Understanding Frailty Screening: a Domain Mapping Exercise

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ABSTRACT

Background

Many definitions and operationalisations of frailty exclude psychosocial factors, such as social isolation and mental health, despite considerable evidence of the links between frailty and these factors. This study aimed to investigate the health domains covered by frailty screening tools.

Methods

A systematic search of the literature was conducted in accordance with PRISMA guidelines. MEDLINE, CINAHL, EMBASE, and PsycInfo were searched from inception to December 31, 2018. Data related to the domains of each screening tool were extracted and mapped onto a framework based on the biopsychosocial model of Lehmans *et al.* (2009) and Wade & Halligans (2017).

Results

Sixty-seven frailty screening tools were captured in 79 articles. All screening tools assessed biological factors, 73% assessed psychological factors, 52% assessed social factors, and 78% assessed contextual factors. Under half (43%) of the tools evaluated all four domains, 33% evaluated three of four domains, 12% reported two of four domains, and 13% reported one domain (biological).

Conclusion

This review found considerable variation in the assessment domains covered by frailty screening tools. Frailty is a broad construct, and frailty screening tools need to cover a wide variety of domains to enhance screening and outcomes assessment.

Key words: frailty, screening tools, domain mapping, psychosocial

INTRODUCTION

Over the past several decades, considerable discussion and debate has surrounded the definition of frailty in older persons. Researchers such as Collard, Boter, Schoevers, and Voshaar have acknowledged the dynamic nature of frailty as something that extends beyond Buchner and Wagner's strictly biomedical definition to include psychosocial factors.[1,2] The separation of physical and psychosocial factors in assessment of frailty feels counterintuitive, given research showing that psychosocial factors influence functional frailty outcomes.[3] Currently, a working definition of frailty, as stated by the Canadian Frailty Network (CFN), is as follows:

> "Frailty is a state of increased vulnerability, with reduced physical reserve and loss of function across multiple body systems. This reduces ability to cope with normal or minor stresses, which can cause rapid and dramatic changes in health."[4]

This definition does not explicitly include psychosocial factors and may reflect a shift away from a holistic conceptualization of frailty. This is reflected with the use of frailty screening tools that provide a primarily biomedical assessment, such as the Clinical Frailty Scale, which is based on clinical judgment of clinicians.[5] Other tools assess only psychosocial factors, such as the Friendship Scale and Social Vulnerability Scale.[6,7]

As Levers *et al.* notes,[3] literature has indicated that psychosocial factors contribute to frailty, but it is not clear how consistently these factors are assessed or measured, making their influence unclear. Morley [et al.] have argued for a more in-depth assessment of frailty that includes both psychosocial and biomedical domains.[8] Tools that do not capture the full scope of frailty will inaccurately rule in or rule out frailty in specific individuals. As such, researchers, clinicians, and policy makers will be using invalid data to guide policy, practice, and the development of care plans. The matter is amplified by the absence of a gold standard clinical definition of frailty, and the lack of objective clinical tests to diagnose the problem. This research project used a domain mapping method to understand how individual frailty screening and assessment tools currently assess or measure psychosocial and biological domains within their evaluations.

METHODS

This study utilized systematic search and review methodology and followed PRISMA guidelines to examine how psychosocial and biomedical factors are currently considered within frailty screening and assessment tools.[9,10] Electronic databases focused on social sciences, community health, public health, medicine, and rehabilitation, including MEDLINE, CINAHL, EMBASE, and PsycInfo, were searched from the inception of the database to December 31, 2018. The search strategy was developed a priori and included terms related to the objectives of this study such as "screening" or "assessment", "frail", and "validation" or "development". The search strategy used for MEDLINE was as follows:

> (screening or screen* or risk assessment or geriatric assessment or evaluation) AND (tool* or instrument* or survey* or questionnaire* or scale* or index or score or scores) AND (frail elderly or frail*) AND (validation or validate or develop* or reliability)

- Limit to English language
- Not conference abstracts.pt

Articles were included in the review if they explicitly discussed a screening or assessment method to evaluate frailty, the full text was available, the aim of the article was to discuss the development or psychometric properties of screening tools (validity, reliability, reproducibility), and the article described the initial development of a tool or a subsequent modification of a tool. Articles were excluded if no information about the domains or psychometric properties of the tools were discussed, full text was not available, full text was in a language other than English, or included a frailty screening tool that was only intended for use in a specific population (e.g., cancer, respiratory, cardiac, cognitive impairment). One reviewer conducted the literature search and completed title and abstract screening. Two independent reviewers then completed full-text reviews. Disagreements were resolved by consensus.

The domain mapping activity utilized the biopsychosocial model proposed by Lehman *et al*. and Wade and Halligan.[11,12] The biopsychosocial model outlines how the core factors—identified as biological, psychological, and social—are influenced by contextual factors which influence an individual's health status.[11,12] We created tables to identify how each tool measured core factors (biological, psychological, social) and contextual factors based on the biopsychosocial framework. Biological factors included individual factors, nutrition, medical conditions, and physical/functional abilities. Psychological factors included cognitive abilities, emotional regulation, motivation, stress appraisal, behaviour, and mental health. Social factors included use of community resources, living situations, leisure, social status, social connections, and support (family/friend). Contextual factors included personal, social, temporal, and physical factors which relate to the environment or "context" for a person based on their unique life experiences. They describe factors such as goals, local community, stage in life, transportation, and living situation. Detailed descriptions of each can be found in the Table 1.

If a component of a tool fit into one of the core factors as well as into a contextual factor, then researchers included it in both aspects. Data related to how each tool assessed and evaluated frailty were extracted from each article into a summary table initially to label components as biological, psychological, or social. From here, information was mapped from the initial charts into a spreadsheet which contained all of the specific biopsychosocial framework components for a more detailed analysis of how the core components were represented in frailty screening tools. One reviewer undertook the initial data extraction process and a second reviewer vetted the results.

RESULTS

Overall, the systematic search identified 2,213 potential articles for inclusion. After a single reviewer completed the title and abstract screen, 1,520 were removed. A reference check completed on previous systematic reviews on frailty screening tools revealed 21 additional articles for inclusion. Upon completion, we included 79 articles in the review, and 67 unique tools were identified and discussed in these articles. The PRISMA flow chart indicating the study selection process can be found in Figure 1. A kappa score of 0.64 indicated moderate agreement between the two reviewers.[13]

All tools assessed biological factors (n=67): 30% (n=20) evaluated personal factors, 64% (n=43) nutritional factors, 75% (n=50) medical conditions, and 94% (n=63) physical/functional abilities. Psychological factors were assessed by 73% (n=49) of the tools: 19% (n=13) evaluated self-rated health, 57% (n=37) evaluated cognitive abilities, 24% (n=16) evaluated emotional regulation, 13% (n=9) evaluated motivation, 9% (n=6) evaluated stress appraisal, 13% (n=13) evaluated behavior, and 43% (n=29) evaluated mental health status. Over half (52%) (n=35) of the tools included social factors: 12% (n=8) evaluated community factors, 28% (n=19) evaluated living situations, 12% (n=8) evaluated leisure, 16% (n=11) evaluated social status, 13% (n=9) evaluated social connections, and 13% (n=9) evaluated social support (friends/family). Contextual factors were assessed by 78% (n=52) of tools: 43% (n=29) evaluated personal context (life goals, beliefs, past experience, expectations, attitudes, financial resources), 31% (n=21) evaluated social context (family and friends, and local culture), 64% (n=43) evaluated temporal context (stage in life, stage in illness), and 39% (n=26) evaluated physical context (actual environment person is situated, use of assistive devices).

Figure 2 depicts the domains that were included in each frailty screening tool. Figure 3 offers an overview of how frailty screening tools assess frailty based on domains. Table 2 provides the name and reference for frailty screening tools that included all four domains of health using the biopsychosocial model proposed by Lehman *et al*. and Wade and Halligan.[11,12]

TABLE 1.
Domain mapping framework

Biological Factors

Individual Factors	Nutrition	Medical Conditions	Physical Abilities
Measurements of the person that are objective (age, sex, BMI, weight, ethnicity)	Nutritional habits including micro/macro nutrient deficiencies, unexpected weight loss/gain, appetite patterns, alcohol consumption, difficulty eating	Chronic conditions, primary conditions, and acute illness that affect the biological systems of the body, continence concerns, sleep patterns, hearing and vision concerns, polypharmacy, pain	Functional capacity to complete Instrumental Activities of Daily Living (IADLs) or Activities of Daily Living (ADLs), risk of falls/falls history, strength, mobility, fatigue

Psychological Factors

Self-perception	Cognitive Abilities	Emotional regulation	Motivational	Stress Appraisal	Behavioural	Mental Health
Self-perceived health status, health attitudes, perceived health lifestyle	Cognitive impairment, dementia, Alzheimer's disease, memory concerns, thinking/attention issues, communication concerns, worsening of decision makings	Loneliness, sadness, irritability, emotional isolation, mood	Pessimism, losing confidence, difficult starting activity, lost of interest in pleasure	Fears, feeling overwhelmed, response to stress, coping abilities	Substance use and abuse	Depression, anxiety, feeling unhappy, feeling rejected, feeling unworthy, psychiatric complaints

Social Factors

Community	Living	Leisure	Social Status	Social Connections	Family/Friend Support
Health-care utilization, use of coordinated care services, neighborhood, public services, transportation	Living situation—alone, with spouse/friend or family. Housing conditions. Housebound.	Ability to do leisure activities, withdrawal from activities	Socioeconomic status, financial status, education, social role, life events	Social network, people who are trusted, social vulnerability, change in social functioning	Family problems, social support, informal care

Contextual Factors

| Personal	Social	Temporal	Physical
Life goals and lifestyle, past experience, beliefs and expectations, attitudes, financial resources, other resources	Local culture—family, friends, work colleagues. General culture—laws, rights, duties, etc. Expectations, attitudes, resources	Stage in life—age and associated factors (family commitment/support, resources available, expectations, responsibilities, employment). Stage in Illness—time since onset, in context of natural history.	Actual environment, peri-personal (clothes, aides, etc.), local (house, larger equipment), community (locality, transport), people as helpers
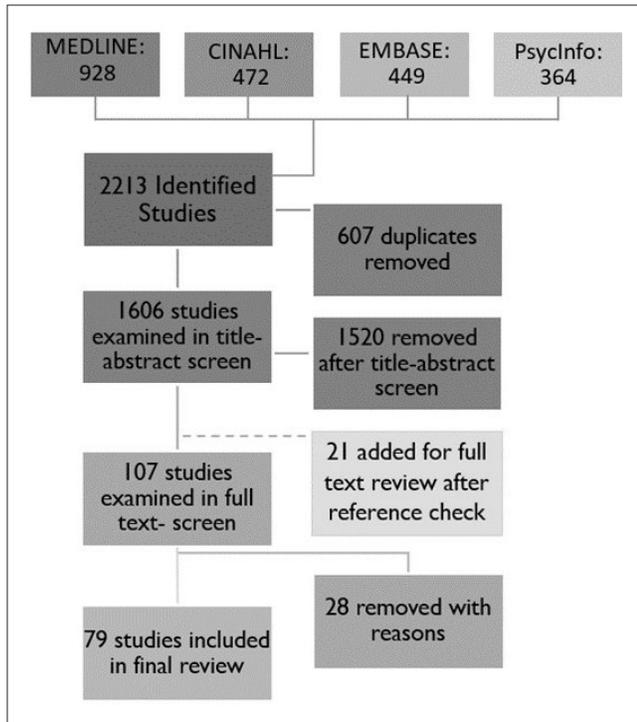
FIGURE 1. PRISMA flow chart

With regard to the comprehensiveness of the tools, 43% (n=28) examined all domains in some manner, and 33% (n=22) assessed three domains. Of the tools which assessed three domains, one assessed biological, psychological, and social factors; 27% (n=6) assessed biological, social and contextual factors; and 68% (n=15) assessed biological, psychological, and contextual factors. The tools which only assessed two factors (12%; n=8) all evaluated biological factors; of these, 38% (n=3) assessed biological and contextual factors, and 63% (n=5) evaluated biological and psychological factors. The tools which assessed one factor (13%; n=9) all considered only biological factors.

DISCUSSION

This review identified 67 frailty screening tools measuring a magnitude of items. Even within broad domains (biological, psychological, social, and contextual factors) specific components differed. Current literature shows that frailty is conceptualized in different ways, likely the cause for the multiplicity of screening tools published, as each tool includes different factors according to the stated conceptualization. Most often frailty is conceptualized either as a frailty syndrome/phenotype or as a frailty index.[14]

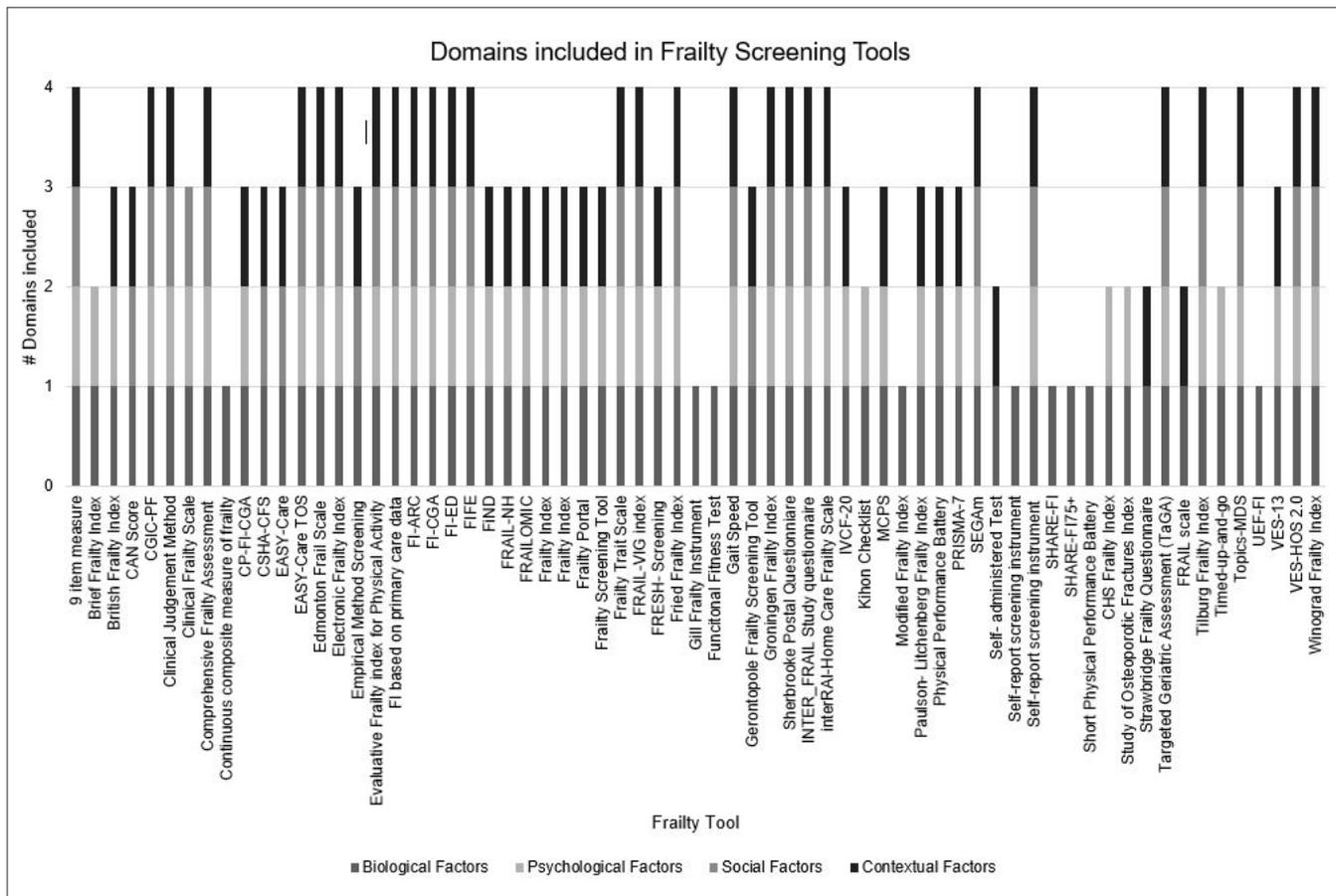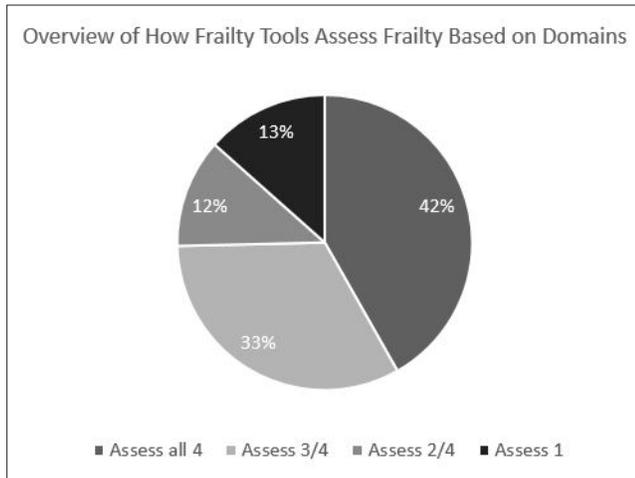

FIGURE 2. Domains included in frailty screening tools

FIGURE 3. Overview of how frailty tools access frailty based on domains

TABLE 2.
Frailty screening tools assessing all four domains of the biopsychosocial model

Frailty Tool	Reference
9 item measure[27]	Ravaglia et al. 2008
CGIC-PF[28]	Studenski et al. 2004
Clinical Judgement Method[29]	Brody et al. 2002
Comprehensive Frailty Assessment[30, 31]	DeWitte et al. 2013
	DeWitte et al. 2013
EASY-Care TOS[32, 33]	van Kempen et al. 2013
	van Kempen et al. 2014
Edmonton Frail Scale[34, 35]	Hilmer et al. 2009
	Rolfson et al. 2006
Electronic Frailty Index[36]	Clegg et al. 2016
Evaluative Frailty index for Physical Activity[37]	de Vries et al. 2013
FI based on primary care data[19]	Drubbel et al. 2013
FI-ARC[38]	Burn et al. 2018
FI-CGA[39 40]	Jones et al. 2005
	Jones et al. 2004
FI-ED[41]	Brousseau et al. 2018
FIFE[42]	Tocchi et al. 2014
Frailty Trait Scale[43]	Garcia-Garcia et al. 2014
FRAIL-VIG index[44]	Amblas-Novellas et al. 2018
Fried Frailty Index[45]	Kim et al. 2014
Gait Speed[46]	Castell et al. 2013
Groningen Frailty Index[47-49]	Peters et al. 2012
	Daniels et al. 2012
	Metzelthin et al. 2010
Sherbrooke Postal Questionnaire[48-49]	Daniels et al. 2012
	Metzelthin et al. 2010
INTER_FRAIL Study questionnaire[50]	Di Bari et al. 2014
interRAI-Home Care Frailty Scale[51]	Morris et al. 2016
SEGAm[52,53]	Oubayaa et al. 2014
	Oubayaa et al. 2017
Self-report screening instrument[54]	de Souto Barreto et al. 2012
Targeted Geriatric Assessment (TaGA)[55]	Aliberti et al. 2018
Tilburg Frailty Index[48,49,56-58]	Daniels et al. 2012
	Metzelthin et al. 2010
	Gobbens et al. 2017
	Gobbens et al. 2009
	Andreasen et al. 2015
Topics-MDS[18]	Lutomski et al. 2013
VES-HOS 2.0[59]	Beckett et al. 2017
Winograd Frailty Index[60]	Winograd et al. 1991

A frailty syndrome is considered a defined set of signs and symptoms, often including phenotypic measurements such as sarcopenia or other biological markers of health.[14,8] The syndrome is considered a "pre-disability" marker whereby, as functional status worsens, a patient is moved from frailty to disability.[14] This review has demonstrated a consensus on the importance of the biological determinants of frailty as observed in their inclusion of frailty screening. All screening tools included biological factors in some capacity (n=67) such as nutrition, medical conditions, physical/functional capacity, or individual factors (age, sex, BMI, etc.). This is unsurprising given the physiological undertones of the major conceptualizations of frailty.[15] This study found that 63 of the 67 tools identified performance indicators, such as gait speed, grip strength, and functional capacity, and these were often used as measurement components in the phenotypic conceptualization of frailty assessment.[14,8]

Alternatively, the frailty index approach is based on an 'accumulation of deficits' model, where health deficits such as primary or chronic diseases, ability to complete activities of daily living, instrumental activities of daily living, and mobility are tabulated to create a score.[8] Since a body of research has highlighted that deficits or performance-based indicators of frailty are determined by psychological factors such as cognitive impairment or mental health,[8] it is promising that 49 of the 67 tools identified assessed psychological components.

The conceptualization of frailty has evolved over the past decades, and these conceptualizations do not always include social considerations.[8] Collard et al. had found that broader or more holistic conceptualizations of frailty,[1] for example including factors such as cognition or social aspects, produced statistically significant increases in frailty prevalence rates versus narrower definitions. However, social factors were identified in only 35 of the 67 tools (n=52%). Social factors most often included in the assessment of frailty were living arrangements and social status. Living arrangements were evaluated in 19 of the 67 tools (n=28%) and social status in

11 out of 67 tools (n=16%). Living situations such as institutionalization or living alone have previously been linked to frailty.[3] Specifically, the literature indicates that frailty is linked to increased risk of institutionalization often caused by an increased dependence on activities of daily living and other self-care activities.[16] Similarly, it is well accepted that social status, including education and economic position, impacts health through behaviour, access to health care, and access to affordable and safe housing.[17] Socioeconomic status has also been linked to cognitive functioning, material deprivation, and increased risk of falls.[7] With the numerous links between social status and overall health, as well as frailty risk, it is disappointing that it was only included in the evaluation of frailty for 16% of frailty screening tools. Inclusion of such items could help to identify individuals at risk for frailty sooner.

While the inclusion of more holistic factors within many frailty screening tools is promising for more accurate and earlier detection and intervention for frailty, researchers should be concerned about the number of tools that exist to assess frailty status. Understanding the potential benefits of routine screening practices within primary care settings on overall health and positive patients-centred outcomes,[14] choosing the "right" tool may prove difficult given the vast number of tools that exist. Frailty has been consistently linked to holistic factors, and results from this study indicate numerous tools that will touch on biological, psychological, social, and contextual factors related to health (n=28). Until a consensus on frailty is reached, researchers and clinicians trying to decipher which tool to use should pay close attention to how authors conceptualized frailty and how they evaluate frailty, in order to choose the best tool for their unique needs.

This comes down to understanding the purpose in screening for frailty status and, specifically, what type of information is required. Frailty screening tools exist for use in specific populations, although not included in this study, as well as different settings, and modes of administration. Self-report tools may be helpful for individuals unable to travel to clinicians, or researchers who have participants across broad geographic regions. Other tools are intended for use in emergency room settings, long-term care settings, and primary care settings. Future research should examine which tools would be best suited for use in various clinical settings, and how scores can be compared across tools to improve consistency and give better meaning to scores. However, frailty screening tools must also be valid and reliable to ensure consistency in this process to identify all individuals living with frailty. Elsewhere there is work which reports on the psychometric properties of the tools identified in this domain mapping review.

Frailty tools should lead to clear action,[14] but research is limited in understanding what the next steps should be. The ambiguity surrounding frailty perpetuates this problem. While there is continued debate in how frailty in defined, there remains limited opportunity to truly understand how interventions can improve outcomes for patients. Conceptualizations can either be too vague or too specific. For example, relating frailty only to vulnerability[18] can make defining interventions to improve frailty difficulty, as it lacks context. Alternatively, if frailty is defined too narrowly, with reference to specific chronic diseases or conditions,[19] individuals at risk for adverse outcomes but who do not have the specific conditions may be overlooked. Frailty consensus would provide significant support to better outlining actionable items. Currently, with so many tools assessing various aspects of health, it is difficult to create actionable items that would make consistent meaningful changes in patients' lives. Future research should focus on understanding which tools are most appropriate in different care settings, to ensure the needs of patients are correctly identified and clear actionable items can be prescribed. Ideally, one tool would be identified as appropriate for use across various settings so that comparisons can be made to the scores obtained.

One consistent frailty screening tool could also be implemented for routine screening practices. Routine frailty screening may be used to determine domains of health that require further investigation and may allow practitioners to observe more subtle changes sooner. As mentioned, Collard et al. argued that screening should assess each domain separately to better understand the needs of patients[1] and, while this approach would have merit, the practical use of multiple screening tools within primary care settings is questionable. Health-care providers have limited time with patients and use of multiple screening tools may be too time-consuming, as has been found with comprehensive geriatric assessments.[20] Instead, regular frailty screening may prove more effective as a routine health monitoring process, and may identify areas of concern across health domains sooner to provide appropriate interventions or solutions.

Previous reviews by Sutton et al., Sutorius et al., Clegg et al., Pialoux et al. captured 38, 10, 7, and 10 tools respectively,[21-24] while this review identified 67. This allowed for a broader evaluation of frailty screening tools, and a more accurate representation to the research and clinical communities of how many tools exist. Despite this increase in the number of tools identified, the search may not have captured all available tools. While bibliographies of previous systematic reviews were checked for additional tools not captured in the systematic search, each individual article was not reference-checked. This is a limitation which could have influenced the number of tools identified. There may be tools that are in use yet unpublished, published in a language other than English, or not accessible to authors. Our study also chose to exclude tools which assessed frailty in specific populations such as cancer, cardiac, or respiratory patients, and patients with cognitive impairments. These criteria excluded known tools such as the simple prognostic risk score for psychogeriatric patients,[25] or FRAIL-NH in long-term care facilities[26] which evaluates frailty in specific subpopulations.

A quality assessment was not completed for this manuscript. The primary objective was to identify and describe the contents of frailty screening tools as opposed to grading the quality of their development or psychometric properties.

This study followed guidelines from Grant and Booth[9] for a systematic search and review. While this methodology incorporates aspects of a systematic review, such as the development of eligibility criteria, data extraction charts, and method of analysis a priori, the manuscript placed importance on outcomes not associated with a traditional systematic review.[9] No protocol was published for this research. However, to improve methodological rigour, the authors utilized the PRISMA guidelines for systematic reviews[10] as the backbone for reporting results.

CONCLUSION

The screening tools identified in this review consider multiple health domains related to frailty. When screening and assessment methods reflect holistic conceptualizations to health, there may be greater opportunity to identify health-related concerns sooner, particularly when screening is completed on a routine basis. Holistic tools provide a foundation to identify frailty earlier and, thus, intervene sooner with patient-centred options. Earlier detection leads to the opportunity for earlier intervention and promotes a space for improved health outcomes.

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CONFLICT OF INTEREST DISCLOSURES

The authors declare that no conflicts of interest exist.

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