Frailty inclusive care in acute and community-based settings: a systematic review protocol

Carmel L. Montgomery, Gareth Hopkin, Sean M. Bagshaw, Erin Hessey and Darryl B. Rolfson

Abstract

Background: Frailty is a known risk factor for an array of adverse outcomes including more frequent and prolonged health services use and high health care costs. Aging of the population has implications for care provision across the care continuum, particularly for people living with frailty. Despite known risks associated with frailty, there has been limited research on care pathways that address the needs of persons living with frailty. Our study aims to review and examine, in a rigorous way, the quality of evidence for multi-component interventions and care pathways focused on frailty.

Methods: A comprehensive electronic search strategy will be used to identify studies that evaluate multi-component interventions or care pathways for persons living with frailty. The search strategy will include terms for frailty, multi-component interventions, effectiveness, and cost effectiveness applied to the following databases: MEDLINE (OVID), EMBASE (OVID), CINAHL (EBSCO), Cochrane Central Register of Controlled Trials (CENTRAL), and Cochrane Database of Systematic Reviews. An adapted search for Google Scholar and gray literature databases will also be used. References of included studies will be hand-searched for additional citations of frailty-inclusive care. Known experts and corresponding authors of identified articles will be contacted by email to identify further eligible studies. Risk of bias will be assessed using the Effective Public Health Practice Project Quality Assessment tool. Data will be extracted from eligible studies and it is anticipated that narrative analysis will be used. If studies with sufficient homogeneity are found, then pooled effects will be reported using meta-analysis.

Discussion: This review will appraise the evidence currently available on multi-component frailty interventions. Results will inform on clinical pathway development for people living with frailty across the care continuum and will guide future research to address gaps in the literature and areas in need of further development.

Systematic review registration: PROSPERO CRD42020166733

Keywords: Frailty, Multi-component interventions, Cost effectiveness
Background
The general health and functional status of patients prior to acute illness and other stressors are accepted as important determinants of hospital outcomes [1, 2]. This status can be captured by measuring frailty, an age-related state of increased vulnerability with disproportionate changes in health status in response to stressors [3]. This creates the opportunity to develop and implement care protocols that are tailored to the health needs of persons who live with frailty.

As the worldwide population ages, the associated increase in prevalence of frailty across the care continuum presents urgent challenges to providing consistently appropriate care. Recent findings from cohort studies have shown prevalence of frailty in the Canadian adult community population is 8-24%, increasing as age advances from 2% (18-34 years) to 20% (≥65 years) [4, 5]. Frailty is common in assisted living environments (29%), and among adults admitted to ICU (28-32%) [6–9]. Frailty in hospitalized patients has been associated with gradient increases in hospital mortality, intensity of organ support, frequency and duration of health services use, and cost, when compared to non-frail patients [8–10].

Despite knowledge that frailty presents high risk for suboptimal outcomes, development and evaluation of comprehensive frailty interventions appears limited to specific circumstances such as improving patient flow after surgery (enhanced recovery after surgery [ERAS]), addressing frailty-related diseases or disability (e.g., delirium, dementia, depression), and providing focused interventions (e.g., nutrition, exercise) in acute and community-based care settings. The opportunity to view frailty as a multi-system syndrome is often overlooked by generic pathways where aspects of frailty are entirely unnoticed or assumed to be addressed by broad criteria such as chronological age. Frailty inclusive care, as defined herein, is an approach to care in any setting that starts with authentic frailty case-finding, followed by further assessment of the underlying vulnerabilities (components), and then leading to advance care planning, general measures to prevent or slow progression, and specific steps to address frailty components. Frailty inclusive care interventions may be generic, or may be specific to medical condition or care setting.

The primary aim of this project is to rigorously examine and document the quality of evidence for multi-component interventions (e.g., frailty-inclusive care pathways) encompassing the broader patient journey through both community and hospital care. In so doing, we will be mindful of a variety of frailty constructs and measures, and the ways that frailty inclusive care has been operationalized using different frailty assessment measures, evaluated based on any comparators and outcomes across patient populations. This will directly inform further development and implementation of frailty-specific recommendations as part of a larger program of work in this area.

Methods/design
The full systematic review protocol is registered with the International Prospective Register of Systematic Reviews (PROSPERO) (ID CRD42020166733, April 28, 2020). A recent search of PROSPERO and the Cochrane Library indicated there were no registered reviews focused on the proposed topic. A Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) checklist is included as an additional file [11] (Additional file 1).

Search methodology and screening
The search strategy will be developed by an information specialist, in partnership with the broader review team and peer-reviewed by a second information specialist. The initial search strategy will be translated for use across bibliographic databases and web search engines. We will identify potentially relevant studies by searching the following bibliographic databases from 2000 onwards (i.e., when frailty became a term used in research) in all languages, using a combination of keywords (i.e., free text) and MeSH terms: MEDLINE (OVID), EMBASE (OVID), CINAHL (EBSCO), Cochrane Central Register of Controlled Trials (CENTRAL), and Cochrane Database of Systematic Reviews (CDSR) (Table 1).

Other searches and strategies will include Google Scholar; ProQuest Dissertation and Theses Global; World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP) and clinicaltrials.gov for ongoing trials; published abstracts; and conference proceedings for 2 years prior to search date. An a priori list of websites which may contain eligible studies that have not been indexed will also be reviewed (Table 2).

Citations identified by the searches will be de-duplicated in EndNote (Clarivate Analytics, v.9), then uploaded to a Covidence (Veritas Health Innovation, Melbourne, Australia) library. Studies reported in languages other than English will be translated to English using Google Translate [12]. Two reviewers will independently screen the titles and abstracts of studies identified by the search (i.e., primary screening). Studies that meet the predetermined eligibility criteria from title and abstract review will undergo screening of full text (i.e., secondary screening) by two independent reviewers. Any disagreements will be resolved by consensus or the decision of a third party.

Study selection
We will include studies in any clinical setting that use an established frailty measure for case-finding. To
### Table 1  Search strategy—Medline

| #  | Searches                                                                 |
|----|---------------------------------------------------------------------------|
| 1  | Frail Elderly/                                                             |
| 2  | Frailty/                                                                   |
| 3  | Geriatric Assessment/                                                      |
| 4  | Sarcopenia/                                                                |
| 5  | (frail* or nonfrail*).tw,kf.                                              |
| 6  | (Fried* adj2 (definition or index or phenotyp* or scor*)).tw,kf.           |
| 7  | (functional-status and (low or poor*)).tw,kf.                             |
| 8  | (geriatric adj2 (assess* or evaluat* or screen*)).tw,kf.                  |
| 9  | sarcop?eni*.tw,kf.                                                        |
| 10 | or/1-9 [MeSH & Keywords for Frailty]                                       |
| 11 | Clinical Protocols/                                                       |
| 12 | Critical Pathways/                                                        |
| 13 | Enhanced Recovery After Surgery/                                          |
| 14 | Patient Care Planning/                                                    |
| 15 | ((care or clinical or critical) adj protocol*).tw,kf.                     |
| 16 | (enhanced-recovery adj2 (path* or program* or protocol* or surg*)).tw,kf. |
| 17 | eras.tw,kf.                                                               |
| 18 | erp*.tw,kf.                                                               |
| 19 | (fasttrack* or fast-track*).tw,kf.                                         |
| 20 | ((multicomponent or multi*-component* or multidimens* or multi-dimens* or multimodal or multi-modal) adj2 (intervention* or program*)).tw,kf. |
| 21 | pathway*.tw,kf.                                                           |
| 22 | (rapid* adj2 recover*).tw,kf.                                              |
| 23 | or/11-22 [MeSH & Keywords for Pathways]                                   |
| 24 | 10 and 23                                                                 |
| 25 | *economics/                                                               |
| 26 | exp **Costs and Cost Analysis**/                                          |
| 27 | (economic adj2 model*).mp.                                                |
| 28 | (cost minimi* or cost-utilit* or health utilit* or economic evaluation* or economic review* or cost outcome or cost analys?s or economic analys?s or budget* impact analys?s).ti,ab,kf,kw. |
| 29 | (cost-effective* or cost-benefit or costs).ti,kf,kw.                      |
| 30 | (life year or life years or qaly* or cost-benefit analys?s or cost-effectiveness analys?s).ab,kf,kw. |
| 31 | (cost or economic*).ti,kf,kw. and (costs or cost-effectiveness or markov).ab. |
| 32 | or/25-31 [Adapted from the CADTH Narrow Economic Filter]                   |
| 33 | randomized controlled trial.pt.                                           |
| 34 | clinical trial.pt.                                                        |
| 35 | randomi?ed.tw.                                                           |
| 36 | randomly.tw.                                                             |
| 37 | trial.tw.                                                                 |
| 38 | groups.tw.                                                                |
| 39 | or/33-38 [Adapted from the Cochrane Filter for RCTs]                      |
| 40 | (pretest* or pre-test*).tw,kf.                                            |
| 41 | pre-post-test*.tw,kf.                                                     |
| 42 | (quasiexperimental or quasi-experimental).tw,kf.                          |
| 43 | repeated-measur*.tw,kf.                                                  |
improve consistency, a table of 93 eligible frailty measures was compiled from 13 literature reviews over the past decade, and classified based on the model of frailty (i.e., physical frailty, cumulative deficit, multidimensional, geriatric syndromes) and the method of administration (i.e., clinician-report, clinician-judgment, self-report, performance-based, anthropometric, calculated) [13–25] (Table 3). To qualify as multi-component, more than one intervention must be present, targeting different components of frailty. The multi-component intervention may include advance care planning, general measures to prevent or slow progression (e.g., a combined exercise and nutritional program), and detailed steps to address frailty. Specific interventions responding to components of frailty identified in particular individuals may include problems with cognition, mood, balance and mobility, continence, medications, and social support.

Eligibility criteria

Population
The population of interest is all adult patients (≥18 years) defined as living with frailty, assessed by a validated frailty measurement, in acute, intermediate, or community-based care settings.

Intervention
We will identify multi-component interventions that have been developed and evaluated for their impact on individuals living with frailty, and the health services that comprise their care. Any intervention that can be applied to the broader patient journey through both community and hospital care will be included. Examples of interventions of interest include enhanced recovery after surgery (ERAS), multi-component fast track surgery programs or “prehabilitation,” hospital to community transition processes, or care pathways that identify frailty and trigger comprehensive geriatric assessment (CGA) to address components of frailty. Interventions (e.g., pharmacological treatments, rehabilitative therapies, nutritional counseling) that are implemented independently or do not influence the overall care plan will be excluded, unless they are used in combination. Screening for frailty without intervention or CGA without the use of frailty measures to inform a personalized assessment or care plan will be excluded.

Comparisons
All comparisons will be included. We anticipate that in most cases usual care within hospital and/or the community will be compared to the intervention.

Outcomes
Outcomes include those associated with evaluation of multi-component frailty care implementation, including process measures (e.g., measures of fidelity; acceptability; feasibility) targeting any person living with frailty, health service utilization (i.e., readmission, contact with services), health outcomes (e.g., adverse events, morbidity, mortality, institutionalization), economic outcomes (e.g., cost, cost-effectiveness), and patient-oriented measures (e.g., quality of life, well-being, satisfaction with care, caregiver burden).

Study designs
We will consider all randomized trials (e.g., patient level or cluster), non-randomized controlled trials (e.g., before/after and time-series), observational studies, and cross-sectional studies. Publications will be excluded if a single intervention or no intervention was applied, no evaluation was conducted, if they contain no valid
| Measure                                                                 | Frailty model         | Scoring method                                      |
|------------------------------------------------------------------------|-----------------------|-----------------------------------------------------|
| 11 item Frailty Index [26]                                              | Multidimensional      | Predefined fields                                   |
| 5 item Frailty Index (mFI) [27]                                         | Multidimensional      | Predefined fields                                   |
| Balance and Muscle Strength [28]                                       | Physical frailty      | Functional performance and self-report              |
| Beaver Dam Eye Study Measure [29]                                       | Physical frailty      | Performance                                          |
| Brief Clinical instrument to Classify Frailty [30]                     | Multidimensional      | Clinician report                                    |
| Brief Frailty Index (bFI) [31]                                          | Multidimensional      | Self-report and performance                         |
| Brief Risk Identification of Geriatric Health Tool (BRIGHT) [32]       | Multidimensional      | Self-report                                          |
| British Frailty Index [33]                                             | Cumulative deficit    | Predefined fields                                   |
| Care Partner derived Frailty Index based on CGA (CP-FI-CGA) [34, 35]  | Cumulative deficit    | Care partners using predefined fields               |
| Chair stands [36]                                                     | Physical frailty      | Performance                                          |
| Chinese Canadian Study of Health and Aging Clinical Frailty Scale Telephone Version [37] | Multidimensional      | Judgment-based                                       |
| Clinical Frailty Scale (CFS) [5]                                       | Multidimensional      | Judgment-based                                       |
| Clinical global impression of change in physical frailty (CGIC-PF)     | Cumulative deficit    | Predefined fields                                   |
| Comprehensive Assessment of frailty [38]                               | Physical frailty      | Performance, self- and clinician report             |
| Comprehensive frailty assessment instrument (CFAI) [39]                | Multidimensional      | Self-report                                          |
| Continuous Composite Measure of Frailty [40]                           | Physical frailty      | Performance, self-report                            |
| Continuous frailty scale [41]                                          | Physical frailty      | Self-report and Performance                         |
| EASYcare - short version [42]                                           | Multidimensional      | Clinician report                                    |
| EASY-Care Two-step Older persons Screening—Easy-Care TOS [43]          | Multidimensional, CGA | Clinician report                                    |
| Edmonton Frail Scale (EFS) [44]                                         | Multidimensional, CGA | Functional performance, self-report, and clinician report |
| Electronic Frailty Index (eFI) [45]                                     | Cumulative deficit    | Predefined fields                                   |
| Emergency General Surgeries Frailty Index—EGS-FI [46]                  | Multidimensional      | Clinician report                                    |
| Evaluative Frailty Index for Physical Activity (EFIP) [47]             | Cumulative deficit    | Clinician report                                    |
| Fatigue, Resistance, Ambulation, Illness, Loss of Weight (FRAIL) [48]  | Physical frailty      | Self-report                                          |
| Forced Expiratory Volume (FEV1) [49]                                    | Physical frailty      | Performance                                          |
| Frail Non Disabled (FIND) [50]                                          | Physical frailty      | Self-report                                          |
| FRAIL—Frailty and Autonomy Scoring Instrument of Leuven [51]           | Multidimensional      | Self-report                                          |
| Frailty Assessment for Care Planning Tool (FACT) [52-54]               | Multidimensional, CGA | Clinician report                                    |
| Frailty GIR Evaluation (FRAGRE) [55]                                    | Multidimensional      | Clinician report                                    |
| Frailty Index (Fi) [56, 57]                                             | Cumulative deficit    | Predefined fields                                   |
| Frailty index derived from comprehensive geriatric assessment (FI-CGA)  | Cumulative deficit, CGA | Trained specialists using predefined fields         |
| Frailty Index for Elders (FIFE) [59]                                    | Multidimensional      | Clinician report                                    |
| Frailty Phenotype, CHS index [60]                                       | Physical frailty      | Self-report and performance                         |
| Frailty predicts death One year after Elective CArdiac Surgery Test (FORECAST) [61] | Physical frailty      | Performance, self-, and clinician report           |
| Frailty Screening Questionnaire (FSQ) [62]                              | Physical frailty      | Self-report                                          |
| Frailty Screening Tool [63]                                             | Multidimensional, CGA | Self- and clinician report                          |
| Frailty Trait Scale (FTS) [64]                                          | Physical frailty      | Performance                                          |
| Functional Ability Index (FA Index) in the LUCAS Cohort [65]            | Physical frailty      | Self-report                                          |
| Functional assessment screening package [66]                            | Multidimensional      | Predefined criteria                                 |
| G-8 Geriatric Screening Tool [67]                                       | Multidimensional      | Self-report                                          |
Table 3 Valid frailty measures (Continued)

| Measure                                                                 | Frailty model        | Scoring method          |
|-------------------------------------------------------------------------|----------------------|-------------------------|
| G8 Questionnaire [68]                                                   | Multidimensional, CGA| Clinician report        |
| Gait Speed Test [GST] [69]                                              | Physical frailty     | Performance             |
| Geriatric Functional Evaluation (GFE) [70]                               | Multidimensional     | Self-report             |
| Gérontopôle Frailty Screening Tool (GFST) [71]                          | Physical frailty     | Clinician report        |
| Groningen Frailty Indicator (GFI) [72]                                   | Multidimensional     | Self-report             |
| Guilley Frailty Instrument [73]                                          | Multidimensional     | Self-report             |
| Hand grip strength [74]                                                 | Physical frailty     | Performance             |
| Health Status Form – HSF [75]                                           | Multidimensional     | Self-report             |
| Identification of Seniors at Risk (ISAR) [76]                           | Multidimensional     | Self-report             |
| Inactivity and Weight Loss [77]                                          | Physical frailty     | Clinician report        |
| Índice de Vulnerabilidade Clínico-Funcional IVCF-20 [78]                | Multidimensional, CGA| Self-report             |
| Instrumento Multidimensional de rastreio da Sindrome da Fragilidade (IMSIFI) [79] | Multidimensional, CGA| Clinician report        |
| INTER-FRAIL Study Questionnaire [80]                                    | Multidimensional, CGA| Self-report             |
| Kaigo-Yobo CheckList [81]                                               | Multidimensional, CGA| Self-report             |
| Kihon Check-list (KCL) [82]                                              | Multidimensional, CGA| Self-report             |
| KLoSHA Frailty Index [83]                                               | Multidimensional, CGA| Clinician report        |
| Korean Frailty Index [84]                                               | Multidimensional, CGA| Clinician report        |
| Margliano-Cacciafesta polypathological scale (MCPS) [85]                | Multidimensional     | Clinician report        |
| Modelo Fried adaptado [86]                                              | Physical frailty     | Self-report             |
| Modified Frailty Score [87]                                             | Multidimensional     | Performance             |
| Modified Physical Performance Test (mPPT) [88]                          | Physical frailty     | Performance             |
| Multidimensional Prognostic Index (MPI) [89]                            | Multidimensional, CGA| Clinician-report        |
| Opasich Frailty Measure [90]                                            | Physical frailty     | Performance             |
| Physical frailty score [91]                                             | Physical frailty     | Performance             |
| Predictive Physical Frailty Score [92]                                  | Physical frailty     | Self- and clinician report, performance |
| PRISMA-7 [93]                                                           | Multidimensional     | Self-report             |
| Prognostic Frailty Risk Score [94]                                      | Multidimensional, CGA| Clinician report        |
| Prognostic Frailty Score [95]                                           | Multidimensional, CGA| Self-report and performance |
| Puts Frailty Criteria [96]                                              | Multidimensional     | Self-report and performance |
| Rapid Geriatric Assessment (RGA) [97]                                   | Physical frailty     | Self-report             |
| Reported Edmonton Frail Scale (REFS) [98]                               | Multidimensional, CGA| Clinician and self-report |
| Resident Assessment Instrument, Minimum Data Set (RAI-MDS) [99]         | Multidimensional, CGA| Clinician report and performance |
| Rothman Frailty Criteria [100]                                          | Multidimensional     | Self-report and performance |
| Schoevaerdts Index [101]                                               | Multidimensional, CGA| Clinician report        |
| SEGAm–Modified Short Emergency Geriatric Assessment [102]               | Multidimensional, CGA| Clinician report        |
measure of frailty or are limited to a study protocol or review of previous studies.

Quality appraisal

Studies selected for inclusion will be assessed for risk of bias by two independent reviewers using the Effective Public Healthcare Practice Project instrument to assess the quality of quantitative studies [121]. This instrument has been considered suitable for assessment of risk of bias in systematic reviews where randomized and non-randomized study designs were included [122, 123]. Disagreements will be resolved by consensus or adjudication of a third party. Summary scores from the instrument will inform synthesis of information and exploration of heterogeneity in study results [121, 124, 125].

Data extraction

A data extraction form will be developed and piloted on a sample of included records in Microsoft Office Excel (v. 2016, Microsoft Corporation, Redmond, WA) to ensure adequate capture of characteristics and findings of included studies. One reviewer will extract the data from each primary study independently, then another will verify the accuracy of the extracted data. Disagreements will be settled through discussion with a third author.

The following information will be extracted from each included study:

Study characteristics

Author, year, publication type, trial registration number, funding source, setting (country, system of health care, acute/community/primary care), theoretical framing, research question(s), aims of study, design, population, sample, recruitment procedure, outcome measures, test statistics, key findings, limitations as noted by authors and reviewers, conclusions as noted by authors, reviewer notes.

Population

Sample size, inclusion/exclusion, number of enrolled and analyzed, description of cases/controls, reasons for withdrawal, missing data, age, proportion female, ethnicity, reason for admission, frailty definition, measure/instrument to identify of frailty, training for frailty instrument application, co-morbidities (dementia, mild-cognitive impairment, known risk for/occurrence of post-treatment delirium, history of falls, occurrence/history of urinary infections/bedsores, other physical health diagnoses, malnutrition), subgroups analyzed in the study.

### Table 3 Valid frailty measures (Continued)

| Measure | Frailty model | Scoring method |
|---------|---------------|----------------|
| Self-report Screening Tool for Frailty [103] | Physical frailty | Self-report |
| Self-rated Health Deficits Index (HDI) [104] | Multidimensional | Self-report |
| SHARE Frailty Instrument [105] | Physical frailty | Self-report, calculator |
| SHARE Frailty Instrument 75+ [106] | Physical frailty | Self-report, calculator |
| Sherbrooke Postal Questionnaire (SPQ) [107] | Multidimensional, CGA | Self-report |
| Short physical performance battery (SPPB) [108] | Physical frailty | Performance |
| Strawbridge questionnaire [109] | Multidimensional | Self-report |
| Study of Osteoporotic Fractures (SOF) Index [110] | Physical frailty | Self-report and performance |
| Subset of Functional Status Questionnaire [111] | Multidimensional | Self-report |
| Three-City Study Frailty Criteria [112] | Multidimensional | Performance |
| Tilburg Frailty Indicator (TFI) [113] | Multidimensional, CGA | Self-report and performance |
| Timed Up and Go (TUG) [114] | Physical frailty | Performance |
| Trauma-Specific Frailty Index (TSFI) [115] | Cumulative deficit | Predefined fields |
| Triage Risk Screening Tool [116] | Multidimensional, CGA | Clinician report |
| Upper Extremity Function (UEF) Frailty [117] | Physical frailty | Performance |
| Vulnerable Elders Survey (VES-13) [118] | Multidimensional | Clinician report |
| Winograd Screening Instrument [119] | Physical frailty | Clinician report |
| Women’s Health Initiative Observational Study (WHI-OS) Multicomponent Measure [120] | Physical frailty | Self-report and performance |
**Intervention/strategy**

Intervention/strategy name, aim of intervention, intervention description, who delivered the intervention, professionals/others involved, intervention setting, intervention recipient, use of manual/guidelines for intervention, frequency of each intervention component, duration of each intervention component, assessment of fidelity, method of data collection, timing of data collection in relation to intervention, cost of intervention.

**Data analysis**

We anticipate a variety of study designs and methods of assessing complex interventions will pose challenges in conducting a meta-analysis. If a meta-analysis is not possible we will pool what data we can, reporting the limitations of our findings. In this case, we will describe findings in a narrative synthesis. To ensure a systematic approach to the narrative synthesis, the guidelines proposed by Cochrane will be adhered to [126]. The narrative will be structured according to study design, type and delivery of interventions, setting, and population. Similarities and differences between findings observed across studies and patterns in data will be outlined. Any data available will be transformed in attempts to find common descriptive and statistical formats for analysis. Within and between study differences will be explored for explanations of direction and size of effects of interventions. Effects of heterogeneity among studies will be discussed, particularly with respect to theoretical framing that may provide explanations for heterogeneity. Finally, the overall strength of the synthesis will be assessed by evaluating the risk of bias results, quality of the evidence, and an overall critical reflection on the synthesis methods [126].

If there are a sufficient number of similar interventions, effects will be pooled using random effects meta-analysis in RevMan (RevMan 5.3 Cochrane). Heterogeneity will be assessed both qualitatively to assess if meta-analysis should be used and measured formally using the I²-squared statistic if possible with publication bias assessed using funnel plots. If meta-analysis is used, the following subgroup analyses will be considered: age, setting (e.g., community-based care vs. acute care, teaching vs. community hospitals), and acute ward types (e.g., ICU, medicine, surgical, specialist geriatric units, outpatient, emergency department).

**Discussion**

Frailty is a relatively new term, and describes both the state of exaggerated vulnerability associated with age-related deficit accumulation, and the associated multidimensional syndrome. To be acceptable to clinicians and the patients they serve, frailty must meaningfully inform decisions about care. As the population ages, health care systems face growing numbers of patients with frailty who may derive less benefit or even more harm from aggressive interventions and invasive procedures while adding cost across the system [127, 128]. In present circumstances, where specialist geriatrician resources are limited, the entire health care workforce needs to be empowered with valid methods of screening for frailty and delivering bespoke models of care [129]. Frailty inclusive care pathways may provide useful guidance in the care of older patients living with frailty in hospital, intermediate and community settings, where clinicians may benefit from presentation of precise considerations in specific patient populations (e.g., primary care, emergency department, surgery) who transition between care settings. Consistent frailty screening and application of frailty-inclusive interventions through existing care pathways and routine care may provide meaningful context to all associated decisions and care provided for this vulnerable population.

**Limitations**

Despite our aging population and expected increased incidence of frailty across the care continuum, we expect that there will be limited evidence of evaluation of multi-component interventions aimed to improve care and outcomes for people living with frailty. We expanded the search strategy to maximize findings, although results may demonstrate heterogeneous study designs and frailty assessment methods, limiting our ability to pool data and make inferences for practice. Moreover, we did not include patient or public input in our protocol development and may have focused on a limited perspective of frailty inclusive care. Regardless of the potential limitations we are committed to finding evidence of frailty pathways with rigorous evaluation to inform future practice where possible.

**Conclusions**

Frailty-inclusive care interventions that can be incorporated into existing pathways for any disease or clinical setting are an essential part of care continuity for people living with frailty. This review will inform future work to develop and implement pathways aiming to improve the care received by this vulnerable population.

**Abbreviations**

CDSR: Cochrane Database of Systematic Reviews; CFS: Clinical Frailty Scale; CGA: Comprehensive Geriatric Assessment; CINAHL: Cumulative Index to Nursing and Allied Health Literature; EMBASE: Excerpta Medica Database; ICTRP: International Clinical Trials Registry Platform; ICU: Intensive care unit; MEDLINE: Medical Literature Analysis and Retrieval System Online; MeSH: Medical Subject Headings; PRISMA-P: Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols; PROSPERO: International Prospective Register of Systematic Reviews; SCN: Strategic Clinical Network; WHO: World Health Organization
Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s13643-021-01638-0.

Additional file 1: Additional Table 1. PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist

Acknowledgements
The authors acknowledge the following individuals whose input was essential to the completion of this protocol in support of the grant proposal: Marjan Abbasi, Liza Bialy, Diana Keto-Lambert, Rachel Khadaroo, Tara Landry, Sheny Khera, Jasneet Parmar.

Authors’ contributions
CLM and GH contributed to writing the draft manuscript. All authors contributed to protocol development. All authors read and approved the final manuscript. All authors confirm their responsibility for its present form. CLM is guarantor of the review.

Funding
Funding to support this review was provided by a grant from the Alberta Health Services Critical Care Strategic Clinical Network (SCN) 2019 Systematic Review competition. The Government of Alberta provided partial support for involvement by Dr. Montgomery and Dr. Hopkin in the study through a grant to the Network of Alberta Health Economists. The terms of the grants mean they are unrestricted and there was no oversight from the Government of Alberta or Critical Care SCN on the topic, methods, results, or interpretation of the study. There was no involvement of funding organizations in the decision to publish.

Availability of data and materials
Not applicable.

Declarations

Ethics approval and consent to participate
Ethics review is not required by the University of Alberta. The review targets previously published articles. No personally identifiable information will be obtained.

Consent for publication
Not applicable.

Competing interests
All authors report no financial relationships with any organizations that might have an interest in the submitted work in the previous 3 years; no other relationships or activities that could appear to have influenced the submitted work.

Carmel Montgomery is supported by a Network of Alberta Health Economists fellowship award and was a 2017 Canadian Frailty Network Interdisciplinary Fellow. Dr. Bagshaw holds a Canada Research Chair in Critical Care Nephrology and is a scientific director for the Alberta Health Services Critical Care Strategic Clinical Network. Dr. Rolfson was a key member of the research group that developed and validated the Edmonton Frail Scale.

Author details
1Institute of Health Economics, 1200 10405 Jasper Avenue, Edmonton, Alberta T5J 3N4, Canada. 2Department of Critical Care Medicine, Faculty of Medicine and Dentistry, University of Alberta, 2–124 Clinical Sciences Building, 11350 83 Ave, Edmonton, Alberta T6G 2G3, Canada. 3Critical Care Strategic Clinical Network, Alberta Health Services, Edmonton, Alberta, Canada. 4Division of Geriatric Medicine, Department of Medicine, Faculty of Medicine and Dentistry, University of Alberta, 1-198 Clinical Sciences Building, 11350 83 Ave, Edmonton, Alberta T6G 2G3, Canada.

References
1. Romero-Ortuno R, Wallis S, Biram R, Keevil V. Clinical frailty added to acute illness severity in predicting mortality in hospitalized older adults: an observational study. Eur J Intern Med. 2016;35:24–34. https://doi.org/10.1016/j.ejim.2016.08.033.
2. Kahlon S, Pederson J, Majumdar SR, Belga S, Lau D, Fradette M, Boyko D, Bakal JA, Johnston C, Padwal RS, McAlister FA. Association between frailty and 30-day outcomes after discharge from hospital. Can Med Assoc J. 2015;187(1):799–804. https://doi.org/10.1503/cmaj.150180.
3. Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. Lancet. 2013;381(9868):752–62. https://doi.org/10.1016/S0140-6736(12)62617-9.
4. Kehler DS, Ferguson T, Stammers AN, Bohm C, Arora RC, Duhamel TA, et al. Prevalence of frailty in Canadians 18–79 years old in the Canadian Health Measures Survey. BMC Geriatr. 2017;17(28). https://doi.org/10.1186/s12877-017-0423-6.
5. Rockwood K, Song X, MacKnight C, Bergman H, Hogan DB, McDowell I, Minns T, A global clinical measure of fitness and frailty in elderly people. CMAJ. 2005;173(3):489–95. https://doi.org/10.1503/cmaj.050051.
6. Hoover M, Rotermann M, Sannmirt C, Bernier J. Validation of an index to estimate the prevalence of frailty among community-dwelling seniors. Health Rep. 2013;24(9):10–7.
7. Hogan DB, Freiheit EA, Stain LA, Patten SB, Schmaltz HN, Rolfson D, Maxwell CJ. Comparing frailty measures in their ability to predict adverse outcome among older residents of assisted living. BMC Geriatr. 2012;12(1):56. https://doi.org/10.1186/1471-2318-12-56.
8. Bagshaw S, Stelfox H, McDermid R, Rolfson D, Tsuyuki R, Baig N, et al. Association between frailty and short- and long-term outcomes among critically ill patients: a multicentre prospective cohort study. CMAJ. 2014;186(2):E95–E102. https://doi.org/10.1503/cmaj.131063.
9. Montgomery CL, Zuege DJ, Rolfson DB, Opogeno H, Hudson D, Stelfox HT, Bagshaw SM. Implementation of population-level screening for frailty among patients admitted to adult intensive care in Alberta, Canada. Can J Anaesth. 2019;66(11):1310–9. https://doi.org/10.1007/s12630-019-01414-8.
10. Montgomery CL, Rolfson DB, Bagshaw SM. Frailty and the association between long-term recovery after intensive care unit admission. Crit Care Clin. 2018;34(4):527–47. https://doi.org/10.1016/j.ccc.2018.06.007.
11. Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015. Elaboration and explanation. BMJ. 2015;350:g6747.
12. Jackson JL, Kuriyama A, Anton A, Choi A, Fournier JP, Fradette M, Boyko D, Hogan DB, Freiheit EA, Stain LA, Patten SB, Schmaltz HN, Rolfson D, Maxwell CJ. Comparing frailty measures in their ability to predict adverse outcome among older residents of assisted living. BMC Geriatr. 2012;12(1):56. https://doi.org/10.1186/1471-2318-12-56.
13. Clegg A, Rogers L, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. CMAJ. 2005;173(3):489–95. https://doi.org/10.1503/cmaj.050051.
14. Romero-Ortuno R, Wallis S, Biram R, Keevil V. Clinical frailty added to acute illness severity in predicting mortality in hospitalized older adults: an observational study. Eur J Intern Med. 2016;35:24–34. https://doi.org/10.1016/j.ejim.2016.08.033.
15. Clegg A, Rogers L, Young J. Diagnostic test accuracy of simple instruments for identifying frailty in community-dwelling older people: a systematic review. Age Ageing. 2015;44(5):677–84. https://doi.org/10.1093/ageing/afv157.
16. Aguayo GA, Donneau AF, Vaillant MT, Schritz A, Franco OH, Stranges S, Malisoux L, Guillaume M, Witte DR. Agreement between 35 published frailty scores in the general population. Am J Epidemiol. 2017;186(4):420–34. https://doi.org/10.1093/aje/kwx061.
17. Ambagtsheer RC, Visvanathan R, Dent E, Yu S, Schultz TJ, Beilby J. Commonly used screening instruments to identify frailty among community-dwelling older people in a general practice (primary care) setting: a study of diagnostic test accuracy. J Gerontol A Biol Sci Med Sci. 2020;75(6):1134–42. https://doi.org/10.1093/gerona/gzbb260.
18. Apostolo J, Cooke R, Bobrowicz-Campos E, Santana S, Marcucci M, Cano A, et al. Predicting risk and outcomes for frail older adults: an umbrella review
of frailty screening tools. JIB Database System Rev Implement Rep 2017; 15(4):1154–208. https://doi.org/10.11124/JIBSRIR-2016-003018.

19. Bouillon K, Kvilimaki M, Hamer M, Sabia S, Fransson EI, Singh-Manoux A, Gale CR, Batty GD. Measures of frailty in population-based studies: an overview. BMC Geriatr. 2013;13(1):64. https://doi.org/10.1186/1471-2318-13-64.

20. de Vries NM, Staal JB, van Ravensberg CD, Hobbelink JS, Olde Rikkert MG. Nijhuis-van der Sanden MW. Outcome instruments to measure frailty: a systematic review. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

21. Faller JW, Pereira DDN, de Souza S, Nampo FK, Orlandi FS, Matumoto S. Instruments for the detection of frailty syndrome in older adults: a systematic review. PLoS One. 2019;14(4):e0216166. https://doi.org/10.1371/journal.pone.0216166.

22. Sutton JL, Gould RL, Daley S, Coulson MC, Butler AM, Nunn SP, Howard RJ. Psychometric properties of multicomponent tools designed to assess frailty in older adults: a systematic review. BMC Geriatr. 2016;16(1):55. https://doi.org/10.1186/s12877-016-0225-2.

23. Buta BJ, Walston JD, Godino J, Park M, Kalyani RR, Xue QL, Bandeen-Roche K, Varadhan R. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2016;26:53–61. https://doi.org/10.1016/j.arr.2015.12.003.

24. Dent E, Kowal P, Hoogendijk EO. Frailty measurement in research and clinical practice: a review. Eur J Intern Med. 2016;31:10–10. https://doi.org/10.1016/j.ejim.2016.03.007.

25. Stenberg SA, Wenshof Schwartz A, Karunanandan a, Bergman H, Mark CA. The identification of frailty: a systematic literature review. J Am Geriatr Soc. 2011;59(11):2297–38. https://doi.org/10.1111/j.1532-5415.2011.03597.x.

26. Velanovich V, Antione H, Swartz A, Peters D, Rubinfeld I. Accumulating deficits model of frailty and postoperative mortality and morbidity: its application to a national database. J Surg Res. 2013;181(1):104–10. https://doi.org/10.1016/j.jss.2013.01.021.

27. Chimukangana M, Helm MC, Fielich MJ, Bosler ME, Rein LE, Szabo A, Gould JC. A S-item frailty index based on NSOP data correlates with outcomes following paraesophageal hernia repair. Surg Endosc. 2017;31(6):2509–19. https://doi.org/10.1007/s00464-016-5253-7.

28. Dayhoff NE, Suhrheinrich J, Wigglesworth J, Topp R, Moore S. Performance depends on sensation, speed, balance, and psychological involvement and frailty. J Am Coll Surg. 2012;210(12):2326–32. https://doi.org/10.1016/j.jamcollsurg.2011.10.005.

29. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

30. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

31. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

32. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

33. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

34. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

35. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

36. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

37. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

38. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

39. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.

40. Cesari M, Demougeot L, Boccalon H, Guyonnet S, Abellan Van Kan G, Vellas B, et al. Frailty assessment instruments: systematic characterization of the uses and contexts of highly-cited instruments. Ageing Res Rev. 2011;10(1):104–14. https://doi.org/10.1016/j.arr.2010.09.001.
58. Jones DM, Song X, Rockwood K. Operationalizing a frailty index from a standardized comprehensive geriatric assessment. J Am Geriatr Soc. 2004; 52(11):1929–33. https://doi.org/10.1111/j.1532-5415.2004.52521.x.

59. Tocchi C, Dixon J, Naylor M, Jean S, McCorkle R. Development of a frailty measure for older adults: the frailty index for elders. J Nurs Meas. 2014;22(2): 223–40. https://doi.org/10.1891/1060-3749.22.2.223.

60. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, Seeman T, Tracy R, Kop WP, Burke GI, McBurnie MA. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci. 2001;56(3):M146–56. https://doi.org/10.1093/gerona/56.3.M146.

51. Sundermann S, Dademasch A, Rastan A, Praetorius J, Rodriguez H, Walther T, Mohr FW, Falk V. One-year follow-up of patients undergoing elective cardiac surgery assessed with the Comprehensive Assessment of Frailty tool and its simplified form. Interact Cardiovasc Thorac Surg. 2011;13(2):119–23; discussion 23. https://doi.org/10.1053/j.ictvs.2010.11.084.

62. Ma L, Tang Z, Chan P, Walston JD. Novel Frailty Screening Questionnaire (FSQ) predicts 8-year mortality in older adults in China. J Frailty Aging. 2019; 8(1):3–8. https://doi.org/10.14283/jfa.2018.38.

66. Moore AA, Siu AL. Screening for common problems in ambulatory elderly: clinical confirmation of a screening instrument. Am J Med. 1996;100(4):438–43. https://doi.org/10.1016/S0002-9343(97)89520-4.

67. Bellera CA, Rainfray M, Mathoulin-Pelissier S, Mertens C, Delva F, Fonck M, et al. A new operational definition of frailty: the Frailty Trait Scale. J Am Med Dir Assoc. 2014;15(5):537 e1–13.

68. Dapp U, Minder CE, Anders J, Golgert S, von Renteln-Kruse W. Long-term prediction of changes in health status, frailty, nursing care and mortality in community-dwelling senior citizens-results from the Longitudinal Urban Cohort Aging Study (LUCAS). BMC Geriatr. 2014;14(1):1. https://doi.org/10.1186/1471-2318-14-14.

69. Moore AA, Siu AL. Screening for common problems in ambulatory elderly: clinical confirmation of a screening instrument. Arch Gerontol Geriatr. 2005;40(2):147–56. https://doi.org/10.1016/j.archger.2004.07.004.

70. Vellas B, Balard Y, Gillette-Guyonnet S, Abellan Van Kan G, Arrazola M, Guesdon J. Evaluation of the Groningen Frailty Indicator and the G8 questionnaire as screening tools for frailty in older patients with cancer. J Am Geriatr Soc. 2013;61(1):32–8. https://doi.org/10.1111/j.1532-5415.2012.04001.x.

71. Stanaway FF, Gnjidic D, Blyth FM, Le Couteur DG, Naganathan V, Waite L, Bitchik A, Van Fraeyenhove F, Vandebroek A, De Droogh E, Galdermans D, Hubbard PA, O’Meara MS, Woodhouse KW. Characterizing frailty in the clinical setting—a comparison of different approaches. Age Ageing. 2009; 38(1):115–9. https://doi.org/10.1093/ageing/afn252.

72. Brown M, Sinclair DR, Binder EF, Kohrt WM. Physical and performance measures for the identification of mild to moderate frailty. J Gerontol A Biol Sci Med Sci. 2000;55A:M350–5. https://doi.org/10.1093/gerona/55.6.M350.

73. Pilotta A, Rengo F, Marchonin N, Sancarlo D, Fontana P, Panza F, Ferrari L, on behalf of the FIBI-SIGG Study Group. Comparing the prognostic accuracy for all-cause mortality of frailty instruments: a multicentre 1-year follow-up in hospitalized older patients. PLoS One. 2012;7(11):e92990. https://doi.org/10.1371/journal.pone.0092990.

74. Opasich C, Patrignani A, Mazza A, Gualco A, Cobelli F, Pinna GD. An elderly-centered, personalized, physiotherapy program early after cardiac surgery. Eur J Cardiovasc Prev Rehabil. 2010;17(5):582–7. https://doi.org/10.1093/eurjcp/jmp214.

75. Gill TM, Baker DJ, Gottschalk M, Peduzzi PN, Alloie H, Byers A. A program to prevent functional decline in physically frail, elderly persons who live at home. N Engl J Med. 2002;347(14):1068–74. https://doi.org/10.1056/NEJMoa024023.

76. Carrieri I, Cozzi A, Favier F, Jeandel C, Blain H, group ES. Hierarchical components of physical frailty predicted incidence of dependency in a cohort of elderly women. J Clin Epidemiol. 2005;58(11):1189–70. https://doi.org/10.1016/j.jclinepi.2005.02.018.

77. Raiche M, Hebert R, Dubois MF. PRISMA-7: a case-finding tool to identify older adults with moderate to severe disabilities. Arch Gerontol Geriatr. 2008;47(1):9–18. https://doi.org/10.1016/j.archger.2007.06.004.

78. Pipers E, Ferreira I, van de Laar RJ, Stehouwer CD, Neuwenhuijzen Kuipers AC. Predicting mortality of psychogeriatric patients: a simple prognostic frailty risk score. Postgrad Med. 2009;85(1007):464–9. https://doi.org/10.3143/geriatrics.48.54.23.

79. Ravaglia G, Fonti P, Lucceansare A, Piscane N, Rietti E, Patterson C. Development of an easy prognostic score for frailty outcomes in the aged. Age Ageing. 2008;37(2):161–6. https://doi.org/10.1093/ageing/afm195.

80. Puts MT, Monette J, Gerre W, Wolkon F, Monette M, Batist G, et al. Does frailty predict hospitalization, emergency department visits, and visits to the general practitioner in older newly-diagnosed cancer patients? Results of a prospective pilot study. Crit Rev Oncol Hematol. 2010;76(2):142–51. https://doi.org/10.1016/j.critrevonc.2010.09.006.

81. Morley JE, Adams EV. Rapid geriatric assessment. J Am Med Dir Assoc. 2015; 16(10):808–12. https://doi.org/10.1016/j.jamda.2015.08.004.
100. Rothman MD, Leo-Summers L, Gill TM. Prognostic significance of potential frailty criteria. J Am Geriatr Soc. 2008;56(12):2211–6. https://doi.org/10.1111/j.1532-5415.2008.02008.x.

101. Schoevaerdts D, Biettlot S, Malhomme B, Rezette C, Gillet JB, Vanpee D, et al. Motor assessment of frailty: association with self-reported disability and prediction of mortality and nursing home admission. J Gerontol. 1994;49(2):M85–107.

102. Hebert R, Waters E, Feliu Sadowsky AJ, Sakravitch C, Song F, et al. Evaluating non-randomised intervention studies. Health Technol Assess. 2003(7):iii–x 1-173.

103. Thomas BH, Ciliska D, Dobbins M, Mucic S. Frailty: emergence and consequences in women aged 65 and older. In: The Women’s Health Initiative Observational Study. J Am Geriatr Soc. 2005;53(8):1321–30. https://doi.org/10.1111/j.1532-5415.2005.53405.x.

104. Thomas B, Ciliska D, Dobbins M, Mucic S. Effective public healthcare. Panacea Project Quality Assessment Tool for Quantitative Studies. Available from: https://www.epphq.ca/quality-assessment-tool-for-quantitative-studies/. Accessed 22 Mar 2021.

105. Ammajo-Olivo S, Stites C, Hagen N, Biondo P, Cummings G. Assessment of study quality for systematic reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Study Quality for Systematic Reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Study Quality for Systematic Reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Study Quality for Systematic Reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Study Quality for Systematic Reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Study Quality for Systematic Reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Project Quality Assessment Tool: methodological research. J Eval Clin Pract. 2012;18(1):12–8. https://doi.org/10.1111/j.1365-2753.2010.01516.x.

106. Ryan R. Cochrane Consumers and Communication Review Group: data synthesis and analysis 2013. Available from: http://www.crcr.cochrane.org.

107. Deschka H, Schreier R, El-Ayoubi L, Uelser S, Muller D, Alken A, et al. Prolonged intensive care treatment of octogenarians after cardiac surgery: a reasonable economic burden? Interact Cardiovasc Thorac Surg. 2013;17(3):501–6. https://doi.org/10.1148/rcvts.v17i3.501-6.

108. Wilkes JG, Evans JL, Prato BS, Hass SA, MacGillivray DC, Fitzgerald TL. Frailty cost: economic impact of frailty in the elective surgical patient. J Am Coll Surg. 2019;228(6):861–70. https://doi.org/10.1016/j.jamcollsurg.2019.01.015.

109. Beckman GA, Molnar FJ, Lee L. Geriatric medicine leadership of health care transformation: to be or not to be? Can Geriatr J. 2013;16(4):192–5.