Quantifying the Impact

Clinical economics references from leading thoracic surgeons

INTUITIVE

About clinical benefits and costs

From a hospital perspective, clinical benefits may result in the potential cost reductions noted below; however, these clinical benefits and costs may vary per hospital and be higher or lower than mentioned during this presentation.

This data comparison is not case-matched for patient complexity and/or disease status and may not be comparable across these surgical modalities.

Individuals' outcomes may depend on a number of factors, including but not limited to patient characteristics, disease characteristics, and/or surgeon experience.

Cost estimates seen here have been independently generated by Intuitive. using cost modeling methodology based on national averages and have not been published or peer-reviewed. Cost calculations include intraoperative instrument and accessory costs. Costs related to da Vinci® system acquisition, yearly service costs and other intraoperative and post-operative hospital costs are not included/considered.

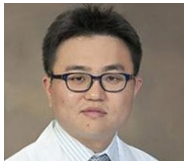
About clinical benefits and costs

When considering cost-effectiveness of an advanced technology like the da Vinci system, we recommend that hospitals perform a full cost-benefit analysis, considering not just the operating room costs but the costs associated with hospital stays, procedure-related complications and hospital re-admissions.

In order to provide benefit and risk information, Intuitive reviews the highest available level of evidence on representative da Vinci procedures. Intuitive strives to provide a complete, fair and balanced view of the clinical literature. However, a quoted article may not be reflective of the broader literature and our materials should not be seen as a substitute for a comprehensive literature review for inclusion of all potential outcomes. We encourage patients and physicians to review the original publications and all available literature in order to make an informed decision. Clinical studies are available at pubmed.gov.

Lobectomy

Mark Dylewski, MD
South Miami Hospital
Miami, FL



Samuel Kim, MD
Banner – University Medical Center Tucson
Tucson, AZ

Dao Nguyen, MD
University of Miami
Miami, FL

Roy Williams, MD
Mount Sinai Medical Center
Miami Beach, FL

G. Kimble Jett, MD
The Heart Hospital Baylor Plano
Plano, TX

Baiya Krishnadasan, MD
St. Joseph Medical Center
Towson, MD

Walter Scott, MD
Albany Medical Center
Albany, NY

James Wudel, MD
Wake Forest Baptist Medical Center
Winston-Salem, NC

Surgeon Profile

Mark Dylewski, MD
South Miami Hospital
Miami, FL

Da Vinci® System Training

2006

Residency

University of California Medical Center, Davis (General)

Albany Medical College, New York (General Surgery)

Fellowship: Albany Medical College, New York (Thoracic)

Memberships

Cardiothoracic Surgery Network (CTSNet)

General Thoracic Surgical Club (GTSC)

Southern Thoracic Surgical Association (STSA)

Society of Thoracic Surgeons (STS)

Background Information

Published results of Mark Dylewski, MD vs. published results

Dylewski, MR, Ohaeto, AC, Pereira, JF. (2011). Pulmonary Resection Using a Total Endoscopic Robotic Video-Assisted Approach. Seminars in thoracic and cardiovascular surgery.

Study Design

- Retrospective, 4-year (from 2006-2010) review of robotic-assisted lung resections for 200 consecutive patients.

Patient Population

- Patients with peripherally located pulmonary nodules clinically suspicious for malignant disease, isolated pulmonary metastasis, clinically resectable NSCLC, and other pathologic tumors

Analysis

- Review of results and complications for total endoscopic robotic-assisted lung resections

Study Limitations

- No comparison to open or video-assisted thoracoscopic approaches
- Single institution review

Outcomes/Results

Robotic video-assisted pulmonary resection was accomplished in 197 of 200 patients. A total of 154 patients underwent lobectomy; 4 patients required bilobectomy, and 35 patients underwent segmentectomy. Three patients underwent a sleeve lobectomy, and 3 patients had an en-bloc resection with lobectomy. One patient received a left pneumonectomy.

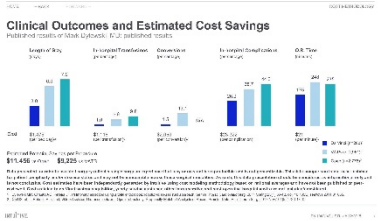
Values are n (range/%)

- OR time, mean/median:
  180 / 175 min (82-370)
- Length of ICU stay, median:
  0 days (0-15)
- Length of hospital stay, median:
  3 days (1-44)
- Conversion for difficulty:
  2 (1.0)
- Conversion for bleeding:
  1 (0.5)
- Transfusion for bleeding:
  2 (1.0)

Study Information

Lobectomy: published results for comparison with the published results of Mark Dylewski, MD

Oh, D., Reddy, R., Gorrepati, M., Mehendale, S., & Reed, M. (2017). Robotic-Assisted, Video-Assisted Thoracoscopic and Open Lobectomy: Propensity-Matched Analysis of Recent Premier Data. Annals of Thoracic Surgery,104(5), 1733-1740. DOI 10.1016/j.athoracsur.2017.06.020.



Study Design

- A retrospective, database study with the objective of providing a comparative analysis of perioperative clinical outcomes from elective robotic-assisted lobectomy (RL), VATS lobectomy (VL), and open lobectomy (OL).

Patient Population

- The Premier Healthcare Database was analyzed for lobectomies performed from January 1, 2011 to September 30, 2015. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis and procedure codes were used to identify surgical approaches (RL, VL, and OL), complications, and conversions to OL.

Outcomes Measured / Evaluated

- Peri-operative complications, conversion to open, length of stay, peri-operative blood transfusions, discharge status. Propensity score matching (1:1) for patient and hospital characteristics allowed comparison of RL versus OL (n = 2,775 each) and RL versus VL (n = 2,951 each).
- The following covariates were used for matching: patient characteristics—age, sex, race, Elixhauser comorbidity score, and type of malignancy; and hospital characteristics—payor type, census region, hospital size (number of beds), type of hospital facility (academic or community), and location of the facility (urban or rural).

Results / Conclusions

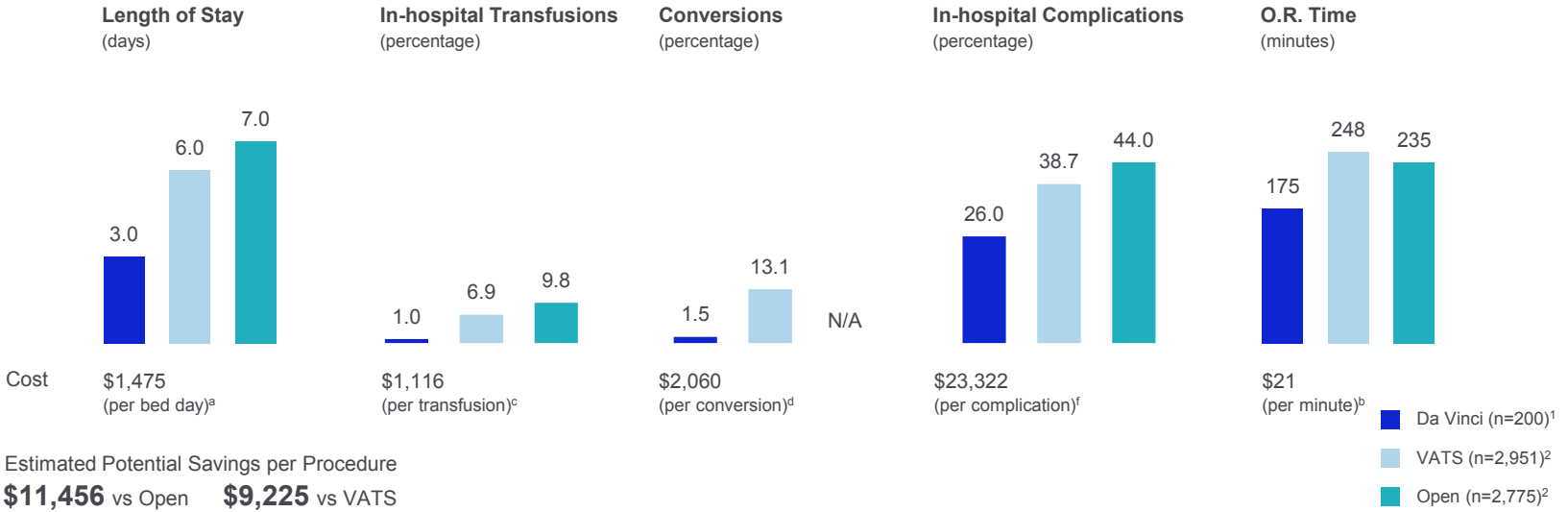
- Postoperatively and at 30 days when compared to VL and OL. RL was associated with a reduced LOS when compared to VL and OL.
- Patients in the RL group were more likely to be discharged home than to a transitional health care facility, when compared to VL and OL.
- RL had fewer conversions when compared to VATs lobectomy.
- RL had a lower in-hospital and 30-day mortality when compared to OL.

Study Limitations

- Oncologic data, such as size of the tumor, stage, recurrence, and survival, could not be extracted from the Premier Healthcare Database. As anticipated in any large administrative database, there is potential for coding errors.

Clinical Outcomes and Estimated Cost Savings

Published results of Mark Dylewski, MD vs. published results



Estimated Potential Savings per Procedure

$11,456 vs Open **$9,225** vs VATS

Data presented for robotic-assisted surgery reflect a single surgeon experience that may or may not be reproducible and is not generalizable. This data comparison is not case-matched for patient complexity and/or disease status and may not be comparable across these surgical modalities. As such, this data presentation should be considered as informational only and is not conclusive. Cost estimates have been independently generated by Intuitive using cost modeling methodology based on national averages and have not been published or peer-reviewed. Costs related to da Vinci system acquisition, yearly service costs and other intraoperative and post-operative hospital costs are not included/considered.

1. Dylewski MR, Ohaeto AC, Pereira JF. Pulmonary resection using a total endoscopic robotic video-assisted approach. Semin Thorac Cardiovasc Surg. 2011 Spring;23(1):36-42. doi: 10.1053/j.semtcvs.2011.01.005. 2. Oh DS, et al. Robotic-Assisted, Video-Assisted Thoracoscopic and Open Lobectomy: Propensity-Matched Analysis of Recent Premier Data. Ann Thorac Surg. 2017 Nov;104(5):1733-1740.

Surgeon Profile

G. Kimble Jett, MD
The Heart Hospital Baylor Plano
Plano, TX

Da Vinci® System Training

2011

IDN System

Baylor Scott and White Health

Residency

Massachusetts General Hospital (General)

Emory University (Thoracic)

National Heart Institute, NIH (Cardiac)

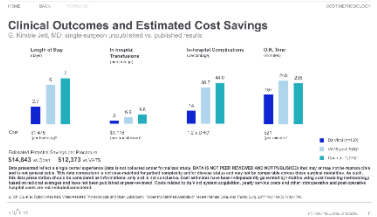
Memberships

Society of Thoracic Surgeons (STS)

Background Information

Clinical Outcomes and Estimated Cost Savings

G. Kimble Jett, MD: single-surgeon unpublished vs. published results



Design

- Unmatched comparison of surgeon provided data (for da Vinci RAS) and published results

Patient Population

- Surgeon's patients who had lobectomy procedures

Outcomes Measured / Evaluated

- Length of stay
- In-hospital transfusions
- In-hospital complications
- OR time

Results / Conclusions

- Results were provided by surgeon
- Length of stay: 2.7 days
- In-hospital transfusions: 3.0%
- In-hospital complications: 14.0%
- OR time: 167 minutes

Cost Methodology

- Cost savings from da Vinci RAS vs. other modality = (Δ LOS days x LOS cost) + (Δ OR Time min x OR cost) + (Δ Transfusions% x Transfusions cost) + (Δ Conversion% x Conversions cost) + (Δ Complication% x Complications cost) + (Δ Readmission% x Readmissions cost)

- Cost estimates have been independently generated by Intuitive Surgical using cost modeling methodology based on national averages and have not been published or peer-reviewed.

Limitations

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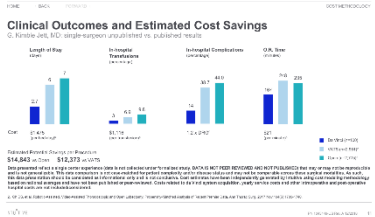
Study Information

Lobectomy: published results for comparison with surgeon's unpublished experience

Oh, D., Reddy, R., Gorrepati, M., Mehendale, S., & Reed, M. (2017). Robotic-Assisted, Video-Assisted Thoracoscopic and Open Lobectomy: Propensity-Matched Analysis of Recent Premier Data. Annals of Thoracic Surgery,104(5), 1733-1740. DOI 10.1016/j.athoracsur.2017.06.020.



Study Design

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Patient Population

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Results / Conclusions

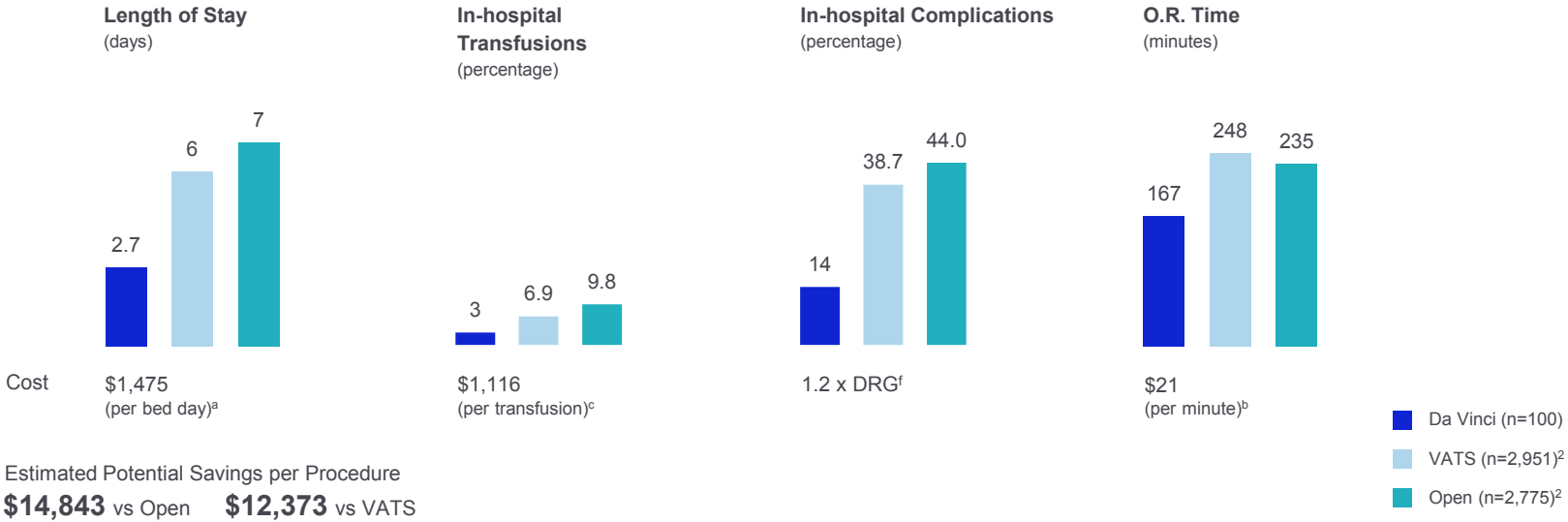
- Postoperatively and at 30 days when compared to VL and OL. RL was associated with a reduced LOS when compared to VL and OL.
- Patients in the RL group were more likely to be discharged home than to a transitional health care facility, when compared to VL and OL.
- RL had fewer conversions when compared to VATs lobectomy.
- RL had a lower in-hospital and 30-day mortality when compared to OL.

Study Limitations

- Oncologic data, such as size of the tumor, stage, recurrence, and survival, could not be extracted from the Premier Healthcare Database. As anticipated in any large administrative database, there is potential for coding errors.

Clinical Outcomes and Estimated Cost Savings

G. Kimble Jett, MD: single-surgeon unpublished vs. published results



Estimated Potential Savings per Procedure

$14,843 vs Open **$12,373** vs VATS

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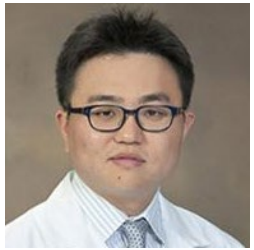
2. Oh DS, et al. Robotic-Assisted, Video-Assisted Thoracoscopic and Open Lobectomy: Propensity-Matched Analysis of Recent Premier Data. Ann Thorac Surg. 2017 Nov;104(5):1733-1740.

Surgeon Profile



Samuel Kim, MD
Banner – University Medical Center Tucson
Tucson, AZ

Da Vinci® System Training

2012

Residency

Hospital of the University of Pennsylvania (General)

Massachusetts General Hospital (Cardiothoracic)

Memberships

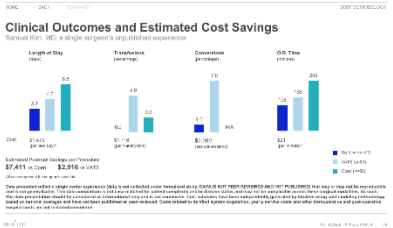
Cardiothoracic Surgery Network (CTSNet)

Society of Thoracic Surgeons (STS)

Western Thoracic Surgical Association (WTSA)

Background Information

Samuel Kim, MD: A single surgeon's unpublished experience



Design

- Surgeon provided data for all cohorts

Patient Population

- Surgeon's patients who had lobectomy procedures

Outcomes Measured / Evaluated

- Length of stay
- Blood transfusions
- Conversions
- OR time

Results / Conclusions

- Results were provided by surgeon
- Length of stay:
  - Da Vinci: 3.2 days
  - VATS: 4.6 days
  - Open: 6.8 days
- Blood transfusions:
  - Da Vinci: 0.0%
  - VATS: 5.0%
  - Open: 2.0%
- Conversions:
  - Da Vinci: 1.0%
  - VATS: 7.0%
  - Open: N/A
- OR time:
  - Da Vinci: 106 minutes
  - VATS: 138 minutes
  - Open: 205 minutes

Cost Methodology

- Cost savings from da Vinci RAS vs. other modality = (Δ LOS days x LOS cost) + (Δ OR Time min x OR cost) + (Δ Transfusions% x Transfusions cost) + (Δ Conversion% x Conversions cost) + (Δ Complication% x Complications cost) + (Δ Readmission% x Readmissions cost)

- Cost estimates have been independently generated by Intuitive Surgical using cost modeling methodology based on national averages and have not been published or peer-reviewed.

Limitations

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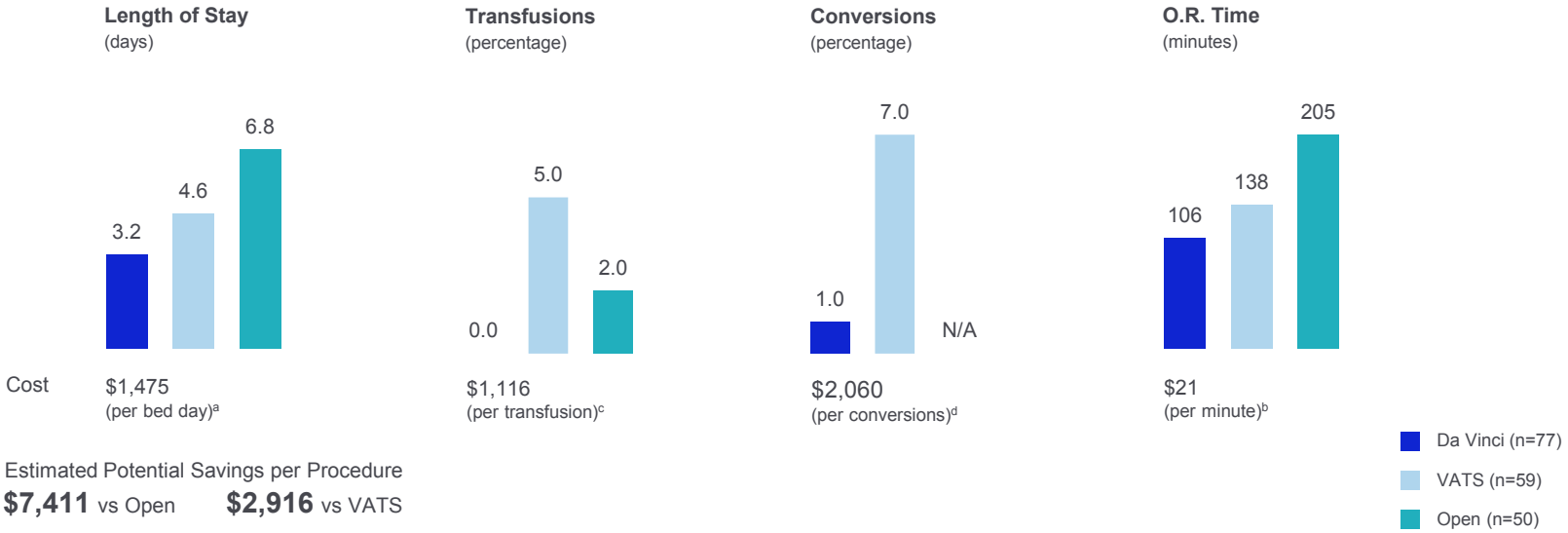
Clinical Outcomes and Estimated Cost Savings

Samuel Kim, MD: a single surgeon's unpublished experience



Estimated Potential Savings per Procedure

$7,411 vs Open **$2,916** vs VATS

All cases represent the surgeon's own data.

Data presented reflect a single center experience (data is not collected under formalized study, DATA IS NOT PEER REVIEWED AND NOT PUBLISHED) that may or may not be reproducible and is not generalizable. This data comparison is not case-matched for patient complexity and/or disease status and may not be comparable across these surgical modalities. As such, this data presentation should be considered as informational only and is not conclusive. Cost estimates have been independently generated by Intuitive using cost modeling methodology based on national averages and have not been published or peer-reviewed. Costs related to da Vinci system acquisition, yearly service costs and other intraoperative and post-operative hospital costs are not included/considered.

Surgeon Profile

Baiya Krishnadasan, MD
St. Joseph Medical Center
Townson, MD

Da Vinci® System Training

2009

Residency

University of Washington, Seattle (General)

Research Fellowship, Cardiothoracic Surgery

University of Washington, Seattle (Thoracic)

Memberships

Cardiothoracic Surgery Network (CTSNet)

General Thoracic Surgical Club (GTSC)

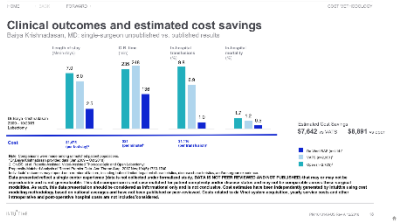
Society of Thoracic Surgeons (STS)

Western Thoracic Surgical Association (WTSA)

Background Information

Clinical Outcomes and Estimated Cost Savings

Baiya Krishnadasan, MD: single-surgeon unpublished vs. published results



Design

- Unmatched comparison of surgeon provided data (for da Vinci RAS) with published results

Patient Population

- Surgeon's patients who had lobectomy procedures (Jan 2009 – Oct 2018)

Outcomes Measured / Evaluated

- Length of stay
- OR time
- In-hospital blood transfusions
- Major complications
- In-hospital mortality

Results / Conclusions

- Surgeon provided summary data for da Vinci Si (N=325) and da Vinci Xi (N=89) separately. Results for the total data set (N=414) were combined using the methodology below.

- Mean LOS (days)=(2.5 days x 325 + 2.3 days x 89) / 414= 2.5 days
- OR time (min)=(137 min x 325 + 131 min x 89) / 414= 136 min
- Transfusions = (0.9% x 325 + 1) / 414 = 1%
- Mortality = (0.6% x 325 + 0) / 414 = 0.5%

Methodology

- Cost savings from da Vinci RAS vs. other modality = (Δ LOS days x LOS cost) + (Δ OR Time min x OR cost) + (Δ Transfusions% x Transfusions cost)
- No cost is calculated for mortality.
- Cost estimates have been independently generated by Intuitive using cost modeling methodology based on national averages and have not been published or peer-reviewed.

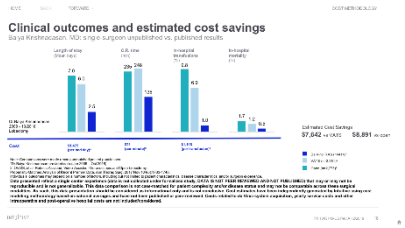
Limitations

- Data presented reflect a single center experience (data is not collected under formalized study, DATA IS NOT PEER REVIEWED AND NOT PUBLISHED) that may or may not be reproducible and is not generalizable. This data comparison is not case-matched for patient complexity and/or disease status and may not be comparable across these surgical modalities. As such, this data presentation should be considered as informational only and is not conclusive. Cost estimates have been independently generated by Intuitive using cost modeling methodology based on national averages and have not been published or peer-reviewed. Costs related to da Vinci system acquisition, yearly service costs and other intraoperative and postoperative hospital costs are not included/considered.

Study Information

Lobectomy: published results for comparison with surgeon's unpublished experience

Oh, D., Reddy, R., Gorrepati, M., Mehendale, S., & Reed, M. (2017). Robotic-Assisted, Video-Assisted Thoracoscopic and Open Lobectomy: Propensity-Matched Analysis of Recent Premier Data. Annals of Thoracic Surgery,104(5), 1733-1740. DOI 10.1016/j.athoracsur.2017.06.020.



Study Design

- A retrospective, database study with the objective of providing a comparative analysis of perioperative clinical outcomes from elective robotic-assisted lobectomy (RL), VATS lobectomy (VL), and open lobectomy (OL).

Patient Population

- The Premier Healthcare Database was analyzed for lobectomies performed from January 1, 2011 to September 30, 2015. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis and procedure codes were used to identify surgical approaches (RL, VL, and OL), complications, and conversions to OL.

Outcomes Measured / Evaluated

- Peri-operative complications, conversion to open, length of stay, peri-operative blood transfusions, discharge status. Propensity score matching (1:1) for patient and hospital characteristics allowed comparison of RL versus OL (n = 2,775 each) and RL versus VL (n = 2,951 each).
- The following covariates were used for matching: patient characteristics—age, sex, race, Elixhauser comorbidity score, and type of malignancy; and hospital characteristics—payor type, census region, hospital size (number of beds), type of hospital facility (academic or community), and location of the facility (urban or rural).

Results / Conclusions

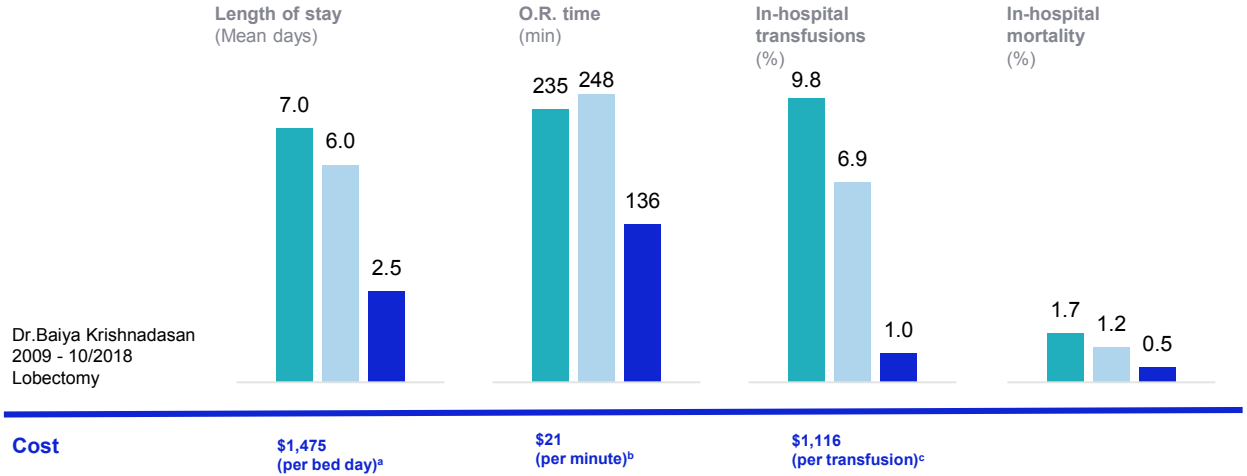
- Postoperatively and at 30 days when compared to VL and OL. RL was associated with a reduced LOS when compared to VL and OL.
- Patients in the RL group were more likely to be discharged home than to a transitional health care facility, when compared to VL and OL.
- RL had fewer conversions when compared to VATs lobectomy.
- RL had a lower in-hospital and 30-day mortality when compared to OL.

Study Limitations

- Oncologic data, such as size of the tumor, stage, recurrence, and survival, could not be extracted from the Premier Healthcare Database. As anticipated in any large administrative database, there is potential for coding errors.

Clinical outcomes and estimated cost savings

Baiya Krishnadasan, MD: single-surgeon unpublished vs. published results



Estimated Cost Savings

$7,642 vs VATS **$8,891** vs open

- Da Vinci RAS (n=414)*
- VATS (n=2,951)[2]
- Open (n=2,775)[2]

Note: Comparisons were made among unmatched patient populations.
*Dr.Baiya Krishnadasan provided data (Jan 2009 – Oct 2018)
2. Oh DS, et al. Robotic-Assisted, Video-Assisted Thoracoscopic and Open Lobectomy:
Propensity-Matched Analysis of Recent Premier Data. Ann Thorac Surg. 2017 Nov;104(5):1733-1740.
Individuals' outcomes may depend on a number of factors, including but not limited to patient characteristics, disease characteristics, and/or surgeon experience.
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Surgeon Profile

Dao Nguyen, MD, FACS
University of Miami
Miami, FL

Da Vinci® System Training

2012

Residency

McGill University (General)

McGill University (Cardiothoracic)

Fellowship: MD Anderson Cancer Center Thoracic Oncology

Memberships

American Association of Thoracic Surgery (AATS)

Cardiothoracic Surgery Network (CTSNet)

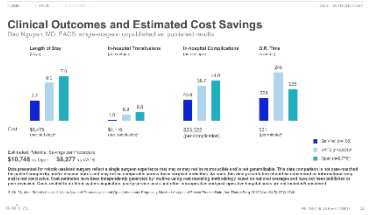
General Thoracic Surgical Club (GTSC)

Society of Thoracic Surgeons (STS)

Background Information

Clinical Outcomes and Estimated Cost Savings

Dao Nguyen, MD: single-surgeon unpublished vs. published results



Design

- Unmatched comparison of surgeon provided data (for da Vinci RAS) and published results

Patient Population

- Surgeon's patients who had lobectomy procedures

Outcomes Measured / Evaluated

- Length of stay
- Blood transfusions
- Complications
- OR time

Results / Conclusions

- Results were provided by surgeon
- Length of stay: 3.2 days
- Blood transfusions: 1.0%
- Complications: 23.0%
- OR time: 228 minutes

Cost Methodology

- Cost savings from da Vinci RAS vs. other modality = (Δ LOS days x LOS cost) + (Δ OR Time min x OR cost) + (Δ Transfusions% x Transfusions cost) + (Δ Conversion% x Conversions cost) + (Δ Complication% x Complications cost) + (Δ Readmission% x Readmissions cost)

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Study Information

Lobectomy: published results for comparison with surgeon's unpublished experience

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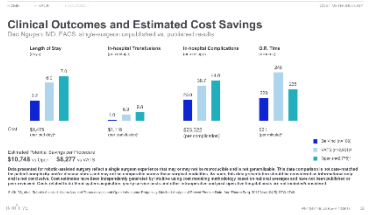

Study Design

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Patient Population

- The Premier Healthcare Database was analyzed for lobectomies performed from January 1, 2011 to September 30, 2015. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis and procedure codes were used to identify surgical approaches (RL, VL, and OL), complications, and conversions to OL.

Outcomes Measured / Evaluated

- Peri-operative complications, conversion to open, length of stay, peri-operative blood transfusions, discharge status. Propensity score matching (1:1) for patient and hospital characteristics allowed comparison of RL versus OL (n = 2,775 each) and RL versus VL (n = 2,951 each).
- The following covariates were used for matching: patient characteristics—age, sex, race, Elixhauser comorbidity score, and type of malignancy; and hospital characteristics—payor type, census region, hospital size (number of beds), type of hospital facility (academic or community), and location of the facility (urban or rural).

Results / Conclusions

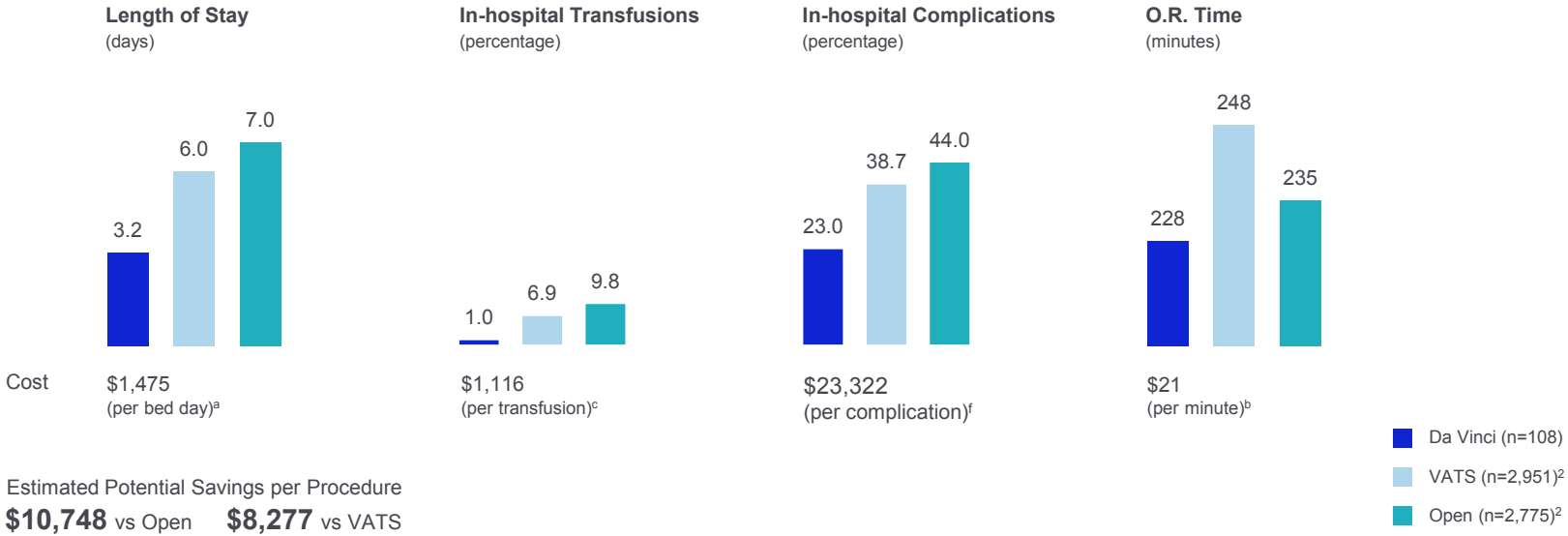
- Postoperatively and at 30 days when compared to VL and OL. RL was associated with a reduced LOS when compared to VL and OL.
- Patients in the RL group were more likely to be discharged home than to a transitional health care facility, when compared to VL and OL.
- RL had fewer conversions when compared to VATs lobectomy.
- RL had a lower in-hospital and 30-day mortality when compared to OL.

Study Limitations

- Oncologic data, such as size of the tumor, stage, recurrence, and survival, could not be extracted from the Premier Healthcare Database. As anticipated in any large administrative database, there is potential for coding errors.

Clinical Outcomes and Estimated Cost Savings

Dao Nguyen, MD, FACS: single-surgeon unpublished vs. published results



Estimated Potential Savings per Procedure

$10,748 vs Open **$8,277** vs VATS

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2. Oh DS, et al. Robotic-Assisted, Video-Assisted Thoracoscopic and Open Lobectomy: Propensity-Matched Analysis of Recent Premier Data. Ann Thorac Surg. 2017 Nov;104(5):1733-1740.

Surgeon Profile

Walter Scott, MD
Albany Medical Center
Albany, NY

Da Vinci® System Training

2002

Residency

University of North Carolina, Chapel Hill (General)

University of Utah (Cardiothoracic)

Memberships

Cardiothoracic Surgery Network (CTSNet)

Eastern Cardiothoracic Surgical Society (ECTSS)

General Thoracic Surgical Club (GTSC)

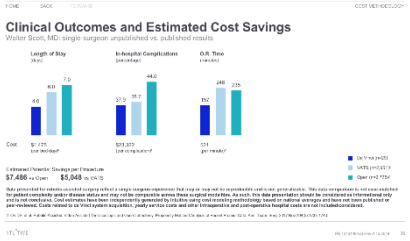
Southern Thoracic Surgical Association (STSA)

Society of Thoracic Surgeons (STS)

Background Information

Clinical Outcomes and Estimated Cost Savings

Walter Scott, MD: single-surgeon unpublished vs. published results



Design

- Unmatched comparison of surgeon provided data (for da Vinci RAS) and published results

Patient Population

- Surgeon's patients who had lobectomy procedures

Outcomes Measured / Evaluated

- Length of stay
- Complications
- OR time

Results / Conclusions

- Results were provided by surgeon
- Length of stay: 4.0 days
- Complications: 37.9%
- OR time: 157 minutes

Cost Methodology

- Cost savings from da Vinci RAS vs. other modality = (Δ LOS days x LOS cost) + (Δ OR Time min x OR cost) + (Δ Transfusions% x Transfusions cost) + (Δ Conversion% x Conversions cost) + (Δ Complication% x Complications cost) + (Δ Readmission% x Readmissions cost)

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Limitations

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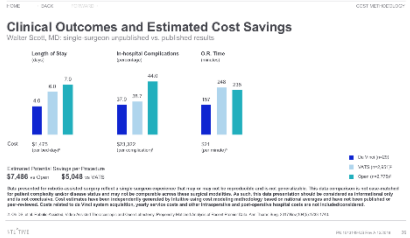
Study Information

Lobectomy: published results for comparison with surgeon's unpublished experience

Oh, D., Reddy, R., Gorrepati, M., Mehendale, S., & Reed, M. (2017). Robotic-Assisted, Video-Assisted Thoracoscopic and Open Lobectomy: Propensity-Matched Analysis of Recent Premier Data. Annals of Thoracic Surgery,104(5), 1733-1740. DOI 10.1016/j.athoracsur.2017.06.020.



Study Design

- A retrospective, database study with the objective of providing a comparative analysis of perioperative clinical outcomes from elective robotic-assisted lobectomy (RL), VATS lobectomy (VL), and open lobectomy (OL).

Patient Population

- The Premier Healthcare Database was analyzed for lobectomies performed from January 1, 2011 to September 30, 2015. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis and procedure codes were used to identify surgical approaches (RL, VL, and OL), complications, and conversions to OL.

Outcomes Measured / Evaluated

- Peri-operative complications, conversion to open, length of stay, peri-operative blood transfusions, discharge status. Propensity score matching (1:1) for patient and hospital characteristics allowed comparison of RL versus OL (n = 2,775 each) and RL versus VL (n = 2,951 each).
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Results / Conclusions

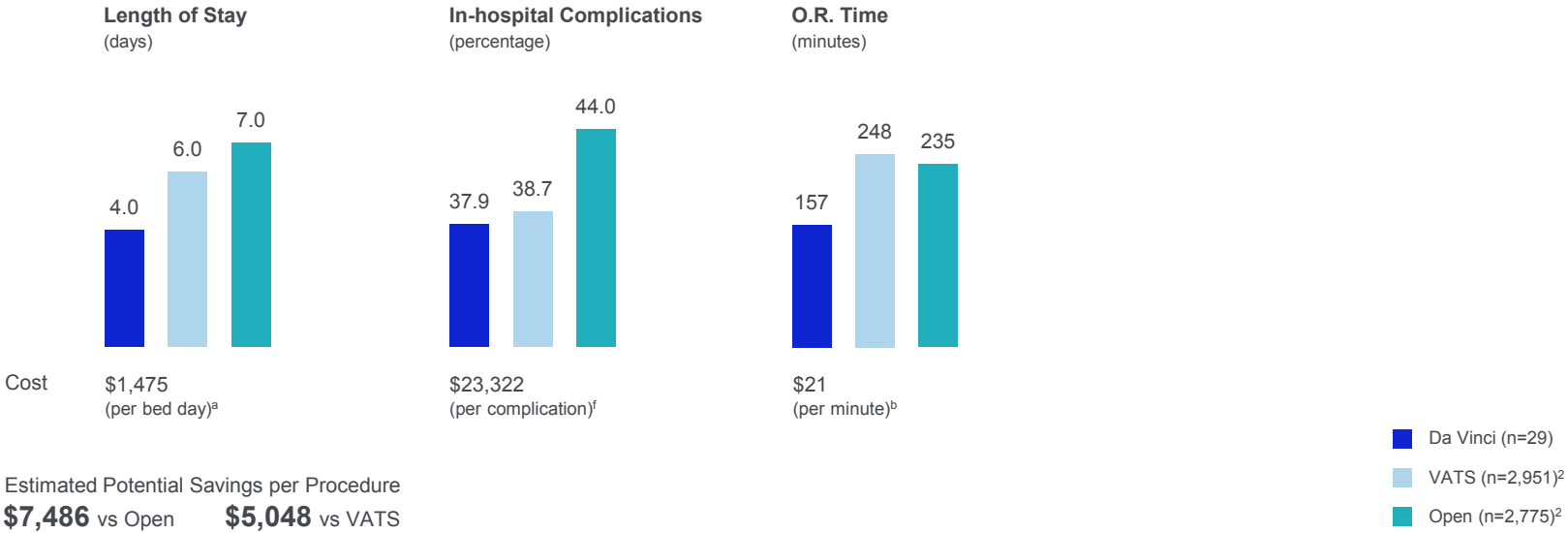
- Postoperatively and at 30 days when compared to VL and OL. RL was associated with a reduced LOS when compared to VL and OL.
- Patients in the RL group were more likely to be discharged home than to a transitional health care facility, when compared to VL and OL.
- RL had fewer conversions when compared to VATs lobectomy.
- RL had a lower in-hospital and 30-day mortality when compared to OL.

Study Limitations

- Oncologic data, such as size of the tumor, stage, recurrence, and survival, could not be extracted from the Premier Healthcare Database. As anticipated in any large administrative database, there is potential for coding errors.

Clinical Outcomes and Estimated Cost Savings

Walter Scott, MD: single-surgeon unpublished vs. published results



Estimated Potential Savings per Procedure

$7,486 vs Open **$5,048** vs VATS

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Surgeon Profile

Roy Williams, MD
Mount Sinai Medical Center
Miami Beach, FL

Da Vinci® System Training

2002

Residency

SUNY Health Science Center at Brooklyn (General)

Fellowship: SUNY Health Science Center at Brooklyn (Thoracic)

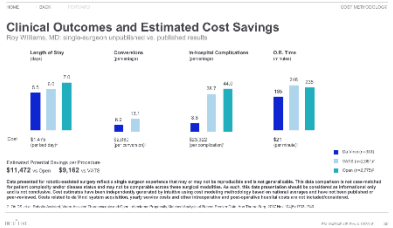
Memberships

American College of Surgeons (ACS)

Background Information

Clinical Outcomes and Estimated Cost Savings

Roy Williams, MD: single-surgeon unpublished vs. published results



Design

- Unmatched comparison of surgeon provided data (for da Vinci RAS) and published results

Patient Population

- Surgeon's patients who had lobectomy procedures

Outcomes Measured / Evaluated

- Length of stay
- Conversions
- Complications
- OR time

Results / Conclusions

- Results were provided by surgeon
- Length of dtay: 5.5 days
- Conversions: 6.9%
- Complications: 8.8%
- OR time: 185 minutes

Cost Methodology

- Cost savings from da Vinci RAS vs. other modality = (Δ LOS days x LOS cost) + (Δ OR Time min x OR cost) + (Δ Transfusions% x Transfusions cost) + (Δ Conversion% x Conversions cost) + (Δ Complication% x Complications cost) + (Δ Readmission% x Readmissions cost)

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Study Information

Lobectomy: published results for comparison with surgeon's unpublished experience

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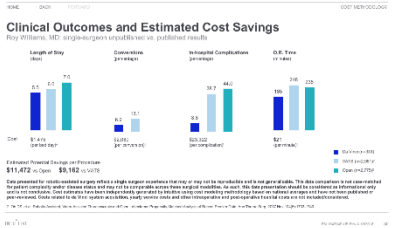

Study Design

- A retrospective, database study with the objective of providing a comparative analysis of perioperative clinical outcomes from elective robotic-assisted lobectomy (RL), VATS lobectomy (VL), and open lobectomy (OL).

Patient Population

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- The following covariates were used for matching: patient characteristics—age, sex, race, Elixhauser comorbidity score, and type of malignancy; and hospital characteristics—payor type, census region, hospital size (number of beds), type of hospital facility (academic or community), and location of the facility (urban or rural).

Results / Conclusions

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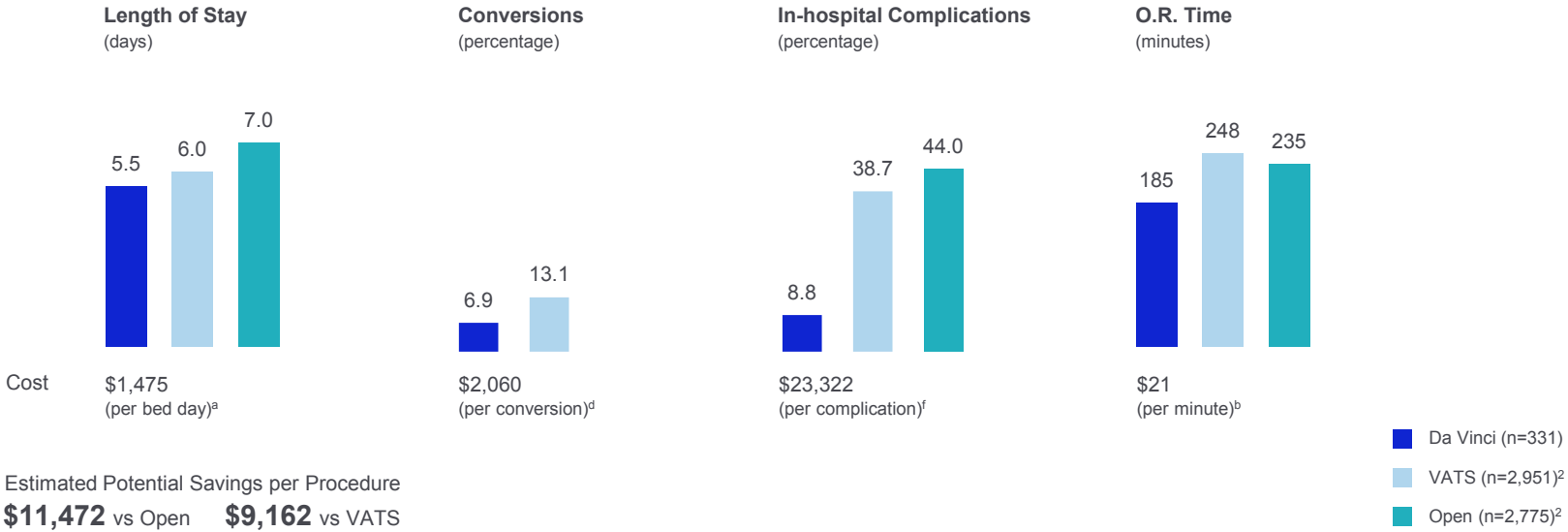
- Patients in the RL group were more likely to be discharged home than to a transitional health care facility, when compared to VL and OL.
- RL had fewer conversions when compared to VATs lobectomy.
- RL had a lower in-hospital and 30-day mortality when compared to OL.

Study Limitations

- Oncologic data, such as size of the tumor, stage, recurrence, and survival, could not be extracted from the Premier Healthcare Database. As anticipated in any large administrative database, there is potential for coding errors.

Clinical Outcomes and Estimated Cost Savings

Roy Williams, MD: single-surgeon unpublished vs. published results



Estimated Potential Savings per Procedure

$11,472 vs Open **$9,162** vs VATS

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Surgeon Profile

James Wudel, MD
Wake Forest Baptist Medical Center
Winston-Salem, NC

Da Vinci® System Training

2011

Residency

Vanderbilt University Medical Center (Internal Medicine)

Vanderbilt University Medical Center (General)

University of Michigan (Cardiothoracic)

Memberships

Cardiothoracic Surgery Network (CTSNet)

Society of Thoracic Surgeons (STS)

Background Information

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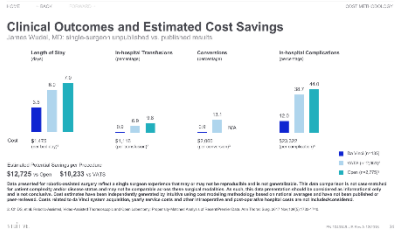
James Wudel, MD: single-surgeon unpublished vs. published results



Design

- Unmatched comparison of surgeon provided data (for da Vinci RAS) and published results

Patient Population

- Surgeon's patients who had lobectomy procedures

Outcomes Measured / Evaluated

- Length of stay
- Blood transfusions
- Conversions
- Complications

Results / Conclusions

- Results were provided by surgeon
- Length of stay: 3.5 days
- Blood transfusions: 0.9%
- Conversions: 0.9%
- Complications: 12.0%

Cost Methodology

- Cost savings from da Vinci RAS vs. other modality = (Δ LOS days x LOS cost) + (Δ OR Time min x OR cost) + (Δ Transfusions% x Transfusions cost) + (Δ Conversion% x Conversions cost) + (Δ Complication% x Complications cost) + (Δ Readmission% x Readmissions cost)

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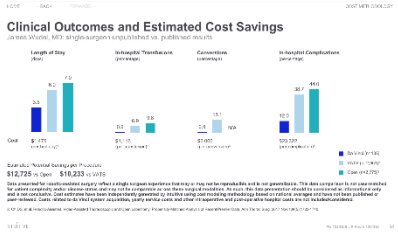

Study Design

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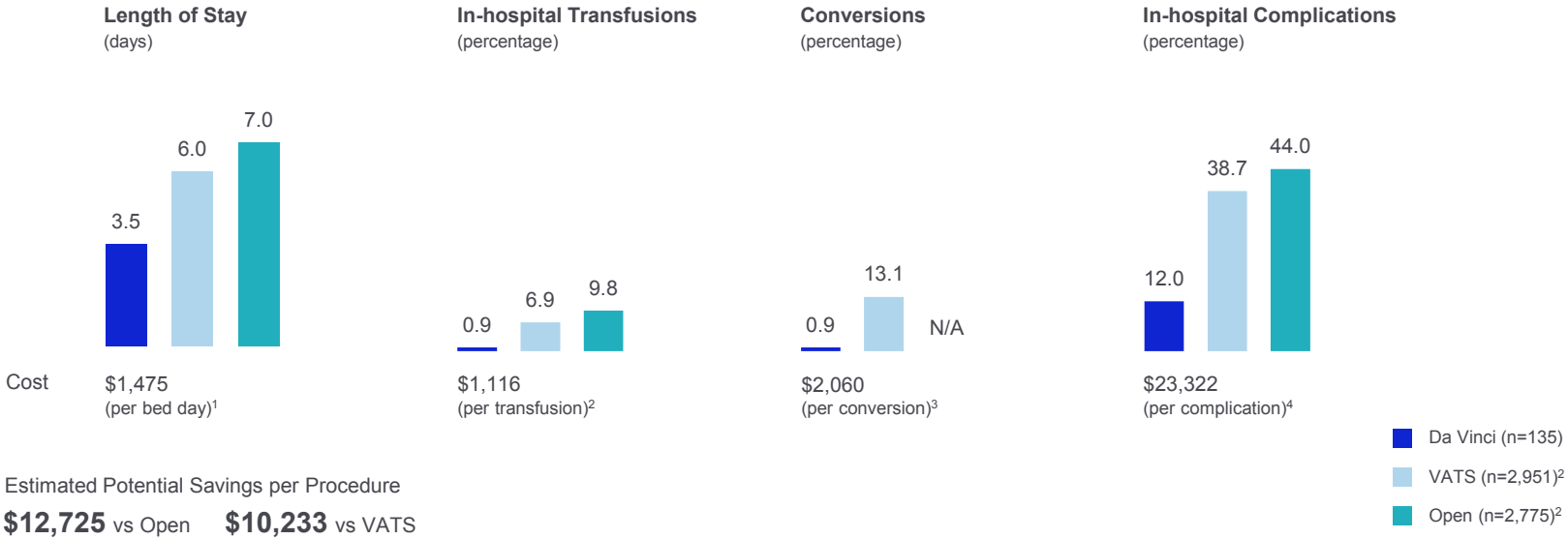
Clinical Outcomes and Estimated Cost Savings

James Wudel, MD: single-surgeon unpublished vs. published results



Estimated Potential Savings per Procedure

$12,725 vs Open **$10,233** vs VATS

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Cost References & Methodology

Ref.	Clinical Metric	Resource(s)	Published Value(s) Used	Price Index Adjustment	Calculation
a.	**Length of stay**	Halpern NA, Pastores SM. Critical care medicine in the United States 2000-2005: an analysis of bed numbers, occupancy rates, payer mix, and costs. Crit Care Med 2010;38(1):65-71. Table 5	$1,153/day (general ward) $3,518/day (intensive care)	From 2005 USD to 2018 USD, using Health care Services Price Index (Index 2012 = 100, Quarterly, Seasonally Adjusted)	$1,153 ÷ 84.474 x 108.036 = $1,475 (general ward) $3,518 ÷ 84.474 x 108.036 = $4,499 (intensive care)
b.	**OR time**	Chatterjee A, Chen L, Goldenberg EA, et al. Opportunity cost in the evaluation of surgical innovations: A case study of laparoscopic versus open colectomy. Surgical Endoscopy 2010;24(5):1075-79. Table 3	Midpoint of published results: $9 - $26 per minute opportunity cost	From 2007 USD to 2018 USD, using Health care Services Price Index (Index 2012 = 100, Quarterly, Seasonally Adjusted)	[($9 + $26) ÷ 2] ÷ 90.319 x 108.036 = $21
c.	**Blood transfusions**	Shander A, Hofmann A, Ozawa S, et al. Activity-based costs of blood transfusions in surgical patients at four hospitals. Transfusion 2010;50(4):753-65. Figure 2	Average of two US Hospitals: $726 (Rhode Island Hospital) and $1,183 (Englewood Hospital Medical Center) per RBC-unit transfusion	From 2008 USD to 2018 USD, using Health care Services Price Index (Index 2012 = 100, Quarterly, Seasonally Adjusted)	[($726 + $1,183) ÷ 2] ÷ 92.402 x 108.036 = $1,116
d.	**Conversions**	Cleary RK, Mullard AJ, Ferraro J, et al. The cost of conversion in robotic and laparoscopic colorectal surgery. Surgical Endoscopy 2018; 32(3):1515-24. Table 4	Index hospital payment for concerted cases $15,660 and for MIS completed cases $13,743	From 2012 USD to 2018 USD, using Health care Services Price Index (Index 2012 = 100, Quarterly, Seasonally Adjusted)	($15,660 - $13,743) ÷ 100.549 x 108.036 = $2,060
e.	**Surgical site infection**	Zimlichman E, Henderson D, Tamir O. Health care-associated infections: a meta-analysis of costs and financial impact on the U.S. health care system. JAMA Intern Med. 2013;173(22):2039-46. Table 1	$20,785	From 2012 USD to 2018 USD, using Health care Services Price Index (Index 2012 = 100, Quarterly, Seasonally Adjusted)	$20,785 ÷ 100.549 x 108.036 = $22,333

Cost References & Methodology (cont'd)

Ref.	Clinical Metric	Resource(s)	Published Value(s) Used	Price Index Adjustment	Calculation
f.	**Complications / reoperations**				Cost of Complication = Multiplier x MS-DRG Medicare Payment
	DRG multiplier	Healy MA, Mullard AJ, Campbell DA, et al. Hospital and payer costs associated with surgical complications. JAMA Surgery 2016;151(9):823-30. Figure 1b	Multiplier = (cost with complications – cost without complications) ÷ cost without complications	Not applied	($36,060 - $16,434) ÷ $16,434 = 1.2
	MS-DRG Medicare payment	Payments: Medicare Inpatient Prospective Payment System (IPPS) FY2018 Final Rule, Table 5 CN. Center for Medicare and Medicaid Services. Weighted by: Number of Medicare Inpatient Discharges from Medicare Charge Inpatient DRGALL DRG Summary Reports FY2016	See table below	No adjustment is needed, since using IPPS for FY2018 already.	Weighted average of national average MS-DRG payment is used for greater generalizability. Weighted Average MS-DRG Payment = SUMPRODUCT(Medicare discharges, Medicare payment) ÷ SUM(Medicare discharges)

Procedure	MS-DRG	Medicare Discharges	Medicare Payment
Lobectomy	163	13,039	$29,784
Lobectomy	164	16,304	$15,534
Lobectomy	165	8,613	$11,153
Colon	329	35,352	$29,610
Colon	330	55,663	$14,879
Colon	331	25,785	$10,099
Rectal	332	239	$23,029
Rectal	333	901	$12,008
Rectal	334	1,090	$7,816
Inguinal	350	1,458	$14,829
Inguinal	351	3,440	$8,975
Inguinal	352	3,306	$6,252
Ventral	353	3,370	$18,139
Ventral	354	8,916	$10,388
Ventral	355	7,715	$7,959

Cost References & Methodology (cont'd)

Ref.	Clinical Metric	Resource(s)	Published Value(s) Used	Price Index Adjustment	Calculation
f.	**Complications / reoperations** (cont'd)				Cost of Complication = Multiplier x MS-DRG Medicare Payment
	MS-DRG Medicare Payment (cont'd)	Payments: Medicare Inpatient Prospective Payment System (IPPS) FY2018 Final Rule, Table 5 CN. Center for Medicare and Medicaid Services. Weighted by: Number of Medicare Inpatient Discharges from Medicare Charge Inpatient DRGALL DRG Summary Reports FY2016	Procedure / MS-DRG / Medicare Discharges / Medicare Payment Bariatric 619 1,012 $18,784 Bariatric 620 3,561 $11,061 Bariatric 621 13,959 $9,538 Prostatectomy 707 4,877 $10,860 Prostatectomy 708 14,413 $8,344 Hyst-Malig 739 588 $21,342 Hyst-Malig 740 2,587 $10,374 Hyst-Malig 741 2,201 $7,620 Hyst-Benign 742 5,423 $9,877 Hyst-Benign 743 8,362 $6,475	No adjustment is needed, since using IPPS for FY2018 already.	Weighted average of national average MS-DRG payment is used for greater generalizability. Weighted Average MS-DRG Payment = SUMPRODUCT(Medicare discharges, Medicare payment) ÷ SUM(Medicare discharges)
g.	**Readmissions**	Healthcare Cost and Utilization Project (HCUP) by U.S. Agency for Healthcare Research and Quality (AHRQ) publishes Hospital Inpatient National Statistics (Years: 2014 | Categorization Type: Medicare-Severity Diagnosis Related Groups (MS-DRG) | Quick Table Type: Readmission) https://hcupnet.ahrq.gov	Procedure / MS-DRG / # of Readmissions / $ Cost per Readmission Lobectomy 163 4,021 $18,055 Lobectomy 164 4,968 $16,188 Lobectomy 165 2,122 $14,297 Colon 329 14,579 $15,878 Colon 330 20,485 $13,491 Colon 331 7,235 $11,716	From 2014 USD to 2018 USD, using Health Care Services Price Index (Index 2012 = 100, Quarterly, Seasonally Adjusted)	Weighted average of national average cost is used for greater generalizability. Weighted Average Cost of Readmission in 2018 USD = (SUMPRODUCT(# of Readmissions, $ Cost per Readmission) ÷ SUM(# of Readmissions)) ÷ 102.767 x 108.036

Cost References & Methodology (cont'd)

Ref.	Clinical Metric	Resource(s)	Published Value(s) Used			Price Index Adjustment	Calculation
g.	**Readmissions** (cont'd)	Healthcare Cost and Utilization Project (HCUP) by U.S. Agency for Healthcare Research and Quality (AHRQ) publishes Hospital Inpatient National Statistics (Years: 2014 | Categorization Type: Medicare-Severity Diagnosis Related Groups (MS-DRG) | Quick Table Type: Readmission) https://hcupnet.ahrq.gov	Procedure	MS-DRG	# of Readmissions	$ Cost per Readmission	From 2014 USD to 2018 USD, using Health care Services Price Index (Index 2012 = 100, Quarterly, Seasonally Adjusted)	Weighted average of national average cost is used for greater generalizability. Weighted Average Cost of Readmission in 2018 USD = (SUMPRODUCT(# of Readmissions, $ Cost per Readmission) ÷ SUM(# of Readmissions)) ÷ 102.767 x 108.036
			Rectal	333	1,503	$12,464		
			Rectal	334	745	$13,752		
			Inguinal	351	790	$13,893		
			Inguinal	352	613	$10,212		
			Ventral	353	1,088	$15,321		
			Ventral	354	2,655	$12,772		
			Ventral	355	1,821	$10,265		
			Bariatric	620	1,638	$12,934		
			Bariatric	621	4,909	$10,962		
			Prostatectomy	707	873	$13,106		
			Prostatectomy	708	1,484	$9,140		
			Hyst-Malig	740	977	$13,212		
			Hyst-Benign	742	3,952	$11,460		
			Hyst-Benign	743	5,255	$9,134		

References

1. Dylewski MR, Ohaeto AC, Pereira JF. Pulmonary resection using a total endoscopic robotic video-assisted approach. Semin Thorac Cardiovasc Surg. 2011 Spring;23(1):36-42. doi: 10.1053/j.semtcvs.2011.01.005

2. Oh DS, et al. Robotic-Assisted, Video-Assisted Thoracoscopic and Open Lobectomy: Propensity-Matched Analysis of Recent Premier Data. Ann Thorac Surg. 2017 Nov;104(5):1733-1740.

Important Safety Information

Financial Disclosure

All surgeons represented in this document have received compensation from Intuitive for consulting and/or educational services.

Dr. Oh discloses a financial relationship with Intuitive.

Surgical Risks

Risks associated with pulmonary resection (wedge resection, segmentectomy, lobectomy) include: persistent air leak, pneumonia, prolonged mechanical ventilation >48 hours, atrial fibrillation, acute respiratory distress syndrome (ARDS), chylothorax, re-intubation, arrhythmias, bronchopleural fistula, phrenic nerve injury, esophageal injury, difficulty breathing, collapsed lung, pulmonary volvulus, recurrent laryngeal nerve injury leading to vocal cord dysfunction.

The friable nature of pulmonary tissue enhances the risk of vascular, bronchiolar or other injury that will be difficult to control when using this device. Published clinical experience as well as clinical studies performed to support this marketing clearance have demonstrated that even surgeons considered expert in laparoscopy/thoracoscopy have substantial learning curves of 10 to 12 cases (Falk, et al., Total endoscopic computer enhanced coronary artery bypass grafting, Eur J Cardiothorac Surg 2000; 17: 38-45).

Important Safety Information

Serious complications may occur in any surgery, including da Vinci® Surgery, up to and including death. Examples of serious or life-threatening complications, which may require prolonged and/or unexpected hospitalization and/or reoperation, include but are not limited to, one or more of the following: injury to tissues/organs, bleeding, infection and internal scarring that can cause long-lasting dysfunction/pain.

Risks specific to minimally invasive surgery, including da Vinci® Surgery, include but are not limited to, one or more of the following: temporary pain/nerve injury associated with positioning; a longer operative time, the need to convert to an open approach, or the need for additional or larger incision sites. Converting the procedure could result in a longer operative time, a longer time under anesthesia, and could lead to increased complications. Contraindications applicable to the use of conventional endoscopic instruments also apply to the use of all da Vinci instruments.

For Important Safety Information, indications for use, risks, full cautions and warnings, please also refer to www.davincisurgery.com/safety and www.intuitivesurgical.com/safety.

Individuals' outcomes may depend on a number of factors, including but not limited to patient characteristics, disease characteristics, and/or surgeon experience.

Important Safety Information

Da Vinci Xi® System Precaution Statement

The demonstration of safety and effectiveness for the specific procedure(s) discussed in this material was based on evaluation of the device as a surgical tool and did not include evaluation of outcomes related to the treatment of cancer (overall survival, disease-free survival, local recurrence) or treatment of the patient's underlying disease/condition. Device usage in all surgical procedures should be guided by the clinical judgment of an adequately trained surgeon.

It is the responsibility of the owner of the da Vinci® surgical system to properly train and supervise its personnel to ensure that the instruments and accessories are properly cleaned, disinfected and sterilized as required by the User's Manual. The da Vinci products should not be used in a clinical setting unless the institution has verified that these products are properly processed in accordance with the da Vinci System User's Manual.


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