

## Appendix 1 ICD-10 and ICD-9 coding for frailty syndromes

| Group                           | ICD-10                        | Description (ICD-10)   | ICD-9  | Description (ICD-9)   |   |
|---------------------------------|-------------------------------|--|--|---|---|
| <b>1. Dementia and Delirium</b> | F00                           | Dementia in Alzheimer's disease  | 2904   | Arteriosclerotic dementia   |   |
|                                 | F01                           | Vascular dementia  | 2941-2942  | Dementia in other diseases and unspecified dementia                               |   |
|                                 | F02                           | Dementia in other diseases classified elsewhere  | 2930-2931  | Subacute delirium and delirium due to conditions classified elsewhere             |   |
|                                 | F03                           | Unspecified dementia   | V4031  | Wandering in diseases classified elsewhere  |   |
|                                 | F05                           | Delirium not induced by alcohol and other psychoactive                                       | 3310   | Alzheimer's disease   |   |
|                                 | G30                           | Alzheimer's disease  | 3312   | Senile degeneration of brain  |   |
|                                 | G31                           | Senile degeneration of brain, not elsewhere classified                                       | 2900-2903  | Senile and presenile dementia, dementia with delirium                             |   |
|                                 | G31                           | Circumscribed brain atrophy  | 33119  | Other frontotemporal dementia   |   |
|                                 | F04                           | Organic amnesic syndrome, not induced by alcohol and other psychoactive substances           | 33182  | Dementia with lewy bodies   |   |
|                                 | R41                           | Other symptoms and signs involving cognitive functions and awareness                         | 2908-2909  | Other senile psychotic conditions   |   |
|                                 |                               |  | 2948-2949  | Other persistent mental disorders due to conditions classified elsewhere          |   |
|                                 |                               |  | 2940   | Amnesic disorder in conditions classified elsewhere                               |   |
|                                 | <b>2. Mobility Problems</b>   | R26  | Abnormalities of gait and mobility   | 7812  | Abnormality of gait   |
|                                 |                               | R29  | Other and unspecified symptoms and signs involving the nervous and musculoskeletal systems | 78199   | Other symptoms involving nervous and musculoskeletal systems      |
|                                 | <b>3. Falls and Fractures</b> | S32  | Fracture of lumbar spine and pelvis  | 8054-8055   | Fracture of lumbar vertebra without mention of spinal cord injury |
|                                 |                               | S33  | Dislocation, sprain and strain of joints and ligaments of lumbar spine and pelvis          | 8064-8065   | Fracture of lumbar spine with spinal cord injury                  |
| S42                             |                               | Fracture of shoulder and upper arm   | 8056-8057  | Fracture of sacrum and coccyx without mention of spinal cord injury               |   |
| S43                             |                               | Dislocation, sprain and strain of joints and ligaments of shoulder girdle                    | 8066-8067  | Fracture of sacrum & coccyx with spinal cord injury                               |   |
| S52                             |                               | Fracture of forearm  | 808-809  | Fracture of pelvis and ill-defined fractures of bones of trunk                    |   |
| S53                             |                               | Dislocation, sprain and strain of joints and ligaments of elbow                              | 8392-8393  | Dislocation, thoracic & lumbar vertebra   |   |
| S62                             |                               | Fracture at wrist and hand level   | 83941-83952  | Dislocation, coccyx and sacrum  |   |
| S63                             |                               | Dislocation, sprain and strain of joints and ligaments at wrist and hand level               | 846  | Sprains & strains of sacroiliac region  |   |
| S72                             |                               | Fracture of femur  | 8472-8474  | Sprain of lumbar, sacrum, coccyx  |   |
| S73                             |                               | Dislocation, sprain and strain of joint and ligaments of hip                                 | 8485   | Sprain of pelvic  |   |
| W0-W1                           |                               | Falls  | 810-812  | Fracture of clavicle, scapula, humerus  |   |
| M8                              |                               | Osteoporosis with pathological fracture  | 831-835  | Dislocation of shoulder, elbow, wrist, finger, hip                                |   |
| M8                              |                               | Osteoporosis without pathological fracture   | 840-843  | Sprains & strains of shoulder, upper arm, elbow, forearm, wrist, hand, hip, thigh |   |
| R29                             |                               | Tendency to fall, not elsewhere classified   | 83961 & 83971  | Dislocation, sternum  |   |
| R55                             |                               | Syncope and collapse   | 8484   | Sternum sprain  |   |
| R54                             |                               | Senility   | 813-817  | Fracture of radius & ulna, carpal bone(s), metacarpal bone(s), phalanges of hand  |   |
| M9                              |                               | Fracture of bone following insertion of orthopaedic implant, joint prosthesis, or bone plate | 820-821  | Fracture of neck of femur and other parts of femur                                |   |
|                                 |                               |  | E88  | Falls   |   |

|   |          |  |       |   |
|---|----------|--|-------|---|
|   |          |  | 7330  | Osteoporosis  |
|   |          |  | 7331  | Pathological fracture   |
|   |          |  | V1588 | History of fall   |
|   |          |  | 7802  | Syncope and collapse  |
|   |          |  | 797   | Senility without mention of psychosis                                   |
|   |          |  | 9964  | Mechanical complication of internal orthopedic device implant and graft |
| <b>4. Pressure Ulcers and Weight Loss</b> | L89      | Decubitus ulcer and pressure area                            | 7072  | Pressure ulcer  |
|   | R63<br>4 | Abnormal weight loss   | 7070  | Decubitus ulcer   |
|   | R63<br>6 | Insufficient intake of food and water due to self neglect    | 7832  | Abnormal Loss of Weight   |
|   | Z72<br>4 | Inappropriate diet and eating habits                         | V691  | Inappropriate diet and eating habits                                    |
| <b>5. Incontinence</b>                    | R32      | Unspecified urinary incontinence                             | 7883  | Incontinence of urine   |
|   | R15      | Faecal incontinence  | 7876  | Incontinence of feces   |
| <b>6. Dependence and Care</b>             | Z74      | Problems related to care-provider dependency                 | V604  | No other household member able to render care                           |
|   | Z75      | Problems related to medical facilities and other health care | V63   | Unavailability of other medical facilities for care                     |
| <b>7. Anxiety and Depression</b>          | F38      | Other mood [affective] disorders                             | 2969  | Other & unspecified affective psychoses                                 |
|   | F41      | Other anxiety disorders                                      | 3000  | Anxiety states  |
|   | F43      | Reaction to severe stress, and adjustment disorders          | 308   | Acute reaction to stress  |
|   | F44      | Dissociative [conversion] disorders                          | 309   | Adjustment reaction   |
|   | F06<br>4 | Organic anxiety disorder                                     | 3001  | Hysteria  |
|   | F32      | Depressive episode   | 2962  | Major depressive disorder, single episode                               |
|   | F33      | Recurrent depressive disorder                                | 2963  | Major depressive disorder, recurrent episode                            |
|   | F20<br>4 | Post-schizophrenic depression                                | 2965  | Bipolar affective disorder, depressed                                   |
|   | F25<br>1 | Schizoaffective disorder, depressive type                    | 3004  | Dysthymic disorder  |
|   | F31      | Bipolar affective disorder                                   | 3090  | Adjustment disorder with depressed mood                                 |
|   | F34<br>1 | Dysthymia  | 3091  | Prolonged depressive reaction   |
|   | F41<br>2 | Mixed anxiety and depressive disorder                        | 3092  | Adjustment reaction with predominant disturbance of other emotions      |
|   | F43<br>2 | Adjustment disorders   | 2968  | Manic-depressive psychosis, other & unspecified                         |
|   |          |  | 2980  | Depressive type psychosis   |
|   |          |  | 3011  | Affective personality disorder  |
|   |          |  | 311   | Depressive disorder, not elsewhere classified                           |

Appendix 2: Odds Ratios for Frailty Score after adjustment for age, gender, country for the outcomes of in-hospital mortality, 30-day non-elective readmission and upper quartile length of stay (for country), by elective and non-elective population groups within the Global Comparators Dataset (Derivation)

In-hospital mortality

Table 12: Odds Ratios of Frailty Score for in-hospital mortality adjusted for age, gender country within each subgroup (elective and non-elective)

Elective

|                          | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>P-value</b> |
|--------------------------|-------------------|-----------------|-----------------|----------------|
| (Intercept)              | 0.001             | 0.000           | 0.001           | <0.001         |
| Age                      | 1.041             | 1.029           | 1.054           | <0.001         |
| Sex - F                  | Reference         |                 |                 |                |
| Sex - M                  | 1.441             | 1.277           | 1.626           | <0.001         |
| Country - Australia      | Reference         |                 |                 |                |
| Country - Belgium        | 1.039             | 0.836           | 1.292           | 0.730          |
| Country - Denmark        | 0.913             | 0.668           | 1.248           | 0.569          |
| Country - Finland        | 0.318             | 0.227           | 0.446           | <0.001         |
| Country - Italy          | 0.702             | 0.496           | 0.994           | 0.046          |
| Country - Netherlands    | 1.413             | 1.107           | 1.803           | 0.005          |
| Country - Norway         | 0.616             | 0.492           | 0.770           | <0.001         |
| Country - United Kingdom | 0.566             | 0.467           | 0.686           | <0.001         |
| Country - United States  | 0.838             | 0.686           | 1.023           | 0.082          |
| Frailty Score            | 1.277             | 1.247           | 1.308           | <0.001         |

Non-elective

|                          | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>P-value</b> |
|--------------------------|-------------------|-----------------|-----------------|----------------|
| (Intercept)              | 0.002             | 0.002           | 0.003           | <0.001         |
| Age                      | 1.040             | 1.037           | 1.043           | <0.001         |
| Sex - F                  | Reference         |                 |                 |                |
| Sex - M                  | 1.305             | 1.265           | 1.346           | <0.001         |
| Country - Australia      | Reference         |                 |                 |                |
| Country - Belgium        | 1.338             | 1.213           | 1.478           | <0.001         |
| Country - Denmark        | 1.480             | 1.371           | 1.598           | <0.001         |
| Country - Finland        | 0.936             | 0.864           | 1.015           | 0.109          |
| Country - Italy          | 1.682             | 1.462           | 1.936           | <0.001         |
| Country - Netherlands    | 1.525             | 1.361           | 1.709           | <0.001         |
| Country - Norway         | 1.001             | 0.942           | 1.062           | 0.987          |
| Country - United Kingdom | 1.492             | 1.419           | 1.570           | <0.001         |
| Country - United States  | 0.897             | 0.844           | 0.953           | <0.001         |
| Frailty Score            | 1.109             | 1.103           | 1.116           | <0.001         |

### 30-day non-elective readmission

Table 13: Odds Ratios of Frailty Score for 30-day non-elective readmission adjusted for age, gender country within each subgroup (elective and non-elective)

#### Elective

|                          | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>P-value</b> |
|--------------------------|-------------------|-----------------|-----------------|----------------|
| (Intercept)              | 0.037             | 0.021           | 0.065           | <0.001         |
| Age                      | 1.002             | 0.995           | 1.009           | 0.622          |
| Sex - F                  | Reference         |                 |                 |                |
| Sex - M                  | 1.159             | 1.087           | 1.236           | <0.001         |
| Country - Australia      | Reference         |                 |                 |                |
| Country - Belgium        | 0.893             | 0.758           | 1.053           | 0.179          |
| Country - Denmark        | 1.573             | 1.339           | 1.847           | <0.001         |
| Country - Finland        | 1.153             | 1.003           | 1.326           | 0.045          |
| Country - Italy          | 0.500             | 0.391           | 0.640           | <0.001         |
| Country - Netherlands    | 1.174             | 0.988           | 1.395           | 0.068          |
| Country - Norway         | 1.616             | 1.434           | 1.821           | <0.001         |
| Country - United Kingdom | 1.094             | 0.975           | 1.228           | 0.125          |
| Country - United States  | 1.323             | 1.168           | 1.498           | <0.001         |
| Admission History        | 1.453             | 1.411           | 1.495           | <0.001         |
| Frailty Score            | 1.106             | 1.060           | 1.154           | <0.001         |

#### Non-elective

|                          | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>P-value</b> |
|--------------------------|-------------------|-----------------|-----------------|----------------|
| (Intercept)              | 0.112             | 0.091           | 0.136           | <0.001         |
| Age                      | 0.998             | 0.996           | 1.001           | 0.201          |
| Sex - F                  | Reference         |                 |                 |                |
| Sex - M                  | 1.167             | 1.137           | 1.198           | <0.001         |
| Country - Australia      | Reference         |                 |                 |                |
| Country - Belgium        | 0.803             | 0.722           | 0.893           | <0.001         |
| Country - Denmark        | 1.317             | 1.231           | 1.408           | <0.001         |
| Country - Finland        | 0.995             | 0.931           | 1.063           | 0.879          |
| Country - Italy          | 0.760             | 0.646           | 0.893           | 0.001          |
| Country - Netherlands    | 0.774             | 0.683           | 0.877           | <0.001         |
| Country - Norway         | 1.582             | 1.507           | 1.660           | <0.001         |
| Country - United Kingdom | 1.362             | 1.302           | 1.425           | <0.001         |
| Country - United States  | 1.274             | 1.211           | 1.340           | <0.001         |
| Admission History        | 1.315             | 1.303           | 1.326           | <0.001         |
| Frailty Score            | 1.056             | 1.031           | 1.082           | <0.001         |

Upper Quartile Length of Stay (for country)

Table 14: Odds Ratios of Frailty Score for Upper Quartile Length of Stay (for country) adjusted for age, gender country within each subgroup (elective and non-elective)

Elective

|                          | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>P-value</b> |
|--------------------------|-------------------|-----------------|-----------------|----------------|
| (Intercept)              | 0.065             | 0.045           | 0.094           | <0.001         |
| Age                      | 1.016             | 1.011           | 1.020           | <0.001         |
| Sex - F                  | Reference         |                 |                 |                |
| Sex - M                  | 0.966             | 0.927           | 1.008           | 0.112          |
| Country - Australia      | Reference         |                 |                 |                |
| Country - Belgium        | 0.415             | 0.376           | 0.457           | <0.001         |
| Country - Denmark        | 0.616             | 0.549           | 0.691           | <0.001         |
| Country - Finland        | 0.511             | 0.467           | 0.558           | <0.001         |
| Country - Italy          | 1.053             | 0.953           | 1.162           | 0.310          |
| Country - Netherlands    | 0.763             | 0.691           | 0.843           | <0.001         |
| Country - Norway         | 0.767             | 0.713           | 0.825           | <0.001         |
| Country - United Kingdom | 0.294             | 0.273           | 0.316           | <0.001         |
| Country - United States  | 0.819             | 0.765           | 0.878           | <0.001         |
| Frailty Score            | 1.365             | 1.347           | 1.382           | <0.001         |

Non-elective

|                          | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>P-value</b> |
|--------------------------|-------------------|-----------------|-----------------|----------------|
| (Intercept)              | 0.284             | 0.245           | 0.330           | <0.001         |
| Age                      | 0.995             | 0.993           | 0.996           | <0.001         |
| Sex - F                  | Reference         |                 |                 | <0.001         |
| Sex - M                  | 1.055             | 1.034           | 1.076           | <0.001         |
| Country - Australia      | Reference         |                 |                 | <0.001         |
| Country - Belgium        | 1.766             | 1.658           | 1.881           | <0.001         |
| Country - Denmark        | 1.570             | 1.492           | 1.652           | <0.001         |
| Country - Finland        | 1.705             | 1.628           | 1.786           | <0.001         |
| Country - Italy          | 2.270             | 2.074           | 2.484           | <0.001         |
| Country - Netherlands    | 2.268             | 2.112           | 2.435           | <0.001         |
| Country - Norway         | 1.303             | 1.254           | 1.353           | <0.001         |
| Country - United Kingdom | 1.508             | 1.459           | 1.559           | <0.001         |
| Country - United States  | 1.434             | 1.382           | 1.488           | <0.001         |
| Frailty Score            | 1.199             | 1.194           | 1.205           | <0.001         |

Appendix 3: Odds Ratios for Frailty Score after adjustment for age, gender, calendar year for the outcomes of in-hospital mortality, 30-day non-elective readmission and upper quartile length of stay (for country), by elective and non-elective population groups in Hospital Episode Statistics dataset (Validation)

In-hospital mortality

Table 15: Odds Ratios of Frailty Score for in-hospital mortality adjusted for age, gender and calendar year within each subgroup (elective and non-elective)

Elective

|                      | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>Z-value</b> | <b>P-value</b> |
|----------------------|-------------------|-----------------|-----------------|----------------|----------------|
| (Intercept)          | 0.001             | 0.001           | 0.001           | -338.153       | 0.000          |
| Age                  | 1.051             | 1.050           | 1.051           | 206.705        | 0.000          |
| Sex - F              | Reference         |                 |                 |                |                |
| Sex - M              | 1.274             | 1.267           | 1.281           | 84.839         | 0.000          |
| Calendar Year - 2012 | Reference         |                 |                 |                |                |
| Calendar Year - 2013 | 0.938             | 0.931           | 0.945           | -16.172        | 0.000          |
| Calendar Year - 2014 | 0.851             | 0.844           | 0.857           | -40.603        | 0.000          |
| Calendar Year - 2015 | 0.865             | 0.858           | 0.871           | -36.727        | 0.000          |
| <b>Frailty Score</b> | <b>1.173</b>      | <b>1.171</b>    | <b>1.174</b>    | <b>279.196</b> | <b>0.000</b>   |

Non-elective

|                      | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>Z-value</b> | <b>P-value</b> |
|----------------------|-------------------|-----------------|-----------------|----------------|----------------|
| (Intercept)          | 0.001             | 0.001           | 0.001           | -353.600       | 0.000          |
| Age                  | 1.055             | 1.055           | 1.056           | 227.822        | 0.000          |
| Sex - F              | Reference         |                 |                 |                |                |
| Sex - M              | 1.233             | 1.226           | 1.240           | 73.302         | 0.000          |
| Calendar Year - 2012 | Reference         |                 |                 |                |                |
| Calendar Year - 2013 | 0.936             | 0.929           | 0.944           | -16.598        | 0.000          |
| Calendar Year - 2014 | 0.850             | 0.844           | 0.857           | -40.640        | 0.000          |
| Calendar Year - 2015 | 0.869             | 0.862           | 0.876           | -35.371        | 0.000          |
| <b>Frailty Score</b> | <b>1.108</b>      | <b>1.107</b>    | <b>1.109</b>    | <b>315.847</b> | <b>0.000</b>   |

### 30-day non-elective readmission

Table 16: Odds Ratios of Frailty Score for 30-day non-elective readmission adjusted for age, gender and calendar year within each subgroup (elective and non-elective)

#### Elective

|                               | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>Z-value</b> | <b>P-value</b> |
|-------------------------------|-------------------|-----------------|-----------------|----------------|----------------|
| (Intercept)                   | 0.055             | 0.054           | 0.057           | -186.458       | 0.000          |
| Age                           | 1.011             | 1.010           | 1.011           | 58.247         | 0.000          |
| Sex - F                       | Reference         |                 |                 |                |                |
| Sex - M                       | 1.119             | 1.114           | 1.123           | 53.787         | 0.000          |
| Calendar Year - 2012          | Reference         |                 |                 |                |                |
| Calendar Year - 2013          | 0.994             | 0.989           | 1               | -1.918         | 0.055          |
| Calendar Year – 2014          | 1.015             | 1.009           | 1.021           | 5.090          | 0.000          |
| Calendar Year – 2015          | 1.018             | 1.012           | 1.024           | 6.228          | 0.000          |
| Previous Emergency Admissions | 1.443             | 1.440           | 1.445           | 379.358        | 0.000          |
| <b>Frailty Score</b>          | <b>1.045</b>      | <b>1.044</b>    | <b>1.047</b>    | <b>77.860</b>  | <b>0.000</b>   |

#### Non-elective

|                               | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>Z-value</b> | <b>P-value</b> |
|-------------------------------|-------------------|-----------------|-----------------|----------------|----------------|
| (Intercept)                   | 0.053             | 0.051           | 0.054           | -191.317       | 0.000          |
| Age                           | 1.011             | 1.011           | 1.012           | 62.570         | 0.000          |
| Sex - F                       | Reference         |                 |                 |                |                |
| Sex - M                       | 1.121             | 1.117           | 1.126           | 54.752         | 0.000          |
| Calendar Year - 2012          | Reference         |                 |                 |                |                |
| Calendar Year - 2013          | 0.993             | 0.987           | 0.998           | -2.526         | 0.012          |
| Calendar Year – 2014          | 1.012             | 1.007           | 1.018           | 4.231          | 0.000          |
| Calendar Year – 2015          | 1.015             | 1.010           | 1.021           | 5.218          | 0.000          |
| Previous Emergency Admissions | 1.439             | 1.436           | 1.442           | 376.406        | 0.000          |
| <b>Frailty Score</b>          | <b>1.030</b>      | <b>1.030</b>    | <b>1.031</b>    | <b>85.172</b>  | <b>0.000</b>   |

Upper quartile length of stay

Table 17: Odds Ratios of Frailty Score for upper quartile length of stay adjusted for age, gender and calendar year within each subgroup (elective and non-elective)

Elective

|                      | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>Z-value</b> | <b>P-value</b> |
|----------------------|-------------------|-----------------|-----------------|----------------|----------------|
| (Intercept)          | 0.030             | 0.029           | 0.031           | -258.331       | 0.000          |
| Age                  | 1.023             | 1.023           | 1.024           | 143.925        | 0.000          |
| Sex - F              | Reference         |                 |                 |                |                |
| Sex - M              | 0.940             | 0.937           | 0.944           | -32.930        | 0.000          |
| Calendar Year - 2012 | Reference         |                 |                 |                |                |
| Calendar Year - 2013 | 0.975             | 0.970           | 0.980           | -9.874         | 0.000          |
| Calendar Year - 2014 | 0.891             | 0.886           | 0.895           | -44.736        | 0.000          |
| Calendar Year - 2015 | 0.872             | 0.868           | 0.877           | -52.705        | 0.000          |
| <b>Frailty Score</b> | <b>1.193</b>      | <b>1.192</b>    | <b>1.193</b>    | <b>593.715</b> | <b>0.000</b>   |

Non-elective

|                      | <b>Odds Ratio</b> | <b>Lower CI</b> | <b>Upper CI</b> | <b>Z-value</b> | <b>P-value</b> |
|----------------------|-------------------|-----------------|-----------------|----------------|----------------|
| (Intercept)          | 0.031             | 0.030           | 0.032           | -255.862       | 0.000          |
| Age                  | 1.023             | 1.022           | 1.023           | 139.087        | 0.000          |
| Sex - F              | Reference         |                 |                 |                |                |
| Sex - M              | 0.948             | 0.944           | 0.951           | -28.576        | 0.000          |
| Calendar Year - 2012 | Reference         |                 |                 |                |                |
| Calendar Year - 2013 | 0.979             | 0.974           | 0.984           | -8.288         | 0.000          |
| Calendar Year - 2014 | 0.896             | 0.891           | 0.900           | -42.538        | 0.000          |
| Calendar Year - 2015 | 0.878             | 0.874           | 0.883           | -50.020        | 0.000          |
| <b>Frailty Score</b> | <b>1.055</b>      | <b>1.055</b>    | <b>1.055</b>    | <b>602.049</b> | <b>0.000</b>   |



Appendix 4 Case-mix adjustment for older persons utilising administrative data

| Author              | Year | Country        | Study population   | N      | Data Source   | Outcome                           | Predictors  | Model performance  |
|---------------------|------|----------------|--|--------|---|-----------------------------------|---|--|
| Von Korff et al.(1) | 1991 | United States  | Population based pharmacy data   | 122911 | Administrative  | Mortality and hospitalisation     | Consensus based Chronic Disease Score(CDS)  |  |
| Rosen et al.(2)     | 2001 | United States  | Long-term facility resident (Veterans Affairs)   | 39839  | Administrative (Patient Assessment File(PAF), Patient Treatment File(PTF), Extended Care File(ECF)) | Decline in functional status      | International Classification of Diseases, Ninth Revision Clinical Modification (ICD-9) , demographics, treatments, activities of daily living | AUC for decline in functional status is 0.70                     |
| Desai et al.(3)     | 2002 | United States  | ≥70 admitted to geriatric service  | 1376   | Administrative (Management Information System)  | Mortality                         | International Classification of Diseases system version 9 (ICD-9)   | AUC 0.76 for mortality in derivation and AUV 0.68 in validation) |
| Kautter et al(4)    | 2004 | United States  | Medicare   | 17597  | Administrative The Medicare Current Beneficiary Survey (MCBS)                                       | Cost                              | ADLs, Long-term institution status, Age   |  |
| Roland et al.(5)    | 2005 | United Kingdom | Individual patients aged ≥ 65, ≥ 75, and ≥ 85who had at least two emergency admissions | 227206 | Administrative (Hospital Episode Statistics)  | Non-elective hospital readmission | Individual patients aged ≥ 65who had at least two emergency admissions  |  |

|                         |      |                |  |        |   |  |  |   |
|-------------------------|------|----------------|--|--------|---|--|--|---|
| Inoye et al.(6)         | 2008 | United States  | Primary care clinic  | 3919   | Administrative  | Non-elective hospital admission  | Deyo-Charlson, comorbidity score $\geq 2$ , any prior hospitalization 6 or more primary care visits, $\geq 85$ years unmarried status  | AUC 0.73  |
| Sternberg et al.(7)     | 2012 | Israel         | Patients receiving Comprehensive Geriatric Assessment via OPD      | 221    | Administrative; and survey  | Resource utilisation (number of physician visits in 3 months, number of ED visits in a year, and number of hospitalizations in the year) | VES Frailty Score(13-item function-based self-report questionnaire The Adjusted Clinical Groups–diagnoses based predictive model (ACG Dx-PM) based on age, sex, diagnostic codes, and pharmacy data                                      | ACG predict frailty defined by VES – AUC 0.63                                     |
| Davidoff et al.(8)      | 2013 | United States  | US Medicare beneficiaries aged $\geq 65$ years                     | 14788  | Administrative (Medicare) and Medicare Current Beneficiary Survey (MCBS), | Disability Status  | Healthcare services, Berenson-Eggers Type of Service (BETOS) codes- American Medical Association's Current Procedural Terminology (CPT) codes, or the CMS, Healthcare Common Procedure Coding System (HCPCS level II) codes, demographic | AUC 0.92 for disability status  |
| Bottle et al.(9)        | 2014 | United Kingdom | Admitted with heart failure  | 84212  | Administrative (Hospital Episode statistics)                              | Non-elective hospital readmission  | AHRQ's (Agency for Healthcare Research and Quality) Clinical Classification System International Classification of Diseases system version 10 (ICD-10)   |   |
| Chrischilles et al.(10) | 2014 | United States  | US Medicare beneficiaries aged $\geq 65$ years admitted with acute | 144112 | Administrative  | Mortality, cardiac catheterisation   | Demographic measures, cardiovascular conditions, comorbidities, previous hospitalization, and Function related indicators(FRI)   | AUC Mortality 0.74, AUC cardiac catheterisation 0.79, Including the FRIs improved |

|                   |      |                |   |           |   |  |   |  |
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|                   |      |                | myocardial infarction                                 |           |   |  |   | prediction models  |
| Ruiz et al.(11)   | 2015 | United Kingdom | Individual patients aged ≥ 65 with hospital admission | 2788900   | Administrative (Hospital Episode Statistics)                  | Mortality, Non-elective hospital readmission, Hospital admission | ≥ 65 years old, who have at least 3 simultaneous diagnoses of major clinical conditions.  |  |
| Faurot et al.(12) | 2015 | United States  | ≥ 65 community dwelling                               | 6391      | Administrative and Medicare Current Beneficiary Survey (MCBS) | Functional decline   | demographics, International Classification of Diseases, Ninth Revision Clinical Modification (ICD-9) diagnosis/procedure and durable medical equipment codes for frailty-associated conditions, (Current Procedural Terminology (CPT) and Healthcare Common Procedure Coding System (HCPC)) |  |
| Hope et al.(13)   | 2015 | United States  | >70 admitted to ICU                                   | 47427     | Administrative (Medicare)                                     | Mortality  | International Classification of Diseases, Ninth Revision Clinical Modification (ICD-9) diagnosis & claims for skilled nursing facility: creation of four categories: 1)Cancer 2)Chronic Organ Failure3)Frailty4) Robust   |  |
| Soong et al.      | 2015 | United Kingdom | >65 non-elective admission to hospital                | 2 099 252 | Administrative  | Mortality, non-elective readmission, functional decline          | ICD-10 coded Frailty Syndromes  | AUC of 0.624–0.659 for inpatient mortality, 0.63–0.654 for institutionalisation and 0.57–0.63 for 30-day |

|                    |      |                |  |           |   |   |  |  |
|--------------------|------|----------------|--|-----------|---|---|--|--|
|                    |      |                |  |           |   |   |  | emergency readmission.   |
| Briggs et al.(14)  | 2016 | Ireland        | Patients admitted with dementia to single hospital         | 929       | Administrative  | Cost  | International Classification of Diseases system version 10 (ICD-10)  |  |
| Mclsaac et al.(15) | 2016 | Canada         | >65 years Elective non-cardiac surgery                     | 202811    | Administrative Discharge Abstract Database, Ontario Health Insurance Plan Database, Registered Persons Database | Inpatient mortality   | John's Hopkins Adjusted Clinical Groups (ACG, Johns Hopkins University) frailty-defining diagnoses indicator,  |  |
| Kim et al.(16)     | 2017 | United States  | ≥ 65 community dwelling                                    | 10017     | Administrative (Medicare) and Medicare Current Beneficiary Survey (MCBS)  | Mortality, disability, mobility impairment, and recurrent falls | International Classification of Diseases, Ninth Revision Clinical Modification (ICD-9) (Current Procedural Terminology (CPT) and Healthcare Common Procedure Coding System (HCPC)) to create a frailty index |  |
| Gilbert et al.(17) | 2018 | United Kingdom | >75 years elective and non-elective admissions to hospital | 1 013 590 | Administrative Hospital Episode Statistics  | Mortality, long length of stay, non-elective readmission        | ICD-10 Codes identified by cluster analysis for Bed days, Hospital costs, and ICD-10 coded Frailty Syndromes   | AUC 0-60 for 30-day mortality, 0-68 for long hospital stay, 0-56 for 30-day readmission. |

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