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| S 1. comparison patients and hospitals characteristics according to 30-day mortality in development clinical database Epithor (n=10 516) |
|  | No  | Yes | p-value |
|  | n=10,289(97.84%) | n=227(2.16%) |  |
| Age (year) | 64.730 (9.549) | 67.004 (9.615) | <0.001 |
| Gender |  |  |  |
|  Male | 6,467 (62.9%) | 185 (81.5%) | <0.001 |
|  Female | 3,822 (37.1%) | 42 (18.5%) |  |
| Body Mass Index (kg/m2) | 25.571 (4.748) | 25.157 (3.981) | 0.422 |
| Performance status |  |  |  |
|  0 | 5,541 (53.9%) | 79 (34.8%) | <0.001 |
|  1 | 4,005 (38.9%) | 106 (46.7%) |  |
|  2 | 743 (7.2%) | 42 (18.5%) |  |
| DYSPNEA score |  |  |  |
|  0 | 6,467 (62.9%) | 108 (47.6%) | <0.001 |
|  1 | 2,799 (27.2%) | 73 (32.2%) |  |
|  2 | 875 (8.5%) | 26 (11.5%) |  |
|  3 | 148 (1.4%) | 20 (8.8%) |  |
| FEV | 87.920 (18.781) | 82.056 (17.719) | <0.001 |
| Gold score |  |  |  |
|  0 | 9,002 (87.5%) | 180 (79.3%) | <0.001 |
|  1 | 501 (4.9%) | 13 (5.7%) |  |
|  2 | 725 (7.0%) | 28 (12.3%) |  |
|  3 | 59 (0.6%) | 5 (2.2%) |  |
|  4 | 2 (0.0%) | 1 (0.4%) |  |
| Asa score |  |  |  |
|  1 | 1,807 (17.6%) | 16 (7.0%) | <0.001 |
|  2 | 4,988 (48.5%) | 91 (40.1%) |  |
|  3 | 3,494 (34.0%) | 120 (52.9%) |  |
| Pulmonary resection |  |  |  |
|  Wedge | 967 (9.4%) | 31 (13.7%) | <0.001 |
|  Segmentectomy | 1,015 (9.9%) | 13 (5.7%) |  |
|  Lobectomy  | 7,380 (71.7%) | 141 (62.1%) |  |
|  Bilobectomy  | 348 (3.4%) | 14 (6.2%) |  |
|  Pneumonectomy  | 579 (5.6%) | 28 (12.3%) |  |
| Extended resection |  |  |  |
|  No  | 10,046 (97.6%) | 218 (96.0%) | 0.118 |
|  Yes  | 243 (2.4%) | 9 (4.0%) |  |
| sleeve |  |  |  |
|  No  | 10,075 (97.9%) | 214 (94.3%) | <0.001 |
|  Yes  | 214 (2.1%) | 13 (5.7%) |  |
| Approach |  |  |  |
|  Thoracotomy | 5,374 (52.2%) | 143 (63.0%) | 0.001 |
|  VATS/robot | 4,915 (47.8%) | 84 (37.0%) |  |
| T |  |  |  |
|  T1a | 2,210 (21.5%) | 36 (15.9%) | <0.001 |
|  T1b | 1,637 (15.9%) | 23 (10.1%) |  |
|  T1c | 282 (2.7%) | 2 (0.9%) |  |
|  T2a | 2,131 (20.7%) | 42 (18.5%) |  |
|  T2b | 592 (5.8%) | 18 (7.9%) |  |
|  T3 | 1,267 (12.3%) | 56 (24.7%) |  |
|  T4 | 458 (4.5%) | 30 (13.2%) |  |
|  Missing | 1,712 (16.6%) | 20 (8.8%) |  |
| N |  |  |  |
|  N0 | 6,492 (63.1%) | 120 (52.9%) | <0.001 |
|  N1 | 972 (9.4%) | 37 (16.3%) |  |
|  N2 | 1,098 (10.7%) | 50 (22.0%) |  |
|  Missing | 1,727 (16.8%) | 20 (8.8%) |  |
| M |  |  |  |
|  M0 | 8,191 (79.6%) | 187 (82.4%) | <0.001 |
|  M1 | 287 (2.8%) | 22 (9.7%) |  |
|  Missing | 1,811 (17.6%) | 18 (7.9%) |  |
| Treatment preop |  |  |  |
|  No | 10,184 (99.0%) | 222 (97.8%) | 0.083 |
|  Yes  | 105 (1.0%) | 5 (2.2%) |  |
| Logarithm (hospital volume) | 5.461 (0.818) | 5.505 (0.844) | 0.586 |
| Type of hospitals |  |  |  |
|  Non academic | 1,078 (10.5%) | 21 (9.3%) | 0.149 |
|  Academic | 5,837 (56.7%) | 137 (60.4%) |  |
|  Private no-profit | 628 (6.1%) | 6 (2.6%) |  |
|  Privat for profit | 2,746 (26.7%) | 63 (27.8%) |  |
| Alcoholism  |  |  |  |
|  No  | 9,727 (94.5%) | 208 (91.6%) | 0.058 |
|  Yes  | 562 (5.5%) | 19 (8.4%) |  |
| Tabacco use |  |  |  |
|  No  | 7,803 (75.8%) | 170 (74.9%) | 0.741 |
|  Yes  | 2,486 (24.2%) | 57 (25.1%) |  |
| Toxicology  |  |  |  |
|  No  | 10,065 (97.8%) | 220 (96.9%) | 0.357 |
|  Yes  | 224 (2.2%) | 7 (3.1%) |  |
| Number of comorbidities |  |  |  |
|  0 | 1,655 (16.1%) | 20 (8.8%) | 0.001 |
|  1 | 2,867 (27.9%) | 51 (22.5%) |  |
|  2 | 2,706 (26.3%) | 73 (32.2%) |  |
|  ≥3 | 3,061 (29.8%) | 83 (36.6%) |  |

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| S 2. comparison patients and hospitals characteristics according to 30-day mortality in validation data clinical database Epithor |
|  | No  | Yes  | p-value |
|  | n=4,414 (98%) | n=93 (2%) |  |
| Age (year) | 64.639 (9.708) | 68.634 (8.974) | <0.001 |
| Gender |  |  |  |
|  Male  | 2,841 (64.4%) | 80 (86.0%) | <0.001 |
|  Female  | 1,573 (35.6%) | 13 (14.0%) |  |
| Body Mass Index (kg/m2) | 25.627 (4.661) | 24.692 (4.062) | 0.082 |
| Performance Status |  |  |  |
|  0 | 2,343 (53.1%) | 29 (31.2%) | <0.001 |
|  1 | 1,746 (39.6%) | 51 (54.8%) |  |
|  2 | 325 (7.4%) | 13 (14.0%) |  |
| Dyspnea |  |  |  |
|  0 | 2,761 (62.6%) | 50 (53.8%) | <0.001 |
|  1 | 1,204 (27.3%) | 19 (20.4%) |  |
|  2 | 388 (8.8%) | 18 (19.4%) |  |
|  3 | 61 (1.4%) | 6 (6.5%) |  |
| FEV (l) | 87.567 (19.079) | 80.301 (20.551) | <0.001 |
| Gold score |  |  |  |
|  0 | 3,885 (88.0%) | 76 (81.7%) | 0.470 |
|  1 | 200 (4.5%) | 6 (6.5%) |  |
|  2 | 293 (6.6%) | 10 (10.8%) |  |
|  3 | 35 (0.8%) | 1 (1.1%) |  |
|  4 | 1 (0.0%) | 0 (0.0%) |  |
| Asa score |  |  |  |
|  1 | 751 (17.0%) | 6 (6.5%) | 0.009 |
|  2 | 2,162 (49.0%) | 45 (48.4%) |  |
|  3 | 1,501 (34.0%) | 42 (45.2%) |  |
| Pulmonary resection |  |  |  |
|  Wedge | 416 (9.4%) | 8 (8.6%) | <0.001 |
|  Segmentectomy  | 417 (9.4%) | 8 (8.6%) |  |
|  Lobectomy  | 3,153 (71.4%) | 53 (57.0%) |  |
|  Bilobectomy  | 160 (3.6%) | 6 (6.5%) |  |
|  Pneumonectomy  | 268 (6.1%) | 18 (19.4%) |  |
| Extended resection |  |  |  |
|  No  | 4,312 (97.7%) | 88 (94.6%) | 0.055 |
|  Yes  | 102 (2.3%) | 5 (5.4%) |  |
| sleeve |  |  |  |
|  No  | 4,307 (97.6%) | 91 (97.8%) | 0.865 |
|  Yes  | 107 (2.4%) | 2 (2.2%) |  |
| Approach  |  |  |  |
|  Thoracotomy | 2,294 (52.0%) | 63 (67.7%) | 0.003 |
|  VATS | 2,120 (48.0%) | 30 (32.3%) |  |
| T |  |  |  |
|  T1a | 934 (21.2%) | 16 (17.2%) | 0.008 |
|  T1b | 665 (15.1%) | 13 (14.0%) |  |
|  T1c | 138 (3.1%) | 2 (2.2%) |  |
|  T2a | 922 (20.9%) | 14 (15.1%) |  |
|  T2b | 243 (5.5%) | 4 (4.3%) |  |
|  T3 | 558 (12.6%) | 23 (24.7%) |  |
|  T4 | 203 (4.6%) | 9 (9.7%) |  |
|  Missing | 751 (17.0%) | 12 (12.9%) |  |
| N |  |  |  |
|  N0 | 2,733 (61.9%) | 47 (50.5%) | 0.004 |
|  N1 | 444 (10.1%) | 16 (17.2%) |  |
|  N2 | 483 (10.9%) | 18 (19.4%) |  |
|  Missing | 754 (17.1%) | 12 (12.9%) |  |
| M |  |  |  |
|  M0 | 3,499 (79.3%) | 73 (78.5%) | 0.129 |
|  M1 | 130 (2.9%) | 6 (6.5%) |  |
|  Missing | 785 (17.8%) | 14 (15.1%) |  |
| Treatment preop |  |  |  |
|  No  | 4,379 (99.2%) | 92 (98.9%) | 0.762 |
|  Yes  | 35 (0.8%) | 1 (1.1%) |  |
| Logarithm (hospital volume) | 5.460 (0.796) | 5.418 (0.877) | 0.745 |
| Type of hospitals |  |  |  |
|  Non academic | 463 (10.5%) | 12 (12.9%) | 0.250 |
|  Academic  | 2,457 (55.7%) | 53 (57.0%) |  |
|  Private no-profit | 255 (5.8%) | 1 (1.1%) |  |
|  Private for profit | 1,239 (28.1%) | 27 (29.0%) |  |
| Alcoholism  |  |  |  |
|  No  | 4,192 (95.0%) | 82 (88.2%) | 0.003 |
|  Yes  | 222 (5.0%) | 11 (11.8%) |  |
| Tabacco use |  |  |  |
|  No  | 3,300 (74.8%) | 66 (71.0%) | 0.405 |
|  Yes  | 1,114 (25.2%) | 27 (29.0%) |  |
| Toxicology  |  |  |  |
|  No  | 4,321 (97.9%) | 91 (97.8%) | 0.977 |
|  Yes  | 93 (2.1%) | 2 (2.2%) |  |
| Number of comorbidities |  |  |  |
|  0 | 735 (16.7%) | 4 (4.3%) | <0.001 |
|  1 | 1,230 (27.9%) | 20 (21.5%) |  |
|  2 | 1,135 (25.7%) | 25 (26.9%) |  |
|  ≥3 | 1,314 (29.8%) | 44 (47.3%) |  |

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| S 3. comparison patients and hospitals characteristics according to 30-day mortality in the Development data medico-administrative database (n=10 516) |
|  | No | Yes | p-value |
|  | 10,233 (97.3%) | 283 (2.7%) |  |
| Age (years) | 65.458 (9.600) | 69.580 (9.235) | <0.001 |
| Logarithm (hospital volume) | 4.912 (0.945) | 4.821 (0.925) | 0.091 |
| Pulmonary disease |  |  |  |
|  No  | 7,118 (69.6%) | 79 (27.9%) | <0.001 |
|  Yes  | 3,115 (30.4%) | 204 (72.1%) |  |
| Heart disease |  |  |  |
|  No  | 8,672 (84.7%) | 183 (64.7%) | <0.001 |
|  Yes  | 1,561 (15.3%) | 100 (35.3%) |  |
| Peripheral vascular disease |  |  |  |
|  No  | 9,332 (91.2%) | 225 (79.5%) | <0.001 |
|  Yes  | 901 (8.8%) | 58 (20.5%) |  |
| Neurological disease |  |  |  |
|  No  | 9,832 (96.1%) | 254 (89.8%) | <0.001 |
|  Yes  | 401 (3.9%) | 29 (10.2%) |  |
| Liver disease |  |  |  |
|  No  | 10,152 (99.2%) | 265 (93.6%) | <0.001 |
|  Yes  | 81 (0.8%) | 18 (6.4%) |  |
| Renal disease |  |  |  |
|  No  | 9,962 (97.4%) | 258 (91.2%) | <0.001 |
|  Yes  | 271 (2.6%) | 25 (8.8%) |  |
| Metabolic disease |  |  |  |
|  No  | 8,924 (87.2%) | 243 (85.9%) | 0.505 |
|  Yes | 1,309 (12.8%) | 40 (14.1%) |  |
| Anemia  |  |  |  |
|  No  | 8,852 (86.5%) | 207 (73.1%) | <0.001 |
|  Yes  | 1,381 (13.5%) | 76 (26.9%) |  |
| Infectious disease |  |  |  |
|  No  | 10,173 (99.4%) | 267 (94.3%) | <0.001 |
|  Yes  | 60 (0.6%) | 16 (5.7%) |  |
| Other disease |  |  |  |
|  No  | 5,973 (58.4%) | 120 (42.4%) | <0.001 |
|  Yes  | 4,260 (41.6%) | 163 (57.6%) |  |
| Other treatment |  |  |  |
|  No  | 9,181 (89.7%) | 235 (83.0%) | <0.001 |
|  Yes  | 1,052 (10.3%) | 48 (17.0%) |  |
| Extended resection |  |  |  |
|  No  | 9,179 (89.7%) | 221 (78.1%) | <0.001 |
|  Yes  | 1,054 (10.3%) | 62 (21.9%) |  |
| Sleeve |  |  |  |
|  No  | 10,001 (97.7%) | 268 (94.7%) | <0.001 |
|  Yes  | 232 (2.3%) | 15 (5.3%) |  |
| Gender |  |  |  |
|  Male | 6,376 (62.3%) | 236 (83.4%) | <0.001 |
|  Female | 3,857 (37.7%) | 47 (16.6%) |  |
| Approach |  |  |  |
|  Thoracotomy | 5,855 (57.2%) | 222 (78.4%) | <0.001 |
|  VATS/robot | 4,378 (42.8%) | 61 (21.6%) |  |
| Pulmonary resection |  |  |  |
|  Limited resection | 1,651 (16.1%) | 42 (14.8%) | <0.001 |
|  Lobectomy | 7,700 (75.2%) | 166 (58.7%) |  |
|  Bilobectomy  | 308 (3.0%) | 22 (7.8%) |  |
|  Pneumonectomy | 574 (5.6%) | 53 (18.7%) |  |
| Charlson modified score |  |  |  |
|  0 | 4,701 (45.9%) | 93 (32.9%) | <0.001 |
|  1 | 992 (9.7%) | 15 (5.3%) |  |
|  2 | 1,062 (10.4%) | 36 (12.7%) |  |
|  >=3 | 3,478 (34.0%) | 139 (49.1%) |  |
| Type of hospitals |  |  |  |
|  Non academic | 1,256 (12.3%) | 40 (14.1%) | 0.046 |
|  Academic  | 4,491 (43.9%) | 121 (42.8%) |  |
|  Private no-profit | 1,310 (12.8%) | 22 (7.8%) |  |
|  Private for profit | 3,176 (31.0%) | 100 (35.3%) |  |

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| S 4. comparison patients and hospitals characteristics according to 30-day mortality in the validation data medico-administrative database (n=4 507) |
|  | No | Yes | p-value |
|  | 4,388 (97.36%) | 119 (2.64%) |  |
| Age (years) | 65.324 (9.711) | 68.563 (8.813) | <0.001 |
| Logarithm (Hospital volume) | 4.958 (0.950) | 4.676 (1.040) | 0.011 |
| Pulmonary disease |  |  |  |
|  No  | 2,968 (67.6%) | 40 (33.6%) | <0.001 |
|  Yes  | 1,420 (32.4%) | 79 (66.4%) |  |
| Heart disease |  |  |  |
|  No  | 3,740 (85.2%) | 85 (71.4%) | <0.001 |
|  Yes  | 648 (14.8%) | 34 (28.6%) |  |
| Peripheral vascular disease |  |  |  |
|  No  | 3,987 (90.9%) | 96 (80.7%) | <0.001 |
|  Yes  | 401 (9.1%) | 23 (19.3%) |  |
| Neurological disease |  |  |  |
|  No  | 4,207 (95.9%) | 105 (88.2%) | <0.001 |
|  Yes  | 181 (4.1%) | 14 (11.8%) |  |
| Liver disease |  |  |  |
|  No  | 4,357 (99.3%) | 105 (88.2%) | <0.001 |
|  Yes  | 31 (0.7%) | 14 (11.8%) |  |
| Renal disease |  |  |  |
|  No  | 4,272 (97.4%) | 107 (89.9%) | <0.001 |
|  Yes  | 116 (2.6%) | 12 (10.1%) |  |
| Metabolic disease |  |  |  |
|  No  | 3,869 (88.2%) | 91 (76.5%) | <0.001 |
|  Yes  | 519 (11.8%) | 28 (23.5%) |  |
| Anemia  |  |  |  |
|  No  | 3,804 (86.7%) | 82 (68.9%) | <0.001 |
|  Yes  | 584 (13.3%) | 37 (31.1%) |  |
| Infectious disease |  |  |  |
|  No  | 4,366 (99.5%) | 115 (96.6%) | <0.001 |
|  Yes  | 22 (0.5%) | 4 (3.4%) |  |
| Other disease |  |  |  |
|  No  | 2,543 (58.0%) | 51 (42.9%) | 0.001 |
|  Yes  | 1,845 (42.0%) | 68 (57.1%) |  |
| Other treatment |  |  |  |
|  No  | 3,953 (90.1%) | 94 (79.0%) | <0.001 |
|  Yes  | 435 (9.9%) | 25 (21.0%) |  |
| Extended resection |  |  |  |
|  No  | 3,938 (89.7%) | 100 (84.0%) | 0.044 |
|  Yes  | 450 (10.3%) | 19 (16.0%) |  |
| Sleeve |  |  |  |
|  No  | 4,293 (97.8%) | 115 (96.6%) | 0.380 |
|  Yes  | 95 (2.2%) | 4 (3.4%) |  |
| Gender  |  |  |  |
|  Male | 2,665 (60.7%) | 101 (84.9%) | <0.001 |
|  Female | 1,723 (39.3%) | 18 (15.1%) |  |
| Approach  |  |  |  |
|  Thoracotomy | 2,458 (56.0%) | 88 (73.9%) | <0.001 |
|  VATS/robot | 1,930 (44.0%) | 31 (26.1%) |  |
| Pulmonary resection |  |  |  |
|  Limited resection | 689 (15.7%) | 17 (14.3%) | <0.001 |
|  Lobectomy | 3,345 (76.2%) | 66 (55.5%) |  |
|  Bilobectomy  | 112 (2.6%) | 12 (10.1%) |  |
|  Pneumonectomy  | 242 (5.5%) | 24 (20.2%) |  |
| Charlson modified score |  |  |  |
|  0 | 1,971 (44.9%) | 36 (30.3%) | 0.005 |
|  1 | 395 (9.0%) | 9 (7.6%) |  |
|  2 | 501 (11.4%) | 16 (13.4%) |  |
|  >=3 | 1,521 (34.7%) | 58 (48.7%) |  |
| Type of hospitals |  |  |  |
|  Non academic | 552 (12.6%) | 21 (17.6%) | 0.255 |
|  Academic  | 1,993 (45.4%) | 49 (41.2%) |  |
|  Private no-profit | 551 (12.6%) | 11 (9.2%) |  |
|  Private for profit | 1,292 (29.4%) | 38 (31.9%) |  |