**SUPPLEMENTAL DIGITAL CONTENT**

**eTable 1 – Electronic Search Strategies**

**Database: Ovid MEDLINE(R) ALL <1946 to May 22, 2019>
Search Strategy:**--------------------------------------------------------------------------------
1     Frail Elderly/ or FRAILTY/ (10865)
2     frail\*.tw,kw. (18946)
3     1 or 2 (22878)
4     exp "Wounds and Injuries"/ (864852)
5     Trauma Centers/ or TRAUMATOLOGY/ (12666)
6     Trauma Severity Indices/ (8096)
7     exp Hip Fractures/ (22529)
8     (trauma\* or injur\* or fracture\* or accident\*).tw,kw. (1192258)
9     or/4-8 (1598637)
10     exp cohort studies/ (1858417)
11     (cohort\* or prospective\* or retrospective\* or longitudinal or follow-up).tw. (2271619)
12     10 or 11 (2898180)
**13     3 and 9 and 12 (882)**

**Database: Embase Classic+Embase <1947 to 2019 May 22>
Search Strategy:**
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1     frailty/ (6716)
2     frail\*.tw. (27581)
3     1 or 2 (28474)
4     exp \*injury/ (1079351)
5     (trauma\* or injur\* or fracture\* or accident\*).tw. (1618543)
6     exp hip fracture/ (36013)
7     traumatology/ (11160)
8     or/4-7 (2088070)
9     3 and 8 (2968)
10     cohort analysis/ (467001)
11     retrospective study/ (777498)
12     prospective study/ (522944)
13     (cohort\* or prospective\* or retrospective\* or longitudinal or follow-up).tw. (3530860)
14     or/10-13 (3769923)
**15     9 and 14 (1197)**

|  |  |  |
| --- | --- | --- |
| **CINAHL** |  |  |
| **S14** | **S9 AND S13** | **367** |
| S13 | S10 OR S11 OR S12 | 743,082 |
| S12 | TI ( (cohort\* or prospective\* or retrospective\* or longitudinal or follow-up) ) OR AB ( (cohort\* or prospective\* or retrospective\* or longitudinal or follow-up) ) | 584,515 |
| S11 | (MH "Retrospective Panel Studies") | 188 |
| S10 | (MH "Prospective Studies+") | 384,066 |
| S9 | S3 AND S8 | 854 |
| S8 | S4 OR S5 OR S6 OR S7 | 415,849 |
| S7 | TI ( (trauma\* or injur\* or fracture\* or accident\*) ) OR AB ( (trauma\* or injur\* or fracture\* or accident\*) ) | 289,500 |
| S6 | (MH "Hip Fractures+") | 8,725 |
| S5 | (MH "Trauma Centers") | 5,598 |
| S4 | (MH "Trauma+") OR (MH "Wounds and Injuries+") | 269,417 |
| S3 | S1 OR S2 | 10,134 |
| S2 | TI frail\* OR AB frail\* | 9,936 |
| S1 | (MH "Frailty Syndrome") | 1,429 |

**eTable 2: Description of frailty instruments and time of administration**

|  |  |  |
| --- | --- | --- |
| **Radiologic** | **Time of administration** | **Description of instrument** |
| Sarcopenia | Within 48 hours of admission | Measurement of psoas cross sectional area on CT scan |
| Osteopenia | Within 48 hours of admission | Measurement of vertebral body density on CT scan |
| Psoas:lumbar vertebral index | During admission | Ratio of psoas cross-sectional area over L4 vertebral cross-sectional area |
| Radiographic composite | During admission | Combination of osteopenia, sarcopenia, vascular calcifications, sarcopenic obesity, emphysema, renal volume, cervical spine degeneration, cerebral atrophy |
| **Multidimensional frailty instruments** |  |
| Vulnerable Elders Survey | Within 48 hours of admission | 13-items assessing age, self-rated health, physical function, disability |
| Clinical Frailty Scale | Initial geriatrics consultation, via chart review, during ICU stay | 9-point scale assessing energy, function, congnition, physical function and disability |
| Frailty Index | During hospitalization | 30+ multidimensional deficits assessed to create a 0-1 score based on deficits present/deficits measured |
| Trauma-specific frailty index | During hospitalization | 15-items assessing comorbidity, cancer, cognition, disability, emotional state, general health, energy and falls |

**eTable 3: Complication outcome definitions as described by study authors**

|  |  |
| --- | --- |
| **Study** | **Complication definition** |
| Kaplan, 2017 | Any in-hospital complication leading to death, skilled nursing facility or long term acute care discharge |
| Joseph, 2014 (a) | Any in-hospital cardiac (myocardial infarction and cardiopulmonaryarrest), pulmonary (pneumonia and pulmonary embolism),infectious (sepsis and urinary tract infections), hematologic (deep venous thrombosis and disseminated intravascularcoagulation), renal (renal insufficiency) complication or reoperation. |
| Min, 2011 | acute renal failure, coma, cardiopulmonary resuscitation, decubitusulcer, deep venous thrombosis, aspiration pneumonia,pneumonia, pulmonary embolism, respiratory failure,and hyponatremia. |
| Joseph, 2016 | pneumonia, deep venous thrombosis (DVT), heart failure (HF), acute kidney injury (AKI), urinarytract infection (UTI), and anemia. |
| Ebbeling, 2014 | respiratory complications (acute respiratory distress syndrome, acute respiratory failure, aspiration/aspiration pneumonia, atelectasis, or pneumonia), infectious complications (sepsis, septicemia, acute sinusitis, soft tissue infection, urinary tract infection, pneumonia, wound infection, central nervous system infection, or empyema), organ failure (acute respiratory distress syndrome, coagulopathy, acute renal failure, or liver failure), thromboembolic complications (pulmonary embolism or deep venous thrombosis), and hemorrhagic complications (coagulopathy or postoperative hemorrhage). |
| Cheung, 2017 | infectious: catheter-related blood stream infection, pneumonia, sepsis; renal: acute renal failure; cardiac: myocardial infarction, cardiac arrest with cardiopulmonary resuscitation; pulmonary: acute respiratory distress syndrome; thromboembolism: pulmonary embolism, deep vein thrombosis; other: decubitus ulcer; stroke; drug or alcohol withdrawal syndrome  |
| McCusker, 2018 | acute respiratory distress syndrome, pneumonia, myocardial infarction, sepsis, urinary tract infection, deep vein thrombosis, acute renal failure |

**eTable 4: Summary of Complications Outcomes**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Study, Year (Reference)** | **Frailty Measure** | **Frail, n** | **Frail With Complications, n** | **Without Frailty, n** | **Without Frailty With Complications, n** | **Adjustment Variables (If Applicable)** |
| **Kaplan et al, 2017** | CT Sarcopenia/Osteopenia  | 289  | 52  | 161  | 30  | Age, Comorbidity, Sex  |
| **Joseph  et al, 2014 (1)** | Frailty Index   | 110  | 41  | 140  | 30  | Age, SBP, Heart Rate, ISS  |
| **Joseph et al, 2017** | TSFI  | 224  | 63  | 126  | 15  | -  |
| **Joseph et al, 2016** | TSFI  | 275  | 90  | 93  | 21  | -  |
| **Cheung,  et al 2017** | CFS  | 158  | 74  | 95  | 31  | Age, Comorbidity, ISS  |
| **Ebbeling  et al, 2014** | CT PLVI  | 90  | 75  | 90  | 52  | Baseline Comorbidity, ISS, Admission SBP  |
| **Mccusker et al, 2018** | TSFI  | 117  | 40  | 208  | 23  | Demographics, Admission vitals, Injury Parameters, Comorbidity, Sarcopenia  |

CFS = Clinical Frailty Scale

PLVI = Psoas:Lumbar Vertebra Index

TFSI = Trauma-Specific Frailty Index

ISS = Injury Severity Scale

SBP = Systolic Blood Pressure

**eTable 5: Summary of Discharge Outcomes**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Study, Year (Reference)** | **Frailty Measure** | **Adverse Discharge Disposition** | **Frail, n** | **Frail With Adverse Discharge Disposition, n** | **Without Frailty, n** | **Without Frailty With Adverse Discharge Disposition, n** | **Adjustment Variables (If Applicable)** |
| **Kaplan et al, 2017** | CT Sarcopenia/Osteopenia  | SNF, Long-term acute care, In-hospital Mortality  | 289  | 142  | 161  | 85  | -  |
| **Joseph  et al, 2014 (1)** | Frailty Index   | SNF, In-hospital Mortality  | 110  | 41  | 140  | 18  | Age, Sex, ISS, Mechanism of Injury  |
| **Cheung et al, 2017** | CFS  | Long-term Chronic or Acute Care Facility, Death  | 158  | 66  | 95  | 27  | Age, Comorbidity, ISS  |
| **Joseph et al, 2017** | TSFI  | SNF, In-hospital Mortality  | 224  | 86  | 126  | 13  | -  |
| **Joseph et al, 2016** | TSFI  | SNF, In-hospital Mortality  | 275  | 82  | 93  | 18  | -  |
| **Lauerman et al, 2019** | Radiographic Marker Composite Score  | Subacute Rehabilitation Facility, SNF, Hospice Facility, Ventilator Rehabilitation Facility, Death  | 137  | 25  | 352  | 24  | ISS, GCS Score, Sex, SBP  |
| **Mccusker et al, 2018** | TSFI  | Rehab/SNF, In-hospital Mortality  | 117  | 58  | 208  | 47  | Demographics, Admission Vitals, Injury Parameters, Comorbidity, Sarcopenia  |
| **Tipping et al, 2019** | CFS  | Not Home, In-hospital Mortality  | 13  | 12  | 87  | 66  | -  |

CFS = Clinical Frailty Scale

TFSI = Trauma-Specific Frailty Index

ISS = Injury Severity Scale

SBP = Systolic Blood Pressure

GCS = Glascow Coma Scale

SNF = Skilled Nursing Facility

**eTable 6: Summary of LOS Outcome**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Study, Year (Reference)** | **Frailty Measure** | **Severe Frailty, n** | **Severe Frailty LOS, days** | **Moderate Frailty/ Binary, n** | **Moderate Frailty/Binary LOS, days** | **Low Frailty, n** | **Low Frailty LOS, days** | **Without Frailty, n** | **Without Frailty LOS, days** |
| **Kaplan et al, 2017** | CT Sarcopenia/Osteopenia  | 74  | 7(5-11)  | 167  | 7(4-12)  | 48  | 6(5-10)  | 161  | 7(5-11)  |
| **Joseph  et al, 2014 (1)** | Frailty Index   | -  | -  | 110  | 7.3(6.2)  | -  | -  | 140  | 5.4(4.8)  |
| **Joseph et al, 2017** | TSFI  | -  | -  | 133  | 5(2-7)  | 91  | 4(2-6)  | 126  | 3(1-6)  |
| **Joseph et al, 2016** | TSFI  | -  | -  | 136  | 5(3-8)  | 139  | 4(2-7)  | 93  | 4(2-7)  |
| **Ebbeling et al, 2014** | CT PLVI  | -  | -  | 90  | 17(9-24)  | -  | -  | 90  | 16(10-29)  |
| **Mccusker et al, 2018** | TSFI  | -  | -  | 117  | 4(1-7)  | -  | -  | 208  | 3(1-7)  |

LOS = Length of Stay (mean/median(SD/IQR))

TFSI = Trauma-Specific Frailty Index

PLVI = Psoas:Lumbar Vertebra Index

**eFigure 1 – Funnell Plot of Adjusted Mortality Data**



**eFigure 2 – Forest plot for unadjusted length of stay data**

**Study name**

**Statistics for each study**

**Std diff in means and 95% CI**

**Std diff**

**Standard**

**Lower**

**Upper**

**in means**

**error**

**Variance**

**limit**

**limit**

**Z-Value**

**p-Value**

0.000

0.348

0.378

0.267

0.124

0.261

0.226

0.110

0.128

0.125

0.135

0.149

0.116

0.062

0.012

0.016

0.016

0.018

0.022

0.013

0.004

-0.216

0.096

0.133

0.002

-0.168

0.033

0.105

0.216

0.600

0.624

0.532

0.417

0.488

0.347

0.000

2.711

3.017

1.978

0.832

2.247

3.650

1.000

0.007

0.003

0.048

0.405

0.025

<0.001

**-1.00**

**-0.50**

**0.00**

**0.50**

**1.00**

**Frailty shorter stay**

**Frailty longer stay**

**Unadjusted Association of Frailty with Length of Stay**

**Random effects inverse variance weighted meta analysis**

Kaplan (2017)

Joseph (2014)

Joseph (2017)

Joseph (2016)

Ebbeling (2014)

Mccusker (2018)

Pooled estimate