

Screening for Frailty in Canada's Health Care System: A Time for Action*

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RÉSUMÉ

Avec le vieillissement de la population canadienne, la fragilité – avec son risque accru du déclin fonctionnel, la détérioration de la santé, et le décès – devient de plus en plus répandue. La physiologie de la fragilité reflète son origine parmi organes et systèmes multiples. Environ un quart des Canadiens qui sont âgés de plus de 65 sont fragiles, augmentant à plus de la moitié de ceux âgés de plus de 85. Notre système de soins de santé est organisé pour gérer les systèmes mono-organes, ce qui nuit à notre capacité à traiter efficacement les personnes atteintes de troubles multiples et des limitations fonctionnelles. Pour faire face à la fragilité, il faut reconnaître quand elle se produit, accroître la sensibilisation à son importance, développer des modèles holistiques pour ses soins, et générer des meilleures preuves pour son traitement. La reconnaissance de la façon dont la fragilité impacte la durée de vie permettrait l'intégration des objectifs en matière de soins dans les options de traitement. Les différents organisations de soins responsables variées dans le système de soins de santé canadien nécessiteront des stratégies et outils différentes pour évaluer la fragilité. Les changements dans la politique sera essentiels, étant donné la portée et la complexité des défis que pose la fragilité au système de soins de santé comme cela est organisé actuellement.

ABSTRACT

As Canada's population ages, frailty – with its increased risk of functional decline, deterioration in health status, and death – will become increasingly common. The physiology of frailty reflects its multisystem, multi-organ origins. About a quarter of Canadians over age 65 are frail, increasing to over half in those older than 85. Our health care system is organized around single-organ systems, impairing our ability to effectively treat people having multiple disorders and functional limitations. To address frailty, we must recognize when it occurs, increase awareness of its significance, develop holistic models of care, and generate better evidence for its treatment. Recognizing how frailty impacts lifespan will allow for integration of care goals into treatment options. Different settings in the Canadian health care system will require different strategies and tools to assess frailty. Given the magnitude of challenges frailty poses for the health care system as currently organized, policy changes will be essential.

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Frailty is increasingly common in the aging Canadian population but is under-recognized, and its impact is under-appreciated. It is estimated that over 1 million Canadians are frail (Hoover, Roterman, Sanmartin, & Bernier, 2013), but the health care system is poorly designed for improving the health outcomes of those who are frail. By systematically recognizing frailty, we can implement care processes to meet this growing societal and health problem. Herein we discuss the concept of frailty, methods to measure it, its biological underpinnings, and how frailty can be assessed and addressed in the sectors of the Canadian health care system, along with the societal, legal, ethical, and policy issues linked to frailty and its identification.

Although the risk of death increases with age, not everyone of the same age has the same risk of dying. This observation led to the concept of frailty. People at a particular age who, in consequence of multisystem impairments, are at higher risk of dying are said to be *frail* while those at lower risk are said to be *fit* (Clegg, Young, Iliffe, Rikkert, & Rockwood, 2013). Clinical frailty can occur at any age and has been documented in teenagers with congenital and acquired multisystem illness (Brothers et al., 2014; Rockwood, MacDonald, Sutton, Rockwood, Baron, & Canadian Scleroderma Research Group, 2014; Rockwood, Song, & Mitniski, 2011; Schoufour, Evenhuis, & Ehteld, 2014). Given that we accumulate cellular and sub-cellular damage with age (López-Otín, Blasco, Partridge, Serrano, & Kroemer, 2013), frailty most often occurs in people older than 65 years (Buckinx et al., 2015; Clegg et al., 2013). The increasing extent of multisystem disease and resulting frailty with age is a challenge for research in aging (Buth, Gainer, Legare, & Hirsch, 2014; Oliver, 2014) and for health care in general (Oliver, 2014).

Modern health care came into being when the population's median age was in the 20s and when a large fraction of people died relatively young of single-system illness. This contrasts with the present reality of many

older adults with multiple, interacting, active medical and social problems, and challenges the medical system which is largely organized around single-organ diseases. As a result, health care systems must restructure to deal with frailty and meet the needs of the aged on more holistic terms (Buth et al., 2014; Clegg et al., 2013; Gordon & Oliver, 2015; Oliver, 2014; Silvester, Mohammed, Harriman, Girolami, & Downes, 2014; Turner & Clegg, 2014). Restructuring will need to include empowering health practitioners with basic skills for managing syndromes that are common in frail older adults through adequate training during either primary certification and/or continuing education. All clinicians and physicians should be competent to manage multisystem impairment, falls, delirium, functional decline, and social abandonment found in frailty (Carlson, Merel, & Yukawa, 2015; Clegg et al., 2013).

Despite the growing and fundamental challenge of frailty, researchers disagree on whether frailty is a *syndrome* (physical and/or cognitive) or a broadly defined *state* (Buckinx et al., 2015; Clegg et al., 2013; Kelaiditi et al., 2013; Morley et al., 2013; Rodríguez-Mañas et al., 2013). However, strong agreement on the need to identify frailty comes from the importance of understanding risk for health care providers. The question of which tools to identify frailty might best be employed in any particular environment is still open (Clegg, Rogers, & Young, 2015; Morley et al., 2013; Rodríguez-Mañas et al., 2013), but the most widely used tools have much in common (Theou, Brothers, Peña, Mitniski, & Rockwood, 2014).

Although it has been argued that the lack of effective interventions for frailty precludes screening, its recognition can increase awareness of a patient's heightened vulnerability, allow for institution of appropriate care plans, and allow for newly emerging evidence for the treatment of those who are frail to be readily implemented. The ultimate goal is to develop a care plan that is appropriate for the person. In general, screening

occurs in three contexts: (1) for specific populations (Buckinx et al., 2015; Clegg et al., 2013); (2) at times of unanticipated health care needs such as in emergency departments (Carpenter et al., 2015) or pre-hospital care (Goldstein et al., 2015); and (3) before elective procedures (Handforth et al., 2014; Sepehri et al., 2014). Screening is a prelude to assessment and care planning, and in many settings is modelled on information gathered as part of a *comprehensive geriatric assessment* (CGA) (Goldstein et al., 2015; Jones, Song, & Rockwood, 2004; Joseph et al., 2014; Jung et al., 2014; Kenig, Zychiewicz, Olszewska, & Richter, 2015; Patel et al., 2014; Pilotto et al., 2008; Subra, Gillette-Guyonnet, Cesari, Oustric, & Vellas, 2012). The line between screening and assessment blurs when frailty tools are generated automatically from health care records. Such tools can grade degrees of frailty and quantitate the number of diseases and impairments present but are not detailed enough for the generation of a care plan (Drubbel et al., 2014; Hubbard et al., 2015).

Frailty Screening Tools

The term *frailty* is often used imprecisely, but with agreement on its meaning and measurement the concept of frailty can powerfully inform researchers, care providers, families, and individuals (de Vries et al., 2011). The two essential features of frailty are risk due to instability and multidimensionality.

Tools for detecting frailty can be used at a single time point or for evaluation over time. In a clinical context, a commonly referenced standard for the detection of frailty is the opinion of experts following a CGA (Rockwood, Silvius, & Fox, 1998). Such a standard emphasizes the multidimensional and heterogeneous nature of frailty, the underlying systems affected, and frailty's expression as geriatric syndromes. In evaluating frailty, we are interested in the *predictive* value of a tool. The relationship between the degree of frailty and the risk of death and adverse outcomes over time has been demonstrated with many commonly used tools (de Vries et al., 2011).

One approach to measuring frailty is to use records already available in databases. The Frailty Index (FI), which emphasizes accumulation of deficits, has proven to be very flexible in this regard (Jones et al., 2004). Frailty tools that are built into clinical datasets should be validated for use by non-specialists, require no special equipment, and be easy to implement. However, trade-offs may be needed in moving towards tools that are acceptable and easy to apply in clinical settings. As the number of factors is reduced, comprehensiveness, generalizability, and clinically useful information may be compromised. For example, the phenotype model of frailty includes only five items and excludes a number

of variables thought to be important in frailty, such as cognition, mood, social support, and self-rated health. That model also obliges testing for grip strength and walking speed, which may not be feasible or informative in some settings (Fried et al., 2001).

Practical considerations may influence the specifics of the implementation of frailty screening in the Canadian population. Using only tools based on a prior CGA may not be feasible (Clegg et al., 2013). A number of candidate tools for screening are available including the frailty phenotype model itself (Fried et al., 2001), the Clinical Frailty Scale (Rockwood et al., 2005), the Edmonton Frail Scale (Rolfson, Majumdar, Tsuyuki, Tahir, & Rockwood, 2006), Groningen Frailty Indicator (Steverink, Slaets, Schuurmans, & van Lis, 2001), Tilburg Frailty Indicator (Gobbens, van Assen, Lijckx, Wijnen-Sponselee, & Schols, 2010), PRISMA 7, gait speed, hand grip strength, and Timed Up and Go (Hoogendijk et al., 2013). A recent systematic review of simple tools for identifying frailty in community-dwelling older adults demonstrated that only a few of these have been validated against criterion standards such as the FI, frailty phenotype model, and CGA (Clegg et al., 2015). Even so, commonly used frontline frailty tools appear to share the characteristics of a non-linear increase in score with age, increasing mortality with increased level of frailty, and age differences in prevalence of frailty (Theou et al., 2014).

Biology of Frailty

Insights into the biology of frailty come from both human and preclinical models. Laboratory research into frailty as a syndrome aligns closely with research on age-related skeletal muscle wasting (sarcopenia) in humans. This research usually employs models of chronic inflammation (Rennick & Fort, 2000) that mimic the inflammation often present in frail older humans (Akki et al., 2014; Walston et al., 2008). Measures of physical performance in aging mice have been used to develop a frailty syndrome scoring system (Liu, Graber, Ferguson-Stegall, & Thompson, 2014). Others have developed animal models of frailty as a state in aging mice, using both invasive (Parks et al., 2012) and observational/clinical means (Feridooni, Sun, Rockwood, & Howlett, 2014; Kane et al., 2015; Whitehead et al., 2014). By tracking age-related deficit accumulation, they have created a mouse FI (Jones et al., 2004). This FI is related to age in mice in a fashion similar to a human FI (Woo, Tang, Suen, Leung, & Leung, 2008). Of particular note, longevity interventions such as caloric restriction and treatment with resveratrol lower FI scores in treated mice (Howlett, Rockwood, Mitnitski, & Rockwood, 2014). These mouse models of frailty will accelerate our understanding of frailty and help us develop interventions.

Human studies identify several potential mechanisms for frailty including immune dysfunction, oxidative stress in metabolism, and shortening of telomeres (Clegg et al., 2013; Zaslavsky et al., 2013). Although human telomere length on its own does not correlate well with frailty (Brault et al., 2014; Collerton et al., 2012; Saum et al., 2014); Woo et al., 2008), telomere length combined with other biomarkers complements the clinical FI in predicting risk of death (Mitnitski et al., 2015).

Recent reports have described using out-of-range abnormalities in common blood tests (Rockwood, MacMillan, Mitnitski, & Howlett, 2015) in a measure of frailty called the FI-LAB which has properties very similar to a clinical FI. FI-LAB scores increase with age and higher scores are related to higher mortality. Even among people with low clinical FI scores, accumulated laboratory measures are linked to increased risk of death. Although much more work needs to be done to elucidate the biochemical and physiological basis of frailty, it is important to recognize that frailty is not just a clinical construct.

Screening for Frailty within the Sectors of the Canadian Health Care System

Different settings in the Canadian health care system – including primary care and ambulatory care, assisted living, long-term care homes, acute care, and critical care – will require different strategies and tools to screen for frailty.

Primary and Ambulatory Care

The growing prevalence of frailty and its clinical variability is most evident in primary and ambulatory care. Primary care providers often encounter frailty and its myriad challenges including acute health crises, multiple chronic co-morbid diseases, and functional impairments. Frailty increases the role and demand for home support, and requires help from family caregivers who may also be experiencing frailty (Sinha, 2012).

Primary care providers are ideally situated to incorporate the concept of frailty into their practice. Recognizing frailty in primary care is hindered, however, by its insidious onset and progression, our single-system disease model, and clinicians mistaking clinical frailty for normal aging (Lee, Heckman, & Molnar, 2015). Cognitive impairment and dementia are important drivers of frailty (Robertson, Savva, & Kenny, 2013) and are similarly under-recognized in primary care, further compounding the challenges to routinely assess and respond to frailty. For example, most screening tools for frailty rely on self-reported deficits in function or health. This method is widely understood to be unreliable for people with cognitive impairment (Debettignies, Mahurin, & Pirozzolo, 1990).

Tools to routinely identify and measure frailty in primary and ambulatory care settings are emerging (Lee et al., 2015), but no consensus has been reached on which tools should be used (Theou, Brothers, Mitnitski, & Rockwood, 2013). Selecting an optimal tool or tools depends on the primary goal since many of the frailty screening tools have been validated on specific outcomes. For example, screening designed to inform programs and policy may best use existing electronic health record data or administrative data. Although walking speed has been validated as a single-item screening tool for frailty (Abellan van Kan et al., 2009), screening tools may be more clinically useful if they identify an individual's multidimensional drivers of frailty (Mallery et al., 2014) and build capacity for primary and other ambulatory care providers to respond to individualized needs.

Once frailty is recognized, opportunities abound for appropriately targeted interventions such as CGAs (Stuck, Siu, Wieland, Adams, & Rubenstein, 1993), medication review, exercise prescription, home care programs, or programs that augment decision-making (Moorhouse & Mallery, 2012). Any contemplated intervention will, however, need to be evidence-based, sustainable, and tailored to the time constraints and environment of primary and other ambulatory care providers.

Assisted Living

Assisted living is an expanding housing and care option for older people who need a protective environment that can offer increased supervision and assistance with activities of daily living. Across Canada, assisted living facilities show a good deal of variability in their admission policies and staffing. In general, assisted living residents tend to be less disabled than those in long-term care, but the characteristics of residents overlap in these two settings (Strain, Maxwell, Wanless, Gilbert, & Alberta Continuing Care Epidemiological Studies [ACCES] Research Group, 2015).

Assisted living is frequently said to cater to frail older adults, but few studies report on the proportion of assisted living residents who are frail (Freiheit et al., 2011; Hogan et al., 2012; Kanwar et al., 2013; Nichols, Varadarajan, Bock, & Blumin, 2015). In those that do, frailty is common however defined (Kanwar et al., 2013), but in comparison, frailty is generally felt to be more common and/or severe in long-term care homes (Nichols et al., 2015). Different approaches for detecting frailty among assisted living residents may lead to differing prevalence estimates. A study comparing three ways of operationalizing frailty (i.e., two frailty indices and Cardiovascular Health Study criteria) in

this population reported a nearly twofold (28.7% to 52.3%) variation in prevalence (Hogan et al., 2012). Because of the high levels of cognitive and physical impairment found in this population, performance-based frailty criteria such as gait speed and grip strength can be difficult to measure (Freiheit et al., 2011).

In view of its high prevalence in this setting, a reasonable approach would be to view all assisted living residents as frail. It is unclear whether identifying the frailest among assisted living residents substantially helps pick out those at higher risk for adverse outcomes or can be used to direct their care. Predictive models improve only modestly in their ability to anticipate adverse outcomes like mortality, hospitalization, and moving to a higher level of care when frailty is added to characteristics such as age, sex, and co-morbidity (Hogan et al., 2012; Nichols et al., 2015). All residents in assisted living would benefit from a number of the approaches advocated for frail individuals such as advance care planning, encouraging physical activity, and careful stewardship of medications.

Long-term Care Homes

In Canada, at any given time, 350,000 adults older than 65 years of age live in long-term care homes (Statistics Canada, 2011). With greater community and home services that support older adults longer in-place, people increasingly enter long-term care homes with far more advanced disease. Sixty per cent of long-term care residents have multiple significant diseases (Doupe et al., 2012), and 70 per cent have age-related dementia (Canadian Study of Health and Aging Working Group, 1994; Doupe et al., 2006; Doupe et al., 2011; Gruber-Baldini et al., 2009). Almost half (45%) of Canadians in long-term care homes are over age 80 (Ramage-Morin, 2005; Statistics Canada, 2001). Overall, long-term care homes in Canada are (very) late-life and end-of-life settings. There is universal agreement that residents are a frail or potentially frail group of vulnerable older adults.

The benefits of frailty screening in long-term care homes may differ from other settings, and the goal of frailty screening has not been settled – whether to identify it or to serve as catalyst to measure its severity. Long-term care settings aspire to focus on preserving and enhancing quality of life in very late life (Brownie & Nancarrow, 2013), while keeping in mind resident and family goals of care and wishes about death and dying. These include trying to prevent premature loss of function, use of non-beneficial interventions, and avoidable hospitalization. In this regard, frailty scores may support advance care planning.

Evidence from long-term care settings reveals that higher frailty scores are linked to increases in hospitalization, emergency department visits, new-onset depression (Gonzalez-Vaca et al., 2014), incident disability (Rockwood, Abeysondera, & Mitnitski, 2007), cognitive decline (Rockwood et al., 2007), greater risk of death (when combined with cognitive dysfunction (Matusik et al., 2012; Rockwood et al., 2007; Tabue-Teguo et al., 2015), and poorer health-related quality of life (Kanwar et al., 2013).

Although the CGA is the gold standard to detect frailty, it is unlikely to be widely adopted in long-term care settings in Canada given the few specialist health care professionals available. However, in a recent study, its successful implementation within long-term care did improve care for frail residents (Marshall, Clarke, Varatharasan, & Andrew, 2015). Long-term care screening for frailty could use existing data such as the routinely collected RAI-Minimum Data Set 2.0 (RAI-MDS 2.0 [Hirdes, Mitchell, Maxwell & White, 2011; Hubbard et al., 2015]) or the new interRAI LTC assessment. Measures of deficits accumulated by older adults (Clegg et al., 2013; Rockwood, 2005b; Rockwood, 2005c; Rockwood et al., 2007; Rockwood et al., 2005) have been derived from the RAI-MDS 2.0 and used in long-term care (Tabue-Teguo et al., 2015). Such measures can be derived using available algorithms (Armstrong, Stolee, Hirdes, & Poss, 2010; Searle, Mitnitski, Gahbauer, Gill, & Rockwood, 2008), and higher scores on three frailty scales using RAI data are linked to increased risk of adverse outcomes (Armstrong et al., 2010). The three scales are as follows: (1) the interRAI CHES (Changes in Health, End-Stage Disease and Signs and Symptoms) Scale (Hirdes, Frijters, & Teare, 2003), (2) the Edmonton Frailty Scale, and (3) the cumulative deficits FI. In particular, CHES has been found to be predictive of mortality in patients with neurological disease and in those with heart failure (Hirdes, Poss, Mitchell, Korngut, & Heckman, 2014; Tjam et al., 2012).

Measures derived from the frailty phenotype model (Fried et al., 2001) assess five items: unintentional weight loss, self-reported exhaustion, low energy expenditure, slow gait speed, and weak grip strength (Clegg et al., 2013; Fried et al., 2001). Some of these items are readily obtained from long-term care residents, but others may not be feasible in a population with significant levels of dementia. Other measures that have been used specifically in long-term care studies include the Cardiovascular Health Survey (Rockwood et al., 2007), the Canadian Study of Health and Aging Clinical Frailty Scale (Matusik et al., 2012; Rockwood et al., 2007), the Frailty Index (Rockwood et al., 2007; Tabue-Teguo et al., 2015), and walking speed (Kanwar et al., 2013). The FRAIL-NH tool (Kaehr, Visvanathan,

Malmstrom, & Morley, 2015) was reported recently and is promising for easy, inexpensive, and quick use in long-term care. It examines fatigue, resistance (ability to self-transfer), ambulation, incontinence or illness (number of medications), weight loss, nutrition, and help with dressing.

Clinicians, researchers, and administrators may each have different objectives that determine their most appropriate tool or method to measure frailty. Given that nearly all residents in residential long-term care settings are not only frail but extremely frail, the use of such a tool, whether for screening or measurement, needs thoughtful assessment. In all cases, though, the overriding objective must be improved quality of life for these vulnerable older adults.

Possible interventions to reduce the severity or prevalence of frailty are the same in long-term care as in other settings. These fall into the general areas of nutrition, mobility, treating depression, appropriate medication prescription, managing functional losses, and addressing social, psychological, and spiritual determinants of well-being. However, interventions need to be adapted to the care goals of the resident and family, the setting, and the unique characteristics of the population. Underlying any contemplated screening is an urgent need for both research and policy development on models of staffing in long-term care homes that will support screening and interventions for frailty.

Acute Care

Although older Canadians are a small (but growing) proportion of the population, they are among the greatest users of acute care services. Approximately 40 per cent of overall hospital admissions are for older Canadians, and their longer stays in hospital account for up to 60 per cent of overall in-patient bed days (Canadian Institute for Health Information, 2011). The great heterogeneity among older adults in hospital settings is under-appreciated, as is the impact of that heterogeneity on their specific use of acute care services. Studies of hospitalization patterns consistently show that only a small proportion of older adults are high users of acute care services. Those users tend to have multiple chronic conditions, at least one functional impairment, and inadequate social supports at home (Wolinsky, Stump, & Johnson, 1995). Moreover, these patients, who tend to have age-related deficits across many systems, are at particular risk for adverse outcomes when hospitalized, such as falls, delirium, drug interactions, functional decline, institutionalization, and death (Costa & Hirdes, 2010; Sinha, Oakes, Suh, & Chaudhry, 2014).

Most older adults admitted to hospital are somewhat frail (Buth et al., 2014; Carlson et al., 2015; de Vries

et al., 2011; Gordon & Oliver, 2015; Joosten, Demuynck, Detroyer, & Milisen, 2014; Jung et al., 2014; Kenig et al., 2015; Oliver, 2014; Patel et al., 2014), and almost half experience a decline in their functional abilities in the weeks before their admission. By discharge, over one third are still functioning below their pre-decline level, and half either do not recover the lost function or acquire new disability (Covinsky, Pierluissi, & Johnston, 2011). These poor outcomes arise from complex interactions of normal age-related changes, higher rates of multiple diseases or illnesses, functional impairments, simultaneous use of multiple medications, and longer hospitalizations that increase the risk of hospital-acquired infections (Brennan et al., 1991). Many adverse outcomes from acute care hospitalizations are preventable. Screening proactively and early for factors contributing to adverse outcomes and their related risks can prevent those outcomes.

Evidence-based screening tools have emerged in the past decade to quickly and effectively identify older adults in the emergency department who are at increased risk of adverse outcomes. Examples include Identification of Seniors at Risk, the interRAI Assessment Urgency Algorithm or interRAI Emergency Department Screener, the Clinical Frailty Scale (Costa et al., 2014; Gray et al., 2013; Hirdes et al., 2009; McCusker et al., 1999; Wallis, Wall, Biram, & Romero-Ortuno, 2015), and the Frailty Index as derived from the interRAI Acute Care Assessment System (Hubbard et al., 2015).

Older patients admitted electively to hospital, most often for surgery, are also at potential risk for adverse outcomes. Recognizing this, major efforts over the past decade have been put into evidence-based tools and guidelines to screen for risk before, during, and after surgery (Chow, Rosenthal, Merkow, Ko, & Esnaola, 2012). In particular, validated screening tools to accurately assess an older patient's risk of delirium are a key step forward (Marcantonio et al., 1994; Rudolph et al., 2009). Clinicians fail to recognize and address postoperative delirium in up to 80 per cent of cases (Marcantonio, 2012) although it is a complication in up to 50 per cent of major operations for older adults.

Screening tools should not be used in isolation but rather should be embedded in proactive systems of care that support immediate action. This would allow for implementation of care plans or strategies that minimize the risk inherent with an individual's degree of frailty. Specific follow-up actions can include more-formal in-depth evaluation, implementation of care plans that reduce the risk of adverse outcomes such as delirium or falls, and referrals to appropriate health and social services. Emphasizing early risk screening and intervention will lead to significant improvements

in patient and system outcomes (Sinha, Bessman, Flomenbaum, & Leff, 2011; Sinha et al., 2014).

Critical Care

Frailty among people admitted to intensive care units (ICUs) has had little evaluation (Bagshaw et al., 2015; Bagshaw et al., 2014; Le Maguet et al., 2014). Critical illness can be a sentinel event for transition to a frail state, and frailty may also be a key unrecognized factor that impedes recovery and function in those who are critically ill (McDermid, Stelfox, & Bagshaw, 2011).

Although ICUs are data-rich environments, gathering data on how older adults functioned before their illness has not been a priority. Such data are essential to understanding frailty before ICU admission. Ascertaining frailty in critical illness is further complicated by the belief that many validated tools and instruments for measuring frailty are impractical for routine use in ICUs. Tools may be exceedingly detailed (70-item FI; Mitnitski, Mogilner, MacKnight, & Rockwood, 2002), or require clinical data analogous to an FI-CGA (Jones, Song, Mitnitski, & Rockwood, 2005), or require specialized training. In critically ill people, surrogate indicators of a pre-existing frail state have been used, such as pre-admission cognitive impairment, residence in a long-term care home, or active cancer or rapidly fatal disease (Garrouste-Orgeas et al., 2009; Rodríguez-Mañas et al., 2013; Sligl, Eurich, Marrie, & Majumdar, 2011).

Much of the work studying frailty in ICUs has been conducted in Canada. A recent multicentre study examined the prevalence of frailty, its clinical features, and outcomes in a heterogeneous group of patients admitted to six ICUs (Bagshaw et al., 2015; Bagshaw et al., 2014). Researchers used the Clinical Frailty Scale because it is relatively simple and likely to be more reproducible, usable, and applicable in critical care settings than other validated tools (Rockwood et al., 2005). Frailty was common among these ICU patients, with 33 per cent classified as frail and another 32 per cent classified as vulnerable. Frail people were more likely to suffer adverse events and have longer stays in ICU and hospital. Their probability of in-hospital death was almost double that of non-frail people. Frail survivors of critical illness were more likely to develop new disabilities or to require re-hospitalization, were less likely to return home, and suffered worse quality of life. Another Canadian study enrolling ICU patients over the age of 80 found that a frailty index derived from a questionnaire modelled on a CGA (Goldstein et al., 2015) improved predictions of adverse outcomes (Goldstein et al., 2015; Heyland et al., 2015). These findings clearly articulate the independent implications of frailty for care processes and transitions, use of

health resources, and long-term recovery by survivors of critical illness (Bagshaw et al., 2015; Bagshaw et al., 2014) and demonstrate that frailty can be measured in real time across a range of ICUs (Bagshaw et al., 2014).

However, these studies also highlight gaps in knowledge about frail ICU patients. We do not know enough about their nuanced and specialized care needs, their use of health resources, the challenges in transitioning them to care on wards and out of hospital, and their specialized rehabilitation needs. These knowledge gaps may explain why some seemingly logical strategies across ICUs, such as interventions to optimize rehabilitation and nutrition, have not improved outcomes for patients (Walsh et al., 2015). Those strategies may not have specifically targeted people most likely to benefit, or they failed to adapt interventions for the needs of frail people.

Social Aspects of Frailty

A key consideration when addressing frailty is how do intrinsic factors, such as medical and functional problems, genetics, and frailty itself, occur in the context of extrinsic factors such as social and physical environments? In addition to socioeconomic gradient (Marmot & Shipley, 1996), other social factors are linked to health status in older adults. These include social support (emotional or hands-on [Berkman, 2000; Holt-Lunstad, Smith, & Layton, 2010]), living situation, social engagement (Bennett, 2005; Krueger et al., 2009), mastery (Marmot, 2004), social capital, and social cohesion (Putnam, 2000; Subramanian, Kim, & Kiwachi, 2002). Since older people's social circumstances are complex, we require a holistic understanding of the complexity of social factors and social vulnerability. For example, two older women with equivalent frailty who both live alone may have very different levels of social vulnerability. One may be well integrated within networks of family and friends, engage regularly in community activities, and feel a high sense of mastery and control over her life circumstances. The other may be isolated, lonely, and have limited social and financial resources. In the same way that the FI measures accumulated health deficits, social factors can be usefully combined by counting accumulated social problems or "deficits", helping to paint an overall picture of social vulnerability or robustness for dealing with health and social problems (Andrew & Keefe, 2014).

In Canadian studies, lower social position (education and income) was strongly associated with frailty (St. John, Montgomery, & Tyas, 2013), and social vulnerability correlated moderately with frailty, with both contributing independently to risk of death (Andrew, Mitnitski, & Rockwood, 2008). Other factors

determining frailty include low socioeconomic status, having few relatives and neighbours or little contact with them, low participation in community or religious activities, and low social support (Lurie, Myers, Goldbourt, & Gerber, 2014; Peek, Howrey, Ternent, Ray, & Ottenbacher, 2012; Salem et al., 2013; Woo, Goggins, Sham, & Ho, 2005). From a societal view, levels of frailty across Europe correlate with national economic indicators such as gross domestic product (Theou et al., 2013).

An understanding of social circumstances is necessary to reduce social risk factors for poor health outcomes from frailty. This is particularly the case with multiple social problems, as overall social vulnerability is linked to cognitive decline and mortality even among the fittest older people (Andrew et al., 2008; Andrew, Mitnitski, Kirkland, & Rockwood, 2012; Andrew & Rockwood, 2010). Health care providers need a comprehensive, organized understanding of social circumstances, available resources, and supports. These are key to planning care for people identified as frail, particularly in care transitions such as hospital discharge and in making decisions about care needs and residence.

Ethical and Legal Implications of Screening for Frailty

Ethical analysis in health care decision-making examines relevant core values and norms, including considering the welfare of persons and the balancing of harms and benefits. It considers the value placed on personal autonomy, fairness, and equity. It is accompanied by legal obligations that provide the structures for applying these fundamental principles.

If frailty goes unrecognized, the current approach to clinical decision-making and health service delivery may be inadequate. People may be harmed if they are denied care or, more typically, are given care without their underlying frailty being considered sufficiently. Frailty must be understood and taken into account because its presence or absence is critical to understanding how care may offer benefit or harm (Mallery & Moorhouse, 2011). Screening for frailty is meant to reduce clinical uncertainty and refine clinical decision-making.

When frailty is not understood in context, standards of practice are followed whether or not they reflect the best interests of frail people. Aggressive and life-sustaining treatments for older adults are increasingly accepted as the norm. They are sometimes applied without careful thought about their inability to reverse declines in function or whether they fit the goals of patients or their families (Ferrucci et al., 2004). When the risk from frailty is not sufficiently considered, the result

may be harm to those treated. Coronary artery bypass surgery is a striking example, whereby most frail people will either die (15%) or be catastrophically disabled (50%) following surgery (Afilalo et al., 2012; Lee, Buth, Martin, Yip, & Hirsch, 2010).

Respect for autonomy occurs via care providers' ethical and legal obligations to help people make informed health care decisions (Entwistle, Carter, Cribb, & McCaffery, 2010). Frail people often face obstacles in health care that hinder truly valid and meaningful choice. For example, choice may be undermined by standards of practice that are not appropriate for frail people; hopes may be raised and risks of conditions and procedures not fully considered (Shim, Russ, & Kaufman, 2006). The void in medical evidence for frail people creates difficulty for health care providers who are ethically and legally obligated to facilitate informed decision-making.

Identifying frailty in older adults can have implications for their informed decision-making. They may be vulnerable to paternalistic health care arising from assumptions about diminished ability to understand and make decisions, particularly in the face of complex information regarding difficult options. As a consequence, they may not be given all the information or adequate assistance to understand the information they need to fully assess their clinical options. This risk is even greater if the diagnostic criteria for identifying frailty emphasize diminished cognitive function or physical dependency (McNally & Lahey, 2014).

Older adults, especially those who lack capacity, are systematically excluded from research trials even though they experience the greatest collective health burdens (Herrara et al., 2010). Chronic disease interventions in older adults are likely to have different outcomes for those who are frail versus those who are not (Bergman et al., 2007). Designing a research agenda appropriate for frail older adults remains a further challenge. Even so, trials and health effectiveness research that meaningfully address the needs of this population remains an urgent need. Evidence from research that does not include frail older adults or even adults with multiple simultaneous diseases should be extended only carefully, if at all, to those who are frail (Ferrucci et al., 2004). Such evidence may not sufficiently reflect outcomes or risks.

By characterizing frailty as a biophysical state, health care providers using frailty as the basis for clinical decision-making could thereby validate and offer objectivity to ageism (Special Senate Committee on Aging, 2009). The risk is that a diagnosis of frailty may be used to justify limiting, withholding, or denying types of care to frail people, increasing their loss of independence in decision-making (McNally & Lahey, 2014).

More broadly, a diagnosis of “being frail” could lead to broader and perhaps more intractable discrimination at home or in social networks and communities.

Conversely, clarifying a person’s position on a spectrum of frailty could ensure that older adults are informed, diagnosed, and treated appropriately for their actual “needs, circumstances and capacities.” This is the concept used in Canadian law to distinguish between valid differentiations based on age (or other grounds of discrimination) and differentiations based on stereotype (Minister of Employment and Immigration, 1999). Differentiating based on relative frailty may indeed avoid differentiating based on age and reduce age-based discrimination (McNally & Lahey, 2014).

Older adults deserve responsive attention in proportion to their health care needs (Giordano, 2005). In Canadian law, equality of older persons requires that their needs be given “equal concern and respect” in health care as elsewhere (Alon-Shenker, 2012). This means that stereotyping based on frailty must be avoided, but it also requires informed evidence-based attention to frailty. Any changes pursued in screening for frailty must consider how we can make fair health care decisions with finite resources. This is especially pertinent for frail older adults who may be particularly vulnerable to ageism and age-based discrimination. Without clarity on the needs, circumstances, and capacity of frail older adults, decisions may be made through legal channels that push towards simple yes/no choices rather than towards reflective deliberation by a broad spectrum of stakeholders (McNally & Lahey, 2014).

Assuring that the voices of the individual and the family are considered in all decision-making reduces concerns about discrimination based on age or frailty. As an example, the Palliative and Therapeutic Harmonization (PATH) program in Nova Scotia provides individuals and their families with comprehensive information and a greater understanding of the implications of treatment decisions and frailty. Individuals and families often opt for fewer interventions and pursue less aggressive alternatives (Capital Health, 2015; Moorhouse & Mallery, 2012). Overall, awareness of frailty may change the benefits and risks seen in any treatment decision, and empower informed decision-making.

Policy Implications of Adopting Frailty Screening

Many political and economic forces require that we focus on frail older adults. The baby boomers, the largest group in our population, are entering age brackets where frailty is increasingly prevalent. They may also be caring for their frail parents and politically will

advocate for changes in how health care manages our aging population (Conference Board of Canada, 2013).

From an economic perspective, the policy discussion around aging is shaped by the recognition that a large and growing proportion of health care spending is on seniors, particularly on those nearing the end of life. In this context, health care systems may provide older adults with both too much care and too little care (Rockwood, 2005a). Our current health care structure excels at illness-specific interventions but does not sufficiently consider higher risk and lower potential benefits in older persons. Providing illness-specific care may come at the expense of responsive, integrated, and continuous programs of care and chronic disease management (McNally & Lahey, 2014).

By systematically and comprehensively identifying frailty and its significance to patients, health care providers can guide evidence-based approaches to clinical care that have the necessary rehabilitative and social supports. A change in health care practice can underpin broader system changes (McNally & Lahey, 2014).

To systematically implement frailty screening, a number of policy changes are required. A common language needs to be used among researchers, health care providers, administrators, policy makers, and the public, particularly in defining frailty. Researchers and clinicians need to identify and agree on which validated frailty tools to use in which setting. Consensus is needed on whom to screen. Possible approaches include screening all individuals over a certain age who come into contact with the health care system, or screening on the basis of selected criteria such as age, selected medical conditions, psychosocial disorders, falls or functional disability, high use of the health care system, and change in living situation such as moving from independent to assisted living. In particular, age as a criterion for screening is the simplest but may vary depending on the setting. For example, age older than 65 years may be an appropriate criterion for older adults presenting to the emergency department or intensive care unit, but age older than 75 may be more appropriate in primary care settings (Bagshaw et al., 2014; McCusker et al., 1999; Romero-Ortuno & Soraghan, 2014; Winograd et al., 1991).

We will need further agreement on individuals who conduct frailty screening and their qualifications. Family members and a variety of health care providers can be trained in simple assessments and screening. However, we do not yet know whether a health care provider trained across multiple disciplines can provide a detailed assessment across a number of domains. Multidimensional assessment may need to be conducted by teams of health care providers with appropriate training.

If we are to meet demand, we must evolve innovative models of care that are tested for their outcomes and effectiveness. Depending on who are the providers that conduct screening, changes may be required to provincial regulation of selected health disciplines to clarify scope of practice and legal liability in order to allow them to act based on the results of the screening conducted.

Finally, the economics of reimbursement for screening require attention. In particular, what funding model should be used to ensure that frailty screening is part of core insured services? Should the model be based on the prevalence of frailty? Who will evaluate whether screening is working or how it could work better? How do we demonstrate the benefits of screening? How do we fully include frail older adults and their families or caregivers in decision-making on these matters (Dickson, Lindstrom, Black, & Van der Gucht, 2012)?

Implementing Frailty Screening through Knowledge Translation

Implementing frailty screening requires broad dissemination of the extensive body of evidence on frailty through knowledge translation efforts. Typically, this knowledge is held mainly by experts in aging. Dissemination requires distributing and sharing evidence by identifying appropriate target audiences and tailoring messages to those audiences.

Some evidence and ideas diffuse passively without additional support (Lomas, 1993), but most evidence requires active knowledge translation strategies and requires building collaborations with researchers and a spectrum of knowledge users including health care providers, administrators, policy makers, decision makers, service organizations, and older adults and their families (Harris et al., 2012).

Strategies for knowledge translation and dissemination will need to reach beyond health care providers, because targeting the health care system, older adults, and their families may be more effective (Tricco et al., 2014). Strategies should be embedded within the health care system and across its various settings to identify frail older adults and target appropriate care to them. With older adults' frailty risk recognized, we can give them evidence-informed self-management strategies to promote successful aging and to help them maintain independent functioning as long as possible. Self-management can include physical activity, healthy diet, smoking cessation, vaccination, and moderation of alcohol consumption (Sabia et al., 2012). Additionally, engaging frail older adults in care planning will ensure that their goals and values are respected (You, Fowler, & Heyland, 2014).

In disseminating knowledge on frailty and the need for screening, we will need a systematic approach to bridge the evidence-to-action gap and consider barriers and enablers. Potential barriers include lack of knowledge on frailty and its impact, lack of caregiver skills, ingrained social or professional roles and identities, existing beliefs about capabilities and consequences in frail people, existing intentions or goals, environmental context and resources, social influences, and behavioural regulation (Cane, O'Conner, & Michie, 2012). Potential enablers include the strong desire to change the status quo and the work that has been done up to the present in Canada, including the widespread adoption and implementation of interRAI assessments in many provinces and health care settings. All of these will need to be considered as we mobilize the evidence base on frailty screening into and across the health care system.

Conclusion

With the progressive aging of the Canadian population, the prevalence of frailty will continue to rise and will require us to alter the single-system illness focus of our health care system. Frail older adults with multisystem disease require holistic models of care to optimize patient-centred outcomes and improve quality of life. Central to this model is the identification and measurement of frailty, both of which will allow health care to be tailored to this growing, vulnerable segment of our society, since some interventions may only benefit those who are frail and some aggressive interventions may harm frail people. As we better understand the biological basis of frailty, its treatments, and ways to slow or reverse it, identifying frailty will become even more vital. For frail people whose decline in health status cannot be treated effectively, we can prevent unnecessary and unwanted interventions by improving care at end of life. By better understanding, recognizing, and managing frailty, we will improve the sustainability of our publicly funded health care system.

References

- Abellan van Kan, G., Rolland, Y., Andrieu, S., Bauer, J., Beauchet, O., Bonnefoy, M., ... & Vellas, B. (2009). Gait speed at usual pace as a predictor of adverse outcomes in community-dwelling older people: An International Academy on Nutrition and Aging (IANA) Task Force. *The Journal of Nutrition Health and Aging*, 13(10), 881–889.
- Afilalo, J., Mottillo, S., Eisenberg, M. J., Alexander, K. P., Noiseux, N., Perrault, L. P., ... Bergman, H. (2012). Addition of frailty and disability to cardiac surgery risk scores identifies elderly patients at high risk of mortality or major morbidity. *Circulation: Cardiovascular Quality Outcomes*, 5(2), 222–228.

- Akki, A., Yang, H., Gupta, A., Chacko, V. P., Yano, T., Leppo, M. K., ... & Weiss, R. G. (2014). Skeletal muscle ATP kinetics are impaired in frail mice. *Age*, 36(1), 21–30.
- Alon-Shenker, P. (2012). The unequal right to equality: Towards a dignified lives approach to age discrimination. *The Canadian Journal of Law & Jurisprudence*, 25(2), 243–282.
- Andrew, M., & Keefe, J. (2014). Social vulnerability among older adults: A social ecology perspective from the National Population Health Survey of Canada. *BMC Geriatrics*, 14(90), 1–14.
- Andrew, M., Mitnitski, A., Kirkland, S. A., & Rockwood, K. (2012). The impact of social vulnerability on the survival of the fittest older adults. *Age and Ageing*, 41(2), 161–165.
- Andrew, M. K., Mitnitski, A., & Rockwood, K. (2008). Social vulnerability, frailty, and mortality in elderly people. *PLoS One*, 3(5), e2232.
- Andrew, M. K., & Rockwood, K. (2010). Social vulnerability predicts cognitive decline in a prospective cohort of older Canadians. *Alzheimers & Dementia*, 6(4), 319–325.
- Armstrong, J. J., Stolee, P., Hirdes, J. P., & Poss, J. W. (2010). Examining three frailty conceptualizations in their ability to predict negative outcomes for home-care clients. *Age and Ageing*, 39(6), 755–758.
- Bagshaw, S. M., Stelfox, H. T., Johnson, J. A., McDermid, R. C., Rolfson, D. B., Tsuyuki, R. T., ... Majumbar, S. R. (2015). Long-term association between frailty and health-related quality-of-life among survivors of critical illness: A prospective multicenter cohort study. *Critical Care Medicine*, 43(5), 973–982.
- Bagshaw, S. M., Stelfox, H. T., McDermid, R. C., Rolfson, D. B., Tsuyuki, R. T., Baig, N., ... et al. (2014). Association between frailty and short- and long-term outcomes among critically ill patients: A multicentre prospective cohort study. *Canadian Medical Association Journal*, 186(2), E95–E102.
- Bennett, K. M. (2005). Social engagement as a longitudinal predictor of objective and subjective health. *European Journal of Ageing*, 2(1), 48–55.
- Bergman, H., Ferrucci, L., Guralnik, J., Hogan, D. B., Hummel, S., Karunanathan, S., & Wolfson, C. (2007). Frailty: An emerging research and clinical paradigm—Issues and controversies. *Journal of Gerontology*, 62A(7), 731–737.
- Berkman, L. F. (2000). Social support, social networks, social cohesion and health. *Social Work in Health Care*, 31(2), 3–14.
- Brault, M. E., Ohayon, S. M., Kwan, R., Bergman, H., Eisenberg, M. J., Boivin, J. F., ... & Afilalo, J. (2014). Telomere length and the clinical phenotype of frailty in older adults undergoing cardiac surgery. *Journal of the American Geriatrics Society*, 62(11), 2205–2207.
- Brennan, T. A., Leape, L. L., Laird, N. M., Herbert, L., Localio, A. R., Lawthers, A. G., ... & Hiatt, H. H. (1991). Incidence of adverse events and negligence in hospitalized patients—Results of the Harvard Medical Practice Study I. *New England Journal of Medicine*, 7(324), 370–376.
- Brothers, T. D., Kirkland, S., Guaraldi, G., Falutz, J., Theou, O., Johnston, B. L., & Rockwood, K. (2014). Frailty in people aging with human immunodeficiency virus (HIV) infection. *Journal of Infectious Diseases*, 210(8), 1170–1179.
- Brownie, S., & Nancarrow, S. (2013). Effects of person-centered care on residents and staff in aged-care facilities: A systematic review. *Clinical Interventions in Aging*, 8, 1–10.
- Buckinx, F., Rolland, Y., Reginster, J. Y., Ricour, C., Petermans, J., & Bruyère, O. (2015). Burden of frailty in the elderly population: Perspectives for a public health challenge. *Archives of Public Health*, 73(1), 19.
- Buth, K. J., Gainer, R. A., Legare, J. F., & Hirsch, G. M. (2014). The changing face of cardiac surgery: Practice patterns and outcomes 2001–2010. *Canadian Journal of Cardiology*, 30(2), 224–230.
- Canadian Institute for Health Information. (2011). *A focus on seniors and aging*. Ottawa, ON: Health Care in Canada.
- Canadian Study of Health and Aging Working Group. (1994). Canadian study of health and aging: Study methods and prevalence of dementia. *Canadian Medical Association Journal*, 150(6), 899–913.
- Cane, J., O'Connor, D., & Michie, S. (2012). Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science*, 7, 37.
- Capital Health. (2015). *Palliative & therapeutic harmonization clinic*. Retrieved from <http://www.cdha.nshealth.ca/geriatric-medicine/palliative-therapeutic-harmonization-clinic>
- Carlson, C., Merel, S. E., & Yukawa, M. (2015). Geriatric syndromes and geriatric assessment for the generalist. *Medical Clinics of North America*, 99(2), 263–279.
- Carpenter, C. R., Shelton, E., Fowler, S., Suffoletto, B., Platts-Mills, T. F., Rothman, R. E., & Hogan, T. M. (2015). Risk factors and screening instruments to predict adverse outcomes for undifferentiated older emergency department patients: A systematic review and meta-analysis. *Academic Emergency Medicine*, 22(1), 1–21.
- Chow, W. B., Rosenthal, R. A., Merkow, R. P., Ko, C., & Esnaola, N. F. (2012). Optimal preoperative assessment of the geriatric surgical patient: A best practices guideline from the American College of Surgeons National Surgical Quality Improvement Program and the American Geriatrics Society. *Journal of the American College of Surgeons*, 215(4), 453–466.
- Clegg, A., Rogers, L., & Young, J. (2015). Diagnostic test accuracy of simple instruments for identifying frailty in

- community-dwelling older people: A systematic review. *Age and Ageing*, 44(1), 148–152.
- Clegg, A., Young, J., Iliffe, S., Rikkert, M. O., & Rockwood, K. (2013). Frailty in elderly people. *Lancet*, 381(9868), 752–762.
- Collerton, J., Martin-Ruiz, C., Davies, K., Hilken, C. M., Isaacs, J., Kolenda, C., ... & Kirkwood, T. B. (2012). Frailty and the role of inflammation, immunosenescence and cellular ageing in the very old: Cross-sectional findings from the Newcastle 85+ study. *Mechanisms of Ageing and Development*, 133(6), 456–466.
- Conference Board of Canada (2013). *Future care for Canadian seniors—Why it matters*. Ottawa, ON: Author.
- Costa, A. P., & Hirdes, J. P. (2010). Clinical characteristics and service needs of alternate-level-of-care patients waiting for long-term care in Ontario hospitals. *Healthcare Policy*, 6(1), 32.
- Costa, A. P., Hirdes, J. P., Heckman, G. A., Dey, A. B., Jonsson, P. V., Lakhan, P., ... Gray, L. C. (2014). Geriatric syndromes predict postdischarge outcomes among older emergency department patients: Findings from the interRAI Multinational Emergency Department Study. *Academic Emergency Medicine*, 21(4), 422–433.
- Covinsky, K. E., Pierluissi, E., & Johnston, C. B. (2011). Hospitalization-associated disability: “She was probably able to ambulate, but I’m not sure”. *Journal of the American Medical Association*, 306(16), 1782–1793.
- Debettignies, B., Mahurin, R., & Pirozzolo, F. (1990). Insight for impairment in independent living skills in Alzheimer’s disease and multi-infarct dementia. *Journal of Clinical and Experimental Neuropsychology*, 12(2), 355–363.
- de Vries, N. M., Staal, J. B., van Ravensberg, C. D., Hobbelen, J. S., Olde Rikkert, M. G., & Nijhuis-van der Sanden, M. W. (2011). Outcome instruments to measure frailty: A systematic review. *Ageing Research Reviews*, 10(1), 104–114.
- Dickson, G., Lindstrom, R., Black, C., & Van der Gucht, D. (2012). *Evidence-informed change management in Canadian healthcare organizations*. Ottawa, ON: Canadian Health Services Research Foundation.
- Doupe, M., Brownell, M., Kozyrskyj, A., Dik, N., Burchill, C., Dahl, M., ... Bodnarchuk, J. (2006). *Using administrative data to develop indicators of quality care in personal care homes*. Winnipeg, MB: Manitoba Centre for Health Policy, Department of Community Health Sciences.
- Doupe, M., Brownell, M., St. John, P., Strang, D. G., Chateau, D., & Dik, N. (2011). Nursing home adverse events: Further insight into highest risk periods. *Journal of the American Medical Directors Association*, 12(6), 467–474.
- Doupe, M. B., St. John, P., Chateau, D., Strang, D., Smele, S., Bozat-Emre, S., ... & Dik, N. (2012). Profiling the multidimensional needs of new nursing home residents: Evidence to support planning. *Journal of the American Medical Directors Association*, 13(5), e9–e17.
- Drubbel, I., Numans, M. E., Kranenburg, G., Bleijenberg, N., de Wit, N. J., & Schuurmans, M. J. (2014). Screening for frailty in primary care: A systematic review of the psychometric properties of the frailty index in community-dwelling older people. *BMC Geriatrics*, 14(27), 1–13.
- Entwistle, V. A., Carter, S. M., Cribb, A., & McCaffery, K. (2010). Supporting patient autonomy: The importance of clinician-patient relationships. *Journal of General Internal Medicine*, 25(7), 741–745.
- Feridooni, H. A., Sun, M. H., Rockwood, K., & Howlett, S. E. (2014). Reliability of a frailty index based on the clinical assessment of health deficits in male C57BL/6J mice. *The Journal of Gerontology Series A: Biological Sciences and Medical Sciences*, 70(6), 686–693.
- Ferrucci, L., Guralnik, J. M., Studenski, S., Fried, L. P., Cutler, G. B., & Walston, J. D. (2004). Designing randomized, controlled trials aimed at preventing or delaying functional decline and disability in frail, older persons: A consensus report. *Journal of the American Geriatrics Society*, 52(4), 625–634.
- Freiheit, E. A., Hogan, D. B., Strain, L. A., Schmaltz, H. N., Patten, S. B., Eliasziw, M., & Maxwell, C. J. (2011). Operationalizing frailty among older residents of assisted living facilities. *BMC Geriatrics*, 11(23), 1–11.
- Fried, L. P., Tangen, C. M., Walston, J., Newman, A. B., Hirsh, C., Gottdiener, J., ... & McBurnie, M. A. (2001). Frailty in older adults: Evidence for a phenotype. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 56(3), M146–M157.
- Garrouste-Orgeas, M., Boumendil, A., Pateron, D., Aegerter, P., Somme, D., Simon, T., & Goudet, B. (2009). Selection of intensive care unit admission criteria for patients aged 80 years and over and compliance of emergency and intensive care unit physicians with the selected criteria: An observational, multicenter, prospective study. *Critical Care Medicine*, 37(11), 2919–2928.
- Giordano, S. (2005). Respect for equality and the treatment of the elderly: Declarations of human rights and age-based rationing. *Cambridge Quarterly of Healthcare Ethics*, 14(1), 83–92.
- Gobbens, R. J. J., van Assen, M. A. L. M., Luijckx, K. G., Wijnen-Sponselee, M. T., & Schols, J. M. (2010). The Tilburg Frailty Indicator: Psychometric properties. *Journal of the American Medical Directors Association*, 11(5), 344–355.
- Goldstein, J., Hubbard, R. E., Moorhouse, P., Andrew, M. K., Mitnitski, A., & Rockwood, K. (2015). The validation of a care partner-derived frailty index based upon comprehensive geriatric assessment (CP-FI-CGA) in emergency medical services and geriatric ambulatory care. *Age and Ageing*, 44(2), 327–330.

- Gonzalez-Vaca, J., de la Rica-Escuin, M., Silva-Iglesias, M., Arjonilla-García, M. D., Varela-Pérez, R., Oliver-Carbonell, J. L., & Abizanda, P. (2014). Frailty in institutionalized older adults from Albacete. The FINAL study: Rationale, design, methodology, prevalence and attributes. *Maturitas*, 77(1), 78–84.
- Gordon, A., & Oliver, D. (2015). Commentary: Frameworks for long term conditions must take account of needs of frail older people. *British Medical Journal*, 10, 350–370.
- Gray, L. C., Peel, N. M., Costa, A. P., Burkett, E., Dey, A. B., Jonsson, P. V., ... Hirdes, J. (2013). Profiles of older patients in the emergency department: Findings from the interRAI Multinational Emergency Department Study. *Annals of emergency medicine*, 62(5), 467–474.
- Gruber-Baldini, A., Stuart, B., Zuckerman, I., Van Doren, H., Boockvar, K., Zimmerman, S., & Magaziner, J. (2009). Sensitivity of nursing home cost comparisons to method of dementia diagnosis ascertainment. *International Journal of Alzheimer's Disease*, 2009, 1–10. doi:10.4061/2009/780720
- Handforth, C., Clegg, A., Young, C., Simpkins, S., Seymour, M. T., Selby, P. J., & Young, J. (2014). The prevalence and outcomes of frailty in older cancer patients: A systematic review. *Annals of Oncology*, 26(6), 1091–1101.
- Harris, J. R., Cheadle, A., Hannon, P. A., Forehand, M., Lichiello, P., Mahoney, E., ... Yarrow, J. (2012). A framework for disseminating evidence-based health promotion practices. *CDC—Preventing Chronic Disease*, 9. http://dx.doi.org/10.5888/pcd9.110081
- Herrara, A. P., Snipes, S. A., King, D. W., Torres-Vigil, I., Goldberg, D. S., & Weinberg, A. D. (2010). Disparate inclusion of older adults in clinical trials: Priorities and opportunities for policy and practice change. *American Journal of Public Health*, 100(51), S105–S112.
- Heyland, D., Cook, D., Bagshaw, S., Garland, A., Stelfox, T., Mehta, S., ... Canadian Critical Care Trials Group and Canadian Researchers at the End of Life Network. (2015). The very elderly admitted to ICU: A quality finish? *Critical Care Medicine*, 41(11), 1911–1920.
- Hirdes, J. P., Curtin-Telegdi, N., Poss, J. W., Gray, L., Berg, K. O., Stolee, P., ... & Szczerbinska, K. (2010). *interRAI contact assessment (CA) form and user's manual: A screening level assessment for emergency department and intake from community/hospital*. Version 9.2. Washington, DC: interRAI.
- Hirdes, J. P., Frijters, D. H., & Teare, G. F. (2003). The MDS-CHESS Scale: A new measure to predict mortality in institutionalized older people. *Journal of the American Geriatrics Society*, 51(1), 96–100.
- Hirdes, J. P., Mitchell, L., Maxwell, C. J., & White, N. (2011). Beyond the 'iron lungs of gerontology': Using evidence to shape the future of nursing homes in Canada. *Canadian Journal on Aging*, 30(3), 371–390.
- Hirdes, J. P., Poss, J., Mitchell, L., Korngut, L., & Heckman, G. (2014). Use of the interRAI CHES Scale to predict mortality among persons with neurological conditions in three care settings. *PLoS ONE*, 9(6), e99066.
- Hogan, D. B., Freiheit, E. A., Strain, L. A., Patten, S. B., Schmaltz, H. N., Rolfson, D., & Maxwell, C. J. (2012). Comparing frailty measures in their ability to predict adverse outcome among older residents of assisted living. *BMC Geriatrics*, 12(56), 1–11.
- Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine*, 7(7), e1000316.
- Hoogendijk, E. O., van der Horst, H. E., Deeg, D. J., Frijters, D. H., Prins, B. A., Jansen, A. P., ... van Hout, H. P. (2013). The identification of frail older adults in primary care: Comparing the accuracy of five simple instruments. *Age and Ageing*, 42(2), 262–265.
- Hoover, M., Roterman, M., Sanmartin, C., & Bernier, J. (2013). Validation of an index to estimate the prevalence of frailty among community-dwelling seniors. *Health Reports*, 24(9), 10–17.
- Howlett, S. E., Rockwood, M. R., Mitnitski, A., & Rockwood, K. (2014). Standard laboratory tests to identify older adults at increased risk of death. *BMC Medicine*, 12(171), 1–8.
- Hubbard, R. E., Peel, N. M., Samanta, M., Gray, L. C., Fries, B. E., Mitnitski, A., & Rockwood, K. (2015). Derivation of a frailty index from the interRAI acute care instrument. *BMC Geriatrics*, 15(27), 1–8.
- Jones, D., Song, X., Mitnitski, A., & Rockwood, K. (2005). Evaluation of a frailty index based on a comprehensive geriatric assessment in a population based study of elderly Canadians. *Ageing Clinical and Experimental Research*, 17(6), 465–471.
- Jones, D. M., Song, X., & Rockwood, K. (2004). Operationalizing a frailty index from a standardized comprehensive geriatric assessment. *Journal of the American Geriatrics Society*, 52(11), 1929–1933.
- Joosten, E. L., Demuyneck, M., Detroyer, E., & Milisen, K. (2014). Prevalence of frailty and its ability to predict in hospital delirium, falls, and 6-month mortality in hospitalized older patients. *BMC Geriatrics*, 14(1), 1–9.
- Joseph, B., Pandit, V., Zangbar, B., Kulvatunyong, N., Hashmi, A., Green, D. J., O'Keeffe, T., ... & Rhee, P. (2014). Superiority of frailty over age in predicting outcomes among geriatric trauma patients: A prospective analysis. *Journal of the American Medical Association Surgery*, 149(8), 766–772.
- Jung, H. W., Kim, S. W., Ahn, S., Lim, J. Y., Han, J. W., Kim, T. H., ... & Kim, C. H. (2014). Prevalence and outcomes of frailty in Korean elderly population: Comparisons of a multidimensional frailty index with two phenotype models. *PLoS One*, 9(2), e87958.
- Kaehr, E., Visvanathan, R., Malmstrom, T. K., & Morley, J. E. (2015). Frailty in nursing homes: The FRAIL-NH scale. *Journal of the American Medical Directors Association*, 16(2), 87–89.

- Kane, A. E., Hilmer, S. N., Boyer, D., Gavin, K., Nines, D., Howlett, S. E., ... & Mitchell, S. J. (2015). Impact of longevity interventions on a validated mouse clinical frailty index. *The Journal of Gerontology Series A: Biological Sciences and Medical Sciences*. doi:10.1093/gerona/glu315 (First published online: February 22, 2015).
- Kanwar, A., Singh, M., Lennon, R., Ghanta, K., McNallan, S. M., & Roger, V. L. (2013). Frailty and health-related quality of life among residents of long-term care facilities. *Journal of Aging and Health*, 25(5), 792–802.
- Kelaiditi, E., Cesari, M., Canevelli, M., van Kan, G. A., Ousset, P. J., Gillette-Guyonnet, S., ... & Vellas, B. (2013). Cognitive frailty: Rational and definition from an (I.A.N.A./I.A.G.G.) international consensus group. *The Journal of Nutrition Health and Aging*, 17(9), 726–734.
- Kenig, J., Zychiewicz, B., Olszewska, U., & Richter, P. (2015). Screening for frailty among older patients with cancer that qualify for abdominal surgery. *Journal of Geriatric Oncology*, 6(1), 52–59.
- Krueger, K. R., Wilson, R. S., Kamenetsky, J. M., Barnes, L. L., Bienias, J. L., & Bennett, D. A. (2009). Social engagement and cognitive function in old age. *Experimental Aging Research*, 35(1), 45–60.
- Lee, D. H., Buth, K. J., Martin, B. J., Yip, A. M., & Hirsch, G. M. (2010). Frail patients are at increased risk for mortality and prolonged institutional care after cardiac surgery. *Circulation*, 121(8), 973–978.
- Lee, L., Heckman, G., & Molnar, F. (2015). Frailty: Identifying elderly patients at high risk of poor outcomes. *Canadian Family Physician*, 61(3), 227–231.
- Le Maguet, P., Roquilly, A., Lasocki, S., Asehnoune, K., Carise, E., Saint Martin, M., ... Seguin, P. (2014). Prevalence and impact of frailty on mortality in elderly ICU patients: A prospective, multicenter, observational study. *Intensive Care Medicine*, 40(5), 674–682.
- Liu, H., Graber, T. G., Ferguson-Stegall, L., & Thompson, L. V. (2014). Clinically relevant frailty index for mice. *The Journal of Gerontology Series A: Biological Sciences and Medical Sciences*, 69(12), 1485–1491.
- Lomas, J. (1993). Diffusion, dissemination, and implementation: Who should do what? *Annals of the New York Academy of Sciences*, 703, 226–237.
- López-Otín, C., Blasco, M. A., Partridge, L., Serrano, M., & Kroemer, G. (2013). The hallmarks of aging. *Cell*, 153(6), 1194–1217.
- Lurie, I., Myers, V., Goldbourt, U., & Gerber, Y. (2014). Perceived social support following myocardial infarction and long-term development of frailty. *European Journal of Preventative Cardiology*, 22(10), 1346–1353.
- Mallery, L., Allen, M., Fleming, I., Kelly, K., Bowless, S., Duncan, J., & Moorhouse, P. (2014). Promoting higher blood pressure targets for frail older adults: A consensus guideline from Canada. *Cleveland Clinic Journal of Medicine*, 81(7), 427–437.
- Mallery, L. H., & Moorhouse, P. (2011). Respecting frailty. *Journal of Medical Ethics*, 37(2), 126–128.
- Marcantonio, E. R. (2012). Postoperative delirium: A 76-year-old woman with delirium following surgery. *Journal of the American Medical Association*, 308(1), 73–81.
- Marcantonio, E. R., Lee, G., Mangione, C. M., Ludwig, L. E., Muraca, B., Haslauer, C. M., ... Lee, T. H. (1994). A clinical prediction rule for delirium after elective noncardiac surgery. *Journal of the American Medical Association*, 271(2), 134–139.
- Marmot, M. (2004). *Status syndrome: How your social standing directly affects your health and life expectancy*. London, England: Bloomsbury.
- Marmot, M. G., & Shipley, M. J. (1996). Do socioeconomic differences in mortality persist after retirement? 25 year follow up of civil servants from the first Whitehall study. *British Medical Journal*, 313(7066), 1177–1180.
- Marshall, E. G., Clarke, B. S., Varatharasan, N., & Andrew, M. K. (2015). A Long-Term Care-Comprehensive Geriatric Assessment (LTC-CGA) tool: Improving care for frail older adults? *Canadian Geriatrics Journal*, 18(1), 2–10.
- Matusik, P., Tomaszewski, K., Chmielowska, K., Nowak, J., Parnicka, A., Dubiel, M., ... Grodzicki, T. (2012). Severe frailty and cognitive impairment are related to higher mortality in 12-month follow-up of nursing home residents. *Archives of Gerontology and Geriatrics*, 55(1), 22–24.
- McCusker, J., Bellavance, F., Cardin, S., Trepanier, S., Verdon, J., & Ardman, O. (1999). Detection of older people at increased risk of adverse health outcomes after an emergency visit: The ISAR screening tool. *Journal of the American Geriatrics Society*, 47(10), 1229–1237.
- McDermid, R. C., Stelfox, H. T., & Bagshaw, S. M. (2011). Frailty in the critically ill: A novel concept. *Critical Care*, 15(1), 301.
- McNally, M. E., & Lahey, W. (2014). Frailty's place in ethics and law: Some thoughts on equality, autonomy and limits and possibilities for ageing citizens. In K. Rockwood & O. Theou (Eds.), *Frailty in ageing: Biological, clinical and social implications* (pp. 174–185). Halifax, NS: Karger Medical and Scientific Publishers.
- Minister of Employment and Immigration. (1999). Law v. Canada: 1 SCR 497. Ottawa, ON: Author.
- Mitnitski, A., Collerton, J., Martin-Ruiz, C., Jagger, C., von Zglinicki, T., Rockwood, K., & Kirkwood, T. B. (2015). Age-related frailty and its association with biological markers of ageing. *BMC Medicine*, 13(161), 1–9.
- Mitnitski, A. B., Mogilner, A. J., MacKnight, C., & Rockwood, K. (2002). The mortality rate as a function of accumulated deficits in a frailty index. *Mechanisms of Ageing and Development*, 123(11), 1457–1460.

- Moorhouse, P., & Mallery, L. H. (2012). Palliative and therapeutic harmonization: A model for appropriate decision-making in frail older adults. *Journal of the American Geriatrics Society, 60*(12), 2326–2332.
- Morley, J. E., Vellas, B., van Kan, G. A., Anker, S. D., Bauer, J. M., Bernabei, R., ... & Waltson, J. (2013). Frailty consensus: A call to action. *Journal of the American Medical Directors Association, 14*(6), 392–397.
- Nichols, B. G., Varadarajan, V., Bock, J. M., & Blumin, J. H. (2015). Dysphonia in nursing home and assisted living residents: Prevalence and association with frailty. *Journal of Voice, 29*(1), 79–82.
- Oliver, D. (2014). Making health and care systems fit for an ageing population. Why we wrote it, who we wrote it for, and how relevant it might be to Canada. *Canadian Geriatrics Journal, 17*(4), 136–139.
- Parks, R. J., Fares, E., Macdonald, J. K., Ernst, M. C., Sinal, C. J., Rockwood, K., & Howlett, S. E. (2012). A procedure for creating a frailty index based on deficit accumulation in aging mice. *The Journal of Gerontology Series A: Biological Sciences and Medical Sciences, 67*(3), 217–227.
- Patel, K. V., Brennan, K. L., Brennan, M. L., Jupiter, D. C., Shar, A., & Davis, M. L. (2014). Association of a modified frailty index with mortality after femoral neck fracture in patients aged 60 years and older. *Clinical Orthopaedics and Related Research, 472*(3), 1010–1017.
- Peek, M. K., Howrey, B. T., Ternent, R. S., Ray, L. A., & Ottenbacher, K. J. (2012). Social support, stressors, and frailty among older Mexican American adults. *Journal of Gerontology Series B: Psychological Sciences and Social Sciences, 67*(6), 755–764.
- Pilotto, A., Ferrucci, L., Franceschi, M., D'Ambrosio, L. P., Scarcelli, C., Cascavilla, L., ... & Leandro, G. (2008). Development and validation of a multidimensional prognostic index for 1-year mortality from the comprehensive geriatric assessment in hospitalized older patients. *Rejuvenation Research, 11*(1), 151–161.
- Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community*. New York, NY: Simon & Schuster.
- Ramage-Morin, P. L. (2006). Successful aging in health care institutions. *Health Reports (Statistics Canada, Catalogue 82-003), 16*(Suppl), 47–56.
- Rennick, D. M., & Fort, M. M. (2000). Lessons from genetically engineered animal models. XII. IL-10-deficient (IL-10(-/-) mice and intestinal inflammation. *American Journal of Physiology: Gastrointestinal and Liver Physiology, 278*(6), G829–G833.
- Robertson, D. A., Savva, G. M., & Kenny, R. A. (2013). Frailty and cognitive impairment—A review of the evidence and causal mechanisms. *Ageing Research Reviews, 12*(4), 840–851.
- Rockwood, K. (2005a). An unsuitable old age: The paradoxes of elder care. *Canadian Medical Association Journal, 173*(12), 1500–1501.
- Rockwood, K. (2005b). Frailty and its definition: A worthy challenge. *Journal of the American Geriatrics Society, 53*(6), 1069–1070.
- Rockwood, K. (2005c). What would make a definition of frailty successful? *Age and Ageing, 34*(5), 432–434.
- Rockwood, K., Abeysondera, M. J., & Mitnitski, A. (2007). How should we grade frailty in nursing home patients? *Journal of the American Medical Directors Association, 8*(9), 595–603.
- Rockwood, K., MacMillan, M., Mitnitski, A., & Howlett, S. E. (2015). A frailty index based on common laboratory tests in comparison with a clinical frailty index for older adults in long-term care facilities. *Journal of the American Medical Directors Association, 16*(10), 842–847.
- Rockwood, K., Silviu, J. L., & Fox, R. A. (1998). Comprehensive geriatric assessment. Helping your elderly patients maintain functional well-being. *Postgraduate Medicine, 103*(3), 247–249.
- Rockwood, K., Song, X., MacKnight, C., Bergman, H., Hogan, D. B., McDowell, I., & Mitnitski, A. (2005). A global clinical measure of fitness and frailty in elderly people. *Canadian Medical Association Journal, 173*(5), 489–495.
- Rockwood, K., Song, X., & Mitnitski, A. (2011). Changes in relative fitness and frailty across the adult lifespan: Evidence from the Canadian National Population Health Survey. *Canadian Medical Association Journal, 183*(8), E487–E494.
- Rockwood, M. R., MacDonald, E., Sutton, E., Rockwood, K., Baron, M. & Canadian Scleroderma Research Group. (2014). Frailty index to measure health status in people with systemic sclerosis. *The Journal of Rheumatology, 41*(4), 698–705.
- Rodríguez-Mañas, L., Féart, C., Mann, G., Viña, J., Chatterji, S., Chodzko-Zajko, W., ... & Vega, E. (2013). Searching for an operational definition of frailty: A Delphi method based consensus statement. The frailty operative definition-consensus conference project. *The Journal of Gerontology A. Biological Sciences & Medical Sciences, 68*(1), 62–67.
- Rolfson, D. B., Majumdar, S. R., Tsuyuki, R. T., Tahir, A., & Rockwood, K. (2006). Validity and reliability of the Edmonton Frail Scale. *Age and Ageing, 35*(5), 526–529.
- Romero-Ortuno, R., & Soraghan, C. A. (2014). Frailty instrument for primary care for those aged 75 years or more: Findings from the Survey of Health, Ageing and Retirement in Europe, a longitudinal population-based cohort study (SHARE-FI75+). *BMJ Open, 4*(12), e006645.
- Rudolph, J. L., Jones, R. N., Levkoff, S. E., Rockett, C., Inouye, S. K., Sellke, F. W., ... Marcantonio, E. R. (2009). Derivation and validation of a preoperative prediction rule for delirium after cardiac surgery. *Circulation, 119*(2), 229–236.

- Sabia, S., Singh-Manoux, A., Hagger-Johnson, G., Cambois, E., Brunner, E. J., & Kivimaki, M. (2012). Influence of individual and combined healthy behaviours on successful aging. *Canadian Medical Association Journal*, 184(18), 1985–1992.
- Salem, B. E., Nyamathi, A. M., Brecht, M. L., Phillips, L. R., Mentis, J. C., Sarkisian, C., & Leake, B. (2013). Correlates of frailty among homeless adults. *Western Journal of Nursing Research*, 35(9), 1128–1152.
- Saum, K. U., Dieffenbach, A. K., Mützlin, A., Müller, H., Holleczeck, B., Stegmaier, C., ... & Brenner, H. (2014). Frailty and telomere length: Cross-sectional analysis in 3537 older adults from the ESTHER cohort. *Experimental Gerontology*, 58, 250–255.
- Schoufour, J. D., Evenhuis, H. M., & Echteld, M. A. (2014). The impact of frailty on care intensity in older people with intellectual disabilities. *Research in Developmental Disabilities*, 35(12), 3455–3461.
- Searle, S., Mitnitski, A., Gahbauer, E., Gill, T., & Rockwood, K. (2008). A standard procedure for creating a frailty index. *BMC Geriatrics*, 8(24), 1–10.
- Sepehri, A., Beggs, T., Hassan, A., Rigatto, C., Shaw-Daigle, C., Tangri, N., & Arora, R. C. (2014). The impact of frailty on outcomes after cardiac surgery: A systematic review. *The Journal of Thoracic and Cardiovascular Surgery*, 148(6), 3110–3117.
- Shim, J. K., Russ, A. J., & Kaufman, S. R. (2006). Risk, life extension and the pursuit of medical possibility. *Sociology Health Illness*, 28(4), 479–502.
- Silvester, K. M., Mohammed, M. A., Harriman, P., Girolami, A., & Downes, T. W. (2014). Timely care for frail older people referred to hospital improves efficiency and reduces mortality without the need for extra resources. *Age and Ageing*, 43(4), 472–477.
- Sinha, M. (2012). *Portrait of caregivers, 2012*. Retrieved from <http://www.statcan.gc.ca/pub/89-652-x/89-652-x2013001-eng.htm>
- Sinha, S. K., Bessman, E. S., Flomenbaum, N., & Leff, B. (2011). A systematic review and qualitative analysis to inform the development of a new emergency department-based geriatric case management model. *Annals of Emergency Medicine*, 57(6), 672–682.
- Sinha, S. K., Oakes, S. L., Suh, T., & Chaudhry, S. (2014). How to use the ACE unit to improve hospital safety and quality for older patients: From ACE units to elder-friendly hospitals. In M. L. Malone, E. A. Capezuti, & R. M. Palmer (Eds.), *Acute care for elders: A model for interdisciplinary care* (pp. 131–156). New York, NY: Humana Press.
- Sligl, W. I., Eurich, D. T., Marrie, T. J., & Majumdar, S. R. (2011). Only severely limited, pre-morbid functional status is associated with short- and long-term mortality in patients with pneumonia who are critically ill: A prospective observational study. *Chest*, 139(1), 88–94.
- Special Senate Committee on Aging (2009). *Canada's aging population: Seizing the opportunity*. Ottawa, ON: Senate of Canada.
- Statistics Canada. (2001). *2001 Census of Canada*. Ottawa, ON: Author.
- Statistics Canada. (2011). *Living arrangements of seniors: Families, households and marital status. Structural type of dwelling and collectives, 2011 census of population*. Ottawa, ON: Author.
- Steverink, N., Slaets, J. P. J., Schuurmans, H., & van Lis, M. (2001). Measuring frailty. Development and testing of the Groningen Frailty Indicator (GFI). *Gerontologist*, 41(1), 236–237.
- St. John, P. D., Montgomery, P. R., & Tyas, S. L. (2013). Social position and frailty. *Canadian Journal on Aging*, 32(3), 250–259.
- Strain, L. A., Maxwell, C. J., Wanless, D., Gilbert, E., & Alberta Continuing Care Epidemiological Studies (ACCES) Research Group. (2015). *Designated Assisted Living (DAL) and long-term care in Alberta: Selected highlights from the Alberta Continuing Care Epidemiological Studies (ACCES)*. Retrieved from <http://www.ab-cca.ca/uploads/files/Documents/ACCES%20Final%20Report%202011.pdf>
- Stuck, A. E., Siu, A. L., Wieland, G. D., Adams, J., & Rubenstein, L. Z. (1993). Comprehensive geriatric assessment: A meta-analysis of controlled trials. *Lancet*, 342(8878), 1032–1036.
- Subra, J., Gillette-Guyonnet, S., Cesari, M., Oustric, S., & Vellas, B. (2012). The integration of frailty into clinical practice: Preliminary results from the Gérontopôle. *The Journal of Nutrition Health and Aging*, 16(8), 714–720.
- Subramanian, S. V., Kim, D. J., & Kawachi, I. (2002). Social trust and self-rated health in US communities: A multilevel analysis. *Journal of Urban Health*, 79(Suppl 1), S21–S34.
- Tabue-Teguio, M., Kelaiditi, E., Demougeot, L., Dartigues, J. F., Vellas, B., & Cesari, M. (2015, July 1). Frailty index and mortality in nursing home residents in France: Results from the INCUR study. *Journal of the American Medical Directors Association*, 16(7), 603–606. doi:10.1016/j.jamda.2015.02.002 (Epub 2015 Mar 10)
- Tjam, E. Y., Heckman, G. A., Smith, S., Arai, B., Hirdes, J., Poss, J., & McKelvie, R. S. (2012). Predicting heart failure mortality in frail seniors: Comparing the NYHA functional classification with the Resident Assessment Instrument (RAI) 2.0. *International Journal of Cardiology*, 155(1), 75–80.
- Theou, O., Brothers, T. D., Mitnitski, A., & Rockwood, K. (2013). Operationalization of frailty using eight commonly used scales and comparison of their ability to predict all-cause mortality. *Journal of the American Geriatrics Society*, 61(9), 1537–1551.
- Theou, O., Brothers, T. D., Peña, F. G., Mitnitski, A., & Rockwood, K. (2014). Identifying common characteristics

- of frailty across seven scales. *Journal of the American Geriatrics Society*, 62(5), 901–906.
- Theou, O., Brothers, T. D., Rockwood, M. R., Haardt, D., Mitnitski, A., & Rockwood, K. (2013). Exploring the relationship between national economic indicators and relative fitness and frailty in middle-aged and older Europeans. *Age and Ageing*, 42(5), 614–619.
- Tricco, A. C., Antony, J., Ivers, N. M., Ashoor, H., Khan, P., Blondal, E., ... Straus, S. (2014). Effectiveness of quality improvement strategies for coordination of care to reduce use of health care services: A systematic review and meta-analysis. *Canadian Medical Association Journal*, 186(15), E568–E578.
- Turner, G., & Clegg, A. (2014). Best practice guidelines for the management of frailty: A British Geriatrics Society, Age UK and Royal College of General Practitioners report. *Age and Ageing*, 43(6), 744–747.
- Wallis, S. J., Wall, J., Biram, R. W., & Romero-Ortuno, R. (2015). Association of the clinical frailty scale with hospital outcomes. *QJM: An International Journal of Medicine*. <http://dx.doi.org/10.1093/qjmed/hcv066> (First published online: March 15, 2015)
- Walsh, T. S., Salisbury, L. G., Merriweather, J. L., Boyd, J. A., Griffith, D. M., Huby, G., ... Ramsay, P. (2015). Increased hospital-based physical rehabilitation and information provision after intensive care unit discharge: The RECOVER randomized clinical trial. *Journal of the American Medical Association: Internal Medicine*, 175(6), 901–910.
- Walston, J., Fedarko, N., Yang, H., Leng, S., Beamer, B., Espinoza, S., ... & Becker, K. (2008). The physical and biological characterization of a frail mouse model. *The Journal of Gerontology Series A: Biological Sciences and Medical Sciences*, 63A(4), 391–398.
- Whitehead, J. C., Hildebrand, B. A., Sun, M., Rockwood, M. R., Rose, R. A., Rockwood, K., & Howlett, S. E. (2014). A clinical frailty index in aging mice: Comparisons with frailty index data in humans. *The Journal of Gerontology Series A: Biological Sciences and Medical Sciences*, 69(6), 621–632.
- Winograd, C. H., Gerety, M. B., Chung, M., Goldstein, M. K., Dominguez, F., & Vallone, R. (1991). Screening for frailty: Criteria and predictors of outcomes. *Journal of the American Geriatrics Society*, 39(8), 778–784.
- Wolinsky, F. D., Stump, T. E., & Johnson, R. J. (1995). Hospital utilization profiles among older adults over time: Consistency and volume among survivors and decedents. *Journal of Gerontology Series B: Psychological Sciences and Social Sciences*, 50(2), S88–S100.
- Woo, J., Goggins, W., Sham, A., & Ho, S. C. (2005). Social determinants of frailty. *Gerontology*, 51(6), 402–408.
- Woo, J., Tang, N. L., Suen, E., Leung, J. C., & Leung, P. C. (2008). Telomeres and frailty. *Mechanisms of Ageing and Development*, 129(11), 642–648.
- You, J. J., Fowler, R. A., & Heyland, D. K. (2014). Just ask: Discussing goals of care with patients in hospital with serious illness. *Canadian Medical Association Journal*, 186(6), 425–432.
- Zaslavsky, O., Cochrane, B. B., Thompson, H. J., Woods, N. F., Herting, J. R., & LaCroix, A. (2013). Frailty: A review of the first decade of research. *Biological Research for Nursing*, 15(4), 422–432.