**APPENDICES**

**eTable 1 – Search strategy**

**Database: Ovid MEDLINE(R) ALL <1946 to November 18, 2018>
Search Strategy:**--------------------------------------------------------------------------------
1     Preoperative Care/ or Preoperative Period/ (64022)
2     (preoperat\* or pre-operat\*).tw,kw. (287394)
3     ((before or undergo\*) adj5 (surg\* or operat\*)).tw. (182295)
4     1 or 2 or 3 (452227)
5     Frailty/ or frailty.tw,kw. (10026)
6     frail.ti. (2528)
7     \*Frail Elderly/ (6567)
8     5 or 6 or 7 (14609)
9     4 and 8 (592)
10     Geriatric Assessment/ (24493)
11     assess\*.tw,kw. (2581692)
12     (index\* or indicator\* or rule\* or measur\* or tool\* or instrument\* or scale\* or score\* or metric\* or rating or designation or phenotype).tw,kw. (5494373)
13     10 or 11 or 12 (6819932)
**14     9 and 13 (527)**

**Database: Embase Classic+Embase <1947 to 2018 November 18>
Search Strategy:**
--------------------------------------------------------------------------------
1     \*preoperative care/ or preoperative evaluation/ (109187)
2     (preoperat\* or pre-operat\*).tw. (411578)
3     ((before or undergo\*) adj5 (surg\* or operat\*)).tw. (270971)
4     1 or 2 or 3 (650494)
5     frailty/ (4764)
6     frailty.tw. (14418)
7     frail.ti. (3396)
8     or/5-7 (17750)
9     geriatric assessment/ or assessment\*.tw. (1318915)
10     outcome assessment/ (446274)
11     \*scoring system/ (16023)
12     (index\* or indicator\* or rule\* or measur\* or tool\* or instrument\* or scale\* or score\* or metric\* or rating or designation or phenotype).tw. (7306624)
13     9 or 10 or 11 or 12 (8131732)
**14     4 and 8 and 13 (895)**

**Database: EBM Reviews - Cochrane Central Register of Controlled Trials <November 2018>
Search Strategy:**--------------------------------------------------------------------------------
1     Preoperative Care/ or Preoperative Period/ (4075)
2     (preoperat\* or pre-operat\*).tw,kw. (29887)
3     ((before or undergo\*) adj5 (surg\* or operat\*)).tw. (24466)
4     1 or 2 or 3 (50641)
5     Frailty/ or frailty.tw,kw. (949)
6     frail.ti. (616)
7     Frail Elderly/ (626)
8     5 or 6 or 7 (1662)
9     4 and 8 (69)
10     Geriatric Assessment/ (1358)
11     assess\*.tw,kw. (334804)
12     (index\* or indicator\* or rule\* or measur\* or tool\* or instrument\* or scale\* or score\* or metric\* or rating or designation or phenotype).tw,kw. (495816)
13     10 or 11 or 12 (626374)
**14     9 and 13 (63)**

CINAHL

|  |  |  |
| --- | --- | --- |
| **#** | **Query** | **Results** |
| **S16** | **S10 AND S15** | **172** |
| S15 | S11 OR S12 OR S13 OR S14 | 1,334,375 |
| S14 | (MH "Outcome Assessment") | 36,524 |
| S13 | TI ( (index\* or indicator\* or rule\* or measur\* or tool\* or instrument\* or scale\* or score\* or metric\* or rating or designation or phenotype) ) OR AB ( (index\* or indicator\* or rule\* or measur\* or tool\* or instrument\* or scale\* or score\* or metric\* or rating or designation or phenotype) ) | 1,023,057 |
| S12 | TI assess\* OR AB assess\* | 635,452 |
| S11 | (MH "Geriatric Assessment+") | 14,462 |
| S10 | S5 AND S9 | 211 |
| S9 | S6 OR S7 OR S8 | 6,865 |
| S8 | TI frail\* | 4,784 |
| S7 | TI frailty OR AB frailty | 4,967 |
| S6 | (MH "Frailty Syndrome") | 1,120 |
| S5 | S1 OR S2 OR S3 OR S4 | 86,647 |
| S4 | TI ( ((before or undergo\*) N5 (surg\* or operat\*)) ) OR AB ( ((before or undergo\*) N5 (surg\* or operat\*)) ) | 35,187 |
| S3 | TI ( (preoperat\* or pre-operat\*) ) OR AB ( (preoperat\* or pre-operat\*) ) | 47,357 |
| S2 | (MH "Preoperative Period+") | 4,127 |
| S1 | (MH "Preoperative Care+") | 19,047 |

**eTable 2 – Predictive accuracy data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
| **Study** | **Frailty Instrument** | **Discrimination** | **Change in discrimination** | **Sensitivity** | **Specificity** | **Likelihood ratio** | **Change in explained variance** |
| ***Mortality*** |   |   |   |   |   |   |   |
| Kenig et al, 2018 | G8 Screening Tool | 0.71 |   | 92 | 50 |   |   |
| Afilalo et al, 2017\* | FP+MMSE+Depression,  |   | 0.02 |   |   |   |   |
|   | FP |   | 0.008 |   |   |   |   |
|   | CFS |   | 0.018 |   |   |   |   |
|   | SPPB |   | 0.023 |   |   |   |   |
|   | Bern Scale |   | 0.031 |   |   |   |   |
|   | Columbia Scale |   | 0.024 |   |   |   |   |
|   | Essential Frailty Toolset |   | 0.064 |   |   |   |   |
| Amabili et al, 2018 | EFS | 0.69 |   |   |   |   |   |
| Hall et al, 2017 | RAI | 0.704 |   |   |   |   |   |
| Reichart et al, 2018\*\* | CFS |  |  0.028 |   |   |   |   |
| \*When added to Society for Thoracic Surgery Predicted risk of Mortality model; \*\*When added to EuroScore II model. |   |   |   |
| ***Complications*** |  |  |  |  |  |  |  |
| Kovacs et al, 2017 | CFS | 0.636 |   |   |   |   |   |
|   | EFS | 0.652 |   |   |   |   |   |
| Joseph et al, 2016 | CSHA FI | 0.75 |   | 80 | 72 |   |   |
| Li et al, 2018a | CSHA FI | 0.815 |   |   |   |   |   |
| Dasgupta et al, 2009 | EFS | 0.69 |   |   |   | +LR 3.9/-LR 0.33 |   |
| Kua et al, 2016\* | EFS |   |   |   |   |   | 0.06 |
|   | FP |   |   |   |   |   | 0.06 |
| Orouji Jokar et al, 2016 | EGSFI | 0.712 |   |   |   |   |   |
| Han et al, 2018 | FP | 0.757 |   |   |   |   |   |
| Kapoor et al, 2017\*\* | FP |   | 0.058 |   |   |   |   |
| Makary et al, 2010\*\*\* | FP | 0.865 | 0.073/0.051/0.036 |   |   |   |   |
| Revenig et al, 2015  | FP | 0.597 |   |   |   |   |   |
| Kenig et al, 2018 | G8 Screening Tool | 0.67 |   | 83 | 53 |   |   |
| Afilalo et al, 2010† | Gait Speed |   | 0.04 |   |   |   |   |
| Afilalo et al, 2016† | Gait Speed | 0.01 | -0.001 |   |   |   |   |
| Itoh et al, 2018 | Gait Speed | 0.659 |   |   |   |   |   |
| Kim et al, 2016 | FP | 0.722 |   |   |   |   |   |
| Robinson et al, 2013‡ | Frailty Score | 0.702/0.711 |   |   |   |   |   |
| Van der Windt et al, 2018 | RAI | 0.56 |   |   |   |   |   |
| Katlic et al, 2017 | SAGE | 0.69 |   |   |   |   |   |
|   | FP | 0.7 |   |   |   |   |   |
| \*When added to age, ASA score, gender; \*\*When added to National Surgical Quality Improvement Calculator score; \*\*\*when added to ASA, Lee and Eagle score respectively; †When added to Society for Thoracic Surgery Predicted risk of Mortality model; ‡colorectal/cardiac |
| ***Adverse Discharge*** |  |  |  |  |  |  |  |
| Katlic et al, 2017 | SAGE | 0.78 |   |   |   |   |   |
|   | FP | 0.78 |   |   |   |   |   |
| Kim et al, 2016 | FP | 0.825 |   |   |   |   |   |
| \*Makary et al, 2010 | FP |   | 0.095/0.126/0.098 |   |   |   |   |
| Van der Windt et al, 2018 | RAI | 0.62 |   |   |   |   |   |
| McIsaac et al, 2018 | CFS |   |   | 80 | 61 |   |   |
|   | FP |   |   | 67 | 66 |   |   |
| \*when added to ASA, Lee and Eagle score respectively; |   |   |   |   |   |   |
| ***Delirium*** |  |  |  |  |  |  |  |
| Katlic et al, 2017 | SAGE | 0.77 |   |   |   |   |   |
|   | FP | 0.73 |   |   |   |   |   |
| Pol et al, 2011 | GFI | 0.7 |   | 50 | 78 |   |   |
| Sato et al, 2016 | TUG | 0.87 |   |   |   |   |   |
|   | Fall Risk Assessment | 0.79 |   |   |   |   |   |
| ASA: American Society of Anesthesiologists; CFS: Clinical Frailty Scale; CSHA: Canadian Study of Health and Ageing; EFS: Edmonton Frail Scale; EGSFI: Emergency General Surgery Frailty Index; FI: Frailty Index; FP: Fried Phenotype; GFI: Gronigen Frailty Indicator; LR: Likelihood Ratio; MMSE: Mini-Mental State Examination; RAI: Risk Analysis Index; SAGE: Sinai Abbreviated Geriatiric Evaluation; SPPB: Short Physical Performance Battery; TUG: Timed up and Go |

**eTable 3 – Complications data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Study, Year (Reference) | Frailty Measure Category | Specific Frailty Measurement | Outcome Window | % frail | Crude HR/OR | 95%CI/p-value |
| Donald et al, 2018 | CFS | CFS | 30 days | 28.8 | 2.19 | 0.79-6.06 |
| McGuckin et al, 2018 | CFS | CFS | 30 days | 50.6 | 1.45 | 0.52-4.01 |
| Rodrigues et al, 2017 | CFS | CFS | 60 days | 65.2 | low vs. none=1.52 | 0.61-3.79 |
| Ad et al, 2016 | Frailty Phenotype | Fried Criteria | In-hospital | 23 | 1.70 | 0.56-5.26 |
| Brown et al, 2016 | Frailty Phenotype | Fried Criteria | In-hospital | 30.9 | 3.63 | 1.08-12.17 |
| Kua et al, 2016 | Frailty Phenotype | Modified Fried Criteria | In-hospital | 86.6 | 7.32 | 0.89-60.29 |
| Kotajarvi et al, 2017 | Frailty Phenotype | Fried Criteria | In-hospital | 52.4 | 1.63 | 0.73-3.62 |
| Revenig et al, 2015 | Frailty Phenotype | Fried Criteria | 30 days | 27.3 | 3.99 | 2.38-6.69 |
| Lytwyn et al, 2017 | Frailty Phenotype | Modified Fried Criteria | In-hospital | 49.5 | 4.14 | 0.45-37.78 |
| Tan et al, 2012 | Frailty Phenotype | Fried Criteria | 30 days | 27.7 | 4.08 | 1.43-11.64 |
| Andreou et al, 2018 | Frailty Phenotype | Fried Criteria  | 30 days | 52 | 2.30 | 1.48-3.80 |
| Khan et al, 2016 | Frailty Phenotype | SHARE | 10 days | 56 | 1.27 | 0.21-7.65 |
| Kim et al, 2016 | Frailty Phenotype | Modified Fried Criteria | 30 days | 34 | 3.07 | 1.02-9.23 |
| Han et al, 2018 | Frailty Phenotype | Fried Criteria  | In-hospital | 70.5 | 5.77 | 8.93-50.0 |
| Gleason et al, 2017 | Frailty Phenotype | FRAIL Scale | In-hospital | 83.4 | low vs. none=9.85 | 1.25-77.4 |
|  |  |  |  |  | mod vs. none=18.45 | 2.38-143.22 |
| Pelavski et al, 2017 | Frailty Phenotype | Fried Criteria | In-hospital | 74 | low vs. none=4.13 | 1.62-10.52 |
|  |  |  |  |  | mod vs. none=3.35 | 1.14-9.85 |
| Kapoor et al, 2017 | Frailty Phenotype | Fried Criteria | 30 days | 18 | low vs. none=2.02 | 0.62-6.53 |
|  |  |  |  |  | mod vs. none=5.19 | 1.68-16.06 |
|  |  |  |  |  | severe vs. none=3.35 | 1.14-9.85 |
| Kristjansson et al, 2012 | Frailty Phenotype | Modified Fried Criteria | 30 days | 60.2 | low vs. none=1.57 | 0.83-2.99 |
|  |  |  |  |  | mod vs. none=1.50 | 0.57-3.93 |
| Huded et al, 2016 | Frailty Phenotype | Modified Fried Criteria | 30 days | 71 | low vs. none=2.29 | 0.88-5.99 |
|  |  |  |  |  | mod vs. none=1.17 | 0.41-3.37 |
| Revenig et al, 2014 | Frailty Phenotype | Fried Criteria  | 30 days | 16.2 | low vs. none=4.21 | 1.00-17.7 |
|  |  |  |  |  | mod vs. none=7.38 | 0.40-129.90 |
| Courtney-Brooks et al, 2012 | Frailty Phenotype | Fried Criteria  | 30 days | 43.2 | low vs. none=0.36 | 0.04-3.54 |
|  |  |  |  |  | mod vs. none=6.4 | 0.89-45.99 |
| Makary et al, 2010 | Frailty Phenotype | Fried Criteria  | 30 days | 41.7 | low vs. none=2.26 | 1.54-3.32 |
|  |  |  |  |  | mod vs. none=3.97 | 2.30-6.90 |
| Sikder et al, 2018 | Frailty Phenotype | Fried Criteria | 6 months | 77.8 | low vs. none=1.83 | 0.74-4.55 |
|  |  |  |  |  | mod vs. none=1.69 | 0.54-5.29 |
| Pelavski et al, 2017 | Physical Measure | Gait Speed | In-hospital | 59.1 | 1.83 | 0.89-3.76 |
| Ad et al, 2016 | Physical Measure | Gait Speed | In-hospital | 26.3 | 1.06 | 0.94-1.19 |
| Itoh et al, 2018 | Physical Measure | Gait Speed | 30 days | 32.5 | 3.34\*\* | 1.51-7.39 |
| Joseph et al, 2016 | Frailty Index | CSHA FI | In-hospital | 37.3 | 2.6 | 1.46-4.62 |
| Saxton et al, 2011 | Frailty Index | CSHA FI | 30 days |  \*  | 1.48 | 1.10-1.99 |
| Li et al, 2018a | Frailty Index | CSHA FI | In-hospital | 70.8 | low vs. none=3.55 | 1.01-12.55 |
|  |  |  |  |  | mod vs. none=7.15 | 2.20-23.28 |
| Lin et al, 2017 | Frailty Index | FI-CGA | 30 days | 55.7 | low vs. none=1.54 | 0.93-2.90 |
|  |  |  |  |  | mod vs. none=1.58 | 0.79-3.16 |
| Pelavski et al, 2017 | Physical Function | Katz Index | In-hospital | 34.9 | low vs. none=0.91 | 0.40-2.08 |
|  |  |  |  |  | mod vs. none=1.29 | 0.40-4.16 |
| Kenig et al, 2018 | Other | G8 Screening tool | 30 days | 60.3 | 5.46 | 3.10-9.61 |
| Saxton et al, 2011 | Other | SF-36, general health | 30 days |  \*  | 1.17 | 0.88-1.55 |
| Tanaka et al, 2018 | Other | KCL | In-hospital | 29 | 1.51 | 0.82-2.76 |
| Tegels et al, 2014 | Other | GFI | In-hospital |  \*  | 3.62 | 1.53-8.58 |
| Marshall et al, 2016 | Other | FP categories+bloodwork+falls+ADL assessment | In-hospital | 13.8 | low vs. none=2.56 | 0.96-6.84 |
|  |  |  |  |  | mod vs. none=7.31 | 2.18-24.49 |
| Robinson et al, 2013 | Other | Multidimensional frailty score | In-hospital | 47.8 | low vs. none=2.18 | 0.95-5.00 |
| Partridge 2015 | Other | EFS | In-hospital | 52 | 2.41 | 1.15-5.02 |
| Cheung 2017 | Other | REFS | In-hospital | 33 | 1.03 | 0.42-2.48 |

\*Information not available; \*\*indicates HR. All other effect measures are OR.; aLi S, Nie Y, Zhan J, et al. The analysis of correlation between frailty index and postoperative complications of aged patients with nodular goiter. *Aging Med*. 2018;1(1):18-22. doi:10.1002/agm2.12016; CFS=Clinical Frailty Scale; SHARE=Survey of Health, Aging and Retirement in Europe; FRAIL=Fatigue, Resistance, Ambulation, Illness, Loss of weight; CSHA FI=Canadian Study of Health and Aging Frailty Index; FI-CGA=Frailty Index based on Comprehensive Geriatric Assessment

G8=Geriatric 8; SF-36=Short Form Health Survey; KCL=Kihon Check-List; GFI=Groningen Frailty Indicator; ADL=Activities of Daily Living; EFS=Edmonton Frail Scale; REFS=Reported Edmonton Frail Scale

**eFigure 1 – Forest plot summary of individual and pooled effect sizes association frailty with postoperative complications by frailty instrument with >2 studies available: a) Frailty phenotype, b) Edmonton Frail Scale, c) Clinical Frailty Scale, d) Physical measures of frailty, e) Frailty index**

**a)**



**b)**



**c)**



**d)**



**e)**



**eTable 4 – Discharge disposition data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Study, Year (Reference) | Frailty Measure Category | Specific Frailty Measure | Adverse Discharge | % frail | Crude HR/OR | 95%CI/p-value |
| Donald et al, 2018 | CFS | CFS | Assisted-living center, Skilled nursing facility, Not home | 28.8 | 4.45 | 1.46-13.54 |
| Wang et al, 2018 | CFS | CFS | Rehabilitation facility | 53.9 | 3.44 | 1.02-11.60 |
| McIsaac et al, 2018 | CFS | CFS | Institutional care | 42.3 | 6.31 | 3.29-12.12 |
| McGuckin et al, 2018 | CFS | CFS | Institutional care | 50.6 | 3.64 | 0.73-18.07 |
| Li et al, 2018b | CFS | CFS | Home with support, Rehabilitation facility, Another hospital, Skilled nursing facility | 76.6 | low vs. none=2.66 | 1.22-5.79 |
|  |  |  |  |  | mod vs. none=12.83 | 5.44-30.25 |
| Ad et al, 2016 | Frailty Phenotype | Fried Criteria | Not home | 23 | 6.40 | 2.79-14.66 |
| Kim et al, 2016 | Frailty Phenotype | Modified Fried Criteria | Nursing home | 34 | 4.15 | 1.50-11.47 |
| Wang et al, 2018 | Frailty Phenotype | FRAIL Scale | Rehabilitation facility | 84.9 | 0.78 | 0.19-3.20 |
| McIsaac et al, 2018 | Frailty Phenotype | Modified Fried Criteria | Institutional care | 36.6 | 3.92 | 2.24-6.87 |
| Sikder et al, 2018 | Frailty Phenotype | Fried Criteria | Not home | 77.8 | low vs. none=0.73 | 0.13-4.15 |
|  |  |  |  |  | mod vs. none=2.85 | 0.48-17.06 |
| Gleason et al, 2017 | Frailty Phenotype | FRAIL Scale | Not home | 83.4 | low vs. none=10.35 | 2.56-41.90 |
|  |  |  |  |  | mod vs. none=10.50 | 2.59-42.49 |
| Pelavski et al, 2017 | Frailty Phenotype | Fried Criteria | Escalation of care in living condition | 74 | low vs. none=2.17 | 0.85-5.76 |
|  |  |  |  |  | mod vs. none=3.98 | 1.31-12.05 |
| Kapoor et al, 2017 | Frailty Phenotype | Fried Criteria | Nursing home | 18 | low vs. none=3.36 | 1.32-8.54 |
|  |  |  |  |  | mod vs. none=3.63 | 1.37-9.61 |
|  |  |  |  |  | severe vs. none=5.50 | 2.07-14.62 |
| Huded et al, 2016 | Frailty Phenotype | Modified Fried Criteria | Rehabilitation facility | 33.5 | low vs. none=1.67 | 0.65-4.28 |
|  |  |  |  |  | mod vs. none=3.93 | 1.60-9.66 |
| Courtney-Brooks et al, 2012 | Frailty Phenotype | Fried Phenotype | Skilled or assisted-care facility | 43.2 | low vs. none=6.80 | 0.25-182.34 |
|  |  |  |  |  | mod vs. none=3.30 | 0.06-183.69 |
| Makary et al, 2010 | Frailty Phenotype | Fried Criteria | Skilled or assisted-care facility | 41.7 | low vs. none=3.61 | 1.79-7.32 |
|  |  |  |  |  | mod vs. none=37.91 | 17.88-80.37 |
| Afilalo et al, 2010 | Physical Measure | Gait Speed | Rehabilitation, Convalescence, Another hospital, Nursing home | 46 | 3.12 | 1.45-7.03 |
| Pelavski et al, 2017 | Physical Measure | Gait Speed | Escalation of care in living condition | 59.1 | 3.25 | 1.51-7.00 |
| Joseph et al, 2016 | Frailty Index | CSHA FI | Rehab or skilled nursing facility | 37.3 | 1.56 | 0.90-2.70 |
| Cooper et al, 2016 | Frailty Index | Frailty Index | Post-acute institutional care | 79 | low vs. none=2.63 | 1.53-4.53 |
|  |  |  |  |  | mod vs. none=6.60 | 3.72-11.72 |
| Lin et al, 2017 | Frailty Index | FI-CGA | Residential aged care | 55.7 | low vs. none=9.11 | 1.10-75.48 |
|  |  |  |  |  | mod vs. none=12.86 | 1.46-113.36 |
| Pelavski et al, 2017 | Physical Function | Katz Index  | Escalation of care in living condition | 23.2 | low vs. none=0.91 | 0.38-2.14 |
|  |  |  |  |  | mod vs. none=0.73 | 0.21-2.58 |
| Tanaka et al, 2018 | Other | KCL | Rehabilitation facility | 29 | 4.32 | 2.00-9.32 |
| Van der Windt et al, 2018 | Other | RAI | Nursing facility |  \*  | 1.10 | 1.03-1.18 |
| Cheung 2017 | Other | REFS | High level residential aged care facility | 33 | 9.10 | 0.97-85.04 |

All effect measures are OR; \*Information not available; bLi Y, Pederson JL, Churchill TA, et al. Impact of frailty on outcomes afer discharge in older surgical patients: A prospective cohort study. *Cmaj*. 2018;190(7):E184-E190. doi:10.1503/cmaj.161403; CFS=Clinical Frailty Scale; FRAIL= Fatigue, Resistance, Ambulation, Illness, Loss of weight; CSHA FI=Canadian Study of Health and Aging Frailty Index; KCL=Kihon Check-List; RAI=Risk Analysis Indicator; REFS=Reported Edmonton Frail Scale

**eFigure 2 – Forest plot summary of individual and pooled effect sizes association frailty with postoperative adverse discharge disposition by frailty instrument with >2 studies available: a) Frailty phenotype, b) Clinical Frailty Scale, c) Frailty Index, d) Physical measures of frailty**

**a)**



**b)**



**c)**



**d)**



**eTable 5 – Delirium data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Study, Year (Reference) | Frailty Measure Category | Specific Frailty Measurement | Outcome Window | % frail | Crude HR/OR | 95%CI/p-value |
| Lytwyn et al, 2017 | Frailty Phenotype | Modified Fried Criteria | In-hospital | 49.5 | 2.76 | 1.35-5.66 |
| Khan et al, 2016 | Frailty Phenotype | SHARE | 10 days | 56 | 0.77 | 0.04-13.87 |
| Leung et al, 2011 | Frailty Phenotype | Fried Criteria | 2 days | 33.3 | 2.68 | 0.81-8.93 |
| Gleason et al, 2017 | Frailty Phenotype | FRAIL Scale | In-hospital | 83.4 | low vs. none=6.07 | 0.76-48.7 |
|  |  |  |  |  | mod vs. none=11.31 | 1.44-88.55 |
| Sato et al, 2016 | Physical Measure | Get up and go  | In-hospital | \*  | 35.05 | 6.98-176.00 |
| Sato et al, 2016 | Physical Measure | Handgrip strength | In-hospital | \* | 6.81 | 1.83-25.40 |
| Sato et al, 2016 | Other | CES-D Fatigue scale | In-hospital | \*  | 4.45 | 1.06-18.72 |
| Sato et al, 2016 | Other | Fall risk assessment | In-hospital | \*  | 6.59 | 1.77-24.50 |
| Tanaka et al, 2018 | Other | KCL | In-hospital | 29 | 7.32 | 1.87-28.59 |
| Partridge 2015 | Other | EFS | In-hospital | 52 | 1.7 | 0.68-4.24 |
| Cheung 2017 | Other | REFS | In-hospital | 33 | 2.21 | 0.59-8.27 |

All effect measures are OR; \*Information not available; SHARE=Survey of Health, Aging and Retirement in Europe; FRAIL=Fatigue, Resistance, Ambulation, Illness, Loss of weight; CES-D=Center for Epidemiological Studies Depression Scale; KCL=Kihon Check-List;EFS=Edmonton Frail Scale; REFS=Reported Edmonton Frail Scale

**eFigure 3 - Forest plot summary of individual and pooled effect sizes association frailty with delirium by frailty instrument with >2 studies available: a) Frailty phenotype, b) Edmonton Frail Scale**

**a)**



**b)**



**eTable 6 – Length of stay data**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Study, Year (Reference) | Frailty Measure Category | Specific Frailty Measurement | % frail | Not frail Mean±SD | Frail Mean±SD/Crude HR/OR | 95%CI/p-value |
| Donald et al, 2018 | CFS | CFS | 28.8 | 4.2 | 6.4 | p=0.03 |
| McIsaac et al, 2018 | CFS | CFS | 42.3 | 3±2.2 | 4±3.7 | \* |
| Goeteyn et al, 2017 | CFS | CFS | 23.5 | 14.7±14 | 14.2±10.2 | p=0.597 |
| McGuckin et al, 2018 | CFS | CFS | 50.6 | 11±9.1 | 22.3±15.8 | p<0.001 |
| Wang et al, 2018 | CFS | CFS | 53.9 |  | 4.53 | 1.67-12.24 |
| Rodrigues et al, 2017 | CFS | CFS | 65.2 | 9±3 | low=12±5 | p<0.001 |
| Li et al, 2018b | CFS | CFS | 76.6 | 7.3±5.3 | low=9±4.5 | p<0.001 |
|  |  |  |  |  | mod=16±15.1 |  |
| Ad et al, 2016 | Frailty Phenotype | Fried Criteria | 23 | 5±3.0 | 8.7±4.6 | p<0.001 |
| Brown et al, 2016 | Frailty Phenotype | Fried Criteria | 30.9 | 6±1.5 | 7±1.6 | p=0.13 |
| Andreou et al, 2018 | Frailty Phenotype | Fried Criteria  | 52 | 9.8±12.0 | 11.7±13.5 | p<0.001 |
| Jha et al, 2017 | Frailty Phenotype | Fried Criteria  | 88.9 | 29±22.7 | 33.3±30.3 | p<0.05 |
| Khan et al, 2016 | Frailty Phenotype | SHARE | 56 | 6.7±2.5 | 10.8±7.8 | p=0.049 |
| Kim et al, 2016 | Frailty Phenotype | Modified Fried Criteria | 34 | 2.3±2.3 | 3±3.1 | p=0.04 |
| McIsaac et al, 2018 | Frailty Phenotype | Modified Fried Criteria | 36.6 | 3.3±2.2 | 4.3±3.7 | \* |
| Lytwyn et al, 2017 | Frailty Phenotype | Modified Fried Criteria | 49.5 |  | 2.98 | 1.63-5.46 |
| Wang et al, 2018 | Frailty Phenotype | FRAIL Scale | 84.9 |  | 1.22 | 0.34-4.34 |
| Sikder et al, 2018 | Frailty Phenotype | Fried Criteria | 77.8 | 5.8±3.5 | low=6.7±3.8 | \* |
|  |  |  |  |  | mod=8±4.7 |  |
| Huded et al, 2016 | Frailty Phenotype | Modified Fried Criteria | 71 | 5.9±6.1 | low=6.3±5.3 | p=0.883 |
|  |  |  |  |  | mod=6±3.5 |  |
| Gleason et al, 2017 | Frailty Phenotype | FRAIL Scale | 16.6 |  | low vs. none=1.59 | 0.67-3.79 |
|  |  |  |  |  | mod vs. none=8.8 | 3.03-25.57 |
| Cooper et al, 2016 | Frailty Phenotype | Fried Criteria | 89 |  | low vs. none=2.21 | 0.7-6.5 |
|  |  |  |  |  | mod vs. none=3.04 | 1.0-9.1 |
| Pelavski et al, 2017 | Frailty Phenotype | Fried Criteria | 74 |  | low vs. none=3.27 | 0.88-12.15 |
|  |  |  |  |  | mod vs. none=7.06 | 1.74-28.57 |
| Itoh et al, 2018 | Physical Measure | Gait Speed | 32.5 | 26.7±45.1 | 26±45.0 | p=0.027 |
| Pelavski et al, 2017 | Physical Measure | Gait Speed | 59.1 |  | 1.98 | 0.83-4.75 |
| Afilalo et al, 2010 | Physical Measure | Gait Speed | 46 |  | 2.4 | 1.08-5.36 |
| Joseph et al, 2016 | Frailty Index | CSHA FI | 37.3 | 6.25±4.23 | 9.95±9.58 | p=0.001 |
| Li et al, 2018a | Frailty Index | CSHA FI | 70.8 | 10.22±1.58 | low=13.01±3.02 | p<0.05 |
|  |  |  |  |  | mod=14.85±4.13 |  |
| Dunlay et al, 2014 | Frailty Index | Cumulative Deficit Index | 61.6 | 19±13.97 | low=17.67±10.07 | p=0.81 |
|  |  |  |  |  | mod=21.33±16.25 |  |
| Pelavski et al, 2017 | Physical Function | Katz Index | 34.9 |  | low vs. none=1.58 | 0.64-3.93 |
|  |  |  |  |  | mod vs. none=2.34 | 0.95-5.75 |
| Orouji Jokar et al, 2016 | Other | EGSFI | 30 | 7.5±3.2 | 13.38±8.5 | p<0.001 |
| Pol 2011 | Other | GFI | 35 | 5.4±3.9 | 5.9±4.2 | p=0.71 |
| Tanaka et al, 2018 | Other | KCL | 29 | 33.3±65.1 | 32±54.6 | p=0.111 |
| Robinson et al, 2013 | Other | Multidimensional Frailty Score | 47.8 | 8.05 | low=9.25 | \* |
|  |  |  |  |  | mod=12.9 |  |
| Chauhan et al, 2016 | Other | Frailty Score (Gait Speed+ADL+Handgrip Strength+Serum Albumin) | 68.13 | 4.22 | low=5.32 | \* |
|  |  |  |  |  | mod=5.25 |  |
|  |  |  |  |  | severe=9.06 |  |
| Cheung et al, 2017 | Other | REFS | 33 | 20.0±19.3 | 18.0±10.2 | p=0.41 |

All effect measures are OR; \*Information not available; aLi S, Nie Y, Zhan J, et al. The analysis of correlation between frailty index and postoperative complications of aged patients with nodular goiter. *Aging Med*. 2018;1(1):18-22. doi:10.1002/agm2.12016; bLi Y, Pederson JL, Churchill TA, et al. Impact of frailty on outcomes afer discharge in older surgical patients: A prospective cohort study. *Cmaj*. 2018;190(7):E184-E190. doi:10.1503/cmaj.161403; CFS=Clinical Frailty Scale; SHARE=Survey of Health, Aging and Retirement in Europe; FRAIL=Fatigue, Resistance, Ambulation, Illness, Loss of weight; CSHA FI=Canadian Study of Health and Aging Frailty Index; EGSFI=Emergency General Surgery Specific Frailty Index; GFI=Groningen Frailty Indicator; KCL=Kihon Check-List; ADL=Activities of Daily Living; REFS=Reported Edmonton Frail Scale

**eFigure 4 - Forest plot summary of individual and pooled effect sizes association frailty with length of stay by frailty instrument with >2 studies available: a) Frailty Index, b) Clinical Frailty Scale; c) Frailty Phenotype**

**a)**



**b)**



**c)**



**eTable 7 – Function data**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Study, Year (Reference) | Frailty Measure Category | Specific Frailty Measurement | Outcome Window | % with frailty | Function Measure | Crude OR/Mean score/Event rate | 95%CI/p-value |
| Rodrigues et al, 2017 | CFS | CFS | At discharge | 65.2 | Requires homecare services | no frailty=0/77low frailty=67/144 |  |
| McIsaac et al, 2018 | CFS | CFS | 90 days | 42.3 | Death or new disability | OR=2.15 | 1.31-3.55 |
| McIsaac et al, 2018 | Frailty Phenotype | Modified Fried Criteria | 90 days | 36.6 | Death or new disability | OR=2.36 | 1.44-3.87 |
| Sikder et al, 2018 | Frailty Phenotype | Fried Criteria | 6 months | 77.8 | Inability to recover to pre-operative ADL |  OR mod vs. none=31.57 | 1.72-580.03 |
| Kotajarvi et al, 2017 | Frailty Phenotype  | Fried Criteria | 3 months | 52.4 | DASI | no frailty=0 improvementfrail=6.5 pt improvement | p<0.05 |
| Kua et al, 2016 | Frailty Phenotype  | Modified Fried Criteria | 6 months | 86.6 | Requires assistance with ADLs | OR=5.11 | 0.49-52.96 |
| Lytwyn et al, 2017 | Frailty Phenotype  | Modified Fried Criteria | 1 year | 49.5 | EQ-VAS ≤60 | OR=3.72 | 1.63-8.48 |
| Kua et al, 2016 | Edmonton Frail Scale | REFS | 6 months | 34.2 | Requires assistance with ADLs | OR=22.55 | p=0.00 |
| Partridge et al, 2015 | Edmonton Frail Scale | EFS | At discharge | 52 | Worsened overall function | OR=2.52 | 1.21-5.23 |
| Cheung et al, 2017 | Edmonton Frail Scale | REFS | 3 months | 33 | Worsening in ADL performance | no frailty=0.24±0.82frailty=0.70±1.40 | P<0.01 |

ADL=Activities of daily living; CFS=Clinical Frailty Scale; CI=Confidence Interval; DASI=Duke Activity Status Index; EQ-VAS=EuroQoL visual analogue scale for overall health related quality of life; REFS=Reported Edmonton Frail Scale; EFS=Edmonton Frail Scale; OR=odds ratio

**eTable 8 – Feasibility data**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category** | **FP** | **CFS** | **FI** | **EFS** | **GFI** | **RAI-C** | **Gait Speed** | **SPPB** |
|
| **Acceptability** |   |   |   |   |   |   |   |   |
| **Satisfaction** |   | (+/O) Rated as 4/5 on Likert Scale for "Useful in my practice"6 | (~/O) Rated as 3/5 on Likert Scale for "Useful in my practice"6 |   |   |   |   |   |
| **Intention to continue use** |   |   |   |   |   |   |   |   |
| **Perceived appropriateness** |   |   |   |   |   |   |   |   |
| **Implementation** |   |   |   |   |   |   |   |   |
| **Degree of successful execution** |   | (+/O) Rated as 5/5 on Likert Scale for "Difficult to use for environmental/logistical reasons"6 | (~/O) Rated as 3/5 on Likert Scale for "Difficult to use for environmental/logistical reasons"6 |   |   |   |   | (-/S) May be impractical to implement in clinical settings32 |
|  |   |   | (-/S) Some areas (self-rated health, motivation, grip strength) were more likely to have missing data, as they relied on patient cooperation75 |   |   |   |   |   |
| **Resources needed to implement** | (+/S) Minimal resources36 |   | (+/S) Does not require measure of grip strength and walking speed76 | (+/S) No prior geriatric assessment is required84 |   |   |   |   |
|  | (-/S) Requires training, space (4–5 meters of unimpeded space for gait speed testing) and equipment (dynamometer for handgrip strength)45 |   |   |   | (+/S) Requires no invasive or physical tests95 |   |   |   |
| **Factors affecting implementation** |   | (~/O) Rated as 3/5 on Likert Scale for "Missing important clinical factors?"6 | (+/S) Can be easily obtained from family member if patient unable to answer, does not require a physical component which makes it advantageous for emergency cases74 | (-/S) Can be interpreted differently by patients from different social and cultural backgrounds (e.g. patients had difficulty understanding, would give inconsistent answers to the same questions asked again)64 |   | (-/S) Relies on clinical judgement of the personnel administering the test87 |   |   |
|  |   |   | (~/O) Rated as 3/5 on Likert Scale for "Missing important clinical factors?"6 |  |   |   |   |   |
| **Practicality** |   |   |   |   |   |   |   |   |
| **Ease of use** |   | (+/S) Simple eyeball test that can be easily measured along with vital signs, in contrast to other risk calculators which are too cumbersome or time-intensive. Ease of use also gives surgeon instant clinical decision making data about whether a patient should go for surgery and for shared decision making60 | (+/S) Data collectors described the form as easy to apply and well received by patients, with a low rate of refusal (2.2%)75 | (+/S) Easy82 | (+/S) Simple95 |   | (+/S) Simple67 |   |
|  | (+/S) Feasible and easy to obtain36 | (+/S) Relatively simplistic and easy to use62 | (+/S) Items are obtained either by history or physical exam and do not require time-consuming testing76 | (+/S)Easy to use in acute care settings81 |   |   |   |   |
|  |   | (+/O) 4/5 rating on Likert scale for "easy to use"6 | (~/O) 3/5 rating on Likert scale for "easy to use"6 | (+/S)Simple, easy84 |   |   |   |   |
|  |   | (+/S) Easy to use63 |   |   |   |   |   |   |
|  |   | (+/S) Easy to perform65 |   |   |   |   |   |   |
| **Efficiency/speed** | (+/O) Takes an average of 10 minutes to complete36 | (+/S) Quick and subjective tool32 | (+/O) Feasible in a busy practice, taking 10 minutes to conduct the assessment61 | (+/S) Quick to administer82 |   |   | (+/S) Rapid67 | (+/S) Takes 5-10 min to complete32 |
|  | (~/S) FRAIL scale easier then phenotype in ortho patients59 | (+/O)The average time for completion of the CFS was 44 seconds (SD ¼ 40)6 | (~/O) Average time to complete form was 12.5 min75  | (~/O) Took less than 5 min to perform; if TUG was not done as part of the EFS, the tool would take less than 1 minute to complete80 |   |   |   |   |
|  | (-/O) May not be practical for providers to complete a Modified Fried assessment in every patient (15-25 min) 32 |   | (~/O) Average time for completion or the FP 312 seconds (SD ¼ 90)6 | (+/S) Quick-to-administer test84 |   |   |   |   |
|  | (~/O) Takes 10-15 minutes to complete4  |   |   |   |   |   |   |   |
|  | (-/O) Requires significant time (typically 15–20 minutes)45 |   |   |   |   |   |   |   |
| **Costs** |   | (+/S) Inexpensive65 |   |   |   |   | (+/S) Inexpensive67 |   |
| **Positive/negative effects on users or targets** |   | (~/O) Rated as 3/5 on Likert Scale for "beneficial to patient care"6 | (~/O) Rated as 3/5 on Likert Scale for "beneficial to patient care"6 |   |   |   |   |   |
| O:Objective data provided; S:Subjective data provided; +:positively supports feasibility; -:negatively supports feasibility; ~:neutral in support of feasibility; CFS: Clinical Frailty Scale; EFS: Edmonton Frail Scale; FI: Frailty Index; FP: Frailty Phenotype; GFI: Gronigen Frailty Indicator; RAI-C: Risk Analysis Index-Clinical; SPPB: Short Physical Performance Battery; TUG: Timed Up and Go |

**eTable 9 – Risk of bias assessment**





|  |  |
| --- | --- |
|   | Low risk |
|   | Moderate risk |
|   | High risk |
|   | Unclear risk |