Geriatric Assessment and Management in Cancer

Siri Rostoft, MD, PhD[1,2]; Anita O'Donovan, PhD[3]; Pierre Soubeyran, MD, PhD[4]; Shabbir M. H. Alibhai, MD, MSc[5,6]; and Marije E. Hamaker, MD, PhD[7]

INTRODUCTION

As the majority of patients with cancer are older than 65 years, most medical, surgical, and radiation oncologists treat a large number of older adults in their clinical practice. Older adults are a heterogeneous group of patients, in terms of physiologic reserves, comorbidity, and geriatric conditions such as cognitive impairment and disability. Comorbidities become increasingly common as people age, as does frailty (limited physiologic reserves that increase the risk of negative outcomes).[1] Neither chronological age alone nor performance status does justice to characterizing this heterogeneity. Furthermore, since older patients are under-represented in clinical cancer trials, especially if they are frail with comorbidity or functional dependency, traditional treatment algorithms may not be applicable.[2,3] As a result, treatment decisions in older adults with cancer are not straightforward.

Fortunately, geriatric assessment (GA) and management is an extremely useful tool to guide decision making and improve outcomes in geriatric oncology. GA can assess the risk of treatment complications and toxicity and patient frailty and resilience, uncover previously unknown conditions that may interfere with cancer treatment, guide interventions to increase resilience, maintain quality of life, decrease chemotherapy toxicity, provide more appropriate cancer treatments, and improve communication with patients and caregivers.[4-7] In clinical practice, GA is a systematic evaluation of areas where older patients often have deficits and includes functional status, mobility, cognition, emotional status, nutritional status, comorbidities, polypharmacy, and social support. Based on GA, we can assess the degree of patient frailty, propose a plan for management, and tailor oncologic treatment. The term *comprehensive* geriatric assessment is sometimes incorrectly used in the literature as *comprehensive* geriatric assessment mandates the development and implementation of a treatment plan for the individual patient. When a study only includes data gathering and discussion among team members without management, the correct term is GA.[8] In this narrative review, we will describe GA and management, review the mounting data that justify its use, describe some common challenges when setting up GA and management in clinic, and look to the future. The review is based on the latest evidence regarding the impact of GA with or without management on oncologic treatment decisions and outcomes. For data on non-oncologic interventions, treatment adaptations, and effect on outcomes, a 2018 systematic review was used[9] with an updated search performed in December 2020.

MODELS OF GA IN CLINICAL PRACTICE

GA can be implemented in clinical care in several ways, depending on available resources and expertise and the setting in which it is used. The time investment required from the oncology team differs according to how GA is organized: it can be low touch, where the team identifies potentially vulnerable patients and refers to others for the assessment and interventions.[5] Alternatively, it can be high touch, where a dedicated team takes on all the steps within the care process themselves.[6]

A first decision concerns how GA is performed: it can be by consultation with a geriatrician or a multidisciplinary team of healthcare professionals, or the oncology team can do GA themselves, using a series of validated instruments. Although filling out a series of screening instruments does not allow for actual clinical diagnosis of underlying illnesses, such as depression or dementia, they are quick and valid methods of identifying areas that may be impaired and acquiring an overall impression of the patient's health status.[10] Combinations are an option: for example, an oncology nurse performs a basic GA and refers the patient to a geriatrician if significant impairments are found. Irrespective of who performs GA, the following domains should be included in the assessment: functional status, objective physical performance, falls, cognitive function, mood or depression, nutritional status, comorbidity, polypharmacy, and social support.[4] Each of these domains have been proven to be relevant to decision making, choice of treatment, and/or care provision (Table 1). The domains can be assessed in a number of ways, including patient or caregiver report, history taking, and objective measurement or with various instruments. There is no specific set of instruments that have been proven to be superior to others; the choice of assessment tools will depend on the specificities of the setting in which they are used.[4] In addition to these domains, the assessment should include conversations about the patient's goals and preferences.

ASSOCIATED CONTENT

Data Supplement

Author affiliations and support information (if applicable) appear at the end of this article.

Accepted on March 5, 2021 and published at ascopubs.org/journal/jco on May 27, 2021: DOI https://doi.org/10.1200/JCO.21.00089

CONTEXT

Key Objective

Why is geriatric assessment and management (GA&M) recommended for older patients with cancer pretreatment?

Knowledge Generated

Older patients are heterogeneous, and tailoring cancer treatment to the individual requires weighing risks against benefits in the context of frailty, which is best assessed through geriatric assessment. GA&M can improve prognostication and risk stratification and communication with patients and caregivers, guide treatment adaptations, and provide nononcologic interventions to increase resilience.

Relevance

As increasing evidence shows that GA&M can improve the course of treatment, with less chemotherapy-related toxicity, lower rates of complications after surgery, and improved functional status and quality of life, the challenge is now about implementation into clinical practice.

A second choice concerns which patients will receive GA. This can be based on age or clinical judgment, or alternatively, patients can be selected with a frailty screening instrument, where only those below a certain cutoff undergo GA. There are multiple short screening tools available, of which Geriatric-8 (G8) has been most extensively

TABLE 1. Geriatric Assessment Domains, Tools, and Proposed Interventions

Domain	Assessment Tool Examples	Evidence	Intervention and Examples
Functional status	ADLs (ie, transferring and eating) IADLs (ie, managing finances, cooking, and driving)	Association with chemotherapy toxicity, hospital admissions, functional decline, and mortality[4,39,46,55]	Aids such as motorized wheelchair Meals on Wheels Physiotherapy Occupational therapy
Objective physical performance	4 m gait speed, TUG; SPPB; grip strength; sarcopenia	Prediction of mortality, treatment-related complications, and functional decline[56-58]	Structured exercise Assistive devices
Falls	No. falls in previous 6 months	Related to chemotherapy toxicity, postoperative complications, and functional decline[24,59]	Falls prevention program
Cognitive function	MMSE, MoCA, Mini-Cog, and BOMC	Assessment of capacity for consent or treatment adherence and cognitive decline associated with treatment. Association with poorer overall survival, chemotherapy toxicity, and delirium[22,43,60]	Support during treatment trajectory Delirium prevention program Treatment reminders, eg, text messages for daily radiation therapy appointments
Mood (depression)	GDS, HADS, and PHQ2/9	Assessment of psychologic adjustment to treatment. Association with postoperative complications, treatment tolerance, functional decline, and mortality[45,46,55,61]	Cognitive-behavioral therapy Medical therapy Counseling
Nutritional status	MNA, BMI, and weight loss combined	Association with mortality, likelihood of treatment completion, and healthcare consumption[62,63]	Dietary counseling
Comorbidity	CIRS-G, CCI, and OARS comorbidity	Assessment of competing causes of mortality, survival, treatment tolerance, and hospital admissions[61,64]	Referral to organ specialist
Polypharmacy	List of medications, STOPP-START, and Beers criteria	Postoperative complications, chemotherapy toxicity, functional decline, and mortality[65]	Geriatrician or clinical pharmacist review of medications
Social support	Focused questions regarding social support, MOS-SSS, and MPSSS	Association with cancer progression, chemotherapy toxicity, poorer survival, and treatment adherence[66]	Home nursing Transportation assistance Buddy support schemes Referral to community or cancer support groups

Abbreviations: ADLs, activities of daily living; BMI, body mass index; BOMC, Blessed Orientation-Memory-Concentration test; CCI, Charlson Comorbidity Index; CIRS-G, Cumulative Illness Rating Scale-Geriatric; GDS, Geriatric Depression Scale; HADS, Hospital Anxiety and Depression Scale; IADLs, Instrumental Activities of Daily Living; MMSE, Mini-Mental State Examination; MNA, Mini-Nutritional Assessment; MoCA, Montreal Cognitive Assessment; MOS-SSS, Medical Outcomes Study Social Support Survey; MPSSS, Multidimensional Scale of Perceived Social Support Scale; OARS, Older Americans Resources and Services; PHQ2/9, Patient Health Questionnaire-2/9; SPPB, Short Physical Performance Battery; STOPP-START, Screening Tool of Older Person's Prescriptions-Screening Tool to Alert doctors to Right Treatment; TUG, Timed Up and Go.

tested in geriatric oncology.[11] G8 takes 4-5 minutes and has a relatively high sensitivity for frailty (85%), meaning that the majority of frail patients are correctly identified, but unfortunately, it has poorer specificity (64%), meaning that one third of fit patients are incorrectly classified as potentially frail.[11] The other screening tool that has been most frequently evaluated in geriatric oncology, the Vulnerable Elders Survey-13, has a higher specificity, increasing the likelihood that the patients referred for GA are the ones most likely to benefit, but the trade-off is a lower sensitivity.[12,13]

A final choice concerns what to do with issues and impairments identified by the assessment. Previous research has demonstrated the importance of having an intervention plan in place, such as a protocol for referral or specific interventions for impairments.[9,14] Without a predefined plan, there is a risk that little is done with potentially reversible issues or future risks that have been identified by GA. A systematic review of 28 studies on nononcologic management showed significant variation in the rate of proposed interventions after GA, ranging from 8% to 100% (median, 67%), which could not be explained by variation in the prevalence of geriatric impairments.[9] Not providing adequate interventions could result in negative health outcomes that may be avoidable.[14]

PROGNOSTICATION AND RISK STRATIFICATION

GA improves prognostication and risk stratification. The former is relevant primarily in the curative or adjuvant setting for any treatment modality. The latter is most relevant in the setting of chemotherapy or surgery. Multiple externally validated prognostic models estimating remaining life expectancy have been published.[15-17] These allow estimation of life expectancy at 4-5 and 10 years, which is particularly relevant in the curative or adjuvant setting for older adults, in whom competing risks of mortality from other causes such as heart disease are common. At the same time, there is tremendous heterogeneity with aging. For example, a 75-year-old woman in the top quartile of health would have an expected life expectancy of 17 years versus 6.8 years for a woman in the bottom quartile.[18] Without well-informed life expectancy estimates, there is a risk of over- or undertreatment of older adults with cancer[19] since clinicians are known to struggle with life expectancy estimation.[20] Each of the prediction models require variables that are not typically obtained in a standard oncologic assessment but are commonly included in GA, such as mobility and bathing independence.

Similarly, two validated prediction models of severe toxicity with chemotherapy in older adults have been published.[21,22] These models are substantially superior to measures typically used in oncology practice such as performance status and require information that is commonly included in GA.

In the surgical oncology setting, the most widely used tool to predict complications such as 30-day mortality, serious complications, length of stay, and the need for skilled nursing home or rehabilitation care comes from the American College of Surgeons National Surgical Quality Improvement Program.[23] GA provides more detailed information than the typical surgical assessment and facilitates application of the National Surgical Quality Improvement Program tool. Interestingly, even a simple question such as asking patients about falls in the 6 months before colorectal surgery is a powerful predictor of outcomes—of the patients reporting $\geq$ 3 falls, 100% experienced postoperative complications in a study by Jones et al.[24] Multiple falls is an example of a geriatric syndrome that has implications in all medical disciplines and therefore should be routinely assessed in older adults with cancer before treatment initiation.

At this time, there is no similar validated risk stratification tool in the radiation oncology setting, although a systematic review found that several studies demonstrated an association between vulnerability or risk based on the GA and treatment completion, treatment-related fatigue, and mortality.[25] Many of these studies included small patient numbers, and currently, no randomized controlled trials (RCTs) have been published in radiation oncology, which is a major limitation.

IMPACT OF GA ON TAILORING OF TREATMENT

Treatment decisions for older patients with cancer can be difficult: risks need to be carefully weighed against benefits within the context of the individual patient, each with their own priorities, goals, concerns, resources, and vulnerabilities. The importance of geriatric impairments for prognosis and treatment complications means that doing GA before treatment decisions allows for upfront tailoring of treatment to the patient's vulnerability, rather than modifying treatment only after complications demonstrate the patient's inability to tolerate standard treatment.[26] Performing GA also forms a starting point for shared decision-making conversations. Understanding a patient's goals and preferences is likely to improve treatment satisfaction and adherence to the treatment protocol.[27] Including GA in oncology clinical visits improves patient-centered and caregiver-centered communications about aging-related concerns[28] and supports advanced care planning conversations.[29,30] In the process of GA, patients and their caregivers also learn about what issues healthcare providers find relevant to the treatment process, and therefore, GA can help create a common understanding of the patient's health status that assists in treatment discussions.

Treatment modifications after GA are commonly seen in clinical practice: a systematic review described 11 studies addressing this outcome. Populations studied were quite diverse, including different tumor types in various settings, and they consistently found alterations of the initial

oncologic treatment plans in 8%-54% (median, 28%) of patients after the results of GA were disclosed to the multidisciplinary team.[9] In general, this resulted in the use of less-intensive treatment options. In medical oncology, choosing monochemotherapy may be an option, or primary dose reduction with or without subsequent dose escalation when treatment is easily tolerated. Less-intensive treatment options may be inferior when focusing solely on the disease-specific outcomes, but from a patient perspective, choosing a treatment that does not exceed the ability to tolerate potential side effects and complications may improve the overall outcome. In some cases, improved control of vulnerabilities could allow for maintaining standard treatment when systemic treatment may be curative, for example, in treatment of lymphoma. In the surgical setting, de-intensified treatment options may include avoiding anastomosis or opting for a diverting stoma or radiotherapy instead of an extensive resection. In radiotherapy, the selection of a shorter (hypofractionated) regime may be appropriate,[31-33] to lessen the burden of travel for a patient who is vulnerable or frail, lives far from the radiotherapy center, or has poor support.

Unfortunately, few studies have assessed whether the treatment adaptations did in fact benefit the patient: only one RCT, in patients with stage IV lung cancer, has focused explicitly on treatment allocation based on GA without any additional nononcologic interventions.[34] This study found that GA-based allocation resulted in less monochemotherapy, more standard combination chemotherapy, and more best supportive care. Besides, patients undergoing geriatric evaluation had a higher rate of treatment completion and less toxicity with similar oncologic outcomes to the control arm.[34] Two other studies also showed higher rates of upfront dose reductions in the GA cohort, resulting in significantly better treatment tolerance and a trend toward less toxicity, without affecting disease control.[35,36] This suggests that using GA to allocate treatment improves tailoring of care and can prevent both over- and undertreatment while maintaining oncologic outcomes.[9] Finally, these studies were performed in various settings and tumor types and concerned mainly standard treatment options such as surgery, radiotherapy, chemotherapy, and hormonal treatment, and we now need data about the impact of GA on decision making when targeted therapies and immunotherapy are foreseen.

NONONCOLOGIC MANAGEMENT BASED ON GA

Many of the issues identified by GA, including frailty and the loss of physiologic reserves, are the result of accumulating aging processes that have been ongoing for decades. Cancer and its treatment may further deplete reserves and increase a patient's vulnerability to adverse outcomes. Nononcologic management serves several purposes. Addressing the issues identified by GA may have a direct impact on quality of life, although not all impairments may be easily reversible. Additionally, interventions can improve treatment tolerance by increasing the patient's individual resilience and ability to tolerate treatment or by preventing further decline. These nononcologic interventions mainly fall into seven groups: (1) Interventions aimed at mobility and falls, (2) Investigations for comorbidity, (3) Medication optimization, (4) Delirium prevention and/or exploration of cognition, (5) Psychologic interventions, (6) Nutritional interventions, and (7) Social interventions (Table 1). Of note, adherence to nononcologic management is less likely to happen if no infrastructure is set up, and therefore, a clear intervention plan is required for implementation.[37]

Medical cancer therapy and radiation therapy represent continuous stressors over a time period, but nevertheless, improving or maintaining resilience through management of nononcologic factors could improve treatment tolerance and functional capacity and possibly decrease treatment burden. Interestingly, studies show that social and nutritional interventions occur most frequently, in addition to polypharmacy optimization.[9] Social interventions and medication optimization are among the core tasks of a geriatrician. Nutritional status is a well-known prognostic factor in patients with cancer; oncologists, surgeons, and geriatricians are all required to deal with nutritional issues. In a recent systematic review of 89 studies on nutritional status, nutritional interventions, and outcomes in older patients with cancer, the authors found a strong association between nutritional status and mortality, completion of oncologic treatment, and healthcare consumption.[38] Although dietary counseling seemed to improve quality of life and reduce postoperative wound infections and radiotherapy toxicity, nutritional support did not show any benefit for survival, chemotherapy toxicity, healthcare consumption, or quality of life.

Reduced functional status is a powerful predictor of adverse outcomes in geriatric oncology.[4,39,40] Exercise improves functional health, even in frail patients in nursing homes, and should include the following components: structured and personalized aerobic and resistance training, flexibility, and balance.[41] In a cohort of noncancer patients with a mean age of 87 years who were hospitalized with acute illness, an exercise intervention lasting a median of 5 days reversed functional decline in an RCT.[42] In addition to exercise, the use of assistive devices may be crucial in maintaining independence in patients with impaired functional status. Such patients may also require practical assistance to benefit feasibility of and adherence to the treatment plan: for example, transportation support to complete radiation therapy. If an older patient with cancer suffers from cognitive impairment, social interventions may be necessary to keep the patient safe during the treatment trajectory. In such cases, we recommend consulting a geriatrician or older age psychiatrist and/or neurologist. Cognitive impairment may also have a significant impact on a patient's decision-making capacity. In addition, the risk of

postoperative delirium and possibly delirium associated with chemotherapy use is higher in patients with cognitive impairment.[43,44] Patients who suffer from depression or anxiety also need special attention. Depression is a risk factor for mortality, postoperative complications, and poor adherence to treatment.[45,46] Since there is effective treatment available for depression, consulting a psychiatrist is an important intervention that may improve outcomes.[47]

IMPACT OF GA AND MANAGEMENT ON OUTCOMES

Geriatric assessment and management (GA&M) is a term used to describe a care process in which all facets of GA are combined: thus, using GA to improve prognostication and risk stratification, guide treatment adaptations, and support shared decision making, while also providing nononcologic interventions to optimize and maintain a patient's health status in the course of treatment. In recent years, increasing evidence has shown that GA&M can improve the course of treatment, with less chemotherapy-related toxicity and lower rates of complications after surgery (Fig 1 and details in Table 2 and the Data Supplement [online only]). Studies that have shown a positive effect of GA&M on outcomes have generally used multifactorial interventions, highlighting the need of a holistic approach to the older patient with cancer. These studies (n = 20) from a range of geographic settings and cancer types are detailed in Table 2. The majority were conducted in medical oncology (n = 9) and surgery (n = 7). In terms of study design, most are RCTs (n = 14), using a range of different GA approaches from consultation with a geriatrician (50% of included studies), GA performed by the oncology team (n = 4) or a multidisciplinary approach (n = 5). One study used GA only for decision making, 12 studies focused only on optimizing health status, and in the remaining seven, GA was used both for decision making and for subsequent optimization and management. A variety of management strategies for geriatric impairments and follow-up were used, more commonly geriatric co-management.

These studies have addressed a variety of outcome measures. One RCT with 718 patients (mean age of 77 years) receiving chemotherapy for incurable solid tumors or lymphoma found that patients receiving multifactorial GA&M had a 21% absolute risk reduction of grade 3-5 toxicity.[5] Multiple studies have also shown that rates of treatment completion according to plan are significantly higher in patients undergoing GA&M (Fig 1); whether this is primarily due to treatment adaptations or nononcologic interventions, or a combination of both, remains to be clarified. There does not appear to be a survival benefit from GA&M: only two of 10 studies showed a positive effect on survival (Fig 1). It is important to note that there was no negative effect; the choice of less-intensive treatment options because of a patient's vulnerability does not seem to increase mortality. Few studies have addressed patient-centered outcomes, and the results are varying. At the 2020 ASCO virtual conference, one RCT was presented in which patient function was the primary study outcome. In that study, 154 patients planned for chemotherapy, targeted therapy, or immunotherapy were allocated to a geriatrician-led GA&M or usual care. Patients in the intervention group had significantly better scores on the Elderly Functional Index than the usual care group across all follow-up timepoints, with a maximal difference at week 18, and showed better scores for physical functioning, role, and social functioning, mobility, burden of illness, and future worries.[7] Another RCT found that the addition of a geriatric evaluation to standard care for hospitalized older patients with cancer resulted in a significant decrease in the amount of emotional limitations, social dysfunction, and bodily pain at 3 months; the effect on pain was still significant 1 year after hospital discharge.[48] A third RCT found a nonsignificant positive effect on quality of life at 3 months, which was

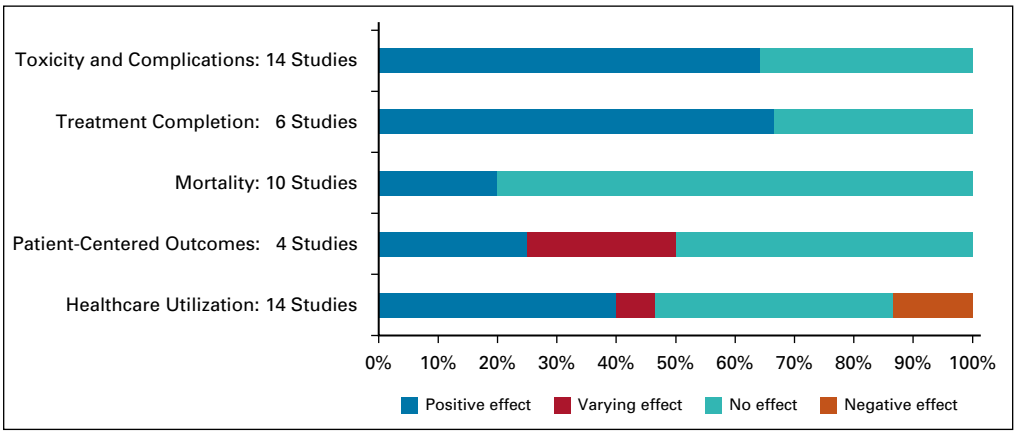

FIG 1. Effect of geriatric evaluation on course of treatment and different treatment outcomes—toxicity and complications, treatment completion, mortality, patient-centered outcomes, and healthcare utilization. Details per study in Table 2 and the Data Supplement.

TABLE 2. Design of Studies on Geriatric Assessment and Management

Reference	Location	Publication Type	Selection Criteria	Cancer Type	Type of Treatment	Study Design	Type of GA	GA Included in Oncologic Treatment Decision?	Management Strategy for Geriatric Impairments and Follow-Up
Abel et al[67]	United States	A	Age ≥ 75	Hematologic	CT	Random assignment	C	Unclear	Geriatric co-management
Corre et al[34]	France	F	Age ≥ 70, PS 0-2	NSCLC	CT	Random assignment	A	Yes	None
Derman et al[68]	United States	F	Age ≥ 60	Hematologic	CT	Historic controls	MDT	Yes	Predefined intervention protocol
Kalsi et al[35]	United Kingdom	F	Age ≥ 70	Various	CT	Historic controls	C	No	Geriatric co-management
Li et al[6]	United States	A	Age ≥ 65	Various	CT	Random assignment	MDT	No	Predefined intervention protocol
Mohile et al[5]	United States	A	Age ≥ 70, > 1 geriatric impairment	Various	CT	Random assignment	A	Yes	Predefined intervention protocol
Nadaraja et al[69]	Denmark	F	Age ≥ 70	Various	CT	Random assignment	C	Yes	Geriatric co-management
Puts et al,[49] Sattar et al[70]	Canada	F	Age ≥ 70	Various	CT	Random assignment	A	No	Predefined intervention protocol
Soo et al[7]	Australia	A	Age ≥ 70	Various	CT	Random assignment	C	Unclear	Not specified
Hempenius et al[50,71]	Netherlands	F	Age > 65, GFI > 3	Various	Surgery	Random assignment	C	No	Geriatric co-management
Ho et al[72]	Hong Kong	A	Age > 70, fit for resection	Colorectal	Surgery	Random assignment	C	No	Geriatric co-management
Mak et al[73]	Hong Kong	A	Age > 70	Colorectal	Surgery	Matched controls	C	No	Geriatric co-management
Odetto et al[74]	Argentina	A	Age ≥ 70	Colorectal	Surgery	Random assignment	MDT	Yes	Not specified
Ommundsen et al[75]	Norway	F	Age > 65, frailty criteria	Colorectal	Surgery	Random assignment	C	No	Geriatric co-management
Qian et al[76]	United States	A	Age ≥ 65	GI	Surgery	Random assignment	C	No	Management recommendations made to surgery or oncology team
Singh et al[77]	United Kingdom	A	Frailty or multimorbidity	GI	Surgery	Historic controls	C	No	Proactive postoperative multidisciplinary support
Fletcher et al[36]	Australia	A	Age ≥ 70	Various	Various	Matched controls	MDT	Yes	Not specified
Magnuson et al[78]	United States	F	Age ≥ 70, stage III/IV	Various	Various	Random assignment	A	No	Predefined intervention protocol
Pattinson et al[79]	United Kingdom	A	Age ≥ 70	Upper GI	Various	Historic controls	MDT	Yes	Follow-up by GA team
Rao et al[48]	United States	F	Age ≥ 65, hospitalized, frail	Various	Various	Random assignment	C	No	Geriatric co-management

Abbreviations: A (publication type), abstract; A (type of GA), geriatric assessment by oncology team; C, geriatric consultation; CT, chemotherapy; F, full text; GA, geriatric assessment; GFI, Groningen Frailty Indicator; MDT, geriatric assessment by multidisciplinary team; NSCLC, non–small-cell lung cancer; PS, performance status.

no longer present 6 months after the evaluation.[49] Finally, a study assessing the effect of GA&M in patients undergoing oncologic surgery found no effect on longer-term physical functioning.[50]

For healthcare utilization, no RCTs are available, but there are several observational studies with conflicting results (Fig 1): 40% of studies show less healthcare consumption, some find no differences, and 14% report higher utilization rates. No studies on cost-effectiveness have thus far been completed, although at least one such trial is underway,[51] and a study presented at the International Society of Geriatric Oncology meeting in 2019 suggested that GA&M was cost saving.[52]

Models of GA have been described in various parts of the world (see the Data Supplement). Inspection of national or regional guidelines demonstrates widespread agreement on domains to be included in the GA and no evidence for geographic differences in specific models or instruments, although empiric data are lacking. Some authors have pointed out the lack of representation from developing countries and the need to consider adapted models of GA in such countries.[53]

SUMMARY

Frailty is common in older patients with cancer, making them more prone to adverse health outcomes. Fortunately, GA&M can improve the decision-making process and outcomes across a variety of settings. In addition to better tailoring of treatment to the patient's health status and optimizing or providing support for issues and impairments that are identified through GA, there are other mechanisms that may explain the observed effects of GA&M on outcomes. First, the assessment itself improves communication by highlighting risks and therefore leads to a broader understanding of the situation for both the treating oncologist and the patient and caregivers.[28] A common ground for decision making, which incorporates the patient's goals and preferences, is likely to improve treatment satisfaction, which in itself affects quality of life. Second, GA establishes a baseline status before cancer treatment is initiated. Without a baseline assessment of functional status, cognition, or mobility, it is difficult to notice and address deterioration in these domains during the course of treatment. In older adults, complications may manifest uncharacteristically, such as delirium, falls, or functional decline, meaning that routine toxicity measurements—such as neutrophil counts—are insufficient. Because GA often uncovers unknown nononcologic issues, such as cognitive impairment, some of these atypical complications may be anticipated and thus prevented.[54]

Treatment decisions in older patients are complex, and there is no simple algorithm that will translate the results of GA to a treatment plan. GA cannot be used as an easy go-no-go instrument. Tumor characteristics, treatment options, a patient's vulnerabilities and reserves, as well as their goals and preferences will all factor into the final treatment decision. This requires careful consideration and multidisciplinary discussion. Although this may take some extra time before the start of treatment, it will save time later, as treatment that is optimally tailored to the patient's situation is less likely to result in treatment-related complications and other adverse health outcomes.[10]

As we know the potential benefits of GA&M on the basis of robust evidence, current challenges are about implementation in daily practice. Various organization systems have been proposed and evaluated depending on the setting and on available resources. Yet, a multiprofessional and patient-centered—not disease-centered—approach is necessary and will demand major organizational changes in oncology departments. We therefore need to convince colleagues that these changes will improve both quality of care and patients' well-being. Oncologists, geriatricians, and allied health professionals, including nurses and supportive care professionals, should be involved in designing this new organization in a multiprofessional order. Patients should be consulted in a codesign approach, which also integrates the patients' goals and preferences for shared decision making. To allow for an appropriate evaluation and follow-up of patients, more healthcare professionals will have to be hired, such as advanced practice nurses. These changes will need support from national health authorities. The evidence shows benefits for patients and health professionals (time saving and securing treatment decisions), but health authorities should also foresee benefits for the health system (decrease of complications and unplanned hospitalizations, reduction of unnecessary prescriptions, and decrease in patients' dependence). All these benefits need to be quantified, raising the need for health economic studies, performed in various health organization systems.

Such an initiative will be launched soon, thanks to European Commission H2020 funding of a large international project called GerOnTe (streamlined Geriatric and Oncological evaluation based on information and communication Technology for holistic patient-oriented healthcare management for older multimorbid patients). GerOnTe multimorbid patient–centered system proposes: (1) Coordination of management by a patient-tailored, interdisciplinary health professional consortium, including hospital- and home-based professionals with a case manager; (2) Timely registration of symptoms and patient-reported outcomes at home through a web-based app for anticipation of avoidable adverse events; (3) Proposal of self-management guidelines according to intrinsic capacity evaluation by geriatrician for patient-driven improvement of independent living; and (4) Structured collection of data from electronic health records into a dashboard made available to health professional consortium members as

well as patient and caregiver, thanks to its capacity to securely interoperate with all electronic health records including software managing medical data. The whole approach will be co-designed with patients, informal caregivers, and healthcare professionals.

In conclusion, treatment decisions for older patients with cancer can be difficult: risks need to be carefully weighed against benefits within the context of the individual patient, each with their own goals, preferences, concerns, resources, and vulnerabilities. GA&M can improve outcomes across a variety of settings by better tailoring of treatment to the patient's health status and optimizing or providing support for issues and impairments that are identified through GA. As the many benefits of GA&M have become increasingly clear, challenges are now about implementation in daily oncology practice.

AFFILIATIONS

[1]Department of Geriatric Medicine, Oslo University Hospital, Oslo, Norway
[2]Institute of Clinical Medicine, University of Oslo, Oslo, Norway
[3]Applied Radiation Therapy Trinity, Trinity St James's Cancer Institute, Trinity College Dublin, Dublin, Ireland
[4]Department of Medical Oncology, Institut Bergonié, Université de Bordeaux, Inserm U1218, Bordeaux, France
[5]Department of Medicine, University of Toronto, Toronto, ON, Canada
[6]Internal Medicine and Geriatrics, University Health Network, Toronto, ON, Canada
[7]Department of Geriatric Medicine, Diakonessenhuis, Utrecht, the Netherlands

CORRESPONDING AUTHOR

Siri Rostoft, MD, PhD, Department of Geriatric Medicine, Research Section, Oslo University Hospital, Ullevaal, Pb 4956 Nydalen, 0424 Oslo, Norway; e-mail: srostoft@gmail.com.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Disclosures provided by the authors are available with this article at DOI https://doi.org/10.1200/JCO.21.00089.

AUTHOR CONTRIBUTIONS

Conception and design: All authors
Collection and assembly of data: All authors
Data analysis and interpretation: All authors
Manuscript writing: All authors
Final approval of manuscript: All authors
Accountable for all aspects of the work: All authors

REFERENCES

1. Barnett K, Mercer SW, Norbury M, et al: Epidemiology of multimorbidity and implications for health care, research, and medical education: A cross-sectional study. Lancet 380:37-43, 2012
2. Abbasi J: Older patients (Still) left out of cancer clinical trials. JAMA 322:1751-1753, 2019
3. Wildiers H, de Glas NA: Anticancer drugs are not well tolerated in all older patients with cancer. Lancet Healthy Longev 1:e43-e47, 2020
4. Mohile SG, Dale W, Somerfield MR, et al: Practical assessment and management of vulnerabilities in older patients receiving chemotherapy: ASCO guideline for geriatric oncology. J Clin Oncol 36:2326-2347, 2018
5. Mohile SG, Mohamed MR, Culekova E, et al: A geriatric assessment (GA) intervention to reduce treatment toxicity in older patients with advanced cancer: A University of Rochester Cancer Center NCI community oncology research program cluster randomized clinical trial (CRCT). J Clin Oncol 38, 2020 (suppl; abstr 12009)
6. Li D, Sun C-L, Kim H, et al: Geriatric assessment-driven intervention (GAIN) on chemotherapy toxicity in older adults with cancer: A randomized controlled trial. J Clin Oncol 38, 2020 (suppl; abstr 12010)
7. Soo W-KS, King MK, Pope A, et al: Integrated geriatric assessment and treatment (INTEGERATE) in older people with cancer planned for systemic anticancer therapy. J Clin Oncol 38, 2020 (suppl; abstr 12011)
8. Puts MTE, Alibhai SMH: Fighting back against the dilution of the Comprehensive Geriatric Assessment. J Geriatr Oncol 9:3-5, 2018
9. Hamaker ME, Te Molder M, Thielen N, et al: The effect of a geriatric evaluation on treatment decisions and outcome for older cancer patients: A systematic review. J Geriatr Oncol 9:430-440, 2018
10. Hamaker ME, Wildes TM, Rostoft S: Time to stop saying geriatric assessment is too time consuming. J Clin Oncol 35:2871-2874, 2017
11. van Walree IC, Scheepers E, van Huis-Tanja L, et al: A systematic review on the association of the G8 with geriatric assessment, prognosis and course of treatment in older patients with cancer. J Geriatr Oncol 10:847-858, 2019
12. Decoster L, Van Puyvelde K, Mohile S, et al: Screening tools for multidimensional health problems warranting a geriatric assessment in older cancer patients: An update on SIOG recommendations. Ann Oncol 26:288-300, 2015
13. Garcia MV, Agar MR, Soo WK, et al: Screening tools for identifying older adults with cancer who may benefit from a geriatric assessment: A systematic review. JAMA Oncol 7:616-627, 2021
14. Jolly TA, Deal AM, Mariano C, et al: A randomized trial of real-time geriatric assessment reporting in nonelectively hospitalized older adults with cancer. Oncologist 25:488-496, 2020
15. Lee SJ, Lindquist K, Segal MR, et al: Development and validation of a prognostic index for 4-year mortality in older adults. JAMA 295:801-808, 2006
16. Suemoto CK, Ueda P, Beltran-Sanchez H, et al: Development and validation of a 10-year mortality prediction model: Meta-analysis of individual participant data from five cohorts of older adults in developed and developing countries. J Gerontol A Biol Sci Med Sci 72:410-416, 2017
17. Schonberg MA, Davis RB, McCarthy EP, et al: External validation of an index to predict up to 9-year mortality of community-dwelling adults aged 65 and older. J Am Geriatr Soc 59:1444-1451, 2011
18. Walter LC, Covinsky KE: Cancer screening in elderly patients: A framework for individualized decision making. JAMA 285:2750-2756, 2001

19. DuMontier C, Loh KP, Bain PA, et al: Defining undertreatment and overtreatment in older adults with cancer: A scoping literature review. J Clin Oncol 38: 2558-2569, 2020
20. Krishnan M, Temel JS, Wright AA, et al: Predicting life expectancy in patients with advanced incurable cancer: A review. J Support Oncol 11:68-74, 2013
21. Hurria A, Togawa K, Mohile SG, et al: Predicting chemotherapy toxicity in older adults with cancer: A prospective multicenter study. J Clin Oncol 29:3457-3465, 2011
22. Extermann M, Boler I, Reich RR, et al: Predicting the risk of chemotherapy toxicity in older patients: The Chemotherapy Risk Assessment Scale for High-age patients (CRASH) score. Cancer 118:3377-3386, 2012
23. Bilimoria KY, Liu Y, Paruch JL, et al: Development and evaluation of the universal ACS NSQIP surgical risk calculator: A decision aid and informed consent tool for patients and surgeons. J Am Coll Surg 217:833-842.e1-3, 2013
24. Jones TS, Dunn CL, Wu DS, et al: Relationship between asking an older adult about falls and surgical outcomes. JAMA Surg 148:1132-1138, 2013
25. Szumacher E, Sattar S, Neve M, et al: Use of comprehensive geriatric assessment and geriatric screening for older adults in the radiation oncology setting: A systematic review. Clin Oncol (R Coll Radiol) 30:578-588, 2018
26. Hoeben KW, van Steenbergen LN, van de Wouw AJ, et al: Treatment and complications in elderly stage III colon cancer patients in the Netherlands. Ann Oncol 24:974-979, 2013
27. Lantz PM, Janz NK, Fagerlin A, et al: Satisfaction with surgery outcomes and the decision process in a population-based sample of women with breast cancer. Health Serv Res 40:745-767, 2005
28. Mohile SG, Epstein RM, Hurria A, et al: Communication with older patients with cancer using geriatric assessment: A cluster-randomized clinical trial from the National Cancer Institute Community Oncology Research Program. JAMA Oncol 6:196-204, 2020
29. Baronner A, MacKenzie A: Using geriatric assessment strategies to lead end-of-life care discussions. Curr Oncol Rep 19:75, 2017
30. Lowenstein LM, Volk RJ, Street R, et al: Communication about geriatric assessment domains in advanced cancer settings: "Missed opportunities". J Geriatr Oncol 10:68-73, 2019
31. Hafeez S, McDonald F, Lalondrelle S, et al: Clinical outcomes of image guided adaptive hypofractionated weekly radiation therapy for bladder cancer in patients unsuitable for radical treatment. Int J Radiat Oncol Biol Phys 98:115-122, 2017
32. Russi EG, Pelissero A, Melano A, et al: Facial basal cell carcinomas in elderly frail patients treated with low total-dose radiotherapy. Anticancer Res 35: 4949-4953, 2015
33. Roa W, Kepka L, Kumar N, et al: International atomic energy agency randomized phase III study of radiation therapy in elderly and/or frail patients with newly diagnosed glioblastoma multiforme. J Clin Oncol 33:4145-4150, 2015
34. Corre R, Greillier L, Le Caër H, et al: Use of a comprehensive geriatric assessment for the management of elderly patients with advanced non-small-cell lung cancer: The phase III randomized ESOGIA-GFPC-GECP 08-02 study. J Clin Oncol 34:1476-1483, 2016
35. Kalsi T, Babic-Illman G, Ross PJ, et al: The impact of comprehensive geriatric assessment interventions on tolerance to chemotherapy in older people. Br J Cancer 112:1435-1444, 2015
36. Fletcher J, Sanmugarajah J, Caird S, et al: Assessing treatment tolerability after geriatric assessment in the Senior Oncology Clinic at the Gold Coast University Hospital. Asia Pac J Clin Oncol 13, 2017 (suppl; abstr 122)
37. Hamaker ME, Schiphorst AH, ten Bokkel Huinink D, et al: The effect of a geriatric evaluation on treatment decisions for older cancer patients: A systematic review. Acta Oncol 53:289-296, 2014
38. Hamaker ME, Oosterlaan F, van Huis LH, et al: Nutritional status and interventions for patients with cancer: A systematic review. J Geriatr Oncol 12:P6-P21, 2020
39. Kenis C, Decoster L, Bastin J, et al: Functional decline in older patients with cancer receiving chemotherapy: A multicenter prospective study. J Geriatr Oncol 8: 196-205, 2017
40. Kristjansson SR, Nesbakken A, Jordhoy MS, et al: Comprehensive geriatric assessment can predict complications in elderly patients after elective surgery for colorectal cancer: A prospective observational cohort study. Crit Rev Oncol Hematol 76:208-217, 2010
41. Carli F: Prehabilitation for the anesthesiologist. Anesthesiology 133:645-652, 2020
42. Martínez-Velilla N, Casas-Herrero A, Zambom-Ferraresi F, et al: Effect of exercise intervention on functional decline in very elderly patients during acute hospitalization: A randomized clinical trial. JAMA Intern Med 179:28-36, 2019
43. Jung P, Puts M, Frankel N, et al: Delirium incidence, risk factors, and treatments in older adults receiving chemotherapy: A systematic review and meta-analysis. J Geriatr Oncol 12:352-360, 2021
44. Watt J, Tricco AC, Talbot-Hamon C, et al: Identifying older adults at risk of delirium following elective surgery: A systematic review and meta-analysis. J Gen Intern Med 33:500-509, 2018
45. Pinquart M, Duberstein PR: Depression and cancer mortality: A meta-analysis. Psychol Med 40:1797-1810, 2010
46. Kristjansson SR, Jordhøy MS, Nesbakken A, et al: Which elements of a comprehensive geriatric assessment (CGA) predict post-operative complications and early mortality after colorectal cancer surgery? J Geriatr Oncol 1:57-65, 2010
47. Saracino RM, Nelson CJ: Identification and treatment of depressive disorders in older adults with cancer. J Geriatr Oncol 10:680-684, 2019
48. Rao AV, Hsieh F, Feussner JR, et al: Geriatric evaluation and management units in the care of the frail elderly cancer patient. J Gerontol A Biol Sci Med Sci 60: 798-803, 2005
49. Puts MTE, Sattar S, Kulik M, et al: A randomized phase II trial of geriatric assessment and management for older cancer patients. Support Care Cancer 26: 109-117, 2018
50. Hempenius L, Slaets JP, van Asselt D, et al: Long term outcomes of a geriatric liaison intervention in frail elderly cancer patients. PLoS One 11:e0143364, 2016
51. Puts MTE, Hsu T, Mariano C, et al: Clinical and Cost-effectiveness of a Comprehensive geriatric assessment and management for Canadian elders with Cancer-the 5C study: A study protocol for a randomised controlled phase III trial. BMJ Open 9:e024485, 2019
52. Alam Z, Malik U, Chan KK, et al: Cost effectiveness of a geriatric oncology clinic. J Geriatr Oncol 10:S10, 2019
53. Soto-Perez-de-Celis E: Global geriatric oncology: One size does not fit all. J Geriatr Oncol 10:199-201, 2019
54. Hshieh TT, Yue J, Oh E, et al: Effectiveness of multicomponent nonpharmacological delirium interventions: A meta-analysis. JAMA Intern Med 175:512-520, 2015
55. Hoppe S, Rainfray M, Fonck M, et al: Functional decline in older patients with cancer receiving first-line chemotherapy. J Clin Oncol 31:3877-3882, 2013
56. Verweij NM, Schiphorst AHW, Pronk A, et al: Physical performance measures for predicting outcome in cancer patients: A systematic review. Acta Oncol 55: 1386-1391, 2016

57. Huisman MG, Van Leeuwen BL, Ugolini G, et al: "Timed Up & Go": A screening tool for predicting 30-day morbidity in onco-geriatric surgical patients? A multicenter cohort study. PLoS one 9:e86863, 2014
58. Pamoukdjian F, Paillaud E, Zelek L, et al: Measurement of gait speed in older adults to identify complications associated with frailty: A systematic review. J Geriatr Oncol 6:484-496, 2015
59. Hurria A, Mohile S, Gajra A, et al: Validation of a prediction tool for chemotherapy toxicity in older adults with cancer. J Clin Oncol 34:2366-2371, 2016
60. Robb C, Boulware D, Overcash J, et al: Patterns of care and survival in cancer patients with cognitive impairment. Crit Rev Oncol Hematol 74:218-224, 2010
61. Clough-Gorr KM, Stuck AE, Thwin SS, et al: Older breast cancer survivors: Geriatric assessment domains are associated with poor tolerance of treatment adverse effects and predict mortality over 7 years of follow-up. J Clin Oncol 28:380-386, 2010
62. Soubeyran P, Fonck M, Blanc-Bisson C, et al: Predictors of early death risk in older patients treated with first-line chemotherapy for cancer. J Clin Oncol 30: 1829-1834, 2012
63. Aaldriks AA, Maartense E, Nortier HJWR, et al: Prognostic factors for the feasibility of chemotherapy and the Geriatric Prognostic Index (GPI) as risk profile for mortality before chemotherapy in the elderly. Acta Oncologica 55:15-23, 2016
64. Williams GR, Mackenzie A, Magnuson A, et al: Comorbidity in older adults with cancer. J Geriatr Oncol 7:249-257, 2016
65. Nightingale G, Skonecki E, Boparai MK: The impact of polypharmacy on patient outcomes in older adults with cancer. Cancer J 23:211-218, 2017
66. Kadambi S, Soto-Perez-de-Celis E, Garg T, et al: Social support for older adults with cancer: Young International Society of Geriatric Oncology review paper. J Geriatr Oncol 11:217-224, 2020
67. Abel GA, Uno H, Tanasijevic AM, et al: Feasibility and impact of embedded geriatric consultation for frail older adults with blood cancer: A randomized controlled trial. Blood 134:67, 2019
68. Derman BA, Kordas K, Ridgeway J, et al: Results from a multidisciplinary clinic guided by geriatric assessment before stem cell transplantation in older adults. Blood Adv 3:3488-3498, 2019
69. Nadaraja S, Matzen LE, Jørgensen TL, et al: The impact of comprehensive geriatric assessment for optimal treatment of older patients with cancer: A randomized parallel-group clinical trial. J Geriatr Oncol 11:488-495, 2020
70. Sattar S, Alibhai SMH, Brennenstuhl S, et al: Health status, emergency department visits, and oncologists' feedback: An analysis of secondary endpoints from a randomized phase II geriatric assessment trial. J Geriatr Oncol 10:169-174, 2019
71. Hempenius L, Slaets JP, van Asselt D, et al: Outcomes of a geriatric liaison intervention to prevent the development of postoperative delirium in frail elderly cancer patients: Report on a multicentre, randomized, controlled trial. PLoS One 8:e64834, 2013
72. Ho M, Dai D, Lee J, et al: A randomized controlled clinical trial to assess the impact of enhanced geriatric input on elderly patients undergoing colorectal cancer surgery. Surg Pract 21:4, 2017
73. Mak T, Dai D, Leung W, et al: A pilot study of enhanced geriatric input in management of elderly patients undergoing colorectal cancer surgery: LTP072. Colorectal Dis 16:56, 2014
74. Odetto D, Smietniansky M, Noll F, et al: Impact of a geriatric consultation in the decision making process for patients with gynecological cancer. Int J Gynecol Cancer26:1175, 2016
75. Ommundsen N, Wyller TB, Nesbakken A, et al: Preoperative geriatric assessment and tailored interventions in frail older patients with colorectal cancer: A randomized controlled trial. Colorectal Dis 20:16-25, 2018
76. Qian CL, Knight HP, Ferrone CR, et al: Randomized trial of a perioperative geriatric intervention for older adults with cancer. J Clin Oncol 38, 2020 (suppl; abstr 12012)
77. Singh S, Hodgkinson R, Shipway D, et al: Perioperative comprehensive geriatric assessment is associated with reduced inpatient length of stay. Eur Geriatr Med 6:S148, 2015
78. Magnuson A, Lemelman T, Pandya C, et al: Geriatric assessment with management intervention in older adults with cancer: A randomized pilot study. Support Care Cancer 26:605-613, 2018
79. Pattinson J, Sims A, Cowley A, et al: Does comprehensive geriatric assessment affect decision-making & outcomes for older adults treated for upper gastro-intestinal cancer. Eur Geriatr Med 7:S101, 2016

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Geriatric Assessment and Management in Cancer

The following represents disclosure information provided by authors of this manuscript. All relationships are considered compensated unless otherwise noted. Relationships are self-held unless noted. I = Immediate Family Member, Inst = My Institution. Relationships may not relate to the subject matter of this manuscript. For more information about ASCO's conflict of interest policy, please refer to www.asco.org/rwc or ascopubs.org/jco/authors/author-center.

Open Payments is a public database containing information reported by companies about payments made to US-licensed physicians (Open Payments).

Pierre Soubeyran
Honoraria: GlaxoSmithKline
Consulting or Advisory Role: Bristol-Myers Squibb, Eisai
Research Funding: Roche
Travel, Accommodations, Expenses: Hospira, Teva, Celgene, AstraZeneca

Shabbir M. H. Alibhai
Stock and Other Ownership Interests: ResMed
Honoraria: Astellas Scientific and Medical Affairs

No other potential conflicts of interest were reported.