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# LITERATURE REVIEW ON HOSPITAL COSTS FOR PATIENTS UNDERGOING COLECTOMY

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## Background

- ❖ Colectomy is a surgical procedure to remove all or part of the colon.
- ❖ In an open colectomy, one long incision is made in the wall of the abdomen and doctors can see the colon directly. In a laparoscopic-assisted colectomy, several small incisions are made and a thin, lighted tube attached to a video camera is inserted through one opening to guide the surgery. Surgical instruments are inserted through the other openings to perform the surgery.
- ❖ The clinical benefits of laparoscopy have been demonstrated including decreased complications and mortality<sup>1</sup>. A dramatic increase in the rate of laparoscopic partial colectomy from 2% in 1996 to 31% in 2009<sup>2</sup>.
- ❖ The impact of increasing use of laparoscopy on hospital costs across countries have not been thoroughly investigated.
- ❖ Most published studies comparing the costs of laparoscopic vs open procedures were conducted only within respective countries

## Objective

- ❖ This study aims to identify the range of direct hospital costs associated with a minimally invasive or open colectomy procedure across different countries.

**Table 1. Selected Study Characteristics, Design, Cost and Cost Analysis Methodologies**

| Citation/Year               | Country/Setting            | Type of Study | Cost Calculation Methodology | Approach              | OR Cost (per Min) | Total Direct Cost Reported |
|-----------------------------|----------------------------|---------------|------------------------------|-----------------------|-------------------|----------------------------|
| da Luz Moreira et al., 2010 | US<br>Single Center        | Observational | Bottom-up (Cost)             | Laparoscopic          | \$ 18.2           | \$ 8,200                   |
|                             |                            |               |                              | Open                  | \$ 13.4           | \$ 9,083                   |
| Ozturk et al., 2009         | US<br>Single Center        | Observational | Bottom-up (Cost)             | Hand-Assisted Lap     | \$ 23.0           | \$ 9,428                   |
|                             |                            |               |                              | Laparoscopic-Assisted | \$ 21.4           | \$ 8,793                   |
| Koopmann et al., 2007       | US<br>Single Center        | Observational | Bottom-up (Cost)             | Laparoscopic          | \$ 24.8           | \$ 15,960                  |
|                             |                            |               |                              | Open                  | \$ 22.7           | \$ 20,520                  |
| Vaid et al., 2012           | US<br>National Database    | Observational | Top-down (Charge)            | Laparoscopic          | N/A               | \$ 46,168                  |
|                             |                            |               |                              | Open                  | \$ 47,805         |                            |
| Salloum et al., 2006        | US<br>Single Center        | Observational | Bottom-up (Cost)             | Laparoscopic          | \$ 19.2           | \$ 10,124                  |
|                             |                            |               |                              | Open                  | \$ 12.6           | \$ 12,158                  |
| Delaney et al., 2008        | US<br>National Database    | Observational | Bottom-up (Cost)             | Laparoscopic          | N/A               | \$ 8,884                   |
|                             |                            |               |                              | Open                  | \$ 8,446          |                            |
| Crawshaw et al., 2015       | US<br>National Database    | Observational | Top-down (Payment)           | Laparoscopic          | N/A               | \$ 25,140                  |
|                             |                            |               |                              | Open                  | \$ 32,431         |                            |
| Hinojosa et al., 2007       | US<br>National Database    | Observational | Top-down (Cost)              | Laparoscopic          | N/A               | \$ 15,398                  |
|                             |                            |               |                              | Open                  | \$ 17,383         |                            |
| Steele et al., 2007         | US<br>National Database    | Observational | Top-down (Charge)            | Laparoscopic          | N/A               | \$ 43,703                  |
|                             |                            |               |                              | Open                  | \$ 43,064         |                            |
| Hardy et al., 2014          | Canada<br>Single Center    | Observational | Bottom-up (Cost)             | Laparoscopic          | \$ 18.2           | \$ 9,377                   |
|                             |                            |               |                              | Open                  | \$ 17.2           | \$ 12,426                  |
| Franks et al., 2006         | UK<br>Multi-Center         | RCT           | Bottom-up (Cost)             | Laparoscopic          | \$ 14.6           | \$ 18,488                  |
|                             |                            |               |                              | Open                  | \$ 14.6           | \$ 18,210                  |
| Noblett et al., 2007        | UK<br>Single Center        | Observational | Bottom-up (Cost)             | Laparoscopic          | \$ 46.9           | \$ 10,958                  |
|                             |                            |               |                              | Open                  | \$ 35.0           | \$ 11,493                  |
| Bertani et al., 2011        | Italy<br>Single Center     | Observational | Bottom-up (Cost)             | Laparoscopic          | N/A               | \$ 9,983                   |
|                             |                            |               |                              | Open                  | \$ 10,352         |                            |
| Ehrlich et al., 2015        | Finland<br>Single Center   | Observational | Bottom-up (Cost)             | Laparoscopic          | \$ 38.7           | \$ 14,259                  |
|                             |                            |               |                              | Open                  | \$ 31.4           | \$ 14,893                  |
| Liu et al., 2012            | China<br>Single Center     | Observational | Bottom-up (Cost)             | Hand-Assisted Lap     | \$ 13.8           | \$ 5,761                   |
|                             |                            |               |                              | Open                  | \$ 12.0           | \$ 5,807                   |
| Sheng et al., 2012          | China<br>Single Center     | Observational | N/A                          | Hand-Assisted Lap     | N/A               | \$ 5,966                   |
|                             |                            |               |                              | Open                  | \$ 5,363          |                            |
| Liang et al., 2006          | Taiwan<br>Single Center    | RCT           | Bottom-up (Cost)             | Laparoscopic          | \$ 13.4           | \$ 6,883                   |
|                             |                            |               |                              | Open                  | \$ 5.4            | \$ 4,829                   |
| Shabbir et al., 2009        | Singapore<br>Single Center | Observational | Bottom-up (Charge)           | Laparoscopic          | \$ 30.6           | \$ 8,817                   |
|                             |                            |               |                              | Open                  | \$ 41.5           | \$ 8,051                   |

## Results

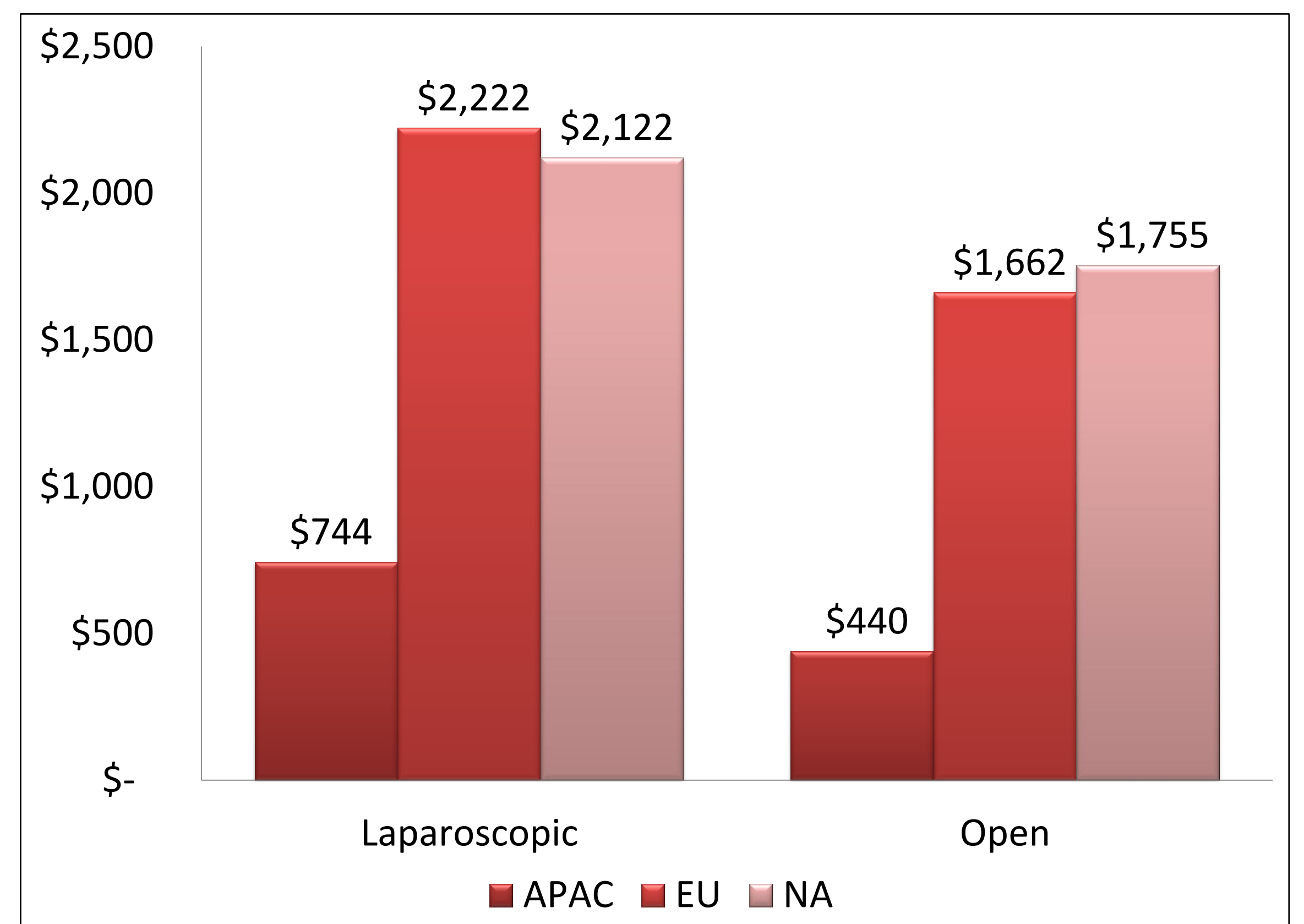
- ❖ Twenty-six of 99 articles were included in the analysis. Ten (38%) studies were conducted in North America with the remaining based in European and Asian-Pacific countries.
- ❖ For laparoscopic colectomy, several review studies reported longer operating time (27-92 mins), shorter hospital stays (2-3 days) and less blood loss (99-104 mL)<sup>24,25,26,27</sup>
- ❖ The findings from 2 meta-analysis studies reporting total direct costs indicated higher costs for laparoscopies ranging from \$117 to \$836.
- ❖ Direct hospital costs varied dramatically across countries. In North America, the cost of operating rooms (minute) ranged from \$13-\$23 for open procedures and \$18-\$25 for laparoscopies. The anesthesia cost (minute) ranged from \$7-\$10 and the hospital cost (day) ranged from \$938-\$3080 regardless of procedure type.
- ❖ In European countries, the cost of operating rooms (minute) ranged from \$15-\$35 for open procedures and \$15-\$47 for laparoscopy. The hospital cost (day) ranged from \$1277-\$2852.
- ❖ In Asia, the cost of operating rooms (minute) ranged from \$5-\$12 for open procedures and \$13-\$14 for laparoscopies. The hospital cost (day) ranged from \$345-\$765.

## Conclusion

Open procedures seem to result in lower hospital costs across studies conducted in several regions, which is consistent with the cost analysis of a recent meta-analysis<sup>28</sup>. Asian-Pacific countries have reported lower direct hospital costs. Cost calculations are challenging even for common surgical procedures like colectomy due to different costing methodologies and categories. A standardized costing methodology guideline is warranted and may shed light on the future considerations of reimbursement strategy.

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**Figure 1. Average Total Direct Cost Reported per Day**  
\* Studies reported charge or payment data were excluded