Supplemental Online Content

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This supplemental material has been provided by the authors to give readers additional information about their work.
eTable 1. Diagnosis and Procedure codes used to identify cases

| Variables                      | Diagnosis and procedure Codes by Code Type | CPT/HCPCS |
|-------------------------------|-------------------------------------------|-----------|
|                               | ICD-9                                     | ICD-10    |            |
| Type of nephrectomy           |                                           |           |            |
| Partial                       |                                           | 0TB04ZZ, 0TB14ZZ, 0TB00ZZ, 0TB10ZZ | 50543, 50240 |
| Radical                       |                                           | 0TT04ZZ, 0TT14ZZ, 0TT00ZZ, 0TT10ZZ | 50545, 50546, 50230 |
| Bilateral                     |                                           | 0TT20ZZ, 0TT24ZZ |           |
| Surgical approach             |                                           |           |            |
| MIS\(^1\)                     | \(54.21, 54.51, 17.41, 17.42, 17.43, 17.44, 17.45, 17.49\) | 0TB04ZZ, 0TB14ZZ, 0TT04ZZ, 0TT14ZZ, 8E0W0CZ, 8E0W3CZ, 8E0W4CZ, 8E0W7CZ, 8E0W8CZ, 8E0WXCZ | 50543, 50545, 50546, S2900 |
| Open                          |                                           | 0TB00ZZ, 0TB10ZZ, 0TT00ZZ, 0TT10ZZ | 50240, 50230 |
| Diagnoses                     |                                           |           |            |
| Malignant kidney tumor        | 189.0                                     | C64.1, C64.2, C64.9 | -          |
| Secondary urinary cancer      | 198.0, 198.1, 198.89                      | C79.00, C79.01, C79.02, C79.11, C79.19 | -          |
| Severe CKD\(^2\)              | 585.4, 585.5, 585.6                      | N18.4, N18.5, N18.6 | -          |

\(^1\) Codes in **bold** were used as modifier codes for minimally invasive surgery (laparoscopic or robotic) with a presence of nephrectomy code.

\(^2\) Severe chronic kidney disease (CKD) includes stage IV, stage V, and end-stage renal disease
eTable 2. Description of place of service codes used to differentiate healthcare use

| Type of Healthcare visit                     | Place of service code (STDPLAC) | Label                                      |
|---------------------------------------------|---------------------------------|--------------------------------------------|
| Emergency/Urgent care visit\(^1\)           | 20, 23                          | Urgent care facility Emergency room – hospital |
| Hospital Outpatient visit                   | 19, 22, 24, 95                  | Outpatient Hospital-Off Campus Outpatient Hospital-On Campus Ambulatory Surgical Center Outpatient (NEC) |
| Office-based provider visit                 | 11                              | Office                                     |

\(^1\) In addition, healthcare encounters with emergency room service category code (SVCSCAT) ending with “20” were considered emergency visits; For example: “12220” - Facility OP ER
**eTable 3. Baseline patient characteristics by surgical approach after inverse probability of treatment weighting adjustment**

| Variable                  | Partial Nephrectomy (n= 2,639) | Radical Nephrectomy (n= 2,465) |
|---------------------------|---------------------------------|---------------------------------|
|                           | MIS (n= 2,009)                  | OS (n= 640)                     | MIS (n= 1,816)                  | OS (n= 649)                     |
| Age, year                 |                                 |                                 | 0.98                           | 0.98                            |
| 18 – 44                   | 327 (16.3)                      | 104 (16.3)                      | 228 (12.6)                     | 80 (12.3)                       |
| 45 – 54                   | 649 (32.3)                      | 204 (31.8)                      | 575 (31.7)                     | 205 (31.5)                      |
| 55 – 64                   | 1,032 (51.4)                    | 331 (51.8)                      | 1,013 (55.8)                   | 365 (56.2)                      |
| Sex                       | 0.34                            |                                 | 0.81                           |                                 |
| Female                    | 746 (37.1)                      | 221 (34.6)                      | 669 (36.8)                     | 236 (36.3)                      |
| Male                      | 1,263 (62.9)                    | 419 (65.4)                      | 1,147 (63.2)                   | 414 (63.7)                      |
| Income, $                 | 0.53                            |                                 | 0.89                           |                                 |
| < 35,000                  | 499 (24.9)                      | 160 (25.1)                      | 559 (30.8)                     | 197 (30.3)                      |
| 35,000 – 39,999           | 683 (34.0)                      | 195 (30.4)                      | 663 (36.5)                     | 233 (35.8)                      |
| ≥ 40,000                  | 659 (32.8)                      | 231 (36.1)                      | 462 (25.5)                     | 166 (25.6)                      |
| Unknown                   | 167 (8.3)                       | 53 (8.3)                        | 132 (7.3)                      | 54 (8.2)                        |
| Region                    | 0.77                            |                                 | 0.96                           |                                 |
| Northeast                 | 446 (22.2)                      | 160 (25.1)                      | 276 (15.2)                     | 107 (16.4)                      |
| North Central             | 454 (22.6)                      | 144 (22.4)                      | 379 (20.9)                     | 134 (20.6)                      |
| West                      | 245 (12.2)                      | 75 (11.8)                       | 240 (13.2)                     | 85 (13.1)                       |
| South                     | 847 (42.2)                      | 255 (39.9)                      | 906 (49.9)                     | 318 (49.0)                      |
| Unknown                   | 18 (0.9)                        | 5 (0.8)                         | 15 (0.8)                       | 5 (0.8)                         |
| Metro status              | 0.84                            |                                 | 0.94                           |                                 |
| Metro                     | 1,692 (84.2)                    | 544 (85.1)                      | 1,513 (83.3)                   | 543 (83.6)                      |
| Non-metro                 | 275 (13.7)                      | 84 (13.2)                       | 269 (14.8)                     | 94 (14.4)                       |
| Unknown                   | 42 (2.1)                        | 11 (1.7)                        | 33 (1.8)                       | 13 (2.0)                        |
| Insurance Plan            | 0.42                            |                                 | >0.9                           |                                 |
| Comprehensive             | 102 (5.1)                       | 34 (5.3)                        | 68 (3.8)                       | 24 (3.8)                        |
| PPO                       | 1,157 (57.6)                    | 359 (56.1)                      | 1,082 (59.6)                   | 390 (60.0)                      |
| HMO                       | 231 (11.5)                      | 66 (10.3)                       | 191 (10.5)                     | 66 (10.1)                       |
| POS                       | 163 (8.1)                       | 51 (8.0)                        | 147 (8.1)                      | 54 (8.3)                        |
| Others                    | 333 (16.6)                      | 109 (17.1)                      | 305 (16.8)                     | 108 (16.6)                      |
| Unknown                   | 23 (1.1)                        | 20 (3.1)                        | 22 (1.2)                       | 8 (1.3)                         |
| Procedure year            | 0.95                            |                                 | >0.9                           |                                 |
| 2013                      | 346 (17.2)                      | 106 (16.6)                      | 299 (16.5)                     | 108 (16.6)                      |
| 2014                      | 409 (20.4)                      | 130 (20.3)                      | 404 (22.2)                     | 147 (22.6)                      |
| 2015                      | 412 (20.5)                      | 140 (21.8)                      | 385 (21.2)                     | 137 (21.1)                      |
| 2016                      | 450 (22.4)                      | 147 (23.1)                      | 384 (21.2)                     | 133 (20.5)                      |
| 2017                      | 391 (19.5)                      | 117 (18.2)                      | 343 (18.9)                     | 125 (19.2)                      |
eTable 3. Baseline patient characteristics by surgical approach after inverse probability of treatment weighting adjustment (continued)

| Variable              | Partial Nephrectomy (n= 2,639) | Radical Nephrectomy (n= 2,465) | p     | MIS (n= 1,816) | OS (n= 649) | p     |
|-----------------------|--------------------------------|--------------------------------|-------|----------------|--------------|-------|
|                       | MIS (n= 2,009) OS (n= 640)     |                                 |       | MIS (n= 1,816) | OS (n= 649) |       |
| CCI score             | 0.69                           | >0.9                            |       | 0.64           | 0.94         |       |
| 0                     | 789 (39.3)                     | 248 (38.7)                      |       | 743 (40.9)     | 267 (41.1)  |       |
| 1-2                   | 936 (46.6)                     | 310 (48.5)                      |       | 794 (43.7)     | 283 (43.6)  |       |
| >2                    | 284 (14.1)                     | 82 (12.8)                       |       | 279 (15.4)     | 99 (15.3)   |       |
| Setting               | 0.64                           | 0.94                            |       | 0.28           |              |       |
| Inpatient             | 1,767 (88.0)                   | 552 (86.4)                      |       | 1,721 (94.8)   | 616 (94.9)  |       |
| Outpatient            | 241 (12.0)                     | 87 (13.6)                       |       | 95 (5.2)       | 33 (5.1)    |       |
| Baseline expense, $   | 8,396 (4,721, 16,082)          | 8,235 (4,993, 17,271)           | 0.42  | 8,293 (4,489, 15,270) | 7,927 (3,880, 16,182) | 0.28 |

**Abbreviations:** MIS, minimally invasive surgery; OS, open surgery; HMO, health maintenance organization; PPO, preferred provider organization, POS, point of service; CCI, Charlson’s comorbidity index; IQR, interquartile range; SD, standard deviation

Baseline expense* = baseline expenditures during the 180 days before surgery

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**Table 4.** Sensitivity analyses on healthcare expenditure outcomes among patients who had partial nephrectomy

| Outcomes                        | MIS mean (95%CI) | OS mean (95%CI) | Adjusted difference (OS as reference) Mean (95%CI) | P |
|---------------------------------|------------------|-----------------|---------------------------------------------------|---|
| Excluding 5% extreme index expenditure 1 |                  |                 |                                                   |   |
| Index, $                        | 29870 (29269, 30484) | 29352 (28257, 30490) | 518 (-752,1789) | 0.43 |
| 1-year post, $                  | 16813 (15430, 18319) | 18906 (16104, 22197) | -2094 (-5453, 1265) | 0.21 |
| Index + 1-year post, $          | 46683 (45071, 48352) | 48258 (45190, 51535) | -1575 (-5453, 1994) | 0.38 |
| Excluding below Medicare payment 2 |                  |                 |                                                   |   |
| Index, $                        | 32571 (31832, 33327) | 31531 (30231, 32887) | 1040 (-484, 2564) | 0.19 |
| 1-year post, $                  | 16777 (15328, 18144) | 19935 (17076, 23273) | -3258 (-6650, 133) | 0.05 |
| Index + 1-year post, $          | 49247 (47542, 51014) | 51466 (48242, 54905) | -2219 (-5973, 1536) | 0.24 |
| Excluding no claim for follow up care 3 |                  |                 |                                                   |   |
| Index, $                        | 30408 (29639, 31197) | 27482 (26264, 28756) | 2926 (1457, 4395) | <.01 |
| 1-year post, $                  | 17180 (15775, 18711) | 19705 (16943, 22918) | -2525 (-5843, 792) | 0.12 |
| Index + 1-year post, $          | 47588 (45845, 49398) | 47187 (44171, 50409) | 401 (-3186, 3988) | 0.83 |
| Excluding multiple surgery cases 4 |                  |                 |                                                   |   |
| Index, $                        | 30723 (29963, 31502) | 28287 (27024, 29609) | 2436 (932, 3939) | <.01 |
| 1-year post, $                  | 15643 (14295, 17119) | 17647 (14972, 20800) | -2004 (-5230, 1222) | 0.21 |
| Index + 1-year post, $          | 46366 (44702, 48092) | 45934 (42972, 49101) | 432 (-3069, 3932) | 0.81 |

1 N=82 patients were excluded; 2 N = 241 patients were excluded; 3 N = 9 patients were excluded; 4 N = 139 patients were excluded

**Abbreviations:** MIS, Minimally Invasive Surgery; OS, open surgery; ER, Emergency Room; OP, outpatient; OR, odds ratio; IRR, incidence rate ratio

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eTable 5. Sensitivity analyses on healthcare expenditure outcomes among patients who had radical nephrectomy

| Outcomes                          | MIS mean (95%CI) | OS mean (95%CI) | Adjusted difference (OS as reference) Mean (95%CI) | P     |
|----------------------------------|------------------|-----------------|-----------------------------------------------------|-------|
| Excluding 5% extreme index expenditure ¹ |                  |                 |                                                    |       |
| Index, $                         | 28510 (27896, 29139) | 30929 (29808, 32092) | -2418 (-3718, -1118)                               | < .01 |
| 1-year post, $                   | 21830 (19498, 24441) | 30211 (24949, 36583) | -8381 (-14667, -2095)                              | < .01 |
| Index + 1-year post, $           | 50340 (47731, 53092) | 61140 (55870, 66906) | -10799 (-16926, -4672)                             | < .01 |
| Excluding below Medicare payment ² |                  |                 |                                                    |       |
| Index, $                         | 30789 (30047, 31550) | 34156 (32790, 35579) | -3367 (-4951, -1783)                               | < .01 |
| 1-year post, $                   | 22595 (20034, 25484) | 30971 (25327, 37872) | -8376 (-15174, -1578)                              | < .01 |
| Index + 1-year post, $           | 53384 (50487, 56448) | 65127 (59324, 71497) | -11742 (-18511, -4974)                             | < .01 |
| Excluding no claim for follow up care ³ |                  |                 |                                                    |       |
| Index, $                         | 28992 (28250, 29754) | 32009 (30651, 33428) | -3017 (-4595, -1438)                               | < .01 |
| 1-year post, $                   | 22611 (20170, 25348) | 30919 (25545, 37425) | -8308 (-14753, -1863)                              | < .01 |
| Index + 1-year post, $           | 51604 (48845, 54518) | 62929 (57407, 68981) | -11325 (-17762, -4888)                             | < .01 |
| Excluding multiple surgery cases ⁴ |                  |                 |                                                    |       |
| Index, $                         | 29128 (28382, 29893) | 32334 (30964, 33764) | -3206 (-4796, -1616)                               | < .01 |
| 1-year post, $                   | 21883 (19447, 24624) | 29430 (24171, 35833) | -7547 (-13890, -1204)                              | 0.01  |
| Index + 1-year post, $           | 51011 (48256, 53922) | 61763 (56301, 67756) | -10753 (-17135, -4371)                             | < .01 |

¹ N=65 patients were excluded; ² N = 196 patients were excluded; ³ N = 11 patients were excluded; ⁴ N = 63 patients were excluded

Abbreviations: MIS, Minimally Invasive Surgery; OS, open surgery; ER, Emergency Room; OP, outpatient; OR, odds ratio; IRR, incidence rate ratio