SUPPLEMENTARY TABLES

Supplementary Table 1. The baseline data of primary liver cancer patients diagnosed at 2015-2016.

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| **Characteristics** | | **<64 years old** | **64-74 years old** | **>74 years old** | ***P-*value** |
| **(n=1013,%)** | **(n=800,%)** | **(n=350,%)** |
| Sex | Male | 771(76.1) | 579(72.4) | 215(61.4) | <0.001 |
| Female | 242(23.9) | 221(27.6) | 135(38.6) |  |
| Race | White | 670(66.1) | 547(68.4) | 257(73.4) | <0.001 |
| Black | 138(13.6) | 101(12.6) | 16(4.6) |  |
| Other | 205(20.2) | 152(19.0) | 77(22.0) |  |
| Marital | Married | 540(53.3) | 479(59.9) | 197(56.3) | 0.020 |
| Unmarried | 473(46.7) | 321(40.1) | 153(43.7) |  |
| Histology | HCC | 888(87.7) | 697(87.1) | 308(88.0) | 0.902 |
| ICC | 125(12.3) | 103(12.9) | 42(12.0) |  |
| Tumor.size | <5cm | 461(45.5) | 369(46.1) | 115(32.9) | <0.001 |
| 5—10cm | 353(34.8) | 288(36.0) | 149(42.6) |  |
| >10cm | 199(19.6) | 143(17.9) | 86(24.6) |  |
| Grade | Grade I | 237(23.4) | 190(23.8) | 85(24.3) | 0.421 |
| Grade II | 487(48.1) | 399(49.9) | 177(50.6) |  |
| Grade III | 277(27.3) | 195(24.4) | 80(22.9) |  |
| Grade IV | 12(1.2) | 16(2.0) | 8(2.3) |  |
| T.stage | T1 | 398(39.3) | 350(43.8) | 150(42.9) | 0.489 |
| T2 | 262(25.9) | 185(23.1) | 78(22.3) |  |
| T3 | 301(29.7) | 221(27.6) | 101(28.9) |  |
| T4 | 52(5.1) | 44(5.5) | 21(6.0) |  |
| N.stage | N0 | 886(87.5) | 704(88.0) | 322(92.0) | 0.067 |
| N1 | 127(12.5) | 96(12.0) | 28(8.0) |  |
| M.stage | M0 | 883(87.2) | 711(88.9) | 302(86.3) | 0.381 |
| M1 | 130(12.8) | 89(11.1) | 48(13.7) |  |
| Treatment | N | 189(18.7) | 165(20.6) | 122(34.9) | <0.001 |
| S | 329(32.5) | 260(32.5) | 71(20.3) |  |
| C | 232(22.9) | 194(24.2) | 99(28.3) |  |
| R | 50(4.9) | 45(5.6) | 34(9.7) |  |
| S+C | 130(12.8) | 74(9.2) | 11(3.1) |  |
| S+R | 12(1.2) | 8(1.0) | 1(0.3) |  |
| C+R | 59(5.8) | 45(5.6) | 12(3.4) |  |
| S+C+R | 12(1.2) | 9(1.1) | 0(0.0) |  |
| AFP | Negative | 365(36.0) | 347(43.4) | 154(44.0) | 0.002 |
| Positive | 648(64.0) | 453(56.6) | 196(56.0) |  |
| Bone | No | 985(97.2) | 778(97.2) | 341(97.4) | 0.981 |
| metastasis | Yes | 28(2.8) | 22(2.8) | 9(2.6) |  |
| Brain | No | 1008(99.5) | 797(99.6) | 350(100.0) | 0.569 |
| metastasis | Yes | 5(0.5) | 3(0.4) | 0(0.0) |  |
| Lung | No | 958(94.6) | 773(96.6) | 326(93.1) | 0.024 |
| metastasis | Yes | 55(5.4) | 27(3.4) | 24(6.9) |  |
| Months(median [IQR]) | | 22.0[7.0, 44.0] | 21.0[5.0, 45.0] | 11.0[3.0, 34.8] | <0.001 |

Supplementary Table 2. The baseline data of primary liver cancer patients in low-age group.

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| **Characteristics** | | **Initial set (n=2961,%)** | **Training set (n=1920,%)** | **In-Validation set(n=841,%)** | ***P-*value** |
| Sex | Male | 2174 (78.7) | 1523 (79.3) | 651 (77.4) | 0.280 |
| Female | 587 (21.3) | 397 (20.7) | 190 (22.6) |  |
| Race | White | 1844 (66.8) | 1286 (67.0) | 558 (66.3) | 0.605 |
| Black | 400 (14.5) | 270 (14.1) | 130 (15.5) |  |
| Other | 517 (18.7) | 364 (19.0) | 153 (18.2) |  |
| Marital | Married | 1537 (55.7) | 1065 (55.5) | 472 (56.1) | 0.782 |
| Unmarried | 1224 (44.3) | 855 (44.5) | 369 (43.9) |  |
| Histology | HCC | 2550 (92.4) | 1771 (92.2) | 779 (92.6) | 0.783 |
| ICC | 211 (7.6) | 149 (7.8) | 62 (7.4) |  |
| Tumor.size | <5cm | 1454 (52.7) | 1014 (52.8) | 440 (52.3) | 0.553 |
| 5—10cm | 813 (29.4) | 555 (28.9) | 258 (30.7) |  |
| >10cm | 494 (17.9) | 351 (18.3) | 143 (17.0) |  |
| Grade | Grade I | 672 (24.3) | 456 (23.8) | 216 (25.7) | 0.426 |
| Grade II | 1291 (46.8) | 915 (47.7) | 376 (44.7) |  |
| Grade III | 757 (27.4) | 523 (27.2) | 234 (27.8) |  |
| Grade IV | 41 (1.5) | 26 (1.4) | 15 (1.8) |  |
| T.stage | T1 | 1130 (40.9) | 803 (41.8) | 327 (38.9) | 0.230 |
| T2 | 753 (27.3) | 502 (26.1) | 251 (29.8) |  |
| T3 | 745 (27.0) | 521 (27.1) | 224 (26.6) |  |
| T4 | 133 (4.8) | 94 (4.9) | 39 (4.6) |  |
| N.stage | N0 | 2445 (88.6) | 1706 (88.9) | 739 (87.9) | 0.496 |
| N1 | 316 (11.4) | 214 (11.1) | 102 (12.1) |  |
| M.stage | M0 | 2380 (86.2) | 1660 (86.5) | 720 (85.6) | 0.594 |
| M1 | 381 (13.8) | 260 (13.5) | 121 (14.4) |  |
| Treatment | N | 581 (21.0) | 424 (22.1) | 157 (18.7) | 0.139 |
| S | 871 (31.5) | 590 (30.7) | 281 (33.4) |  |
| C | 716 (25.9) | 498 (25.9) | 218 (25.9) |  |
| R | 56 (2.0) | 41 (2.1) | 15 (1.8) |  |
| S+C | 384 (13.9) | 264 (13.8) | 120 (14.3) |  |
| S+R | 12 (0.4) | 11 (0.6) | 1 (0.1) |  |
| C+R | 112 (4.1) | 70 (3.6) | 42 (5.0) |  |
| S+C+R | 29 (1.1) | 22 (1.1) | 7 (0.8) |  |
| AFP | Negative | 945 (34.2) | 639 (33.3) | 306 (36.4) | 0.124 |
| Positive | 1816 (65.8) | 1281 (66.7) | 535 (63.6) |  |
| Bone metastasis | No | 2681 (97.1) | 1871 (97.4) | 810 (96.3) | 0.131 |
| Yes | 80 (2.9) | 49 (2.6) | 31 (3.7) |  |
| Brain metastasis | No | 2750 (99.6) | 1915 (99.7) | 835 (99.3) | 0.101 |
| Yes | 11 (0.4) | 5 (0.3) | 6 (0.7) |  |
| Lung metastasis | No | 2627 (95.1) | 1828 (95.2) | 799 (95.0) | 0.895 |
| Yes | 134 (4.9) | 92 (4.8) | 42 (5.0) |  |
| Months(median [IQR]) | | 20.0[5.0,67.0 | 19.0[4.0,67.0] | 23.0[6.0,68.0] | 0.060 |

Supplementary Table 3. The baseline data of primary liver cancer patients in middle-age group.

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| **Characteristics** | | **Initial set (n=1475,%)** | **Training set (n=1028,%)** | **In-Validation  set(n=447,%)** | ***P-*value** |
| Sex | Male | 1056 (71.6) | 730 (71.0) | 326 (72.9) | 0.491 |
| Female | 419 (28.4) | 298 (29.0) | 121 (27.1) |  |
| Race | White | 1002 (67.9) | 681 (66.2) | 321 (71.8) | 0.100 |
| Black | 165 (11.2) | 123 (12.0) | 42 (9.4) |  |
| Other | 308 (20.9) | 224 (21.8) | 84 (18.8) |  |
| Marital | Married | 889 (60.3) | 624 (60.7) | 265 (59.3) | 0.651 |
| Unmarried | 586 (39.7) | 404 (39.3) | 182 (40.7) |  |
| Histology | HCC | 1336 (90.6) | 930 (90.5) | 406 (90.8) | 0.904 |
| ICC | 139 (9.4) | 98 (9.5) | 41 (9.2) |  |
| Tumor.size | <5cm | 646 (43.8) | 456 (44.4) | 190 (42.5) | 0.211 |
| 5—10cm | 546 (37.0) | 387 (37.6) | 159 (35.6) |  |
| >10cm | 283 (19.2) | 185 (18.0) | 98 (21.9) |  |
| Grade | Grade I | 374 (25.4) | 267 (26.0) | 107 (23.9) | 0.501 |
| Grade II | 676 (45.8) | 462 (44.9) | 214 (47.9) |  |
| Grade III | 396 (26.8) | 276 (26.8) | 120 (26.8) |  |
| Grade IV | 29 (2.0) | 23 (2.2) | 6 (1.3) |  |
| T.stage | T1 | 647 (43.9) | 444 (43.2) | 203 (45.4) | 0.400 |
| T2 | 321 (21.8) | 232 (22.6) | 89 (19.9) |  |
| T3 | 419 (28.4) | 286 (27.8) | 133 (29.8) |  |
| T4 | 88 (6.0) | 66 (6.4) | 22 (4.9) |  |
| N.stage | N0 | 1326 (89.9) | 926 (90.1) | 400 (89.5) | 0.800 |
| N1 | 149 (10.1) | 102 (9.9) | 47 (10.5) |  |
| M.stage | M0 | 1275 (86.4) | 892 (86.8) | 383 (85.7) | 0.632 |
| M1 | 200 (13.6) | 136 (13.2) | 64 (14.3) |  |
| Treatment | N | 362 (24.5) | 241 (23.4) | 121 (27.1) | 0.661 |
| S | 433 (29.4) | 300 (29.2) | 133 (29.8) |  |
| C | 417 (28.3) | 305 (29.7) | 112 (25.1) |  |
| R | 50 (3.4) | 35 (3.4) | 15 (3.4) |  |
| S+C | 120 (8.1) | 85 (8.3) | 35 (7.8) |  |
| S+R | 12 (0.8) | 9 (0.9) | 3 (0.7) |  |
| C+R | 69 (4.7) | 45 (4.4) | 24 (5.4) |  |
| S+C+R | 12 (0.8) | 8 (0.8) | 4 (0.9) |  |
| AFP | Negative | 535 (36.3) | 369 (35.9) | 166 (37.1) | 0.691 |
| Positive | 940 (63.7) | 659 (64.1) | 281 (62.9) |  |
| Bone metastasis | No | 1426 (96.7) | 997 (97.0) | 429 (96.0) | 0.402 |
| Yes | 49 (3.3) | 31 (3.0) | 18 (4.0) |  |
| Brain metastasis | No | 1474 (99.9) | 1027 (99.9) | 447 (100.0) | 0.999 |
| Yes | 1 (0.1) | 1 (0.1) | 0 (0.0) |  |
| Lung metastasis | No | 1405 (95.3) | 978 (95.1) | 427 (95.5) | 0.849 |
| Yes | 70 (4.7) | 50 (4.9) | 20 (4.5) |  |
| Months(median[IQR]) | | 16.0[4.0,56.5] | 16.0[4.0,57.0] | 16.0[4.0,53.0] | 0.981 |

Supplementary Table 4. The baseline data of primary liver cancer patients in old-age group.

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| **Characteristics** | | **Initial set (n=845,%)** | **Training set (n=587,%)** | **In-Validation  set(n=258,%)** | ***P-*value** |
| Sex | Male | 523 (61.9) | 361 (61.5) | 162 (62.8) | 0.780 |
| Female | 322 (38.1) | 226 (38.5) | 96 (37.2) |  |
| Race | White | 588 (69.6) | 409 (69.7) | 179 (69.4) | 0.665 |
| Black | 50 (5.9) | 32 (5.5) | 18 (7.0) |  |
| Other | 207 (24.5) | 146 (24.9) | 61 (23.6) |  |
| Marital | Married | 509 (60.2) | 356 (60.6) | 153 (59.3) | 0.771 |
| Unmarried | 336 (39.8) | 231 (39.4) | 105 (40.7) |  |
| Histology | HCC | 767 (90.8) | 530 (90.3) | 237 (91.9) | 0.550 |
| ICC | 78 (9.2) | 57 (9.7) | 21 (8.1) |  |
| Tumor.size | <5cm | 248 (29.3) | 181 (30.8) | 67 (26.0) | 0.237 |
| 5—10cm | 372 (44.0) | 248 (42.2) | 124 (48.1) |  |
| >10cm | 225 (26.6) | 158 (26.9) | 67 (26.0) |  |
| Grade | Grade I | 240 (28.4) | 170 (29.0) | 70 (27.1) | 0.747 |
| Grade II | 374 (44.3) | 263 (44.8) | 111 (43.0) |  |
| Grade III | 212 (25.1) | 141 (24.0) | 71 (27.5) |  |
| Grade IV | 19 (2.2) | 13 (2.2) | 6 (2.3) |  |
| T.stage | T1 | 392 (46.4) | 274 (46.7) | 118 (45.7) | 0.386 |
| T2 | 145 (17.2) | 105 (17.9) | 40 (15.5) |  |
| T3 | 262 (31.0) | 173 (29.5) | 89 (34.5) |  |
| T4 | 46 (5.4) | 35 (6.0) | 11 (4.3) |  |
| N.stage | N0 | 775 (91.7) | 538 (91.7) | 237 (91.9) | 1.000 |
| N1 | 70 (8.3) | 49 (8.3) | 21 (8.1) |  |
| M.stage | M0 | 740 (87.6) | 513 (87.4) | 227 (88.0) | 0.899 |
| M1 | 105 (12.4) | 74 (12.6) | 31 (12.0) |  |
| Treatment | N | 318 (37.6) | 227 (38.7) | 91 (35.3) | 0.536 |
| S | 183 (21.7) | 121 (20.6) | 62 (24.0) |  |
| C | 245 (29.0) | 173 (29.5) | 72 (27.9) |  |
| R | 44 (5.2) | 32 (5.5) | 12 (4.7) |  |
| S+C | 22 (2.6) | 14 (2.4) | 8 (3.1) |  |
| S+R | 3 (0.4) | 3 (0.5) | 0 (0.0) |  |
| C+R | 27 (3.2) | 15 (2.6) | 12 (4.7) |  |
| S+C+R | 3 (0.4) | 2 (0.3) | 1 (0.4) |  |
| AFP | Negative | 339 (40.1) | 242 (41.2) | 97 (37.6) | 0.360 |
| Positive | 506 (59.9) | 345 (58.8) | 161 (62.4) |  |
| Bone metastasis | No | 829 (98.1) | 577 (98.3) | 252 (97.7) | 0.736 |
| Yes | 16 (1.9) | 10 (1.7) | 6 (2.3) |  |
| Brain metastasis | No | 843 (99.8) | 585 (99.7) | 258 (100.0) | 0.999 |
| Yes | 2 (0.2) | 2 (0.3) | 0 (0.0) |  |
| Lung metastasis | No | 798 (94.4) | 550 (93.7) | 248 (96.1) | 0.210 |
| Yes | 47 (5.6) | 37 (6.3) | 10 (3.9) |  |
| Months(median[IQR]) | | 9.0[2.0,29.0] | 9.0[2.0,28.5] | 10.0[2.0,32.0] | 0.857 |