Adequate assessment yields appropriate care—the role of geriatric assessment and management in older adults with cancer

a position paper from the ESMO/SIOG Cancer in the Elderly Working Group

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REVIEW

Adequate assessment yields appropriate care—the role of geriatric assessment and management in older adults with cancer: a position paper from the ESMO/SIOG Cancer in the Elderly Working Group

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With the aging population, older adults constitute a growing proportion of the new cancer cases. Given the heterogeneous health status among older adults and their susceptibility to aging-related vulnerabilities, understanding their diversity and its implications becomes increasingly crucial for prognostication and guiding diagnostics, treatment decisions, and follow-up, as well as informing supportive care interventions. Geriatric assessment and management (GAM) refers to the comprehensive evaluation of an older individual's health status with subsequent management plans focusing on both oncologic and non-oncologic interventions. In 2019, the European Society for Medical Oncology (ESMO) and the International Society of Geriatric Oncology (SIOG) established the ESMO/SIOG Cancer in the Elderly Working Group. This position paper reflects the recommendations of the working group. Our paper summarizes the existing evidence with a focus on recent key trials and based on this, we propose several recommendations and future directions.

Key words: geriatric assessment, older adults, cancer, management

INTRODUCTION

Worldwide, there will be an estimated 28.4 million new cancer cases in 2040, representing a 47% increase compared to 2020.[1] In the next few decades, older adults will constitute a growing proportion of the new cancer cases.[2,3] Along with advances in cancer therapeutics that are more tolerable and improve outcomes, more older adults will receive and benefit from cancer-directed treatments.[4,5] Given the heterogeneous health status among older adults and their susceptibility to aging-related vulnerabilities, understanding their diversity and its implications becomes increasingly crucial for prognostication and guiding diagnostics, treatment decisions, and follow-up, as well as informing supportive care

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interventions.[6] Geriatric assessment and management (GAM) refers to the comprehensive evaluation of an individual's health status with subsequent management plans focusing on both oncologic and non-oncologic interventions. Over the past decade, several large, randomized trials have investigated the effects of GAM on outcomes.

In 2019, the European Society for Medical Oncology (ESMO) and the International Society of Geriatric Oncology (SIOG) established the ESMO/SIOG Cancer in the Elderly Working Group. The aims are to improve the management of older patients with cancer, enhance education for oncology professionals on issues pertinent to this demographic, and raise awareness regarding their specific needs and management requirements. This position paper reflects the recommendations of the working group and summarizes the existing evidence with a focus on recent key trials, allowing us to propose several recommendations and future directions.

GERIATRIC ASSESSMENT AND MANAGEMENT (GAM)

Geriatric assessment (GA) evaluates multiple domains that influence prognosis and treatment decisions in older adults.[1,7] The most common domains include, but are not limited to, functional status, comorbidities, cognitive function, psychological status, social functioning and support, nutritional status, and medications (Table 1). Suggested tools used to assess these domains are highlighted. Assessing all domains is more important than using multiple tools within each domain, with the choice of tools depending on local resources and expertise. Completing a GA alone is not sufficient, as clinicians should utilize this data to inform management decisions [i.e. GAM or comprehensive geriatric assessment (CGA)]. The assessment can also guide referrals to health care professionals specific to the identified deficit. Additionally, a one-time assessment may overlook changes in the patient's clinical status over time. For example, treatment regimens that include platinum or 5-flurouracil frequently cause nausea and loss of appetite, leading to impaired nutritional status. On the other hand, patients may have improvement in cancer symptoms because of treatments. Therefore, reassessment at intervals, upon progression or changes in health status, can facilitate dynamic decision making in cancer care for older adults, including treatment changes (e.g. dose intensification, reduction, dose delays) and supportive care interventions.

Table 1. Geriatric assessment domains and tools

Geriatric assessment domain	Tools[a]	Interventions for positive finding

Functional status	• Self-reported:
	  ○ Activities of daily living
	  ○ Instrumental activities of daily living
	  ○ Falls
	• Objective tests:
	  ○ Timed up and go test
	  ○ Gait speed
	  ○ Short physical performance battery
		1. Mobility and health aids
		2. Home safety equipment
		3. Promote physical activity
		4. Physical therapy and rehabilitation

Comorbidity	• Charlson Comorbidity Index • Cumulative Index Rating Scale-Geriatric • Adult Comorbidity Evaluation-27	1. Comorbidity management 2. Referral to a geriatrician or other specialists 3. Clarify goals of care
Social functioning and support	• Medical Outcomes Study survey • RAND-36 Healthcare Survey	1. Consult social work 2. Consult financial services
Cognition	• Blessed Orientation Memory Concentration test • Mini Cog • Mini Mental State Examination • Montreal Cognitive Assessment	1. Counseling 2. Assess inappropriate medications 3. Evaluate decisional capacity 4. Referral to geriatric neuropsychologist
Psychological status	• Distress Thermometer • Geriatric Depression Scale (several versions available) • Mental Health Inventory • Patient Health Questionnaire (several versions available)	1. Cognitive behavioral therapy 2. Non-pharmacological approaches (meditation) 3. Anti-depressants 4. Referral to a geriatric psychiatrist 5. Communicate with primary care team
Nutrition	• Weight loss • Body mass index • Mini Nutritional Assessment • Malnutrition Universal Screening Tool	1. Address factors contributing to malnutrition 2. Address chemotherapy-induced adverse effects like nausea/vomiting 3. Oral care 4. Supplemental nutrition 5. Refer to dietitian
Polypharmacy	• Beers Criteria • Medication Appropriateness Index • STOPP/START criteria	1. Medication reconciliation 2. Evaluate adherence 3. Evaluate drug interactions 4. Deprescribing 5. Home health for medication management

START, Screening Tool to Alert to Right Treatment; STOPP, Screening Tool of Older Persons' Prescriptions.
[a]At a minimum, consider one tool from the domains of functional status (instrumental activities of daily living), cognition (Mini Cog or Blessed Orientation Memory Concentration), and psychological status (PHQ-2); assess weight loss, comorbidity, and medications from the medical records; and inquire about source of social support from the patient.

EVIDENCE FROM RANDOMIZED TRIALS OF GAM

In this section, we discuss and summarize results of selected randomized trials testing GAM for older adults with cancer (Tables 2 and 3).

The Improving Communication in Older Cancer Patients and Their Caregivers (COACH) cluster-randomized trial investigated whether providing oncologists the results of GA and GA-guided recommendations improved patient and caregiver satisfaction as well as number and quality of conversations about aging-related concerns compared to those who received usual care.[8] The study recruited 541 patients aged ≥70 years with an advanced solid malignancy or lymphoma who had one or more GA-identified impairment, and 414 associated caregivers. The study recruited a population of vulnerable older adults with cancer as 90% of patients were found to have three or more impairments in GA domains. Compared to the usual care arm, patients and caregivers in the intervention arm were more satisfied with communication about aging-related concerns and they had more aging-related conversations. Quality of life (QoL) was not different between arms.

The GAP70+ cluster-randomized study employed a similar study design and eligibility criteria, except that patients were also planning to start a new cancer treatment regimen with a high risk of toxicity ($N = 718$).[6] The study found that the proportion of grade 3-5 toxicities was lower in the intervention arm compared to usual care [51% versus 71%; relative risk (RR): 0.74, $P = 0.0001$]. Non-hematologic adverse events (AEs) were also lower, with no difference in survival between arms. Notably, upfront dose reduction was more common in the intervention arm versus the usual-care arm (49% versus 35%, adjusted RR: 1.38, $P = 0.015$) and subsequent dose modifications due to toxicity were lower in the intervention arm (43% versus 58%, $P = 0.18$). Patients in the intervention arm also experienced significantly fewer falls (RR: 0.58, $P = 0.0035$) and reduction in polypharmacy ($P = 0.015$). Together, both the COACH and GAP70+ studies demonstrate that providing oncologists with GA and GA-guided recommendations can lead to a decrease in serious toxicities and improvements in patient and caregiver communication and satisfaction without a negative impact on overall survival.

The GAIN study ($N = 605$) utilized a different model than COACH and GAP70+.[8] In the intervention arm, a multidisciplinary team implemented GA-guided interventions, whereas in the usual-care arm, treating oncologists received the GA results for use at their discretion. The study recruited patients aged ≥65 years with a solid tumor who were starting a new chemotherapy regimen. Like GAP70+, the study showed a 10.1% reduction in the incidence of grade 3-5 hematologic and non-hematologic toxicities favoring the intervention arm (50.5% versus 60.6%, $P = 0.02$). Completion of advanced directives was also higher in the intervention arm (28.4% versus 13.3%; $P < 0.001$), with no differences in survival between arms. The study confirmed that use of a multidisciplinary team model to deliver GAM reduced the rate of serious toxicities and increased the completion of advanced directives.

The INTEGERATE study, a randomized parallel group trial, examined the effect of GAM integrated into oncology care versus usual care on QoL in patients aged >70 years receiving systemic cancer treatments ($n = 154$).[9] Results showed that patients in the intervention arm reported significantly higher QoL scores compared to those in the usual-care arm, with the most significant difference observed at week 18 ($P = 0.039$). Moreover, there were fewer unplanned hospitalizations in the intervention group by week 24 ($P = 0.0066$). Exploratory analyses revealed that patients receiving GAM experienced significantly fewer toxicities ($P = 0.0013$), leading to a lower rate of early treatment discontinuation ($P = 0.010$). Similar to the GAIN study, the INTEGERATE trial utilized a multidisciplinary approach and demonstrated that integrating GAM not only improved QoL but also reduced health care utilization in older adults with cancer.

The Canadian 5C randomized multicenter trial aimed to determine whether GAM could enhance QoL compared to standard care among patients aged ≥70 years with solid malignancies or myeloma/lymphoma undergoing adjuvant or palliative systemic cancer treatments ($N = 340$).[10,11] However, despite the provision of GAM for 6 months, there was no observed improvement in global QoL. Additionally, the study found no significant differences in OS, treatment-related AEs, alterations in treatment plans, or rates of unplanned hospitalization. It is worth noting that in this study, GA was conducted on the first day of treatment for most patients, potentially minimizing the impact of GA on treatment adjustments.

The randomized phase III GERICO trial investigated the effect of GAM in adults ≥70 years of age with colorectal cancer receiving either adjuvant or first-line palliative systemic cancer treatments ($N = 142$).[12] Notably, a higher proportion of patients in the GAM arm successfully completed their planned treatments compared to those in the control arm (45% versus 28%, $P = 0.0366$). Furthermore, individuals in the intervention group experienced lower rates of dose reduction (28% versus 45%, $P = 0.037$) and were more likely to receive all chemotherapy cycles at the intended dosage (65% versus 42%, $P = 0.007$). Additionally, they exhibited significant improvements in QoL ($P = 0.048$) and mobility ($P = 0.008$). However, the trial observed no discernible differences in AEs or QoL between the two groups.

Dumontier et al. conducted a randomized controlled trial to evaluate the impact of integrating geriatric consultation within the oncology clinic compared to standard care among adults aged ≥75 years diagnosed with hematologic malignancies ($N = 160$).[13] The study found that 80% of participants randomized to receive geriatric consultation completed at least one visit with a geriatrician. There was no significant improvement in 1-year survival rates compared to standard care ($P = 0.65$). Additionally, there

Table 2. Study design and settings for pivotal CGA-guided trials

Study	Study acronym	Country	Study type	Trial population	Key inclusion criteria	Model of care/ involved teams	Setting (academic versus community)	Intervention arm	Standard-of-care arm
Mohile et al., 2020[8]	COACH	USA	RCT (cluster-randomized), multisite	Patients: $n = 541$; meanA = 76.6 years; Caregivers: $n = 414$; meanA = 66.5 years	Age ≥70 years; advanced solid cancer or lymphoma and ≥1 GA impairment at baseline; 1 caregiver of patients' choice (optional)	Consultation	Community centers	Community oncology received GA and tailored recommendations for interventions	GA was carried out without reporting to oncologist, exception: alerts for depression/ cognitive impairment
Mohile et al., 2021[6]	GAP70+	USA	RCT (cluster-randomized), multisite	$n = 718$; meanA = 77.2 years	Age ≥70 years; incurable solid cancer or lymphoma and ≥ 1 GA impairment at baseline	Consultation	Community centers	Community oncology received GA and tailored recommendations for interventions	GA was carried out without reporting to oncologist, exception: alerts for depression/ cognitive impairment
Li et al., 2021[24]	GAIN	USA	RCT, single site	$n = 613$; mdA = 71 years	Age ≥65 years; solid cancer, new therapy line intended	Consultation	Academic	CGA	GA results sent to oncologist for consideration; alerts for depression/ cognitive impairment send with urgency
Soo et al., 2022[9]	INTEGERATE	Australia	RCT, multisite	$n = 154$; mdA = 75.5 years	Age ≥70 years; solid cancer, or DLBCL; chemo-, immune-, or targeted therapy intended	Integrated oncogeriatric care	Academic	CGA, geriatric follow-up	No CGA, referral to geriatrician possible if requested by oncologist
Puts et al., 2023[11]	5C	Canada	RCT, multisite	$n = 340$; meanA = 76 years	Age ≥70 years; solid cancer, lymphoma, or myeloma; chemo-, immune-, or targeted therapy intended	Co-management		CGA, geriatric follow-up as needed	No CGA
Lund et al., 2021[12]	GERICO	Denmark	RCT, single site	$n = 142$; mdA = 75 years	Age ≥70 years; first diagnosis of CRC stage II-IV; adjuvant or palliative chemotherapy intended; G8 score ≤14	Co-management	Academic and community centers	Pre-therapeutic CGA, regular geriatric follow-up as needed	No CGA

Continued

Table 2. Continued

Study	Study acronym	Country	Study type	Trial population	Key inclusion criteria	Model of care/ involved teams	Setting (academic versus community)	Intervention arm	Standard-of-care arm
Paillaud et al., 2022[25]	EGeSOR	France	RCT, multisite	$n = 475$; mdA = 75.3 years	Age ≥65 years; first diagnosis or late relapse of HN pre-treatment	Co-management	Academic + community centers	Pre-therapeutic CGA, geriatric follow-up for 24 months	Standard of care, no initial GA
DuMontier et al., 2022[13]	—	USA	RCT, single center	$n = 160$ (IA: $n = 100$; SA: $n = 60$); meanA = 80.4 years	Age ≥75 years, initial consultation for multiple myeloma, lymphoma, or leukemia; transplant-ineligible; (pre-) frail	Consultation	Academic	Initial GA; geriatric consultation twice-weekly, geriatric interventions initiated	GA initially carried out, results blinded to oncologist, no geriatric consultations or interventions
Orum et al., 2021[26]	—	Denmark	RCT, single center	$n = 301$; mdA = 75 years	Age ≥70 years, newly diagnosed solid cancer (LC, GI, HN), planned radiation or systemic cancer therapy	Consultation	Academic	CGA at study initiation with recommendations for interventions, further follow-up, and adaptation of interventions by the geriatric team	CGA at study initiation with recommendations for interventions without further follow-up or adaptation of interventions by the geriatric team
Nipp et al., 2020[14]	—	USA	Pilot RCT, single center	$n = 62$; mdA = 72.3 years; LC: 43.55%; GI: 56.45%	Age ≥65 years, incurable GI cancer or LC	Co-management	Academic	Two in-person consultations with geriatrician, evaluation, and management of geriatric and palliative symptoms	Usual care without geriatric consultations
Nipp et al., 2022[27]	—	USA	RCT, single center	$n = 160$ ($n = 137$ in PP analysis); mdA = 72 years	Age ≥65 years; GI, planned cancer surgery	Consultation	Academic	Preoperative geriatric consultation with CGA, one follow-up visit post-operative	No CGA, standard care
Nadaraja et al., 2020[28]	—	Denmark	RCT, single center	$n = 96$; mA (IA) = 73.9 years; mdA (SA) = 76.8 years	Age ≥70 years; primary sites: GI, GU, GYN, or NSCLC; staring new line of systemic cancer therapy	Consultation	Academic	Screening with G8; if G8 < 14, CGA was carried out and treatment intensity discussed with MDT based on GA results; interventions initiated	Treatment as indicated, treatment decision based on the oncologist's clinical judgment

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Table 2. Continued

Study	Study acronym	Country	Study type	Trial population	Key inclusion criteria	Model of care/ involved teams	Setting (academic versus community)	Intervention arm	Standard-of-care arm
Jeppesen et al., 2018[29]	—	Denmark	Pilot RCT, single center	$n = 51$; mdA = 72 years	Localized NSCLC, intended for SBRT, no age restriction	Consultation	Academic	SBRT +CGA	SBRT − CGA
Hempenius et al., 2016, 2013[30,31]	LIFE	Netherlands	RCT, multicenter	$n = 260$; meanA = 77.4 years	Age ≥65 years; GFI <3; planned surgery for solid cancer	Co-management	Academic and community	Preoperative assessment of risk for delirium by the geriatric team, ongoing geriatric co-management after surgery	Usual care without geriatric co-management

CGA, comprehensive geriatric assessment; CRC, colorectal cancer; DLBCL, diffuse large B-cell lymphoma; GA, geriatric assessment; GFI, Groningen Frailty Indicator; GI, gastrointestinal cancer; GU, genitourinary cancer; GYN, gynecological cancer; HN, head and neck cancer; IA, intervention arm; LC, lung cancer; meanA, mean age; mdA, median age; MDT, multidisciplinary team; NSCLC, non-small-cell lung cancer; PP, per protocol; RCT, randomized controlled trial; SA, standard arm; SBRT, stereotactic body radiotherapy.

was no difference in the incidence of emergency department visits, hospital admissions, or days spent in the hospital. Nevertheless, the intervention did lead to a notable more than threefold increase in the likelihood of engaging in end-of-life goals-of-care discussions [odds ratio (OR) = 3.12, 95% confidence interval (CI) 1.03-9.41].

Nipp et al. conducted a randomized study focusing on a 12-week transdisciplinary intervention designed to address both geriatric and palliative care needs among adults aged ≥65 years diagnosed with incurable gastrointestinal or lung cancer.[14] Almost 90% of patients completed both the baseline and week 12 surveys, indicating a high level of engagement and acceptance of the intervention. In comparison to those receiving usual care, patients in the intervention group experienced a smaller decrease in QoL [effect size (ES) = 0.21], a reduction in the number of moderate to severe symptoms (ES = 0.58), and an improvement in communication confidence (ES = 0.38). This pilot study underscores the feasibility and acceptability of transdisciplinary interventions, with small to medium effects on QoL, symptom management, and communication.

SUMMARY AND RECOMMENDATIONS

Collectively, while models of care differed, several large, randomized trials have demonstrated the positive impact of GAM on multiple meaningful endpoints. These trials demonstrated improvements in QoL, treatment tolerability, physical function or independence, and communication. Although GAM does not influence survival, these outcomes are patient centered and valued by older adults. Additionally, three recently published systematic reviews have further reinforced the benefits of GAM, particularly in reducing treatment-related toxicity and the need for dose reductions.[15-17] Note that these trials were conducted primarily in high-income countries, and many took place in settings with ample resources.

Taken together, the ESMO/SIOG Cancer in the Elderly Working Group proposes the following recommendations:

1. GAM should be implemented in patients aged ≥70 years (and ≥65 years when possible) being considered for cancer-directed treatments, especially systemic treatments.
2. GAM should be carried out as early as possible before treatment initiation, and when possible, before finalization of the treatment plan.
3. In settings where GAM cannot be carried out for all patients, use validated screening tools to identify those who are likely to benefit from subsequent GAM.[18]
4. Models of GAM delivery needs to be tailored to the availability of local resources, settings (e.g. academic cancer centers versus community oncology practices), and staff (e.g. geriatricians or geriatric oncologists, and other allied health care professionals).
5. Utilize the Cancer and Aging Research Group (CARG) or Chemotherapy Risk Assessment Scale for High-Age Patients (CRASH) tools to estimate chemotherapy toxicity in older patients with cancer.

Table 3. Outcomes of pivotal CGA-guided trials

Study	Primary endpoint	Primary outcome	Selection of secondary endpoints (instrument)	Secondary outcomes	Cost-effectiveness data	Strengths and limitations
Mohile et al., 2020[8]	Patient satisfaction with communication about aging-related concerns (mHCCQ), measured after the first oncology visit after the GA	Greater satisfaction with communication about aging-related concerns in IA (difference in mean score, 1.09 points; 95% CI 0.05-2.13 points, $P = 0.04$)	Number of aging-related concerns discussed during oncology visit, QoL (FACT-G), caregiver satisfaction	Number of aging-related concerns discussed during oncology visit higher in IA (difference, 3.59; 95% CI 2.22-4.95, $P < 0.001$); no difference in QoL; caregivers in IA were more satisfied with communication (difference, 1.05; 95% CI 0.12-1.98, $P = 0.03$)	NA	S: involvement of caregivers; involvement of community centers
Mohile et al., 2022[6]	% of participants with toxicities CTCAE ≥III within 3 months	51% (IA) versus 71% (SA), RR 0.74 (95% CI 0.64-0.86, $P = 0.0001$)	6 month-OS, DI #1, RDI, falls	6 m-OS 72% (IA) versus 75% (SA), $P = 0.38$; DI #1↓ 49% (IA) versus 35% (SA), RR 1.38 (95% CI 1.06-1.78, $P = 0.015$); Falls: 12% (IA) versus 21% (SA), RR = 0.58 (95% CI 0.40-0,84, $P = 0.0035$)	NA	S: involvement of community centers
Li et al., 2021[24]	% of participants with toxicities CTCAE ≥III within 6 months	50.5% (IA; 95% CI 45.6% to 55.4%) versus 60.6% (SA; 95% CI 53.9% to 67.3%), $P = 0.02$)	Advance directive completion, emergency department visits, unplanned hospitalizations, average length of stay, unplanned hospital readmissions, chemotherapy dose modifications, early discontinuation, and OS	Advance directive completion: 28.4% (IA) versus 13.3% (SA), $P < 0.001$; no significant differences in emergency department visits, unplanned hospitalizations, average length of stay, unplanned readmissions, chemotherapy dose modifications or discontinuations, and OS	NA	S: GA results available for IA and SA, geriatric impairments well balanced between both arms
Soo et al., 2022[9]	Longitudinal change of QoL over 24 weeks (ELFI)	Better adjusted ELFI change scores over 24 weeks in IA ($P = 0.039$, effect size = 0.38)	Unplanned hospital admissions, OS	Fewer unplanned hospital admissions at 24 weeks (multivariable-adjusted incidence rate ratio 0.60; 95% CI 0.42-0.87, $P = 0.0066$); no difference in OS	NA	L: 96% received CGA after treatment initiation - no modification of DI#1; no data on toxicities available
Puts et al., 2023[11,32]	QoL at 6 months (measured by EORTC QLQ C 30 questionnaire, global score)	No significant difference	Treatment-related toxicities CTCAE ≥III, functional status (IADL), unplanned health care use, OS, patient satisfaction, cancer treatment plan modification, adherence to the intervention	No significant differences in toxicities, functional status, unplanned health care use, patient satisfaction, cancer treatment plan modification, and OS. Adherence to interventions (selection): 42%/physiotherapy, 89%/specialist referral, 42%/rehabilitation, 72%/dietician	CGA cost-effective for patients treated with curative intent, not cost-effective for palliative intent	L: CGA was mostly carried out after treatment decision was made and no modification on DI#1 was possible. 1/3 of participants had a G8 score >14 and might not have benefitted from interventions

Continued

Table 3. Continued

Study	Primary endpoint	Primary outcome	Selection of secondary endpoints (instrument)	Secondary outcomes	Cost-effectiveness data	Strengths and limitations
Lund et al., 2021[12]	% of patients completing chemotherapy as intended	45% (IA) versus 28% (SA), $P = 0.0366$; no statistical significance in palliative situation ($P = 0.751$), effect most prominent in patients with G8 score ≤11 (OR, 3.76, 95% CI 1.19-13.45)	Treatment-related toxicities CTCAE ≥III, dose reductions, PFS, OS, QoL	Toxicities: 28% (IA) versus 39% (SA), $P = 0.156$; DI#1: 60%, no difference between IA and SA; secondary dose reductions: 28% (IA) versus 45% (SA), $P = 0.037$; no difference in PFS and OS	NA	L: no GA in SA, imbalance in impairments between groups possible S: homogenous population
Paillaud et al., 2022[25]	Composite endpoint: 6 month mortality, ADL decline ≥2 points, weight loss ≥10%	No significant differences in composite endpoint (in ITT and PP analysis); total events: 41.0% (IA) versus 38.0% (SA), $P = 0.53$; mortality: 13% (IA) versus 11.4% (SA), $P = 0.48$; ADL decline: 3.8% (IA) versus 5.5% (SA), $P = 0.35$; weight loss: 29% (IA) versus 27.4% (SA), $P = 0.73$	—	—	NA	L: high drop-out rate in IA (73.9%) due to missing GA or discontinuation of geriatric interventions, possible bias
DuMontier et al., 2022[13]	1-year OS	No significant difference; IA: 81.7% (95% CI 71.0% to 90.2%), SA: 78.8% (95% CI 69.7% to 85.7%), $P = 0.65$	Unplanned care utilization within 6 months; documented EOL goals-of-care discussions; clinician acceptability of model (survey)	No significant differences in unplanned care utilizations between IA and SA; EOL discussion↑ in IA (OR = 3.12, 95% CI 1.03-9.41); geriatric consultations highly valued by clinicians	NA	L: 20% in IA did not receive their geriatric consultation, possible underestimation of effect in IA
Orum et al., 2021[26]	Completion of initially proposed anticancer treatment within 90 days	No significant difference: 61% (IA) versus 52% (SA), RR = 1.16 (95% CI 0.95-1.42), $P = 0.14$	90 days ADL, physical activity, and hospitalization over time	No significant difference in ADL and physical activity; hospitalization: 47% (IA) versus 55% (SA), RR = 0.86 (95% CI 0.69-1.07), $P = 0.19$	NA	
Nipp et al., 2020[14]	Feasibility outcomes: enrolment rate ≥70%; completion of visits and survey ≥75%; survey on patient's confidence	Endpoints achieved	At baseline+12 weeks: QoL (FACT-G), symptoms (ESAS-r), depression (GDS), functioning (ADL, IADL), illness perception (IPQ), communication confidence (EPPI)	IA: Less decrement in QoL (mean change−0.77 versus −3.84; ES = 0.21); number of moderate-severe ESAS Symptoms ↓ (mean change, −0.69 versus 11.04; ES = 0.58); less depression (GDS scores mean change, −0.47 versus 10.58; ES = 0.36); communication confidence↑ (mean change, 11.06 versus −0.80; ES = 0.38)	NA	L: feasibility trial, additional endpoints not powered

Continued

Table 3. Continued

Study	Primary endpoint	Primary outcome	Selection of secondary endpoints (instrument)	Secondary outcomes	Cost-effectiveness data	Strengths and limitations
Nipp et al., 2022[27]	Length of post-operative hospitalization	PP analysis: primary endpoint reached: 5.90 (IA) versus 8.21 (SA) days, $P = 0.024$; in ITT analyses: primary endpoint not reached; 7.23 (IA) versus 8.21 (SA) days, $P = 0.374$	Post-operative ICU use, 90-day hospital readmission rates, complication rates	ITT analysis: ICU use: 23.2% (IA) versus 32.4% (SA), $P = 0.257$; 90-day hospital readmission rates: 21.7% (IA) versus 25.0% (SA), $P = 0.690$; complication rates: 17.4% (IA) versus 20.6% (SA), $P = 0.668$; PP analysis: non-significant differences	NA	S: comparison of ITT and PP analyses allows estimation of impact of the intervention
Nadaraja et al., 2020[28]	Completion rate of cancer therapy as intended	No significant differences: completion rate 48% (IA) versus 54% (SA), $P = 0.208$	Incidence of treatment-related toxicities CTCAE III-IV, time from randomization to start of treatment, PFS, OS	No significant differences between IA and SA. Toxicities: 20% (IA) versus 38% (SA), $P = 0.055$; mOS: 19.1 months (IA) versus 14.1 months (SA), $P = 0.911$; mPFS: 7.1 months (IA) versus 9.0 months (SA), $P = 0.838$	NA	
Jeppesen et al., 2018[29]	Differences in QoL (EQ-5D) after SBRT	No significant differences between IA and SA	OS and unplanned hospitalizations	1-year OS: 92% (IA) versus 72% (SA), 2-year OS: 69% (IA) versus 59% (SA), $P = 0.32$; unplanned hospital admission: 46% (IA) versus 52% (SA), $P = 0.68$	NA	
Hempenius et al., 2031, 2016[30,31]	Incidence of delirium within 10 days post-surgery (DOS)	No significant differences between IA and SA	Severity of delirium, length of hospital stays, complications, mortality, care dependency, QoL (PCS, MCS of SF-36), return to an independent preoperative living situation (ADL)	No significant differences between IA and SA in secondary outcomes	NA	

ADL, activities of daily living; CGA, comprehensive geriatric assessment; CI, confidence interval; CTCAE, National Cancer Common Terminology Criteria for Adverse Event; DI #1, dose intensity during cycle 1; DOS, Delirium Observation Scale; ELFI, Elderly Functional Index; EOL, end-of-life; EORTC QLQ, European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire; EPPI, 10-item perceived efficacy in patient-physician interactions questionnaire; ES, effect size; ESAS-r, Edmonton Symptom Assessment System — Revised; FACT-G, Functional Assessment of Cancer Therapy General; GA, geriatric assessment; GDS, Geriatric Depression Scale; IA, intervention arm; IADL, instrumental activities of daily living; ICU, intensive care unit; IPQ, Brief Illness Perception Questionnaire; ITT, intention-to-treat; L, limitations; MCS, mental component summary measure; mHCCQ, modified Health Care Climate Questionnaire; mOS, median overall survival; NA, not available; OR, odds ratio; OS, overall survival; PCS, physical component summary measure; PFS, progression-free survival; PP, per protocol; QoL, quality of life; RDI, relative dose intensity; RR, relative risk; S, strength; SA, standard arm; SBRT, stereotactic body radiotherapy; SF-36, Short Form-36.

MODELS TO DELIVER GAM IN CLINICAL PRACTICE

Understanding local resources and expertise available can guide the appropriate models to deliver GAM (Table 4). The traditional gold standard model of care involves a comprehensive multidisciplinary clinic where patients undergo GA and receive oncologic treatment planning from either a geriatrician or geriatric oncologist with the primary oncologist at a single time point and setting (unless the geriatric oncologist serves as the primary oncologist).[19] During this visit, patients also have access to supportive or holistic care services, such as dietitians, pharmacists, physical/occupational therapists, and social workers, minimizing the need for additional clinic visits. This model creates an opportunity for ongoing follow-up throughout the treatment course to address any changes or challenges that arise. While providing comprehensive care, its implementation is limited to a few select centers with ample resources and specialized personnel. Consequently, several alternative models have emerged to deliver GAM.[20]

Table 4. Models of care for geriatric assessment and management based on local resources

Settings	Proposed approaches for geriatric assessment and management	Models of care
High resource (geriatric oncologist or geriatrician and oncologist are available)	• Comprehensive multidisciplinary clinic where patients undergo geriatric assessment and management • Chemotherapy toxicity tools	• Traditional gold standard morel • Shared-care model
Intermediate resource (geriatrician and oncologist are available)	• Validated screening tools (e.g. Geriatric-8, Vulnerable Elders Survery-13, Senior Adult Supplement Screening Questionnaire) or abbreviated geriatric assessment • Geriatric assessment and management based on pre-defined intervention plan or evaluation in a comprehensive multidisciplinary clinic if positive screening • Chemotherapy toxicity tools by the geriatricians or oncology teams	• Shared-care model • Two-step consultative model
Low resource (oncologist is available)	• Validated screening tools • Selected validated geriatric assessment tool that may or may not be based on screening tools • Pre-defined geriatric intervention plan (i.e. carried out in the community setting) • Chemotherapy toxicity tools	

In the shared-care model, patients are co-managed by a geriatrician and an oncologist, with separate visits to each specialist in different clinics, possibly at different times. The geriatrician conducts the GA, while the oncologist carried out the oncologic assessment. An interdisciplinary team then collaborates to develop a comprehensive care plan, including referrals to additional support services. The geriatrician and support services may provide longitudinal care alongside the oncologist. While more feasible, particularly in moderate resource settings, this model places a higher burden on patients and caregivers due to multiple visits. A variation of this model is having a geriatrician embedded in the oncology clinic without access to support services.

For centers with intermediate resources, a two-step consultative model may be more practical. An oncologist uses a geriatric screening tool [e.g. Geriatric 8, Vulnerable Elders Survey-13, Senior Adult Supplement Screening Questionnaire (SAOP3)] to identify patients at higher risk who would benefit from a GA conducted by a geriatrician or geriatric oncologist.[21-23] These patients are then referred to the geriatric-specialized team for evaluation, after which a summary of recommendations is shared with the oncologist to inform the treatment plan. In this model, the oncology team carries the onus to initiate the geriatric screening tool and refer patients to the geriatrician or geriatric oncologist where a traditional or shared-care model can be implemented.

In settings with even more limited resources, geriatric screening tools may be utilized solely to facilitate selected management decisions (e.g. cancer-directed treatment versus specific non-oncologic intervention). In any of the aforementioned models, innovative strategies such as telehealth or video-assisted GA should be considered.

FUTURE DIRECTIONS AND CONCLUSIONS

GAM is crucial in delivering patient-centered and personalized care to older adults with cancer. The working group proposes several future directions to advance this field: (i) studying GAM (by itself or with other interventions) or comparing models of GAM in specific cancer types; (ii) investigating the effects of longitudinal GAM on outcomes; (iii) exploring the role of GAM during treatment (e.g. maintenance phase) and after completion of curative-intent treatments; (iv) incorporating biological markers of aging with GA to predict outcomes and guide subsequent management; (v) developing and validating predictive models and risk stratification algorithms, such as machine learning, to better identify older adults with cancer at risk and streamline referrals and subsequent management; (vi) leveraging technologies (e.g. telemedicine, wearables, mobile applications) to monitor and deliver supportive care interventions as well as facilitate self-management; (vii) using dissemination and implementation science methods to understand barriers and facilitate the integration of GAM into clinical practice; (viii) studying the impact of system change (e.g. implementing age-friendly health care) on outcomes; and (ix) integrating novel or combined endpoints in clinical trials of GAM, such as both objective outcomes (e.g. toxicities) and patient-reported outcomes (e.g. functional status, QoL). Advancing collaborative research in these areas will lead to improvement of outcomes that matter to this growing and diverse population.

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