can arise from uncovering new problems. There is a risk of overmedicalising differences between individuals. The clinician is best placed to predict the difference that CGA can make and the associated burdens, but it is for the patient to judge the utility of these.

CGA is resource intensive. In all healthcare systems, there is inevitably a trade-off between the cost of CGA, the benefits to some patients and impact on other health costs. For example, introducing CGA as part of a preventative approach in primary care is a new cost but may prevent or ameliorate disabling illness and reduce subsequent specialist healthcare or social care costs. Adding CGA to existing clinical programmes, such as elective surgery for older people, will likewise increase initial costs but might reduce subsequent costs if complications such as delirium can be prevented.

From the viewpoint of patients and healthcare providers, therefore it is important to be focused and proportionate. It is important therefore that the right level of intensity and the appropriate approach are used according to the purpose, which may include screening, case finding, providing comprehensive care, monitoring treatment outcomes and research. Each of these purposes has its own requirements in terms of breadth and depth of assessment, feasibility and cost and the performance characteristics of measurement in the tools and scales used.

There are some circumstances in which CGA is well justified by current evidence, but in other situations there are no established criteria to easily identify suitable patients. This will depend upon the degree of frailty/complexity in the patient group but also the service delivery model.

3.3 The Purposes of Assessment

For individual patients, these include:

- Identifying older people among a relatively low-risk population (such as in primary care) who are likely to benefit from a more detailed assessment, which may be broader and deeper in scope
- Optimising the clinical response to an acute medical event or injury
- Monitoring the patient's progress following the provision of a multidimensional treatment programme
- Identifying risk associated with specific clinical challenges such as surgery or cancer therapies and optimising the patient to minimise these risks and optimise outcomes

To develop and maintain good clinical services:

- To describe casemix of a cohort of patients:
  - To design a service in terms of the resources and skills needed
  - To estimate (changing) need over time
- To describe a research patient population to better understand the generalisability of the benefits, risks and burden associated with a treatment being evaluated

3.4 Assessment Tools

Systematic CGA usually employs standardised assessment tools. Generally, assessment tools are designed to identify the nature of an issue, the presence or absence of an issue and/or the magnitude of the issue of interest. Some tools enable description: others enable quantification with systematic scaling. Tools are central to systematic CGA. They are named according to what they purport to do, but a word of warning is needed, as provided by Humpty Dumpty to Alice (in *Through the Looking Glass* by Lewis Carroll):

> When I use a word,' Humpty Dumpty said, in rather a scornful tone, 'it means just what I choose it to mean — neither more nor less.' 'The question is,' said Alice, 'whether you can make words mean so many different things.' 'The question is,' said Humpty Dumpty, 'which is to be master — that's all.

A tool may claim to encapsulate the issue of interest so well that we may come to allow the tool to define what the issue is, rather than the other way around. The quality of a tool can be judged according to several properties, as shown in the Table 3.1.

Table 3.1 Properties of assessment tools in health and social care

Property	Explanation	
Validity	Does the tool do what it is intended to do?	
-Types	Face	Does it seem to be about the issue of interest?
	Content	The degree which test items match some objective criterion
	Construct	The degree to which a test measures an attribute it is supposed to measure and in appropriate relative proportion
	Predictive	Does the tool result predict subsequent events as expected?
	Concurrent	Does the tool result match that of an alternative, preferably well established, tool which addresses the same issue?
Reliability	Does the tool give consistent results?	
-Types	Test-retest	Does the tool produce consistent results when tested repeatedly in a stable situation?
	Inter-rater	Do different raters obtain the same results from the same phenomenon, same person or similar casemix or people?
	Format	Does the tool behave the same in a variety of alternative formats, such as self-completion, face to face, by telephone and proxy scoring?
	Internal consistency	Do items in the tool behave in a consistent way relative to each other? Internal agreement between parts of the whole tool
Responsiveness	Does the tool detect change when this is evident by some other appraisal?	
Feasibility	Can it be used in the real clinical situation it is intended for? This includes resource requirements, time, skill and convenience	
Acceptability	Is the experience of the tested participants satisfactory?	

A consensus guideline with checklist has been developed to assess the quality of health measurement instruments [1]. Most of the aspects above are included, but in addition it includes cross-cultural validity and considers measurement error incorporating standard error of measurement, smallest detectable change and limits of agreement. Terwee et al. [2] described a rating system based on the agreed criteria.

3.5 Measurement and Scaling

Scales are designed to measure the "amount" of an issue of interest. This may be a single domain such as cognition or mobility or subdomain such as memory or gait speed. Therefore, the output of the assessment phase of CGA consists of several types of data:

- Presence or absence of a clinical phenomenon, e.g. a geriatric syndrome or disease diagnosis
- A score or category on a measurement scale, e.g. to assess capacity or impairment and to describe the level of functional ability or aspects of social support or networks
- Presence or absence of a defined risk level according to a cut point on a scale

The method of scaling is generally dependent on the nature of the issue in question, as shown in Table 3.2.

Each type of scale has its use for which it is suitable, uses for which it may be used but may not be optimal for the purpose and uses for which it should not be used.

There may be a need to amalgamate scores in some way to summarise the results of an assessment. The way in which the data is amalgamated varies. In some scales such as an ordinal scale for measurement of ADL categorical items such as "can dress independently," "can do some but needs help" and "cannot dress," these categories are given numerical notation, for example, 2, 1 and 0, respectively, which enables numerical aggregation with the equivalent numbers from other aspects of ADL. This then becomes the "score" on the ADL scale, representing an estimate of the amount of ADL that can be performed. Clearly any total score can be reached by different combinations of individual item scores, each representing different aspects of functional abilities/deficits. Thus the same score does not depict the same situation for each individual.

In this type of scaling, although it may not be immediately obvious, the choice of item scores, 2, 1 and 0, for these categorical values contains an implicit weighting, in relation to each other and in relation to values in other ADL subdomains. So a score of 2 may be achieved by being able to dress independently or, for example, by being able to bathe independently. In what way are these categories of activity equivalent? Generally the implicit weighting is not arbitrary but related to some other consideration. Some ordinal scales do not use all the numbers in the range in an attempt to overcome this limitation, with the result that some degree of proportionality is given to the scaling.

Table 3.2 Methods of scaling used in measurement tools in health and social care

Type	Explanation
Categorical (nominal)	These may be dichotomous (yes/no; male/female) or have several values, each mutually exclusive (e.g. ethnicity). Categories may be labelled for convenience with numbers (a nominal scale), but these are arbitrary and do not imply any relative size
Ordinal	Numbers are used as labels, but these numbers reflect an undefined but increasing quantity of the thing being assessed. For example, the numbers 1–4 may be given to the following responses: no pain/mild pain/moderate pain/severe pain. A unit numerical difference does not imply a consistent difference in the amount of the assessed issue. Thus, for example, a score of 4 does not imply twice the amount of pain as 2
	Aggregating scores into means is often done but can be misleading in that the mean number does not indicate a true average of the amount of the parameter being measured
Interval	The numbers here have a precise relationship to each other. A unit change in the scale represents a constant difference within the total range. Thus the difference between 10 and 20 °C is the same as between 20° and 30°. Means and distribution measures (such as standard deviations) are meaningful. However, it is not the case that 40° is twice as hot as 20°
	Interval scales may be applied to continuous data, where the precise value is limited only by the measurement precision, or discrete data, where there are whole integers but fractions would be meaningless, such as in the number of siblings
Ratio	This is like an interval scale but with a real zero, such that doubling the score truly represents twice the amount. For example, 20 kg is twice the weight of 10 kg

When scales are put together, the reasoning for the weightings may not be disclosed and indeed may not be clear even to the authors. There are several reasonable bases upon which the weighting could be justified:

- The subjective sense of importance attributed to the individual ADL activities by a representative group of older people or patients: in this case the higher score is associated with more independence in important activities.
- The average amount of time that carers would need to assist the person in completion of the task: in the case of the example above, a low score would suggest more carer time was needed.
- The average daily cost of the care time needed: in this case assistance with an activity that was needed frequently each day would tend to attract a lower score.
- The average quantified association of the ability or inability with a numerical score of quality of life: this could be derived from statistical analysis of scores from a representative patient group, the scoring then reflecting the average attribution.
- The contribution of individual items to the likelihood of a subsequent event (outcome), such as being admitted to hospital, dying or needing institutional care within a specified time period: this would be derived again by statistical analysis from a prospective observational study.

It is clear from this list that what differs across these potential approaches to weighting is the perspective being employed. Each is perfectly legitimate, depending on the purpose of the scale. A care provider, for example, may wish to aggregate a score of ADL in terms of likely resource needs. A clinical researcher testing an intervention may choose instead to weigh ADL items in terms of the likely quality of life impact of a change in ADL function.

What matters to the general user of scales is to be aware that weighting is present even when not explicit, and that this will reflect a perspective about ADL or whatever is the issue being assessed and scored. Some widely used assessment scales combine data from several domains, and once again in reaching a total score, there is an implicit weighting across the domains. So, for example, a subscore about mobility may be added to a subscore about cognition. In developing these scales with aggregated item scores, the creators may demonstrate that the weighting chosen across domains provides the best performance for that group of participants for the specific outcome being considered, for example, clinical prediction. It is then tempting to treat the total scores as representing a latent parameter and that the scoring system is transferable to other groups of participants and other purposes. Conceptually this would be a mistake, but in practice, many scales used in CGA are indeed successfully used for many purposes.

3.6 Choosing the Appropriate Type of Assessment Scale

The discussion above illustrates the variety of factors which are relevant to choosing a tool to incorporate into a CGA process. Table 3.3 highlights features relevant to some of the purposes described earlier.

Table 3.3 Matching the properties of assessment tools to the purpose of their use

Purpose	Relevant tool properties
Screening for risk in primary care	Optimal discrimination (balance of sensitivity/specificity) depends partly on the ease and acceptability of a "light touch" tool. Whilst discriminant ability is important, responsiveness to change is not. Face validity is important to well people. Predictive validity is important but construct validity less so as a more extensive CGA is anticipated
Optimising clinical care in an acute setting	The objective here is to detect and describe the full range of problems, particularly modifiable factors. Content and construct validity are therefore important, but overall CGA predictiveness is not the issue. Responsiveness may be required for selected domains to monitor progress. Reliability in the hands of routine staff is important if they are not specialist trained
To design and monitor service performance	Comparing casemix over time requires reasonable reliability but only sufficient responsiveness to change to enable detection of a magnitude of difference in casemix which would suggest the need for service redesign or explain a difference in clinical outcomes
Research populations to understand generalisability	Here the purpose is descriptive. The validity of the CGA tool requires it to include those factors likely relevant to the benefits, risks and burdens of treatments. The tool does not need responsiveness to change, but reliability is important if the tool might be used subsequently to inform clinical decision-making

3.7 Clinical Prediction Tools

Components of CGA may be used to predict clinical outcomes (prognostic tools) or to identify if an issue is present or not. This could be as a screening tool to identify, from among a larger group, those with a higher likelihood of already having a clinical issue (e.g. undiagnosed disease). Tools and scales vary in their ability to discriminate, i.e. to detect an issue when it is there or predict a specific clinical outcome and to be sure that an issue is not present or the clinical outcome will not happen (specificity). The terms used to describe the properties of tools are set out in Table 3.4 but can also be illustrated in the Venn diagram in Fig. 3.1.

In CGA prediction tools, for example, for identifying higher-risk older patients among acute hospital admissions so that they can be targeted for specialist attention, there is also a choice to be made about the most suitable cut point. This is usually done by plotting a receiver operating curve (ROC) to identify the optimum combination of sensitivity and specificity. A random association of a positive test result and the clinical outcome produces a ROC area under the curve of 0.5. Total concordance would produce a value of 1.0. In general, a ROC value of about 0.8 or above is regarded as clinically useful.

Clinical or epidemiological studies which demonstrate impressive associations between, for example, a combination of variables in a tool and a clinical outcome do not necessarily make prediction tools which have clinical utility. An odds ratio of 3.0, for example, is unlikely to produce a useful clinical tool. This odds ratio can be

Table 3.4 Psychometric terms used to describe the performance of an assessment tool

Psychometric property		Explanation
True positive	TP	The test accurately identifies or predicts the issue[a]
True negative	TN	The test accurately identifies or predicts the absence of the issue
False positive	FP	The test wrongly indicates the presence of the issue or wrongly predicts the subsequent clinical outcome (type I error)
False negative	FN	The test wrongly indicates that the issue is absent (type II error)
Sensitivity	TP/TP + FN	The hit rate: the proportion of real positives (with the issue or who experience the clinical outcome being predicted) who are correctly identified
Specificity	TN/FP + TN	The proportion of real negatives who are accurately identified or predicted
Accuracy	TP + TN/total	Correct identifications or predictions as a percentage of the total
Positive predictive value	PPV = TP/TP + FP	Precision
Negative predictive value	NPV = TN/TH + PN	

[a]Accurately identifies the presence of an issue (such as occult disease) or accurately predicts the subsequent outcome of interest (such as falling more than once in the next 12 months or being admitted to hospital within 12 weeks from hospital discharge)

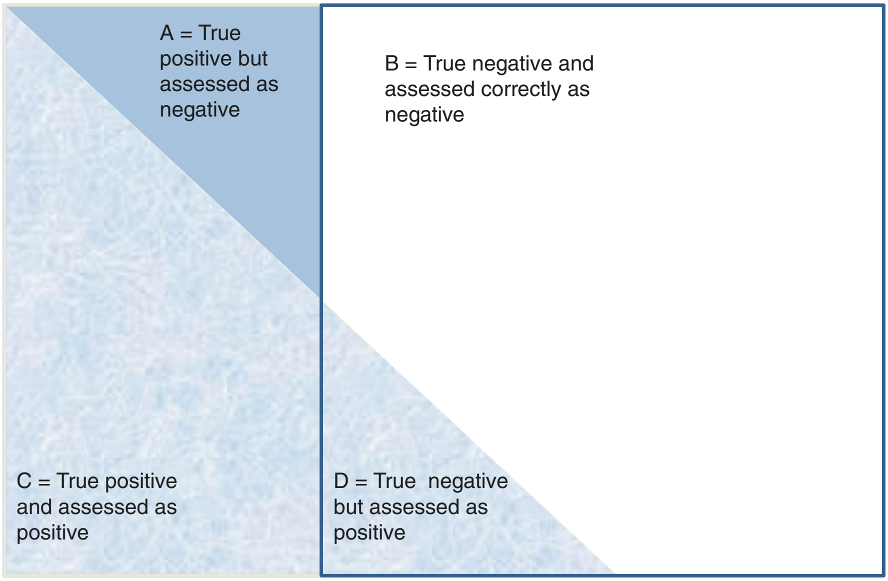

Fig. 3.1 The 4 divisions within a population in terms of true and false positives and negatives. The relative sizes shown are arbitrary but their sizes determines the utility of a tool

derived from a range of sensitivity and specificity values. But, for example, a useful sensitivity of 0.8 could be accompanied by a false positive rate of nearly 60% [3].

For a prediction tool to be useful, it must also be applicable to groups other than those involved with its initial development. A key issue here is the effect of prevalence on predictiveness. Assuming the same sensitivity and specificity, the rarer the issue being predicted (e.g. occult disease or a specific clinical outcome), the more likely that a negative test indicates no abnormality, but the likelihood that a positive result is a true positive becomes less. Thus clinical utility of a tool in one setting (e.g. a clinic with many frail persons) cannot be assumed to be as useful in another, such as a generally healthy community-dwelling population. Predictive values observed in one study do not apply universally. The demonstration that a clinical prediction tool is fit for purpose has several stages, as described in Table 3.5.

There are several statistical approaches to internal validation of reproducibility of predictiveness, using the same dataset as for development of the tool. External validation however can demonstrate both reproducibility and transportability, i.e. the extent to which a different casemix results in the same predictiveness. Reasonable transportability is needed for it to be useful. Methods have been developed for systematic review and meta-analysis of validation studies to summarise the predictive performance of a tool across different settings and populations [4, 5]. Key items are summarised in the PICOTS system:

- Population: define the target population
- Intervention: the tool (model) being used
- Comparator: if applicable, competing tools (models)

Table 3.5 Stages in the development and use of a clinical prediction tool

Stage	Explanation
Concept	Defining the clinical problem to be addressed and the potential utility of a prediction tool
Development	Use clinical and epidemiological evidence and experience to select parameters for a putative prediction tool
	Create a dataset of suitable variables which are likely to produce a feasible, transportable tool
	Statistically analyse the observed relationships in a cross-sectional or prospective observational cohort to identify a suitable predictive cut point
	Use statistical techniques (e.g. boot strapping) to test the reproducibility in the development cohort
Validation	Check that using the tool with its optimum cut point for discrimination has superior predictive ability in comparison to routine clinical care
	Model the likely outcome in representative populations
	Test the reproducibility of discrimination in a remote cohort, e.g. a similar clinical group in a different hospital or community
Impact assessment	Test whether the use of the prediction tool by specified groups (e.g. trained non-specialist health professionals) improves decision-making and results in better clinical outcomes or more efficient resource use. This is equivalent to establishing effectiveness
Implementation and spread	Tailor the tool for use in individual settings, with retesting for discrimination if the format of the tool changes significantly or the casemix is very different. Assess feasibility and user-friendliness

- Outcome(s): of interest for which the model is validated
- Timing: over what time period the outcome is predicted
- Setting: the intended role or setting of the predictive/prognostic tool

There are clinical situations in which prediction itself is the requirement of the tool, but in most clinical circumstances, the objective is to identify the likelihood of specified outcomes and then modify it. Some of the items, but rarely all, contributing to a prediction score may be modifiable so become the focus of an intervention. The impact on overall outcomes achieved by using a prediction tool can then be investigated. Accuracy of a tool is no guarantee to its having an impact on outcomes! Other factors in determining usefulness include the resources, time, skills and training needed to use it and the feasibility of its use in routine clinical practice.

3.8 The Clinical Team

The success of CGA in practice depends upon the composition and skills of the clinical team members, the way that the team works together and the ongoing method for coordination or case management of patients. Geriatricians have been at the forefront of developing CGA, but in most healthcare settings, they are a scarce resource. Furthermore, other health professionals are becoming increasingly expert in working with older people and bring with them additional knowledge and skills and different attitudes which all add to the overall competence of the team.

CGA light, for example, for identifying a risk population in primary care, can be done in a structured way by one adequately prepared health professional, e.g. a nurse practitioner. But in most clinical settings, the minimum team will include a doctor, nurse, therapist and social worker. Both physiotherapists and occupational therapists are usually members of a core CGA team. There is overlap between them as well as distinct expertise, so the efficient use of resources may dictate that they are involved selectively based on the patient's clinical profile. Depending upon the findings of a broad CGA, specialists in other disciplines may be needed for further assessment and/or treatments. Most commonly this will include dieticians, pharmacists and mental health specialists (psychiatrists or psychologists), but oral hygienists, audiologists, podiatrists, opticians or dentists will sometimes be needed. These occasional participants may not have the general skills required to work successfully with frail older patients, and therefore education and training throughout the healthcare workforce is a priority going forwards.

Patients and those important to them in providing care, support or advocacy comprise the wider team, and creating working partnerships is crucial. Some older patients are less able to indicate the role that they would like these others to play, and this needs sensitive elaboration. In some settings, geography dictates that the team operates in virtual space. Although information can be readily shared, without making provision for team building, this may limit the effectiveness of CGA.

3.9 Team Building and Team Working

The purpose of the team is to work in partnership with patients and others on their behalf to achieve optimal clinical outcomes. This would most commonly be the best achievable outcomes as judged by the clinical team although some patients will opt for less in accordance with their aspirations and beliefs. This shared goal setting with patients is a key element in planning care.

The team membership may be based on those people working together with specific patients or, more broadly, by those working in a service setting with shared goals but not necessarily the same patients. The degree of interdependency and collaboration between members will vary, and various terms are in use to describe these differences: multidisciplinary teams, interprofessional or interdisciplinary teams and transdisciplinary teams.

The use of these terms is not consistent internationally, but the relevant factors which distinguish patterns of collaboration include:

- A patient may be routinely assessed by several team members of different professions, or one leading member (usually a physician) determines their involvement (or not).

- Team members agree a collective goal with the patient, or each member negotiates “their” specific goals with the patient individually.
- Team members share some assessment processes/tools and the information derived, whilst retaining specific expertise-based tools, or one team member has skills across the domains (wider than the usual skill set for that profession) and completes the initial assessment (and perhaps the treatment) on the team’s behalf.
- Each team member retains their own clinical records, or there is a shared clinical record to which all have equal access and entry rights. This is often cumbersome in practice unless facilitated by electronic records.
- The team has a shared clinical quality monitoring and review system, or members retain accountability and quality management only within their own professional structures.

Whatever the degree of shared knowledge, skills and collaboration, communication and team governance are necessary for sustainable teamwork. A patient-centred approach requires as a minimum a negotiated goal and a shared vision in the team of the overall strategy to achieve this goal and a respect for the roles of each other in doing so. Scheduled regular meetings to discuss patients’ progress, review goals and agree revisions to care plans are usually an essential component of successful team working.

Quality in care delivery can be judged by:

- Effectiveness – optimal outcome based on agreed goals
- Efficiency – best use of resources
- Experience of the patient during the journey of care
- Equitable – equal access for equal need regardless of age, sex, race, etc.
- Timeliness – the right care at the right time

Evaluations rarely encompass all these aspects, but comparative studies have demonstrated that at least effectiveness, efficiency and patient experience are enhanced by a closer collaboration in what would usually be regarded as an interdisciplinary approach [6]. Professional guidance on standards of team working has been produced by the American Geriatrics Society [7] including a description of team member competencies.

Individual health professions tend to have distinct language and behaviours and different expectations of how dialogue is conducted. These differences have the potential both to enhance the team and its other members and also to become an obstacle to communication and collaboration. There is also an inevitable difference in levels of experience, which can result in hierarchies between members translating into an overemphasis on some aspects of the treatment approach. Experienced leadership can mitigate this pitfall.

The clinical complexity of older frail patients who benefit from CGA often requires careful scheduling of clinical inputs with contributions from less regular participants. A holistic approach means respecting the differential contributions of medical treatments, functional rehabilitation and social and environmental adjustments.

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4 Comprehensive Geriatric Assessment in the Hospital

Alberto Pilotto and Nicola Veronese

4.1 Introduction

The observations of high rates of institutionalization in the frail older population and the inadequacy of provision for readily recognizable and remedial problems in this high-risk group led to the development of one of the cornerstones of modern geriatric medicine: the comprehensive geriatric assessment (CGA). CGA is a multidimensional, interdisciplinary diagnostic process focused on determining the medical, psychological, and functional capabilities of frail elderly persons for developing a coordinated and integrated plan for treatment and long-term follow-up [1]. CGA differs from the standard medical evaluation by its concentration on frail older people with complex problems, emphasis on functional status and quality of life, use of interdisciplinary teams, and quantitative assessment scales [2]. Furthermore, the range of intensity characterizes CGA starting from the screening assessment (focused to identify older persons' problems performed by primary care/community health workers), to the diagnostic assessment and management of these problems, usually carried out by a multidisciplinary team with geriatric training and experience.

The CGA uses validated geriatric scales and tests to produce an inventory of health problems, which can then serve to develop an individualized geriatric intervention plan. An interdisciplinary team approach is employed in most CGA programs to assess patients, interpret results, and pool expertise in working toward common goals.

During the last 30 years, models of CGA have evolved in different healthcare settings to meet differing needs becoming the foundation of "progressive" geriatric care, including not only hospital but also rehabilitation units, nursing homes, and community services [3]. In progressive geriatric care, CGA is performed at varying levels of intensity in different settings.

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4.2 CGA in Hospital

Table 4.1 summarizes the most important studies (in term of meta-analyses and trials) regarding the use of CGA in hospital.

Even if important in other settings, CGA is probably more commonly used in hospital where a geriatrician could have easily available other health professions, such as nurses, psychologists, and, if needed, other medical specialists. The organization of inpatient CGA is commonly divided into two types. The first was delivered by a team in a discrete ward, with control over the delivery of the multidisciplinary team recommendations, and these are sometimes known as a geriatric evaluation and management units (GEMUs) or alternatively acute care for elders (ACE) units. The second was a multidisciplinary team assessing patients and delivering recommendations to the general physicians or internists, and this is known as the inpatient geriatric consultation service (IGCS).

In 1981, Rubenstein et al. published some hospital-based observational findings from a GEMU showing that after 1 year of CGA, treatment, and rehabilitation, major improvements occurred in several outcome areas [15]. However, this was a descriptive study. The authors subsequently reported a randomized clinical trial (RCT) conducted on 123 older patients from the same GEMU which substantially confirmed the pre-post data, also showing that CGA was effective also on mortality, nursing home admission avoidance, and rehospitalization rates and costs [16]. These exciting findings were further confirmed, by another RCT of a GEMU in a private US rehabilitation hospital [4]. An initial meta-analysis of 6-month mortality on 15 subsequent published RCTs demonstrated a 39% reduction of mortality for inpatients from IGCSs and a 37% reduction of mortality for inpatients from GEMUs/ACEs [1]. After these studies, an important meta-analysis including 28 RCTs confirmed that across all CGA programs (GEMU/ACE units, IGCS), there was an 18% reduced mortality risk for patients in the CGA programs, a 25% increased likelihood of living at home at follow-up, a 41% increased chance of cognitive improvement, and overall a 12% reduced hospital readmission risk [17]. GEMU/ACE unit and IGCS programs had more benefits since functional improvement was only significant for patients in the GEMUs/ACE units [17].

Since this meta-analysis, a number of studies have reported RCTs of hospital-based CGA programs [6, 9, 10, 12, 18, 19]. In these RCTs, care in GEMUs/ACE units was associated with greater functional independence at discharge, less frequent institutionalization rate, shorter and less expensive hospitalization [18], as well as higher satisfaction rates among patients, family members, physicians, and nurses [10]. Moreover, there have been several systematic reviews and meta-analyses of various hospital-based subgroups of CGA [7, 11, 14, 20]. One meta-analysis looked specifically at ACE units, reporting that those admitted to ACE units had a lower risk of functional decline at discharge and were more likely to live at home after discharge compared to usual care [20]. A meta-analysis of 17 RCTs, specifically evaluating a subgroup of post-acute geriatric wards in combination with orthogeriatric rehabilitation units, found that inpatient multidisciplinary programs were associated with improvement in all

Table 4.1 Principal studies and meta-analyses on comprehensive geriatric assessment (CGA) in hospital

Author, year	Type of study	Number of participants/trials with general characteristics	Role of the CGA intervention
Applegate et al. (1990) [4]	RCT	155 disabled older patients	Lower institutionalization rate
Arbaje et al. (2010) [5]	RCT	717 hospitalized patients aged 70 and older	Similar quality care transitions and greater patient satisfaction with inpatient care
Asplund et al. (2000) [6]	RCT	190 older patients	Reduction in the length of hospital stay and the need for long-term institutional living
Bachmann et al. (2010) [7]	Meta-analysis	17 trials (4780 older people randomized)	Improvement in functional status and decreased nursing home admission and mortality
Baztan et al. (2009) [20]	Meta-analysis	11 studies (both interventional and observational)	Lower risk of functional decline and more probability to live at home after discharge, but no difference in mortality
Buurman et al. (2016) [8]	RCT	674 participants with a mean age of 80 years	CGA and transitional care with nurses is similar to CGA alone on ADL but associated with lower mortality rate
Cohen et al. (2002) [9]	RCT	1388 patients aged 65 years and more	Greater improvements in quality of life, ADL, and physical performance
Counsell et al. (2000) [10]	RCT	1531 community-dwelling patients, aged 70 or older	Less ADL decline and nursing home placement after the discharge, until 1 year following hospitalization
Deschodt et al. (2013) [11]	Meta-analysis	12 studies (4546 participants)	CGA beneficial for short-term survival, but no significant effect on functional status, readmission, or length of stay in hospital
Ekerstad et al. (2017) [12]	RCT	408 frail elderly patients, aged ≥75 years	The intervention group was less likely to present decline in quality of life and mortality after 3 months
Ellis et al. (2011) [13]	Meta-analysis	22 RCTs (10315 participants)	Longer survival rate, less institutionalization
Landefeld et al. (1995) [18]	RCT	651 patients aged ≥70 years	Higher functional independence at discharge, less frequent discharge to a nursing home, shorter and less expensive hospitalization
Nikolaus et al. (1999) [19]	RCT	545 older patients with acute illnesses	Improvement in functional status, the length of the initial hospital stay, and subsequent readmissions; reduction in the rate of nursing home admissions. No improvement in survival
Rubenstein et al. (1991) [1]	Meta-analysis	15 RCTs	Reduction of 39% of mortality for inpatients from IGCSs and a 37% reduction of mortality for inpatients from GEMUs/ACEs
Van Craen et al. (2010) [14]	Meta-analysis	7 studies ($n = 4759$ patients)	Less functional decline at discharge from the GEMU and a lower rate of institutionalization 1 year after discharge

GEMUs geriatric evaluation and management units, *RCT* randomized controlled trial, *IGCSs* inpatient geriatric consultation services, *ACEs* acute care for elders, *ADL* activities of daily living outcomes at discharge, including better functional status, decreased nursing home admission, and reduced mortality [7]. Another meta-analysis has evaluated the subgroup of GEMUs showing less functional decline at discharge from the GEMU and a lower rate of institutionalization 1 year after discharge [14].

A meta-analysis of RCTs of IGCS found benefit for short-term survival, but no effect on functional status, readmission, or length of stay [11], substantially confirming two previous meta-analyses of IGCS for CGA showing limited benefits [13, 17]. As a result, IGCS has largely been abandoned. These meta-analyses were limited by wide variability in interventions across collected RCTs. A subsequent and updated systematic review and meta-analysis of all these subgroups, including 22 RCTs of 10315 participants in six countries with inpatient CGA by mobile teams (general ward setting) or in designated wards (GEMUs, ACE units, or rehabilitation wards), found that patients who received CGA were more likely to be alive and in their own homes at the end of the scheduled follow-up and less likely to be living in residential care, compared with usual care. There was also a reduction in the combined outcome of death or functional decline and an improved cognitive functioning, with wards that appeared to be more effective than mobile units [13, 17].

Finally, some CGA programs have attempted to recreate the core elements of ACE units for hospitalized older persons who are located in general medicine services to improve their hospital care and their transitions to post-acute settings [5]. These geriatric-focused models of inpatient care staffed by geriatricians and others trained in delivering care for older adults have been associated with better outcomes, such as reduced risk of institutionalization and functional decline [20, 21]. Whether these "virtual" units are as effective as ACE units is unknown. The lack of a consistent nursing staff trained in the care of older persons may diminish the effectiveness of this model. In particular, one matched cohort study indicated that benefits of the mobile acute care of the elderly (MACE) service, a novel model of care designed to deliver specialized interdisciplinary care to hospitalized older adults, may include lower rates of adverse events, shorter hospital stays, and better satisfaction [22].

More recently, a randomized, controlled, one-center intervention study conducted in 408 frail elderly patients aged ≥75 years, with a mean age of 85.7 years, demonstrated that the patients who were allocated to the intervention group, i.e., a structured, systematic interdisciplinary CGA-based in-hospital care, were less likely to present with decline after 3 months in vision, ambulation, emotion, cognition, and pain than the control group. Moreover and in contrast to some earlier meta-analyses, treatment in the CGA unit was independently associated with lower 3-month mortality without significant differences in terms of hospital care costs [12].

4.3 CGA in Posthospital Discharge

Posthospital discharge CGA/HHAS usually is initiated 1–2 days prior to hospital discharge with the aim to reduce hospital length of stay and readmission to hospital and improve the coordination of services following discharge from hospital.

Contrary to the hospital, RCTs of CGA have found inconsistent benefit for post-hospital discharge/HHAS programs [17, 23–26]. In particular, the meta-analysis of Stuck et al. [17] for HHAS programs found only an increased likelihood of living at home after hospital discharge versus death or institutionalization, while no effects on mortality risk, hospital readmission, or physical and cognitive function were found. In a RCT of posthospitalization CGA conducted in the home versus usual care, there was no difference between treatment and control arms in reducing mortality, hospital readmission, or long-term care [26]. In another RCT, there was no difference in post-discharge acute care visits, functional status, depression, and patient satisfaction after 24 weeks [25]. A systematic review of 21 RCTs on discharge management programs with in-home follow-up has also found a reduction in readmission rates, for up to 12 months in some clinical trials [24]. Another systematic review conducted on RCTs mainly involving older patients in a variety of settings found that many of the components of CGA were parts of care transition interventions that were effective in reducing rehospitalizations and emergency department visits [23].

Interestingly, a recent RCT involving 674 older participants reported that CGA together with a transitional care bridge was not more effective than CGA alone at 6 months after the discharge from the hospital in improving the mean Katz Index of ADL. Conversely, in CGA with transitional care group, a significant lower risk of death within 6 months after hospital admission was observed compared to subjects of the CGA-alone group, with a number needed to treat to prevent 1 death of 16 [8].

Conclusions

CGA is a broad term used to describe the health evaluation of the older patient, emphasizing components and outcomes different from that of the standard medical evaluation. CGA is based on the premise that a systematic evaluation of frail older adults by a team of health professionals may identify a variety of treatable health problems and lead to better health outcomes.

Current evidence suggested that the healthcare setting may modify the effectiveness of CGA programs. CGA performed in the hospital, especially in dedicated units (GEMUs/ACE), have been shown to be consistently beneficial for several health outcomes, including cognitive impairment, institutionalization, hospital readmission, and mortality risk, while in other settings (such as posthospital) further studies are consequently needed.

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Comprehensive Geriatric Assessment in Long-Term Care and Nursing Homes

5

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5.1 Introduction

The CGA was defined as a multidisciplinary evaluation in which the multiple problems of older persons are uncovered, described, and explained, if possible, and in which the resources and strengths of the person are catalogued, need for services assessed, and a coordinated care plan developed [1].

The range of healthcare professionals working in the assessment team varies based on the services provided by individual CGA programs, usually organized around a core team consisting of a physician (usually a geriatrician), a nurse, and a social worker. When appropriate, an "extended" team of health professionals, i.e., physical and occupational therapists, nutritionists, pharmacists, psychologists, dentists, audiologists, podiatrists, and opticians, may be involved in specific and individual CGA programs. These professionals are usually on staff in the long-term care and nursing homes and are also available in the community.

At present, CGA programs are moving toward a "virtual team" concept in which members are included as needed, assessments are conducted at different locations, and team communication is completed via telephone or electronically [2]. Different models of CGA have been proposed in different healthcare settings to meet differing needs of the older subjects. According to the concept of "progressive" geriatric care, CGA is performed at varying levels of intensity in different settings, and its content may vary with the healthcare setting [3]. In the present chapter, we considered the body of evidence coming from clinical research devoted to the systematic implementation of CGA programs, with a focus on long-term care, i.e., rehabilitation units and nursing homes, analyzing the benefits that come from the application in these scenarios of the broad principles of CGA.

5.2 CGA in Long-Term Care

Long-term care (LTC) refers to a variety of services which help meet both the medical and nonmedical needs of people with a chronic illness or disability who cannot care for themselves for long periods and can be provided at home, in the community, or in LTC facilities (LTCF). These are facilities that provide rehabilitative, restorative, and/or ongoing skilled nursing care to patients or residents in need of assistance with activities of daily living (ADL), including nursing homes, rehabilitation facilities, inpatient behavioral health facilities, and LTC hospitals. For LTC, it is common to provide custodial and non-skilled care, such as assisting with ADL like dressing, feeding, or using the bathroom. LTC may be needed by people of any age, although it is a more common need for older individuals to address the multiple chronic conditions associated with older age.

5.3 The Resident Assessment Instruments (RAI)

The development of the resident assessment instrument (RAI) minimum data set (MDS) [4] in 1987 and its introduction in 1991 were prompted by LTC reforms endorsed by the United States (US) government, requiring that all LTC residents undergo a CGA on a regular basis, on admission to a facility. A network of researchers and clinicians committed to (the interRAI network) was formed to promote and guide the use of the RAI-MDS instrument for comprehensive assessment of the older subjects. InterRAI instruments include a clinical data set, a training manual, and algorithms that generate clinical assessment protocols (CAPs), scales (including screeners and severity measures), case-mix measures, and quality indicators (QIs). In 1995, a revised version of the RAI-MDS, the RAI-MDS 2.0, was developed, resulting in over 400 data elements, with improved reliability [5]. In 2005, the multinational consortium interRAI released the interRAI suite of instruments tailored to a specific healthcare setting (interRAI Home Care, interRAI Acute Care, interRAI Long-term Care, interRAI Palliative Care, etc.) [6]. A more recent version of the LTC assessment instrument, the interRAI Long-Term Care Facility (LTCF), and an adaption of the RAI-MDS 2.0, the MDS 3.0, have been released. At present, the interRAI LTCF instrument has not been widely implemented, and the MDS 3.0 has been implemented in the USA only.

Data collected from residents in LTC is aggregated to produce indicators of the quality of care provided. One study examined 38 chronic care QIs, of which strong evidence for the validity of 12 QIs was found [7]. A systematic review on observational studies conducted in "real-world" conditions tested the validity and/or reliability of individual QIs (falls, depression, depression without treatment, urinary incontinence, urinary tract infections, weight loss, bedfast, restraint, pressure ulcer, and pain) with mixed results. Indeed, this systematic review revealed the potential for systematic bias in reporting, with underreporting of some QIs (pain, falls, and depression) and overreporting of others (urinary tract infections) [8]. In 30 urban Canadian nursing homes with a total of 94 care units, an observational study showed the necessity of facility-level and unit-level measurement when calculating QIs derived from RAI-MDS 2.0 data for pressure ulcer, antipsychotic with no diagnosis of psychosis, and pain [9]. Furthermore, RAI-MDS can be a valuable tool in targeting residents for a transition program from LTC to community. Secondary data from RAI-MDS assessments for an annual cohort of first-time admissions to nursing homes suggested that at 90 days the majority of residents showed a preference or support for community discharge, and many had health and functional conditions predictive of community discharge or low-care requirements [10] (Table 5.1). However, a validation study of the RAI-MDS conducted in four states in the USA suggested that the accuracy for identifying hospitalization events and payment sources in LTC of this CGA-based tool varied across the study states and should be evaluated carefully with regard to the intended uses of the data [11] (Table 5.1). In a longitudinal cohort study on newly admitted Icelandic nursing home residents among RAI-MDS 2.0 variables and scales, significant predictors of mortality were age, gender, place admitted from, functional status, health stability, and social engagement [12] (Table 5.1).

Recently, given the lack of findings on a psychometrically evaluated CGA for nursing home residents with palliative care needs, a protocol based on the Medical Research Council framework has been implemented to examine the effect of using the interRAI Palliative Care on the quality of palliative care in nursing homes [13]. Interestingly, given that oral health in nursing home residents is poorly addressed,

Table 5.1 Principal observational studies and systematic reviews on comprehensive geriatric assessment (CGA) in long-term care, i.e., rehabilitation units and nursing homes

Author, year, reference	Setting	Type of study	Number of participants/trials with general characteristics	Role of the CGA intervention	Comments
Arling et al. (2010) [10]	Post long-term care community discharge	Observational	MDS analysis file of 24,648 first-time nursing home admissions	Major MDS variables were discharge status, resident's preference and support for community discharge, gender, age, and marital status, pay source. Major diagnoses, cognitive impairment or dementia, activities of daily living, and continence	At 90 days, 64% of residents showed a preference or support for community discharge, with health and functional conditions predictive of community discharge (40%) or low-care requirements (20%). A community discharge intervention could be targeted to residents at 90 days after nursing home admission when short-stay residents are at risk of becoming long-stay residents
Cai et al. (2011) [11]	Hospitalizations in long-term care	Observational	The 2003 MDS, MedPAR, Medicare denominator file, MAX long-term care file, and MAX personal summary file for four states in the USA	The accuracy of the MDS in identifying hospitalizations and payment sources varied across the study states and should be evaluated carefully with regard to the intended uses of the data	The MDS alone did not seem to be an ideal source for identifying payer source or hospitalization events in nursing home residents

Hjaltadóttir et al. (2011) [12]	Nursing homes	Observational	2206 residents admitted to nursing homes in Iceland in 1996–2006	Age, gender, place admitted from, ADL functioning, health stability, and ability to engage in social activities were significant predictors of mortality	More than 50% died within 3 years, and almost a third of the residents may have needed palliative care within a year of admission
Hermans et al. 2014 [27]	Nursing homes	Systematic review	Seven studies included	The interRAI PC covered all domains for a palliative approach in residential aged care, while the McMaster quality of life scale covered nine domains	The interRAI PC and the McMaster quality of life scale were the most comprehensive CGAs to evaluate the needs and preferences of nursing home residents receiving palliative care
Abrahamsen et al. (2016) [28]	Nursing homes after hospitalization	Observational	961 community-dwelling patients aged ≥70 years, considered to have a rehabilitation potential and no major cognitive impairment or delirium, transferred from acute hospital departments	Slow or poor recovery was significantly associated with low scores on the Barthel index and orthopedic admission diagnosis	Different caring pathways for different patient groups in intermediate care unit in nursing homes should be considered

MDS minimum data set, *MedPAR* Medicare provider analysis and review file, *MAX* Medicaid analytical extract, *interRAI PC* inter resident assessment instrument palliative care an assessment tool such as the RAI-MDS 2.0 appeared to be useful to monitoring and improving quality of oral healthcare. However, using data on 13,118 residents collected in a stratified random sample of 30 urban nursing homes in Western Canada, RAI-MDS 2.0 oral/dental items likely underdetected oral/dental problems and were not associated with well-proven predictors for oral health, indicating poor validity [14]. At present, the potential effect on this issue of the interRAI LTCF with its modified oral/dental items and more frequent collection is unknown.

5.4 Other CGA Programs for Nursing Homes

In the LTC setting, particularly in nursing homes, many other CGA programs have been proposed [15]. In fact, the paucity of geriatricians and certified medical directors suggested to develop rapid CGA-based tools to enhance the ability of primary care physicians in nursing homes to recognize and treat geriatric syndromes. In Japan, to overcome this problem, the Kihon index has been developed [16], while in France there was the Gerontopole screening tool [17]. In the USA, the rapid geriatric assessment (RGA) has been developed as part of the Medicare wellness visit [18]. The RGA consisted of simple screening tools for the major geriatric syndromes, as well as checking the individual advanced directives [19]. All these screening tools have been extensively validated and are copyright free. These tools were the FRAIL for frailty [20], the SARC-F for sarcopenia [21], the simplified nutritional appetite questionnaire (SNAQ) for anorexia of aging [22], and the rapid cognitive screen (RCS) for cognitive dysfunction [23]. The total screen takes 3–4 min to complete and can be done by office personnel in the physician's office. At present, the RGA was successfully used on more than 1500 older persons and some recent RCTs, showing that simple exercise programs and nutritional intervention can reverse frailty and sarcopenia and slow cognitive deterioration [24, 25], supported the use of these rapid screens also in nursing homes.

In a recent systematic review on CGA used to assess palliative care needs in LTC settings and validated for nursing home residents receiving palliative care, the interRAI Palliative Care and the McMaster Quality of Life Scale [26] were considered to be the most comprehensive tools to evaluate the needs and preferences of this particular population [27] (Table 5.1).

5.5 CGA Programs for Patients Admitted to Nursing Homes After Acute Hospitalization

CGA programs may be useful also to evaluate the recovery and outcome of older community-dwelling patients admitted to intermediate care (IC) in nursing homes after acute hospitalization. In a prospective observational study, the trajectory of recovery was divided into three groups: rapid recovery (able to return home after median 14 days in IC), slow recovery (requiring additional transfer to other nursing home after IC but still able to return home within 2 months), and poor recovery (requiring transfer to other nursing home after IC and still in a nursing home or dead at 2 months) [28] (Table 5.1). Among CGA-based tools, slow or poor recovery was significantly associated with low scores on the Barthel index and orthopedic admission [28] suggesting that CGA at admission may help to select appropriate caring pathways for different patient groups also in this setting. However, in older age, institutionalization following acute hospital admission is common and yet poorly described, and CGA may help to characterize this particular population. In a retrospective cohort study of 100 people admitted to a single large Scottish teaching hospital and discharged to a care home, these individuals were predominantly female, widowed older adults who lived alone, with a diagnosed cognitive disorder or evidence of cognitive impairment [29]. Family request, dementia, mobility, falls risk, and behavioral concerns were the commonest reasons for the decision to admit to a home care [29].

Furthermore, recently, also other classical CGA tools have been modified for use in LTC [30, 31]. In fact, an adapted CGA, the "LTC-CGA," has been modified and validated for use in LTCFs to better suit the LTC setting including documentation of behavioral disturbances common in dementia, foot and dental care requirements, skin integrity, whether a legal next of kin has been appointed, and goals of care (e.g., whether resuscitation is to be attempted or hospital transfer for acute illness) [30]. The LTC-CGA also includes a frailty measure which is a focused version of the CSHA Clinical Frailty Scale [32]. A mixed-method study on this tool has been conducted in ten LTCFs in Halifax, Nova Scotia, Canada, reviewing 598 resident charts from pre- and post-implementation of the LTC-CGA, and qualitative findings suggested the LTC-CGA may describe a clinical baseline health status which enabled timely and informed clinical decision-making [30].

Very recently, a study explored the ability of nursing home residents to use two different mobile devices for a self-CGA with a modified MDS 3.0 converted to a format for use with a 6-in. mobile pad and a 3.7-in. mobile smartphone [31]. All participants were able to use a 6-in. pad (average completion rate, 92.9%), and only 20% of the participants could complete the assessment with the 3.7-in. smartphone [31]. This exploratory study suggested that nursing home residents may be able to use a mobile device to perform a self-CGA for assessment of their health status.

5.6 CGA and Quality of Care in Nursing Homes

Quality of care in nursing homes has been a challenge for decades, and evidence to support consistent quality improvement strategies is still lacking [33]. International reports described suboptimal quality of care in nursing homes [34]. Therefore, a large, longitudinal and focused research program called Translating Research in Elder Care (TREC) has been designed to collect comprehensive data from care providers and residents in Canadian nursing homes to improve quality of care and life of residents and quality of work life of caregivers [35]. Within the TREC research program, INFORM (Improving Nursing Home Care through Feedback On PerfoRMance Data) is a 3.5-year, three-arm, parallel, cluster-randomized trial ongoing in 67

Western Canadian nursing homes with 203 care units to the three study arms, a standard feedback strategy and two assisted and goal-directed feedback strategies [35]. Interventions will target care unit managerial teams based on theory and evidence related to audit and feedback, goal setting, complex adaptive systems, and empirical work on feeding back research results. The primary outcome is the increased number of formal interactions (e.g., resident rounds or family conferences) involving care aides. Secondary outcomes are (1) other modifiable features of care unit context (improved feedback, social capital, slack time), (2) care aides' quality of worklife (improved psychological empowerment, job satisfaction), (3) more use of best practices, and (4) resident outcomes based on the RAI-MDS 2.0 [35]. Outcomes are assessed at baseline, immediately after the 12-month intervention period and 18 months post intervention. INFORM is the first study to systematically assess the effectiveness of different strategies to feedback research data to nursing home care units in order to improve their performance. Results of this study will enable development of a practical, sustainable, effective, and cost-effective feedback strategy for routine use by managers, policy makers, and researchers.

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6 Comprehensive Geriatric Assessment in the Community and in Outpatient Consultation

Alberto Cella

6.1 Introduction and General Characteristics

In the last 30 years, it has emerged that comprehensive geriatric assessment (CGA) has a place in best practice for the care of older people [1]. Although the evidence base is particularly strong in acute settings (see Chap. 4), a number of positive studies have also been carried out in people's homes and in community settings. The first programmes of geriatric evaluation in the community were implemented in the UK in the 1970s, a time when CGA rapidly became a cornerstone in the British system of 'progressive geriatric care' (continuum of geriatric services, including acute hospital care, day hospitals, rehabilitation units and home care services) [2]. Indeed, in the UK, yearly multidimensional assessments of physical and cognitive health for all individuals aged at least 75 years were included in the government contract terms for NHS primary care in 1989 with guidelines on content and implementation provided for England. Subsequently, a targeted approach to assessment and care was developed and promoted, with community nurse-led case management of elderly people with medical conditions identified from hospital admissions and general practice records.

Patients undergoing geriatric assessment in outpatient or home-visitation settings are most often not acutely ill, nor do they require as much treatment and/or rehabilitation as those referred to inpatient settings (acute care or rehabilitation units). Nevertheless, many elderly persons 'at risk' live in the community, and their problems are likely to be identified late or undervalued; outpatient community-oriented services with outreach case-finding competencies may benefit these individuals more and earlier than inpatient services.

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CGA, in some form, has been undertaken in many different community settings and can play a key role in community-based services, such as the Chronic Care Model for ill and impaired adults [3] and the Program of All-Inclusive Care for the Elderly (PACE) for the frail and disabled [4]. It can also be implemented as an adjunct to standard medical evaluations in primary care settings. An abbreviated form of CGA (though still covering medical, functional, psychological and social domains) is performed in screening by community health professionals and primary care providers, who can use the results to refer patients to geriatric specialty programmes for more comprehensive evaluation and management. Moreover, some hospital-based outpatient clinics also have home-visit services to perform this outreach function.

The focus of the more extensive forms of CGA is older people who are ‘frail’ (i.e. those with greater vulnerability to stressor events) or disabled or both. Since the advent of geriatric medicine, it has been recognized that frail and disabled older adults are those at highest risk of adverse outcomes and that they are also the most likely to benefit from geriatric care. Several health organizations and various clinical studies have sought to define the healthcare delivery modalities and specific interventions that would attenuate, or even prevent, frailty and its outcomes. CGA has been central to this approach, its objectives being to improve diagnostic accuracy, optimize medical treatment and health outcomes, improve function and quality of life, increase the possibility of living at home, reduce the use of unnecessary formal services (particularly hospital and long-term care facilities) and institute or improve long-term care management [5]. CGA is based on the premise that the systematic evaluation of frail, older persons by a team of health professionals can identify a variety of treatable health problems and lead to better health outcomes.

In general terms, the best evidence for CGA is obtained when patients are appropriately identified (i.e. patients who are either too well or are too sick are excluded); however, no clearly defined criteria for readily identifying patients who are likely to benefit from CGA have been validated. Most outpatient CGA programmes exclude patients thought to be unsuitable because of terminal illness, severe dementia, complete functional dependence and inevitable nursing home placement, but also older persons who are ‘too healthy’ to benefit, such as those who are completely functional and have no medical comorbidities [5]. One outpatient approach would be to refer patients for CGA who are found to have problems in multiple areas during geriatric assessment screening. Major illnesses (e.g. those requiring hospitalization or increased home resources to manage medical and functional needs) should also prompt referral for CGA, particularly to assess functional status, fall risk, cognitive problems and mood disorders. Another approach would be to have all patients above a certain age (e.g. 75 years) undergo preliminary screening to determine whether a full multidisciplinary evaluation is needed [6], but wide variation among individuals makes chronological age a poor indicator of likely needs.

On the basis of a well-known classification, outpatient CGA is divided into three types [7]: the first is the home assessment service (HAS), with in-home CGA for community-dwelling older persons; the second is the hospital home assessment service (HHAS), with in-home CGA for patients recently discharged from hospital; the third type is the outpatient assessment service (OAS), with CGA provided in an outpatient setting (including programmes integrated into primary care practices).

6.2 Evidence Supporting HAS/HHAS CGA

Older patients assessed at home are usually followed up for at least 1 year, and home CGA/HAS programmes focus primarily on preventive rather than rehabilitative services. Like posthospital discharge CGA/HHAS programmes, most home CGA/HAS programmes involve a visiting nurse trained in geriatrics, a physical therapist, a social worker and, when appropriate, specialty referrals. In addition to home visits, telephone follow-up is routinely performed [1]. A substantial body of evidence based on multiple meta-analyses suggests that home assessments are consistently effective in reducing functional decline and overall mortality [7–10] (Table 6.1). In 2000 and 2001, two systematic reviews of home-visit assessment studies were published. The first review focused on the apparent discrepancies between study methods and results and concluded that the evidence was not strong enough to enable firm conclusions to be drawn regarding the effectiveness of preventive home visits to older people living in the community [14]. According to the second systematic review, which used formal techniques to pool the data for meta-analysis, home visiting was associated with a significant reduction in mortality and admissions to long-term care (LTC) in the general older population [8] (Table 6.1).

In 2002, Stuck et al. updated their previous meta-analysis [7] to include the new randomized controlled trials (RCTs) on home CGA programmes and performed a meta-regression analysis to search for programme elements associated with greater benefit [10]. This meta-analysis showed that preventive home-visit programmes appeared to reduce the risk of LTC admission, provided the interventions were based on multidimensional CGA, including multiple follow-up home visits, and targeted persons at lower risk of death [10], thus confirming that CGA programmes need to target the right patient subgroups. More recently, a meta-analysis of 21 RCTs found that multidimensional home CGA programmes were effective in reducing functional decline, if a clinical examination was conducted, and in reducing mortality in patients aged ≤77 years. However, the home visits did not significantly prevent nursing home admissions [9], and, like other meta-analyses of home CGA, this study was limited by the heterogeneity of the studies with regard to all outcomes (Table 6.1).

Table 6.1 Meta-analyses on CGA in the community and in outpatient consultation

Author, year	Subjects/setting	Number of participants/trials	Results	Comments
Stuck et al. (1993) [7]	In- and outpatients	28 trials 9871 subjects	Certain types of CGA were effective on mortality, on living location and on cognitive and physical function. HASs decreased long-term mortality by about 14% HASs, and HHASs had a favourable effect on living location	Programmes with control over medical recommendations and extended follow-up were more likely to be effective
Elkan et al. (2001) [8]	Community dwelling	15 RCTs	Reduction in mortality and admissions to LTC in the general older population	RCTs were grouped into two more homogenous types of interventions (for the general elderly population and for frail older people)
Stuck et al. (2002) [10]	Community dwelling	18 RCTs 13,447 subjects	Preventive home visits were effective on NH admissions, functional decline and on mortality	Intervention effects depended on follow-up visits, underlying mortality risk and study population age
Huss et al. (2008) [9]	Community dwelling	21 RCTs	Lower functional decline; lower mortality in patients aged ≤77	Heterogeneous effects on NH admissions, depending on population factors, programme characteristics and healthcare setting
Kuo et al. (2004) [11]	Outpatients consultation	9 trials, 3750 subjects	No benefit of outpatient CGA on survival	Tests for heterogeneity showed consistency between RCTs data
Beswick et al. (2008) [12]	Community dwelling	89 trials, 97,984 subjects	Complex interventions were associated with reduced NH admissions and lower risk of falls	Benefit in trials was particularly evident in studies started before 1993

Table 6.1 (continued)

Author, year	Subjects/setting	Number of participants/trials	Results	Comments
Lin et al. (2012) [6]	Community dwelling	70 trials, 40,917 subjects	Small beneficial effect of multifactorial interventions on ADL and IADL (in selected trials)	The wide heterogeneity among studies prevents the generalizability of results
Mayo-Wilson et al. (2014) [13]	Community dwelling	64 trials, 28,642 subjects	Home visiting was not associated with differences in mortality or independent living	Investigations of heterogeneity did not identify programmes associated with consistent benefits

LTC long-term care, *NH* nursing home, *ADL* activities of daily living, *IADL* instrumental ADL

6.3 Evidence Supporting OAS and CGA Programmes Integrated into Primary Care

Although two meta-analyses have not shown the benefit of outpatient CGA consultation [7, 11], more complex CGA programmes that address adherence to programme recommendations and treat patients at higher risk of hospitalization have led to improved outcomes [15, 16] and, in one study, also to increased survival [17].

The first meta-analysis to evaluate CGA included four randomized trials and did not demonstrate benefit from outpatient CGA consultation in terms of hospital admission, nursing home placement or physical/cognitive function [7]. However, one trial from this meta-analysis did not address whether recommendations from CGA were implemented, and another included patients with poor prognoses, which may limit the generalizability of these data.

Some of the subsequent randomized trials have shown some efficacy of OAS. In one of these, outpatient CGA coupled with intervention to improve the adherence of primary care physicians and patients to CGA recommendations prevented functional and health-related quality-of-life decline among community-dwelling older persons who had specific geriatric conditions (functional disability, urinary incontinence, falls or depressive symptoms) [15]. In another study, CGA, followed by 6 months of interdisciplinary primary care, versus usual primary care in a population at risk of high healthcare utilization reduced functional decline, depression and the use of home health services over 15–18 months following randomization [18].

By contrast, in a large, cluster-randomized trial of multidimensional geriatric assessment followed by management either by a geriatric team or by the primary care clinician alone, no differences in hospitalization, admission to other institutions or quality of life emerged between the groups [19].

Moreover, in a meta-analysis of nine randomized controlled trials (cumulative number of patients 3750) evaluating mortality, outpatient CGA provided no benefit in terms of survival (RR 0.95, 95% CI 0.82–1.12) [11]; tests for heterogeneity showed consistency among trial data (Table 6.1).

However, the more recent AGe-FIT study showed a benefit of outpatient CGA even on mortality: this long-term (36 months) study of CGA in an ambulatory setting was the first to document that the intervention prolonged survival and reduced hospitalization time, without engendering significantly higher cost; the authors believe that the improvement in survival may be explained in part by the intervention's goal of empowering patients through the provision of continuous advice (e.g. on physical activity and proper nutrition) and active follow-up (continuous updating of medication lists and support to ensure good compliance with prescriptions) [17].

Some innovative approaches to outpatient CGA/OAS have involved specialized team management and have adapted some of the more successful components of older models to programmes within primary care practices. In this area, studies carried out in the USA and in Northern Europe have yielded different results; these data should probably be viewed within the different organizational context of primary care, which is traditionally more widespread and stronger in Europe than in the USA.

One of the approaches adopted in the USA is the Geriatric Resources for Assessment and Care of Elders (GRACE). This involves home-based CGA and LTC management by a nursing practitioner and social worker, who collaborate with the primary care physician and an interdisciplinary geriatric team. In one RCT of low-income older patients, those randomly assigned to the GRACE intervention had better health-related quality of life and fewer emergency department visits than those assigned to usual care. A subgroup of patients at high risk of hospitalization also had fewer admissions in the second year [20].

Guided Care (GC) is an enhanced model of primary care. Developed at Johns Hopkins University, this model integrates the work of a nurse highly trained in chronic care into the activity of the primary care physician, in order to provide CGA and chronic care management for older at-risk patients with multiple chronic conditions and complex needs. In a randomized trial of chronically ill older patients, those randomly assigned to GC reported greater satisfaction and less healthcare utilization over 8 months of follow-up than those randomly assigned to usual care [18]; after 20 months, however, the only significant overall effect of GC was a reduction in episodes of home healthcare [21]. Among health maintenance organization (HMO) patients, the intervention also reduced both the number of admissions to skilled nursing facilities and days of hospitalization [21].

Practice redesign approaches (screening, structured visit notes, delegation to office staff and outreach to community resources) focus on specific geriatric conditions for assessment and management by clinicians or nursing practitioners. In two trials involving patients in community-based practices in California, those randomly assigned to practice-based interventions received better quality of care for falls and incontinence than those randomly assigned to usual care

[16]. In a study within an academic geriatrics practice (UCLA Division of Geriatrics, Los Angeles), this model of co-management resulted in improvements in quality of care for dementia, falls and urinary incontinence in comparison with a waiting-list control group; similar findings have emerged from community-based practices in California [22, 23].

Several European countries, such as the UK, Denmark and the Netherlands, have a well-developed primary healthcare system. In 2008, the Dutch government launched the National Care for the Elderly Programme (NCEP) (http://www.nationaalprogrammaouderenzorg.nl/english/the-national-care-for-the-elderly-programme), which promoted innovative healthcare projects for older people with multifactorial care needs, in order to foster physical, mental and social health and well-being. Indeed, the Netherlands has been very active in the last few years in the search for organizational models that incorporate such interventions as CGA into primary care. So far, however, the results have been relatively modest. A cluster-randomized controlled trial carried out in 12 general practices in the south of the Netherlands provided no evidence of the effectiveness of a proactive primary care approach (in-home multidimensional assessment with interdisciplinary care based on a tailor-made treatment plan and regular evaluation and follow-up) among frail older people with regard to disability (primary outcome) or other secondary outcomes (depression, social support interactions, fear of falling and social participation) [24]. In the authors' opinion, possible explanations for these results were the high number of too frail participants, the only partial implementation of the intervention protocol and the relatively high level of standard healthcare in the Netherlands, independently from this proactive model. Another Dutch cluster-randomized trial (11 practices with 1209 participants aged 70 or older randomized to the intervention group and 13 practices with 1074 participants randomized to the control group) yielded no evidence that a 1-year individualized multifactorial intervention programme with nurse-led care coordination (in-home CGA, individually tailored care plan, follow-up visits) was better than the current primary care in preventing disability in community-living older people [25]; the relative low intensity of the intervention, the time required to find the right collaboration between general practitioners (GPs) and nurses and the high quality of regular primary care in the Netherlands are some possible explanations for the results of this trial [25]. Again in the Netherlands, a recent multicomponent programme (the CareWell-primary care) consisting of four key elements (multidisciplinary team meetings, proactive care planning, case management and medication review) showed no beneficial effects in the prevention of adverse outcomes in community-dwelling frail elderly people [26].

Other recent studies in the UK, Canada and the Netherlands found neutral effects of multifactorial interventions to prevent disability or functional decline [27–31]; one exception, however, was a study which described a modest effect of nurse-led personalized care on postponing functional decline among highly educated participants [32].

These results as a whole are consistent with two recent meta-analyses of multifactorial interventions [6, 12] and one meta-analysis of preventive home visits [13], which have revealed little effect on functional decline (Table 6.1). However, these results should be interpreted with caution, owing to the heterogeneity of the target populations, the large variability of possible interventions and the differences in outcome measurements of ADL and IADL.

One meta-analysis demonstrated that studies that were conducted before 1993 showed greater reductions in risks regarding physical function [12]. This implies that healthcare systems have probably improved since then and adapted principles of effective elderly care into usual care. Studies performed in the USA have also found a greater reduction in the risk of functional decline, because primary care for older people is less developed in the USA than in most European countries; the potential of multifactorial interventions to prevent functional decline may therefore be greater in countries without a well-developed system of primary healthcare, such as the USA [6].

6.4 Primary Care Physicians and Outpatient CGA

Primary care-based models of care for older people pose challenges for GPs, on account of the difficulty of dealing with multiple and often co-occurring medical conditions, communication barriers, the pressure of time and the burden of administrative work [33].

In several European countries, interventions comprising CGA exist in which the GP acts as the central care provider [19, 24, 34], in order to deliver coherent, proactive, patient-centred care to older people. Indeed, primary care practices in northern Europe are increasingly important in multifactorial programmes for community-dwelling frail older people, so that, for instance, in a proactive and integrated care intervention (the Walcheren Integrated Care Model), the GP practice was the single entry point and the GPs were the coordinators of care [29]. In this respect, the failure of the programme implemented by van Hout and colleagues was probably due to its lack of integration into primary care practices [35].

In many other countries, however, primary care is not well equipped to deal with the frail or disabled elderly. A key step in improving outpatient CGA is to learn about the attitudes and experiences of the stakeholders who use CGA, namely, patients, caregivers and referring clinicians who seek guidance on how to care for their patients better. Because GPs also refer patients to outpatient consultative CGA and implement CGA recommendations, understanding their perceptions is essential for at least two reasons: first, they are important mediators, through whom CGA recommendations are put into practice; second, they also provide valuable insights into the strengths and failings of outpatient consultative CGA programmes and how they might be improved [36].

Maximizing the effectiveness of CGA in primary care-based models will require a well-structured approach that involves closer engagement and follow-through with patients and GPs and provides GPs with geriatric training, so that they become more receptive and better equipped to implement CGA recommendations [36].

6.5 Perspectives in Research on Multifactorial CGA-Based Interventions in Preventing Functional Decline in the Community-Dwelling Elderly Population

The risk factors for reduced physical function in elderly people, as identified in longitudinal studies [37, 38], concern comorbidities, physical and psychosocial health, environmental conditions, social circumstances, nutrition and lifestyle. The need for a preventive strategy based on the identification and treatment of various risk factors was recognized more than 50 years ago [39], and many trials of complex interventions have been reported and reviewed. The evidence suggesting little or no benefit does not mean that multifactorial interventions cannot be effective. Indeed, it is not possible to determine net benefit for several reasons: the heterogeneity of studies, including how older adults were selected and their risk of functional decline; the broad spectrum and multifactorial nature of the interventions evaluated; the sub-optimal and inconsistent use of outcome measurements; and the inconsistent and inadequate reporting of data, which prevents comparison of populations, interventions and outcomes among studies [6, 13].

The considerable variability in the natural history of functional decline in older adults requires more complete and consistent ascertainment of ‘intrinsic capacity’ and the risk of functional decline, in order to identify subgroups with differing disability trajectories; this could allow investigators to better examine the effectiveness of the interventions planned [6].

Moreover, complex interventions are difficult to characterize. For this reason, it would be important to enhance the consistency and reproducibility of interventions by better reporting of details concerning subject characteristics and targets, mode of delivery, frequency, contact time, duration and the personnel involved in assessment and management. More research is needed in order to test model consistency or intervention components, in similar populations with regard to reproducibility of effectiveness, and in different populations and settings [6, 13, 40].

Finally, there is considerable variability in the trial outcomes reported and the methodology of outcome measurement. Indeed, there is a clear need for consensus and standardization in measuring global functioning and functional decline in community-dwelling older adults. For instance, authors using ADL, IADL and health-related quality-of-life (HRQL) instruments need to report the specific scale used, its intended purpose and its validity and sensitivity in the study population [6, 13].

Future research would greatly benefit from the use of a focused and consistent set of agreed-upon measures, or ‘core clinical outcomes’, that can adequately capture clinically meaningful change in function within a given population (e.g. valid and responsive measurements of functional ability may differ between community-dwelling and institutionalized older adults), capture multiple dimensions of health (e.g. HRQL) and include common healthcare utilization measures (e.g. emergency department visits, hospitalizations or institutionalizations) [6]. Standards for these types of research should consider whether a set of well-validated performance-based measures should be used in order to enhance the measurement of self-reported function [40]; gait speed, grip strength, rising from a chair and standing balance, for example, have been shown to be associated with mortality [41], while poor grip strength is associated among community-dwelling older people with risk of hospital admission during the following decade [42].

Such a set of 'core clinical outcomes' would greatly improve the ability to synthesize evidence in order to facilitate medical decision-making and could shed light on the cost-effectiveness of these interventions.

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Comprehensive Geriatric Assessment and Personalized Medicine

7

Arduino A. Mangoni

7.1 Introduction

Personalized medicine has led to significant advances in the screening, diagnosis, prognosis, treatment and monitoring of several medical conditions. However, the confounding effect of comorbidities, polypharmacy and interindividual variability in homeostatic capacity on treatment outcomes makes the applicability of personalized medicine in the older patient population problematic. Furthermore, the significance of disease-specific end points, based on objective clinical parameters and biomarkers, is also questionable in frail older patients with poor functional status and limited life expectancy. The assessment of patient-centred end points, such as measures of frailty, independence and self-rated health, might be particularly useful to optimize therapies in this group. However, this can only be accomplished using robust and validated tools to objectively quantify patient-centred end points in clinical practice. This chapter discusses the issues with the routine use of personalized medicine in the older patient population, the importance of assessing patient-centred end points in the context of frailty and disability, the available tools to quantify key components of the comprehensive geriatric assessment (CGA) and their utility in selecting and monitoring specific interventions in this patient group. This might lead to a new definition, patient-centred medicine, which is primarily based on measures of frailty, functional status and quality of life, rather than more fundamental genetic, cellular or molecular factors.

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7.2 Personalized Medicine and Old Age

Personalized medicine is an advancing field of medicine which is based on the use of information regarding a patient's clinical, genetic and genomic characteristics to individualize care and improve disease outcomes (Fig. 7.1). This approach has been successfully used to predict the risk of specific diseases, e.g. breast cancer [1], to identify disease subtypes, e.g. acute coronary syndrome [2], to establish prognosis, e.g. renal transplant [3] and to predict the response to pharmacological treatment, e.g. warfarin in thromboembolic disease [4].

Pending further evidence on the impact and use of personalized medicine in a wider range of disease states, the concept of tailoring patient care according to basic, fundamental, molecular and cellular characteristics represents a promising strategy to enhance treatment efficacy, reduce toxicity and ultimately decrease the public health and financial burden of disease, and related disability, worldwide. An important issue, however, is whether personalized medicine can be routinely applied in the older population, the group primarily affected by the burden of acute and chronic diseases, and their sequelae. Several factors might potentially reduce the applicability and the impact of personalized medicine in old age (see also Table 7.1):

1. Older patients generally suffer from coexisting disease states, which might adversely affect similar end points [5]. For example, type 2 diabetes, chronic kidney disease and rheumatoid arthritis, when coexisting in the same patient, can each adversely affect blood pressure control and cardiovascular risk. However, available personalized medicine protocols focus on single disease states, failing to account for the impact of comorbidities, or specific disease clusters, on the end points of interest.
2. Medications per se may also adversely affect key clinical end points in old age. For example, nonsteroidal anti-inflammatory drugs, commonly prescribed for the management of musculoskeletal disorders, have been shown to increase the risk of gastrointestinal bleeding and cardiovascular events in older adults, although the evidence for the latter is not as clear as that reported in younger cohorts [6–8]. Therefore, their use as part of personalized medicine treatment protocols should also take into account potential issues with toxicity, as well as interactions with concomitant drugs [9].

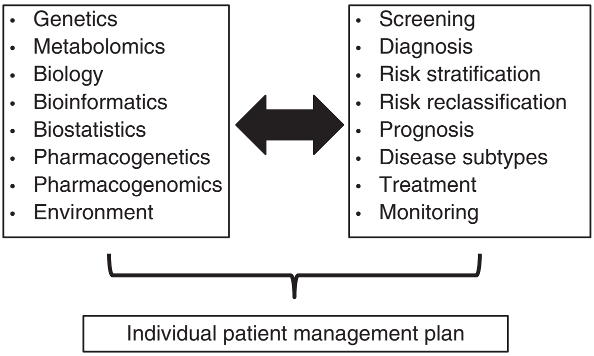

Fig. 7.1 The principle of personalized medicine. Key basic disciplines (*left*) are applied to disease processes (*right*) to generate management plans based on a patient's fundamental cellular, genetic and molecular characteristics

Table 7.1 Factors limiting the routine use of personalized medicine in older patients

Factor	Effect
Comorbidities	Confounding effect (e.g. protective, additive, multiplicative) on disease-specific end points
Other medications	• Direct or indirect effect on disease-specific end points • Interactions with drug therapies used in personalized medicine protocols • Direct or indirect effect on patient-centred end points
Frailty, reduced quality of life and limited survival	• Impact on the significance of disease-specific end points • Direct or indirect effect on disease-specific end points
Limited participation of frail older patients in clinical trials	• Limited evidence of the efficacy and safety of personalized medicine in this patient group • Off-label prescribing

3. The choice of treatment strategies with personalized medicine and in current clinical practice overall, is primarily based on objective markers of response, e.g. blood pressure, serum cholesterol concentrations, tumour mass, cancer biomarkers and transplant rejection rates [10]. However, such disease-specific end points do not account for other key individual characteristics, such as frailty, functional status and social circumstances [11]. Maintaining independence and adequate physical and cognitive function are pivotal to the perceived health and well-being of older adults [12]. Consequently, the achievement of disease-specific end points might not represent the most important goal for a frail patient with poor quality of life and limited survival [13].
4. Specific medications, e.g. drugs with anticholinergic and/or sedative effects, have also been shown to negatively affect end points that are not disease-specific, e.g. physical function, risk of falls and loss of independence [14–16]. However, the identification of iatrogenic causes of frailty and/or reduced functional status can be challenging because of the generally slow onset, progression and close relationship of the latter with the process of ageing per se [17].

A further limitation in the routine use of personalized medicine in old age is that frail older patients are virtually excluded from participating in clinical trials, an essential step to robustly test the efficacy and toxicity of therapies. The main reasons include the often stringent participation criteria, the logistical issues with patient transport to the study sites and the intensity of follow-up assessments [18]. However, translating the evidence generated from trials in younger, and healthier, patients into a population characterized by significant interindividual differences in homeostatic reserve, pharmacokinetics and pharmacodynamics, is problematic [19, 20]. This issue is further compounded by the off-label prescribing, and potential therapeutic futility, of many medicines in this group [21]. For these reasons, there is an urgent need to generate solid evidence on the efficacy and safety of pharmacological therapies in frail older patients with complex comorbid states. Unlike the traditional approach used with personalized medicine, this evidence should not only be limited to disease-specific end points, but should also take into account important patient characteristics such as frailty, functional status and life expectancy.

7.3 Patient-Centred End Points

Patient-centred end points might be useful, alone or in combination with disease-specific end points, to identify specific pharmacological treatments and monitor their effects, in frail older patients. Examples of patient-centred end points include the following:

- Frailty
- Self-rated health
- Capacity to perform daily activities
- Balance
- Fatigue
- Nausea
- Shortness of breath
- Behavioural symptoms

Epidemiological and observational studies have shown that disease states affecting different organs and systems exert negative effects on such end points, particularly measures of self-rated health, capacity to perform daily activities, behavioural symptoms and fatigue [22]. Importantly, the coexistence of two or more comorbidities imposes a greater burden on frailty, reduced self-rated health and functional status [23]. The aforementioned end points might allow the identification of appropriate treatment goals and drug therapy. The management of a frail old patient with complex comorbidities and polypharmacy, while still accounting for disease-specific end points, would also be based on measures of frailty, self-rated health and disabling symptoms as well as the anticipated life expectancy [11]. However, the assessment of patient-centred end points, traditionally based on qualitative data, should be performed using tools designed to provide objective and quantifiable information, thus facilitating routine use in clinical practice.

The comprehensive geriatric assessment (CGA) contains several domains that can be used to characterize patient-centred end points, such as functional capacity, risk of falls, cognition and behaviour, social support, treatment goals and advance care preferences [24]. However, the CGA is typically based on a multidisciplinary assessment and discussion regarding a patient's degree of frailty and dependence. Consequently, it does not provide an objective, consistent and quantifiable tool for risk prediction and patient stratification. A quantification of the information provided by the CGA would allow the development of more effective, patient-centred management pathways in this population.

7.4 Multidimensional Prognostic Index and Patient-Centred End Points

A number of tools have been developed to assess frailty and functional status in the older population [25]. However, their applicability and predictive capacity in real-life patients have been questioned [26]. The multidimensional prognostic index (MPI), developed by Pilotto et al. [27], provides a quantifiable index score, between 0 and 1, based on eight components of the CGA:

1. Activities of daily living
2. Instrumental activities of daily living
3. Short portable mental status questionnaire
4. Mini-nutritional assessment
5. Exton-Smith scale
6. Cumulative index rating scale
7. Total number of medications
8. Social support network

The MPI has superior predictive capacity and discrimination in relation to adverse outcomes, such as short- and long-term mortality, hospital length of stay and readmission rates, when compared to other tools [28]. Moreover, the MPI has also been studied as an end point to assess the effects of pharmacological and non-pharmacological interventions. D'Onofrio et al. investigated the effects of the acetylcholinesterase inhibitor rivastigmine, alone or in combination with cognitive stimulation, in patients with dementia [29]. The combination of rivastigmine with cognitive stimulation led to a greater improvement in cognitive and behavioural end points. However, a significant improvement in the total MPI score was also observed. This improvement involved noncognitive domains, such as activities of daily living and nutrition [29]. Similarly, Pilotto et al. reported that treatment with selective serotonin reuptake inhibitors in older patients with depression significantly improved the total MPI score, in addition to depressive symptoms [30]. The effect size of the change in the total MPI score was also associated with a higher probability of treatment response [30].

Therefore, the available evidence suggests that tools such as the MPI might provide objective, quantitative, information on key baseline characteristics such as frailty, functional status, burden of disease and polypharmacy as well as life expectancy. This information might be used to tailor pharmacological and/or non-pharmacological treatments not only to disease-specific end points but also to patient-centred end points and potential treatment futility. For example, the management of a frail old patient with chronic heart failure would be aimed at improving dyspnoea-related symptoms and preventing hospital admission, as well as addressing muscle strength, appetite, depressive symptoms and fatigue [31]. Although multidisciplinary teams have been shown to improve patient management and outcomes in several common disease states in old age [31, 32], the proposed approach provides robust, objective and quantitative baseline information to better formulate personalized management plans.

At the same time, the MPI might also be repurposed as a 'universal', patient-centred, end point in order to assess the efficacy and safety of treatment on outcomes that, albeit not primarily related to the disease of interest, are key to a patient's overall health, such as general well-being and independence [13]. Furthermore, the monitoring of MPI scores during follow-up provides opportunities for review, change or refinement of the original treatment plan.

7.5 Patient-Centred Medicine in Old Age

What are the required steps to develop a new approach to the management of diseases in the older population? As discussed, frail older patients should increasingly participate in pre- and post-marketing trials to identify early signs of efficacy and toxicity of new and established medicines in this ever-growing population. The inclusion of such patients would necessarily require some study adaptations, e.g. less strict inclusion and exclusion criteria and reduced number of follow-up assessments [18]. The evaluation of disease-specific, as well as patient-centred, end points in these studies would allow a more comprehensive assessment of the benefits, risks and potential futility of specific treatments. A new concept in this context, patient-centred medicine, would be primarily based on measures of frailty and quality of life, rather than fundamental genetic, cellular or molecular factors. The availability of robust, easy to use and quantifiable tools such as the MPI provides significant opportunities to investigate these complex issues in this vulnerable group.

The traditional concept of personalized medicine might still be applied, perhaps in combination with the proposed, adapted, approach of patient-centred medicine, in older patients. However, a significant amount of research is required to investigate the impact of factors such as comorbidities, frailty and concomitant medications on the genetic and molecular targets of interest. For example, the serum/plasma concentrations of high-sensitivity C-reactive protein (hs-CRP) and brain natriuretic peptide (BNP) have been proposed as biomarkers for risk stratification and response to treatment in patients at high cardiovascular risk and chronic heart failure, respectively [33, 34]. However, recent evidence also suggests that frailty per se is independently associated not only with cardiovascular risk and heart failure prognosis but also with hs-CRP and BNP concentrations [35–38]. Therefore, future studies should investigate the role of frailty, as well as other patient-centred end points, on the genetic, molecular and cellular factors identified with personalized medicine, and test their combined impact on risk stratification, prognosis and treatment effects.

Conclusions

Despite significant advances in the screening, diagnosis, treatment and monitoring of many disease states, significant issues remain with the applicability and the impact of current management protocols in the ever-growing older patient population, particularly in frail subjects with complex comorbidities and polypharmacy. Personalized medicine has provided significant insights towards a more individualized patient management. However, it fails to account for a constellation of factors affecting per se a patient's well-being, response to treatment and prognosis. A comprehensive assessment of disease-specific as well as patient-specific domains would allow a better identification of ad-hoc treatment plans that are more likely to be effective, tolerated and adhered to, in this patient group. For this to occur, assessing the combined use of personalized medicine and patient-centred medicine is considered an essential step for the development of future therapies in old age.

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CGA and Clinical Decision-Making: The Multidimensional Prognostic Index

8

Alberto Pilotto, Julia Daragjati, and Nicola Veronese

8.1 Frailty and Prognosis in Clinical Decisions in Older Adults

The lack of randomized controlled trials (RCTs) involving representative numbers of older individuals makes clinical decisions particularly difficult and may lead to inappropriate decisions in older populations. The guidelines regarding diagnostic and therapeutic decisions are based mostly on data obtained from middle-aged or younger subjects that have characteristics dissimilar from older people. Since our knowledge regarding appropriate decision-making derives from RCTs and meta-analysis of RCTs with low heterogeneity, these studies should be representative of the population to which the guidelines will be applied. Therefore, there is an urgent need to obtain clinical research scientific evidence to enable more appropriate clinical decisions in older subjects. This is especially true for frail subjects, at higher mortality risk and usually excluded from RCTs [1].

Conversely frailty, defined as a marker of reduced physiological reserve, is an important factor for clinical decisions, since it identifies a population at greater risk of adverse health outcomes [2]. Recent epidemiological data suggested that frailty is common in older populations. Among community-dwelling individuals, the estimated prevalence is about 10% [3]. This prevalence is higher among nursing home residents and probably among hospitalized older subjects, although equivocal data exist for this last population [4].

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8.2 Frailty and Medications

Frail individuals are particularly susceptible to adverse drug reactions (ADRs), including commonly used drugs such as proton-pump inhibitors [5]. Frailty might also result in a reduction of treatment efficacy [6]. As suggested by the SPRINT trial [7], aggressive treatment of hypertension in robust older patients resulted in reduced mortality and cardiovascular disease end points, but the benefits were not seen if the older participants were frail [6]. The recognition of frail older subjects is therefore essential for improving the prognostication and shared decision-making and in order to identify vulnerable patients, with specific needs and peculiarities, who might benefit from follow-up and personalized interventions. Recent guidelines [8] recommend inclusion of life expectancy in clinical decision-making tools, in order to better assess the potential benefits and risks of different drug treatments and therefore provide health care closer to the real needs of the patients. The aim is to identify subjects that might benefit from a specific therapeutic intervention, avoiding unnecessary diagnostic tests, which may lead to overdiagnosis, as well as procedures (particularly surgical/invasive), which don't change the prognosis of these patients and may eventually cause harm (overtreatment or mistreatment). Moreover, this approach will avoid of time- and cost-consuming medical interventions in older frail subjects [8].

It is noteworthy that, for example, American general practitioners assessed life expectancy based more on their clinical experience rather than using validated tools [9]. These physicians, who are often the first contact point for older patients, found numerous barriers to incorporating prognosis in the care of older adults, including uncertainty in predicting prognosis, difficulty in discussing prognosis, and concern about patient reactions [9]. These concerns underscore the necessity of validated tools for assessing prognosis in older people.

Clinical prediction rules (CPRs) (commonly called clinical decision rules, or prediction models, or prognostic tools, or risk scores) are specific tools designed to assist the physician in clinical decision-making. The aim of the CPRs is to give a good estimate of the risk of disease, to better determine outcomes in a specific disease, or to assess the benefits of a diagnostic/therapeutic action.

8.3 Role of CGA in Prognosis

Great attention has been given to the proper identification of mortality prognostic tools that could help clinical decision-making in diagnostics and therapeutics to tailor appropriate intervention for frail patients. Although several models have been validated in different populations, the prognostic performance of the most popular and widely used risk models in terms of discrimination, calibration, generalizability, and reclassification is largely unknown in older people [10]. This information is particularly important in advanced age, characterized by the frequent presence of multiple comorbidities and functional deficits that affect life expectancy.

The prognosis of older patients is likely associated with multimorbidity and with the degree of physical, cognitive, biological, and social impairment. [11] CGA, which explores the multiple domains typical of older subjects, is defined as the multidimensional and multidisciplinary tool of choice, essential for better understanding of the prognosis of the frail older subject. Historically, the instruments for the CGA were specific in terms of targets and older populations, having the aim to better identify and stratify the risk in predetermined clinical settings (e.g., older patients with depression, cognitive impairment, or physical disability). More recently, new multidimensional instruments have been introduced, in order to create global scores (i.e., aggregating findings from several different aspects into a single, standardized, numerical score), with the intention of early identification of subjects at higher risk of negative health outcomes such as institutionalization, hospitalization, or death. Typical examples of these CGA-based indices are the frailty index-CGA (FI-CGA) [12] and the Multidimensional Prognostic Index (MPI) [13] that could be useful in identifying older subjects at higher risk of mortality and for stratifying the subjects to low, moderate, or severe risk of all-cause mortality. These tools are based on a list of well-known risk factors that the research literature suggests to be of great importance to the concept of CGA, including the physical dimension (nutritional status, physical activity, mobility, strength, and energy), the psychological dimension (cognition and mood), and the social dimension (lack of social contacts and social support).

A large systematic review identified a small number of validated prognostic indices for mortality that meet the necessary requirements of accuracy and calibration required for the use in a clinical setting [14]. This relevant paper identifies eight indices for hospitalized older patients, two for those living in nursing homes, and six for community-dwellers [14]. Among the eight tools selected in the hospital-based setting, only four estimated mortality over a sufficient follow-up period (i.e., at least 1-year mortality from the time of admission), and the MPI was the only CGA-based predictive tool to be included in this list. This tool has been demonstrated to be well-calibrated, with good discrimination, and accuracy for determining mortality at short (1 month) and long (1 year) follow-up. In a prospective multicenter study involving over 2000 hospitalized older patients in 20 different hospitals worldwide, MPI was a significantly more accurate predictor of short- and long-term all-cause mortality than three other frailty indices commonly used in clinical practice [15], including the FI-CGA.

8.4 The CGA-Based Multidimensional Prognostic Index (MPI)

The Multidimensional Prognostic Index (MPI) is a tool that predicts survival and other negative health outcomes (hospitalization, institutionalization, length of hospital stay), based on a standard CGA, that considers information on eight domains, i.e., basal and instrumental activities of daily living, cognitive, nutritional, and mobility functions, multimorbidity, polypharmacy, and cohabitation status [13]. Up-to-date, MPI has been validated and successfully applied in older patients hospitalized for acute diseases (i.e., gastrointestinal bleeding, heart failure, pneumonia, transient ischemic attack) or relapses/exacerbations of chronic disorders (i.e., chronic kidney disease, liver cirrhosis, dementia, cancer). Modified versions of MPI have been validated and successfully applied in large populations of community-dwelling "frail" older subjects who underwent a CGA to be admitted to nursing homes or home care services [17]. Moreover, CGA-based MPI have been validated and successfully applied in healthy elderly people at population-based level in different countries also demonstrating excellent results in terms of accuracy, calibration, and feasibility [28] (Table 8.1).

Systematic reviews recently report that the MPI demonstrated the highest validity, reliability, and feasibility (i.e., a score 14—maximum value—on the QUADAS system), compared to other tools used to identify frail older patients [34] and that MPI was one of the three CGA-based prognostic tools that are validated both in clinical practice and in research to measure frailty [35].

Very recently, the MPI_AGE project (www.mpiage.eu), a multicenter project including over 20 partners from 7 different EC countries, the United States and Australia, was co-funded by the European Union through the Health Program 2007–2013 with the main objective to improve cost-effectiveness of interventions in multimorbid frail older persons by [36]. The main project results demonstrated that:

1. there is a clear and significant association between MPI score and survival time and risk of hospitalization in a population-based cohort with a very long-term follow-up up to 12 years;
2. multidimensional indicators are not frequently recorded in general practitioners database across Europe but the use of a MPI model incorporating age, sex, functional, and cognitive functions results in very effective prediction of 1 month and 1 year mortality among community-dwelling older people;
3. MPI at hospital admission is an accurate predictor of inhospital mortality, length of stay (LOS), and long-term mortality [27]. Moreover, during hospitalization, the MPI score changes in most patients, and thus it may be useful to objectively monitor the clinical evolution of acutely ill older patients in hospital [37].

8.4.1 Practical Notes

The MPI includes 63 items distributed in eight domains of CGA as follows:

1. Activities of daily living (ADL): six items
2. Instrumental activities of daily living (IADL): eight items
3. Short portable mental status questionnaire (SPMSQ): ten items

Table 8.1 Clinical studies of development and validation of the multidimensional prognostic index (MPI) and predictive values against different disease-specific prognostic indices

Disease	Setting, patients number	Accuracy AUC (95% CI) C-index risk: OR or HR (95% CI)	Follow-up	Accuracy of other prognostic indices vs. MPI
Acute diseases or exacerbations of chronic diseases [13]	Hospital development cohort 838, validation cohort 856	0.75 (0.70–0.80)	6 months	
		0.75 (0.71–0.80)	1 year	
Acute diseases or exacerbations of chronic diseases [16]	Hospital 4088 patients	0.76 (0.73–0.79)	1 month	m-MPI = 0.75 (0.72–0.78), p = NS
		0.72 (0.70–0.74)	1 year	m-MPI = 0.71 (0.69–0.73), p = NS
Acute diseases or exacerbations of chronic diseases [15]	Hospital multicenter study 2033 patients	0.76 (0.72–0.80)	1 month	FI-SOF = 0.69 (0.64–0.73) $p < 0.0001$
				FI-CD = 0.74 (0.69–0.78) $p < 0.0001$
				FI-CGA = 0.72 (0.68–0.77) $p < 0.0001$
		0.83, 0.75 (0.72–0.78)	1 year	FI-SOF = 0.69, (0.67–0.72) $p < 0.0001$
				FI-CD = 0.73, (0.70–0.76) $p < 0.0001$
				FI-CGA = 0.73, (0.70–0.75) $p < 0.0001$
Acute diseases or exacerbations of chronic diseases [17]	Community	MPI-SVaMA	1 month	
	Development cohort 7876	0.83 (0.82–0.84)		
	Validation cohort	0.80 (0.78–0.80)	1 year	
	4144	0.83 (0.82–0.85)	1 month	
		0.79 (0.78–0.80)	1 year	
Community-acquired pneumonia [18]	Hospital 134	0.83 (0.75–0.87)	1 month	PSI = 0.7I (0.62–0.78) $p = 0.019$
		0.79 (0.71–0.85)	6 months	PSI = 0.69 (0.61–0.77) $p = 0.035$
		0.80 (0.72–0.86)	1 year	PSI = 0.75 (0.65–0.82) $p = 0.185$
Transient ischemic attack [19]	Hospital 654	0.82 (0.75–0.89)	1 month	
		0.80 (0.74–0.86)	6 months	
		0.77 (0.72–0.82)	1 year	
Gastrointestinal bleeding [20]	Hospital 91	0.76 (0.58–0.94)	2 years	RRSS = 0.57 (0.40–0.74)
				GBS = 0.61 (0.42–0.80)
Liver cirrhosis [20]	Hospital 129	0.90 (0.85–0.96)	1 year	Child-Pugh score = 0.70 (0.52–0.88) $p = 0.03$
Dementia [21]	Hospital 262	0.77 (0.73–0.84)	1 month	
		0.78 (0.72–0.83)	1 year	

(continued)

Table 8.1 (continued)

Disease	Setting, patients number	Accuracy AUC (95% CI) C-index risk: OR or HR (95% CI)	Follow-up	Accuracy of other prognostic indices vs. MPI
Dementia [22]	Ambulatory 340 outpatients	MPI score: 0–1	1 year	Risk of hospitalization
		Or (95% CI)	2.2 years	Risk of mortality
		6.50 (1.64–25.85)		
		9.53 (2.90–31.33)		
Congestive heart failure [23]	Hospital 376	Men: 0.83 (0.75–0.90)	1 month	NYHA
		Women: 0.80 (0.71–0.89)		Men: 0.63 (0.57–0.69) $p = 0.015$
				Women: 0.65 (0.55–0.75) $p = 0.064$
				EFFECT
				Men: 0.69 (0.58–0.79) $p = 0.045$
				Women: 0.71 (0.55–0.87) $p = 0.443$
				ADHERE
				Men: 0.65 (0.52–0.78) $p = 0.023$
				Women: 0.67 (0.49–0.83) $p = 0.171$
Chronic kidney disease [24]	Hospital 786 patients	0.70 (0.66–0.73)	1 year	eGFR = 0.58 (0.54–0.61) $p < 0.001$
Chronic kidney disease [25]	Hospital 1198 patients	0.65 (0.62–0.68)	2 years	eGFR = C-index: 0.58 (0.55–0.61) $p < 0.0001$
				Adding MPI to eGFR = 0.65 (0.62–0.68) $p < 0.0001$
Inoperable or metastatic solid cancer[26]	Hospital 160 patients	0.91 (0.87–0.96)	6 months	
		0.87 (0.82–0.93)	1 year	
Acute diseases or exacerbations of chronic diseases [27]	Hospital 1178 patients	In-hospital mortality C-index 0.85 (0.79–0.91)		
		HR (95% CI)		
		MPI-1 reference		
		MPI-2 3.48 (1.02–11.88)		
		MPI-3 8.31 (2.54–27.19)		
		Length of hospital stay Mean value (95% CI)		
		MPI-1 11.3 (9.3–13.7) days		
		MPI-2 13.7 (11.3–16.7) days		
		MPI-3 15.3 (12.6–18.6) davs		

General population [28]	General population 2472	Number of days spent in–hospital	10 years	
		Mean (95% CI)		
		MPI–2 35.5		
		Age 72–78		
		MPI–1 37.9 (32.8–2.9) days		
		MPI–2 58.5 (48.0–69.0) days		
		MPI–3 34.6 (6.8–62.3) days		
		Age 81–87		
		MPI–1 48.7 (41.9–55.4) days		
		MPI–2 66.5 (57.2–75.8) days		
		MPI–3 45.7 (25.1–66.2) days		
		Age 90–99		
		MPI–1 46.8 (39.8–53.8) days		
		MPI–2 49.0 (43.3–54.6) days		
		MPI–3 37.9 (27.0–48.9) days		
		Survival years		
		Median (95% CI)		
		Age 72–78		
		MPI–1 reference		
		MPI–2 –2.5 (–4.4 to –0.6) years		
		MPI–3 –8.9 (–10.4 to –7.5) years		
		Age 81–87		
		MPI–1 reference		
		MPI–2 –3.6 (–4.3 to –2.8) years		
		MPI–3 –6.8 (–7.6 to –5.9) years		
		Age 90–99		
		MPI–1 reference		
		MPI–2 –2.2 (–3.1 to –1.3) years		
		MPI–3 –3.8 (–4.7 to –2.8) years		
Cancer [29]	Ambulatory 658 outpatients	0.87 (0.84–0.90)	1 year	

(continued)

Table 8.1 (continued)

Disease	Setting, patients number	Accuracy AUC (95% CI) C-index risk: OR or HR (95% CI)	Follow-up	Accuracy of other prognostic indices vs. MPI
Cancer [30]	Hospital 160 patients	0.73 (0.65–0.81)	1 year	MGA
		OR (95% CI)		0.65 (0.56–0.73)
		MPI–1 reference		OR (95% CI)
		MPI–2 4.7 (2.1–10.4)		Fit reference
		MPI–3 23.3 (2.9–189.2)		Vulnerable 2.93 (0.9–9.1)
				Frail 4.76 (1.7–13.1)
Generalpopulation and acute diseases or exacerbations of chronic diseases [31]	Community 999	GPI0.78 (9 0.74–0.82)	3 years	
	Hospital 1282	C-index 0.80 (0.76–0.83)	5 years	
		0.77 (0.69–0.72)	3 years	
		0.80 (0.77–0.82)	5 years	
Transcatheter aortic valve implantation [32]	Hospital 116	MPI (mean ± SD): Alive (0.37 ± 0.12)	6 months	
		vs. dead (0.46 ± 0.16); $p = 0.044$	12 months	
		Alive (0.37 ± 1.12) vs. dead		
		(0.44 ± 0.15); $p = 0.055$		
		HR (95% CI) 2.83 (1.38; 5.82) MPI		
		2–3 vs. MPI 1		
Acute diseases or exacerbations of chronic diseases [33]	Hospital 691	MPI admission	In-hospital	
		0.73 (0.69–0.77)	1 year	
		MPI discharge	In-hospital	
		0.74 (0.70–0.78)	1 year	
		MPI as continuous		
		HR (95% CI)		
		1.22 (1.07–1.39)		
		1.24 (1.18–1.30)		

4. Mini-nutritional assessment (MNA) or MNA-Short Form (MNA-SF): 18 or 8 items
5. Exton-Smith scale (ESS): five items
6. Cumulative index rating scale – comorbidity index (CIRS-CI): 14 items
7. Number of drugs used: one item
8. Cohabitation status: one item

To obtain the final index of a given individual, a program calculates the MPI score, which ranges from 0 to 1. This calculation can be easily performed by a program that can be downloaded at no cost (http://www.mpiage.eu/home/about-mpi) or using an IOS free app (iMPI).

Usually, results are ranked in three levels:

- 0–0.33—low mortality risk, MPI 1
- 0.34–0.66—moderate mortality risk, MPI 2
- 0.67–1—high mortality risk, MPI 3

The MPI-SVAMA index is an evolution of the MPI. This version obtains information from SVAMA (*Scheda per la Valutazione Multidimensionale delle persone adulte e Anziane*), a standardized CGA used in community-dwelling older people to have health and social care in eight regions in Italy.

The MPI-SVAMA index is calculated from the following nine domains:

1. Age (years)
2. Gender
3. Nursing care: 11 items
4. Exton-Smith scale: five items
5. Short portable mental status questionnaire: ten items
6. Activities of daily living: six items
7. Functional mobility (mobility items of Barthel scale): three items
8. Social network: one item
9. Main medical diagnosis: one item

This index can be calculated with the use of a free program (http://www.mpiage.eu/home/about-mpi-svama) and also ranges from 0 to 1. However, cutoff points used to rank MPI-SVAMA are different and time-dependent.

It is available, also, an app for iPhone and iPad (download for free from App Store, iMPI). Both applications have the ability to generate a PDF file with the calculation executed.

8.5 The Role of MPI in Clinical Decision-Making

An important aim of the MPI_AGE European project was to evaluate whether drug treatments for which the evidence is still lacking and the risk-benefit ratios are still under debate in older subjects, i.e., anticoagulants in stroke prevention in patients with atrial fibrillation, statins in secondary prevention of diabetes mellitus, and coronary artery disease and antidementia drugs in subjects with dementia, were differently effective across strata of mortality risk assessed by the MPI.

Thus, while recent retrospective observational studies on octogenarians hospitalized for AF [38] and older adults with AF and acute ischemic stroke [39] confirmed that frailer patients were less often treated with warfarin and had a higher mortality rates than not frail subjects, results of the MPI_AGE project carried out in a large population of older subjects with AF divided according to MPI in three classes of mortality risk demonstrated that anticoagulant treatment was associated with increased survival at 3 years of follow-up independently from age, poor clinical conditions, and multidimensional impairment. In fact, the analyses for heterogeneity suggested that the association between warfarin treatment and reduced mortality was not different among the three MPI risk groups [40]. These data are consistent with a large observational study from the United States [41].

Similarly, the clinical decision-making for giving statins to older patients with cardio- and cerebrovascular disease is under debate [42], with equivocal evidence to support or refute benefit, particularly in frail older patients with comorbidity and high mortality risk.

Findings from the MPI_AGE Project in very large populations of community-dwelling older subjects with diabetes mellitus [43] and coronary artery disease [44] who underwent a CGA evaluation to establish accessibility to home care services or nursing home admission, demonstrated that statin treatment was significantly associated with reduced three-year mortality independently of old age and the MPI grade, although the frailest were less likely to be treated with statins.

The use of antidementia drugs and mortality risk stratification in older patients with dementia is of considerable interest and importance. Previous studies showed that MPI accurately stratified hospitalized older patients with dementia [21] into groups at varying risk of short- and long-term mortality. Also, MPI predicts the risk of hospitalization in outpatients with cognitive impairment and dementia [22] and has been used as a valid outcome measure in an intervention trial in patients with Alzheimer's disease [45]. In the MPI_AGE European project, a cohort of 6800 community-dwelling older persons with dementia were identified in a database of almost 23,000 community-dwelling older residents in Veneto Region (Italy) who applied to home care services or nursing home admission. In this population, MPI strongly predicted 3-year mortality. After adjustment for covariables, the use of drugs for dementia (anticholinesterase inhibitors and/or memantine) was associated with lower mortality in subjects stratified as MPI-defined low-risk (HR 0.71 95% CI 0.54–0.92, $p < 0.01$) and moderate-risk (HR 0.61, 95% CI 0.40–0.91, $p < 0.01$), but not in those with high-risk of mortality (HR 1.04, 95% CI 0.52–2.06).

A further important issue is the appropriate selection of older patients who can benefit from invasive therapeutic procedures. In the frame of the MPI_AGE project, a prospective observational study was carried out in consecutive patients aged ≥75 years who underwent transcatheter aortic valve implantation (TAVI) [32]. MPI was calculated at baseline and at 1-year of follow-up. Among the 116 patients included (mean age 86.2 ± 4.2 years, mean MPI score 0.39 ± 0.13), mortality rate was significantly different between MPI groups at 6 and 12 months ($p = 0.040$ and $p = 0.022$). Kaplan Meier survival estimates at 1-year stratified by MPI groups were significantly different (HR = 2.83, 95% CI 1.38–5.82, $p = 0.004$). The study indicated that CGA-based MPI was an accurate tool to predict prognosis and select older patients undergoing TAVI procedure [32].

All these data show that MPI may be useful to make treatment choices in particularly challenge clinical topics giving the opportunity to the clinicians to identify the most effective interventions of older subjects according to their individual life expectancy profile.

8.6 Future Directions

As mentioned before, the age distribution of participants in interventional research studies should be consistent with the age distribution of patients who may need the treatment being investigated. While evidence from RCTs is used to determine the efficacy of a treatment/intervention with the presence of minimal biases, studies of observational design are used to measure the effectiveness of an intervention in "real world" scenarios. This approach is probably more reliable in a population such as frail older persons who are infrequently involved in RCTs due to a number of reasons such as the presence of exclusion criteria.

Indeed, a recent Cochrane review assessing the impact of study design on the effect measures estimated, suggested that there was little evidence for significant effect estimate differences between observational studies and RCTs [46]. Therefore, the data from observational studies suggest that it is time to develop clinical trials designed specifically for frail older adults. These trials might be tailored for the older people, and so they should ideally include appropriate dosing schemes, alternative end points (such as the impact of therapy on quality of life), cognitive and physical function, and, of course, multidimensional assessment tools [47]. Future studies need to test the accuracy and the suitability of these prognostic tools in heterogeneous populations, and their ability to improve clinical outcomes before their widespread use can be recommended.

Prognosis seems to be the most important determining factor for clinical decision-making by physicians. The risk of mortality may influence not only the effectiveness of specific treatments in older patients but also the appropriate choices, particularly in the presence of frailty. Therefore, physicians need to consider the prognostic information obtained through tools tailored for the needs of older people, i.e., based on the CGA, to identify those patients who may benefit from drug treatments given with the aim of increasing survival. This concept further highlights the need that older people will be consistently included in future RCTs in order to better understand the role of these multidimensional tools and the attitudes of clinicians taking care of older patients.

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9 Comprehensive Geriatric Assessment in the Emergency Department

Simon Conroy, Els Devriendt, and Sarah Turpin

9.1 Introduction

In most Western health systems, urgent care for older people with frailty is predominantly based in acute hospitals. Whilst there is a growing evidence base to support the delivery of hospital at home, the proportion of older people who might benefit from such schemes is significantly less than the proportion that will continue to be treated in acute hospital settings.

9.1.1 Routes into Hospital

The patient care journey leading to an emergency department (ED) attendance usually starts with a call for help in the primary care setting, whether in the individual's own home or other care facility. For older people with frailty and urgent care needs, the focus of this chapter, this will lead to verbal advice, a visit from a primary care practitioner or an assessment from the prehospital service—such as a paramedic or in some countries a multidisciplinary team delivering hospital at home (see Chap. 6). This chapter will focus upon the emergency care axis, arbitrarily defined as starting with an assessment from the paramedic team, leading to the decision to convey to hospital.

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9.1.2 Paramedic-Led Responses

The literature describes several innovative schemes which focus upon the paramedic response to urgent care needs in older people living with frailty. Broadly these have addressed enhanced training of paramedic teams, with or without liaison into community care teams. For example, Mason et al. [1] evaluated enhanced training of paramedics in the UK, which involved 3 weeks full-time theory course and a 45-day period of supervised clinical practice in the emergency department. The training in this scheme did not explicitly focus upon geriatric assessment, rather the treatment of minor injuries and illnesses, but did include some training on falls. This model was evaluated in a large multicentre trial, which found that patients in the intervention group (mean age 83 years) were less likely to attend an emergency department (RR 0.72, 95% CI 0.68–0.75) or require hospital admission within 28 days (RR 0.87, 0.81–0.94). Patients in the intervention group were more likely to report being highly satisfied, and there was no significant difference in 28-day mortality [1]. The intervention was highly likely to be cost-effective, with a significant component of the cost savings being derived from a reduction in ED attendances and hospital admissions [2].

9.1.3 Community Team-Led Responses

Other approaches have focussed more explicitly upon older people with geriatric syndromes; for example, Logan et al. offered enhanced access to community falls prevention teams for older people with falls, assessed by paramedics but not conveyed to hospital [3]. This trial demonstrated an impressive reduction in subsequent falls (incidence rate ratio 0.45, 95% CI 0.35–0.58), improvements in function and reductions in fear of falling and follow-up paramedic visits for falls-related incidents. It was also highly likely to be cost-effective [4].

Both the Mason paramedic study and the Logan falls study were well-conducted RCTs embedding robust health economic evaluations, but both have limitations with regard to emergency care axis. Notably, in both models, the services did not run 24 h a day, 7 days per week. As urgent care issues for older people with frailty occur throughout the 24-h period, this limits the proportion of people able to access such services. Subsequent clinical iterations of similar services have reportedly been effective, but typically for small numbers of patients, accounting for a minor proportion of urgent care episodes.

In general terms, the impact of services which do not run on a 24/7 basis on the totality of urgent care for older people is limited to, at best, a 10–20% reduction in hospital attendances/admissions [5]. So whilst Comprehensive Geriatric Assessment (CGA) can be effective in community settings [6], it is less clear how best to configure services to be available for all patients with frailty and urgent care needs in community settings. This means that significant numbers of older people, with and without frailty, will continue to access emergency departments at the start of their urgent care episode, echoing the near global experience of growing ED attendances for older people [7].

9.2 Inside the Emergency Department

Older people form a small but important proportion of emergency department (ED) attendees; for example, in England, people aged 65+ accounted for an estimated 20% (3.6 million out of 18.3 million) of attendees to EDs in 2012/2013. But older people in the ED tend to wait longer for a final decision on the next step (e.g. discharge home or admission), and so their presence results in a greater impact than these figures might suggest. Some of the increased length of stay in the ED relates to complexity; older people often present with combinations of cognitive impairment, multiple comorbidities, polypharmacy and functional impairment. These interacting issues, combined with non-specific presentations, make assessment and management challenging. The accumulation of such deficits is one means of assessing frailty [8], which is an independent predictor of falls, delirium, disability, hospitalisation and care home admission [9–11].

9.2.1 'Organised Chaos'

Traditionally, ED care is focused on 'doing the most for the most', prioritising those who are more likely to have life-threatening or time-critical conditions to be seen first. Commonly used triage systems are known to disadvantage older adults who are more likely to present late and to underestimate their symptoms. Chronic crowding or 'boarding' of patients designated for admission can mean that some patient assessments are undertaken in unsuitable, makeshift spaces. In addition, the physical environment in many EDs creates practical difficulties and can be disorientating for people with sensory, cognitive or functional limitations.

The ED setting is sometimes described as 'organised chaos', with multiple simultaneous demands placed on clinical staff, caring for multiple patients with variable illness acuity and at various stages in their assessment and treatment. In the ED, decisions are often made on the basis of a single encounter and often without a complete history. This is particularly true in those patients with cognitive impairment who present without a key informant. Other clinical records may not be available, including primary care records. It may be necessary to make urgent clinical decisions before the results of investigations are available. All of these factors add to the difficulty in reaching an accurate diagnosis and formulating a comprehensive plan.

In keeping with the general concept of frailty (a key tenet of which is the vulnerability to catastrophic decline in the face of apparently minor stressors), an ED attendance alone can be harmful, with prolonged hospital admission adding to the insult. For example, crowding in the ED is associated with increased mortality, increased length of stay, medical accidents, patient harm and reduced staff morale [12–18]; admission can add to the harms through deconditioning [19]. How much of the harms seen with current models of acute care for older people are related to the environment or processes of care, over and above the presenting problem, is unclear. But it is worth noting that the hospital at home literature has consistently shown mortality benefits for patients treated at home compared to an acute hospital [20].

9.2.2 Identifying Older People with Frailty in Urgent Care

In light of these complexities illustrated in the assessment and treatment decisions for older people with frailty in the ED, it seems logical to highlight this population as being at high risk as soon as possible.

Although there is limited evidence for the discriminant ability of frailty scales in the urgent care context [21], meaning that the tools *alone* are not sufficiently precise to direct clinical care, frailty identification offers a number of advantages. Firstly, it can prompt a more holistic clinical assessment, guided by the principles of Comprehensive Geriatric Assessment (CGA) [22]. Secondly, it may influence clinical decision-making; identifying an individual with a Clinical Frailty Scale of 9 indicates that they are high risk of death as an inpatient [23]. This might prompt more aggressive treatment or alternatively a more palliative approach. Thirdly, it can guide decisions on the best place for ongoing care, by identifying the risk of readmission for those being discharged or the potential for benefit from specialist geriatric services for those being admitted. Finally, measuring the magnitude and nature of frailty in the ED and mapping this onto patient flow pathways can guide service design and evaluation.

Whilst some might be tempted to state that more studies are required to further define frailty [24], or enlighten a frailty identification process in the ED, others would argue that there is already sufficient data to be acting on this issue now [25]. Moreover, practical application and ease of use of a tool within the pressurised, fast-paced urgent care context is a very relevant consideration. An instrument can have the best reliability and validity, but these benefits will not be realised if the instrument is not used because it is too difficult, takes too long or can only be used by a few trained people. With that in mind, it is reassuring to know that several commonly used frailties or risk stratification tools designed for use in the ED setting are quick, simple and easy to complete (Fig. 9.1).

9.2.3 Clinical Evaluation

The reality of frailty is well exhibited in common emergency presentations in older people, some examples of which are described here.

9.2.4 Falls

Falls are a common reason for older people to present to urgent care and result from various combinations of diseases and functional and cognitive impairments. Some of the contributory factors are amenable to treatment or modification. It is important to carefully differentiate between syncopal and non-syncopal falls is important but not always easy because of memory impairment, recall bias or syncope-related antero- or retrograde amnesia, which are common. All too often, direct witness accounts are not available, meaning that the clinician has to base their judgement on the balance of probabilities. Falls from a

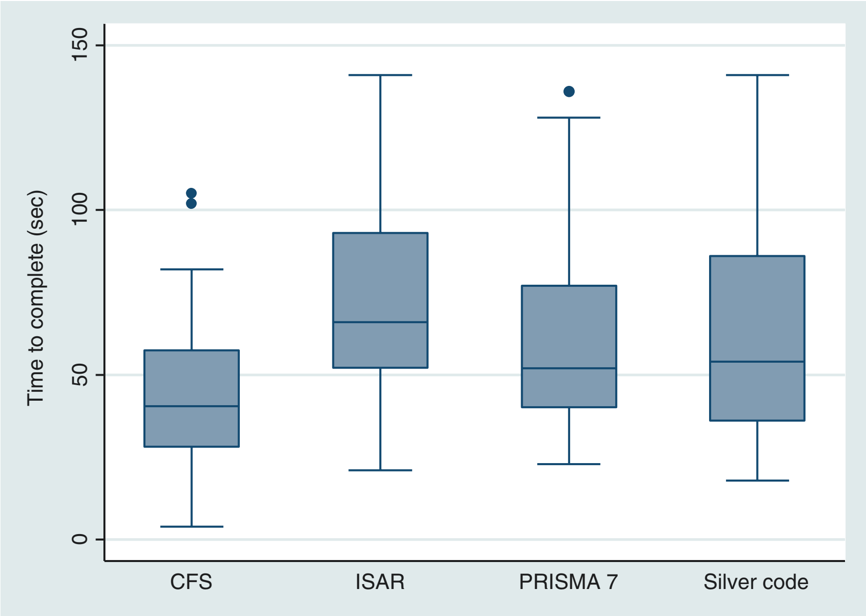

Fig. 9.1 Box and whisker plot for the time taken to complete four commonly used risk stratification tools in the ED. *CFS* Clinical Frailty Scale [26], *ISAR* Identification of Seniors At Risk [27], *PRISMA 7* the Program on Research for Integrating Services for the Maintenance of Autonomy [28], Silver Code [29]

standing height—'stealth trauma'—can be associated with severe injuries in older people with frailty, which can be easily missed.

9.2.5 Pain

Pain can be difficult to assess because of communication barriers, so non-verbal cues may be more useful. Pain management in people with dementia may be challenging because of comorbidities and polypharmacy. The importance of assessing changes in the individual's normal behaviour patterns as an indicator of increasing stress levels or potential pain cannot be underestimated. The modified Abbey pain scale emphasises involving the person's carers/family. Early, effective pain relief is self-evidently important but also reduces the risk of incident delirium.

9.2.6 Sepsis

Sepsis is a huge challenge in older people with frailty, being both over- and underdiagnosed. Volume replacement will be needed in most cases unless fluid overload is evident (remember sacral oedema may be the only sign). Care bundles can be helpful

Table 9.1 Considerations when implementing the sepsis care bundles in older people

Deliver high-flow oxygen	Remember CO_2 retention
Take blood cultures	Be careful; delirium-related agitation does not result in injury (to patient or staff)
Administer empiric intravenous antibiotics	Balanced against the risk of *Clostridium difficile*, antibiotic resistance, missed non-infective diagnoses (the patient was given antibiotics, so it must be sepsis… missing the subdural)
Measure serum lactate and send full blood count	Validation studies based in 60-year-olds; unclear if prognostic significance holds up in older people with frailty and multiple comorbidities
Start intravenous fluid resuscitation	Important as premorbid dehydration is common and volume depletion exacerbated by acute illness; but beware fluid overload—careful boluses titrated against clinical response are mandatory
Commence accurate urine output measurement	But do not rush to insert urinary catheters: catheter-associated sepsis is common as is subsequent incontinence due to deconditioning of the detrusor muscle; reducing unnecessary catheterisations improves patient safety [32]. Consider instead assessment of hydration state based on blood pressure, pulse and JVP

as guides but have generally not been validated or designed for older people with frailty (Table 9.1). Many abnormalities in older people are incidental, best exemplified by the ubiquitous 'dipstick-positive UTI'. The conundrum here is that asymptomatic bacteriuria, which commonly causes positive urine dips, is prevalent (up to 50% of care home residents), and the treatment of asymptomatic bacteriuria confers no benefit [30]. A clinical diagnosis of urinary tract infection requires the presence of two or more of dysuria, frequency, suprapubic tenderness, urgency, polyuria and haematuria in the absence of any other good explanation for the apparent sepsis [31].

The importance of a CGA approach is evident when considering the range of potential issues when implementing a conventional sepsis care bundle, as illustrated in Table 9.1.

9.3 Why CGA in the ED?

The previous section will have hopefully highlighted that frailty is an important consideration in the ED, that can be identified relatively quickly and simply, and for which evidence-based interventions can be useful. In this section, the research evidence for improving care for older people in the ED will be briefly summarised, with a perspective on future approaches.

First it is important to note the well-established evidence based that shows that CGA can improve outcomes for older people (with frailty) in acute care settings [33, 34]. But CGA is a 'black-box' intervention, and to understand its application in the ED requires some deconstruction. The core elements of CGA include:

- Patient centred (as opposed to disease focused)
- Multidimensional (medical, psychological and functional capability), interdisciplinary diagnostic process (in which the interactions between professionals

discussing the patient are as important if not more so than the individual assessments)
- Development of a coordinated and integrated plan for treatment
- Reducing iatrogenesis (accurate diagnosis, medication reviews, avoiding unnecessary procedures, such as urinary catheters)
- Early discharge planning
- Follow-up (case management)

It is also worth noting that environments designed to prevent cognitive and physical functional decline through early mobilisation, orientation, wayfinding, familiarity and socialisation improve outcomes [35]. Table 9.2 lists published ED CGA studies and assesses the components of CGA defined as in the list above that appeared to have been delivered as part of each intervention. Whilst this is not a formal meta-regression analysis, there does appear to be some correlation between improvements in outcomes and the greater number of CGA components offered. All seven of those studies describing interventions containing five or more of the listed domains of CGA being delivered were able to show improvement in service metrics, in contrast to one out of the four with less than five CGA components. Whilst it seems likely that the more robust in depth and breadth an intervention might be, the more likely it is to have an impact, there is also a growing awareness that *all* components of CGA are likely to be necessary for an effective service. From a clinical perspective, there appears to be a synergistic effect, with the whole being greater than the sum of the parts. This is nicely illustrated in clinical scenarios which demonstrate interaction between disciplines—the interdisciplinarity of CGA—rather than just having individual disciplines undertaking assessment with recourse to an MDT discussion, operating within a flattened hierarchy that allows constructive challenge. This is nicely illustrated by clinical scenarios which demonstrate the benefit of the interaction between disciplines rather than solely the individual assessments. This interaction is facilitated by having a flattened hierarchy to enable constructive interdisciplinary challenge. For example, the option to admit for rehabilitation by a therapist concerned about falls at home might be challenged by pointing out that admission often increases the risk of falls and that home-based rehabilitation may offer substantial benefits. Equally therapists will bring useful information to the diagnostic process—for example, the patient who is ‘fit to return home’ that develops new dyspnoea on mobilisation might prompt a re-evaluation of respiratory function and identify potentially new diagnoses.

That this assessment is a process and not a discrete event is also a key; the process should continue in an iterative manner over the course of the acute stay, and the diagnostic elements should be sensitive to deviations from the anticipated pathway. For example, if the initial treatment plan for an individual with a fall and hip pain but no fracture was to ‘increase analgesia, reduce anti-hypertensives and aim to return home once able to walk 5 m unaided using a frame’, yet after 14 hours, pain remains a problem, the diagnosis may need to be revisited and further imaging considered.

The team caring for an individual needs to know and respect each other’s roles and know and understand what each other is doing and how the medical treatment will impact upon the rehabilitation goals and vice versa. For example,

Table 9.2 ED-based CGA studies deconstructed

Trial	Population	Intervention	PC	MD	ID	CIP	RI	ED	CM	Impact on outcomes					
			CGA components, key: + evident; ? not clear; – absent							Count of components	Readmission	Admission	Activities of daily living	Admission to long-term care	Mortality
Miller et al. (1996) [36]	65+	Geriatric case finding and liaison service involving gerontological nurse specialist and ED staff	+	+	?	?	?	+	?	3	3 m ↔	N/A	N/A	↔	↔
McCusker et al. (2001, 2003) [37, 38]	65+, ISAR ≥ 2, for discharge	Gerontological nurse specialist, consultation with ED and geriatric medical staff	+	+	+	?	?	NA	+	4	30d ↑	N/A	4 m ↓	N/A	N/A
Mion et al. (2003) [39]	65+, for discharge	Gerontological nurse specialist, consultation with ED staff	+	+	+	+	+	NA	?	5	30d ↔ 120d ↔	N/A	N/A	30d ↓ 120d ↔	30d ↔ 120d ↔
Caplan et al. (2004) [40]	75+, for discharge	Gerontological nurse specialist, consultation with geriatric medical staff	+	+	+	+	?	NA	+	5	30d ↓ 18 m ↓	N/A	6 m ↓	↔	↔
Basic and Conforti (2005) [41]	65+ with geriatric syndrome	Gerontological nurse specialist	+	?	?	?	?	+	–	2	N/A	↔	During HOS ↔	N/A	N/A
Foo et al. (2012) [42]	65+, living at home	Emergency nurse trained in geriatric care, consultation with ED physician or gerontological nurse specialist	+	+	+	+	+	+	–	6	3 m ↓ 6 m ↓ 9 m ↓ 12 m ↓	N/A	N/A	N/A	↔

Arendts et al. (2012, 2013) [43, 44]	65+ with geriatric syndrome	Allied health personnel, consultation with other specialists when required	+	?	?	–	?	?	–	1	28d ↓ 1y ↑	↓	N/A	N/A	28d ↔ 1y ↔
Wright et al. (2014) [45]	70+ with geriatric syndrome	Multidisciplinary geriatric team	+	+	+	+	+	+	+	7	N/A	↓	N/A	N/A	N/A
Foo et al. (2014) [46]	65+, TRST ≥ 2, for discharge	Gerontological nurse specialist	+	+	–	?	–	NA	+	3	3 m, 6 m, 9 m, 12 m ↔	N/A	3 m ↓ 6 m ↓ 9 m ↓ 12 m ↓	N/A	↔
Ellis et al. (2012) [47]	65+ with geriatric syndrome	Gerontological nurse specialist and geriatrician, ACE unit	+	+	+	?	+	+	?	5	7d ↔ 30d ↔	↔	N/A	12 m ↔	12 m ↔
Keyes et al. (2014) [48]	65+	Nurses, social workers, pharmacist, and physician	+	+	+	+	+	+	+	7	30d ↔	↓	N/A	N/A	N/A
Conroy et al. (2014) [49]	65+ with geriatric syndrome	Interdisciplinary team, geriatrician, liaison with ED, access to dedicated area	+	+	+	+	+	+	+	7	7d ↔ 30d ↔ 90d ↓	↓	N/A	N/A	N/A

Key: *PC* patient centred, *MD* multidimensional assessment, *ID* interdisciplinary intervention, CIP coordinated, integrated plan, *RI* reduced iatrogenesis, *ED* early discharge planning, *CM* case management whilst therapists would not need to know the detailed intricacies of the management of acute heart failure, it is important that they know that intravenous diuretics might be required for the first few days that will result in polyuria and then be able to incorporate continence needs into the rehabilitation plan. Equally, doctors will need to appreciate that just because a patient has grade 5 power on the MRC grading system, this does not necessarily translate into useful functional ability.

9.4 What Does Ideal CGA in the ED Look Like?

By deconstructing CGA in the manner described above, it becomes possible to reconstruct it in an adapted version suited to the ED setting. In the following section, the ideal CGA service in the ED setting will be described. The authors are not aware that such a service currently exists or, at least if it does, that it has been formally described and/or evaluated.

9.4.1 Environment

The ED is designed with a focus on older people with frailty, similar to paediatric EDs. However in contrast to the separate paediatric EDs which are common place, it is accepted that older people will be core users of the ED and so separate structures are unlikely to be sustainable. The following frail-friendly features should be seen throughout ED:

- Floors and ceilings should be laid with absorbent, rubber materials to reduce noise and increase verbal comprehension and reduce risk of injury if a patient falls.
- Natural and artificial light that can be adjusted to reflect the time of day. Where direct natural light is not possible, consideration should be given to the use of borrowed light, light tubes and other artificial sources of illumination.
- Warm-coloured, matte-finished non-patterned walls.
- Floors with no specks, sparkles or grain, tone contrasting with the capping strip matching the tone of the wall, not the floor.
- Signage in word and pictures with a strong signature colour in and outside the bay.
- Colour of bays should start with the doorway and be continued with curtains and furniture.
- Clear, large analogue clocks.
- Handrails at 900 mm.
- Regular seating spaces for rest.
- Medium effort to open doors with comfortable handles.
- Use of glass to see into rooms.
- Interesting focal points on walls.
- Hoists and other equipment easy to store to reduce clutter.
- Accessible toilets in the near surroundings.

Clearly, these lists are not exhaustive but give an idea of the scope and detail of adaptation required.

9.4.2 Patient Centred

Person-centred care (PCC) attempts to respect the person as an individual, with a history (biography), values, preferences and the right to make choices [50]. This aims to enhance engagement and enjoyment of life, preserve abilities and avoid or diffuse distress.

Consider a frail older person attending an ED with chest pain. A common approach for people with chest pain is to undertake a rapid assessment, initiate tests that will stratify cardiac risk and then discharge with reassurance that the chest pain is not cardiac. For patients who have attended and worried they might have heart conditions, this might be helpful. Protocols can be prepared that can automate much of this process, resulting in a rapid, efficient and possibly effective service, for some.

But such an approach is not so useful for frail older people, in whom the range of conditions that might present with chest pain is broad. It is important to evaluate the pain in a broader context, which can really only be addressed by undertaking multidimensional assessment. This might then reveal that actually the pain is resulting from shoulder arthritis that has flared up because the person has forgotten to take their pain killers because of worsening, hitherto undiagnosed cognitive impairment. The solution here is not then the reassurance that the pain is not cardiac but a referral to the memory service and to organise supervision of medication. So this is individualised care, tailored to the person based on an understanding of a range of factors.

Person-centred care also respects individual preferences and choices—so, for example, the refusal of ongoing investigation for apparently severe conditions as the individual prefers quality to quantity of life. Put very simply person-centred care is about treating the person, not simply following a condition-specific protocol.

Whilst all patients will want to receive patient-centred care, it is even more important for older people with frailty, who will have a number of comorbidities, which means that a traditional disease-orientated approach may not be effective and may be dangerous.

9.4.3 Patient Identification

The ideal ED will routinely risk stratify their population based on frailty (needs), as well as specific conditions (diseases). They might use a simple scale, which is valid and easy to complete, such as the Clinical Frailty Scale (see above). The frailty identification might be undertaken by the prehospital service and be part of the handover, or it will be part of the handover assessment process carried out alongside the early warning score. Automated tracking systems will alert care providers to the presence of frailty, which in turn will trigger a different model of care.

9.4.4 Multidimensional Assessment

All urgent care staff will possess the basic competencies necessary to initiate a multidimensional assessment (CGA), supported by easily accessible e-learning platforms and/or clinical navigation toolkits. Geriatric teams will be embedded at key interfaces on the patient pathway, supporting urgent care staff in the more difficult scenarios, through role modelling and some direct clinical care.

9.4.5 Development of a Coordinated and Integrated Plan for Treatment

CGA usually gives a lot of information that needs prioritisation by developing a stratified problem list—which will be informed by the multiple domains described above. The care plan should be an individual plan for each patient and is preferably discussed with all healthcare workers, the patient and informal caregivers involved in the care for the patient.

As the ED plays an important role in the screening and identification of problems, an important part of the further planning will be referral to other services in and outside the hospital, e.g. referral to memory clinic, falls clinic, CGA unit and primary care provider.

Having an overall picture of the older patient in the ED through geriatric assessment can enhance the decision-making process with regard to orientation of the patient (admission or discharge) and may impact indirectly patient flow in the ED. An admission to the hospital can be avoided and replaced by a safe discharge or alternatives to admission (day hospital) or hospital at home services [19, 20, 46–51].

Standardised communication systems will allow the generation and case management of stratified problem lists which are multidimensional in nature and focus upon patient-centred goals of care.

9.4.6 Reducing Iatrogenesis

ED staff will be aware of the harms of common procedures, such as urinary catheterisation, and will think twice about undertaking such a procedure without robust justification in older people identified as being frail.

ED staff will have access to scales such as the STOPP-START tool and the Anticholinergic Burden Scale which will allow them to confidently rationalise medication in the ED setting, in some case precluding the need for admission. They will be aware of the importance of communicating and change back to the primary care practitioner for ongoing monitoring.

Consideration will be given to the appropriateness of investigations that carry a risk of harm, for example, contrast-enhanced CT scans, in people who are severely frail, as to whether or not investigation will add to quality of life.

9.4.7 Early Discharge Planning

Careful consideration will be given to the relative risks and benefits of treatment in hospital or at home. ED staff will be aware of the risks of hospital-associated harms and will weigh admission for investigation and management up against care at home. If home is deemed an appropriate option, after discussion with the patient and family, then the stratified problems list, the initial output of the CGA, will be communicated to the primary care practitioner and community teams to direct ongoing care. The ED staff will be aware that the ED itself is not an ideal setting to undertake a detailed assessment and so will communicate the urgent and important issues first, so that the community team can address any outstanding issues. The ED staff will be aware of the risk of readmission as they will have received real-time data from the IT systems that indicate the risk of readmission based upon locally run algorithms derived from the Clinical Frailty Scale. The ED team will identify which issues are most likely to contribute to readmission and prioritise these accordingly. For example, if an individual attends the ED with a fall, then it is probable that a future readmission will be related to falls or mobility, and hence an early referral to community therapy or a falls prevention service, alongside consideration of bone protection, will be helpful.

9.4.8 Follow-Up

The coordination of referrals and coordination of implementation of recommendations will improve the chance of a successful discharge.

The ED staff will routinely ask if there is a case manager already involved in the patient's care and ensure that they received a copy of the ED summary if being discharged or that it is highlighted to the inpatient care team for those being admitted.

9.5 How Can CGA Be Delivered in the ED?

Consider the following case study as an example:

Gina has dementia and lives at home with a twice-daily package of care; she usually walks with a stick. She has a past medical history of cataracts, osteoarthritis, hypertension, heart failure and deafness. She has been brought to the ED in an ambulance because her evening carers found her on the floor in the hallway; she was alert but disorientated and had been incontinent of urine. Medications: amlodipine, donepezil, bendroflumethiazide and amitriptyline.

On arrival to the ED, Gina arrives in the initial assessment area. The nursing staff obtain baseline observations; they use an age-adjusted triage tool—this reduces the risk of under triage by allowing for the altered physiology in older people. During the initial assessment, they note that Gina is frail from the existing information, which prompts them to screen for geriatric syndromes. Screening takes less than 2 min to complete; Gina is identified as having likely delirium.

Since the ED is frail friendly, Gina's trolley is adjustable to a low level, making it much easier for her to transfer on and off the trolley. Due to Gina's deafness, the nurses use a portable amplifier (one of two which are kept in the department) to communicate—this makes it much easier for Gina to understand what is going on.

Due to her cataracts and her cognitive impairment, it is difficult for Gina to process environmental cues—fortunately, there is a large clock on the wall of the bay, and the staff are all wearing large print ID badges with simple titles which makes it a little easier. The department colour scheme is a contrast of cream walls and maroon signage and floors; this is easier on the ageing retina than the commonly used pale blue—which does not offer such clear contrast and can appear as a dirty grey.

The ED registrar in the assessment area has recently been to a training day on trauma in older people, as part of the national GEM curriculum. He remembers that falls from standing height in frail patients are more likely to result in cervical spine injury and that his threshold for CT scanning her neck should be lower. He also remembers to check for pressure damage and rib fractures, since these are often overlooked.

Once Gina has had her CT scan arranged, she is moved to the main area of the department—she is handed over to a locum doctor who is new to the department. He is asked to prescribe analgesia and uses the department guidelines on 'acute pain management in frail older people'. Following the guideline, he assesses for signs of constipation before prescribing a laxative alongside a low dose of opiate.

Gina's CT comes back showing that she has no fractures but has severe degenerative changes in her cervical spine and moderate cerebral atrophy with periventricular white matter changes suggestive of small vessel disease.

Because Gina has been identified as frail and probably delirious, she is automatically referred to the frailty team based in the ED—there is a frailty nurse present on every shift; she obtains a collateral history from Gina's daughter and assesses the social background. Meanwhile an ED consultant who has done a fellowship in geriatric emergency medicine reviews her medications and discusses her case with the locum doctor—explaining the need to further investigate the fall and the urinary incontinence. He withholds her amitriptyline. He advises the locum to begin an initial delirium screen—a locally agreed range of blood tests, sepsis screen and medication review, along with a bladder scan for the urinary incontinence.

The department has a policy that frail older patients should be seated rather supine on a trolley if it is safe to do so—Gina is uncomfortable in her trolley, so she is transferred onto a padded recliner chair. The floor is special non-slip material to reduce the risk of Gina falling when transferring. During the step around transfer onto the chair, the nurse assesses her ability to stand unsupported. She is unable to do this and so is flagged up as requiring input from a physiotherapist.

Since Gina is not able to stand or walk unsupported, she is referred into the acute frailty unit within 2 h of arrival in the ED. Her paperwork from the ED accompanies her, which contains space for the assessing doctor to form a stratified problem list and contains the baseline collateral that has been obtained by the frailty nurse.

9.6 Summary

This chapter has highlighted the importance of the ED as a key decision-making setting in the health and social care system, which is uniquely placed to influence the care and care pathways of older people with urgent care needs in a cost-effective manner. ED teams are dynamic, adaptable and pragmatic—so ideally placed to meet the needs of an ageing population.

The core care processes required to achieve this transformation are already well established—frailty identification, Comprehensive Geriatric Assessment and transferable competencies to help teams deliver the care needed.

Not all ED staff will see themselves as having a role in the care of older people. Some of this will be related to confidence and competence, which can be taught, but some will relate to attitudes. Attitudes can be shifted, through role modelling, incentives and rewards, as well as managing individual who does not engage in delivering the behaviours required.

Geriatric Emergency Medicine is already well established in North America; it is now time for Europe to lead the way.

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Comprehensive Geriatric Assessment in Cancer Patients

10

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10.1 Introduction

With the aging of society, oncologists will see increasing numbers of older cancer patients. Indeed, the number of older patients with cancer represents two thirds of newly diagnosed cancers, and nearly three quarters of death-related cancers occur in patients 65 years and older [1]. However, older cancer patients are underrepresented (one third of patients 65 years and older) in cancer clinical trials, mostly because of comorbidities and functional status [2].

With increasing age, the cancer population features a great heterogeneity of comorbidities, functional status, nutrition, mobility, mood, and cognition, which requires adapted therapeutic strategies [3]. In this epidemiologic context, the International Society of Geriatric Oncology (SIOG), US National Comprehensive Cancer Network, European Organisation for Research and Treatment of Cancer

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(EORTC), and European Society of Breast Cancer Specialists recommend a comprehensive geriatric assessment (CGA) for older cancer patients to help cancer specialists determine the best treatment and avoid under- or overtreatment [4–7]. However, CGA is time- and resource-consuming and not necessary for all patients. Thus, with a multidisciplinary approach, physicians have developed simple screening tools to identify patients who need a GGA—so-called vulnerable patients—who would most benefit from CGA [8].

This chapter focuses on evidence obtained during the last decade on the use of CGA in the geriatric oncology setting.

10.2 Domains and Tools Used for CGA of Cancer Patients

CGA is a multidimensional and multidisciplinary assessment approach that has been progressively used for older cancer patients in the last decade. CGA aims to detect and treat some unknown issues that commonly occur in older patients and that interfere with the natural course of cancer and anticancer treatment [4]. Thus, CGA provides a comprehensive approach to guide targeted geriatric interventions with or without follow-up and appropriate cancer treatment selection [4]. Most studies conducted in geriatric oncology have used age 70 years and older as the threshold age for a CGA, but other age cutoffs have been proposed [4].

We lack evidence to recommend the number of domains that should be assessed in a CGA, which probably explains the wide variation in CGA tools used in studies. Moreover, there is no consensus about the number of impaired domains to define CGA impairment and to define "vulnerability" in older patients with cancer [9, 10]. Table 10.1 provides most of domains and tools (at least two tools per domain) used in CGA among studies of older patients with various cancers conducted between 2007 and 2014 [3–7, 9–11]. The number of domains used varied from 3 to 8, the number of tools from 4 to 11, and the number of domains impaired to define CGA impairment from 1 to 2.

Table 10.1 Domains and tools most frequently used for CGA of older cancer patients [3–7, 9–11]

Domains	Tools
Social	Medical Outcomes Study Social Support Survey Live Alone
Dependency	Activities of daily living Instrumental activities of daily living
Mobility	Timed get up and go test Short physical performance battery At least 2 falls within the 6 last months
Nutrition	Mini Nutritional Assessment Body mass index $\leq$18 kg/m^2, loss of $\geq$1 kg within the 3 last months
Cognition	Short Portable Mental Status Questionnaire Mini-Mental State Examination Clock-drawing test, trail-making test a/b
Mood	Geriatric Depression Scale 4, 15, or 30 items Hospitalized Anxiety and Depression Scale
Comorbidity	Charlson Comorbidity Index Cumulative Illness Rating Scale for Geriatrics
Medication	$\geq$5 medications a day $\geq$9 medications a day $\geq$10 medications a day

10.3 How to Identify Older Cancer Patients Who May Benefit from a CGA

Considering the increasing incidence of cancer in older patients, the limited number of geriatricians trained in geriatric oncology, and the fact that CGA is time-consuming, CGA seems difficult to perform systematically for all patients in daily practice. Thus, scientific societies have proposed a two-step approach: (1) screening tools that are simple and easy to use in routine clinical practice to identify vulnerable older cancer patients and (2) a CGA.

Among 17 tools identified by Decoster et al. in a recent review, only two were specifically developed with cohorts of older cancer patients [8]: the abbreviated CGA (aCGA) [12] and the geriatric-8 (G8) [13]. Other screening tools frequently used in the geriatric oncology setting include the Eastern Cooperative Oncology Group-Performance Status (ECOG-PS) [14], the Fried's frailty phenotype [15], the Groningen Frailty Indicator [16], the Triage Risk Screening Tool [17], and the Vulnerable Elders Survey-13 (VES-13) [18]. Considering statistical performance, the aCGA, G8, and VES-13 have shown sensitivities of 80% or more and specificities of 60% or more.

The SIOG, the French Society of Geriatric Oncology, and the French National Cancer Institute currently recommend the G8, which is easy to use in daily clinical practice (less than 5 min to perform), to identify older patients with cancer who may benefit from a complete CGA [8, 19]. However, the use of the tool results in variations in sensitivity and specificity depending on the tumor site [20]. These findings led to exploring ways to improve its statistical performance. A modified G8, including only six items (weight loss, cognition/mood, performance status, self-rated health status, six or more medications per day, and history of heart failure/coronary heart disease), has been currently validated, with 89.2% sensitivity and 79% specificity and good homogeneity across cancer types [21]. The gold standard was abnormal GA defined as an impaired score on at least one of the following tests: activities of daily living (ADL $\leq$ 5/6), instrumental activities of daily living (IADL $\leq$ 7/8), Mini-Mental State Examination (MMSE $\leq$ 23/30), Mini Geriatric Depression Scale (Mini GDS $\geq$ 1), Mini Nutritional Assessment (MNA $\leq$ 23.5/30), Cumulative Illness Rating Scale for Geriatrics (CIRS-G; at least one comorbidity grade 3 or 4), and Timed Up and Go test (>0.20 s).

Because of the several screening tools that have been developed to identify older cancer patients who are likely to benefit from a complete CGA and their lack of appropriate sensitivity and specificity, another approach might be to propose a different screening tool for each cancer site or a single tool with different weightings according to the type of cancer. This approach needs to be validated by further prospective studies.

10.4 CGA as a Decision Support in Geriatric Oncology

CGA is recommended to help oncologists individualize and optimize the best anticancer treatment strategies for older cancer patients. Indeed, with its multidimensional approach, CGA can assess the strengths and weaknesses of older patients and thus may help oncologists select patients who can benefit from a standard anticancer treatment, those who require adjusted treatment according to other existing health problems, and those who should receive only the best supportive care. According to published studies in the past decade, CGA has influenced the treatment plan for 20.8–60% of cases, and CGA factors associated with treatment modifications varied among studies.

To date, in the largest published prospective study of 1967 older cancer patients (median age 76 years [range 70–96]; 87.2% solid tumors), when oncologists were aware of the CGA results at the time of the therapeutic decision (61.3% of patients), the final treatment decision was changed for 25.3% of evaluated patients. However, this study provided no information about the relationship between individual CGA factors and cancer treatment decisions [22]. In a 2008 study of 105 prospectively included older cancer patients with solid tumors (median age 82.4 years [range 73–97]) to investigate the effect of a CGA on the final therapeutic decision [23], the CGA modified the cancer treatment for 38.7% of cases. The absence of depressive mood and BMI 23 kg/m^2 or less were associated with treatment changes on univariate analysis. For 36 treatment plan modifications, 33 (91.7%) concerned plans involving chemotherapy. In 2011, in another prospective study of 161 patients with solid tumors (median age 82.4 years [range 73–97]), the CGA modified the cancer treatment for 49% of cases: more intensive therapy for 57%, less intensive therapy for 36.7%, and delayed treatment for 6.3% [24]. Severe comorbidities and dependency for one or more activities of daily living (ADL) were associated with decreased therapeutic intensity or delayed treatment on univariate analysis.

The effect of CGA on the decision-making process in geriatric oncology was strengthened by prospective studies involving multivariate analyses. In the first study, of 571 older patients with solid malignancies (mean age 78.0 ± 4.8 years), 23.4% were considered ineligible for active treatment according to CGA results [25]. Older age, living alone, impaired ADL, and low BMI were independent factors associated with receiving only the best supportive care, whereas increased instrumental ADL (IADL) score was associated with receiving active cancer treatment. In a cohort study of 375 older patients with various solid cancers (mean age 79.6 ± 5.6 years), the treatment plan was modified for 20.8% of cases (81% treatment intensity decrease) [26]. Low ADL score and malnutrition were independently associated with treatment changes. In a homogenous population of patients with lung cancer who were 70 years and older, treatment decisions were modified for 60% on the basis of CGA results [27]. Cognitive impairment according to the Mini-Mental State Examination (MMSE) was the only independent factor associated with the medical decision. More recently, in a pilot study of 217 older patients (mean age 83.2 ± 5.3 years) with various solid cancers, 40.5% of patients had their treatment plan modified after CGA [28]. On multivariate analysis, the number of frailty markers (i.e., nutrition, energy, strength, physical activity, and mobility) and ADL were significantly associated with final treatment recommendations.

These studies suggest that some CGA factors may affect treatment decision-making. More particularly, function and nutritional status seem to be associated with cancer treatment modification.

10.5 Clinical Relevance of CGA to Detect Health Problems in Oncology

The CGA detects multiple unknown health problems and should be used to propose multiple interventions in older cancer patients. In a study of 1967 older patients with cancer, CGA detected unknown geriatric problems in 51% [23]. In a study of 15 older patients with early-stage breast cancer, a mean of 1.5 new medical problems per patient required an intervention, and the mean number of interventions during 6-month follow-up was 17 per patient [29]. The identified geriatric problems are most often functional dependence, walking problems and falls, depressive or cognitive disorders, malnutrition, and comorbidities [3, 9–11].

Older patients with cancer often require functional assistance. Traditionally, for assessing functional status, oncologists use the ECOG-PS, whereas geriatricians use ADL and IADL tools. In a systematic review of 29 studies describing CGA findings in older patients with solid malignancies [3], 2–50% of patients showed functional impairment, defined as ECOG-PS grade 2 or more, whereas 10–61% showed deficiency in at least one ADL item. The correlation between the need for assistance in ADL and IADL and the ECOG-PS was moderate, and ADL seemed to be more informative than ECOG-PS for characterizing the functional status of older cancer patients [26, 30].

Mobility assessment and fall risk should always be part of a CGA. In a review of 27 studies, fall rates and injury fall rates varied widely among older cancer patients, and consistent predictors of falls were prior falls among outpatients and cognitive impairment among inpatients [31].

Another important aspect to consider is malnutrition [32]. In a review of 29 studies [3], 13 (45%) used the Mini Nutritional Assessment (MNA) to evaluate nutritional status, and 34% used BMI and/or weight loss. Overall, 27–83% of patients showed malnutrition or a high risk for malnutrition. The main factors associated with malnutrition in older cancer patients are gastrointestinal tract tumor, advanced tumor stage, chemotherapy, cognitive impairment, fall risk, and depressive mood [32].

Cognitive impairment and depression have significant practical implications for older patients under cancer treatment. Cognitive status assessed usually by the MMSE revealed cognitive dysfunction in 6–42% of patients [3]. Mood status was assessed most widely by the Geriatric Depression Scale (GDS), and depression was found in 10–65% of patients. The main factors associated with depression in older cancer patients are impaired mobility and function, inadequate social support, cognitive impairment, polypharmacy, and multimorbidity, independent of gender, tumor site, and metastatic status [33].

Many tools can be used for assessing comorbidities [3, 9–11]. In oncology, the Cumulative Illness Rating Scale for Geriatrics or the Charlson Comorbidity Index is often used. With these tools, at least one comorbidity was found in 23–70% of older cancer patients, at least two comorbidities in 16–59%, and at least three comorbidities in 50–81% [3]. Colorectal and lung cancer was associated with increased comorbidity burden in older patients as compared with the general population [34].

Thus, CGA has identified a large number of geriatric problems and multiple comorbidities likely to interfere with cancer treatment and to compete with cancer as a cause of death. Identifying these problems is a crucial initial step when implementing comprehensive care for older patients with cancer.

10.6 Clinical Relevance of CGA to Organize an Individualized Geriatric Intervention Program and Follow-Up in Geriatric Oncology

An important aim in conducting a CGA is to develop and implement individually tailored geriatric interventions. Studies of CGA in geriatric oncology have generally reported limited evaluations of the screening and/or assessment part of the CGA process. The assessment is largely tool based, without a comprehensive clinical review or a follow-up [4]. In most of the cancer studies, the geriatric assessment is not conducted for targeted clinical interventions and is often not performed by geriatricians. Few studies have described interventions implemented on the basis of CGA results in older cancer patients. In one study [26], a geriatrician performed a CGA and then suggested multidisciplinary interventions based on the results for 375 patients referred to a geriatric oncology unit. The interventions involved social support for 172 (46%) patients, physiotherapy for 157 (41%), changes in current chronic medications for 115 (31%), nutritional care for 262 (70%), a memory evaluation for 79 (21%), and psychological care for 135 (36%). Similar findings were obtained in a study of 161 patients: 122 (76%) received CGA-based interventions, including nutritional care (43%), treatment for depression (19%), a memory evaluation (18%), changes in chronic medications (37%), and/or social support (20%) [24]. In a recent large cohort study of 1967 patients, the CGA results led to intervention plans targeting all CGA domains for only 25% of patients [22].

Very few randomized trials have assessed the potential effect on patient outcomes of CGA-based management and follow-up of health problems in older cancer patients. Two randomized trials of older postsurgical cancer patients showed significant survival gains with home care by advanced practice nurses [35] or improved appropriateness of treatment strategies with nurse case management [36]. In a secondary sub-analysis of data from a randomized 2 × 2 factorial trial comparing care in a geriatric inpatient unit, geriatric outpatient clinic, both, and neither for frail older cancer inpatients, inpatient geriatric assessment and management significantly improved quality of life but not 1-year survival [37]. A recent study demonstrated better outcomes for older patients undergoing chemotherapy with geriatrician-led CGA-based than non-CGA-based interventions. The intervention group undergoing CGA were more likely to complete cancer treatment as planned and required fewer treatment modifications than the observational group [38]. Two randomized controlled trials are currently assessing the potential effect on cancer patient outcomes of CGA-based management and follow-up of health problems [39, 40].

10.7 The Prognostic Value of CGA for Predicting Chemotherapy Toxicity and Feasibility, Functional Decline, and Mortality in Oncology

Determining the optimal therapeutic strategy is a major challenge for older cancer patients. An important goal of CGA is predicting cancer treatment toxicity and feasibility as well as mortality (Table 10.2). The feasibility rates were considerably lower with chemotherapy than with other cancer treatments [41]. Factors independently associated with chemotherapy feasibility were good functional status, normal mobility defined as having no difficulty walking or no fall risk, and higher creatinine clearance.

Some studies investigated relationships between CGA components and chemotoxicity [42–45]. Non-small cell lung cancer patients with better ADL, IADL, and EORTC Quality-of-Life Questionnaire C30 scores were likely to complete chemotherapy, and those with higher depression scores or poor emotional functioning were likely to show grade 2 or higher psychiatric toxicity [42]. An MMSE score 27/30 or less and altered IADL were associated with severe chemotoxicity in 123 patients with metastatic colorectal cancer [43]. Hurria et al. [44] and Extermann et al. [45] developed chemotherapy toxicity prediction scores for mixed cancer patients undergoing various chemotherapy regimens. Hurria et al. reported that 53% of 500 patients showed grade 3 or higher toxicity. The final prediction score included 11 scored variables: age 72 years and older, cancer type, standard dosing of chemotherapy, polychemotherapy, low hemoglobin level, creatinine clearance less than 34 ml/min,

Table 10.2 The predictive values of CGA components [41–51]

Outcomes predict by CGA	CGA domains
Feasibility of chemotherapy	Altered functional status assessed by ECOG-PS, IADL, or ADL Impaired mobility assessed by TGUG or risk of fall High number of comorbidities assessed by the Charlson Comorbidity Index or increased number of medications
Chemotoxicity	Altered functional status assessed by ADL or IADL Impaired mobility assessed by walking one block or risk of fall Undernutrition assessed by MNA Impaired cognitive status assessed by MMSE Decreased social activity Impaired hearing
Overall survival	At least three domains impaired Impaired functional status assessed by ECOG-PS or ADL Impaired mobility assessed by TGUG Undernutrition assessed by MNA Depression assessed by GDS Increased number of severe comorbidities
Functional decline	Altered functional status assessed by IADL Depression assessed by GDS

TGUG timed get up and go test, *ADL* activities of daily living, *ECOG-PS* Eastern Cooperative Oncology Group-Performance Status, *IADL* instrumental activities of daily living, *GDS* geriatric depression scale, *MNA* mini nutritional assessment, *MMSE* mini-mental state examination hearing impairment, one or more falls in the past 6 months, limited in walking a block, assistance needed for taking medications, and decreased social activities due to physical or emotional health. In the Extermann et al. study, of 518 older patients, 64% showed severe toxicity, 56% grade 3 or higher non-hematologic toxicity, and 32% grade 4 hematologic toxicity. The best predictive model for hematologic toxicity included diastolic blood pressure, lactate dehydrogenase level, and IADL. The best predictive model for non-hematologic toxicity included the ECOG-PS, MMSE, and MNA scores and regimen toxicity index.

Several studies examined the ability of CGA to predict mortality. Among the studies involving multivariable analysis, Clough-Gorr et al. reported that three or more CGA deficits predicted all-cause and breast cancer-specific mortality at 5 and 10 years after the assessment [46]. Kanesvaran et al. reported age, serum albumin level, ECOG-PS and GDS scores, and cancer stage associated with overall survival in a mixed cancer population [47]. Soubeyran et al. found that advanced disease, a low MNA score, and poor mobility (long timed get up and go test results) predicted early death [48]. Ferrat et al. reported tumor site, metastatic status, age more than 80 years, increased number of severe comorbidities, and malnutrition associated with death independent of functional impairment [49].

Only one study determined factors associated with early functional decline during first-line chemotherapy in older patients and found high baseline GDS and low IADL scores independently associated with increased risk of functional decline [50].

Finally, each CGA domain was associated with chemotoxicity and survival in at least one study. The domains that most often predicted mortality and chemotoxicity were functional impairment and malnutrition.

Conclusion

With its multidimensional character, CGA provides multiple information on the health status of older patients with cancer. The assessment is based on validated tools to systematically assess functional, nutritional, cognitive, emotional, and social status as well as comorbidities. It allows for (1) detecting numerous unrecognized health problems existing in parallel with the cancer, (2) implementing tailored and individualized geriatric interventions to correct the detected health problems, (3) identifying geriatric factors and comorbidities competing with the cancer in terms of mortality risk, and (4) identifying geriatric prognostic factors in terms of treatment feasibility and toxicity risk. In particular, impaired nutritional and functional status can predict mortality and chemotoxicity. Thus, CGA can help oncologists identify older patients with cancer who could benefit from optimal anticancer treatment and those likely to benefit from adapted treatment. Moreover, CGA allows for organizing early medico-psychosocial follow-up and supportive care, before and during the anticancer treatment, to improve treatment safety and to maintain the quality of life of older cancer patients.

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11 Comprehensive Geriatric Assessment in Orthogeriatrics

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11.1 Introduction

Hip fractures (HF) are a major healthcare issue in developed countries characterized by increasing numbers of older adults, being associated with significant mortality, disability, and relevant healthcare costs [1–9]. Although the figures vary considerably in epidemiological studies, the mortality rate is about 10% 1 month after the fracture and up to 30% at 1 year (with some reports describing even higher rates) [1, 3–6]. Functional recovery after HF is strongly dependent on the pre-fracture functional status and on the degree on frailty [2, 7–9]. However, observational studies demonstrated that only about one-third of HF survivors return completely to their previous level of functional ability (in basic activities of daily living) at 12 months after the fracture, with a high rate (up to 15%) of permanent institutionalization [7–9]. Direct hospital costs and rehabilitation expenses are quite relevant, being comparable to those reported for stroke and acute myocardial infarction [10].

The growing awareness of the detrimental consequences of hip and other fragility fractures and the expected rise in the total number of osteoporotic fractures worldwide have led to the development and implementation of integrated models of care alternative to the traditional ones for acute and post-acute management of fractured older adults [1–3]. These services, generically designed as orthogeriatric models, were set to minimize in-hospital complications, streamline hospital care, and provide early and protected discharge with the main objectives of improving

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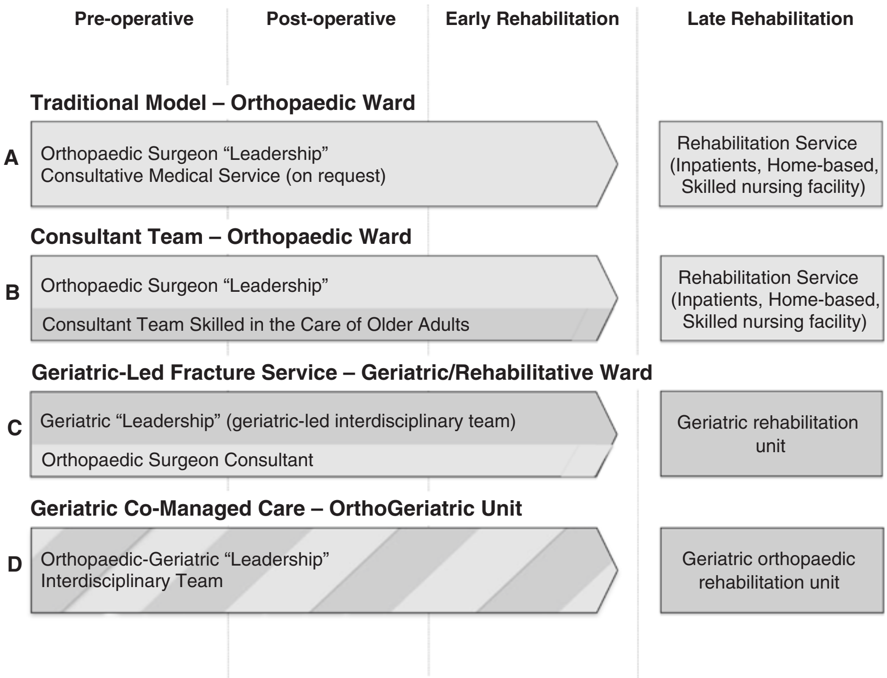

Fig. 11.1 (**A**–**D**) Orthogeriatric models of integrated care for the management of older adults presenting with hip fracture. The models are distinguished by the different healthcare professionals that retain the responsibility for the management of the patients throughout the care pathway. Early rehabilitation usually refers to the first 3–5 days after surgical repair and includes mobilization out of bed and early ambulation, while late rehabilitation refers to exercises and training aimed at recovery of prior functional status. In the traditional model, in-hospital stay lasts about 2 weeks, which includes an important part of rehabilitation, and a significant proportion of subjects may be discharged directly home without further rehabilitation (A). In the most sophisticated model, the rehabilitation ward is a unit specifically designed for the rehabilitation of the geriatric patient (Geriatric Rehabilitation Unit) or even orthopedic geriatric patients (Geriatric Orthopedic Rehabilitation Unit). For further details about the specific models of care see the text

survival, quality of life, functional and clinical outcomes, and reducing healthcare costs associated with HF.

There are a number of recognized features that distinguish these innovative models of care from the traditional ones [1]. These include:

- The different healthcare professionals that retain the responsibility of care during the acute and post-acute phases
- The approach based on comprehensive geriatric assessment (CGA)
- The skilled multidisciplinary team of healthcare professionals
- The setting and care organization of the Orthogeriatric Unit

While differences are recognizable in the huge variety of orthogeriatric models implemented worldwide (Fig. 11.1), regarding, for example, the physician in charge or the organizational setting, the CGA approach by a multidisciplinary team is the most characteristic aspect of all effective examples and is the only one that can successfully face the complex issues surrounding frail older adults presenting with hip or other fragility fractures [1, 11].

11.2 Hip Fracture in Older Adults: The Paradigm of Frailty

In adults or young adults, an osteoporotic or traumatic fracture is usually associated with only transient and/or self-limiting disability and reduced quality of life, since after operative treatment and a variable period of rehabilitation, the patients usually achieve full recovery to their pre-fracture medical and functional status (Fig. 11.2), with only few of them having difficulties in returning to their pre-injury level of function at 12 months [12–14]. This may be also the case of fit and healthy older adults, but that usually represents a very small proportion of HF subjects. Indeed, most HF patients are frail and comorbid and are at high risk of medical and surgical complications, disability, falls, and premature death (Fig. 11.2). Therefore, their medical and surgical management is more complex and tricky compared to younger adults. Moreover, in particularly vulnerable older adults, not only HF but even apparently less "severe" fractures, such as those affecting the wrist, spine, or clavicle, may produce significant disability and impaired quality of life [15–19]. In conclusion, an older adult presenting with a HF may be even more challenging compared to the "traditional" geriatric patient referred to a Geriatric Unit for a non-orthopedic condition, in the light of several additional issues related to the operative and perioperative surgical care.

All these considerations suggest that the HF elderly subject, being a paradigm of frailty, may represent one of the most complex and challenging patient to deal with in the geriatric and orthopedic areas. In this context, the CGA approach, the cornerstone of modern geriatric care, plays a key role in the management of these subjects by influencing decisions on surgical and nonsurgical treatments, on the overall healthcare pathway and rehabilitation, on discharge location and resource allocation [1, 2, 11, 20–24].

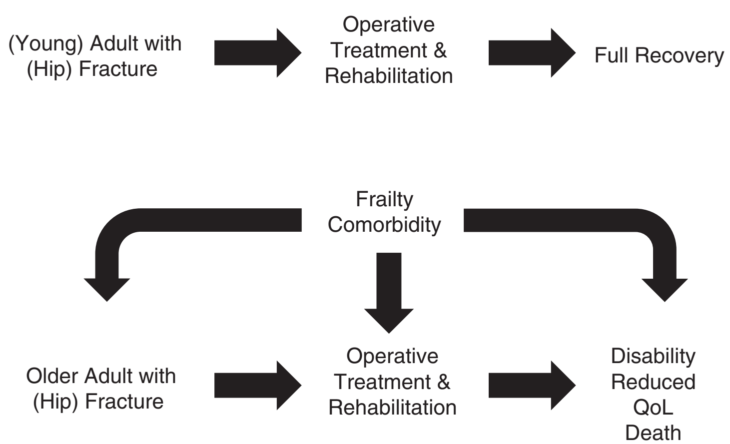

Fig. 11.2 The "fracture pathway" in adults/young adults and in frail and multimorbid older adults

11.3 The Comprehensive Geriatric Assessment Approach in Orthogeriatric Care

In orthogeriatric care, as well as in "traditional" geriatric care, the CGA approach should be defined as a multidimensional, multidisciplinary diagnostic process focused on determining the medical, surgical, psychological, and functional capabilities of the frail HF elderly person in order to develop a geriatric-orthopedic coordinated and integrated plan for the acute and post-acute treatment, and for the long-term follow-up [1, 11, 20–24]. The basic idea is that the early identification of subjects at greatest risk of peri- and postoperative medical and surgical complications and unfavorable outcomes would facilitate the appropriate prevention/management of such complications and improve short- and long-term outcomes after hip or other osteoporotic fractures. These medical/surgical complications and unfavorable outcomes have been characterized by a number of studies and are depicted in Table 11.1 [25–27].

Table 11.1 Common medical and surgical complications and adverse outcomes in HF older adults

Medical complications	Surgical complications	Adverse outcomes
Cardiovascular (acute myocardial infarction, congestive heart failure, arrhythmias)	Surgical site infection (any surgical site infection requiring additional surgery or readmission)	Death
Stroke	Surgical complications requiring surgery (any surgical complication related to treatment requiring surgery or readmission, including periprosthetic fractures)	New functional disability and/or deterioration of functional status
Deep venous thrombosis and pulmonary embolism		Permanent institutionalization
Pulmonary infections		Reduction of quality of life
Septic shock		
Respiratory failure		
Urinary tract infections		
Anemia		
Dehydration/acute renal failure		
Hypotension		
Delirium		
Pressure ulcers		
Gastrointestinal bleeding		
Constipation and intestinal obstruction		
Adverse drug reactions		
Urinary incontinence or retention		
Subsequent fracture		

The key elements of the Orthogeriatric CGA should include: a coordinated multidisciplinary assessment; geriatric-orthopedic medicine expertise; orthopedic surgery expertise; identification of medical, surgical, functional, physical, social, and psychological problems; and the definition of a healthcare plan including early surgery, early mobilization, short- and long-term rehabilitation, and discharge planning [11]. Health status, pre-fracture functional status and mobility, cognition, mood and emotional status, nutritional status, comorbidities and polypharmacy, geriatric syndromes (fall risk, delirium, urinary incontinence, dentition, visual or hearing impairment), and disease-specific rating scale (i.e., dementia) are the standard domains that should be evaluated with the CGA [2, 11]. In addition, there are a number of other domains that may contribute to identify treatment goals, including social supports and interactions, environment, and financial resources [2, 11]. Finally, in the context of fragility fractures, comprehensive fracture risk assessment is extremely relevant in order to minimize the risk of subsequent osteoporotic fractures. This should be based on the implementation of a Fracture Liaison Service and on the use of validated algorithms for absolute fracture risk prediction and standardized tools for fall risk definition [28–32].

There are a huge variety of experiences validating the use of CGA approach in HF older adults [1, 11]. In most of the cases, all the traditional domains of CGA were incorporated, although the tools and scales used were quite heterogeneous. Recently, a systematic review conducted on 56 studies investigated risk factors for institutionalization and mortality post-HF [33]. The results suggested that age and cognitive impairment were the best CGA-based predictors of long-term care placement after HF. CGA-based predictors of increased mortality were age, male gender, disability, coronary artery disease, preoperative anemia, pressure ulcers, and pneumonia, while predictors of subsequent fractures were higher functional level, previous fracture, and falls. These results were in agreement with earlier studies investigating predictors of unfavorable outcomes after HF, evidently supporting and demonstrating that the CGA approach is able to identify HF older adults at risk of adverse outcomes who should undergo a more intensive and/or dedicated approach.

An example of this CGA-based methodology has been proposed by a prospective multicenter cohort study investigating the relationship between functional status, delay to surgery, and adverse outcomes after HF [34]. After adjusting for confounders, the authors reported that surgery delay after HF is an independent predictor for mortality only for the frail older people with pre-fracture functional impairment, thus suggesting that a more intensive approach should be adopted for older people with hip fractures who have pre-fracture disabilities. In order to standardize the CGA approach in the orthogeriatric setting, an exploratory study was undertaken in elderly patients presenting with HF to investigate the predictive ability on adverse outcomes of the Multidimensional Prognostic Index (MPI) [21, 22]. The MPI, calculated from information collected in a standardized CGA, is a validated and accurate index able to predict adverse outcomes in elderly patients [35]. Vitale et al. developed and validated the Ortho-MPI in a retrospective study of HF subjects [21, 22]. This standardized comprehensive orthopedic-geriatric assessment incorporating information about depressive symptoms, cognitive, functional (basic and instrumental activities of daily living) and nutritional status, laboratory tests, risk of pressure sore, and comorbidity demonstrated a correlation with 6-month mortality. Further validation studies of the Ortho-MPI are ongoing, but these preliminary data, if confirmed, should encourage its implementation as a standardized CGA approach useful to predict adverse outcomes and improve the assessment and decision-making process in older adults with HF.

11.4 Orthogeriatric Models of Integrated Care: Optimal Setting and Care Organization

Innovative models of integrated care for the management of older orthopedic patients, particularly HF, have been developing for over 30 years, with the first studies comparing the traditional model with orthopedic-geriatric inpatients services [1, 2]. In the traditional model (Fig. 11.1A), the fracture patient is admitted to the orthopedic ward, where the orthopedic surgeon is solely responsible for the care of the patient. Medical queries and complications are dealt by a consultative medical service when the surgeon considers it required. In general, the rehabilitation is started in the orthopedic ward, but the post-acute rehabilitative phase after discharge is fragmented and not standardized, depending upon whatever post-acute care services are available in the community. Following early experiences of integrated orthopedic-geriatric care, which introduced a range of simple variations to the traditional approach, a number of more complex and systematized alternative models were developed during the last 30 years. These services can be broken down into just three main models illustrated in Fig. 11.1B–D [1, 2].

The geriatric consultant team in the orthopedic ward is a variation of the traditional model and was the first developed (Fig. 11.1B). The main features characterizing it are [1]: (1) the overall responsibility is under the orthopedic surgeon and the orthopedic surgical staff; (2) a geriatric team including several different healthcare disciplines collaborates in the management of the patients during the acute and post-acute phases; (3) there is a regular input by the geriatric consultant team; and (4) early discharge programs and post-acute healthcare pathways are defined and implemented. The geriatric team contribution could start early after admission or postoperatively. Weekly or more frequent rounds are held, and the orthopedic surgeon is responsible for all main clinical and surgical decisions, including early mobilization, discharge timing, and location. Summarizing available evidences, the implementation of a geriatric consultant team in the orthopedic ward demonstrated some additional benefit over traditional care only when the multidisciplinary team (implementing the CGA approach) was involved early in the process of care [1, 36].

The geriatric-orthopedic co-managed care is the most sophisticated model implemented for the management of older adults with hip or other osteoporotic fractures (Fig. 11.1D) [1, 37]. The key and characterizing feature is the co-management of the patient by a geriatrician and an orthopedic surgeon that share the leadership responsibilities and clinical decisions from admission in the Orthogeriatric Unit to discharge. Clinical decisions that are usually considered to be a surgical competence (e.g., timing and choice of surgery) are shared and discussed. An interdisciplinary team of healthcare providers skilled in the care of geriatric-orthopedic patients supports the codirection. This model is also characterized by the implementation of standardized patient-centered, protocol-driven treatments and interventions. The geriatric-orthopedic co-managed care service has been demonstrated in RCTs, observational studies, and meta-analyses to be a valuable and more effective alternative to the traditional model, producing better short- and long-term outcomes [1, 36]. These significant results were probably the consequence of the optimal clinical coordination between the two figures directly involved (geriatrician and surgeon) and of the implementation of a standardized CGA approach (involving also the orthopedic surgical staff).

The Geriatric-Led Fracture Service with orthopedic consultant is a quite unique model firstly implemented in Israel in 1999 and recently adopted in other countries (Fig. 11.1C) [1, 38]. The overall management and healthcare pathway take place in the geriatric ward with the geriatrician as the primary attending physician with complete responsibility for all patients from hospital admission to discharge. During the perioperative phase, the therapeutic and surgical choices are shared with the orthopedic surgeon and the anesthesiologist, while in the postoperative phase, the surgeon consults until the patient has achieved complete wound healing. An interdisciplinary team is integrated in the service, and standardized protocols are implemented. Usually the HF patient is admitted directly to the geriatric ward from the emergency department, where he/she is prepared for surgery. After the operating room, he/she returns to the geriatric ward. The post-acute rehabilitative phase may take place in the same setting under the care of the same interdisciplinary team producing a continuum of care, or in the community at home or within a skilled nursing facility. The Geriatric-Led Fracture Service with orthopedic consultant has been demonstrated to be feasible, applicable, and effective in terms of functional outcomes when the overall care takes place in the same setting [1, 36]. The potential beneficial effects of a Geriatric-Led Fracture Service with orthopedic consultant in which the geriatric leadership is limited to the acute phase and the post-acute rehabilitation takes place in the community still need to be addressed, even if a separation of the intensity of care from the acute to the post-acute phase appears to have some economic advantages [1].

11.5 Conclusions: What's Next?

The implementation of orthogeriatric services, integrating the traditional geriatric competences, particularly the CGA approach, has significantly improved the care of frail older adults presenting with hip or other osteoporotic fractures. On the basis of available data, it is still uncertain which model, setting, and care organization is optimal in terms of short- and long-term outcomes or more cost-effective. Moreover, there is still insufficient evidence to draw conclusions about how effective these services are for particularly frail and vulnerable patients, such as those with pre-fracture cognitive impairment or severe disability. However, the most complex and sophisticated orthogeriatric models characterized by a standardized CGA approach, a multidisciplinary team, and a co-managed care have been shown, in randomized controlled studies (RCTs), before-after trials, and meta-analyses, to produce better outcomes compared to the traditional or simplest ones [1, 36]. Well-designed and head-to-head RCTs are warranted to directly compare the different models and to investigate their efficacy in specific high-risk subgroups of patients. Finally, although CGA methodology has been demonstrated to be an effective and crucial approach to optimize the short- and long-term outcomes of the orthogeriatric model, a better standardization, validation, and implementation of an orthogeriatric CGA may further improve and optimize clinical and functional outcomes.

Conflicting Interests A Giusti has received consulting fees from bisphosphonates, teriparatide, and denosumab manufacturers: Abiogen, Merck & Co, Chiesi, Amgen, and Eli Lilly.

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Comprehensive Geriatric Assessment in Patients with Organ Failure

12

Nicola Veronese, Anna Maria Mello, Clarissa Musacchio, and Alberto Pilotto

12.1 Cardiovascular Diseases

Cardiovascular diseases (CVD) are the main cause of morbidity and mortality among the adults aged 65 and older, affecting approximately 40 million individuals in the United States. For individuals over the age of 80 years, the prevalence of CVD reaches 83% of men and 87% of women [1]. Nowadays, due to evolving technical innovations, a wide number of older patients, previously considered as "ineligible," can be treated with devices, procedures, and pharmacological therapies [2]. In this contest, the issue of appropriate patient selection has become crucial in clinical practice. Indeed, on the one hand, there is need to avoid undertreatment of older adults based just on the "chronological age" criterion, while on the other hand, it is more and more important to optimize resource allocation to prevent patients from receiving costly and futile interventions [3].

The majority of standardized scores for risk stratification in CVD have been developed and validated in middle-aged adults. However, in the very elderly, their value in discrimination between benefit and harm from a specific management strategy or intervention is unreliable. Moreover, since frail older people are often excluded from the clinical trials, standardized guidelines are often not useful in the very old adult with significant multi-morbidity, polypharmacy, and in whom goals of care should be focused not only on mortality but also on quality of life and

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maintaining independence [4]. Hence the importance of assessment tools accounting for the complexity of older individuals, which is able to measure the multiple determinants of frailty and to stratify risks due not only to the severity of CVD itself but also on the global and functional status of older persons.

Understanding the relationship between frailty and CVD remains challenging. A bidirectional causal relationship may operate between these two conditions, like a vicious cycle [3, 5]. Traditional CVD risk factors (e.g., obesity, low physical activity) are also significantly associated with the onset of frailty [6, 7], but CVDs are among the strongest contributors to the development of frailty in people with advanced age. Among people with CVD, the presence of frailty increases the risk of falls, institutionalization, hospitalization, and finally mortality [3, 8]. However, since frailty and CVD share some common pathways (e.g., low-grade inflammation, insulin resistance, and short telomere length) [9], increasing research is showing that frailty could be considered a potential CVD risk factor [10–12].

In this perspective, interventions aimed to break this vicious cycle earlier in the disease course would be able to enhance global physiological reserve and to improve outcomes [13]. On the other hand, at a clinically manifest stage of disease, in order to better assess benefits and risks and avoid over- or undertreatment and resource use, recent guidelines recommend including life expectancy in clinical decision-making paths. The recognition of frail older subjects may enable better estimate of prognosis and consequently avoidance of potentially useless time- and cost-consuming medical interventions in such people [14].

For this reasons very recently, the European Society of Hypertension-European Union Geriatric Medicine Society Working Group on the management of hypertension in very old frail subjects published an expert opinion paper suggesting that therapeutic decisions should be preceded by (1) accurate information on their functional capacity and cognitive status, (2) attention to multiple drug administration, (3) stratification of the frailty status by one of the available rapid methods, and (4) identification and correction of factors or conditions that predispose to common and possible severe adverse effects of treatment [15].

Thus, the clinical approach to older patients with CVD cannot be limited to a traditional, purely cardiological paradigm but should also consider the particularities of these syndromes in late life, which encompass problems in the physical, psychosocial, and cognitive domains. Complex clinical pictures and highly unstable health trajectories distinguish older ill adults, for whom a traditional clinical approach based just on disease-specific guidelines can be misleading with regard to prognosis, resulting in poor quality of care and negative outcomes [16]. Physical performance assessment contributes to functional evaluation and provides valuable prognostic information in older subjects, across a variety of settings and clinical conditions.

One of the most used tools is the *short physical performance battery (SPPB)*, which includes three tests exploring balance, gait, and, indirectly, via repeated chair standing, lower limb strength [17]. Population-based cohort studies have demonstrated that the SPPB is a strong, independent predictor of mortality, institutionalization, and incident disability in old age. In subjects older than 65 years living in the community, the risk of death and disability increased 7–9% for every point reduction in SPPB score, even after adjustment for complex measures of comorbidity [18]. In patient hospitalized for an acute medical event, in most cases congestive heart failure (HF), SPBB is a powerful short- and long-term predictor of global clinical and functional status, length of hospital stay, rehospitalization, or death [19]. SPPB has been applied to elderly patients being discharged from hospital after an episode of worsening HF: the battery accurately predicted 1-year survival independently of demographics, comorbidity, and, notably, also of ejection fraction and New York Heart Association classification, both of which are recognized as cornerstones of risk stratification in cardiac patients [20].

Another widely used measure of physical performance is *gait speed* that has been proposed as a novel "vital sign" for older persons [21] and that has demonstrated to be a good predictor of survival and other strong outcome in older populations [22]. Gait speed is usually evaluated on a short distance (4 or 5 m), walking at a usual, comfortable velocity. Accepted cutoff varies between 0.8 and 1 m/s, depending upon the purpose of the discrimination. In cardiology, gait speed has shown to improve risk stratification for adverse outcomes after cardiac surgery, percutaneous coronary intervention, and transcatheter aortic valve implantation [3, 23]. In particular, in assessing surgical risk for surgical aortic valve replacement, frailty evaluation seems to increase the prognostic value of a traditional validated score, the *Society of Thoracic Surgeon (STS) risk score*. For a given STS risk prediction for mortality or major morbidity, the predicted risk based on the model was 2–3 times greater in patients with slow gait speed vs. patients with normal gait speed.

The *Multidimensional Prognostic Index (MPI)* is a prognostic tool, based on a standardized CGA that has been developed and validated for 1-month and 1-year mortality in two wide cohorts of hospitalized patients older than 65 years [24]. The role of MPI as a prognostic tool for 30-day mortality has been tested even in older adults discharged after hospitalization for HF [25]. In a cohort of 376 patients over age 65 admitted to a geriatric unit with a diagnosis of HF, increasing MPI grades were associated with progressively higher 30-day mortality rates both in men and in women. The discrimination of MPI was also good, with a ROC area for mortality of 0.83 (95% CI, 0.76–0.90) in men and of 0.80 (95% CI, 0.71–0.89) in women. In the same study, MPI has been compared with other "traditional" prognostic scores: the predictive value of MPI was higher than that of the New York Heart Association (NYHA), the Enhanced Feedback for Effective Cardiac Treatment (EFFECT), and the Acute Decompensated Heart Failure National Registry (ADHERE) models both in men and in women. Thus, it appears evident that prognosis of HF in older patients is maybe "not (only) an affair of the heart" [26].

A sensitive measure of the multidimensional impairment such as MPI might be useful in identifying elderly CVD patients with different risk of mortality, who could then be directed to the most appropriate management depending on the individual situation (Table 12.1). In a recent retrospective observational Italian study on 2597 community-dwelling patients aged ≥65 years with a previous hospitalization for coronary artery disease (CAD), authors estimated mortality risk assessed with the MPI, based on the Standardized Multidimensional Assessment Schedule for

Table 12.1 Usefulness of CGA in patients with organ failure

Condition	State of the art	Role of CGA	Future directions
Cardiovascular diseases (CVD)	Association between frailty and CVD is probably bidirectional Equivocal role of medications used for prevention/treatment of CVD in frail older people	Several tools are used for stratifying the prognosis of older people having CVD, particularly related to physical performance/ activity	Interventional trials are needed to confirm the importance of CGA in the prevention and treatment of CVD
Chronic kidney disease	Typical condition of frail older people affected by several comorbidities Could be an early predictor of frailty in older people	CGA-based MPI showed a greater discriminatory power than organ-specific prognostic indexes such as the estimated renal function	CGA as step for identification of people having benefits from renal replacement therapy
Respiratory disorders	Older patient with COPD is a clinical challenge for the presence of comorbidities and other conditions Pneumonia is a relevant problem in the elderly and associated with poor prognosis in frail individuals	Limited evidence regarding the role of geriatric CGA in COPD In pneumonia, CGA-based MPI was better than other common tools in predicting short- and long-term mortality	More studies regarding the efficacy of the CGA in chronic and acute respiratory conditions are needed
Gastrointestinal disorders	Upper gastrointestinal bleedings: poor prognosis in older patients. The risk scores available do not consider important aspects of CGA Liver cirrhosis: prognosis is an important factor for therapeutic/diagnostic interventions, but the scores available seem to have a poor predictive power in older people	In upper gastrointestinal bleedings and liver cirrhosis, CGA is a better prognostic tool than the scores usually adopted for stratifying risk in these subjects	The studies regarding the use of CGA are limited only to upper gastrointestinal bleedings and liver cirrhosis

CGA comprehensive geriatric assessment, *COPD* chronic obstructive pulmonary disease, *CVD* cardiovascular disease, *MPI* multidimensional prognostic index

Adults and Aged Persons (SVaMA). Participants were categorized as having mild (MPI-SVaMA-1), moderate (MPI-SVaMA-2), and high (MPI-SVaMA-3) mortality risk, and propensity score adjusted hazard ratios of 3-year mortality were calculated according to statin treatment in these subgroups. Higher MPI-SVaMA scores were associated with lower rates of statin treatment and higher 3-year mortality. Statin treatment was significantly associated with reduced 3-year mortality irrespective of age and multidimensional impairment, although the frailest patients were less likely to be treated with statins [27].

Similarly, a study of 1827 community-dwelling older persons with atrial fibrillation classified by the MPI into three grades of risk of death demonstrated a benefit of anticoagulation treatment with warfarin, in terms of lower all-cause mortality over a mean follow-up of 2 years, regardless of poor health and functional conditions. Interaction tests showed that reduction of mortality with anticoagulants was higher in subjects with severe multidimensional impairment [28].

A relevant topic in geriatric medicine is the selection of appropriate elderly who can benefit from interventions with invasive therapeutic procedures. In the frame of the MPI_AGE project, a prospective observational study was carried out in consecutive patients aged ≥75 years who underwent transcatheter aortic valve implantation (TAVI). MPI was calculated at baseline and after 1-year of follow-up. Among the 116 patients (mean age 86.2 ± 4.2 years, mean MPI score 0.39 ± 0.13), the mortality rate was significantly different between MPI groups at 6 and 12 months ($p = 0.040$ and $p = 0.022$). Kaplan Meier survival estimates at 1-year stratified by MPI groups were significantly different (HR = 2.83, 95% CI 1.38–5.82, $p = 0.004$). The study indicated that CGA-based MPI was an accurate tool to predict prognosis and contribute to selection of older patients suitable for the TAVI procedure [29].

Figure 12.1 shows a practical approach considering the pivotal role of frailty in determining the appropriate treatment for patients with CVD or at higher risk of these conditions. A formal screening for frailty should be done in every older patient using a validated tool, such as the FRAIL questionnaire [30]. If the individual is at high suspicion of frailty, a CGA should be performed with appropriate tools. CGA-based tools such as the MPI that allow stratification of older patients facilitate clinical decision-making in terms of diagnostic and therapeutic choices. As shown in Fig. 12.1, people at low risk of frailty, i.e., MPI-1, should be treated according to usual guidelines. Conversely, aged individuals at moderate or high risk of frailty (i.e., MPI-2 or MPI-3) should be not managed with tailored interventions according to their frailty profile and prognosis.

12.2 Chronic Kidney Disease

Chronic kidney disease (CKD) is a typical age-related condition due to physiological decline in glomerular filtration rate (GFR) with a progressive increased burden of multi-morbidity and decrease in survival. Indeed, it dramatically impacts survival and other major health outcomes in the general and in many selected populations. CKD is a common condition worldwide, with a prevalence ranging from 5.8 to 13.1% in different countries [31], and is particularly common in the older population. Aging, hypertension, diabetes, and cardiovascular diseases are important determinants of CKD [32], but some cases of CKD are of unknown etiology [33].

Kidney disease is associated with physiological changes that may predispose to frailty. A recent study of Cardiovascular Health Study participants found that worse kidney function was independently associated with higher risk of prevalent and incident frailty among older community-dwelling adults [34].

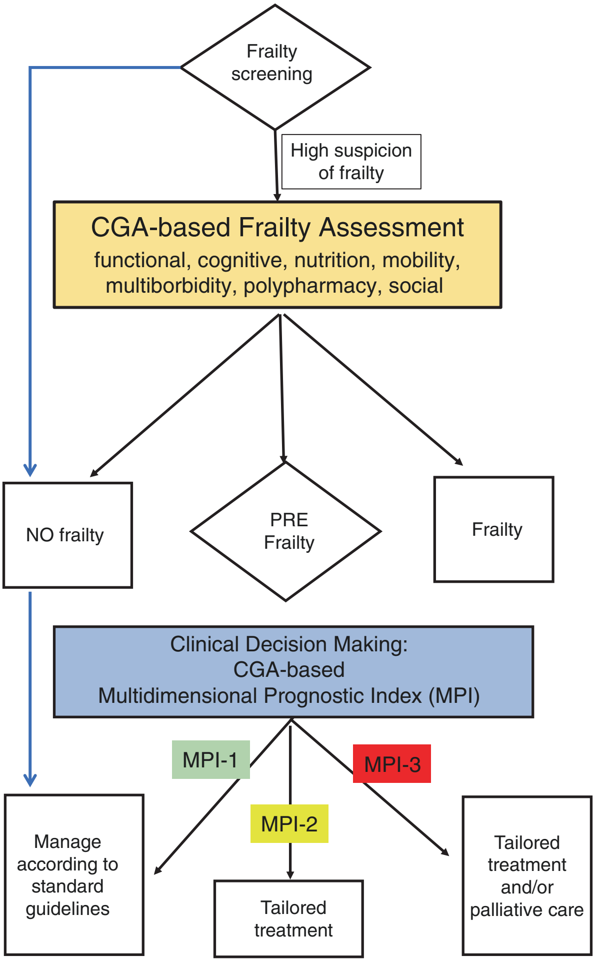

Fig. 12.1 A practical decisional algorithm considering the pivotal role of frailty in determining the appropriate management for patients with CVD or at higher risk of these conditions

Epidemiologic data suggest that individuals with all stages of CKD have a higher risk of developing cognitive disorders and dementia, two conditions closely associated with frailty. Although it is sometimes subtle, CKD may interfere with the comprehension and decision-making of these individuals. Lower cognitive scores and worse executive function and memory are associated with an increased risk of mortality. Dementia further worsens the adverse outcomes, including disability, hospitalization, dialysis withdrawal, and mortality. Thus, CKD is a potential cause of frailty and cognitive impairment [35].

CKD in older persons was significantly associated with poor prognosis because of cognitive and functional decline [36] and worsening of physical performance and frailty, with elevated risks of death and disability [37]. More recent studies explored how frailty is measured in patients with CKD and the association between frailty and adverse outcomes across different stages of renal impairment [38].

The prevalence of frailty ranged from 7 to 42.6% in pre-dialysis patients [39], being higher (73%) in patients undergoing dialysis [40]. Interestingly, patients with CKD who were frail were at increased risk of mortality and hospitalization independently of kidney function [41–43].

The prognostic evaluation of elderly patients with CKD plays a key role in decisions about care processes including the organization of the healthcare system and support to families, caregivers, and patients, as well as the choice of appropriate treatment. For many older adults who meet criteria for CKD, an individualized patient-centered approach may have more to offer than the traditional disease-oriented approach.

An important feature of the individualized approach is that it can always accommodate disease-based treatment strategies if these are aligned with patient goals and preferences [44]. The mechanism of chronic kidney disease-induced physical frailty and cognitive impairment suggests that multidimensional interventions may be effective therapeutic strategies in the early stage of chronic kidney disease [35].

Several studies reported that comprehensive geriatric assessment (CGA) may be useful in approaching the older patients with CKD to identify specific functional, cognitive, and psychosocial impairments and to manage personalized care. In a study involving 50 older patients undergoing dialysis, the authors found that in this population somatic and psychosocial problems were very frequent e.g., polypharmacy (94.6%) and depression (24.5%) and prevalence of most geriatric conditions was comparable to those in elderly cancer patients [45].

Recently, the MPI has been tested on a sample of 786 hospitalized patients aged 65 years or older (mean age 80.8 ± 6.5 years) with moderate-severe CKD (eGFR <60 mL/min). Higher MPI grades, indicating higher multidimensional impairment, were significantly associated with progressively higher 1-year mortality rates, with almost 40% mortality in the highest third class of MPI. Moreover, a direct comparison of the areas under the ROC curves of the MPI versus the eGFR demonstrated that the MPI had a significantly higher accuracy than the eGFR in predicting mortality (ROC curve for MPI 0.70; 95% CI, 0.66–0.73 vs. eGFR 0.58; 95% CI, 0.54–0.61; $p < 0.001$). So, MPI showed greater discriminatory power than the organ-specific prognostic index [46]. Similar results have been confirmed with longer follow-up: MPI added to the eGFR significantly improved the prediction of 2-year all-cause mortality [47] (Table 12.1).

End-stage renal failure affecting older patients presents a therapeutic dilemma. The majority of patients starting renal replacement therapy (RRT) are over 75 years old. Several factors have contributed to this increase: (1) the attitude toward chronological age as a factor in therapeutic decisions has changed, (2) modern techniques make dialysis better tolerated, and (3) effective treatments of anemia and mineral metabolism are available. The increased incidence of diabetic nephropathy, vascular diseases, endovascular procedures, congestive heart failure, and use of nephrotoxic drugs are all frequent causes of RRT in older people. Consequently, a high prevalence of impairment in physical and psychosocial domains, such as ADL dependency, cognitive impairment, depression, and malnutrition, can be found in the dialysis population. Accumulation and interaction of impairment in multiple domains may contribute to increased vulnerability to external stressors, also referred to as the (renal) frailty phenotype.

This complicates treatment decisions in vulnerable and elderly patients with end-stage renal disease (ESRD). Conservative care has become an accepted alternative to dialysis for discussion with selected patients with ESRD who may not benefit from dialysis. There is general consensus that chronologic age is not a useful selection criterion here, because aging is a heterogeneous process. Patients who enter dialysis therapy will more frequently have geriatric impairments and a considerable comorbidity burden. The most vulnerable among these patients might benefit from conservative therapy. The assessment of geriatric impairments could contribute to the decision-making process of dialysis initiation, although information is limited as a systematic assessment of multiple domains with respect to poor outcomes has not been performed. Because a geriatric assessment has proved useful in predicting outcome in other medical fields, its potential role in the ESRD population should be the subject of future research [48].

12.3 Respiratory Disorders

Respiratory diseases are common conditions in older subjects. For example, chronic obstructive pulmonary disease (COPD) affects 10% of the general population aged over 65 years, being 50% in heavy smokers [49].

Since COPD is associated with several negative outcomes, including higher mortality and disability risk [50], it is important to have prognostic tools for appropriate clinical decision-making in these individuals. In a large systematic review including 15 indices, 21 predictors, and 7 outcomes (such as mortality and hospitalization), only 1 index seems to be reliable for application in daily practice [51]. All these indices are based on instrumental (such as oxygen saturation) and/or clinical parameters (such as presence of dyspnea), but they do not include any parameter such as disability or cognitive impairment useful for stratifying prognosis in older patients.

The older patient with COPD represents a clinical challenge for several reasons. First, FEV1, the most common tool for evaluating respiratory function in COPD, may not be appropriate. Frailty and dementia, in fact, prevent about one-fifth of people over 65 years old from reaching a high-quality spirometry making this instrument a less reliable tool for the diagnosis of COPD [52]. Second, the evaluation of dyspnea in COPD is often problematic due to the frequent increase in dyspnea threshold with age, physical impairment, and other medical conditions such as heart failure negatively affecting respiratory function. Finally, indices of exercise capacity that require sufficient locomotor function are poorly reliable in older subjects, even if of possible importance. For example, slow 4 m gait speed independently predicts the risk of readmission in older patients hospitalized for exacerbation of COPD [53]. For all these reasons, the prevalence of COPD in the older population is probably underestimated, particularly in frail people who may be more affected by the condition [54].

The role of prognostic tools important in geriatric medicine is unfortunately limited in patients with COPD (Table 12.1). In 707 patients with COPD, the use of BODE (BMI, obstruction, dyspnea, exercise) score poorly predicts the risk of overall mortality [55]. Other authors have proposed modified scores to better account for the peculiarity of geriatric patients. Using the quasi-BODE index, a multidimensional health status instrument based on the BODE index with the addition of simple measures of physical and respiratory function, there was a significant improvement in the prediction of death in older people affected by COPD, compared to BODE alone [56].

Interestingly, only a quarter of older people affected by COPD die for respiratory causes [57], suggesting that other factors are important for determining poor prognosis in older people with COPD. In one study involving 816 outpatients, the authors found that frailty (defined using the Fried's criteria) affects one in four patients with COPD referred for pulmonary rehabilitation, being an independent predictor of poor compliance to a rehabilitation program [58]. In another work, sarcopenia (a state of early frailty) is a common condition in older people with COPD (15%) but reversible if treated with appropriate rehabilitation programs [59]. Moreover, older people with COPD experience multiple clinical management problems, and these issues may not be addressed using the current COPD management guidelines. Thus, the management of older people usually requires a CGA, in order to better assess the importance of conditions other than COPD [60].

Although respiratory diseases are common in the older population, the literature regarding use of CGA is limited. For example, pneumonia is common and associated with higher hospitalization and mortality rates [61]. One of the few studies exploring the role of CGA in predicting outcomes with pneumonia included 134 hospitalized older patients. In this study, MPI was better than the commonly used pneumonia severity index (PSI) in predicting short- and long-term mortality [62]. These findings suggest that MPI might be useful in distinguishing older patients with different mortality risks and who therefore probably need a different intensity of diagnostic and therapeutic interventions (Table 12.1).

In conclusion, the literature regarding the use of CGA in respiratory diseases is promising but unfortunately limited to few studies. The tools available (although multidimensional) mainly include parameters associated with respiratory function, but they do not include some aspects typical of geriatric evaluation such as disability or frailty. There are additional issues that could be addressed and require further consideration, such as end-of-life care and whether disease severity using validated tools in middle-aged people has an impact on problem assessment and management in older patients [63]. More studies are needed in order to enable tailoring appropriate diagnostic and therapeutic interventions specific for older people.

12.4 Gastrointestinal Disorders

The literature regarding CGA in gastrointestinal disorders is mainly limited to upper gastrointestinal bleedings and liver cirrhosis.

12.4.1 Upper Gastrointestinal Bleeding

Upper gastrointestinal bleeding is defined as bleeding derived from a source proximal to the ligament of Treitz and can be divided in variceal or nonvariceal hemorrhage and as acute (presenting with hematemesis, melena, and/or hematochezia), or chronic, usually suspected as occult gastrointestinal blood loss or anemia. Upper gastrointestinal bleeding remains a significant cause of hospitalization: the mortality related to this condition is about 14%.

Due to the high mortality rate, several scoring systems have been developed to early identify the individuals at higher risk of rebleeding and/or mortality who are candidates to be intensively treated (e.g., with transfusions and/or endoscopic or surgical interventions), while the use of prognostic systems might also be useful to identify patients at lower risk of mortality, who could be discharged early from the hospital or even be treated as outpatients.

The Rockall score is a widely used tool able to predict the risk of rebleeding and mortality, based on age, clinical parameters (heart rate, blood pressure), comorbidities (presence of heart, renal and/or liver failure, and coronary heart disease), and endoscopic presence of recent hemorrhage. However, the use of this tool led to equivocal results [64, 65]. For this reason, Blatchford and colleagues reported a new prognostic index based on pre-endoscopy evaluation [66]. Based on clinical parameters (blood pressure, heart frequency, syncope, or melena), comorbity (liver and heart failure), and laboratory exams (hemoglobin and urea levels), this score seems to have a high sensitivity for identifying high-risk patients (almost 100%) but poor specificity (13%) [67, 68].

These two scores were validated and used in young subjects, but a large study of nearly 10,000 cases of upper gastrointestinal bleedings occurring in older subjects demonstrated that, although patients were selected for outpatient management based on clinical criteria, the overall mortality remained high, suggesting that in older patients better discrimination of candidates for in- or outpatients management is needed [69].

These findings suggest that the Rockall and Blatchford scores are probably unreliable tools for the older patient presenting with an upper gastrointestinal bleeding, since such patients typically have a multitude of other disorders and age-related conditions that complicate diagnosis and treatment choices, such that CGA may be particularly valuable [70]. With this aim, a study was carried out in patients having a mean age of 83 years (range 70–101 years) hospitalized for upper gastrointestinal bleeding. In these patients, higher CGA-based MPI grades were significantly associated with progressively higher 2-year mortality rates, even after adjusting for potential confounders [71]. Another study comparing the prognostic value for short-term (1 month) mortality of the MPI with disease-specific predictive tools such as the Rockall and Blatchford scores in older patients with upper gastrointestinal bleeding evaluated 91 patients aged over 65 years with an endoscopic diagnosis of nonvariceal upper gastrointestinal bleeding [74]. The overall mortality rate at 1 month was high, 13.2%. Higher MPI grades were significantly associated with progressively higher mortality, and MPI had greater discriminatory power than Rockall and Blatchford scores (Table 12.1). It is noteworthy that in this population, the prevalence of several prognostic factors (e.g., hemoglobin levels, urea blood levels, NSAID use, and percentages of patients who needed transfusions) did not differ by age suggesting, again, that these predictive factors are probably not tailored for older patients.

12.4.2 Liver Cirrhosis

The prognosis of older patients with liver disease (particularly cirrhosis) may be influenced by a combination of biological, functional, pathological, and environmental factors. Several tools identifying high-risk patients have been reported, but none of these used a multidimensional approach, probably limiting their use in older patients.

The Child-Pugh score is widely accepted as a grading system for the prognosis of patients with cirrhosis and esophageal varices [72]. Although it was originally used to predict death during surgery, it is used not only for assessing prognosis but also the necessity of liver transplantation. The score employs five clinical measures of liver disease (encephalopathy, ascites, bilirubin, albumin, and INR).

The model for end-stage liver disease (MELD) score is another common tool [73] initially developed to predict survival in patients with complications of portal hypertension, but like the Child-Pugh score, it is the standard on which most decisions regarding liver transplantations are taken.

Even if these tools are of importance, for the same reasons given for upper gastrointestinal bleedings, they seem to be poorly tailored for older individuals. In one study 154 patients aged 65 years or more were discharged from the hospital with a diagnosis of liver cirrhosis. In this population, higher MPI grades were significantly associated with progressively higher short-term and long-term mortality rate. In 129 of these patients, a Child-Pugh score was also calculated. The area under the ROC curve calculated for MPI was significantly higher than for the Child-Pugh score, suggesting that in this population of older patients, MPI had a better discriminatory power (Table 12.1) [74].

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Comprehensive Geriatric Assessment in Perioperative Medicine

13

Jugdeep Dhesi and Judith Partridge

13.1 Perioperative Medicine in Older People

Increasing numbers of older people are undergoing both emergency and elective surgery. This is due to several factors: first, changing demographics, with the age over 75 now constituting the fastest growing age cohort in the developed world; second, the association between ageing and degenerative, neoplastic and metabolic disease (e.g. osteoarthritis, bowel cancer and peripheral vascular disease), conditions for which surgery is often the mainstay of treatment; and third, advances in surgical technique, for example, minimally invasive techniques, which may be associated with less surgical stress and therefore more acceptable to older patients. Furthermore changing public, patient and health care professional attitudes and behaviours mean that older people increasingly seek and receive equal access to surgical interventions.

The surgical literature demonstrates that older people benefit from surgical intervention, both in terms of symptomatic relief and improved survival. However, it is also apparent that in comparison to younger patients, older patients are more likely to have adverse postoperative outcomes [1]. Examination of the literature suggests that it is not age per se which confers a less favourable risk profile, rather the accumulation of age-related physiological decline and increased frequency of multimorbidity and geriatric syndromes, such as frailty and cognitive impairment. The interplay of these factors results in a pathophysiological profile associated with an increased risk of adverse outcome [2].

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There is a wealth of data examining postoperative morbidity and mortality across surgical specialties particularly examining the relationship with age. This data demonstrates that older people across a variety of surgical subspecialties are more likely to have postoperative complications in comparison to younger patients. These postoperative complications are predominantly medical as opposed to surgical: for example, studies in colorectal surgery demonstrate no increase in rates of anastomotic leak with advancing age but instead show higher rates of respiratory decompensation, cardiac events and acute kidney injury. The increase in medical complications seen in older patients is relevant because of the clear association seen between postoperative medical complications and both immediate and longer-term mortality rates [3]. This may potentially explain the higher mortality rates observed in the over 80s in comparison to the under 80s across most surgical subspecialties.

Whilst organ-specific medical complications and mortality rates are important postoperative measures, there is an increasing emphasis on patient-reported outcomes and geriatric syndromes after surgery. These include postoperative cognitive and functional deterioration. Literature shows that postoperative delirium is common and has lasting implications for patients with an observed deterioration in cognitive trajectory, increased rates of institutionalisation and psychological sequelae relating to the associated distress [4]. Similarly although limited, studies have shown that functional recovery from surgery is slower in older than in younger people, can take up to 6 months and can result in an increased level of dependency [5].

13.2 Comprehensive Geriatric Assessment in Perioperative Medicine

Perioperative medicine aims to provide best care before, during and after surgery, in order to reduce variation in practice and to improve clinician-reported, patient-reported and process-related outcomes. To achieve this, surgical patients require holistic assessment and optimisation, shared decision-making and consistent hands-on follow-up. This is clearly a complex multicomponent intervention which needs to be underpinned by a multidomain, multidisciplinary methodology such as comprehensive geriatric assessment [6].

Applying comprehensive geriatric assessment to the perioperative pathway involves:

- Proactive identification, assessment and optimisation of physiological status, multimorbidity and geriatric syndromes and the predictors of adverse outcome
- Shared decision-making, ensuring the patient receives the appropriate intervention whether surgical or conservative
- Anticipation, prevention and modification of potential postoperative complications with a focus on reducing the incidence and severity of complications

Together, this approach positively impacts mortality, length of hospital stay and healthcare resource use.

In practical terms this requires the same steps as conducting comprehensive geriatric assessment in other clinical settings:

- Describe recognised and previously unrecognised disease, geriatric syndromes and functional limitations thorough medical history (with collateral if necessary) and physical examination
- Appropriate and targeted investigations (laboratory and radiological)
  - Agree the goals of treatment with the patient, taking into account the individualised assessments of potential benefits, risks and burden, and the patient's preferences and priorities
  - A multidisciplinary 'hands-on' approach from the preoperative period through to post acute recovery and rehabilitation phases ensuring a focus on both short-term and longer-term goals

Whilst these steps are similar to those undertaken in other clinical settings, they require adaptation to the differing timeframes of elective, urgent planned and emergency surgery. For example, using comprehensive geriatric assessment to prepare a patient for a joint replacement will require a different approach to that needed for a patient listed for an emergency laparotomy for bowel obstruction secondary to malignancy.

13.3 Comprehensive Geriatric Assessment in the Preoperative Setting

Conducting effective comprehensive geriatric assessment in the preoperative setting requires a thorough knowledge of frequently encountered postoperative complications and the risk factors for developing these adverse events. These complications include surgical and medical complications, functional deterioration with delays to transfer of care or discharge home and changes in the underlying trajectory of disease (e.g. delirium changing the trajectory of underlying cognitive impairment). This should prompt the multidisciplinary team to use comprehensive geriatric assessment to:

a. Describe and optimise recognised disease.

For example, the patient might be a smoker with a diagnosis of chronic obstructive pulmonary disease (COPD) presenting for elective abdominal aortic aneurysm repair with a self-reported exercise tolerance of 50 m. Tailoring comprehensive geriatric assessment in this perioperative scenario involves:

- Objective evaluation of known COPD using history (length of diagnosis, symptoms, frequency of exacerbation, prior need for invasive medical support, etc.), examination (including appraisal of respiratory reserve using tool such as 6 min walk test or shuttle walk) and investigation (pulmonary function tests)
- Multidisciplinary optimisation including referral for smoking cessation, pulmonary rehabilitation (which may be undertaken preoperatively or scheduled

postoperatively depending on surgical urgency), appropriate prescribing according to current guidelines and evaluation of inhaler technique
- Shared decision-making regarding risk/benefit of undertaking life-protracting surgery in a patient with coexistent life-limiting condition causing functional impairment
- Individualised perioperative care plan, for example, recommending appropriate use of postoperative level 2/3 care
- Proactive multidisciplinary postoperative management planning including setting target oxygen saturations, early postoperative mobilisation, etc.

b. Identify and optimally manage previously unrecognised disease.

For example, a patient with a new finding of atrial fibrillation (AF) presenting in preparation for transurethral resection of prostate gland is at increased risk of late cancellation of surgery due to inadequate rate control, intraoperative and postoperative fast AF and longer-term risk of thromboembolic stroke. Tailoring comprehensive geriatric assessment to this perioperative scenario involves:

- Screening for AF (a common cardiac arrhythmia prevalent in older patients) using preoperative ECG.
- Investigation for possible underlying causes, e.g. hyperthyroidism, alcohol excess, hypertension and managing these accordingly.
- Preoperative treatment informed by the decision to rate or rhythm control. This should take the timing and indication for surgery into account. For example, in cancer surgery, postponing the procedure in order to electrically cardiovert with the necessary prior of anticoagulation may not be appropriate. Instead the emphasis should be on rate control using evidence-based guidelines extrapolated to the perioperative setting, e.g. using beta blockers as opposed to digoxin for rate control.
- Standardisation of perioperative management, for example, ensuring magnesium is replaced, and continuation of rate/rhythm controlling medications throughout the perioperative period.
- Longer-term management with reconsideration of the rate or rhythm strategy and evaluation of stroke risk and need for anticoagulation.

c. Tailor the assessment and management to the available timeline.

For example, a patient is presenting with acute bowel obstruction secondary to incarcerated inguinal hernia with resultant acute delirium. Tailoring comprehensive geriatric assessment to this perioperative scenario involves:

- Rapidly obtaining collateral history regarding premorbid cognitive issues, medical multimorbidity and functional status

– Assessment of capacity regarding treatment options (conservative/palliative/operative management) and identification of any legal arrangements for proxy decision-making (such as lasting power of attorney in England)
– Preoperative medical optimisation including analgesia, volume resuscitation, antibiotics and optimisation of other comorbidities (e.g. iron deficiency anaemia management)
– Perioperative planning including relevant use of level 2/3 care and ensuring appropriate ceilings of care
– Standardisation of postoperative care particularly using an evidence-based approach to the management of postoperative delirium (e.g. HELP) and associated risks, e.g. falls
– A proactive rehabilitation strategy with clear goal setting and multidisciplinary decision-making regarding place of discharge (rehabilitation in bed-based unit, rehabilitation and care provision at home, need for institutional care, etc.)
– Longer-term management with memory service evaluation

d. Pre-emptively consider the discharge plan from hospital even prior to admission.

For example, a patient is listed for elective hip arthroplasty who is sleeping downstairs on the sofa and currently unable to manage personal activities of daily living because of pain and functional limitation due to rheumatoid and osteoarthritis. Tailoring comprehensive geriatric assessment to this perioperative scenario involves:

– Screening for issues related to the pre-existing musculoskeletal conditions known to be relevant in the perioperative period and providing individualised plans for managing these (stopping non-steroid anti-inflammatory medications due to renal risk, providing a perioperative plan for increased steroid cover in those on long-term exogenous steroids, evaluating cervical spine stability and movement in preparation for intubation, etc.)
– Proactive multidisciplinary optimisation of functional limitation and domestic environment thus preventing an elective admission without a clear discharge strategy (this may involve establishing a micro-environment downstairs in order that the patient does not need to use the stairs, providing carers to facilitate activities of daily living, use of equipment to promote independence, referral for exercise programmes aimed at improving function and reducing falls, providing clear expectations regarding length of hospital stay to the patient and their family, etc.)
– Standardised postoperative management including analgesic strategy, therapy goals, discussion at ward level multidisciplinary team meeting, estimated discharge date setting, etc.

13.4 Comprehensive Geriatric Assessment to Facilitate Shared Decision-Making

The established methodology of comprehensive geriatric assessment utilises tools to help objectively describe different aspects of health status. For example, these may include tools to assess activities of daily living or severity of depressive symptoms. Similarly there are tools that are specific to perioperative risk which can be incorporated into preoperative comprehensive geriatric assessment. Examples include the Physiological Operative and Severity Score for the enUmeration or Mortality and Morbidity (POSSUM), Surgical Outcome Risk Tool (SORT) or more organ-specific scores such as the Lee cardiac index describing cardiac risk following different types of surgery [7]. These tools have an established evidence base and can be useful on a population basis or in the research setting. Within an older population such risk prediction tools can be less discriminatory due to the universal inclusion of age. Furthermore tools focussing on organ-specific risk are less useful in a population with multimorbidity. For this reason risk prediction tools should be used in the context of the multidomain comprehensive geriatric assessment in order to facilitate shared decision-making between patients, relatives or carers, surgeons, anaesthetists and geriatricians. This process can be supported by decision-making tools which incorporate patient information. For example, in an older patient with stage 4 chronic kidney disease due to diabetic nephropathy presenting with an abdominal aortic aneurysm, comprehensive geriatric assessment with risk prediction tools will help describe the risk-benefit ratio of proceeding with surgery. This can be presented to the patient and their family as follows:

- Benefits of surgery
  - Reduced risk of rupture with associated death: risk can be estimated according to the aneurysm size amongst other factors
- Risks of surgery
  - Risk of acute kidney injury necessitating renal replacement therapy which may be permanent
  - Risk of perioperative (30 days) mortality
- Burden
  - Psychological stress associated with surgery and hospitalisation
  - Postoperative pain and (temporarily) reduced functional ability

Supporting the process of shared decision-making also involves the provision of anticipatory advanced care planning if surgery is declined. This may include liaison with primary care and ambulance services regarding not admitting to hospital in the event of rupture and referral to community palliative care services to ensure that medicines to palliative symptoms at the end of life can be rapidly accessed.

13.5 Comprehensive Geriatric Assessment in the Postoperative Setting

Application of comprehensive geriatric assessment in the postoperative setting will vary according to whether the patient presented electively or as an emergency. Elective patients who have already undergone preoperative comprehensive geriatric assessment can be followed up on the ward ensuring that anticipated postoperative complications are proactively identified and managed whilst employing multidisciplinary interventions to efficiently rehabilitate and plan discharge. For example, in a patient with chronic obstructive pulmonary disease, the postoperative plan may involve close monitoring by nursing staff with clear oxygen saturation targets, early mobilisation and positive incentive spirometry exercises by physiotherapy, review by pharmacists of inhaler technique with employment of spacer devices as needed and planned early escalation to nebulised therapy and antibiotics by the medical team if sepsis symptoms develop.

In a similar way, comprehensive geriatric assessment can be used to identify the need for multidisciplinary input in those patients admitted in a semi-urgent or emergency fashion. For example, in a patient with critical limb ischaemia who undergoes urgent revascularisation, comprehensive geriatric assessment and optimisation may involve: Obtaining a telephone collateral history in order to describe premorbid cognition and assess ongoing delirium risk

Prompt medical treatment of previously undiagnosed prostatic enlargement in an attempt to mitigate risk of postoperative urinary retention

Nutritional assessment and optimisation by dietician to promote wound healing (such as rapid replacement of soluble vitamins and minerals, plus proactive nutritional supplementation)

Early assessment of domestic environment by occupational therapy to identify and mitigate obstacles to functional independence when returning home

13.6 The Evidence for Comprehensive Geriatric Assessment in Perioperative Care

Despite the established evidence for comprehensive geriatric assessment in medical inpatients and community-dwelling older people, there is less literature to support the use of comprehensive geriatric assessment in the perioperative setting. A systematic review conducted in 2014 identified five studies, two randomised control trials and three before and after intervention studies [8]. The main limitation of these studies was the lack of inclusion of all components of comprehensive geriatric assessment: assessment, optimisation and follow through, with a focus on assessment only. Other methodological limitations included period effect in the before and after studies and lack of blinding with subjective observer bias. The heterogeneity of the studies precluded meta-analysis, but they were appraised using narrative synthesis. This review concluded that preoperative comprehensive geriatric assessment may have a positive effect on postoperative outcomes (medical complications and length of stay) in older patients undergoing elective surgery. Following publication of this review, a randomised clinical trial was undertaken in older patients undergoing elective and planned vascular surgery (aortic and lower limb arterial procedures) [9]. This study randomised patients to receiving routine anaesthetic focussed preoperative assessment or comprehensive geriatric assessment using length of stay as the primary outcome. The length of hospital stay in the comprehensive geriatric assessment arm was 40% shorter (5.53–3.32 days) predominantly due to fewer medical complications and delayed discharges. Future work is needed to establish whether comprehensive geriatric assessment has similar benefits across surgical populations and whether it can be implemented in routine clinical practice.

13.7 Establishing Comprehensive Geriatric Assessment in Routine Perioperative Care

Despite this emerging evidence base and several best practice guidelines supporting the use of comprehensive geriatric assessment in perioperative care [6], this approach is not yet widely established. A recent UK survey showed only three hospitals proved comprehensive geriatric assessment throughout the whole perioperative pathway of care for both elective and emergency patients [10]. The main barriers to establishing such services include workforce limitations, a lack of education and training regarding the interface of comprehensive geriatric assessment and perioperative medicine and funding shortfalls. Implementing comprehensive geriatric assessment into routine care requires the establishment of collaborative clinical services, relevant education and training and a robust evidence base to underpin pathway development.

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Comprehensive Geriatric Assessment in Patients with Cognitive Decline

14

Maria Cristina Polidori

14.1 Burden of Dementia in Advanced age and Multidimensional Aspects

Cognitive impairment with or without dementia is a major public health problem worldwide as global life expectancy has reached 71.4 years [1]. There is a large body of epidemiological evidence showing that the large majority of demented patients are 75 years old and older, one in three seniors is over 85 years, and the sharpest escalation in the incidence rate occurs at age 75—increasing by 5.07 times compared to 64–75 years; dementia incidence rate has been reported to increase 152 times between 45–54 years and 85 years and older [2–5]. Independently of the name of the current unique demographic phenomenon in the human history, "aging boomers," "silver tsunami," "childless societies," etc., and of its socioeconomic and political causes and consequences [6], the aged population over 75 years of age is not only often affected by dementia but also by multimorbidity. In Germany, where life expectancy at birth reached 80.9 years in 2012 [6], multimorbidity affects up to 67.3% of the population between 50 and 94 years of age [7]. Multimorbidity and dementia in older subjects are associated with loss of function, increased mortality, and high hospitalization rate, and the HR for all-cause mortality increases with the number of comorbidities up to 6.9 for three comorbidities [8].

The deterioration in memory, thinking, and behavior related to multifactorial age-related neurodegeneration is associated with the progressive loss of the ability to perform everyday activities. Presence of disability is indeed a crucial requirement for the diagnosis of dementia. Over 17 years lived with disability are allocated to dementia, a critical issue in light of the estimate of 47.5 million people worldwide living with this syndrome. The total number of people with dementia is projected to

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increase to 75.6 million in 2030 and 135.5 million in 2050, with the majority of sufferers living in low- and middle-income countries [9]. There are significant social and economic issues in terms of the direct costs of medical, social, and informal care associated with dementia. Moreover, physical, emotional, and economic pressures can cause great disadvantages to families. Support is needed from the health, social, financial, and legal systems for both people with dementia and their caregivers. From this perspective, the comprehensive geriatric assessment (CGA) appears the most appropriate examination to identify needs and resources of aged subjects with dementia with respect to their physical, psychosocial, and functional status. This chapter provides evidence that also older patients with dementia, like all subjects in advanced age with or at risk of frailty, benefit from CGA performance in terms of diagnosis, disease progression, risk identification, hospitalization, nursing home admission, and mortality. On the other end, older adults, both (apparently) healthy and/or seeking medical advice for reasons independent of cognition, may substantially benefit from CGA in terms of diagnosis and therapy of altered psychosocial conditions including cognitive decline known to have profound impact in health-related outcomes. In summary, the beneficial effects of CGA performance in older adults with and without dementia will be presented in the next sections.

14.2 Identification of Cognitively Impaired Patients by Means of CGA

The CGA as cornerstone of the geriatric medical specialty evaluates the main spheres of the aged person with or at risk of disability, i.e., physical, psychosocial, and functional domains. As such, the CGA can overcome the difficulties intrinsic to the identification of patient's resources and problems. Older patients present often with different combinations of nonspecific, apparently unrelated, and seemingly trivial complaints. Particularly older patients with cognitive impairment might refer to the physician for minor problems and do not report, often due to impaired judgment, relevant conditions, and related treatment (Table 14.1). In contrast to younger patients, older patients are seldom clearly and quickly diagnosed, as many of them believe their discomfort, such as chronic pain, insomnia, or forgetfulness, to be part of "normal" aging; for these reasons, cognitive impairment remains largely undiagnosed.

Table 14.1 Risk factors for underdiagnosing older adults with cognitive decline

• Isolation and withdrawal, no regular medical visits
• Inability to understand and communicate cognitive decline
• Interpretation of forgetfulness as "normal" with increasing age
• Fear of being considered unable to live alone, manage finances and transfer with own transportation
• Masked functional deficits within the familiar environment
• Sensory impairment and time restrictions during medical visits causing incomplete assessments and history collection
• Presence of depression, chronic pain, lack of sleep, personality alterations, and attention deficits in malnutrition

Another important fact is the lack of ability of the older subject to properly communicate, due to fear, illiteracy, and denial. When patients present with irrelevant complaints, and often the children are those who take the initiative to go to the doctor, the latter not rarely shares the trivializing view of the patient and misses diagnosis chances. On the other end, when older patients present or are referred to the doctor and are alone at the visit, not only receiving effective medical attention is challenging as cognitive impairment is not immediately noticeable, but adequate decision-making cannot be properly shared. Finally, coexisting depression and sensorial impairment may all contribute to the collection of an inadequate, or even unintelligible, description of the chief complaint and present illness (Table 14.1).

Multiple problems are the rule in advanced age, and disease-centered, systems-based medicine is poorly adapted to care for the older subject. With this respect, it adds to the difficulties of age-related disorders that they present with complex pathophysiology manifesting in clinically unsystematic ways. Furthermore, it is not unusual for one organ system to signal pathology in another. By systematically performing a CGA, the primary and secondary preventive effect against consequences and progression of cognitive decline become evident:

1. Disclosure of unsuspected, very mild, and mild cognitive impairment in patients referred for otherwise noncognitive symptoms
2. Improvement of the clinical therapeutic decision-making in demented patients in light of their prognosis (Fig. 14.1)

The use of a CGA implies always that the older subject undergoes cognitive evaluation by means of a neuropsychological test that is easy to evaluate. Usually

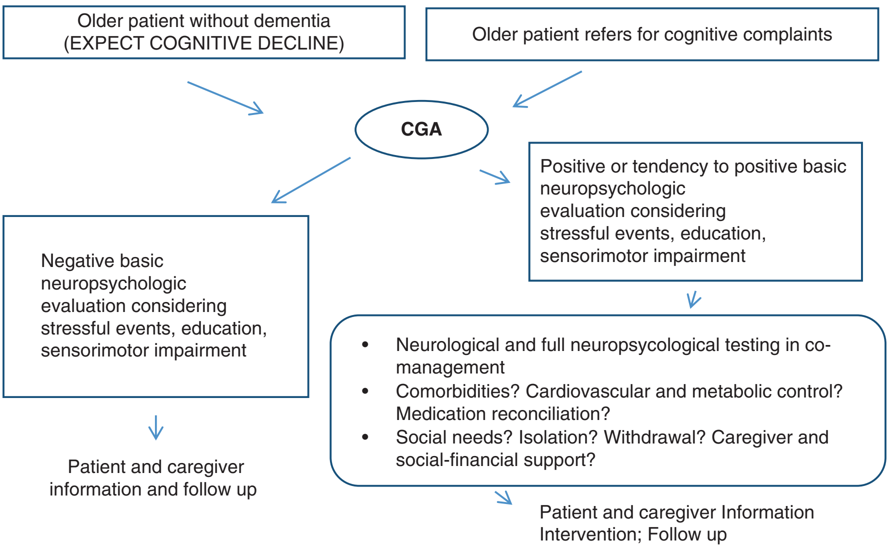

Fig. 14.1 The CGA in older patients without dementia or seeking medical advice for cognitive complaints

the MMSE is used [10], but many other tests, also shorter ones, are being implemented and validated. The evaluation of cognition can disclose early deterioration and pave the way to appropriate diagnosis through a broader test battery, but it can also immediately identify through medication anamnesis the use of potentially deleterious drugs for cognitive performance, such as anticholinergics [11], sedatives [12], or proton pump inhibitors [13].

An exemplary report of the enormous potential of CGA performance in the older subject presenting to the doctor for noncognitive reasons is the recently published cross-sectional study part of the ambulatory geriatric assessment—a Frailty Intervention Trial (AGe-FIT; $N = 382$) [14]. Participants—community dwelling, aged ≥75 years, with inpatient hospital care at least three times during the past 12 months, and three or more concomitant diagnoses according to the ICD10—underwent the MMSE, and 53 (16%) of 337 participants with a measure of MMSE had a MMSE scores <24. Six of them (11%) had a diagnosis of dementia according to medical records, but 89% did not, implying that cognitive decline and the diagnosis of dementia remain undetected in older people with multimorbidity. The authors concluded that proactive care of older people with multimorbidity should focus on cognitive decline to detect cognitive impairment and to provide necessary help and support to this very vulnerable group.

14.3 CGA in Dementia and Clinical Decision-Making

Once dementia is diagnosed and in its mild and moderate stages, patients are overtly forgetful and disoriented, neglect their disorder, and are not able to judge its consequences. Later on, during the course of the disease, patients lose their ability to communicate, fail to recognize loved ones, become bedridden, and require continuous care, with 12–17 years living with disability [9]. Dementia is indeed known to increase mortality, but contributing factors are not well established, although some variables, such as being male, neuropsychiatric symptoms, comorbidity, and the development of functional disability during follow-up, have been associated with a decrease in survival [2, 9]. In the absence of disease-modifying drugs and of disabling behavior disorders, the decision of using symptomatic antidementia drugs, such as acetylcholinesterase inhibitors (AChEIs) (tacrine, donepezil, galantamine, and rivastigmine) and the N-methyl-D-aspartate (NMDA) receptor antagonist memantine as well as the use of antipsychotics needs to be taken in a very calibrated way. While antidementia drugs may delay nursing home placement alone or in combination and may reduce mortality for patients living in nursing homes and in the community [15], decision-making for therapeutical, including non-pharmacological options in older patients with dementia, is a major challenge for health practitioners, particularly in frail older patients with comorbidity and high mortality risk. Use of CGA allows the identification of resources and problems in several personal domains potentially able to negatively affect cognitive impairment progression (Fig. 14.2), but there is a paucity of systematic data on the real effect of the performance of CGA in the dementia population.

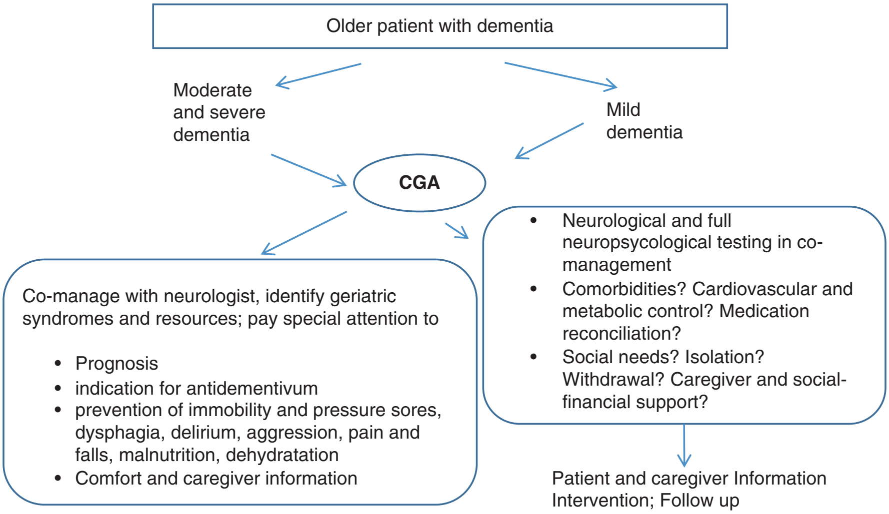

Fig. 14.2 CGA of the older patient with dementia

14.3.1 Drug Treatments in Dementia: The Role of CGA

There is a huge debate on use of antidementia drugs (donepezil, galantamine, rivastigmine, and/or memantine) with respect to increase of survival in older community-dwellers subjects with dementia and particularly frail. Studies conducted in different settings showed that antidementia drugs can delay nursing home placement alone or in combination [16]; however, the effect on mortality is uncertain. More recently, two observational studies showed that AChEIs can delay a move to a nursing home, but have no effect on life expectancy [18], and that AChEI use alone or AChEI plus memantine use were not associated with time to death [17]. A cohort study in 7073 AD patients in the Swedish Dementia Registry suggested that AChEIs were associated with a lower risk of death and myocardial infarction [18] confirming a positive effect of donepezil on lifetime expectancy after onset of AD in a Japanese retrospective observational study [19]. On the contrary, in other large observational studies, cumulative antidementia drugs or memantine alone did not prolong overall survival in patients with AD [16], and memantine was also associated with greater risk of all-cause mortality in the Medicare and Danish cohorts suggesting that sicker individuals were selected for memantine therapy [20, 21].

It is not surprising that data on effectiveness of antidementia drugs is conflicting. Antidementia drugs have been tested in RCTs typically excluding real-life patients indeed receiving those drugs. In clinical experience, subjects treated with antidementia drugs are very old, mostly women, and suffer from vascular comorbidities. Antidementia RCTs, in contrast, exclude very old, frail, multimorbid patients and might be not representative of the population. In addition, it is questionable whether prolongation of life or a few points in ADAS-Cog changes must be considered index of efficacy in such a devastating disorder like dementia, in which quality of life and functionality in advanced age might constitute more relevant endpoints. Due to the high variability and heterogeneity of disease severity and comorbid status, consensus is growing that mortality risk stratification in older patients should be based on information on comorbidity and functional status and integrate information of several domains of health and function. According to the definition of CGA, this type of multidimensional prognostic evaluation should be targeted to improved cost-effective clinical decision-making and to patient-centered care oriented to the appropriate prescription of the appropriate (symptomatic) drug.

Recently, a Multidimensional Prognostic Index (MPI) derived from a standardized CGA has been developed and validated for mortality risk assessment in several independent cohorts of hospitalized and community-dwelling older subjects with acute or chronic diseases (see Chap. 8). The CGA assessment was carried out according to the Standardized Multidimensional Assessment Schedule for Adults and Aged Persons (SVaMA), the officially recommended multidimensional assessment schedule used since 2000 by the health personnel of the Veneto Regional Healthcare System to perform a multidimensional assessment in community-dwelling older persons to establish accessibility to some healthcare resources (homecare services or nursing home admission). Further information on MPI use and calculation can be downloaded from the following address: http://www.mpiage.eu/home/about-mpi-svama.

As survival after diagnosis of dementia is known to vary considerably, depending on numerous factors and their complex interactions, and it may directly influence prevalence and service needs, the MPI has been validated also in dementia and has been shown to accurately predict mortality in hospitalized patients [22] and to predict mortality and hospitalization risk in outpatients [23]. In particular, in an observational prospective cohort study of 340 outpatients with cognitive impairment, the probability of death and hospitalization was nine- and sixfold higher, respectively, in patients with MPI-3 compared to patients with MPI-1, supporting the MPI's ability to disclose risk for mortality and hospitalization also in older cognitively impaired community dwellers [24]. Due to the high validity, accuracy, and reliability of the MPI (see Chap. 8), a multicentric European study is ongoing which includes existing cohorts of older multimorbid subjects as well as a prospective study (www.mpiage.eu). The retrospective analysis of data from over 6800 older community dwellers with dementia shows that these subjects have a mean age of 84 years and are mostly women, a large percentage (about 80%) have vascular comorbidities, and only 20% receive treatment with anti-dementia drugs; however, preliminary survival curves show that antidementia treatment is associated with prolongation of life only for subjects with low and moderate mortality risk and not for subjects at high risk of mortality [25]. Taken together, these data suggest not only that dementia among older community dwellers is underdiagnosed and undertreated but also that it is very frequently associated with vascular disease and that the relatively few patients treated might not even be those who really benefit from the treatment at least in terms of life prolongation. These and other MPI_Age results (see Chap. 8) strongly support the hypothesis that clinical decisions in older multimorbid subjects should be taken multidimensionally and individually based on prognosis.

14.4 Future Perspective: The Key Role of CGA to Prevent Dementia

Cognitive impairment is a very frequent, often underdiagnosed geriatric syndrome which does not lead to easily recognizable signs and symptoms for a long time during the course of the disease; the problem of the (too) late diagnosis is worsened by the fact that once the diagnosis of dementia is established, there is no cure available. There is no cure as dementia is not a single cause-single mechanism-single therapeutic option-condition; rather it is, as mentioned before, a multifactorial syndrome. The consequence of the absence of a cure against dementia is the mandatory need to prevent the disease. Critical premises to successful prevention are early detection and modifiable risk factors, but the vast majority of risk factors for dementia are not modifiable; in other words, to avoid dementia and to modify the course of transition from cognitive impairment to dementia, it is necessary to identify patients at risk of cognitive impairment-related disability and quickly identify and keep under control their vascular and lifestyle-related risk factors.

Cognitive impairment is known to have a neurovascular degenerative pathophysiological basis which may begin decades prior to overt symptoms. As the aging process itself, age-related changes in the brain occur in an heterogeneous way. Similarly and simultaneously to the large interindividual differences in physical phenotype across subjects, the brain ages differently from individual to individual depending on a large number of elements. This multifactorial and multidimensional process is characterized by early-life events, personality profile, education, resiliency, personal and social resources, individual outcomes, lifestyle, fate, genes, and risk factor exposure. The factors influencing morbidity profiles may lead to the differentiation of the aging process in unsuccessful, usual, successful, or, as described more recently, aged subjects in escapers, delayers, survivors. In the brain, age-related changes may occur through different mechanisms varying from subject to subject, being prevalently chemical, structural, vascular, or metabolic, and manifesting in different regions of the brain leading to different neuropathologic consequences in different individuals. This kind of heterogeneous cerebral aging feature accompanies three relevant geriatric traits, i.e.:

1. The transitions between brain healthy aging, usual aging, unsuccessful aging, and cognitive impairment/dementia occurs in a continuum. Especially in advanced age, the predictive value of biomarkers and the interpretability of neuropsychological and psychometric tests are substantially limited.
2. Age-related adverse changes such as cholinergic depletion, energy deficit, or circulatory homeostasis make the brain, as "the weakest link", the organ most frequently revealing pathologic signs in the presence of a non-cerebral condition.
3. Cognitive impairment is, among the "Is" or the "big 10" of geriatrics, the single specific organ-related disorder defined as a geriatric syndrome. Under this perspective, it is extremely important that older subjects undergo a CGA possibly

with calculation of prognosis in order to meet patient-centered needs and clinical decisions in the prevention of cognitive impairment or its progression.

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Teaching CGA

15

Regina Elisabeth Roller, Maria Cristina Polidori, and Katrin Singler

15.1 Introduction

Geriatrics is the discipline that deals with physical, psychological, social and functional aspects of the older adult (www.uems.com). These are the four dimensions of the "older patient" as a person. All four need to be accurately evaluated as their adequacy will profoundly impact the success of any medical intervention planned and performed. With the rise in the number of older and vulnerable adults, there is an urgent need not only of doctors skilled in geriatric medicine [1, 2] but of as many doctors as possible competent in the complex management of older patients. Medical students, residents in geriatrics or in other disciplines, or young specialists, need to be prepared about the significance of (re)acting in an age-attuned way and expecting older patients – in the emergency department, as inpatients and in the outpatient clinic.

Due to the challenges linked to the implementation of the Bologna model of medical education [3, 4], integrated and longitudinal undergraduate education of geriatric content is a challenge for many medical schools.

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15.2 Background on Education and Training

Many students today are trained in geriatric medicine at remote clinical sites, i.e. away from the university campus. Therefore, prompt reaction from the teacher's side to students' training deficits is challenging; curriculum directors in the field face the demands associated with this issue. It is well known, in fact, that the capability of faculty members as role models has an impact on the success and sustainability of continuous educational programmes, teaching content and professionalism (International Encyclopedia on Education, 2010). In addition, a role model faculty member is effective in transferring a kind of "hidden" curriculum which typically includes attitudes, activities and teaching behaviours beyond the formal curriculum. This implies that teachers are needed who not only fulfil the formal requirements of being practicing specialists in geriatric medicine for at least 5 years but who are equipped with solid didactic knowledge. Awareness of and ability in teaching methods are fundamental instruments to deliver the complex learning objectives and professional behaviours developed by the geriatrics societies (http://uemsgeriatricmedicine.org/www/dok/Minimum%20Training%20Requirment%202016.pdf). In this context, distant teaching using hybrid techniques including workshops, small group case discussion, and online video and an online discussion of a new geriatric case have been demonstrated to be effective and efficient [5] and may also be a resource for further improvement and development of training in geriatric medicine.

From this perspective, it is not surprising that only a low number of medical faculties across Europe provide teaching to cover topics of the complex care management of older people [2, 6, 7]. To foster undergraduate education in geriatrics, the American as well as European associations and societies of geriatric medicine have agreed very recently upon *minimum geriatric competencies* in undergraduate medical training which are considered critical for the adequate medical management of the older adult (Minimum Competences AGS; [2]).

15.3 Competencies and Learning Theories

Several of the core competencies described in the two catalogues cited above are critical for an optimal clinical performance with older patients and are required skills for the performance and interpretation of a comprehensive geriatric assessment (CGA), the cornerstone of geriatric medicine. A curiosity for geriatrics, the performance, application and interpretation of CGA along with planning complex interventions are the major teaching outcomes for medical students and colleagues at the postgraduate level. Whether the learning objectives defined by the societies really reflect defined learning outcomes is still under debate. The recently published competencies to be achieved in geriatric medicine by medical undergraduates are strongly built upon Benner's developmental model of a learner [8] and grounded on the Bloom's cognitive taxonomy [9].

To teach the recommended learning objectives within the currently running knowledge-based and classroom-oriented medical programmes, a strong paradigm shift in teaching activities is necessary. Medical students and residents are per se "adult learners", and teaching and assessment strategies have to be adapted accordingly. Following Kolb's scheme [7] learners have a concrete experience upon which they reflect. Through their reflection they are then able to formulate abstract concepts and make generalizations; a next step is consolidation of this understanding by testing the implications of their knowledge in new situations. This sequence in grasping and mastering knowledge usually favours acceptance to learn about CGA because students and trainees tend to learn best by observation, as reflected in the history of teaching medicine [10]. Of the key elements of the clinical diagnostic reasoning process – knowledge, context and experience – the appreciation of context and experience are pivotal for the meaningful application of CGA. Therefore, an increasing emphasis upon collaborative learning approaches as evidenced by enquiry-based and action learning styles is mandatory, especially to teach CGA as a core concept of geriatric medicine. Geriatricians need to ask for adequate human and material resources to enable more teaching in small group work and technology-assisted teaching/learning about CGA.

15.4 How to Plan and Design Teaching CGA

Careful planning of an integrated and stepwise educational approach exposing young learners repetitively during their training to geriatric content is mandatory for the implementation of successful and sustainable curricula for medical management of older patients with complex care needs. Whatever teaching method a faculty chooses to train students in the performance and interpretation of CGA, a detailed programme evaluation should follow. Using models of evaluation such as the one by Spilsbury and colleagues ([11]; Fig. 15.1) provides evidence on training in the field of geriatrics and supports bids for resources from training bodies, such as universities and deaneries.

This approach may help to raise acceptance by students of the training content as they see the direct connection with the clinical care pathways. As medical students are adult learners, they need to have a concrete experience of knowledge content applied either in simulation scenes or with patients, upon which they can than reflect either in a group or led by a tutor. Through their reflection they are able to formulate abstract concepts and may test the implications of their knowledge in individual situations. With respect to CGA, by giving students the opportunity to perform this diagnostic and therapeutic approach in a *real-life* situation, a learning environment will be provided in which they can reach the highest competence level according to the Miller's pyramid ([12]; Fig. 15.2).

Doubtlessly, residents in their early training phase need to achieve the highest competence level to be able to perform CGA in a self-directed way, interpret results and design care plans in patients according to results obtained.

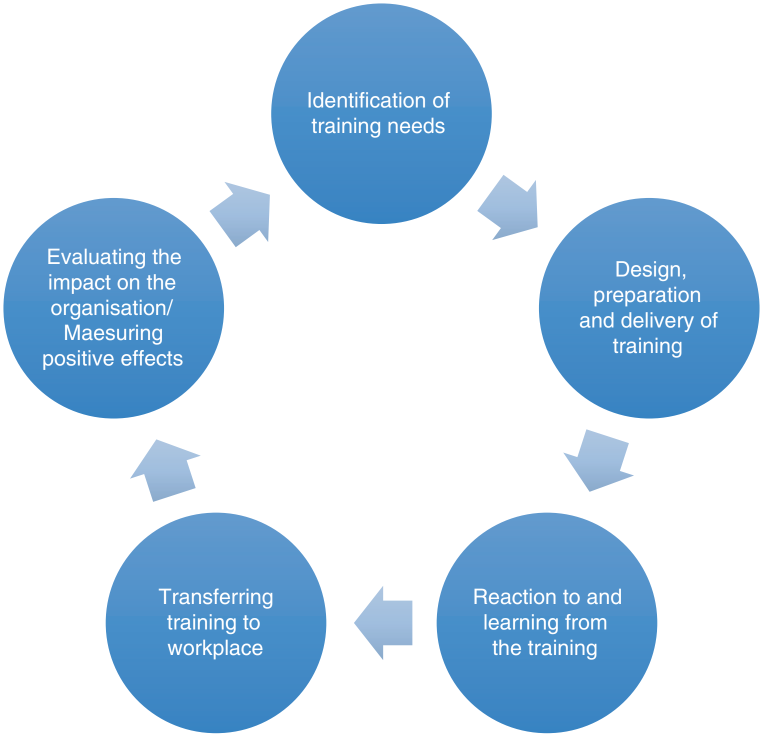

Fig. 15.1 Pathway for the measurement of effectiveness of training. (Adapted with permission from Spilsbury [11]

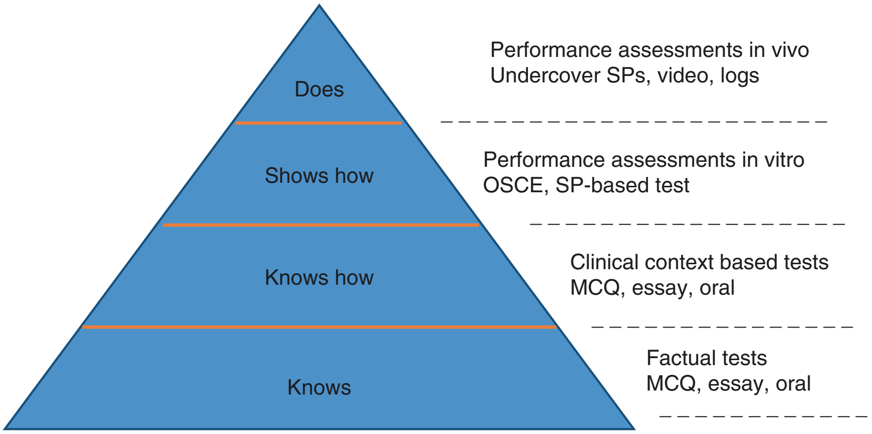

Fig. 15.2 Miller's pyramid of competence [12]. Abbreviations: *OSCE* objective structured clinical examination, *MCQ* multiple choice question, *SP-based test* simulation patient-based test

Table 15.1 Teaching and evaluation formats for CGA

	Teaching formats	Evaluation formats
Knowledge on CGA	Classroom teaching, self-directed learning of given content, e-learning modules, webinars	Multiple choice in different formats, short answer assessment, short essay assessment, structured oral assessments
Technical skills	Simulation patients, e-learning modules, bedside teaching	OSCE (objective structured clinical examination), PACES (practical assessment of clinical examination skills, Mini-CEX (mini clinical examination assessment)
Communication skills during CGA	Simulation training, bedside teaching using various educational approaches	OSCE (objective structured clinical examination), PACES (practical assessment of clinical examination skills, Mini-CEX (mini clinical examination assessment)
Interpretation of results and care planning/ professionalism	(Simulation training), bedside teaching	Mini-CEX, DOPS, 360° assessment, case-based discussion, clinical and educational supervisor reports

Planning educational events and curricula for undergraduate education raises the question what is the "basic competence" to be achieved for CGA. As outlined in the recommendations published by Masud and collaborators, "Graduates should have the special skills needed to conduct a history and perform an assessment in an older patient" [2]. This learning objective clearly outlines that students need to acquire basic skills to handle an assessment situation for various functional domains, outlined in more detail within the recommendation. This implies that giving access to information on functionality in old age and the CGA as an instrument to assess this functionality is the first step in the educational "helix". As outlined earlier, this information may be offered either through live classroom educational events or using blended learning formats involving information communication technologies (ICT)-based learning modules together with live educational events (Table 15.1). There is currently some evidence that e-learning-based medical education can be beneficial for learners as well as educators. Web-based learning may improve students' adherence and compliance as it offers the opportunity to "consume" learning content whenever convenient and for the learners to have as many repetitions as they perceive that they need. Furthermore, outcome assessment can be determined directly within the e-learning module [13].

However, information as a "stand-alone" offer will not be sufficient to drive undergraduate medical students towards the competence level requested within the European recommendations. The most appropriate educational format for CGA is clinic or bedside teaching, especially if performed with the interdisciplinary geriatric team with its multiprofessional membership [14]. At this level and at a subsequent management one, students and trainees will learn the importance of being an interdisciplinary team player in co-management with other expertise. This approach has been shown to enable more effective implementation of interprofessional learning activities and assessment within the core curriculum [14]. Special attention should be given to the role and structure of the geriatric team. In fact, in every developmental step of a preliminary management plan for patients presenting with functional deficits, including adaptive interventions, the involvement of interdisciplinary team members from appropriate disciplines, such as social work, nursing, rehabilitation, nutrition and pharmacy, needs to be clearly described and highlighted. The educational formats of simulation training and bedside teaching after theoretical lectures, case scenarios and educational videos fit perfectly for the teaching of CGA, especially if the activity of the geriatric team can be demonstrated. Finally, the last educational step after theory (*know*), practice (*know how*) and professional development (*does*) [15] comprises examinations (*shows how*) (Fig. 15.2).

While exposing the basis of geriatrics, the educator will inevitably present the essential nature of the discipline, which is multidimensional, crossing and going beyond the organ approach. The meaning of multidimensionality, obvious to geriatrics experts, must be clarified for an inexperienced public, which will struggle with time-pressure medicine and needs to be convinced about the unavoidably personalized character of geriatric medicine. During the geriatrics courses, students have been exposed to the topic of evidence-based medicine and its challenges in advanced age and to the fundamental gerontological concept of the heterogeneity of ageing. This way, an understanding of CGA as representing personalized medicine will be facilitated.

It is important that students grasp the theory of CGA, which reflects the multidimensionality of the person. Students and trainees must be made aware that even the most advanced therapy applied in the best way and with the most appropriate indication will be subject, in advanced age, to a high risk of failing or in fact of being counterproductive if risk or presence of geriatric syndromes or psychosocial and functional needs is not assessed. In recent years, screening instruments have been developed and evaluated in their efficacy to *promptly* identify geriatric patients at risk of frailty or adverse outcomes or those benefiting from rehabilitative interventions. Their efficacy, however, has been shown to be limited [16], probably because personalized medicine cannot be rapidly conducted with yes/no questions. Older patients in settings where typically only a short time is available (such as the emergency department or the general practitioner outpatient clinic) are often alone, may consider their complaints as "normal" signs of being older, might be acutely disorientated and/or sensorially impaired, etc. Communication alone and history collection can be extremely difficult in ageing medicine, which is the reason why, as mentioned before, both are highlighted outcomes of the undergraduate curriculum in geriatric medicine [2].

So-called soft skills like appropriate communication with older persons including those with cognitive or sensory impairment are included in the frame of a main geriatric curriculum outcome, i.e. *graduates should respect patients regardless of their age* [2, 15]. Within the latter, an important professional behaviour to be conveyed is the maintenance of a person-centred and professional approach to the older person; this skill, as well as empathy beyond the dichotomy between biomedicine and the humanities [17], has important ethical implications and is to be encouraged within the hard core of medicine. To demonstrate empathy and improve the technical skills described below, simulation training is being successfully adopted where students are exposed to the several impairments occurring with increasing age [18].

Finally, the assessment of learning success seems to play a major role in driving students' as well as residents' learning behaviour. As may be seen from Miller's pyramid, assessment formats have to be strictly aligned with the competence levels of outlined learning outcomes. This means that during conceptualization of the curriculum for teaching CGA, colleagues should consider how the learning outcomes of students and residents are to be assessed. Table 15.1 outlines possible training and assessment formats already used by many faculties across the globe.

The decisions on how to teach and evaluate CGA strongly depend on the needs of trainees and given contextual factors. The number of students to be trained, the availability of teaching staff and time as well as the structural environments strongly influence the didactic decisions in curriculum development.

In conclusion, teaching CGA is a demanding task, which encompasses several levels of difficulty including imparting the importance of communication and technical skills. Once the understanding of the latter is ensured, the multidimensionality has to be explained. Beyond the use of scales, the complexity of the patient and interpretation of CGA results should be clear to the students. Finally, using CGA to implement plans of care in different settings is the competence to be achieved at novice and experienced resident and postgraduate level. This latter phase, in addition to improvement through gaining experience, might be further deepened by conveying the use of CGA tools including apps to assess multidimensional prognosis and thereby improving clinical decision-making in older patients [19–22].

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