Electronic Rapid Fitness Assessment: A Novel Tool for Preoperative Evaluation of the Geriatric Oncology Patient

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Abstract

Background: The American College of Surgeons and American Geriatrics Society recommend performing a geriatric assessment (GA) in the preoperative evaluation of older patients. To address this, we developed an electronic GA, the Electronic Rapid Fitness Assessment (eRFA). We reviewed the feasibility and clinical utility of the eRFA in the preoperative evaluation of geriatric patients. **Methods:** We performed a retrospective review of our experience using the eRFA in the preoperative assessment of geriatric patients. The rate and time to completion of the eRFA were recorded. The first 50 patients who completed the assessment were asked additional questions to assess their satisfaction. Descriptive statistics of patient-reported geriatric-related data were used for analysis. **Results:** In 2015, 636 older patients with cancer (median age, 80 years) completed the eRFA during preoperative evaluation. The median time to completion was 11 minutes (95% CI, 11–12 minutes). Only 13% of patients needed someone else to complete the assessment for them. Of the first 50 patients, 88% (95% CI, 75%–95%) responded that answering questions using the eRFA was easy. Geriatric syndromes were commonly identified through the performance of the GA: 16% of patients had a positive screening for cognitive impairment, 22% (95% CI, 19%–26%) needed a cane to ambulate, and 26% (95% CI, 23%–30%) had fallen at least once during the previous year. **Conclusions:** Implementation of the eRFA was feasible. The eRFA identified relevant geriatric syndromes in the preoperative setting that, if addressed, could lead to improved outcomes.

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Background

Older patients (aged >65 years) with cancer have a higher risk of developing postoperative surgical complications,¹ including delirium² and prolonged hospital length of stay,³ and have poorer overall survival⁴ compared with younger patients. Although a significant number of studies have investigated the effects of age on surgical outcomes, others have argued that overall fitness, rather than age, should be the chief consideration in surgical decision-making.⁵ Frailty, as opposed to fitness, is a state of preexisting limited organ and functional reserve in response to stress (eg, surgery).⁶ Preoperative age-related deficits (or geriatric syndromes) have been shown to be associated with a higher risk of postoperative mortality, institutionalization, and delirium in

older patients undergoing cancer and noncancer-related surgery.⁷ Older patients with cancer with a slower walking pace, poorer nutritional status, higher number of medications taken, and more comorbid conditions have poorer surgical outcomes.^{8–10} A patient's level of frailty can be determined by geriatric assessment (GA),¹¹ which is a multidimensional evaluation encompassing several functional and psychosocial domains. Various organizations have recommended incorporating GA into the assessment of older patients with cancer.^{12–14}

Despite these recommendations, the inclusion of GA in the preoperative assessment of older patients with cancer has been poor. Recently, the Surgical Task Force at the International Society of Geriatric Oncology found that only 6% of clinicians used GA in daily prac-

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tice, and only 34% collaborated with geriatricians.¹⁵ These poor compliance rates likely stem from the practical difficulties of implementing GA in routine surgical practice.

To increase the rate of GA performance in the preoperative setting, we developed a patient-centered assessment that is feasible and effective, with no added burden for the provider. We have found that the key to successful implementation of this GA is to have patients complete it online, using an electronic tablet, with the results automatically collated and reported to the treating clinician. This article reviews our experience with the development and implementation of an electronic GA, the Electronic Rapid Fitness Assessment (eRFA).

Materials and Methods

Data Collection and Analysis

We performed a retrospective review of our institution's experience using the eRFA in the routine and elective preoperative evaluation of geriatric patients with cancer who presented to Memorial Sloan Kettering Cancer Center (MSKCC) geriatrics clinics in 2015. To assess and improve the quality of patient and/or caregiver interactions with the eRFA, data on time to complete the eRFA and the person who completed the eRFA were collected. The first 50 patients who completed the eRFA were asked additional questions to assess their satisfaction with the process. Descriptive statistics of patient-reported geriatric-related data were used for analysis. The Institutional Review Board at MSKCC approved this study.

Referral to Geriatrics Service for Preoperative Assessment

At MSKCC, patients aged ≥ 75 years who are willing to be assessed by MSKCC Geriatrics Service, instead of their primary care provider, are referred to the Geriatrics Service. Surgeons may also refer younger patients who have geriatric syndromes (eg, cognitive deficits).

Project Site

The eRFA was developed at MSKCC through collaboration between the Geriatrics Service and the Web Survey Core Facility (Webcore). The Geriatrics Service performs preoperative assessments of approximately 900 older patients with cancer annually. The MSKCC Webcore is an NCI-funded core facil-

ity that was created to develop and administer secure online questionnaires.

Development of the eRFA

During the eRFA development process, the Geriatrics Service held multiple discussions to determine which GA domains to assess and which validated assessment methods to use (Table 1). The name "Electronic Rapid Fitness Assessment" was selected to reflect the purpose of the GA, which is to distinguish patients who are fit from those who are frail.

Administration and Reporting of the eRFA

All patients who present to MSKCC geriatric clinics complete the eRFA while they are waiting to be seen by a geriatrician for their initial consultation. Patients may complete the eRFA on their own or with assistance from others (eg, a caregiver), or they may allow someone else (eg, a caregiver) to complete the assessment for them. Patients may also complete the eRFA at home, before their appointment, if they have Internet access and an e-mail account. After the assessment has been completed, a registered nurse (RN) performs a cognitive assessment using the Mini-Cog¹⁶ and establishes the patient's mobility using the Timed Up and Go (TUG)¹⁷ test, the results of which are then entered into the eRFA by the RN.

The eRFA is accessible using computers, tablets, and smartphones. It is partially integrated with the electronic medical record (EMR), with patients' names and medical record numbers pulled from the EMR as patient-specific questionnaires are generated. After the patients complete the eRFA, clinicians can copy and paste the final report into their notes in the EMR under the GA subheading. For patients with significant GA deficits, geriatricians would include the eRFA report in the e-mail they send to the treating surgeons. Most of the time the impaired domains are highlighted and a postoperative action is emphasized. Moreover, the eRFA final report is included in the geriatrics preoperative clearance under the GA section for surgical teams to review in the postoperative period.

Quality and Quantity Assurance

The leader of the project (A.S.), with the help of the Webcore staff, has been responsible for monitoring the quality and quantity of the eRFAs. As a result of

Table 1. Electronic Rapid Fitness Assessment Domains and Instruments

Domain	Assessment Tool	Description and Score Range (if Applicable)
Functional status	Karnofsky performance scale (rated by the patient) ³⁶	30–100, in increments of 10. 30 means severely disabled; 100 means normal without any symptoms.
	ADLs ^{37–39}	7 activities: bathing, dressing, grooming, feeding, walking inside the home, walking outside the home, and bladder and bowel control. Patients get 2 points for each activity that is not limited at all, 1 point for limited a little, and 0 points for limited a lot. Total ADL score ranges from 0 to 14.
	iADLs ^{40,41}	8 activities: telephone use, doing laundry, shopping, preparing meals, doing housework, handling own medications, handling money and finances, and transportation to visit one's doctor. Patients get 2 points for each activity that can be done without help, 1 point for needing some help, and 0 point for being unable to do. Total iADL score ranges from 0 to 16.
	Timed Up and Go ^{42–44}	Patients are asked to get up from the chair, walk 10 feet, turn, and walk back to the chair (<10 seconds, 10–20 seconds, >20 seconds).
	History and number of falls in the past year, context of fall	<ul style="list-style-type: none"> Falls in the past year (yes, no) Number of falls in the past year (1 or >1) Context of last fall (inside or outside the home)
	Use of assistive devices	Use of cane, walker, or wheelchair.
Cognition	Mini-Cog test ⁴⁵	CDT and 3-word recall. Normal CDT gets 2 points, and each recalled word gets 1 point. Score ranges from 0 to 5. Score of ≤2 is indicative of cognitive deficit.
Social support	Four-item Medical Outcomes Study Social Support Survey ⁴⁶	Four 5-point Likert scale questions addressing 4 domains of social support: emotional/informational, tangible, affectionate, and positive social interaction. Score for each item ranges from 1 to 5, and total score ranges from 4 to 20. A higher score means better social support.
Social activity interference	Medical Outcomes Study Social Activity Survey ⁴⁷	Three 5-point Likert scale questions addressing the interference of patient's health condition with the social activity. Total score ranges from 3 to 15. Higher score means more health-related interference with social activities.
Emotional status	Distress Thermometer ^{48–52}	Score ranges from 0 to 10. 0 means no distress at all; 10 means extreme distress. Score of ≥4 is suggestive of high level of distress.
	Geriatrics Depression Scale 4-item questionnaire ⁵³	Four yes/no questions regarding patient's psychological status. Score ranges from 0 to 4, and a score of ≥1 is usually indicative of depression.
Nutrition status	Single item on weight change during the past 6 months. Items range from "No weight change"/"Weight gain" to "Weight loss of >20 lb."	
Vision	Questions about vision quality (excellent, good, fair, poor), wearing eyeglasses (yes, no), and effectiveness of eyeglasses in improving vision (a great deal, somewhat, not at all).	
Hearing	Questions about hearing quality (excellent, good, fair, poor), wearing hearing aid (yes, no), and effectiveness of hearing aid in improving hearing (a great deal, somewhat, not at all).	
Polypharmacy ³⁰	<ul style="list-style-type: none"> Number of prescribed medications: 0, 1–4, 5–10, >10. Number of herbals, supplements, and vitamins: 0, 1–4, 5–10, >10. 	

Abbreviations: ADLs, activities of daily living; CDT, clock-drawing test; iADLs, instrumental activities of daily living.

this process, the final report of the eRFA was revised to highlight missing data, and healthcare providers were asked to review the final report with the patients to make necessary corrections to ensure completion.

Results

Pilot Phase

Time to Complete the eRFA: The pilot phase of this project began in January 2015 and concluded in April 2015, with an average of 22 eRFA surveys completed each month for either preoperative

assessment or other geriatric consultation. The median time to complete the eRFA was 15 minutes (95% CI, 13–17 minutes), and 83% of patients (95% CI, 73%–90%) were able to complete the eRFA in ≤25 minutes.

Satisfaction Survey: To assess patient and caregiver satisfaction with the content and delivery of the eRFA, the first 50 patients who completed the eRFA were given a 16-item satisfaction questionnaire. The questionnaire included 3 sociodemographic questions (age, education, and sex); 3 technology questions (about the computer, the handheld device [eg,

phones and tablets], and the availability of Internet access at home); and 10 questions regarding the patient's experience with the eRFA (Figure 1).

Of the 50 individuals who completed this questionnaire, 22% were aged <75 years, 30% were aged 75 to 79 years, 36% were aged 80 to 84 years, and 12% were aged ≥85 years. A total of 64% were women, 38% had a high school diploma or less, 34% were college graduates or had some college education, and 28% had an advanced degree. As shown in Figure 1, approximately 90% of patients (respective 95% CI, 75%–98%) responded that answering questions, changing answers, and moving between questions were easy.

In response to the technology questions, 43 patients in the pilot study (86%; 95% CI, 73%, 94%) responded that they have a handheld device, computer at home, or Internet at home. Four patients reported that they disagreed with “not mind[ing] answering questions using the tablet,” but only 2 of these 4 patients agreed that they would prefer to answer questions on paper over the tablet. Of the remaining 7 patients who did not report having any of the aforementioned technology, only 1 patient agreed that they would prefer answering questions on paper rather than on the tablet and none disagreed with “not mind[ing] answering questions using the tablet.”

Figure 1. Patient satisfaction with the electronic rapid fitness assessment (blue bars represent strong and somewhat agreement; red bars represent strong and somewhat disagreement).

Expansion Phase

Use of the eRFA was expanded to all geriatric clinics in May 2015, leading to a significant increase in the number of monthly completions. In total, 1,024 older patients with cancer completed the eRFA, 636 of whom had presented to a geriatric clinic for preoperative assessment. Sociodemographic and clinical characteristics of the preoperative patient cohort are listed in Table 2.

The following sections summarize the additional data obtained by administration of the eRFA to these preoperative patients.

Completion of the eRFA: In this larger group, the median time to complete the eRFA was 11 minutes (95% CI, 11–12 minutes), and 90% (95% CI, 88%–93%) of patients were able to complete the eRFA in ≤25 minutes. Of the 636 preoperative eRFAs completed in 2015, 50% were completed by the patients, 37% were completed with assistance, and 13% were completed by another person (likely a caregiver). Additionally, we were able to distinguish whether surveys were filled out in clinic or “home” (defined as anywhere outside of clinic) based on whether the user logged in with credentials, or if a member of the medical team (such as a research study assistant) signs in and hands off the device, thereby bypassing the patient’s need to log in. Among this cohort, 59% (95% CI, 55%, 63%) of these surveys were accessed from home.

Comparison of Paper Format GA and eRFA: We compared the missing items in the paper-format GA that was completed by 283 patients in our institution in 2013 with the missing items in the eRFA. The missing rate for these 2 data collection methods was almost similar (1.8% missing rate for activities of daily living [ADLs] in paper format vs 1.1% in the eRFA). On the other hand, cognitive assessment was missing for 3.5% of patients with paper-format GA compared with missing items for approximately 10% of patients completing the eRFA. This difference occurred as a result of change in the data entry process. For paper-format GA, clinicians were responsible for entering cognitive assessment data, whereas in the eRFA, nurses were responsible for data entry, which led to missing data, especially in the pilot and early expansion phase (see “Quality and Quantity Assurance,” page 173).

eRFA Results Functional Domain: The median patient-rated Karnofsky performance scale score was

Table 2. Sociodemographic and Clinical Characteristics (N=636)

Characteristic	N (%)
Age, median (interquartile range), y	80 (77–84)
Female	331 (52)
Marital status	
Married	338 (53)
Widowed	180 (28)
Divorced	50 (8)
Single	44 (7)
Domestic partnership	13 (2)
Separated	9 (1)
Unknown	2 (<1)
Education level	
Advanced degree	151 (24)
College graduate	148 (23)
Some college	108 (17)
High school diploma	159 (25)
Less than high school diploma	62 (10)
Unknown	8 (1)
Living situation	
Living with family or partner	411 (65)
Living alone	201 (32)
Living with someone who is not family/a partner	7 (1)
Assisted living facility	3 (1)
Nursing home	1 (<1)
Other	8 (1)
Unknown	5 (1)
Race	
White	514 (81)
Black	38 (6)
Asian	25 (4)
Refused to answer	44 (7)
Other	4 (1)
Missing	11 (2)
Surgery type	
Ambulatory	296 (47)
Surgery requiring hospitalization	340 (53)
Surgical site	
Genitourinary	162 (25)
Head and neck	85 (13)
Colorectal	78 (12)
Gynecological	60 (9)
Hepatopancreatic	49 (8)
Breast	36 (6)
Thoracic	37 (6)
Gastric/mixed	38 (6)
Ophthalmic	33 (5)
Neurosurgery	21 (3)
Orthopedic	17 (3)
Other	18 (3)
Unknown	2 (<1)

90 (range, 30–100). Overall, 26% of patients (95% CI, 23%–30%) experienced at least 1 fall during the previous year. Of these patients, 37% (95% CI, 30%–45%) had more than one fall. Of the 161 patients who reported the location of the fall, a small majority experienced their last fall at home rather than outside the home (56% vs 44%). In total, 22% (95% CI, 19%–26%), 11% (95% CI, 9%–14%), and 4% (95% CI, 3%–6%) of patients presented to the geriatric clinic using a cane, walker, or wheelchair, respectively. The time to complete the TUG test was <10 seconds in 56% of patients, 10 to 19 seconds in 23% of patients, and >20 seconds in 10% of patients. The remaining 74 patients had missing data (see “Quality and Quantity Assurance,” page 173). Patients’ levels of independence for ADLs and instrumental ADLs are shown in Figure 2.

Cognition: In total, 58% of patients were able to recall 3 words, 26% were able to recall 2 words, 12% were able to recall 1 word, and 4% could recall no words. Results of the clock-drawing test were abnormal for 146 (26%). Overall, 16% of patients had a positive screening for cognitive impairment (Mini-Cog score of ≤ 2). It should be noted that 65 patients had missing data (see “Quality and Quantity Assurance,” page 173).

Social Support and Social Activity Interference: Among our cohort, more patients expressed having adequate support (defined as all or most of the time) in the affectionate domain (83%) than in positive social interaction (75%), emotional/informational support (71%), or tangible support (57%). Responding to the impact of their health/emotional condition on their social activities, 39% thought they were somewhat or much more limited than 6 months ago, and 24% thought they were somewhat or much more limited than their peers.

Emotional Status: The median distress score for this cohort was 4, with 31% of patients (95% CI, 28%–35%) experiencing a distress score of ≥ 6 . The median Geriatric Depression Scale 4-item score was 1.

Nutrition Status: In total, 44% reported no weight loss during the previous 6 months compared with 17% who lost <5 pounds, 17% who lost 5 to 10 pounds, 8% who lost 10 to 20 pounds, and 6% who lost >20 pounds; 7% did not know whether or by how much their weight changed during the previous 6 months.

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Figure 2. Patients' limitations in activities of daily living (ADLs) and instrumental activities of daily living (iADLs).

Sensory Deficit: Of the patients who presented for preoperative evaluation, 7% considered their vision quality to be poor, and 24% considered their vision quality to be fair. Reported hearing quality was poor for 15% and fair for 27% of patients.

Polypharmacy: In total, 92% of patients took at least 1 medication. Among these patients, 50% took 1 to 4 medications, 38% took 5 to 10 medications, and 5% took >10 medications; 40 patients did not provide details about the number of medications they took.

Discussion

To our knowledge, this is the first study to show the feasibility and utility of performing an electronic GA in the preoperative assessment of older patients with cancer. The median time to complete the eRFA for preoperative assessment was an acceptable 11 minutes, which is similar to the time it takes to complete a screening assessment (rather than a complete GA)¹⁸ and is much shorter than the time reported to complete a paper-version GA (30 minutes).¹⁹ In addition, most patients were able to complete the eRFA on their own or with assistance from a caregiver. The number of missing items between the

paper-format GA and eRFA were similar, which is consistent with what was reported in the prior literature.²⁰ However, we showed the need for quality and quantity assurance in implementing electronic patient-reported outcomes. Simple interventions, such as reviewing missing items and educating staff about the importance of complete data entry, could be helpful in this setting. In order to develop the eRFA, we used the already available health information technology (HIT) infrastructure within our institution. We suggest that other investigators interested in implementing tools such as the eRFA assess the available HIT infrastructure within their institutions; use of those infrastructures may decrease the cost of developing such tools.

Through the use of the eRFA, aging-related deficits were discovered that otherwise might have gone unnoticed. Among our cohort, 16% had a positive screening for cognitive deficit. The incidence of cognitive deficit in our cohort is slightly higher than the incidence of cognitive deficit seen in the preoperative evaluation of 460 patients aged ≥ 70 years reported previously (10.6%).²¹ The difference could be reflective of age differences between the cohorts, because our cohort included patients aged ≥ 75 years. Studies have shown that patients with cognitive deficits have a higher risk of postoperative delirium,²² which may lead to prolonged hospital stay and other complications.²³ A substantial percentage of patients (37%) had limitations walking outside the home, and expressed the need for assistance with transportation. These findings are important, because such limitations may jeopardize a patient's ability to adhere to postoperative follow-up recommendations by healthcare providers. Approximately 25% of our patients experienced at least 1 fall during the year before their surgical procedure. This is similar to the previously reported 21% incidence of falls in 111 patients (median age, 72 years) in the last 6 months before preoperative evaluation.¹⁰ This raises the need for postoperative physical therapy and home safety assessment for these patients.²⁴

More than half of our patients expressed a high level of distress, indicating that interventions such as referral to a social worker should be considered.²⁵ In total, 14% of patients experienced weight loss of >10 pounds during the previous 6 months, reflecting the need for nutritionist involvement.²⁶ Poor or fair hearing quality, identified in 15% and 27%

of patients, respectively, may jeopardize patients' ability to understand care instructions, which may increase the likelihood of hospital readmission and functional decline.^{27,28} Polypharmacy was present in approximately 40% of patients; these patients are 2.4 times more likely to develop major postoperative morbidity.²⁹ In a population of community-dwelling men aged ≥ 70 years, polypharmacy was associated with an increased likelihood of frailty, disability, falls, and mortality.³⁰ Therefore, conducting preoperative medication review to assess the appropriateness of the patient's medications is critical.

The correlation between frailty and surgical outcomes has been studied in older patients with cancer. In a study of 176 patients with colorectal cancer aged 70 to 94 years, postoperative complications and survival were strongly associated with frailty, which was defined as having one or more of the following conditions: ADLs dependency, severe comorbid conditions, cognitive deficit, depression, malnutrition, and taking > 7 medications.³¹ Similarly, a study of 281 women with cancer aged ≥ 65 years with an American Society of Anesthesiologists physical status classification system score of 1 or 2 found that multidimensional frailty score³² was associated with postoperative complications, increased likelihood of institutionalization, and prolonged hospital stay.³³

Our study has several limitations. We tested the eRFA in a single institution with a patient population that may not be reflective of older community-dwelling patients elsewhere. Approximately 65% of our cohort had at least some college education and were more likely to have Internet access. Studies have shown that, among older patients, higher education levels and more Internet access are associated with better acceptance of computers.^{34,35} The generalizability of our success needs to be tested in community clinics and among less-educated patients or those with less Internet access. Moreover, the

eRFA was included as part of a preoperative assessment within MSKCC's geriatric clinics. Additional challenges for implementing the eRFA in surgical oncology clinics need to be studied.

Conclusions

The highlight of our study is the development and successful implementation of the first patient-friendly electronic GA. Several future projects related to this work are planned. First, we will combine data obtained through the use of the eRFA with the MSKCC Surgical Outcomes Dataset to evaluate the correlation between aging-related deficits and surgical outcomes among older patients with cancer. Second, we will strive to implement the eRFA in all surgical oncology clinics at our institution so that older patients with cancer, regardless of whether they are referred to the Geriatrics Service, can be evaluated comprehensively. Finally, we will test the effectiveness of the eRFA in improving postoperative outcomes among older patients with cancer by conducting a prospective, randomized trial among this patient population.

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