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SPECIAL ISSUE

IMPLEMENTING FRAILTY MEASURES IN THE CANADIAN HEALTHCARE SYSTEM

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ON BEHALF OF CANADIAN FRAILTY NETWORK

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Abstract: Canadian healthcare is changing to include individuals living with frailty, but frailty must be better operationalized and better framed by sound data standards and policy. Frailty results from deficit accumulation in multiple body systems, with exaggerated vulnerability to external stressors. A growing consensus on defining frailty sets the stage for consensus on operationalization and widespread implementation in care settings. Frailty measurement is not yet integrated into daily clinical practice in Canada. Here, we will present how this integration might occur. We hope to demonstrate that implementation must appeal to inter-professional practice needs in different settings or circumstances. In some settings, methods for frailty case finding are expected to evolve as deemed to be most appropriate to the front-line users. In this "hands-off" approach, care providers, supported by emerging knowledge translation on frailty operationalization, would be informed by their setting and local practices to establish patterns of ad hoc case finding and component definition of frailty. This more nimble case finding strategy would be opportunistic, and would appeal to expert clinicians and self-directed teams who emphasize an individualized health care experience for their patients. In other settings, we can shape frailty case finding by building care algorithms around existing standardized practices and data repositories, leading to a systematic application of frailty measures and a more coordinated process of component definition and care protocols. Here, recommended instruments and data standards must be endorsed by health networks locally, provincially and nationally. The interRAI suite of assessment instruments has pan-Canadian standards in place and its pervasiveness makes it the most obvious starting point, especially in home care and long-term care. We anticipate the evolution of an integrated model informed by stakeholders and settings, where policy makers focus on system supports for frailty case finding, while front-line clinicians use case finding strategies to pinpoint and act on key frailty components.

Key words: Frailty, measurement, case finding, standards.

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It is difficult to overstate the importance of employing meaningful frailty criteria in the Canadian healthcare system. Our healthcare system was designed to respond to acute illness in otherwise healthy individuals or to aid those with a single stable disease or disability. However, frail older adults typically have multiple interacting health issues and, when they become acutely ill, they manifest illness in atypical ways. With a rapidly expanding population at risk, policy makers, researchers and healthcare providers must understand the characteristics of older adults who live with frailty. An understanding of frailty and guidance on how to respond must be better communicated so that its impact on health-related decisions can enter everyday dialogue and so that improved models of care can be re-imagined and integrated. To realize this, the way that frailty is operationalized in health records and employed to inform care practices will need to be fit to purpose.

Frailty is a state of exaggerated vulnerability, resulting from accumulation of deficits in multiple body systems, and it is manifest as a multidimensional syndrome (1). As such, frailty is both a state of vulnerability and a clinical syndrome (2) This duality in the nature of frailty helps to explain historical challenges in settling on a single definition or measure, but equally informs the discussion on whether case finding ought to be opportunistic, systematic or both.

The state of frailty develops gradually over the life course as deficits accumulate. A robust individual possesses a repertoire of homeostatic responses to stressors, thus maintaining their independence. As more deficits accumulate, the impact on independence is minimal as long as other assets are sufficiently abundant to compensate. Eventually, the compensatory repertoire narrows, hastening accumulation of more deficits and leading to emergence of apparent vulnerability and frailty. Clinical instincts alone may be inadequate to recognize early vulnerability and mild frailty or to anticipate or prevent associated adverse outcomes. Expert clinicians are trained to look for more discrete illness scripts and may only recognize frailty after external stressors are at play and when the consequences are in full force. This is why augmentation of

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clinical instincts with frailty measures that capture the nature and severity of frailty, including its silent early state, holds such promise.

In the eyes of healthcare providers, the illness script of frailty is a clinical syndrome rather than a quiet state of vulnerability. The syndrome may be more reductionist, as in the well-known Cardiovascular Health Study (CHS) physical phenotype model (3). In the same family of measures, an even more simplified case finding approach is gait speed (4, 5). Judgment-based measures such as the CSHA Clinical Frailty Scale (6) allow clinicians to anchor their intuition in a reliable measure. Multidimensional measures of frailty are the most authentic clinical operationalization of the full syndrome of frailty.

In past years, very few frailty measurement options were available, of which the CHS Frailty Phenotype (3) and the CSHA Frailty Index were most utilized by researchers and certainly best known. Neither of these have found widespread use in clinical practice, however. Three systematic reviews (7,-9) have compared the many other frailty tools that exist, and no consensus has yet been reached on a single measure superior to the others.

The high prevalence of frailty in populations seen by specialized geriatric services or in other chronic care settings obviates the need for case finding. However, when frailty is discovered in mixed populations with a spectrum from fitness to frailty, clinical teams can be empowered to better define the issue, address the particular components and, as needed, seek further guidance from experts. Examples here include primary care, home care, emergency care and acute care. In such settings, there is a need for simple, acceptable and trustworthy measures. Frailty measurement may motivate meaningful person-centered decisions (Table 1). For example, identifying frailty in clinical settings would permit earlier access to innovative and personalized processes of care, adaptation or avoidance of inappropriately aggressive medical treatments, and meaningful discussions with individuals at any stage of frailty about their overall goals of care.

Table 1
How Frailty Identification May Inform Person-Centered Decisions

* Leads to early interventions to prevent or slow further decline
* Prompts meaningful discussions regarding goals of care
* Informs prognosis to assist in care planning well before end of life
* Allows early access to innovative care processes
* Ensures that appropriate medical treatments proceed while accounting for additional hazards
* Emphasizes choice for less invasive but appropriate medical treatments
* Leads to avoidance of inappropriately aggressive medical treatments
* Provides a helpful way to determine the impact of therapies

Frailty is a latent variable, and its existence must be inferred by measuring other more observable variables such as a physical characteristic, a performance measure, a biological marker or responses to a series of questions. Hogan et al. (10) proposed a taxonomy to better group candidate measures for frailty. A comparison of the characteristics of frailty measures relevant to widespread clinical usage is presented in Table 2. Table 3 compares the requirements of these measures and their proposed suitability for opportunistic and systematic use. Clegg et al. (11) emphasized the need to develop efficient methods to detect frailty and measure its severity in routine clinical practice. These included judgment-based measures, physical performance-based measures, multidimensional measures and the electronic frailty index.

Judgment-based measures presuppose that the operator, informed by clinical information, is able to make an independent clinical judgment about the presence and degree of frailty (12). This strategy formalizes traditional intuition about frailty in clinical settings where rapid decisions need to be made by busy clinicians. A judgment-based tool makes sense for rapid opportunistic case finding as an adjunct to a clinician's assessment. As such, judgment-based measures are most useful to competent operators who are not necessarily experts in the care of older adults. Evidence about the psychometric properties of these measures is lacking, with the notable exception of the CSHA Clinical Frailty Scale or CFS (13). If the target population has a higher prevalence of frailty, a more standardized approach to frailty case finding is preferred, as operators in such circumstances may not be qualified to rely on clinical judgment.

Discrete physical performance measures such as gait speed, grip strength and chair stands have been used as surrogates for frailty and have the appeal of simplicity and speed. Thus, less-experienced operators can learn to perform these tests quickly in a variety of settings. One caution with performance-based measures is the possibility of false positives in acutely ill patients with sudden changes in physical function. The question of diagnostic accuracy for performance measures was settled for both gait speed and the "Timed Up and Go" test, which both show excellent sensitivity and moderate specificity (14) against the CHS phenotype as the criterion standard. Performance-based measures could be used opportunistically or systematically. Because the content validity of performance-based measures is poor, these measures have a role in case finding and prognosis, but not in grading severity or capturing the nature of frailty or its components. Despite widespread adoption of physical frailty measures such as the CHS Frailty Phenotype in research settings, the uptake has been disappointing in clinical settings. This may be because of the need for a dynamometer, the need for training or the narrow scope. In some ways, the physical performance measures have inherited this role of case finding in physical frailty.

Multidimensional measures are designed to capture the richness of frailty and align closely with the emerging concept

Table 2
Characteristics of Frailty Measures by Category

Frailty Measure Category	Example	No special equipment	Requires no prior assessment	Non-Expert operator	Standalone-Bedside tool	Admin Time	Grades severity	Defines components	Rapid Interpretation
Judgment-based Measures	Clinical Frailty Scale	+	-	-	+	< 1 min	+	-	+
Physical Performance Measures	Gait Speed	+	+	+	+	<1 min	-	-	+
Physical Frailty	Frailty Phenotype	-	+	+	+	<5 min	+	-	+
Multidimensional Frailty	Edmonton Frailty Scale	+	+	+	+	<5 min	+	+	+
Frailty Index	Electronic Frailty Index	+	-	+	-	<1 min	+	-	+

Characteristics: + (present, advantageous); - (absent, disadvantageous)

Table 3
Suitability and Requirements of Frailty Measures by Category for Different Clinical Settings

Frailty Measure Category	Example	Requirements	Suitability for Opportunistic Use	Suitability for Systematic Use
Judgment-based Measures	Clinical Frailty Scale	Prior Clinical Assessment Operator must exercise clinical judgement	+++	+
Physical Performance Measures	Gait Speed	Training on administration and interpretation A 10 meter path with floor markings and a timer	++	++
Physical Frailty	Frailty Phenotype	Training on administration and interpretation A dynamometer for grip strength	+	+
Multidimensional Frailty	Edmonton Frailty Scale	Training on administration and interpretation A 3 meter path, a chair, and a timer	++	++
Frailty Index	Electronic Frailty Index	Training on interpretation A prepopulated clinical database and a calculator	+	+++

Suitability (+++ Suitable ++ Adaptable + Challenging)

of “intrinsic capacity” as recently articulated by the World Health Organization (15). These measures not only case-find and grade frailty but also illustrate the component domains that are relevant to individuals. These components may include motor (gait, strength, balance), sensory, cognitive and psychological aspects. Even functional ability or external factors such as social variables may be included in such a measure. These have good content validity and many have been shown to be valid and reliable in clinical settings, making them useful for case finding by non-experts. Administration time tends to be short and minimal training is required. When it is desirable to first screen for frailty, then drill down to the components(s) of interest, multidimensional scales add real value for clinicians. However, these scales are cumbersome when applied to existing databases for research or policy purposes because the items are often challenging to reconstruct. Examples in this category are the EFS (16), and the FACT (17, 18). These measures could be used opportunistically or systematically, as the operator need only be familiar with the clinical setting, and the application could be in target groups at immediate high risk or in vulnerable populations with a higher prevalence.

Finally, the CSHA Frailty Index is by far the most flexible for research and policy applications. It has not yet found widespread use in clinical settings, perhaps because it lacks content that many clinicians expect and requires at least 30 health status items in the database that cover a range of systems and that increase (but do not saturate) with age. Clinicians may also have found it cumbersome to employ a prior database of searchable deficits that meet specific criteria. A promising solution is the electronic Frailty Index which can be integrated into existing electronic medical records and administrative databases, then presented to clinicians with prompts as a decision aid (19-21). This method has been employed in different settings, including home care (19), acute care (20) and primary care (21).

So far, we have highlighted the frailty measures that could be used opportunistically or systematically in clinical practice. We now ask what would be required to include measures of frailty in electronic health records and in the full range of care practices and protocols that support the intended population.

The status quo is to simply allow heterogeneity in the operational definitions and measurement tools used, such that preferred choices by clinicians vary by practice or care setting. Typically, the decision on whether to use a particular frailty instrument in a clinical setting would be judged opportunistically by the clinician and team to inform, but not to make, decisions. Here, clinicians and teams are using frailty measures as "part of the work-up", the way they might use blood tests, imaging or other bedside instruments to refine diagnostic reasoning from initial presentation to formulation to care plan. However, if frailty is to be used for past and future comparisons, the heterogeneous use of frailty tools might fail to capture the ever-changing health state of the individual, and meaningful frailty information might not be carried from one setting to the next.

Table 4

Common Component Domains in Measuring Frailty as a Syndrome

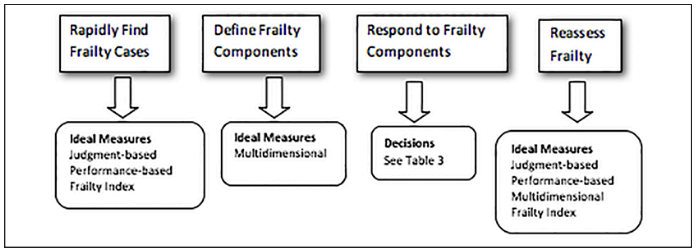
Component Domain
Nutritional Status/ Weight Loss
Physical Performance (Gait Speed, Grip Strength)
Physical Activity
Subjective Energy Levels
Number of Comorbidities
Mood
Cognition/ Motor Processing
Urinary Incontinence
Activities of Daily Living
Medication Management
Social Support
Self-rated Health

The challenge with the purely opportunistic approach is that the majority of frail older persons likely receive care or support services from a range of clinicians or sectors of the health system. Within a relatively short time, such a person may be in contact with a primary care provider, home care agency, emergency department, acute care hospital and long-term care home. If clinicians in each of those settings chose a different frailty scale, the costs and assessment burden on the person could rise, communication between settings could be inefficient, allocation of resources could be inconsistent and the use of change in frailty levels as an outcome measure could be difficult. Any inferences about the care experience of older persons with frailty would be frustrated by questions about the comparability of the groups. Hence, when considering frailty from both a policy and health research perspective, the need for agreement on a common standard measure of frailty or bundle of interacting measures becomes apparent.

Another gap in this approach is that many front-line care providers, having identified frailty, do not necessarily know how to respond to it or to problems within its component domains. This gap lies within the aforementioned larger challenge on how to respond to different frailty measures across the continuum of care. Some degree of heterogeneity in case finding by setting and care provider is inevitable when frailty is first considered. Frailty case finding can enhance existing future processes of care, such as emergency room visits in both general and personalized ways. The British Geriatric Society published Best Practice Guidelines (22) that proposes the use of frailty case finding in all older persons followed by a holistic medical review based on the principles of Comprehensive Geriatric Assessment. A simultaneous call for widespread changes in the British Health Care System to fit the aging population was applauded here in Canada with a proposed shift in the acute care hospital to other models of care (23). All individuals with frailty stand to benefit when their primary care team uses frailty as a trigger for appropriate care practices (Table 1). Persons who are identified as having more severe frailty or frailty associated with significant complexity may also undergo a comprehensive geriatric assessment by a specialist. In a step beyond case finding, a multidimensional measure could then help define particular components (Table 4, Figure 1), which in turn motivate an individualized care plan that could be physically or electronically carried from one setting to the next.

Figure 1

An Integrated Model for Identifying Frailty



If standard measures of frailty were employed across care settings, incorporating frailty in a comprehensive electronic health record would become feasible. This would provide the information needed to develop effective national responses to frailty as has been done through previous public reporting initiatives to improve the quality of long-term care (25). Achieving a uniform national consensus on the operationalization of any concept as complex as frailty will be difficult. However, there are many other factors to address before such a tool can be used both at the individual level by clinicians and at the population level by managers and policy makers.

The way to national standards that would meet the needs of care providers, policymakers and scientists would include at least two major efforts. The first is a broad-based consensus process on a core data set, similar to the OMERACT group that for 20 years has done this for various rheumatologic conditions (26), or the even more broadly scoped COMET initiative (27). While processes such as this would raise trust by front-line users, the transition from optional ad hoc local uses of clinical scales to routinely administered information standards that are deployed to support performance measurement systems across the continuum of care also requires attention to a number of considerations (28-35). These include:

1) Standardization of measurement. Clear definitions of each item in the instrument are needed, including time frames for observation, inclusion and exclusion criteria, strategy for ascertaining responses and anchor points for response values.

2) Specifications of data standards and coding rules. Once measures are precisely defined, and after appropriate licensing, those measures need to be translated into data standards that can be used by software vendors selling products to support the instrument and employ data warehouses to receive, analyze and report on those data.

3) Training. Any effort to employ a common standard as a national measure of frailty will depend heavily on an effective strategy to support ongoing education of the clinicians responsible for completing the scale and of stakeholders who use those data to inform decision making. The education strategy must be flexible, as updated coding standards may be implemented from time to time. Without such a training strategy, data quality may deteriorate over time and the utility of the data may fall for all stakeholders.

4) Reporting standards. If the data are to be aggregated for use at the organizational, regional, provincial or national level (e.g., for quality reporting) it is important that common reporting standards be employed. These should also have mechanisms for preserving the capacity to maintain comparisons over time.

5) Cross-sector consistency. Because frailty is pervasive across the continuum of care, it is not enough to have a common standard measure within one sector alone. Instead, there has to be an ability to compare frailty consistently across all the major settings that provide services.

6) Data sharing. The transitions through various degrees of frailty lead to encounters with different sectors of the health system over time. To obtain a longitudinal view and to reduce redundant reassessment, a mechanism for sharing data between clinicians and service agencies involved in the individual's care is essential. Records linking multiple comparable measures of frailty over time provide a sense of the baseline and clinical trajectory. This means that all parties must have convenient access and trust the assessments of frailty done by others.

7) Timing of initial and reassessments. Frailty status can gradually change over time. Therefore, it is important to standardize when frailty should be first measured and reassessed. For example, individuals transitioning from one care setting to another may require timely reassessment.

8) Data quality. There is a considerable difference between the quality of data obtained in highly controlled research studies and data that are recorded by clinicians as part of normal, day to day practice. Therefore, it is essential to have continuous, real-time mechanisms available to ensure that data from frailty assessments continue to measure what they are intended to measure and that they do so reliably. Such a system would allow rapid identification of and response to erroneous assessment practices that may emerge over time.

9) Key stakeholders. Any effort to establish a national common standard for measuring frailty that becomes part of the electronic medical record should engage at least three major stakeholders: (a) provincial and territorial ministries of health under whose auspices provincial implementation of a standard may be undertaken; (b) the Canadian Institute for Health Information (CIHI), which manages numerous national reporting systems for health data across the full continuum of care and (c) Canada Health Infoway, which provides national support and standards for the electronic medical record.

To front-line clinicians, the need for consensus statements on a core dataset and the additional standardization, training and engagement processes would seem to require far too much time. The rising demographic of octogenarians is now upon us, so we cannot afford to wait for a decade. We will now provide practical suggestions on how to move deliberately yet expeditiously, meeting the immediate needs of clinicians who are starting to use opportunistic frailty measures, while also addressing the need for trusted and acceptable measures with strong psychometrics, implemented systematically across our nation.

Recommendations

1. Construct frailty measures from existing electronic databases. Single case finding measures such as gait speed or multidimensional components may already be collected. For example, in critical care settings across Alberta, the CFS has been collected for all admissions for a few years. Likewise, in home care and long-term care settings across Canada, interRAI assessments already capture the key components of frailty. It has already been demonstrated that deficit accumulation can be extracted from existing electronic databases across sectors and a frailty index calculated, provided that the candidate items in each database adhere to appropriate definitions. Existing clinical information systems could be used with supplementary items, if needed, to derive frailty algorithms based on relevant domains that are already measured. If an existing standard already has the items that most frailty researchers agree on, it may be possible to use that data source to derive frailty scores from the existing standard. For widespread adoption, we should strive to select frailty data that simultaneously meets the needs of front-line clinicians, policy makers and researchers. Supporting this recommendation is evidence in systematic

reviews (7-9) that frailty measures have many component domains in common (Table 4) and many also have common properties (Table 5), though the specific items and coding rules may differ (36).

Table 5

Common Properties of Frailty Measures

Right-skewed density distribution
Nonlinear increase with age
Dose-response relationship with five-year mortality
Sex differences, with women having higher frailty scores but better survival
Actual scores never reach the theoretical maximum

2. Expand systematic frailty measurement in Home Care and Long-Term Care using interRAI. In the last two decades, the interRAI suite of assessment instruments has emerged as the pan-Canadian standard for home care and long-term care, with implementation in eleven Canadian provinces and territories (Table 6, 37). In addition, interRAI instruments for mental health (inpatient and community), community support services and palliative care have been implemented in one or more of these provinces. Several provinces have already implemented or begun to implement interRAI instruments to assist intake into home care from hospital settings or adapted versions of the home care instrument to support placement into long-term care from hospital settings. Based on CIHI data holdings by 2016, over 9.6 million interRAI assessments had been done on over 3.3 million Canadians in 1,827 different care settings, and about 600,000 assessments are added each year (Table 7). These instruments have already been designated as Canadian Approved Standards for the electronic medical record by Canada Health Infoway, and CIHI supports three national reporting systems for the home care, long-term care and mental health instruments.

All the domains described by Sternberg et al. (7) are addressed in the interRAI suite of instruments, and at least four frailty algorithms have already been developed for these instruments. Frailty has been measured using the interRAI Home Care Assessment in the general home care population (19) and in people with intellectual disabilities (38). Hubbard et al. (20) used the interRAI Acute Care assessment to measure frailty in acute hospitals. All three groups used interRAI data to create frailty index scores matching the framework put forward by Sternberg et al. (7). Using a cross-walk algorithm, Armstrong et al. (19) coded a multidimensional frailty scale using interRAI home care assessment items. Luo et al. (39) used data from the RAI 2.0 for long-term care to derive the FRAIL-NH algorithm for long-term care. Finally, the interRAI CHESS scale (40-42) provides a clinician-oriented frailty measure that predicts mortality in diverse community-based and inpatient populations. Newer interRAI instruments include a gait speed measure or grip strength.

It should be noted that interRAI assessments are used on only a limited scale in acute hospital settings, except perhaps in assessments for individuals in hospital awaiting placement into long-term care (43) or for those persons being discharged

Table 6

Use of interRAI Assessment Instruments and Screeners in Canada

Instrument	NT	Yt	NWT	BC	AB	SK	MB	ON	QC	NB	NS	PEI	NL
RAI 2.0 (Long-Term Care)		●	●	●	●	●	○	●			○		●
interRAI Long-Term Care Facility					○	○	○		◊	●	●		
RAI-Home Care		●		●	●	●	○	●			●		●
interRAI Home Care	○		●		○		○	●				●	
interRAI Contact Assessment					○	*	*	●					
interRAI Community Health Assessment								●		○		●	
interRAI Palliative Care					◊	◊		●			◊		
RAI-Mental Health							○	●	*				●
interRAI Community Mental Health								○	*				●
interRAI Emergency Screener for Psychiatry								○					
interRAI Brief Mental Health Screener						*	*	○					
interRAI Intellectual Disability												●	
interRAI Child/Youth Mental Health								*				●	
interRAI Acute Care								◊	◊				◊
interRAI Quality of Life				●		◊	◊	*			◊		●

● – Mandated across province/territory; ○ – Recommended or mandated regionally only; * - Pilot or local implementations only; ◊ - Research use

Table 7
Volume of interRAI Assessments Held by Canadian Institute for Health Information (CIHI) as of December 2016 (Data provided courtesy of CIHI)

Healthcare Setting	interRAI Instrument	CIHI Reporting System	Number of Canadians Assessed	Number of Assessments	Number of Organizations
Long-stay home care	RAI – Home Care	Home Care Reporting System	2,757,608	3,269,571	167
Long-term care & complex continuing care hospitals	RAI 2.0	Continuing Care Reporting System	762,458	5,104,193	1,576
Inpatient mental health	RAI – Mental Health	Ontario Mental Health Reporting System	358,582	1,184,733	84
TOTAL			3,333,471*	9,558,497	1,827

RAI – Resident Assessment Instrument; * Value reflects the number of unique individuals in the three reporting systems.

to home care from hospitals (44). The second notable gap in use of interRAI assessments in Canada is in primary care. Here, only small scale studies have been done with the interRAI Contact Assessment, and a recent larger study used the interRAI Assessment Urgency Algorithm to screen for frailty in primary care settings (45). Further research is needed to better define why primary care settings have proved to be challenging contexts for the interRAI approach. Promising opportunities would include the electronic Frailty Index or other rapid opportunistic case finding measures such as the CFS, gait speed or a multidimensional tool.

3. Explore a cross-sectoral approach of frailty assessment in acute and primary care. For both acute care and primary care, a mixed approach of new assessment of frailty in some contexts and data sharing related to frailty in others may be most sensible. For example, given that home care is an important sector adjacent to both acute care and primary care, sharing of assessments by home care professionals with their counterparts in these other settings should be of paramount importance. Many clinical problems encountered by home care assessors may be best addressed by enhanced communication and partnership between home care and primary care providers. For individuals admitted to acute care, recent assessments by home care professionals can be an essential source of information about the individual's premorbid status. Indeed, the point of entry into acute care may not be the best starting point for assessment of frailty when the individual's current condition is highly changeable.

4. Develop mechanisms to imbed Electronic Frailty Indices across sectors. Like InterRAI, the Frailty Index also has a family of scales that could be used in association with one another in both opportunistic and systematic ways. Using Frailty index methodology, the FI-CGA was derived from a standardized dataset of comprehensive geriatric assessments and demonstrated graded prediction of distal outcomes such as death and institutionalization (46, 47). Both a social vulnerability index (48) were developed on this same model. In front-line care, the Clinical Frailty Scale (13) is closely associated with the Frailty Index in predicting mortality or the need for institutional care in community settings (6) and mortality, disability and cognitive decline in long-term care settings (50). It has also been used to predict morbidity and mortality in acute care settings such as intensive care (51).

The CSHA Frailty Index itself is the only stand-alone frailty measure that has been shown in various national and international settings to be easily derived from existing clinical and research databases (21, 52) including those based on interRAI assessments. It has been demonstrated that, regardless of the dataset, there is a predictable logarithmic accumulation of deficits (53) despite the use of very different numbers and types of variables in different datasets. Increasing degree of frailty is highly associated with an increased risk of death (54-56). By definition, the CSHA Frailty Index lacks specific emphasis on particular component domains of frailty but, like other scales, it covers the common characteristics (Table 5; 57) and can be derived directly or indirectly from comprehensive geriatric assessment, including interRAI assessments (19, 20, 58). Next to the CHS Frailty Phenotype, the CSHA Frailty Index is the most commonly cited measure for frailty. However, the Frailty Index is dependent on the existence of a database of appropriate clinical items and its content validity is poor. It could not be used alone to screen for component domains of frailty nor to predict outcomes specific to these components.

Frailty as a Multidimensional Construct

If we accept that existing comprehensive assessment systems can be used as data sources to derive frailty algorithms, a remaining issue is whether frailty should be operationalized as a single construct or as an umbrella term for risks of different adverse outcomes in multiple domain areas.

Simple frailty measures can predict adverse future outcomes such as death, disability, institutionalization and hospitalization (7). The clinical value is estimating prognosis.

The challenge with those outcomes presumed to be related to frailty is that they may not all have the same causal pathways or sets of risk factors. For example, within interRAI, the CHESS scale is highly predictive of mortality in home care, long-term care and post acute hospital settings (41), but it is not an especially strong predictor of long-term care placement. Conversely, the Method for Assigning Priority Levels (MAPLe) has been validated as a strong predictor of long-term care placements and caregiver distress in Canada and other countries (59-61), but it tends not be associated with hospitalization (62).

In other words, there is considerable risk that single scores to measure frailty as a unidimensional construct may underperform in predicting specific adverse outcomes of frailty compared to algorithms that are intended to best predict only one or closely inter-related outcomes. This dilemma expands the scope of the problem in case finding for frailty. We may reasonably accept that single, unidimensional measures can predict a variety of poor outcomes related to frailty and motivate a more full multidimensional assessment. On the other hand, if one prefers to maximize the prediction of each of an array of adverse outcomes, the approach should also assign independent meaning to the various components of frailty measured.

An Integrated Model

Frailty measurement itself appears to be no less complex than the entity it is intended to capture. To help move forward, we propose an integrated approach (Figure 1) that starts with rapid case identification using judgment-based measures, physical performance-based measures or an electronically derived Frailty Index. Depending on the prevalence of frailty in the population and the readiness of the care setting, this case finding might be a standard practice for an identified risk group, or it may be an opportunistic practice as a part of dynamic clinical decision making. Opportunistic case finding makes sense in primary care or acute settings where frailty is less frequent but must be discovered. As the prevalence of frailty rises in the target population, the case finding should be more standardized, such as in a home care or assisted-living setting. Either way, when a better understanding of the nature of the frailty is desired, the subsequent use of a multidimensional tool is recommended to define component issues such as cognition, balance or nutrition, which in turn may prompt appropriate decisions such as comprehensive geriatric assessment (see Table 1). Finally, the impact of clinical decisions and treatments in frail individuals can be tracked using various measures appropriate to the setting.

We affirm the growing burden of frailty in the Canadian healthcare system and hope to draw attention to the sophisticated and complex array of options for its measurement. We call for national standards in measuring frailty that adhere to the highest expectations of data stewardship. We certainly continue to promote the heterogeneous use of frailty case finding instruments that are fit to purpose for settings and individual circumstances. However, we also suggest a pragmatic approach to national standards of measurement building on existing electronic platforms. Frailty can be derived from the interRAI standards already used throughout Canada in many settings, including primary care, home care, long-term care, acute care and emergency care. Complementary to this, frailty can be captured using health records data to derive the Frailty Index where interRAI assessment data are not available.

Conflict of interest: Dr Rolfson is the original author of the Edmonton Frail Scale and holds the copyright. The EFS is not available for proprietary use. Dr Hirdes is the senior Canadian Fellow and a board member of interRAI.

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