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Translating Frailty Research Into Clinical Practice: Insights From the Successful Aging and Frailty Evaluation Clinic

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A B S T R A C T

Aging researchers have been studying frailty for decades. Experts agree that frailty is a medical syndrome marked by reduced physiologic function, which increases the risk of vulnerability and short-term mortality, particularly in the face of a stressor. Frailty has been shown to predict poor outcomes including falls, disability, major morbidity following surgery, and mortality among older adults. Despite hundreds of papers identifying frailty as a useful marker of risk, its translation into clinical practice has lagged. The Successful Aging and Frailty Evaluation (SAFE) clinic was established in 2011 specifically to implement routine and structured frailty assessment and management in a variety of referred patients. Now, more than 7 years after its inception, we offer our "in the trenches" clinical perspective on logistical challenges, the clinical utility of the frailty assessment, and future frailty needs and targets to help further the frailty translation research efforts.

Aging researchers have been studying frailty for decades. Despite some remaining disagreement about the best method to measure frailty,[1–3] there is consensus that frailty is a medical syndrome marked by reduced physiologic function, which increases the risk of vulnerability and short-term mortality, particularly in the face of a stressor.[4] Multiple tools have been developed that attempt to measure this "reduced physiologic function," most stemming from 2 main theoretical constructs: the biologic frailty phenotype and the accumulated deficits theory.[1,5–7] Frailty measurement tools have been shown to predict poor outcomes including falls, disability, major morbidity following surgery, and mortality.[5,8–10] Despite hundreds of papers identifying frailty as a useful marker of risk, there have been a number of barriers to its translation into clinical practice. This is a priority among frailty research leaders, and the theme of recent meetings.[11,12]

To help translate frailty science into clinical practice—including its implementation, its utility, and remaining gaps—we offer an "in the trenches" perspective from clinicians in the field. The Successful Aging and Frailty Evaluation (SAFE) clinic was established in 2011 specifically to implement routine and structured frailty assessment and management in a variety of referred patients. Now, more than 7 years after its inception, we hope to contribute our clinical insights to the frailty research community to help further the translation efforts while welcoming constructive academic criticisms to move the field forward.

We cover a number of important themes in this paper, relevant to both clinicians and researchers. We include an overview of the SAFE clinic infrastructure, format, and adaptations for the local patient environment. We then discuss the typical categories of frail patients referred for evaluation and the unique needs of each group. These needs have directed our translation of the frailty science into our care planning and frailty management, forming a foundation for frailty guideline discussions. We share logistical barriers encountered, remaining gaps in science, and future directions. We conclude with a summary of implications for frailty practice, policy, and research. We specifically avoid making any statements about the "best" or "most accurate" frailty assessment tool given that a number of prior consensus meetings of frailty experts have been dedicated to this

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Table 1
Successful Aging and Frailty Evaluation Clinic Assessment Tools

Domain	Tool
Frailty	Phenotypic Frailty Criteria[6]
Functional assessment	
Disability and vulnerability	Vulnerable Elders Survey–13[45]
	(Instrumental) Activities of Daily Living—Katz/Lawton[46,47]
Physical function	Short Physical Performance Battery[14]
Falls	American Geriatrics Society Fall Screen[48]
Cognition	Montreal Cognitive Assessment[49]
Psychological health	Patient Health Questionnaire–2[50]
Multimorbidity	Charlson Comorbidity Index[51]
Polypharmacy	Medication number and review[52]
Advance care planning	Healthcare Power of Attorney (state specific)
	Physician Order for Life Sustaining Treatment (state specific)
Healthcare utilization (eg, hospitalizations, emergency room visits, rehabilitation, hospice services)	Focused questions
Social, instrumental, and financial support	
Home service utilization	
Geriatric review of systems (eg, pain)	
Other geriatric syndromes (eg, urine incontinence)	

discussion.[4,13] Rather, we focus on a possible framework for the application of frailty assessment into geriatric clinical practice.

The Successful Aging and Frailty Evaluation (SAFE) Clinic Infrastructure and Local Environment

The SAFE clinic was established in 2011 as a consultative clinic offering structured frailty assessment and management to a variety of referred clinical patient populations. It is affiliated with an academic medical center in an urban, medically underserved community. The SAFE clinic interprofessional team is composed of geriatricians (3), a geriatric-trained advanced practice nurse (1), social workers (2), registered nurses (2), and a medical assistant (1), in addition to scheduling staff. All staff members are employed by the academic medical center and are shared with other clinical providers, off-setting costs.

The SAFE clinic offers 90-minute new patient evaluations during which geriatricians implement a highly structured, evidence-based comprehensive geriatric assessment format including a formal frailty assessment, using evidence-based measures whenever possible (Table 1). We chose to measure the 5 phenotypic frailty criteria because of the large supporting literature and its relevance to several of our targeted referral patient populations.[1,6] We additionally include the Short Physical Performance Battery (SPPB) because of its notable supporting evidence base and its ability to detect concrete, modifiable functional impairments.[14] Some researchers have used parts of the SPPB to construct frailty tools, and, indeed, the SPPB has been considered a frailty assessment tool in its entirety.[15] Assessments also include measures of frailty outcomes (eg, falls, disability, hospitalizations) and frailty modifiers (eg inadequate social support, cognitive impairment). Follow-up visits are 30 minutes and are provided when clinically indicated. To facilitate standardization of the assessment across clinicians and sites, we created a note template in our electronic medical record including all assessment pieces.

The SAFE clinic offers flexible consultation based on patient needs spanning from 1-time consultative visits to long-term comanagement. The most common referring physicians are primary care physicians followed by surgical specialists. The standard approach to frailty assessment has also provided an excellent environment for teaching geriatrics principles and interprofessional care models to rotating students, residents, and fellows.

To facilitate the interpretation and communication of our frailty assessment to referring providers, we created a "report card," which is included in the assessment and plan section of our clinic note (Figure 1). The report card summarizes patient scores on key domains of our comprehensive geriatric and frailty assessment and provides low, medium, and high risk score references. We felt this interpretation was critical because most referring providers are only superficially familiar with many of the incorporated assessment tools. This approach helped provide some context and meaning for the assessment and recommendations and introduced referring providers to frailty and its implications. This tool has also served to help interpret risk to and engage patients in shared decision making and care-planning conversations.

It should be noted that the local patient environment has shaped the SAFE clinic infrastructure and referral groups. Located on the South Side of Chicago, the SAFE clinic primarily serves patients residing in the surrounding neighborhoods, which have a high prevalence of minority and low-income families relative to national rates.[16] The prevalence of frailty and rate of frailty decline is known to be higher in both of these subgroups.[17,18] Furthermore, patients referred for tertiary specialty care are commonly being considered for high-risk interventions (eg, transplantation, cancer therapy, lung resection, HIV care). Therefore, a frailty assessment and management clinic focused on frailty reduction is potentially quite valuable to our local practice environment.

Referred Patient Cohorts

After 7 years of evaluating patients in the SAFE clinic, we can categorize our typical referrals into 1 of 3 groups: (1) preprocedural referrals, (2) comanagement referrals, and (3) symptom-specific referrals. Each of these referral types has unique frailty assessment and management needs that may be used to inform clinical frailty guidelines.

Preprocedural Referrals

Procedures are commonly surgery but may include less invasive procedures (eg, biopsy) or high-risk medical interventions (eg, chemotherapy, radiation). The patients referred for a preprocedural frailty evaluation tend to be nonfrail, prefrail, or have very early frailty. Most patients with more advanced frailty have already been excluded for surgery by others, including surgical colleagues who often rely on "eyeball" frailty assessments.[19] Key goals of frailty assessment and management include (1) establishing surgical risk, (2) informing eligibility, (3) implementing presurgical interventions that may reduce frailty and surgical risk, and (4) preparing for postoperative

A

	Frailty Phenotype	Memory*	Leg Strength†	Balance†	Gait Speed†	Disability‡	Weight loss§	Energy level§	Grip Strength§	Physical activity§
No or Low Risk	0	26 - 30	4	4	4	0 < 4	0%	Not Exhausted	Normal	Active
Medium Risk	1-2	<26	3	3	3	5 < 6	1%-4%			
High Risk	3-5		1-2	1-2	1-2	7 < 10	>%5	Exhausted	Weak	Inactive

B

	Frailty Phenotype	Memory*	Leg Strength†	Balance†	Gait Speed†	Disability‡	Weight loss§	Energy level§	Grip Strength§	Physical activity§
No or Low Risk	0	26 - 30	4	**4**	4	0 < 4	0%	**Not Exhausted**	Normal	Active
Medium Risk	1-2	**<26**	**3**	3	**3**	**5 < 6**	1%-4%			
High Risk	**3-5**		1-2	1-2	1-2	7 < 10	**>%5**	Exhausted	**Weak**	**Inactive**

*Scoring based on performance on the Montreal Cognitive Assessment
†Scoring based on performance of the Short Physical Performance Battery subdomains: 5-repeated chair stands, gait speed, balance. Scoring on gait speed could also be determined from the frailty phenotype criteria.
‡Scoring based on responses to the Vulnerable Elders Survey – 13.
§Scoring based on performance or responses to the phenotypic frailty criteria: unintentional weight loss, exhaustion, weakness, low physical activity, and gait speed. Scoring for gait speed currently determined by performance on Short Physical Performance Battery but could also be determined from the frailty phenotype criteria.

Fig. 1. (A) The Successful Aging and Frailty Evaluation clinic frailty assessment "Report Card" template used for summarizing patient performance on evidence-based frailty, functional, and cognitive assessments with associated risk to referring physicians is presented. (B) A sample completed template is also provided. The patient's frailty status, determined by the phenotypic frailty criteria, is used to frame overall care targets (eg aggressive, palliative, or somewhere in between) and is also listed as a geriatric syndrome with specific recommendations for addressing identified criteria (eg, weight loss, exhaustion, and slow gait). The additional impairments identified on other evidence-based assessments (Montreal Cognitive Assessment, Short Physical Performance Battery, Vulnerable Elders Survey–13) become targets for intervention.

care. The time available for implementing frailty interventions and preparing for postoperative care needs ranges from a short time frame (eg, 4-6 weeks) for patients with scheduled elective surgeries that cannot be postponed (eg, resection of malignant tumor) to a long time frame (eg, years) for patients on transplant wait lists.

Comanagement Referrals

Long-term comanagement referrals are typically patients with advanced frailty who have been followed in a primary care setting but who are becoming complex to manage. Patients included in this group commonly also have complicated multimorbidity or coexisting dementia. Key goals of frailty assessment and management include (1) confirming the presence and documenting degree of frailty, (2) identifying and addressing any physical or social modifiers of frailty (eg, over- or undercontrolled disease, dementia, polypharmacy), (3) framing overall care planning in light of frailty status, (4) treating elements of frailty syndrome, and (5) implementing advance care planning. In our experience, this group tends to present at a moderate-to-late stage of frailty when frailty reversal cannot always be achieved. Although the term *frailty modifier* has yet to be defined in the literature, we would label any coexisting condition, social situation, environment, or exposure that affects the slope of the frailty trajectory to be a frailty modifier. Comanagement often includes frequent follow-up visits to avoid unnecessary hospitalization, reassessing frailty measures periodically (eg, every year) to determine overall aging trend, measure impact of recent stressor, or to help indicate when a patient may be becoming eligible for hospice care; in addition, it commonly involves family or caregivers. The comanager role is one that integrates direct care management of specific age-related conditions with active care coordination with primary care and subspecialty physicians, keeping the patient's overall health goals at the center of decision making.

Symptom- or Geriatric Syndrome–Specific Referrals

A final group of referrals are for symptom- or geriatric syndrome–specific reasons. Common referral indications include falls or poor balance, frailty, weight loss, depression, memory concerns, polypharmacy review or medication management, urine incontinence, frequent hospitalization, or inadequate social support. Referring providers frequently ask for a 1-time evaluation or an evaluation with short-term follow-up as needed. Patients in this referral group are typically prefrail or have early frailty that is more amenable to intervention, although a smaller proportion have more advanced frailty. Of note, referrals specifically for "frailty syndrome" management have increased since the introduction of our clinic, possibly indicating some transfer of frailty awareness following education efforts.

A Foundation for Frailty Clinical Guidelines

Given our clinical experiences implementing frailty assessment and management into practice, we propose 3 primary utilities for the clinical frailty evaluation: (1) identifying and treating the medical syndrome of frailty, (2) assessing risk, and (3) providing a framework for care planning.

Frailty Status as a Medical Syndrome

To align with expert opinion,[4] we use our frailty assessment to identify the presence of a medical syndrome. We currently measure the 5 frailty phenotype criteria in all presenting patients.[6] Our frailty risk reduction approach follows current evidence-based interventional studies that target a reduction in specific frailty syndrome criteria or that implement multifaceted interventions. Strategies have included targeted muscle strengthening with or without protein

Risk Assessment	Clinician Overall Estimate of Surgical Risk	Frailty Phenotype Status	Montreal Cognitive Assessment	Short Physical Performance Battery	Adequate Social Support	Comorbidities	Healthcare Utilization
Excellent	Average	Not frail (0/5 criteria)	26+	10+	Yes	None or Well-controlled	No Emergency Department visits or hospitalizations in past year
Good	Above Average Likely to survive surgery, but some pre- and post-operative risk reduction suggestions are offered. Adequate social support	Pre-frail (1-2/5 criteria)	22-25	7-9	Yes	Yes, generally well-controlled	1 Emergency Department visits or hospitalizations in past year
Fair	Significantly Increased Significant concerns about surgical success but may be able to optimize over time with interventions.	Frail (3/5 criteria)	<22	4-6	No	Poorly controlled	2+ Emergency Department visits or hospitalizations in past year
Poor	High Deficits unlikely to be remediable, would not recommend surgery	Frail (4-5/5 criteria)	<22	0-3	No	Poorly controlled	2+ Emergency Department visits or hospitalizations in past year
Associated Risks	*Overall geriatric surgical morbidity and mortality*	*Length of stay, discharge location, post-operative morbidity and mortality, post-operative functional recovery potential, incident disability risk, re-hospitalization and healthcare utilization*	*Delirium, ability to understand and adhere to complex post-operative care plans, critical medication adherence (e.g., immune suppression)*	*Post-operative recovery*	*Post-operative care and recovery, short and long-term organ transplant success*	*Surgical morbidity and mortality*	*Re-hospitalization*

*The table is to be used as a rough guideline to help standardize geriatric risk assessment but does require clinical interpretation and judgement which is reflected in the "Clinical Overall Estimate of Surgical Risk" column.

Fig. 2. Decision support tool for geriatric surgical risk stratification*

supplementation for identified weakness or slow gait and increasing exercise for people with low activity.[20,21] We additionally address weight loss and exhaustion when present using targeted nutrition support and exploring factors that may be contributing to weight loss or exhaustion (eg, mood disorders, polypharmacy), but these interventions have not been as well studied in this context and remain controversial.[20–22] Multifactorial frailty reduction interventions in the literature have shown early success; therefore, we also address any geriatric syndromes or frailty modifiers identified during our comprehensive geriatric assessment.[23]

Frailty Status in the Assessment of Risk

There is now a well-established and growing body of literature supporting frailty status as a predictor of major morbidity and mortality following surgery.[9,24] Frailty has been shown to predict poor outcomes across numerous surgical specialties, including transplant, general surgery, and trauma.[25–27] As such, we have found great interest among our surgical colleagues to implement frailty measures into the preoperative assessment of older adults.

Using frailty status to assess surgical risk in older adults has several important implications for surgical decision making, risk reduction, and preoperative planning. First, frailty status provides surgeons and patients a graded risk for poor outcomes that can help frame surgical risk discussions and consent processes with patients. In our experience, older patients who have already been deemed surgical candidates and are referred for a frailty evaluation demonstrate 0-3/5 frailty criteria. Less commonly, we identify 4-5/5 frailty criteria or 3-5/5 criteria plus multiple additional frailty modifiers (eg, poor social support, dementia). To foster consistency of recommendations across geriatric providers, we created a decision support tool for geriatric surgical risk stratification framed by frailty status (Figure 2). This tool outlines an overall geriatric risk category and level of risk based on key domains evaluated in our assessment. Since standardizing our assessment, frailty has become a target for risk reduction prior to organ transplant and a contraindication if not reversed at our institution. Second, once frailty status has been identified, there is an opportunity for frailty syndrome mitigation prior to surgery to reduce surgical risk. The duration of time to planned surgery can be a limiting factor in the ability to reduce surgical risk. Frailty interventional studies have assessed change over as few as 6 weeks[28,29] and as long as several years,[20] though most fall between 12 weeks and 12 months. More research is needed to assess the impact of frailty interventional studies on underlying aging physiology and surgical or procedural outcomes. Finally, the presurgical frailty assessment also allows us to help patients plan for postoperative care needs. Prefrail and frail older adults are much more likely to have prolonged lengths of stay,[26] have functional decline,[30] be discharged to a skilled nursing facility for rehabilitation,[9] and likely experience more delirium.[31–33] Once we have identified prefrail or frail states among older surgical candidates, we engage in care planning with patients and family to prepare for these common outcomes. This includes identifying ways to reduce risk for delirium and functional decline and preparing caregivers to meet patients' postoperative and post-acute care needs, interventions that may also reduce length of stay.

Frailty Status for Framing Care Plans

Although frailty experts have defined frailty primarily as a medical syndrome,[4] clinically, we also consider frailty as a "state" of vulnerability. We use our frailty evaluation to frame care planning according to the identified "state" of the individual patient. In our experience, categorizing an individual patient as robust, prefrail, or frail can have significant impact on our care plan priorities. For example, the care plan for a 75-year-old identified as robust might include cancer screening, tighter glucose and blood pressure control, and strong surgical eligibility. In contrast, the care plan for a 75-year-old identified as frail might include reducing polypharmacy, frequent outpatient visits to help avoid hospitalization, and assessment for palliative care or hospice eligibility. Critical to all care planning is incorporating the health care priorities of the patient and aligning care plans with these priorities in mind.[34]

Limitations

We faced a number of logistical hurdles to implementing routine frailty assessment and management into clinical practice. We assess frailty phenotype as part of a comprehensive geriatric assessment. Although the frailty phenotype assessment takes approximately 15 to 20 minutes to complete, many other tests (SPPB, Montreal Cognitive Assessment) take additional time. Our initial visit is 90 minutes; however, even this time commitment may be burdensome with current reimbursement. For a provider with 30-minute return visits, assessing the frailty phenotype would require most of the visit. Without changes to reimbursement for this type of assessment, routine implementation may not be economically feasible. Training staff such as certified nurse assistants or licensed practical nurses to conduct assessments may also be an option; however, these responsibilities may take them away from other duties. Interspersing frailty evaluations among usual care visits could also help offset visit times.

We initially found that even among local geriatricians, comprehensive geriatric and frailty assessments were not standardized. This practice variation made it difficult to communicate with referring providers about what a standard frailty assessment entailed and posed a challenge to trending and comparing markers over time. We have since standardized our evaluation, including creating a standard note template and identifying standard components of assessments. Future work is also needed to guide the integration of these standard medical assessments with patient preferences, supporting shared decision making.

Frailty Knowledge and Science Gaps

We propose a few targeted gaps in current frailty knowledge and science that, if addressed, would help translate frailty research into clinical practice. These priorities fall in to several major categories:

Screening for Frailty

In our clinical experience, frailty mitigation is best achieved when patients are in the early-to-moderate stages of frailty. This is also an ideal time to address other geriatric syndromes or frailty modifiers. At the most advanced stages of frailty, acute and sustained frailty mitigation becomes more difficult. Many patients referred for frailty assessment and management from primary care already have advanced frailty or have suffered a consequence of their frailty that may miss the most effective time to prolong the independent health span. In contrast, preprocedural or surgical candidate referrals tend to have prefrailty or early frailty, but the referral typically only occurs after a surgeon has evaluated and referred them, often just weeks before a planned surgery.

We suggest the implementation of a brief frailty screening tool among older adult primary care patients to identify frailty earlier in its course and to prompt a referral for more extensive frailty and aging assessment. Among older preprocedural adults who have a high prevalence of prefrail and frailty with a short time frame for risk reduction,[35] we would suggest administering a full frailty and aging assessment at the time surgical decisions are being made to frame risk discussions and to maximize risk-reduction time.

Ideally, a frailty screening tool would be brief, easy to administer, and would have a high sensitivity for detecting frailty. A number of existing tools, previously compiled in review studies,[1,5] may be candidates, and experts have even suggested formal frailty assessments be conducted in all adults $\geq$70 years or who have experienced $\geq$5% weight loss in the prior year.[4] However, as frailty research advances, perhaps with the creation of a physiologic-based evaluation (see below), the screening tool will need to be refined in parallel to maximize sensitivity to the new gold standard. We are not the first to consider the application of a frailty screening tool in a primary care population. Although we have not yet implemented screening strategies into our care process, others have studied and shown success implementing frailty screening in primary care.[36] Others have created electronic medical record–based frailty screening tools to identify high-risk groups of older adults.[37] New Medicare Annual Wellness Visit requirements[38] may offer a unique opportunity to incorporate a frailty screening tool among older adults in primary care. Frailty assessment among surgical candidates to support surgical decision making and risk reduction has not been standardized, and the SAFE team members and referring providers are among a number of early adopters. Existing literature supports the utility of a frailty assessment to aid in postoperative risk prediction.[39] Trials studying the impact of preoperative interventions on frailty and surgical outcome are just starting to emerge.[40,41] We believe a frailty screening tool would help identify individuals most likely to benefit from a more comprehensive frailty evaluation among the general older adult population, and moving the frailty assessment earlier in the course of preprocedural evaluations would benefit risk assessment discussions and extend the brief window for risk reduction.

Frailty Measurement Validity, Reliability, Distribution, and Administration Guidelines

The literature has yet to provide test characteristics for frailty measures including the reliability, validity, normal variability of repeated measures in the same person, variation by administrator, or consistency in objective measures (eg, gait, grip strength, chair stands) repeated in the same day or over time in the same patient, posing barriers to implementing frailty into clinical practice. Once established, clinicians would also then benefit from recommendations or indications for repeating the measures and guidelines for proper administration to standardize assessment across providers and institutions. Furthermore, we lack reference data for the distribution of each frailty measure by age and gender for US older adults, data that should be regularly repeated in future cohorts as life expectancy continues to increase.

The Future Frailty Assessments: Acute Assessment of Physiologic Reserve vs Trending Biological Aging Markers Over Time

We believe the frailty assessment science is in its early stages. For instance, several frailty measures rely on self-reported information (eg, physical activity, exhaustion). Although self-reported measures are an important contribution to any medical assessment, the high prevalence of cognitive impairment in this group may limit accuracy.[42] We would like to see the development of objective measures of physiologic reserve and multisystem dysregulation and propose 2 possible future applications for physiologic and biologic frailty assessments: (1) a brief stress test to quantify short-term and global physiologic reserve across systems and (2) a standardized set of biological frailty markers to trend long-term frailty and aging indicators over time. In older preprocedural candidates, there is an inherent need to know how well a person will withstand and recover from an acute stressor. We seek a dynamic measure of physiologic vulnerability that is sensitive to small changes in physiologic reserve (eg, may change day to day), a test that could be implemented shortly before or repeatedly until the day of a planned stressor. We also seek a separate biological assessment of aging to be conducted serially over time. This expanded objective biologic assessment could augment or even replace our current frailty assessment tools. We anticipate that the patient's position in the distribution of each biologic measure among all older adults as well as the change in these measurements over time will provide meaningful information, much like pediatric growth

charts for height, weight, and head circumference trend both position and trajectory. Movement in this direction has occurred with early development of biologic frailty markers.[43] Trending markers would help identify people aging more or less precipitously than age- and gender-matched peers. These trends would further help identify shorter-term frailty transitions (eg, after a stressor), would track longer-term frailty trajectories, and could potentially serve as therapeutic targets.[44]

Implications for Practice, Policy, and Research

Our substantial clinical experience implementing frailty assessment and management in clinical practice can help inform practice, policy, and research that supports care for the growing population of frail patients. Practice implications taken from our experience include the importance of utilizing standardized, evidence-based measures of frailty and frailty modifiers and communicating results of frailty assessments to referring providers using a "report card" or other means to address knowledge gaps around frailty and its effects. Policy implications of our experience include the importance of reimbursement models that account for the time required to assess frail and multimorbid older adults and developing health systems-based approaches to frailty screening and management. Areas for further study include development of standardized physiologic measures to identify and track frailty and reserve and strengthening the data on test characteristics of frailty measures to improve their reliability and validity.

In summary, our SAFE clinic experience demonstrates that assessing and managing frailty is a feasible, clinically valuable service that can be provided by a geriatrics interprofessional team—one that will become increasingly necessary based on demographic trends. Future reimbursement structures and research funding should be developed with models of care for frail patients in mind.

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