**Appendix 1**

**Supplementary Table 1.** Search strategy processed through Ovid databases on January 15th, 2018.

|  |  |  |
| --- | --- | --- |
| **Databases** | **Search Terms** | **Detailed Search Strategy (Results)** |
| **Embase**1988 to 2018 Week 3    **Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily**1946 to January 15th, 2018 | Hysterectomy | 1 exp Hysterectomy/ (87306)  2 (hysterectom\* or hysterotom\*).tw,kf. (81933)  3 (colpohysterectom\* or colpo-hysterectom\* or hysterocolpectom\* or hystero-colpectom\* or panhysterectom\* or pan-hysterectom\*).tw,kf. (390)  4 ((supervaginal or super-vaginal\* or uterus or uteri) adj3 (amputat\* or excis\* or extirpat\* or remov\*)).tw,kf. (2715)  5 (trachelectom\* or cervicectom\*).tw,kf. (1793)  6 or/1-5 [HYSTERECTOMY] (114243)  7 Hepatectomy/ (60646)  8 ((hepat\* or liver?) adj3 resect\*).tw,kf. (50522)  9 hepatectom\*.tw,kf. (44911)  10 (hemihepatectom\* or hemi-hepatectom\*).tw,kf. (2429)  11 ((hepat\* or liver?) adj3 lobectom\*).tw,kf. (2545) |
| Hepatectomy | 7 Hepatectomy/ (60646)  8 ((hepat\* or liver?) adj3 resect\*).tw,kf. (50522)  9 hepatectom\*.tw,kf. (44911)  10 (hemihepatectom\* or hemi-hepatectom\*).tw,kf. (2429)  11 ((hepat\* or liver?) adj3 lobectom\*).tw,kf. (2545)  12 or/7-11 [HEPATECTOMY] (98629) |
| Sleeve Gasterectomy | 13 (sleeve adj1 gastrectom\*).tw,kf. (13068)  14 LSG.tw,kf. (5182)  15 or/13-14 [SLEEVE GASTRECTOMY] (14068) |
| Lobectomy | 16 Pneumonectomy/ (46407)  17 (pneumonectom\* or pneumectom\* or pulmonectom\* or pneumoresect\* or pneumo-resect\*).tw,kf. (19788)  18 ((lung or lungs or pneumo\* or pulmonar\*) adj3 resect\*).tw,kf. (33347)  19 (lung? volume reduction\* or LVRS).tw,kf. (3660)  20 lobectom\*.tw,kf. (39879)  21 ((lobe or lobes) adj3 (amputat\* or excis\* or extirpat\* or remov\*)).tw,kf. (1605)  22 or/16-21 [LOBECTOMY] (97775) |
| Gastric Bypass | 23 Gastric Bypass/ (10868)  24 ((gastric or gastro\* or stomach\*) adj3 bypass\*).tw,kf. (28687)  25 (RYGB or RYGBs).tw,kf. (6773)  26 or/23-25 [GASTRIC BYPASS] (31336) |
| Colectomy | 27 exp Colectomy/ (54150)  28 (colectom\* or hemicolectom\* or hemi-colectom\*).tw,kf. (34402)  29 ((bowel? or colon? or colorect\* or colo-rect\* or intestin\* or rectal\* or rectum?) adj3 resect\*).tw,kf. (60372)  30 ((lbowel? or colon? or colorect\* or colo-rect\* or intestin\* or rectal\* or rectum?) adj3 (amputat\* or excis\* or extirpat\* or remov\*)).tw,kf. (11851)  31 (proctocolectom\* or procto-colectom\*).tw,kf. (6810)  32 ((ileal or ileoanal or ileo-anal) adj (pouch\* or reservoir?) adj3 anastomos#s).tw,kf. (4723)  33 or/27-32 [COLECTOMY] (127734) |
| Gastrectomy | 34 Gastrectomy/ (58876)  35 gastrectom\*.tw,kf. (58982)  36 ((gastric or gastro\* or stomach\*) adj3 resect\*).tw,kf. (22640)  37 (pyloromyotom\* or pyloro-myotom\*).tw,kf. (1546)  38 Fredet-Ramstedt.tw,kf. (49)  39 (GPOEM? or G-POEM?).tw,kf. (74)  40 (POEM? adj3 (procedure? or operation?)).tw,kf. (409)  41 or/34-40 [GASTRECTOMY] (95772) |
| Cost Economics (all procedures of interest) | 42 6 or 12 or 15 or 22 or 26 or 33 or 41 [ALL PROCEDURES OF INTEREST] (538579)  43 exp Hysterectomy/ec [economics] (458)  44 Hepatectomy/ec [economics] (127)  45 Pneumonectomy/ec [economics] (178)  46 Gastric Bypass/ec [economics] (163)  47 exp Colectomy/ec [economics] (288)  48 Gastrectomy/ec [economics] (108)  49 exp Dissection/ec [economics] (27)  50 exp Endoscopy/ec [economics] (5347)  51 Robotics/ec [economics] (537)  52 Surgical Procedures, Operative/ec [economics] (1135)  53 Bariatric Surgery/ec [economics] (335)  54 Digestive System Surgical Procedures/ec [economics] (184)  55 Economics/ (220159)  56 exp "Costs and Cost Analysis"/ (518176)  57 Economics, Nursing/ (25892)  58 Economics, Medical/ (31795)  59 Economics, Pharmaceutical/ (11160)  60 exp Economics, Hospital/ (711044)  61 Economics, Dental/ (25070)  62 exp "Fees and Charges"/ (62463)  63 exp Budgets/ (37321)  64 budget\*.ti,ab,kf. (55849)  65 (economic\* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic\* or pharmaco-economic\* or expenditure or expenditures or expense or expenses or financial or finance or finances or financed).ti,kf. (391843)  66 (economic\* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic\* or pharmaco-economic\* or expenditure or expenditures or expense or expenses or financial or finance or finances or financed).ab. /freq=2 (563806)  67 (cost\* adj2 (effective\* or utilit\* or benefit\* or minimi\* or analy\* or outcome or outcomes)).ab,kf. (316846)  68 (value adj2 (money or monetary)).ti,ab,kf. (4661)  69 exp models, economic/ (15551)  70 economic model\*.ab,kf. (6471)  71 markov chains/ (15962)  72 markov.ti,ab,kf. (41882)  73 Monte Carlo Method/ (59888)  74 monte carlo.ti,ab,kf. (82833)  75 exp Decision Theory/ (13569)  76 (decision\* adj2 (tree\* or analy\* or model\*)).ti,ab,kf. (45242)  77 Health Resources/ec, ut [economics, utilization] (4936)  78 (resource? adj3 ("use" or used or uses or using or utilis\* or utiliz\*)).tw,kf. (84094)  79 Hospitalization/ec, sn [economics, statistics & numerical data] (33570)  80 Length of Stay/ec, sn [economics, statistics & numerical data] (24187)  81 (("length of stay" or LOS) adj3 (cost\* or economic\* or expens\* or financ\* or pric\*)).tw,kf. (9122)  82 or/43-81 [COST, ECONOMICS] (1856468)  83 42 and 82 [COST, ECONOMICS - ALL PROCEDURES OF INTEREST] (16289) |
| Medline Records (Animal-Only Removed) | 84 exp Animals/ not (exp Animals/ and Humans/) (13470234)  85 83 not 84 [ANIMAL-ONLY REMOVED] (11980)  86 limit 85 to english (11158)  87 limit 86 to yr="2007-current" (7160)  88 87 use ppez [MEDLINE RECORDS] (4110) |
| Hepatectomy | 95 exp liver resection/ (43636)  96 ((hepat\* or liver?) adj3 resect\*).tw,kw. (50913)  97 hepatectom\*.tw,kw. (45829)  98 (hemihepatectom\* or hemi-hepatectom\*).tw,kw. (2439)  99 ((hepat\* or liver?) adj3 lobectom\*).tw,kw. (2552)  100 or/95-99 [HEPATECTOMY] (93651) |
| Sleeve Gastrectomy | 101 laparoscopic sleeve gastrectomy/ (1290)  102 (sleeve adj1 gastrectom\*).tw,kw. (13117)  103 LSG.tw,kw. (5190)  104 or/101-103 [SLEEVE GASTRECTOMY] (14216) |
| Lobectomy | 105 lobectomy/ (12033)  106 lung resection/ (24333)  107 (pneumonectom\* or pneumectom\* or pulmonectom\* or pneumoresect\* or pneumo-resect\*).tw,kw. (20090)  108 ((lung or lungs or pneumo\* or pulmonar\*) adj3 resect\*).tw. (33279)  109 (lung? volume reduction\* or LVRS).tw,kw. (3744)  110 lobectom\*.tw,kw. (40172)  111 ((lobe or lobes) adj3 (amputat\* or excis\* or extirpat\* or remov\*)).tw,kw. (1599)  112 or/105-111 [LOBECTOMY] (92888) |
| Gastric Bypass | 113 exp gastric bypass/ (12928)  114 ((gastric or gastro\* or stomach\*) adj3 bypass\*).tw,kw. (28967)  115 (RYGB or RYGBs).tw,kw. (6833)  116 or/113-115 [GASTRIC BYPASS] (32029) |
| Colectomy | 117 exp colectomy/ (54150)  118 (colectom\* or hemicolectom\* or hemi-colectom\*).tw,kw. (34756)  119 ((bowel? or colon? or colorect\* or colo-rect\* or intestin\* or rectal\* or rectum?) adj3 resect\*).tw,kw. (60581)  120 ((lbowel? or colon? or colorect\* or colo-rect\* or intestin\* or rectal\* or rectum?) adj3 (amputat\* or excis\* or extirpat\* or remov\*)).tw,kw. (11869)  121 (proctocolectom\* or procto-colectom\*).tw,kw. (6952)  122 ((ileal or ileoanal or ileo-anal) adj (pouch\* or reservoir?) adj3 anastomos#s).tw,kw. (4796)  123 or/117-122 [COLECTOMY] (128060) |
| Gastrectomy | 124 gastrectomy/ (58876)  125 gastrectom\*.tw,kw. (59494)  126 ((gastric or gastro\* or stomach\*) adj3 resect\*).tw,kw. (22692)  127 (pyloromyotom\* or pyloro-myotom\*).tw,kf. (1546)  128 Fredet-Ramstedt.tw,kw. (49)  129 (GPOEM? or G-POEM?).tw,kw. (74)  130 (POEM? adj3 (procedure? or operation?)).tw,kw. (409)  131 or/124-130 [GASTRECTOMY] (95977) |
| Cost Economics (all procedures of interest) | 132 94 or 100 or 104 or 112 or 116 or 123 or 131 [ALL PROCEDURES OF INTEREST] (529066)  133 Economics/ (220159)  134 Cost/ (89344)  135 exp hospital cost/ (39293)  136 health care cost/ (198914)  137 exp Health Economics/ (687142)  138 Budget/ (34862)  139 budget\*.ti,ab,kw. (56171)  140 (economic\* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic\* or pharmaco-economic\* or expenditure or expenditures or expense or expenses or financial or finance or finances or financed).ti,kw. (411272)  141 (economic\* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic\* or pharmaco-economic\* or expenditure or expenditures or expense or expenses or financial or finance or finances or financed).ab. /freq=2 (563806)  142 (cost\* adj2 (effective\* or utilit\* or benefit\* or minimi\* or analy\* or outcome or outcomes)).ab,kw. (320692)  143 (value adj2 (money or monetary)).ti,ab,kw. (4672)  144 Statistical Model/ (237570)  145 economic model\*.ab,kw. (6679)  146 Probability/ (131505)  147 markov.ti,ab,kw. (42545)  148 monte carlo method/ (59888)  149 monte carlo.ti,ab,kw. (83916)  150 Decision Theory/ (2495)  151 Decision Tree/ (20309)  152 (decision\* adj2 (tree\* or analy\* or model\*)).ti,ab,kw. (45974)  153 health care utilization/ (98413)  154 (resource? adj3 ("use" or used or uses or using or utilis\* or utiliz\*)).tw,kw. (84422)  155 (("length of stay" or LOS) adj3 (cost\* or economic\* or expens\* or financ\* or pric\*)).tw,kw. (9202)  156 or/133-155 [COST, ECONOMICS] (2098078)  157 132 and 156 [COST, ECONOMICS - ALL PROCEDURES OF INTEREST] (17101) |
| Final Search (Both Databases) | 158 exp animal experimentation/ or exp animal model/ or exp animal experiment/ or nonhuman/ or exp vertebrate/ (42881899)  159 exp human/ or exp human experimentation/ or exp human experiment/ (34448092)  160 158 not 159 (8435002)  161 157 not 160 [ANIMAL-ONLY REMOVED] (16863)  162 limit 161 to english (15937)  163 limit 162 to yr="2007-current" (11433)  164 163 use emed [EMBASE RECORDS] (8344)  165 88 or 164 [BOTH DATABASES] (12454)  166 conference abstract.pt. (2854449)  167 165 not 166 [CONFERENCE ABSTRACTS REMOVED] (9320)  168 limit 167 to yr="2014-current" (4433)  169 remove duplicates from 168 (2960)  170 167 not 168 (4887)  171 remove duplicates from 170 (3537)  172 169 or 171 [TOTAL UNIQUE RECORDS] (6497)  173 172 use ppez [MEDLINE UNIQUE RECORDS] (3367)  174 172 use emed [EMBASE UNIQUE RECORDS] (3130) |

**Supplementary Table 2.** Search strategy processed through Cochrane databases on January 15th, 2018.

|  |  |  |
| --- | --- | --- |
| **Databases** | **Search Terms** | **Detailed Search Strategy (Results)** |
| **EBM Reviews - Cochrane Database of Systematic Reviews**2005 to September 19, 2018**,**    **EBM Reviews - ACP Journal Club**1991 to September 2018**,**    **EBM Reviews - Database of Abstracts of Reviews of Effects**1st Quarter 2016**,**    **EBM Reviews - Cochrane Clinical Answers**September 2018**,**  **EBM Reviews - Cochrane Central Register of Controlled Trials**August 2018**,**    **EBM Reviews - Cochrane Methodology Register**3rd Quarter 2012**,**  **Reviews - Health Technology Assessment**4th Quarter 2016**,**    **EBM Reviews - NHS Economic Evaluation Database**1st Quarter 2016**,**    **Embase**1988 to 2018 Week 3**,**    **Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily**1946 to September 28th, 2018 | Hysterectomy | #1 [mh Hysterectomy] 1860  #2 (hysterectom\* or hysterotom\*):ti,ab,kw 4234  #3 (colpohysterectom\* or colpo-hysterectom\* or hysterocolpectom\* or hystero-colpectom\* or panhysterectom\* or pan-hysterectom\*):ti,ab,kw 4  #4 ((supervaginal or super-vaginal\* or uterus or uteri) near/3 (amputat\* or excis\* or extirpat\*)):ti,ab,kw 10  #5 (trachelectom\* or cervicectom\*):ti,ab,kw 11  #6 [[130-#5](#_ENREF_130)] 4246 |
| Hepatectomy | #7 [mh Hepatectomy] 724  #8 ((hepat\* or liver?) near/3 resect\*):ti,ab,kw 588  #9 hepatectom\*:ti,ab,kw 1017  #10 (hemihepatectom\* or hemi-hepatectom\*):ti,ab,kw 37  #11 ((hepat\* or liver?) near/3 lobectom\*):ti,ab,kw 5  #12 [[131-#11](#_ENREF_131)] 1296 |
| Gastrectomy | #13 (sleeve near/1 gastrectom\*):ti,ab,kw 447  #14 LSG:ti,ab,kw 181  #15 [[132-#14](#_ENREF_132)] 467 |
| Pneumonectomy | #16 [mh Pneumonectomy] 567  #17 (pneumonectom\* or pneumectom\* or pulmonectom\* or pneumoresect\* or pneumo-resect\*):ti,ab,kw 703  #18 ((lung or lungs or pneumo\* or pulmonar\*) near/3 resect\*):ti,ab,kw 922  #19 ((lung? next volume next reduction?) or LVRS):ti,ab,kw 82  #20 lobectom\*:ti,ab,kw 805  #21 ((lobe or lobes) near/3 (amputat\* or excis\* or extirpat\* or remov\*)):ti,ab,kw 14  #22 [[133-#21](#_ENREF_133)] 1735 |
| Gastric Bypass | #23 [mh "Gastric Bypass"] 493  #24 ((gastric or gastro\* or stomach\*) near/3 bypass\*):ti,ab,kw 1131  #25 (RYGB or RYGBs):ti,ab,kw 251  #26 [[134-#25](#_ENREF_134)] 1135 |
| Colectomy | #27 [mh Colectomy] 828  #28 (colectom\* or hemicolectom\* or hemi-colectom\*):ti,ab,kw 1203  #29 ((bowel? or colon? or colorect\* or colo-rect\* or intestin\* or rectal\* or rectum?) near/3 resect\*):ti,ab,kw 1758  #30 ((lbowel? or colon? or colorect\* or colo-rect\* or intestin\* or rectal\* or rectum?) near/3 (amputat\* or excis\* or extirpat\* or remov\*)):ti,ab,kw 274  #31 (proctocolectom\* or procto-colectom\*):ti,ab,kw 236  #32 ((ileal or ileoanal or ileo-anal) next (pouch\* or reservoir?) near/3 anastomos\*):ti,ab,kw 80  #33 [[135-#32](#_ENREF_135)] 3105 |
| Gastrectomy | #34 [mh Gastrectomy] 999  #35 gastrectom\*:ti,ab,kw 2186  #36 ((gastric or gastro\* or stomach\*) near/3 resect\*):ti,ab,kw 872  #37 (pyloromyotom\* or pyloro-myotom\*):ti,a |

**Appendix 2**

| **Supplementary Table 3.** Lobectomy Studies with Costs Converted to 2018 USD | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Study Design**  **(Data Source)** | **Approach** | **Procedure Details** | **Sample Size** | **OR Cost per Minute** | **Ward Cost per Day** | **Total OR Room Cost** | **Total OR Cost** | **Total Ward Cost** | **Total Admission Cost** |
| **Americas** | | | | | | | | | | |
| **Deen et al., 2014** | Retrospective cohort | Open | Lobectomy or Segmentectomy | 69 | $26.25 | $524.19 | $4,724.17 | $8,714.49 | $2,867.32 | $18,202.35 |
| Thoracoscopic | VATS | 58 | $24.58 | $664.73 | $4,964.82 | $10,144.91 | $3,157.45 | $17,238.84 |
| Robotic | Lobectomy | 57 | $25.82 | $673.88 | $5,758.74 | $11,022.61 | $3,113.30 | $18,265.88 |
| **Medbery et al., 2014** | Retrospective cohort | Thoracoscopic | VATS lobectomy | 149 | $51.65 | $1,337.70 | $8,160.22 | $9,499.06 | $5,350.79 | $20,847.30 |
| **Paul et al., 2014** | Retrospective cohort | Thoracoscopic | Lobectomy | 2,498 | - | - | - | - | - | $19,992.94 |
| Robotic | Lobectomy | 37,595 | - | - | - | - | - | $25,259.07 |
| **Swanson et al., 2014** | Retrospective cohort | Thoracoscopic | VATS lung resection (lobectomy) | 295 | - | - | - | - | - | $22,904.05 |
| Robotic RATS | RATS lung resection (lobectomy) | 295 | - | - | - | - | - | $28,009.25 |
| **Khullar et al., 2016** | Retrospective cohort | Thoracoscopic | VATS lobectomy, bilobectomy or segmentectomy | 263 | $17.90 | $1,093.67 | $4,223.38 | $9,382.65 | $4,374.68 | $21,389.25 |
| **Rodgers-Fischl et al., 2017** | Retrospective cohort | Open | Thoracotomy | 48 | - | - | - | - | - | $15,476.40 |
| Thoracoscopic | VATS | 61 | - | - | - | - | - | $16,375.89 |
| **Asia-Pacific** | | | | | | | | | | |
| **Cho et al., 2011** | Retrospective cohort | Open | Lobectomy | 97 | $10.99 | $59.34 | $1,499.49 | $4,526.47 | $706.12 | $9,206.02 |
| Thoracoscopic | VATS | 86 | $10.27 | $62.13 | $1,497.85 | $5,081.17 | $441.13 | $8,873.52 |
| **Tantraworasin et al., 2014** | Non-blinded RCT | Open | Pulmonary lobectomy using staples only | 26 | - | - | - | $4,049.34 | - | $6,362.43 |
| Open | Pulmonary lobectomy using sutures only | 27 | - | - | - | $4,367.39 | - | $6,799.04 |
| **Yang et al., 2015** | RCT | Thoracoscopic | 2D VATS lobectomy | 150 | $19.63 | $326.07 | $3,454.63 | $7,240.52 | $2,608.58 | $12,109.18 |
| Thoracoscopic | 3D VATS lobectomy | 150 | $25.06 | $338.88 | $3,633.28 | $7,437.81 | $2,372.19 | $12,213.94 |
| **Wang et al., 2016** | Retrospective cohort | Open | Lobectomy | 3,166 | $10.67 | $31.04 | $3,551.91 | $7,277.29 | $542.95 | $11,921.37 |
| Thoracoscopic | Lobectomy | 2,200 | $12.70 | $32.09 | $4,113.72 | $9,340.87 | $417.18 | $12,925.95 |
| **EMEA** | | | | | | | | | | |
| **Ramos et al., 2012** | Retrospective cohort | Open | PLT | 189 | - | $535.45 | - | $4,253.78 | $4,283.63 | $19,111.31 |
| Thoracoscopic | Totally Endoscopic Approach | 98 | - | $483.02 | - | $6,113.80 | $3,381.12 | $16,123.56 |
| **Augustin et al., 2013** | Unspecified observational cohort study | Thoracoscopic | VATS lung lobectomy | 26 | $9.80 | - | $1,793.99 | $2,408.19 | - | - |
| Robotic | Anterior and posterior approach RATS lung lobectomy | 26 | $9.81 | - | $2,108.92 | $3,477.06 | - | - |
| **Piwkowski et al., 2013** | Retrospective cohort | Open | Antero-lateral thoracotomy | 104 | $8.84 | $245.40 | $1,175.47 | $1,570.58 | $2,454.03 | $5,023.39 |
| Thoracoscopic | VATS lobectomy | 108 | $26.75 | $245.40 | $3,423.36 | $6,046.72 | $1,717.82 | $6,000.09 |
| **Alpay et al., 2014** | Retrospective cohort | Open | Thoracotomy | 49 | - | $14.45 | $677.93 | $3,758.77 | $153.88 | $4,589.05 |
| Thoracoscopic | VATS lobectomy | 32 | - | $14.45 | $1,027.61 | $2,133.59 | $112.41 | $3,563.74 |
| **Mafé et al., 2017** | Prospective (VATS) and retrospective (open) cohorts | Open | Open thoracic surgery | 75 | $22.54 | $508.05 | $5,548.19 | $8,857.56 | $4,162.40 | $15,778.63 |
| Thoracoscopic | VATS lung lobectomy | 42 | $22.54 | $508.05 | $5,225.33 | $8,939.72 | $2,830.53 | $13,764.34 |

Abbreviations: PLT = Classical Post-Lateral Lobectomy; RATS = Robotic Assisted Thoracic Surgery; VATS = Video-Assisted Thoracic Surgery

| **Supplementary Table 4.** Hysterectomy Studies with Costs Converted to 2018 USD | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Study Design** | **Approach** | **Procedure Details** | **Sample Size** | **OR Cost per Minute** | **Ward Cost per Day** | **Total OR Room Cost** | **Total OR Cost** | **Total Ward Cost** | **Total Admission Cost** |
| **Americas** | | | | | | | | | | |
| **Jonsdottir et al., 2011** | Retrospective cohort | Open | Abdominal Hysterectomy | 682 | - | - | - | $7,180.80 | - | $14,650.49 |
| Open | Vaginal Hysterectomy | 163 | - | - | - | $4,865.01 | - | $13,659.00 |
| Laparoscopic | Abdominal and vaginal laparoscopic hysterectomies | 187 | - | - | - | $8,909.55 | - | $14,247.20 |
| Robotic | Abdominal and vaginal robotic hysterectomies | 22 | - | - | - | $12,165.98 | - | $12,716.04 |
| **Scribner et al., 2012** | Retrospective cohort | Laparoscopic | Standard laparoscopic hysterectomy | 48 | $12.92 | $327.03 | $1,601.63 | $3,640.09 | $327.03 | $5,189.73 |
| Robotic | Laparoscopic hysterectomy | 28 | $12.44 | $288.01 | $2,114.72 | $5,826.46 | $374.41 | $7,661.52 |
| **Venkat et al., 2012** | Retrospective cohort | Laparoscopic | Standard laparoscopic hysterectomy | 27 | - | $2,363.75 | - | $10,422.99 | $4,254.75 | $18,881.47 |
| Robotic | Laparoscopic hysterectomy | 27 | - | $1,928.02 | - | $13,967.08 | $3,277.63 | $22,010.46 |
| **EMEA** | | | | | | | | | | |
| **Tapper et al., 2014** | Systematic Review and Cost Analysis (Two RCTs) | Open | Vaginal Hysterectomy | 111 | $10.41 | $456.35 | $1,165.53 | $1,377.66 | $821.42 | $2,384.09 |
| Open | Hysterectomy without dissection  of lymph nodes | 53 | $10.20 | $456.34 | $1,530.60 | $1,809.35 | $2,372.99 | $4,367.34 |
| Open | Hysterectomy with dissection of  lymph nodes | 215 | $11.11 | $456.34 | $2,089.31 | $2,374.23 | $2,509.89 | $5,070.36 |
| Laparoscopic | Laparoscopic hysterectomy without  dissection of lymph nodes | 119 | $9.80 | $456.34 | $1,783.44 | $2,389.02 | $1,003.96 | $3,579.21 |
| Laparoscopic | Laparoscopic hysterectomy with  dissection of lymph nodes | 52 | $9.94 | $456.34 | $2,265.69 | $2,893.47 | $1,049.59 | $4,129.30 |
| Robotic | Robotic hysterectomy without dissection  of lymph nodes | 20 | $10.73 | $456.34 | $2,178.12 | $6,378.95 | $775.78 | $7,339.74 |
| Robotic | Robotic hysterectomy with dissection of  lymph nodes | 92 | $10.26 | $456.34 | $2,586.36 | $6,787.19 | $1,049.59 | $8,023.02 |
| **Eklind et al., 2015** | Retrospective cohort | Open | Laparotomy | 48 | $5.08 | $125.76 | $908.75 | $1,390.27 | $603.66 | $12,980.33 |
|  | Robotic laparoscopy using | 40 | $5.08 | $125.76 | $644.75 | $1,743.03 | $226.37 | $12,820.82 |
| **Marino et al., 2015** | Retrospective cohort | Laparoscopic | Laparoscopy for simple and radical hysterectomy | 226 | $7.30 | $430.12 | $1,752.30 | $3,666.34 | $2,150.62 | $7,463.67 |
| Robotic | Robot-assisted laparoscopy for simple and radical hysterectomy | 80 | $6.64 | $361.56 | $1,991.56 | $6,228.63 | $2,169.33 | $9,409.78 |
| **Baffert et al., 2016** | Prospective cohort | Open | Laparotomy for total and extra fascial hysterectomy | 23 | - | $1,218.39 | - | $3,790.38 | $8,894.25 | $12,684.62 |
| Laparoscopic | Laparoscopy for total and extra fascial hysterectomy | 39 | - | $1,242.40 | - | $6,952.28 | $7,081.66 | $14,033.94 |
| **Ind et al., 2016** | Prospective cohort cross-referenced to patient charts | Open | Open hysterectomy | 95 | $19.60 | $963.34 | $3,527.72 | - | $5,780.07 | $19,264.84 |
| Laparoscopic | Laparoscopic hysterectomy | 77 | $17.24 | $973.39 | $3,965.20 | - | $2,920.18 | $15,386.21 |
| Robotic | Robotic hysterectomy | 24 | $18.36 | $1,103.76 | $3,524.62 | - | $2,207.53 | $12,186.23 |
| **Rossitto et al., 2016** | Phase 2 RCT | Robotic | Robot-assisted total hysterectomy | 81 | $13.86 | - | $3,825.86 | $4,773.07 | - | - |
| **Mohammed et al., 2017** | Prospective RCT | Open | Vaginal hysterectomy | 25 | - | - | - | - | - | $1,105.91 |
| Laparoscopic | LAVH | 25 | - | - | - | - | - | $1,626.77 |
| **Pellegrino et al., 2017** | Prospective cohort | Open | Open hysterectomy | 74 | $11.49 | $714.79 | $1,332.74 | $1,544.76 | $2,430.27 | $3,975.02 |
| Laparoscopic | Total laparoscopic hysterectomy | 130 | $10.53 | $680.14 | $1,105.83 | $1,303.12 | $1,564.31 | $2,867.01 |
| Robotic | Robotically-assisted hysterectomy | 64 | $11.28 | $714.98 | $1,274.19 | $5,056.07 | $1,501.45 | $6,557.53 |
| **Pellegrino et al., 2017 (2)** | Prospective cohort | Laparoscopic | TLRH | 18 | $7.78 | $729.16 | $1,890.19 | $2,086.12 | $3,113.53 | $5,199.66 |
| Robotic | RRH | 34 | $7.00 | $693.13 | $1,592.53 | $5,347.23 | $2,481.40 | $7,832.79 |
| **Wright et al., 2012** | Retrospective cohort | Open | Abdominal hysterectomy | 185 | - | - | - | $10,776.05 | - | $15,122.67 |
| Open | Vaginal hysterectomy | 135 | - | - | - | $9,252.76 | - | $11,070.73 |
| Laparoscopic | Laparoscopic hysterectomy | 354 | - | - | - | $11,745.01 | - | $13,281.82 |
| Robotic | Robotic hysterectomy | 14 | - | - | - | $15,182.30 | - | $17,169.44 |
| **Yu et al., 2013** | Cross-sectional study | Open | Open hysterectomy | 1,370 | - | $276.10 | $3,907.73 | $4,951.21 | $1,076.77 | $12,651.34 |
| Laparoscopic | Laparoscopic hysterectomy | 228 | - | $295.06 | $4,743.91 | $5,772.83 | $531.11 | $12,897.01 |
| Robotic | Robotic hysterectomy | 649 | - | $257.84 | $7,834.86 | $9,468.74 | $412.55 | $17,877.69 |
| **Dayaratna et al., 2014** | Retrospective cohort | Open | TVH | 185 | - | - | - | $5,685.34 | - | $9,022.32 |
| Laparoscopic | LAVH | 110 | - | - | - | $7,305.31 | - | $11,494.55 |
| Laparoscopic | TLH | 9 | - | - | - | $9,349.97 | - | $13,194.99 |
| Robotic | Robotic hysterectomy | 30 | - | - | - | $10,245.01 | - | $15,330.99 |
| **Leitao et al., 2014** | Retrospective cohort | Open | Laparotomy | 42 | - | - | $8,231.18 | $10,016.69 | $3,513.94 | $17,216.97 |
| Laparoscopic | Laparoscopy | 132 | - | - | $8,096.46 | $10,261.00 | $2,082.34 | $15,012.48 |
| Robotic | Robotic treatment | 262 | - | - | $8,596.50 | $15,064.99 | $1,854.02 | $19,447.72 |
| **Hanafi et al., 2015** | Retrospective cohort | Robotic | RLH | 84 | - | - | - | - | - | $5,918.47 |
| Open | TAH | 92 | - | - | - | - | - | $6,202.80 |
| Open | TVH | 27 | - | - | - | - | - | $4,977.93 |
| **Bogani et al., 2016** | Retrospective cohort | Open abdominal | Abdominal hysterectomy | 384 | $28.72 | $1,147.76 | $4,824.95 | $5,577.71 | $4,591.03 | $20,812.76 |
| Robotic | Robotic hysterectomy | 251 | $28.53 | $1,308.84 | $7,703.11 | $8,640.89 | $1,308.84 | $19,993.01 |
| **El Hachem et al., 2016** | Retrospective case-control | Laparoscopic | Conventional laparoscopy | 59 | $20.59 | - | $1,618.24 | $5,019.52 | - | $6,871.66 |
| Robotic | Robotic single-site surgery | 33 | $21.24 | - | $1,818.12 | $7,689.29 | - | $9,235.23 |
| **Avondstondt et al., 2017** | Retrospective cohort | Robotic | Robotic hysterectomy | 20 | $20.62 | - | $3,315.96 | $8,741.48 | - | $9,376.26 |
| **Moawad et al., 2017** | Retrospective cohort | Laparoscopic | Laparoscopic hysterectomy | 95 | - | - | - | - | - | $7,306.68 |
| Robotic | Robotic hysterectomy | 101 | - | - | - | - | - | $5,730.81 |
| **Asia-Pacific** | | | | | | | | | | |
| **Cho et al., 2014** | Retrospective cohort | Open | TVH | 52 | - | - | - | $2,136.40 | - | $2,370.71 |
| Laparoscopic | TLH | 51 | - | - | - | $2,743.89 | - | $3,132.68 |
| **Gu et al., 2015** | Retrospective cohort | Open | TVH | 129,668 | - | - | - | $530.68 | - | $2,541.30 |
| Open | Abdominal hysterectomy | 9,134 | - | - | - | $746.19 | - | $2,763.36 |
| Laparoscopic | Laparoscopic hysterectomy | 9,164 | - | - | - | $880.66 | - | $3,470.23 |
| **EMEA** | | | | | | | | | | |
| **Coronado et al., 2012** | Retrospective cohort | Open | Laparotomy for total hysterectomy | 192 | - | $858.50 | - | $1,815.18 | $6,953.85 | $7,423.63 |
| Laparoscopic | Laparoscopy for total hysterectomy | 84 | - | $928.95 | - | $3,702.54 | $4,273.18 | $7,286.60 |
| Robotic | Robot-assisted laparoscopy for total hysterectomy | 71 | - | $926.77 | - | $4,787.20 | $3,243.71 | $8,006.64 |
| **Desille-Gbaguidi et al., 2013** | Retrospective cohort | Laparoscopic | Laparoscopy for endometrial cancer | 15 | $9.66 | $1,050.52 | $2,309.64 | $3,652.98 | $5,536.27 | $8,909.88 |
| Laparoscopic | Laparoscopy for cervical cancer | 12 | $9.66 | $889.32 | $2,783.15 | $4,329.30 | $5,184.74 | $9,514.03 |
| Robotic | Robotic-assisted laparoscopy for endometrial cancer | 20 | $18.91 | $998.10 | $5,087.63 | $9,893.64 | $4,591.28 | $14,456.85 |
| Robotic | Robotic-assisted laparoscopy for cervical cancer | 10 | $18.91 | $956.11 | $5,503.72 | $11,362.58 | $4,493.71 | $15,856.28 |
| **Reynisson et al.,2013** | Retrospective cohort | Open | Laparotomy for radical hysterectomy | 51 | $21.42 | $452.36 | $6,405.38 | $6,685.54 | $3,302.21 | $10,699.98 |
| Robotic | Robot-assisted laparoscopy for radical hysterectomy | 180 | $21.42 | $452.36 | $6,741.00 | $9,759.38 | $1,666.18 | $12,104.55 |
| **Turunen et al., 2013** | Retrospective cohort | Laparoscopic | Laparoscopic hysterectomy | 150 | $9.54 | - | $1,144.80 | $1,962.53 | - | - |
| Robotic | Robotic-assisted hysterectomy | 67 | $6.73 | - | $1,413.48 | $4,509.13 | - | - |

Abbreviations: LAVH = Laparoscopic Assisted Vaginal Hysterectomy; RCT = Randomized Controlled Trial; RRH = Robotic Radical Hysterectomy; TLRH= Laparoscopic Radical Hysterectomy; TAH = Total Abdominal Hysterectomy; TLH = Total Laparoscopic Hysterectomy; TVH = Total Vaginal Hysterectomy

| **Supplementary Table 5.** Gastrectomy Studies with Costs Converted to 2018 USD | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Study Design** | **Approach** | **Procedure Details** | **Sample Size** | **OR Cost per Minute** | **Ward Cost per Day** | **Total OR Room Cost** | **Total OR Cost** | **Total Ward Cost** | | **Total Admission Cost** |
| **Americas** | | | | | | | | | | | |
| **Glenn et al., 2015** |  | Open | Open gastrectomy | 8,585 | - | - | - | - | - | | $44,661.10 |
| Unreported observational cohort study | Laparoscopic | Hand-assisted and combined laparoscopic gastrectomy | 789 | - | - | - | - | - | | $43,912.17 |
|  | Robotic | Robotic gastrectomy | 223 | - | - | - | - | - | | $58,730.76 |
| **Asia-Pacific** | | | | | | | | | | | |
| **Chang et al., 2011** | Retrospective cohort | Open | ODG | 44 | - | - | - | $2,677.55 | - | | $14,344.97 |
|  | Laparoscopic | GLADG | 31 | - | - | - | $11,532.21 | - | | $13,434.05 |
| **de Angelis et al., 2015** | Retrospective cohort | Open | Open-wedge (gastric) resection | 25 | - | - | - | - | - | $13,045.38 | |
| Laparoscopic | Laparoscopic-wedge (gastric) resection | 25 | - | - | - | - | - | $17,509.68 | |
| **Kuwabara et al., 2011** | Retrospective cohort study | Open | Typically total, and some partial, open gastrectomy | 13,847 | - | $271.25 | - | - | $6,265.93 | | $17,166.65 |
| Laparoscopic | Typically, partial (for malignant disease and teaching hospitals), and some total laparoscopic gastrectomy | 3,914 | - | $252.12 | - | - | $4,260.83 | | $14,327.09 |
| **Park et al., 2012** | Prospective cohort study | Laparoscopic | Laparoscopic-assisted distal gastrectomy | 120 | - | $49.92 | - | $4,034.70 | $349.47 | | $6,316.79 |
| Robotic | Robot-assisted distal gastrectomy | 30 | - | $49.92 | - | $5,314.73 | $349.47 | | $6,414.06 |
| **Yasunaga et al., 2013** | Retrospective cohort | Open | Open gastrectomy | 2,473 | - | - | - | - | - | $24,002.07 | |
| Laparoscopic | Laparoscopic and laparoscopic-assisted gastrectomy | 2,473 | - | - | - | - | - | $24,556.91 | |
| **Murata et al., 2014** | Unspecified cohort study | Laparoscopic | Laparoscopic gastrectomy | 12,522 | - | - | - | - | - | $16,736.79 | |
| **Kim et al., 2015** | Prospective cohort study | Open | Open gastrectomy | 21 | - | $65.00 | - | $1,375.83 | $760.53 | $8,191.21 | |
| Laparoscopic | Laparoscopic-assisted gastrectomy | 51 | - | $65.89 | - | $1,303.98 | $724.84 | $9,368.56 | |
| **Tegels et al., 2017** | Prospective cohort study with some retrospective data | Open | Subtotal and total open gastrectomy | 25 | $17.28 | $191.80 | $3,301.16 | $4,833.05 | $2,877.00 | $9,952.77 | |
| Laparoscopic | Subtotal and total laparoscopic gastrectomy | 52 | $17.32 | $199.04 | $4,953.68 | $7,898.14 | $1,791.32 | $10,619.49 | |

Abbreviations: GLADG = Gasless Laparoscopy-Assisted Distal Gastrectomy; ODG = Open Distal Gastrectomy;

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Supplementary Table 6.** Bariatric Studies with Costs Converted to 2018 USD` | | | | | | | | | | |
| **Study** | **Study Design** | **Approach** | **Procedure Details** | **Sample Size** | **OR Cost per Minute** | **Ward Cost per Day** | **Total OR Room Cost** | **Total OR Cost** | **Total Ward Cost** | **Total Admission Cost** |
| **Americas** | | | | | | | | | | |
| **Masoomi et al., 2012** | Unspecified cohort study | Open | Open gastric bypass | 42,591 | - | - | - | - | - | $15,938.62 |
| Laparoscopic | Laparoscopic gastric bypass | 183,452 | - | - | - | - | - | $13,822.16 |
| **Schraibman et al., 2014** | Prospective cohort | Laparoscopic | LSG for obesity treatment | 32 | - | - | - | $14,856.50 | - | $18,900.47 |
| Robotic | RSG for obesity treatment | 16 | - | - | - | $25,177.12 | - | $29,417.33 |
| **Villamere et al., 2015** | Unspecified cohort study | Laparoscopic | Laparoscopic gastric bypass | 34,667 | - | - | - | - | - | $10,743.96 |
| Laparoscopic | Laparoscopic sleeve gastrectomy | 18,694 | - | - | - | - | - | $9,351.12 |
| Robotic | Robotic gastric bypass | 1,217 | - | - | - | - | - | $13,471.14 |
| Robotic | Robotic sleeve gastrectomy | 957 | - | - | - | - | - | $11,223.47 |
| **Pepper et al., 2016** | Retrospective cohort | Laparoscopic | LSG | 14 | - | - | - | $9,910.38 | - | $15,788.35 |
| Robotic | RSLG | 14 | - | - | - | $12,804.07 | - | $18,068.35 |
| **Roy et al., 2017** | Retrospective cohort | Laparoscopic | Laparoscopic Roux-en-Y gastric bypass | 9,613 | $26.99 | $1,035.29 | $5,198.15 | $11,333.20 | $2,381.17 | $15,590.26 |
| Laparoscopic | LSG | 11,945 | $31.24 | $1,072.57 | $4,223.37 | $9,273.09 | $1,930.63 | $12,889.06 |
| **Asia-Pacific** | | | | | | | | | | |
| **Gounder et al., 2016** | RCT | Open | Laparoscopic Roux-en-Y gastric bypass | 56 | - | $271.65 | - | $3,382.69 | $1,135.46 | $8,951.52 |
| Laparoscopic | LSG | 58 | - | $271.65 | - | $2,185.42 | $1,163.50 | $6,562.00 |
| **EMEA** | | | | | | | | | | |
| **Hagen et al., 2017** | Prospective cohort study | Robotic | Robotic gastric bypass surgery | 254 | - | - | $4,045.52 | $10,964.57 | - | $16,864.41 |
| **Ismail et al., 2015** | Modeling studya | Robotic | Robot assisted gastric bypass | 86 | - | - | - | $10,528.72 | - | - |
| **Ijah et al., 2014** | Retrospective cohort | Laparoscopic | SLSG | 20 | - | - | - | - | - | $8,105.21 |
| Robotic | Robotic Sleeve Gastrectomy | 20 | - | - | - | - | - | $9,726.26 |
| **Scozzari et al., 2011** | Prospective cohort | Laparoscopic | Laparoscopic Roux-en-Y gastric bypass | 423 | $11.11 | $444.56 | $2,078.33 | $3,213.13 | $3,689.88 | $6,903.02 |
| Robotic | Robot-assisted hand-sewn gastrojejunal  anastomosis | 110 | $11.11 | $444.56 | $2,750.74 | $5,094.35 | $3,467.61 | $8,561.95 |

Abbreviations: LSG = Laparoscopic sleeve gastrectomy; RCT = Randomized Controlled Trial; RSG = Robotic-assisted sleeve gastrectomy; RSLG = Robotic-assisted laparoscopic sleeve gastrectomy; SLSG = Standard laparoscopic sleeve gastrectomy

aStudy used hospital-data to validate model and to project reported cost.

| **Supplementary Table 7.** Hemicolectomy Studies with Costs Converted to 2018 USD | | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Study Design** | **Approach** | **Procedure Details** | | **Sample Size** | **OR Cost per Minute** | **Ward Cost per Day** | **Total OR Room Cost** | | **Total OR Cost** | | **Total Ward Cost** | | **Total Admission Cost** | |
| **Americas** | | | | | | | | | | | | | | | |
| **Orenstein et al., 2011** | Retrospective cohort | Open | Open colon resection | | 323 | - | - | - | | $1,156.21 | | - | | $11,579.60 | |
| Laparoscopic | Hand-assisted colon resection | | 66 | - | - | - | | $1,458.01 | | - | | $8,429.53 | |
| **Vaid et al., 2012** | Unspecified cohort study | Open | Open (left, right, sigmoidal) colectomy | | 58,802 | - | - | - | | - | | - | | $15,180.62 | |
| Laparoscopic | Laparoscopic (left, right, sigmoidal) colectomy | | 5147 | - | - | - | | - | | - | | $14,660.85 | |
| **Halabi et al., 2013** | Retrospective cohort | Laparoscopic | Conventional laparoscopic surgery (left and right hemicolectomies, sigmoidoscopy, anterior resection, abdominoperineal resection) | | 115,648 | - | - | - | | - | | - | | $15,602.82 | |
| Robotic | Robotic-assisted colorectal surgery (left and right hemicolectomies, sigmoidoscopy, anterior resection, abdominoperineal resection) | | 2,143 | - | - | - | | - | | - | | $21,495.01 | |
| **Davis et al., 2014** | Unspecified cohort study) | Laparoscopic | | Laparoscopic cecectomy, left/right hemicolectomy, and sigmoidectomy | 533 | - | - | | - | | - | | - | | $17,279.34 |
| Robotic | | Robot-assisted laparoscopic cecectomy, left/right hemicolectomy, and sigmoidectomy | 533 | - | - | | - | | - | | - | | $19,513.09 |
| **Hardy et al., 2014** | Retrospective cohort | Open | | Open colon surgery (right and extended right hemicolectomy; ileocecal and Hartmann’s resection; transverse, left, sigmoidal and subtotal colectomy) | 168 | - | $742.68 | | - | | $3,213.35 | | $5,198.79 | | $11,827.14 |
| Laparoscopic | | Straight and hand-assisted laparoscopic colon surgery (right and extended right hemicolectomy; ileocecal and Hartmann’s resection; transverse, left, sigmoidal and subtotal colectomy) | 223 | - | $599.47 | | - | | $3,878.14 | | $2,997.33 | | $8,925.36 |
| **Keller et al., 2014** | Retrospective cohort | Laparoscopic | | Laparoscopic resections (laparoscopic cecectomy, left/right hemicolectomy, transverse colon resection, sigmoidectomy, total intra-abdominal colectomy, abdominoperineal, pull-through, and other resection of the rectum) | 17,265 | $19.28 | $998.12 | | $3,874.31 | | $8,139.68 | | $6,118.46 | | $18,288.27 |
| Robotic | | RALR | 744 | $18.75 | $913.88 | | $4,894.78 | | $11,800.69 | | $6,817.55 | | $24,185.26 |
| **Stewart et al., 2014** | Retrospective cohort | Laparoscopic | | Single-site laparoscopy | 111 | - | $1,141.39 | | - | | $7,353.23 | | $5,821.09 | | $16,840.51 |
| Laparoscopic | | Standard laparoscopy (multi-trocar) | 149 | - | $1,021.44 | | - | | $7,558.62 | | $5,515.75 | | $16,807.55 |
| **Crawshaw et al., 2015** | Retrospective cohort | Open | | Elective open colectomy | 2,265 | - | - | | - | | - | | - | | $10,823.03 |
| Laparoscopic | | Elective laparoscopic colectomy | 1,895 | - | - | | - | | - | | - | | $8,286.89 |
| **Hollis et al., 2016** | Retrospective cohort | Open | | Open colorectal surgeries (APR, LAR, LHC, RHC, TAC, TPC) matched to laparoscopic surgeries | 67 | $27.87 | $1,087.96 | | $4,682.68 | | $7,556.27 | | $7,615.70 | | $15,171.98 |
| Open | | Open colorectal surgeries (APR, LAR, LHC, RHC, TAC, TPC) matched to robotic surgeries | 45 | $24.56 | $1,000.58 | | $5,011.22 | | $7,885.88 | | $7,004.03 | | $14,889.92 |
| Laparoscopic | | Laparoscopic surgeries to treat APR, LAR, LHC, RHC, TAC, and TPC | 67 | $24.97 | $1,385.24 | | $4,195.29 | | $7,467.65 | | $6,926.22 | | $14,393.87 |
| Robotic | | Robotic surgeries to treat APR, LAR, LHC, RHC, TAC, and TPC | 45 | $20.20 | $876.88 | | $5,091.19 | | $10,344.48 | | $4,384.40 | | $14,728.89 |
| **Keller et al., 2016** | Prospective cohort | Open | | Open multiple segmental and abdominoperineal resections, cecectomy, LHC, RHC, transverse and total intra-abdominal colectomy, partial excision, pull-through resection of rectum | 6,343 | - | $857.55 | | $4,880.58 | | $8,911.82 | | $6,688.88 | | $22,988.71 |
| Laparoscopic | | Laparoscopic multiple segmental and abdominoperineal resections, cecectomy, LHC, RHC, transverse and total intra-abdominal colectomy, partial excision, pull-through resection of rectum | 6,343 | - | $934.51 | | $5,088.22 | | $9,281.74 | | $5,401.45 | | $19,315.98 |
| **Vasudevan et al., 2016** | Retrospective cohort | Laparoscopic | | Laparoscopic right, left, and other resections | 131 | - | - | | - | | - | | - | | $37,236.60 |
| Robotic | | Open right, left, and other resections | 96 | - | - | | - | | - | | - | | $34,761.80 |
| **Asia-Pacific** | | | | | | | | | | | | | | | |
| **Li et al., 2012** | Prospective cohort | Open | | Open RHC | 74 | - | - | | - | | - | | - | | $7,906.75 |
| Laparoscopic | | LARH | 71 | - | - | | - | | - | | - | | $10,987.54 |
| **Liu et al., 2012** | Retrospective cohort | Open | | Open colectomy | 45 | $13.30 | - | | $2,274.24 | | $4,569.03 | | - | | $6,436.83 |
| Laparoscopic | | HALC | 42 | $15.27 | - | | $2,580.22 | | $4,764.27 | | - | | $6,385.46 |
| **Park et al. 2012** | RCT | Robotic | | Robotic assisted colectomy | 35 | - | $123.75 | | - | | $13,349.36 | | $977.60 | | $16,165.63 |
| Laparoscopic | | Laparoscopic assisted colectomy | 35 | - | $196.41 | | - | | $8,983.65 | | $1,630.18 | | $13,635.02 |
| **Sheng et al.** | RCT | Open | | Open RHC | 57 | - | - | | - | | - | | - | | $11,221.71 |
| Laparoscopic | | Hand-assisted laparoscopic RHC | 59 | - | - | | - | | - | | - | | $12,482.36 |
| **Thompson et al., 2014** | Unspecified cohort study | Open | | Open abdominoperineal resections, cecectomy, LHC, RHC, extended RHC, total colectomy, sigmoidectomy, transcolectomy and total colectomy, anterior resection of rectum and ultralow anterior resection | 647 | $23.79 | - | | $5,091.87 | | $7,056.94 | | - | | $20,464.13 |
| Laparoscopic | | Laparoscopic abdominoperineal resections, cecectomy, LHC, RHC, extended RHC, total colectomy, sigmoidectomy, transcolectomy and total colectomy, anterior resection of rectum and ultralow anterior resection | 744 | $23.76 | - | | $5,131.08 | | $7,341.45 | | - | | $18,591.16 |
| **Hayashi et al., 2017** | Retrospective cohort | Open | | Open resection of the colon or rectum | 127 | - | $478.68 | | - | | $8,154.67 | | $7,850.29 | | $18,972.46 |
| Laparoscopic | | Laparoscopic resection of the colon or rectum | 253 | - | $467.42 | | - | | $9,821.47 | | $5,655.74 | | $17,138.87 |
| **EMEA** | | | | | | | | | | | | | | | |  |  |  |
| **Bertani et al., 2011** | Prospective cohort | Open | | Open rectal resection (≤12cm above the anal verge) and colectomies | 34 | $15.48 | $892.46 | | $2,059.17 | | $5,274.97 | | $5,354.74 | | $11,651.90 |
| Laparoscopic | | Laparoscopic rectal resection (≤12cm above the anal verge) and colectomies | 30 | $13.91 | $812.44 | | $2,920.36 | | $6,685.67 | | $4,062.22 | | $11,770.08 |
| Robotic | | Robotic rectal resection (≤12cm above the anal verge) and colectomies | 52 | $13.49 | $886.30 | | $2,617.54 | | $9,357.86 | | $4,431.50 | | $14,811.58 |
| **Veenhof et al., 2011** | Prospective cohort | Open | | Open RHC | 28 | $18.80 | $520.51 | | $1,447.48 | | $3,507.37 | | $4,684.63 | | $8,192.00 |
| Laparoscopic | | Laparoscopic RHC | 25 | $19.46 | $527.53 | | $3,015.82 | | $5,584.90 | | $4,220.25 | | $9,805.14 |
| **Berto et al., 2012** | Retrospective cohort | Open | | Laparotomy for right colon | 15 | $18.02 | $570.37 | | $3,460.19 | | $4,976.16 | | $5,287.36 | | $14,208.28 |
| Open | | Laparotomy for left colon | 15 | $18.58 | $570.38 | | $3,808.43 | | $6,060.90 | | $5,401.45 | | $14,952.18 |
| Laparoscopic | | Laparoscopy for the right colon | 15 | $18.38 | $570.33 | | $3,344.61 | | $5,705.24 | | $4,146.30 | | $12,624.15 |
| Laparoscopic | | Laparoscopy for the left colon | 15 | $19.03 | $570.94 | | $3,805.47 | | $7,573.89 | | $3,956.63 | | $14,692.85 |
| **Michalopoulos et al., 2013** | Case-control study | Open | | RHC, sigmoidectomy and lower anterior resection | 50 | - | - | | - | | - | | - | | $5,984.68 |
| Laparoscopic | | RHC, sigmoidectomy and lower anterior resection | 42 | - | - | | - | | - | | - | | $9,555.54 |
| **Ehrlich et al., 2015** | Case-control study | Open | | Traditional open and fast-track ileocolic resection, right/transverse colon resection, left/sigmoid colon resection and total colectomy | 43 | $10.48 | $657.92 | | $1,499.09 | | $2,764.54 | | $4,605.45 | | $10,608.97 |
| Laparoscopic | | Traditional laparoscopic and fast-track ileocolic resection, right/transverse colon resection, left/sigmoid colon resection and total colectomy | 73 | $10.53 | $657.92 | | $1,422.06 | | $4,219.55 | | $3,289.61 | | $10,014.31 |
| **de Angelis et al., 2016** | Prospective cohort | Laparoscopic | | LARH | 50 | - | - | | - | | $2,297.85 | | - | | - |
| Robotic | | RARH | 30 | - | - | | - | | $3,816.97 | | - | | - |
| **van der Linden et al., 2017** | Retrospective cohort | Laparoscopic | | Conventional laparoscopic resection | 189 | - | $735.62 | | - | | $2,204.64 | | $8,871.57 | | $16,889.40 |
| Laparoscopic | | Single-port laparoscopic resection | 78 | - | $747.79 | | - | | $2,361.07 | | $10,364.31 | | $20,220.88 |

Abbreviations: APR = Abdominal perineal resection; HALC = Hand-assissted laparoscopic colectomy; HCUP-NIS = Cost & Utilization Project National Inpatient Sample; LAR = Low Anterior Resection; LARH = Laparoscopic-assisted right hemicolectomy; LHC = Left Hemicolectomy; NHI = National Health Insurance;

NIS = National Inpatient Sample; RALR = Robot-assisted laparoscopic resection; RARH = Robot-assisted right hemicolectomy; RHC = Right Hemicolectomy; TAC = Total Abdominal Colectomy; TPC = Total Proctocolectomy.

| **Supplementary Table 8.** Hepatectomy Studies with Costs Converted to 2018 USD | | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Study Design** | **Approach** | **Procedure Details** | **Sample Size** | **OR Cost per Minute** | | | **Ward Cost per Day** | **Total OR Room Cost** | | **Total OR Cost** | | **Total Ward Cost** | | **Total Admission Cost** |
| **Americas** | | | | | | | | | | | | | | | |
| **Bhojani et al., 2012** | Retrospective cohort | Open | Open liver resection | 81 | $13.79 | $806.52 | $3,847.12 | | | - | | $4,839.11 | | $11,457.67 | |
| Laparoscopic | Laparoscopic liver resection | 43 | $14.35 | $839.52 | $3,286.50 | | | - | | $3,358.09 | | $10,093.79 | |
| **Cannon et al., 2013** | Retrospective cohort | Open | Right and left open hepatectomy and posterior sectorectomy, central liver resection | 41 | - | - | - | | | $10,536.73 | | - | | $18,356.70 | |
| Laparoscopic | Right and left laparoscopic hepatectomy and posterior sectorectomy, central liver resection | 57 | - | - | - | | | $11,415.58 | | - | | $16,776.05 | |
| **Medbery et al., 2014** | Retrospective cohort | Open | Open right hepatectomy | 57 | $10.07 | $284.72 | $2,839.38 | | | $3,430.27 | | $1,993.04 | | $8,814.41 | |
| Laparoscopic | Laparoscopic right hepatectomy | 48 | $21.62 | $297.99 | $5,036.86 | | | $5,471.10 | | $1,489.97 | | $8,461.15 | |
| **Martin et al., 2015** | Retrospective cohort | Open | Open hepatic resection | 137 | - | - | - | | | $13,488.97 | | - | | $27,957.80 | |
| Laparoscopic | Laparoscopic hepatic resection | 100 | - | - | - | | | $13,937.97 | | - | | $24,335.97 | |
| **Sham et al., 2016** | Retrospective cohort | Open | Open hepatectomy | e88 | $15.65 | $972.94 | $3,958.41 | | | $4,629.31 | | $6,324.10 | | $20,199.28 | |
| Robotic | Robotic hepatectomy | 71 | $15.14 | $1,007.54 | $4,588.90 | | | $5,345.93 | | $4,231.66 | | $15,686.92 | |
| **Daskalaki et al., 2017** | Retrospective cohort | Open | Open hepatectomy | 55 | $50.48 | $495.36 | $12,923.03 | | | $14,470.61 | | $4,557.32 | | $43,145.95 | |
| Robotic | Robotic hepatectomy | 68 | $54.02 | $642.30 | $15,848.50 | | | $17,409.03 | | $3,853.79 | | $38,948.50 | |
| **Asia-Pacific** | | | | | | | | | | | | | | | |
| **Yu et al., 2014** |  |  | Laparoscopic liver resection | 17 | - | - | - | | | - | | - | | $7,563.58 | |
| Unspecified observational study | Laparoscopic | Robotic liver resection | 13 | - | - | - | | | - | | - | | $12,835.28 | |
| **Zhou et al., 2014** | Retrospective cohort | Robotic | Robotic liver resection | 21 | - | - | - | | | - | | - | | $4,071.22 | |
| **Jiang et al., 2015** | RCT | Open | Partial open hepatectomy | 50 | - | - | - | | | - | | - | | $9,795.40 | |
| Laparoscopic | Partial laparoscopic hepatectomy | 50 | - | - | - | | | - | | - | | $8,810.36 | |
| **Wang et al., 2015** | Retrospective cohort | Open | Open liver resection | 60 | - | - | - | | | - | | - | | $11,555.08 | |
| Laparoscopic | Pure laparoscopic liver resection | 30 | - | - | - | | | - | | - | | $9,726.61 | |
| **Kawaguchi et al., 2016** | Retrospective cohort | Open | Open hepatectomy | 16 | $16.23 | $803.22 | $4,187.03 | | | $5,301.16 | | $7,228.98 | | $12,530.14 | |
|  | Laparoscopic | Liver hepatectomy | 10 | $15.18 | $1,148.89 | $5,603.19 | | | $6,984.08 | | $5,744.45 | | $12,728.53 | |
| **Zhang et al., 2016** | Prospective cohort | Open | Conventional open resection | 34 | - | - | - | | | - | | - | | $4,544.58 | |
| **EMEA** | | | | | | | | | | | | | | | |
| **Stoot et al, 2012** | Retrospective cohort | Open | Open liver resection for left lateral segments | 14 | $24.66 | $370.38 | $4,068.29 | | | $6,748.66 | | $2,222.29 | | $8,970.94 | |
| Laparoscopic | Laparoscopic liver resection for left lateral segments | 14 | $29.74 | $381.29 | $3,449.31 | | | $5,848.84 | | $2,287.72 | | $8,317.93 | |
| **Abu Hilal et al., 2013** | Retrospective cohort | Laparoscopic | Laparoscopic left lateral sectionectomy | 46 | $40.45 | $385.60 | $7685.79 | | | $10,387.12 | | $3,470.38 | | $22,511.03 | |
| Open | Open left lateral sectionectomy | 19 | $46.60 | $578.40 | $6,990.43 | | | $7,810.77 | | $4,048.78 | | $16,215.95 | |
| Open | Open right hepatectomy | 38 | $37.30 | $347.04 | $11,561.53 | | | $16,124.62 | | $1,735.20 | | $22,517.43 | |
| Laparoscopic | Laparoscopic right hepatectomy | 46 | $35.68 | $578.40 | $5,173.53 | | | $8,837.78 | | $1,735.20 | | $13,388.06 | |
| **Dokmak et al., 2013** | Prospective cohort | Open | Open left lateral liver resection | 31 | - | - | - | | | - | | - | | $15,232.64 | |
|  | Laparoscopic | Laparoscopic left lateral liver resection | 31 | - | - | - | | | - | | - | | $9,897.78 | |
| **Bell et al., 2015** | Prospective cohort | Open | Open left lateral sectionectomy | 43 | $9.99 | $340.09 | $1,198.33 | | | $3,029.66 | | $1,700.47 | | $8,646.78 | |
|  | Laparoscopic | Laparoscopic left lateral sectionectomy | 43 | $10.64 | $340.09 | $1,277.10 | | | $3,700.36 | | $1,020.28 | | $5,556.14 | |
| **Arkadopoulos et al., 2016** | Retrospective cohort | Open | Open hepatic resection | 146 | $4.19 | $133.09 | $687.11 | | | $3,168.95 | | $931.61 | | $7,364.38 | |
| **Salloum et al., 2017** | Retrospective cohort | Laparoscopic | Laparoscopic left lateral sectionectomy | 80 | - | - | - | | | $744.05 | | - | | $7,795.74 | |
| Robotic | Robotic left lateral sectionectomy | 16 | - | - | - | | | $1,882.09 | | - | | $7,133.06 | |
| **Fretland et al., 2018** | RCT | Open | Open liver resection | 147 | $20.05 | $990.54 | $2,406.36 | | | $3,512.89 | | $3,962.15 | | $10,298.93 | |
|  | Laparoscopic | Laparoscopic liver resection | 133 | $19.89 | $1,327.18 | $2,446.93 | | | $4,036.66 | | $2,930.85 | | $10,421.39 | |