**Additional file 1**. Definitions of covariates and measurements.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Diagnosis**  | **ICD-10-CM code and medication**  | **Number of diagnosis**  | **Diagnosis test or treatment** | **Combination\***  |
| **Inclusion/Exclusion** |  |  |  |  |
| Vertebral fracture | S22.0, S22.1 S32.0, S32.8 T08, M484  | Admission ≥ 1 or Outpatient department with diagnostic test or treatment ≥ 1 | N0471, N0472, N0473,N 0474, N0630, G430, G440, G450, G460 |  |
| Hip fracture | S72.0, S72.1 | N0601, N0991, N0981, N0641, N0652, N0654, N0715, N0711, N0611, N2070, N2710 |  |
| Radius fracture | S52.5, S52.6 | N1601, N1611, N1603, N1613, N0996, N0998, N0983T6020, T6030, T6151, T6152 |  |
| Humerus fracture | S42.2, S42.3 | N0602, N0612, N0992, N0982, N0986, N0722, N2711, N2716, T6010, T6110 |  |
| **Comorbidities based on the last health examination**  | 　 | 　 |
| **Comorbidities**  |  |  |  |  |
|  Hypertension | I10-I13, I15; and minimum 1 prescription of anti-hypertensive drug (thiazide, loop diuretics, aldosterone antagonist, alpha-/beta-blocker, calcium-channel blocker, angiotensin-converting enzyme inhibitor, or angiotensin II receptor blocker) | Admission ≥ 1 or outpatient department ≥ 2  | Systolic/diastolic blood pressure ≥ 140/90 mmHg  | 1+2 or 3 |
|  DM | E11-E14; and minimum 1 prescription of anti-diabetic drugs (sulfonylureas, metformin, meglitinides, thiazolidinediones, dipeptidyl peptidase-4 inhibitors, α-glucosidase inhibitors, or insulin)  | Admission ≥ 1 or outpatient department ≥ 2 | Fasting glucose level ≥ 126 mg/dL | 1+2 or 3 |
|  Dyslipidemia | E78 | Admission ≥ 1 or outpatient department ≥ 1 | Total cholesterol ≥ 240 mg/dL | 1+2 or 3 |
|  CKD | N/A | N/A | eGFR<60ml/min/1.73m2 | 3 |
| **Definitions of life style behavior based on the last health examination questionnaire**  |
| **Alcohol consumption**  |  |  |  |  |
|  Mild to moderate drinker | Alcohol consumption > 0g to < 30g per day |  |  |
|  Heavy drinker | Alcohol consumption ≥ 30g per day |  |  |
| **Regular exercise** |  |  |  |  |
|  | performing over 30 minutes moderate intensity exercise over 5 times per a week or over 20 minutes vigorous intensity exercise over 3 times per a week |
| **Smoking**  |  |  |  |  |
|  Ex-smoker | Ex-smoker at the 1st examination and sustaining non-smoking till the 2nd examination |  |  |
|  Current smoker | Current smoker at the 2nd examination regardless of the smoking status at the 1st examination. |
| **Information of income**  |
|  Low income  | Income belongs to lower 20% among the entire Korean population and supported by the Medical Aid program |  |

Abbreviation: N/A, not applicable; DM, diabetes mellitus; CKD, chronic kidney disease.

\* Combination: 1= ICD-10-CM code and medication; 2 = Number of diagnosis; and 3 = Diagnosis test or treatment