The population of the United States and other industrialized nations is aging rapidly. The increased life span allows for longer exposure to carcinogens and the accumulation of genetic alterations. Thus, the incidence of cancer is increasing along with the aging of the population.

Health and functional ability vary more in older adults than in younger patients. Even without the presence of actual disease, aging itself causes gradual, progressive loss in the biologic reserve necessary for the body to maintain physiologic homeostasis under stress, a phenomenon called “homeostenosis.” Even in healthy and highly functioning older adults, there is some degree of loss in the ability to tolerate stress. In addition, many older adults have one or more chronic medical conditions, which further decrease their organs’ reserve and ability to respond to stress. Over time, increasing homeostenosis contributes to a gradual but progressive decline in the ability to function in the environment and to tolerate illness and disease.

In the general geriatric population, functional status and level of dependency have been found to predict survival. For the older adult with cancer, then, the oncologist must be able to stage not only the cancer but also consider how a patient's functional status may affect the ability to tolerate and respond to treatment. To accommodate this variable homeostenosis in older patients with cancer and increase their chances for survival, treatment plans need to be more individualized than for the younger population.

Many oncologists use the Karnofsky performance status score (KPS) or Eastern Cooperative Oncology Group (ECOG) scale to assess a patient’s ability to perform daily tasks. However, with older patients, these scales often miss subtle degrees of functional impairment. While about 80% of older adults with cancer have an ECOG performance status of 0 or 1 at the time of diagnosis, more than 50% of these patients require assistance with instrumental activities of daily living such as driving, shopping, and managing finances. This functional dependence can have a negative impact on treatment tolerance and survival. For the older adult with cancer, a broader assessment of function is needed.

Geriatricians use standardized assessment tools to distinguish clinical functional age from chronologic age; this is referred to as a comprehensive geriatric assessment (CGA). In the older adult with cancer, the goal of such an assessment would be to identify subtle functional issues that might contribute to morbidity and mortality independent of cancer therapy.

This article identifies some of the tools utilized by geriatricians in assessing the functional status of older adults. We also review the literature that supports the validity of these tools in the general geriatric population and, if available, in the geriatric oncology population. With these tools, oncologists could identify problems that, if modified, would potentially improve the older adult's ability to tolerate treatment.

### Table 1

<table>
<thead>
<tr>
<th>Measures for Assessing Physical Function in the Geriatric Population</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-Report Tools</strong></td>
</tr>
<tr>
<td>IADLS</td>
</tr>
<tr>
<td>ADLs</td>
</tr>
</tbody>
</table>
Toileting, transfer from bed to chair, continence, feeding increases the odds of nursing home placement 10-fold or mortality 9-fold at 6 yr of follow-up.[8]

Stair climbing Ability to climb flight of stairs Having difficulty increases risk of mortality 3-fold at 2 yr.[64]

Walking Ability to walk several blocks Having difficulty increases risk of mortality 4-fold at 2 yr.[64]

Performance-Based Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gait speed, 4 m</td>
<td>Decline of 0.1 m/s from baseline at 1 yr increases the 5-yr risk of mortality by 2.23 times.[17]</td>
<td></td>
</tr>
<tr>
<td>Gait speed, 400 m</td>
<td>Participants in the poorest quartile of functional capacity (&gt; 362 s) had a 3-fold increased risk of death at 5 yr of follow-up compared with those in the best quartile (&lt; 290 s).[65]</td>
<td></td>
</tr>
<tr>
<td>Get Up and Go test</td>
<td>Subjects needing &gt; 30 s were dependent in transfers and needed assistance to climb stairs.[15]</td>
<td></td>
</tr>
<tr>
<td>SPPB</td>
<td>Scores of 4–6 were 3.2–7.4 times more likely to reflect ADL impairment; scores of 7–9 were 1.4–3.3 times more likely to reflect ADL impairment.[13] Those with decline of 1 point from baseline at 1 yr were 1.8 times more likely to die within 5 yr.[17]</td>
<td></td>
</tr>
</tbody>
</table>

ADLs = activities of daily living; IADLs = instrumental activities of daily living; m = meters; s = seconds; SPPB = Short Physical Performance Battery.

Tools for Assessing Physical Function in the Geriatric Population

Self-Reported Physical Function

Geriatricians evaluate function by scoring the need for assistance with instrumental activities of daily living (IADLs) and basic activities of daily living (ADLs). IADLs encompass complex skills that are necessary for maintaining independence in the community, such as using the telephone; taking transportation; doing shopping, housework, and laundry; taking medications; and managing finances. ADLs encompass more basic functions required to maintain independence in the home, including bathing, dressing, toileting, feeding oneself, transferring from a bed or a chair, and maintaining continence (Table 1).

In the general geriatric population, requiring assistance with IADLs and ADLs has foreshadowed both further functional decline and mortality.[2,7] A study of community-dwelling older adults found that those who were impaired in one or more IADLs at the start of the study had almost sevenfold greater odds of being admitted to a nursing home within the next 6 years. However, if the respondents were dependent in one or two ADLs at the start of the study, they had almost 10-fold greater odds of being institutionalized.[8] In terms of mortality, community-dwelling older adults who were dependent in at least one IADL had almost a sevenfold greater risk of dying over the 6-year follow-up period compared with subjects who had no impairment.[8]

In older adults with cancer, independence in IADLs has been associated with improved treatment tolerance and improved survival. In a study of patients aged ≥ 70 years with advanced non-small-cell lung cancer receiving chemotherapy, independence in IADLs before starting treatment was associated with higher quality of life and improved overall survival.[9] In a smaller study of patients with ovarian cancer aged ≥70, functional dependence, defined as living at home with assistance or living in an assisted-care facility, independently predicted the risk of toxicity from...
chemotherapy.[6] ADL dependence and how it affects outcomes has not been established in studies of outpatient cancer care for older adults, likely because most of this population does not require assistance with ADLs. However, the story for hospitalized older adults with cancer is more compelling. In a study of older adults with cancer admitted to an acute care for elders (ACE) unit, 45% required assistance in ADLs.[10] This has significant implications for these patients, as previous studies have demonstrated that the presence of impairment in ADLs increases the risk of mortality for hospitalized older adults.[7,11]

**Performance-Based Measures of Physical Function**

Older adults who are beginning to experience functional decline may not always detect and subsequently report early changes in function. Thus, while the IADL and ADL scales are convenient in a busy office setting because of their quick and easy administration, some studies have indicated that performance-based measures more accurately identify limitations in function than those relying on self-report.[12,13]

- **Short Physical Performance Battery**—A simple, standardized examination of physical function is the Short Physical Performance Battery (SPPB). It involves five directly observed tests that can be conducted by a member of the office staff (Table 2): walking 8 ft at the patient's usual walking speed; rising from a chair and returning to the seated position 5 times; and standing for 10 seconds with the feet together (in the side-by-side position), semitandem position (heel of one foot placed to the side of the first toe of the other foot), and tandem position (heel of one foot directly in front of the toes of the other foot).[13] Total scores range from 0 to 12, with higher scores indicating better function.

In a study of more than 5,000 subjects aged ≥ 71, increasing SPPB performance scores were associated with a stepwise decline in the mortality rate. Subjects who scored in the 25th percentile were more than twice as likely to die as those in the 75th percentile (a 5-point difference in scores). As decline in mobility has been correlated with progressive loss of other functions, it is particularly telling that low SPPB scores predict disability in ADLs at 1 and 4 years of follow-up.[14]

- **Timed Up and Go Test**—The Timed Up and Go (or Get Up and Go) test is a performance-based measure of functional mobility. To perform the test, the older adult sits in a chair with arms folded across the chest. While being timed with a stopwatch, the patient stands, walks forward 3 meters, turns, walks back to the chair, and sits, all the while without using the arms for support.

In a study of community-dwelling older adults ranging in age from 70 to 84 years, the mean time to complete the test was 8.5 seconds. Patients who were able to perform the test in less than 20 seconds tended to be independent in transfers. Older adults who required 30 or more seconds were more likely to require assistance with chair and toilet transfers, were at high risk for falls, and the majority could not climb stairs. The 25% of subjects who required between 20 and 29 seconds to complete the test varied widely in their balance, gait speed, and functional abilities. In this “grey zone” group, further individual assessment was needed to clarify functional ability. Scores on the Timed Up and Go correlated with measures of balance and gait speed.[15]

- **Walking Speed**—Several studies in the geriatric literature have indicated that gait speed is a valid functional indicator, and its simplicity is attractive for the clinical setting. An office staff member simply times patients walking at their usual speed for 4 meters marked on the floor with tape. In a prospective cohort study of 487 community-dwelling older adults, 41% of “slow walkers” (gait speed < 0.6 m/s) were admitted to the hospital at least once in the ensuing 12 months, compared with 26% of medium-speed walkers (0.6–1.0 m/s) and only 11% of “fast walkers” (> 1.0 m/s).[16] A decrease in walking speed by 0.1 m/s within 1 year is associated with a higher mortality rate at 5 years.[17] We found no studies of gait speed specific to the older adult cancer population; nevertheless, it provides a simple performance-based measure for the office setting, and merits further study.

**Other Geriatric Issues Important to Cancer Treatment**

As previously described, older adults constitute a complex population with considerable variability in degree of wellness and ability to tolerate cancer treatment. Just examining functional ability with one of the tests mentioned will not give a complete picture. Issues such as memory impairment, malnutrition, and depression, often referred to as “geriatric syndromes,” are also prevalent in older adults and should be considered as well.

**Cognitive Function**

Cognitive impairment and dementia are diseases that predominantly strike older adults. In studies where comprehensive geriatric assessments were conducted in older patients with cancer, as many
as 25% to 50% of the subjects screened positive for cognitive abnormalities.[5] However, a positive screen for cognitive impairment does not diagnose dementia; further testing and work-up are recommended. If a patient screens positive for memory impairment, referral to geriatrics, neurology, or psychiatry should be considered.

Previous studies have demonstrated an association between physical and cognitive function in older adults.[18-21] Fitzpatrick and colleagues studied 3,035 healthy older adults with a mean age of 78.6 and found an association between low cognitive score on the Modified Mini-Mental Status exam and the slowest quartile on a walking test.[20] Coppin and colleagues studied 737 older adults, mean age 72.7, and found an association between poor executive function and slow gait speed.[21] In the Women's Health and Aging Study, difficulties in executive function were associated with slower performance on tasks of higher-order IADLs.[22]

Other studies have demonstrated that changes in cognitive status are associated with longitudinal changes in physical function and subsequent disability. The MacArthur Research Network on Successful Aging Community Study evaluated changes in physical and cognitive function over a 7-year period in a cohort of high-functioning older adults. This study found that declines in cognitive function were associated with declines in routine physical tasks such as walking at a normal pace, as well as demanding physical tasks such as standing on one leg.[19] In a community-based longitudinal study of 977 individuals aged < 65, cognitive status predicted functional limitations (upper and lower body) as well as disability in ADLs. Atkinson and colleagues studied 2,349 older adults, mean age 75.6, and found that global and executive cognitive function predicted declines in gait speed.[21]

• Implications for Cancer Patients—Cognitive function has significant practical implications for a patient receiving cancer therapy. In the presence of memory impairment, the patient will have difficulty understanding and remembering treatment instructions, potentially affecting compliance with oral cancer therapy or supportive medications. Patients with cognitive impairment may have difficulty remembering the signs and symptoms of cancer or cancer therapy side effects that warrant medical attention, or may have trouble remembering appointments. In more advanced cases of dementia, the capacity of patients to make decisions regarding treatment also becomes problematic. These issues help explain the association of dementia with increased mortality across all older populations.[24] Identifying and enlisting the patient's social support network or community-based support systems (such as a visiting nurse) are critical in optimizing results and minimizing complications from cancer therapy.

A second issue with cognitive complaints in older adults with cancer is the current lack of understanding of whether the cognitive problem is from a preexisting condition or if it is cancer- or cancer therapy–related. Complaints of cognitive dysfunction following cancer treatment have been described, particularly among breast cancer survivors. However, few studies have specifically focused on the association between cancer therapy and cognitive function in older adults or those with preexisting cognitive problems.[25,26] A recent review of published studies did not conclusively show an association between cancer treatment and subsequent development of dementia.[27] This deserves further research because of its important survivorship implications.

Simple, valid screening tests for cognitive impairment include the Mini-Mental Status exam.[28] Other shorter screening tests include the Six-item Screener,[29] the Clock-Draw test,[30] and the Blessed Orientation-Memory-Concentration test.[31]

<table>
<thead>
<tr>
<th>Score</th>
<th>Standing Balance Tests</th>
<th>Semitandem</th>
<th>Full-Tandem</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>• &lt; 10 s&lt;br&gt;• Tried but unable&lt;br&gt;• Not attempted</td>
<td>• &lt; 10 s&lt;br&gt;• Tried but unable&lt;br&gt;• Not attempted</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>10 s</td>
<td>• &lt; 10 s&lt;br&gt;• Tried but unable&lt;br&gt;• Not attempted</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>—</td>
<td>10 s</td>
<td>• &lt; 3 s&lt;br&gt;• Tried but unable&lt;br&gt;• Not attempted</td>
</tr>
<tr>
<td>3</td>
<td>—</td>
<td>10 s</td>
<td>&lt; 3 s to &lt; 10 s</td>
</tr>
</tbody>
</table>
### Functional Assessment of the Older Patient With Cancer

<table>
<thead>
<tr>
<th>Score</th>
<th>Time (s)</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Walking 8 ft</td>
<td>10 s</td>
</tr>
<tr>
<td>1</td>
<td>&gt; 5.7 s</td>
<td>10 s</td>
</tr>
<tr>
<td>2</td>
<td>4.1–5.6 s</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3.2–4.0 s</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>&lt; 3.1 s</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Score</th>
<th>Time (s)</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Sit to Stand From Chair 5 Times</td>
<td>10 s</td>
</tr>
<tr>
<td>1</td>
<td>&gt; 16.7 s</td>
<td>10 s</td>
</tr>
<tr>
<td>2</td>
<td>13.7–16.6 s</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>11.2–13.6 s</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>&lt; 11.1 s</td>
<td></td>
</tr>
</tbody>
</table>

s = seconds.
Source: Guralnik JM et al.[13]

### Comorbidity

The typical older oncology patient has multiple noncancer conditions (comorbidities), and the complexity of comorbidity increases with age.[32] Accordingly, older patients are more likely to take multiple medications, to suffer significant impairments and symptomatic limitations related to their comorbidity, and to have less functional reserve in the face of the stresses related to the primary cancer and its treatment.[33-37] Despite widespread recognition that comorbidity is clinically relevant, the application of this concept is more complex in daily practice. Comorbidity is frequently considered in terms of an index, or as the total number of noncancer conditions, and even a simple method of counting chronic conditions provides an estimation of life expectancy among patients with cancer.[38] Other commonly used tools include the Charlson Comorbidity Index, which weighs the number and severity of comorbid medical conditions as well as the age of the patient.[39,40] The Adult Comorbidity Evaluation–27 weighs each comorbid condition according to level of severity and then generates an overall comorbidity score based on the severity of the highest-rank ailment.[41] Both of these comorbidity indexes can be abstracted from a chart review.[39,40] Other comorbidity indexes use patient self-report to capture illnesses, age, and physical function in order to stratify the risk of mortality among community-dwelling older adults.[42]

While these tools are helpful when the goal is estimation of life expectancy or risk adjustment across hospitals or providers, it is unlikely that a single index will capture the complexity of a heterogeneous population of older adults across different types of cancer.[43-45] More importantly, combining conditions into a single score fails to capture the clinical complexities of caring for adults with multiple chronic conditions or the variation in the clinical relevance of these conditions across patients.[38,46,47] Clinical decision-making in older persons with cancer would benefit from a better understanding of the impact that specific conditions, as well as combinations of conditions, have on patient outcomes.

### Nutrition/Weight Loss

Screening for malnutrition is warranted in older adults with cancer. Among community-dwelling older adults in the general population, the prevalence of malnutrition is low (mean: 2%, range: 0%–8%), although the risk of malnutrition is high (mean: 24%, range: 8%–76%). However, studies of hospitalized older adults found a mean prevalence of malnutrition of 23% (range: 1%–74%).[48] Weight loss and poor nutritional status are associated with poorer response to therapy and decreased survival.[49,50]

Several tools can provide nutritional screening. One that has been well validated to correlate with clinical assessment and objective indicators of nutritional status is the Mini Nutritional Assessment (MNA), which evaluates dietary intake, anthropometrics, self-perceived nutrition and health, and a general assessment of lifestyle, mobility, medications, and cognition.[51] The MNA–Short Form (MNA-SF) was validated to employ a two-step screening process, with lower scores indicating higher risk for malnutrition. If the score is ≥ 12, the patient is at low risk for malnutrition and no further assessment is needed at that time. If the score is ≤ 11, the rest of the MNA should be completed to determine whether the patient is malnourished or is at risk of becoming so, and the patient should be referred to a dietitian for assistance.[48]

### Polypharmacy

Normal physiologic changes that accompany aging can also cause changes in the pharmacokinetics...
and pharmacodynamics of cancer therapy. Older adults lose muscle and gain fat as they age. Total body water decreases while percentage of body fat increases, a fact that alters the distribution of drugs in the body. In addition, renal clearance decreases, even if no elevation in blood urea nitrogen or creatinine is detected. Finally, with increasing age, blood flow to the liver is less vigorous than at younger ages, and the liver shrinks in size. These changes have an impact on hepatic metabolism. As the body ages, it can accumulate chronic diseases such as diabetes mellitus and hypertension. Many older adults who present with a new cancer diagnosis are already taking multiple medications, and cancer treatment and its side effects will likely add more. While there have been few studies about the impact of polypharmacy in cancer treatment, we do know from geriatric literature that the more medications someone is taking, the higher the risk of an adverse drug reaction (ADR).[52,53] A thorough review of a patient's medications, both prescribed and over-the-counter, can help decrease the risk of ADRs. Such an assessment allows for the identification of potential drug interactions or the need for dose adjustments to accommodate age-related changes in organ function, as well as the elimination of unnecessary medications. Having the patient bring all medication bottles to an outpatient visit provides the most accurate picture of what the person has access to and is taking. It can also corroborate compliance with a treatment regimen.

Psychosocial Support
In recent years, cancer care has moved from the inpatient to the outpatient setting. While beneficial on many levels for both the patient and the health-care system, this shift has thrust family and friends into caregiving roles that were previously performed by trained hospital staff. This can be particularly problematic for patients who have no social network of support, and it may be why such isolation has been associated with a greater mortality risk.[54] Asking simple questions such as: “Who would you call in an emergency?” and “Who is available to help you in times of need?” can help identify patients who are socially isolated. Depression has been shown to increase the risk of functional decline and increase health-care resource use. It is also associated with poorer survival for cancer patients. While some studies have demonstrated that a more comprehensive screen for depression is needed,[55] other studies have demonstrated that an effective screening tool for depression is to simply ask the patient if he or she feels depressed or sad.[56,57] A positive answer should be followed with further questioning for common depressive symptoms, such as anhedonia, changes in sleep patterns, crying spells, etc. The oncologist can then ask if the patient would be interested in counseling, medication, or both. These few questions can help guide the plan for further evaluation and treatment of a mood disorder.

Integrating Geriatric Assessment Tools Into Oncology Practice
In this article we reviewed some practical tools for assessing the functional status of older adults with cancer, as well as highlighted other domains that may affect an older adult's ability to tolerate cancer therapy. A comprehensive geriatric assessment and intervention has proven clinical benefit for optimizing health outcomes as well as improving function and quality of life in older adults.[58,59] The feasibility of including a geriatric assessment[60] as part of the baseline evaluation of older adults on clinical trials is being studied by the Cancer and Leukemia Group B Cancer in the Elderly Committee. Other approaches have been described in the literature, including a mailed geriatric assessment completed by the patient prior to an office visit, a primarily self-administered geriatric assessment, or an abbreviated geriatric assessment.[5,60-63] Studies are underway to evaluate which domains and questions from a geriatric assessment are predictive for the risk of chemotherapy toxicity. These data can guide subsequent studies of interventions to help improve tolerance to cancer therapy in older adults. Ultimately, the integration of knowledge learned in the fields of both geriatrics and oncology will optimize cancer care for older adults.

This article is reviewed here: Translation Requires Evidence: Does Cancer-Specific CGA Lead to Better Care and Outcomes?

Disclosures:
Financial Disclosure:The authors had no conflicts of interest to disclose.
Dr. Schubert's efforts are supported by the US Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions Geriatric Academic Career Award Program. Dr. Gross's efforts are supported by a Beeson Career Development Award (1 K08 AG24842 (Paul Beeson Career Development Award in Aging Research). Dr. Hurria's efforts are supported by K23 AG026749-01 (Paul Beeson Career Development Award in Aging Research), and American Society of Clinical Oncology-Association of Specialty Professors-Junior Development Award in Geriatric Oncology.
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