**Appendix**

**Appendix 1. ICD-10 definitions for comorbidities and complications**

|  |  |
| --- | --- |
|  Comorbidities | ICD-10 codes |
| Coronary heart disease | I21, I22, I252 |
| heart failure | I50 |
| peripheral vascular disease | I71, I790, I739, R02, Z958, Z959 |
| cerebrovascular disease | I60-63, I65-66, G450-452, G458-459, G46, I64, G454, I670-672, I674, I675-679, I681-682, I688, I69 |
| dementia | F00-03, F051, G30 |
| pulmonary disease | J40-47, J60-67 |
| connective tissue disease | M32, M34, M332, M053, M058-060, M063, M069, M050, M052, M051, M353 |
| gastric ulcer | K25-28 |
| mild liver disease | K702-703, K73, K717, K740, K742-746 |
| diabetes mellitus | E109, E119, E139, E149, E101, E111, E131, E141, E105, E115, E135, E145 |
| diabetes with complications | E102, E112, E132, E142, E142, E113, E133, E143, E104, E114, E117, E134, E144, E117 |
| paralysis | G041, G820, G821, G822 |
| renal failure | N03, N052-056, N072-074, N01, N18-19, N25 |
| cancer | C0-9 |
| metastatic cancer | C77-80 |
| severe liver disease | K729, K766-7, K721 |
| HIV | B20-24 |
| anemia | D509 |
| Parkinson disease | G20 |
| Stable angina | I20 |
| hypertension | I10 |
| osteoarthritis of hip | M16 |

**Appendix 2. ICD-10 definitions for complications**

|  |  |
| --- | --- |
|  Complications | ICD-10 codes |
|  |  |
| Coronary heart disease | I20-25 |
| heart failure | I50 |
| respiratory disorder | J12-18, J95-96 |
| pulmonary embolism | I26 |
| stroke | I60-64 |
| renal failure | N17-19 |
| urinary tract infection | N390 |
| sepsis | A40-41, D65 |
| surgical site infection | T793, T814 |
| Hip dislocation.  | K0631 |

**Appendix 3. Patient characteristics (Full description)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Total | Cemented | Cementless | p-value | Cemented | Cementless | p-value |
| 　 | N=129,368 | N=15,690 | N=113,678 | 　 | N=15,666 | N=15,666 | 　 |
| Age, year mean (SD) | 82.20 (7.38) | 83.09 (7.31) | 82.07 (7.38) | <0.001 | 83.09 (7.31) | 83.17 (7.24) |  0.29 |
| Female, n (%) | 101,751 (78.7) | 12,695 (80.9) | 89,056 (78.3) | <0.001 | 12,675 (80.9) | 12,776 (81.6) |  0.14 |
| BMI, n (%) |  |  |  | <0.001 |  |  |  0.50 |
|  <18.5 | 34,332 (26.5) | 4,514 (28.8) | 29,818 (26.2) |  | 4,503 (28.7) | 4,591 (29.3) |  |
|  18.5-25 | 72,603 (56.1) | 8,432 (53.7) | 64,171 (56.4) |  | 8,420 (53.7) | 8,433 (53.8) |  |
|  25-30 | 10,841 (8.4) | 1,237 (7.9) | 9,604 (8.4) |  | 1,237 (7.9) | 1,213 (7.7) |  |
|  >=30 | 1,329 (1.0) | 162 (1.0) | 1,167 (1.0) |  | 162 (1.0) | 146 (0.9) |  |
|  Missing | 10,263 (7.9) | 1,345 (8.6) | 8,918 (7.8) |  | 1,344 (8.6) | 1,283 (8.2) |  |
| Smoking, n (%) |  |  |  | <0.001 |  |  |  0.34 |
|  Never-smoking | 104,961 (81.1) | 12,890 (82.2) | 92,071 (81.0) |  | 12,866 (82.1) | 12,961 (82.7) |  |
|  Smoking | 13,527 (10.5) | 1,483 (9.5) | 12,044 (10.6) |  | 1,483 (9.5) | 1,419 (9.1) |  |
|  Missing | 10,880 (8.4) | 1,317 (8.4) | 9,563 (8.4) |  | 1,317 (8.4) | 1,286 (8.2) |  |
| Charlson Comorbidity Index, n (%)  |  |  |  |  0.64 |  |  |  0.019 |
|  0 | 62,223 (48.1) | 7,555 (48.2) | 54,668 (48.1) |  | 7,544 (48.2) | 7,822 (49.9) |  |
|  1 | 39,878 (30.8) | 4,794 (30.6) | 35,084 (30.9) |  | 4,788 (30.6) | 4,635 (29.6) |  |
|  2 | 18,587 (14.4) | 2,254 (14.4) | 16,333 (14.4) |  | 2,249 (14.4) | 2,162 (13.8) |  |
|  >=3 | 8,680 (6.7) | 1,087 (6.9) | 7,593 (6.7) |  | 1,085 (6.9) | 1,047 (6.7) |  |
| Coronary heart disease, n (%) | 1,812 (1.4) | 199 (1.3) | 1,613 (1.4) |  0.13 | 198 (1.3) | 179 (1.1) |  0.32 |
| Heart failure, n (%) | 9,340 (7.2) | 1,315 (8.4) | 8,025 (7.1) | <0.001 | 1,312 (8.4) | 1,339 (8.5) |  0.58 |
| Peripheral vascular disease, n (%) | 646 (0.5) | 79 (0.5) | 567 (0.5) |  0.94 | 79 (0.5) | 73 (0.5) |  0.63 |
| Stroke, n (%) | 13,316 (10.3) | 1,515 (9.7) | 11,801 (10.4) |  0.005 | 1,514 (9.7) | 1,426 (9.1) |  0.088 |
| Dementia, n (%) | 19,700 (15.2) | 2,246 (14.3) | 17,454 (15.4) | <0.001 | 2,242 (14.3) | 2,201 (14.0) |  0.51 |
| Pulmonary Disorders, n (%) | 4,894 (3.8) | 585 (3.7) | 4,309 (3.8) |  0.70 | 582 (3.7) | 560 (3.6) |  0.51 |
| Connective tissue disease, n (%) | 357 (0.3) | 38 (0.2) | 319 (0.3) |  0.39 | 38 (0.2) | 30 (0.2) |  0.33 |
| Peptic ulcer, n (%) | 4,227 (3.3) | 506 (3.2) | 3,721 (3.3) |  0.75 | 505 (3.2) | 498 (3.2) |  0.82 |
| Mild liver disease, n (%) | 685 (0.5) | 83 (0.5) | 602 (0.5) |  0.99 | 83 (0.5) | 76 (0.5) |  0.58 |
| Mild to moderate diabetes, n (%) | 19,356 (15.0) | 2,226 (14.2) | 17,130 (15.1) |  0.004 | 2,224 (14.2) | 2,085 (13.3) |  0.023 |
| Diabetes with complications, n (%) | 3,332 (2.6) | 412 (2.6) | 2,920 (2.6) |  0.67 | 411 (2.6) | 416 (2.7) |  0.86 |
| Hemiplegia, n (%) | 9 (0.0) | 2 (0.0) | 7 (0.0) |  0.35 | 2 (0.0) | 1 (0.0) |  0.56 |
| Renal failure, n (%) | 5,973 (4.6) | 770 (4.9) | 5,203 (4.6) |  0.064 | 768 (4.9) | 738 (4.7) |  0.43 |
| Cancer, n (%) | 6,150 (4.8) | 807 (5.1) | 5,343 (4.7) |  0.014 | 806 (5.1) | 780 (5.0) |  0.50 |
| Metastatic cancer, n (%) | 565 (0.4) | 92 (0.6) | 473 (0.4) |  0.002 | 92 (0.6) | 76 (0.5) |  0.22 |
| Sever liver disease, n (%) | 26 (0.0) | 4 (0.0) | 22 (0.0) |  0.61 | 4 (0.0) | 5 (0.0) |  0.74 |
| HIV, n (%) | 6 (0.0) | 1 (0.0) | 5 (0.0) |  0.73 | 1 (0.0) | 2 (0.0) |  0.56 |
| Hypertension, n (%) | 45,835 (35.4) | 5,207 (33.2) | 40,628 (35.7) | <0.001 | 5,203 (33.2) | 5,124 (32.7) |  0.34 |
| Stable angina, n (%) | 9,862 (7.6) | 1,263 (8.0) | 8,599 (7.6) |  0.032 | 1,260 (8.0) | 1,198 (7.6) |  0.19 |
| Parkinson disease, n (%) | 3,860 (3.0) | 437 (2.8) | 3,423 (3.0) |  0.12 | 435 (2.8) | 421 (2.7) |  0.63 |
| Anemia, n (%) | 3,987 (3.1) | 531 (3.4) | 3,456 (3.0) |  0.019 | 529 (3.4) | 480 (3.1) |  0.12 |
| Hip Osteoarthritis, n (%), | 169 (0.1) | 24 (0.2) | 145 (0.1) |  0.41 | 24 (0.2) | 24 (0.2) |  1.00 |
| Ability to transfer, n (%) |  |  |  | <0.001 |  |  |  0.063 |
|  Unable | 93,319 (72.1) | 11,023 (70.3) | 82,296 (72.4) |  | 11,010 (70.3) | 11,216 (71.6) |  |
|  Heavy assist | 11,494 (8.9) | 1,400 (8.9) | 10,094 (8.9) |  | 1,395 (8.9) | 1,300 (8.3) |  |
|  Light assist | 10,253 (7.9) | 1,425 (9.1) | 8,828 (7.8) |  | 1,421 (9.1) | 1,421 (9.1) |  |
|  Independent | 9,439 (7.3) | 1,164 (7.4) | 8,275 (7.3) |  | 1,162 (7.4) | 1,079 (6.9) |  |
|  Missing | 4,863 (3.8) | 678 (4.3) | 4,185 (3.7) |  | 678 (4.3) | 650 (4.1) |  |
| Waiting time (Hr) , n (%) |  |  |  | <0.001 |  |  |  0.81 |
|  Less than 72 | 55,498 (42.9) | 6,226 (39.7) | 49,272 (43.3) |  | 6,223 (39.7) | 6,244 (39.9) |  |
|  More than 72 | 73,870 (57.1) | 9,464 (60.3) | 64,406 (56.7) |  | 9,443 (60.3) | 9,422 (60.1) |  |
| Anesthesia, n (%) |  |  |  | <0.001 |  |  |  0.048 |
|  General Anesthesia | 73,318 (56.7) | 8,624 (55.0) | 64,694 (56.9) |  | 8,622 (55.0) | 8,726 (55.7) |  |
|  Spinal Anesthesia | 49,537 (38.3) | 6,270 (40.0) | 43,267 (38.1) |  | 6,249 (39.9) | 6,249 (39.9) |  |
|  General and Epidural | 6,155 (4.8) | 770 (4.9) | 5,385 (4.7) |  | 769 (4.9) | 669 (4.3) |  |
|  Spinal and Epidural | 358 (0.3) | 26 (0.2) | 332 (0.3) |  | 26 (0.2) | 22 (0.1) |  |
| Admission through ER, n (%) | 114,540 (88.5) | 13,327 (84.9) | 101,213 (89.0) | <0.001 | 13,323 (85.0) | 13,351 (85.2) |  0.66 |
| Teaching hospital, n (%) | 3,688 (2.9) | 640 (4.1) | 3,048 (2.7) | <0.001 | 640 (4.1) | 620 (4.0) |  0.57 |
| Hospital volume, n (%) |  |  |  | <0.001 |  |  |  0.56 |
|  Less than 20 | 636 (0.5) | 249 (1.6) | 387 (0.3) |  | 225 (1.4) | 221 (1.4) |  |
|  20 to 100 | 30,295 (23.4) | 3,204 (20.4) | 27,091 (23.8) |  | 3,204 (20.5) | 3,154 (20.1) |  |
|  100 to 500 | 92,424 (71.4) | 11,145 (71.0) | 81,279 (71.5) |  | 11,145 (71.1) | 11,249 (71.8) |  |
|  More than 500 | 6,013 (4.6) | 1,092 (7.0) | 4,921 (4.3) |  | 1,092 (7.0) | 1,042 (6.7) |  |
| Annual surgical volume, n (%) |  |  |  | <0.001 |  |  |  0.20 |
|  Less than 100 | 125,662 (97.1) | 15,450 (98.5) | 110,212 (97.0) |  | 15,426 (98.5) | 15,453 (98.6) |  |
|  More than 100 | 3,706 (2.9) | 240 (1.5) | 3,466 (3.0) |  | 240 (1.5) | 213 (1.4) |  |
| Admission on weekend | 26,555 (20.5) | 3,129 (19.9) | 23,426 (20.6) |  0.053 | 3,125 (19.9) | 3,033 (19.4) |  0.19 |