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The Feasibility of Inpatient Geriatric Assessment for Older Adults Receiving Induction Chemotherapy for Acute Myelogenous Leukemia

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Abstract

OBJECTIVES—To test the feasibility and utility of a bedside geriatric assessment (GA) to detect impairment in multiple geriatric domains in older adults initiating chemotherapy for acute myelogenous leukemia (AML).

DESIGN—Prospective observational cohort study.

SETTING—Single academic institution.

PARTICIPANTS—Individuals aged 60 and older with newly diagnosed AML and planned chemotherapy.

MEASUREMENTS—Bedside GA was performed during inpatient examination for AML. GA measures included the modified Mini-Mental State Examination; Center for Epidemiologic Studies Depression Scale; Distress Thermometer, Pepper Assessment Tool for Disability (includes self-reported activities of daily living (ADLs), instrumental ADLs, and mobility questions); Short Physical Performance Battery (includes timed 4-m walk, chair stands, standing balance); grip strength, and Hematopoietic Cell Transplantation Comorbidity Index.

RESULTS—Of 54 participants (mean age 70.8 ± 6.4) eligible for this analysis, 92.6% completed the entire GA battery (mean time 44.0 ± 14 minutes). The following impairments were detected:

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cognitive impairment, 31.5%; depression, 38.9%; distress, 53.7%; impairment in ADLs, 48.2%; impaired physical performance, 53.7%; and comorbidity, 46.3%. Most were impaired in one (92.6%) or more (63%) functional domains. For the 38 participants rated as having good performance status according to standard oncologic assessment (Eastern Cooperative Oncology Performance Scale score = 1), impairments in individual GA measures ranged from 23.7% to 50%. Significant variability in cognitive, emotional, and physical status was detected even after stratification according to tumor biology (cytogenetic risk group classification).

CONCLUSION—Inpatient GA was feasible and added new information to standard oncology assessment, which may be important for stratifying therapeutic risk in older adults with AML.

Keywords

geriatric assessment; acute myelogenous leukemia; cancer; functional status; elderly

Acute myelogenous leukemia (AML) is largely a disease of older adults and has disproportionately worse survival with older age; optimal therapy for older adults is unclear.^{1–4} The disease presents acutely and aggressively, requiring intense chemotherapy for cure. Initial (induction) chemotherapy is given in the hospital and is associated with long hospitalization while awaiting marrow recovery. Although selected older adults can benefit from standard induction chemotherapy, as a group, older adults experience greater treatment-related toxicity and poorer overall survival than younger individuals.^{1,2,5–7} Research efforts to define optimal therapy have focused on age-related changes in tumor biology and their effect on prognosis.^{8–13} Less attention has been focused on host-specific clinical characteristics such as cognitive, emotional, and physical function that might predict vulnerability to toxicity^{14,15} and for which chronologic age alone is an inadequate measure. A limited ability to identify who can tolerate and potentially benefit from standard curative induction chemotherapy hampers treatment decision-making for older adults with AML.

Practical clinical assessment tools that reflect an individual's pathologic burden of disease and age-related physiologic changes could add important prognostic information by improving toxicity prediction and informing interventions to improve treatment tolerance. Presently, oncologists estimate functional status using the Karnofsky Scale or the Eastern Cooperative Oncology Group (ECOG) performance status scale (Appendix 1).¹⁶ These scales lack sensitivity, are subjective, and do not address specific tasks. Many older adults with “good” performance scores have meaningful impairments in physical function that may reduce reserve capacity.¹⁷

Translating geriatric assessment (GA) strategies into the evaluation of older adults with AML could help improve assessment of reserve capacity and inform treatment decision-making. Specifically, a GA including evaluation of cognitive function, psychological state, physical function, and comorbid disease could identify individuals most vulnerable to the side effects of AML chemotherapy.¹⁸ In older adults, GA can identify problems that may interfere with cancer treatment in other tumor types.^{17,19,20} The National Comprehensive Cancer Network guidelines for Senior Adult Oncology recommend this type of assessment, but it has not been extensively validated in individual cancer types,²¹ nor is it routine in clinical practice.

There are no published studies evaluating the feasibility or utility of performing a comprehensive GA in newly diagnosed older adults with AML. GA could be more difficult to implement in such individuals, because they often present acutely, with high symptom burden and multiple competing medical problems. Individuals are frequently assessed and treated in the hospital, rather than in the clinic, and often have conditions requiring rapid attention. To address these issues, the current study set out to determine whether bedside GA

is feasible in older adults hospitalized with newly diagnosed AML, describe the performance of older adults with newly diagnosed AML on multiple GA assessment domains, and determine whether these measures add information to assessments of functional status (ECOG score) and tumor biology (cytogenetic risk group classification). Ultimately, information gained from GA could help optimize therapeutic decision-making and clinical outcomes for older adults with AML.

METHODS

Study Design and Population

Between January 2009 and July 2010, a prospective, single-institution cohort of consecutive individuals aged 60 and older admitted to the inpatient leukemia service at Wake Forest University with newly diagnosed, pathologically confirmed AML or undergoing examination for AML was studied. Age 60 was set as the entry criterion to align the results with previous AML trials.^{8,22} Additional eligibility criteria were inpatient status, candidate for induction chemotherapy per treating physician, capacity to sign informed consent, and ambulatory (ECOG score 0–3). Individuals who required intensive care unit support at initial evaluation or had had prior therapy for AML were ineligible. The analysis cohort consisted of participants who received induction chemotherapy including anthracycline or cytarabine to maximize homogeneity and permit comparison with the existing literature.^{6,7}

Participants were enrolled within 5 days of initial hospitalization. The study nurse performed bedside GA on the inpatient ward at enrollment. The study nurse administered all survey measures in interview format. Physical performance measures were performed in the individual's room or hallway on the leukemia ward. The institutional review board of Wake Forest University approved the study, and all participants provided written informed consent.

GA Measures

Cognitive Function—The modified Mini-Mental State Examination (3MS) is a validated cognitive screening tool to assess global cognition in elderly adults.²³ A score of <80 (of 100) indicated cognitive impairment.²³

Psychological Function—Depressive symptoms were assessed using the 20-item Center for Epidemiologic Studies Depression Scale (CES-D).^{24,25} A score of 16 or greater was used as an indicator of depressive symptoms. The Distress Thermometer, a single-item rating from 0 (no distress) to 10 (extreme distress) was used to evaluate distress.^{26,27} A score of 4 or greater was used as an indicator of distress.²⁸

Physical Function—Self-reported physical function was assessed using a 19-item questionnaire, the Pepper Assessment Tool for Disability (PAT-D) (Appendix 2).^{29–31} The questionnaire contains subscales assessing mobility, activities of daily living (ADLs), and instrumental ADLs (IADLs).³² Participants answer questions on a Likert scale from 1 (usually do with no difficulty) to 5 (unable to do); a sixth category entitled “unable to do for other reasons” was also available and was not included in the scoring. A summary score is calculated by adding all items scored 1 to 5 and dividing by the total number of items answered (lower score indicates better functioning). Subscales are scored in the same manner. A minimum of four items must be answered to calculate any subscale. In this analysis, participants were considered impaired if they reported difficulty with one or more items in any subscale.

Objective physical performance measurements included hand grip strength and the Short Physical Performance Battery (SPPB). Hand grip strength predicts mortality, functional limitations, and disability in the ambulatory geriatric population.³³ Grip strength in both hands was measured using an adjustable hydraulic grip strength dynamometer. The best performance of three trials was selected for each hand, with averages of the left and right hand used in analyses. The SPPB evaluates lower extremity physical function.³⁴ This validated measure comprises a short walk (4 m), repeated chair stands, and a balance test. Each measure was scored ranging from 0 (unable to complete the test) to 4 (highest performance level), with total summed score ranging from 0 to 12. The examiner moved medical equipment (e.g., the intravenous pole) to allow participants to walk unencumbered. A score of less than <9 indicated impairment.³⁵

Comorbidity—Comorbidity burden was determined according to the validated Hematopoietic Cell Transplantation Comorbidity Index (HCT-CI) score.³⁶ It is more sensitive than the Charlson Comorbidity Index in older adults with AML and is associated with treatment-related mortality.³⁷ All data were abstracted from the medical record at enrollment. Higher scores indicated greater comorbidity, and a HCT-CI score greater than 1 indicated significant comorbidity.³⁷

Covariates—Additional data on demographics (age, sex, race or ethnicity), laboratory data (e.g., hemoglobin), tumor characteristics, and treatment were collected from the medical record. Tumor-specific variables were white blood cell count, lactate dehydrogenase at admission, history of prior myelodysplastic syndrome, and cytogenetic risk group categorized from the diagnostic bone marrow biopsy according to Southwest Oncology Group classification.^{2,5} In analyses, cytogenetic risk group was categorized as favorable or intermediate versus unfavorable. Admission height and weight were used to calculate body mass index. The treating attending physician's estimate of the participant's ECOG Performance Score (PS) at the time of admission was recorded.² In analyses, ECOG PS was categorized as good (≤1) or poor (>1) functional status.

Feasibility Assessment—Measures to assess feasibility were recruitment, proportion of participants completing entire GA battery, and time to complete the assessment. Additional qualitative data, including reasons for not completing the battery, were collected.

Statistical Analyses

Means and proportions were used to describe the baseline characteristics of the study population and performance on GA measures. Median scores and ranges were used to describe GA scores stratified by cytogenetic risk group classification. Proportions were used to describe the cumulative number of geriatric domain impairments among participants. The four geriatric domains were defined as impaired if a participant's score indicated impairment in any measures in the domain, including cognition (3MS), psychological function (CES-D, Distress Thermometer), physical function (impairment according to PAT-D ADL or IADL subscale, SPPB), and comorbidity (HCT-CI). The proportion of participants impaired in each measure was calculated stratified according to ECOG status. To explore the relationship between GA scores and cytogenetic risk group, Wilcoxon rank sum testing was used to compare median GA scores according to risk group. Further exploratory analyses were performed using analysis of covariance to evaluate differences in GA measure scores according to cytogenetic risk group controlling for age and hemoglobin. All analyses were conducted at a two-sided alpha-level of .05 using SAS statistical software, version 9.2 (SAS Institute, Inc., Cary, NC).

RESULTS

Of 71 eligible individuals, 61 (85.9%) agreed to participate. Of the 54 participants who received induction chemotherapy with an anthracycline or cytarabine, 92.6% completed the entire GA battery, and all completed the self-report measures. The mean time to complete the GA was 44 ± 14 minutes. Four participants failed to complete grip strength testing, two because of arthritis. Forty-six participants (64.8%) performed all components of the SPPB (walking, balance testing, chair stands). Participants who could not perform components of the SPPB received a score based on the standardized scoring algorithm. The in-room assessment was interrupted at least once for 87% of participants because of usual care. The mean duration of interruptions was short (8.1 minutes). Interruptions did not preclude completing assessments.

Although all participants completed the self-report physical function survey (PAT-D), many selected the response “unable to do for other reasons” for multiple items. Thus, only 74.1% had a calculable score on the entire survey using the scoring algorithm; of the subscales, there were calculable scores for 100% for ADLs, 92.6% for IADLs, and 90.7% for mobility.

The mean age of the participants was 70.8 ± 6.4 , 59.3% were male, and 96.3% were white (Table 1). Most (69.8%) were well educated (high school education) and had no history of coronary disease, chronic obstructive pulmonary disease, diabetes mellitus, or congestive heart failure. Initial laboratory evaluation revealed anemia, high lactate dehydrogenase level, and leukocytosis. Only 3.8% had favorable tumor biology according to cytogenetic risk group classification, with 33.3% presenting with antecedent myelodysplastic syndrome.

Mean baseline GA scores are reported in Table 2. As a group, these participants presented with depressive symptoms, distress, and impairments in physical function. As expected, they reported more difficulty with mobility tasks than performance of ADLs and IADLs. Overall, the low SPPB scores characterized the population as physically frail.³⁵

A substantial proportion met criteria for impairment on GA measures (Table 2). Cognitive impairment was detected in 31.5%, depression in 38.9%, distress in 53.7%, impairment in ADLs in 48.2%, impairment in IADLs in 40.7%, impaired objective physical performance (SPPB score <9) in 53.7%, and significant comorbidity in 46.3%. In addition, 63% of participants were impaired in two or more geriatric domains; only 7.4% screened negative for any impairment (Figure 1).

Participants with good ECOG PS according to the treating physician represented a substantial proportion of those who were impaired on specific GA measures. For example, of those who screened positive for depression, 50% had an ECOG score of 1 or less. Similarly, more than 50% of participants who screened positive for cognitive impairment had a good PS (ECOG = 1). Overall, in participants not considered impaired according to ECOG (score = 1), impairments on individual GA measures ranged from 23.7% to 50% (Figure 2).

Finally, participants with unfavorable tumor biology according to cytogenetic risk group classification presented with more depressive symptoms and lower self-reported physical function than those with favorable or intermediate tumor biology at baseline (Table 3). Results remained significant after adjustment for age and hemoglobin (CES-D $P = .01$, PAT-D $P = .01$), although a broad range of cognitive, psychological, and physical function was seen in both groups after stratification according to cytogenetic risk group classification.

DISCUSSION

This study showed that a bedside GA could be performed in older adults hospitalized for treatment of newly diagnosed AML. Despite high medical acuity and the competing demands of a rapid and intense medical examination, nearly 90% of participants were willing to complete survey measures, and most completed physical performance testing. Most, although deemed fit for aggressive chemotherapy, had significant impairments in one or more geriatric domains that may affect prognosis and treatment response. Impairments detected using GA measures were not adequately reflected in the standard ECOG performance scale. Finally, a broad range of cognitive, psychological, and physical function was detected regardless of stratification for tumor biology. These findings support the hypothesis that GA testing adds important information to the evaluation and management of older adults with AML.

The acute, aggressive nature of AML and intense treatments can profoundly stress older adults' reserve capacity. Because of poor treatment outcomes in older adults, there is no consensus regarding optimal treatment. Older adults with profound functional impairment (ECOG PS > 2) at diagnosis or aged 80 and older³⁸ are at high risk for treatment-associated morbidity and mortality.² Less clear is the degree to which the heterogeneity of cognitive, emotional, or physical function may influence treatment tolerance in individuals who lack overt disability on standard oncologic evaluation (ECOG PS < 2). Under acute stress, even subtle impairments in functional domains detected using GA may be associated with clinically significant differences in reserve capacity. Prior studies in AML have individually demonstrated that IADL impairment and comorbidity burden (e.g., HCT score > 1) are associated with treatment outcomes.^{14,15,37} The current study further identified impairments in multiple geriatric domains that could individually or cumulatively affect treatment morbidity and survival.

This study adds to the current literature in several ways. It demonstrated that performing an in-hospital GA in acutely ill older adults initiating chemotherapy for AML is feasible. Feasibility of performing GA on outpatients with cancer has been demonstrated previously.²⁰ No published studies have investigated inpatient GA in this high-acuity setting. Participants were willing to participate and completed most assessment measures. Use of upper and lower extremity physical performance measures is unusual in studies of GA in cancer populations, and no safety concerns were identified. The GA assessment took longer to complete than reported in other GA studies,²⁰ but this GA was administered in interview format to diminish participant burden. Ideally, a streamlined leukemia-specific GA will be developed based on measures most associated with treatment tolerance and survival.

Another important finding was the high percentage of impairments detected in this population, most in more than one geriatric domain. These findings are consistent with studies in other people with cancer.^{28,39,40} In an investigation of an outpatient GA in people aged 70 and older with newly diagnosed cancer of any type, 75% required assistance with IADLs, and 29.3% had cognitive impairment.⁴¹ The population of the current study was a more-homogeneous population of older adults who had been referred for consideration of aggressive chemotherapy than in other studies. Nonetheless, significant impairments were documented in multiple geriatric domains.

Most oncology GA studies have evaluated people with multiple tumor types receiving a broad range of therapies. The significance of impairment in specific GA domains may differ according to tumor burden or treatment type. For example, the implications of impairment in IADLs may differ for an older adult with chronic leukemia than for an older adult with acute

leukemia. A few studies have now documented an association between performance on GA measures and treatment outcomes in specific tumor types. For example, a preoperative GA identified individuals at risk for complications within 30 days of surgery for colorectal cancer.⁴² Another study used GA to identify older adults with lymphoma who were most likely to benefit from aggressive curative chemotherapy.⁴³ The current study provides the foundation for this line of investigation in acute leukemia.

Another important finding in this study is that impairments were not adequately reflected in the ECOG PS. Previously, 9.3% ADL disability and 37.7% IADL disability was identified in older adults with a good ECOG PS (1) who were evaluated in an oncology clinic.¹⁷ The current study confirmed this lack of sensitivity of the ECOG score in identifying impairments in physical function. It found that physical performance testing (SPPB) classified the most participants as “impaired.” Performance testing may provide the least-biased, most-sensitive assessment of physical function reserve.^{44,45}

Using a multidimensional assessment battery also underscores that the ECOG PS lacks information on important functional domains, including cognition and psychological health. The prevalence of cognitive impairment in older adults with cancer in particular has been understudied. Cognitive deficits detected in the current study may reflect undiagnosed preexisting cognitive impairment or delirium related to acute illness or medications. Both may increase the risk of morbidity and mortality during therapy. Future studies should not only investigate the prognostic significance of cognitive impairment, but also attempt to differentiate the etiology of cognitive impairment to better inform optimal management strategies.

Finally, the exploratory data suggest two important points regarding the relationship between tumor biology (assessed according to cytogenetic risk group) and functional status. First, participants with more-aggressive tumor biology had more depressive symptoms and poorer self-reported physical function upon presentation (detected before availability of biopsy results). This may reflect the emotional and physical consequences of rapidly progressing symptoms. The present study is hypothesis generating and suggests another mechanism by which poor tumor biology may negatively affect prognosis. These individuals may benefit from interventions to improve emotional and physical function in addition to novel chemotherapeutic agents. Second, a broad range of cognitive, psychological, and physical function was found despite stratification according to cytogenetic risk group. This finding highlights the importance of using methods such as GA to assess domains of functional status for individualized treatment planning.

This study has several strengths. It is the first to perform inpatient multidimensional GA in older adults receiving chemotherapy for AML. The GA battery included self-report and performance-based measures of physical function. The participant population was homogeneous, which improves internal validity. The high recruitment rate diminishes concerns regarding response bias.

This study also has several limitations. It was a small, single-institution study that requires external validation. The GA battery was lengthier than others but is a foundation for identifying characteristics most predictive of treatment tolerance. Results from the PAT-D highlight the limitations of applying non-cancer-specific self-report measures to individuals with newly diagnosed malignancy. Many participants chose the “do not do for other reasons” option on the physical function survey, in part because of their recent hospitalization for cancer treatment. Finally, a small number of participants (16.7%) had started chemotherapy shortly before the GA was performed. This was allowed to accommodate participants starting treatments over weekends and holidays and was not

expected to significantly affect the primary outcomes of the analysis. In all cases, assessments were made no later than Day 4, before the onset of major toxicities.

In conclusion, this study demonstrates the feasibility and utility of performing a bedside GA to detect impairment in multiple domains in older adults initiating induction chemotherapy for AML. Detection of these impairments may improve care of older adults with AML by identifying those who can tolerate standard, aggressive therapies; vulnerable older adults who may benefit from novel therapeutic agents; and modifiable risk factors (e.g., impaired physical function, depression, delirium) that may affect treatment tolerance and are potentially amenable to intervention. Identification of modifiable risk factors is one of the potential strengths of the type of approach outlined here, allowing for the design of interventions with the possibility of improving outcomes in addition to increasing the ability to risk stratify this vulnerable population. For example, this study demonstrated that a physical activity intervention is feasible in older adults receiving chemotherapy for AML.⁴⁶ Given the high prevalence of physical function limitations at baseline, this type of intervention may be an important component of improving outcomes when partnered with active treatment.

The next step in this line of research is to prospectively evaluate which GA measures are independently predictive of treatment toxicity, early mortality, and overall survival in this population. Future directions include developing a predictive model of characteristics associated with treatment tolerance and survival with validation of this AML-specific assessment tool in a multisite fashion. Ultimately, if simple GA measures can detect impairments that predict outcomes in this population, these tools could be added to usual care assessments to optimize management of older adults with AML.

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Appendix

Appendix 1

Eastern Cooperative Oncology Group Performance Scale

Score	Description
0	Fully active
1	Restricted in physically strenuous activity
2	Ambulatory and capable of all self-care but unable to perform any work activities
3	Capable of only limited self-care
4	Totally confined to bed or chair

Appendix 2

Pepper Assessment Tool for Disability (PAT-D 19 item)

We want to know how well you can take care of yourself and do things by yourself. These questions will ask about things that most people do or have done in the past. Mark the box under the phrase that best tells how you were able to do the described activity in the past month.

How much difficulty, if any, do you have with each of these activities? Think about the past month. How hard was it to do the activity because of your health?

1. Doing light housework (such as washing dishes, dusting, etc.)	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
2. Walking several blocks	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
3. Lifting heavy objects	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
4. Participating in community activities such as religious services, social activities, or volunteer work	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
5. Walking one block	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
6. Lifting or carrying something as heavy as 10 pounds, such as a bag of groceries	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
7. Moving in and out of a chair	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
8. Managing your money, such as paying bills	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
9. Visiting with relatives or friends	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
10. Moving in and out of a bed	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
11. Gripping with your hands	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
12. Using the telephone	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
13. Using the toilet including getting on and off the toilet	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
14. Dressing yourself	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
15. Getting in and out of a car	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
16. Bathing or showering	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
17. Taking care of a family member	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
18. Climbing several flights of stairs	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆
19. Climbing one flight of stairs	Usually did with no difficulty c ₁	Usually did with a little difficulty c ₂	Usually did with some difficulty c ₃	Usually did with a lot of difficulty c ₄	Unable to do c ₅	Usually did not do for other reasons c ₆

Scoring (Items for each scale):*

1. Total score—sum all items and divide by 19
2. Basic ADLs—sum items 7, 10, 11, 13, 14, 15, and 16 and divide by 7
3. Mobility—sum items 2, 3, 5, 6, 18, and 19 and divide by 6
4. IADLs—sum items 1, 4, 8, 9, 12, and 17 and divide by 6

Source: Rejski WJ, Edward Hips, Marsh AP et al. Measuring disability in older adults: The International Classification System of Functioning, Disability and Health (ICF) framework. *Geriatr Gerontol Int* 2008;8:48–54.

* Items that receive a score of 6 (usually did not do for other reasons) are not included in scoring.

No fewer than four items should be used in calculating any subscale score.

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Figure 1.
Proportion of older adults with acute myelogenous leukemia (AML) with deficits in up to four geriatric domains (psychological, cognitive, physical, comorbidity) at baseline (N = 54).

Figure 2.

Proportion of older adults with acute myelogenous leukemia (AML) with impairments in geriatric assessment measures among the overall cohort and the subset with good oncology performance status (Eastern Cooperative Oncology Group (ECOG) Performance Status score = 1). Figure displays results for participants with available ECOG scores; N = 52 for overall and N = 38 for ECOG = 1 subsets.

Table 1

Characteristics of Older Participants Initiating Induction Chemotherapy for Acute Myelogenous Leukemia (N = 54)

Characteristic	Value
Demographic	
Age, mean $\pm$ SD	70.8 $\pm$ 6.4
Age, %	
60–69	51.8
70–79	35.2
80	13.0
Male, %	59.3
White, %	96.3
Education level, %	
<High school	30.2
High school	17.0
College	52.8
Clinical	
Hemoglobin, g/dL, mean $\pm$ SD	9.3 $\pm$ 1.3
Lactate dehydrogenase, U/L, mean $\pm$ SD	328.0 $\pm$ 239.5
White cell count, $\times 10^3/\text{mm}^3$, mean $\pm$ SD	18.0 $\pm$ 28.3
Body mass index, kg/m^2 , mean $\pm$ SD	29.2 $\pm$ 6.3
Eastern Cooperative Oncology Group score 1, % *	73.1
Prior myelodysplastic syndrome, %	33.3
Cytogenetic risk group, % †	
Favorable	3.8
Intermediate	71.7
Poor	24.5
Coronary artery disease, %	18.5
Chronic obstructive pulmonary disease, %	16.7
Diabetes mellitus, %	22.2
Congestive heart failure, %	5.6
Treatment, %	
Anthracycline+cytarabine+etoposide, %	17.7
Anthracycline+cytarabine, %	64.7
Other, %	17.6

* Score was unavailable for two participants.

† Cytogenetic test results were unavailable for one participant.

Table 2

Baseline Geriatric Assessment Measure Scores in Older Adults Initiating Induction Chemotherapy for Acute Myelogenous Leukemia (N = 54)

Measure	Mean ± Standard Deviation	Impaired, %
Modified Mini-Mental State Examination Scale score (range: 0–100, impairment <80) [§]	82.4 ± 9.7	31.5
Psychological function		
Center for Epidemiologic Studies Depression Scale score (range: 0–60, impairment >16)	13.6 ± 11.4	38.9
Distress thermometer (range: 0–10, impairment >4)	4.2 ± 3.3	53.7
Physical function		
Pepper Assessment Tool for Disability score (range: 1–5, impairment >1) [*]	1.6 ± 0.6	70.0
Activity of daily living subscale	1.3 ± 0.5	48.2
Instrumental activity of daily living subscale	1.4 ± 0.7	40.7
Mobility subscale	2.3 ± 1.3	71.4
SPPB score (range: 0–12, impairment >9) [§]	6.4 ± 4.2	53.7
Walking speed, m/s [†]	0.8 ± 0.2	–
Grip strength, kg ^{‡§}		
Male	37.0 ± 6.9	–
Female	25.1 ± 5.2	
Hematopoietic Stem Cell Transplantation Comorbidity Index (impairment >1)	1.6 ± 1.5	46.3

* Results based on participants with calculable survey scores (reported in Results).

[†] Score based on 37 participants who performed walking component of Short Physical Performance Battery (SPPB).

[‡] Scores are based on 52 participants who performed grip strength.

[§] Higher scores reflect better function.

Higher scores reflect worse function.

Table 3

Geriatric Assessment Scores Stratified According to Tumor Biology (Cytogenetic Risk Group) (N = 53)

Characteristic	Median (Range)		P-Value
	Favorable to Intermediate (n = 40)	Unfavorable (n = 13)	
Modified Mini-Mental State Examination Scale score	84 (59–97)	85 (68–92)	.88
Center for Epidemiologic Studies Depression Scale score	8 (0–49)	18 (8–40)	.002
Distress Thermometer	4 (0–10)	5 (0–10)	.85
Pepper Assessment Tool for Disability score *	1.2 (1.0–2.7)	1.8 (1.0–3.1)	.04
Short Physical Performance Battery score	8 (0–12)	8 (0–11)	.42

Cytogenetic test results were unavailable for one participant.

* Results based on participants with calculable survey scores.