Department of Defense Robotic Surgery Overview: Enhancing Operational Readiness

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24 September 2020
1645 - 1745 (ET)

Presenter

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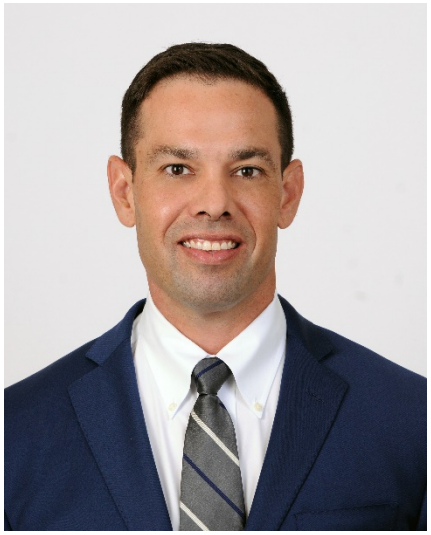

Lt Col Tyler is an active duty Air Force colorectal surgeon stationed at Keesler Air Force Base (AFB), Mississippi. He is a distinguished graduate of the Air Force Reserve Officer Training Corps (AFROTC) program at Florida State University, and the Uniformed Services University of the Health Sciences. His practice is comprised of the Keesler beneficiary population, and also in the community via Training Affiliation Agreement (TAA), where he is one of only two surgeons in his specialty in the state. He is the Chief of Colorectal Surgery and Director of robotic surgery at Keesler, as well as the Director of robotic surgery at his TAA hospital, Merit Health Biloxi.

DISCLOSURES

- Lt Col Tyler is a Proctor and Advanced Course Instructor for Intuitive Surgical.
- The views expressed in this presentation are those of the author and do not necessarily reflect the official policy or position of the Department of Defense, not the U.S. Government.
- The DoD/VA is contracted with da Vinci product systems to utilize the product in providing healthcare to patients.
- This continuing education activity is managed and accredited by the Defense Health Agency J-7 Continuing Education Program Office (DHA J-7 CEPO). DHA J-7 CEPO and all accrediting organizations do not support or endorse any product or service mentioned in this activity.
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- Commercial support was not received for this activity.

Learning Objectives

At the conclusion of this activity, participants will be able to:

1. Describe the benefits of robotic surgery for patients
2. Recognize obstacles to successful robotic surgery implementation in the Military Health System
3. Articulate how robotic surgery enhances readiness.

OVERVIEW

- Introduction
- DoD Robotic Evolution
- Why Robotics?
- Economic and Quality impact of robotics
- Robotic program goals
- Robotics and readiness?

My opinions are my own and do not reflect USAF/DoD policy or endorsement

Introduction

- Undergraduate: B.S., Florida State University
  - 2002 (ROTC)
- Medical: Uniformed Services University of the Health Sciences (Bethesda, MD)
  - 2007
- Residency: Brooke Army Medical Center (San Antonio, TX)
  - 2007-2013
- Fellowship: Washington University in St. Louis
  - 2013-2014

My Practice

- Chief, Colorectal and Robotic Surgery, Keesler AFB Medical Center
  - Military
  - Treat patients from seven different Military Treatment Facilities (MTFs) and Veterans Affairs (VA)
- Director of Robotics, Merit Health Biloxi
  - Via TAA agreement (volunteer)
  - Private for-profit hospital
  - solo practice first 4 years
- 90% Colorectal (CR), 10% General surgery

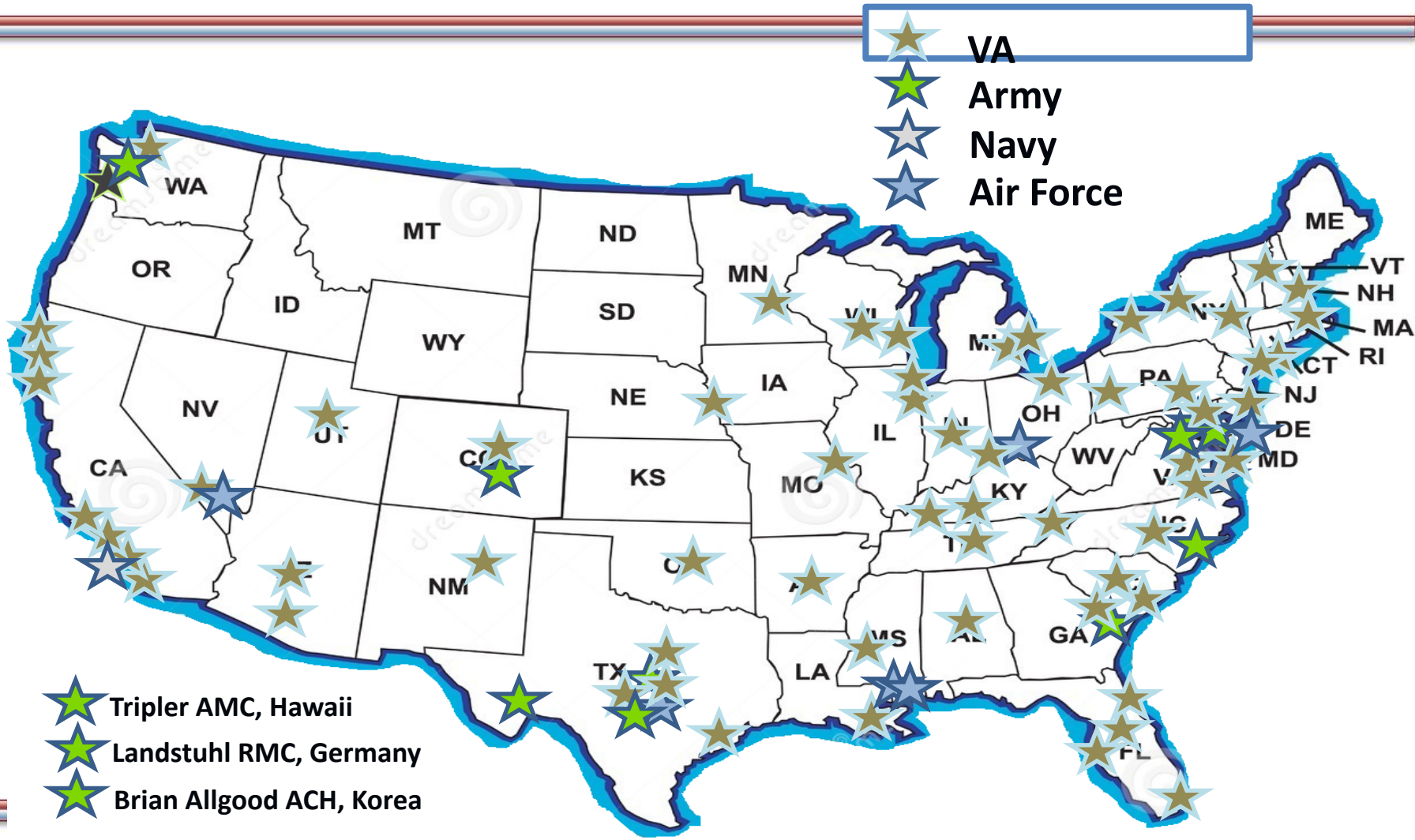
Robotic Program Equipment

- Keesler Medical Center:
  - Residency program, (24 residents)
  - Dual console Xi with Table Motion
  - First robotic hospital in US Air Force
- Merit Health Biloxi:
  - X, Xi with TM
- Institute for Defense Robotic Surgical Education (InDoRSE):
  - Founder/Director
  - Xi Intuitive training site for DoD and VA surgeons
  - Porcine/cadaveric protocols on 2 Xi machines

DoD Robotic Evolution

- Has mirrored private sector
  - Started in with Urology followed by Gynecology (GYN)
  - General Surgery and subspecialties latest growth
- Other than Army, has largely been locally managed with significant variation
  - Army had centralized guidance under Mike Duggan
- As of June, DHA with new robotic surgery steering committee under Surgical Services Clinical Community (S2C2)
- Between DoD/VA: $300 million invested by federal government thus far
  - New Defense Logistics Agency (DLA) Electronic Catalog (ECAT) sole source contract for next 5 years

Government da Vinci® Programs
(84 Programs: 62 VA & 22 DoD)



(dreamstime.com, n.d.)

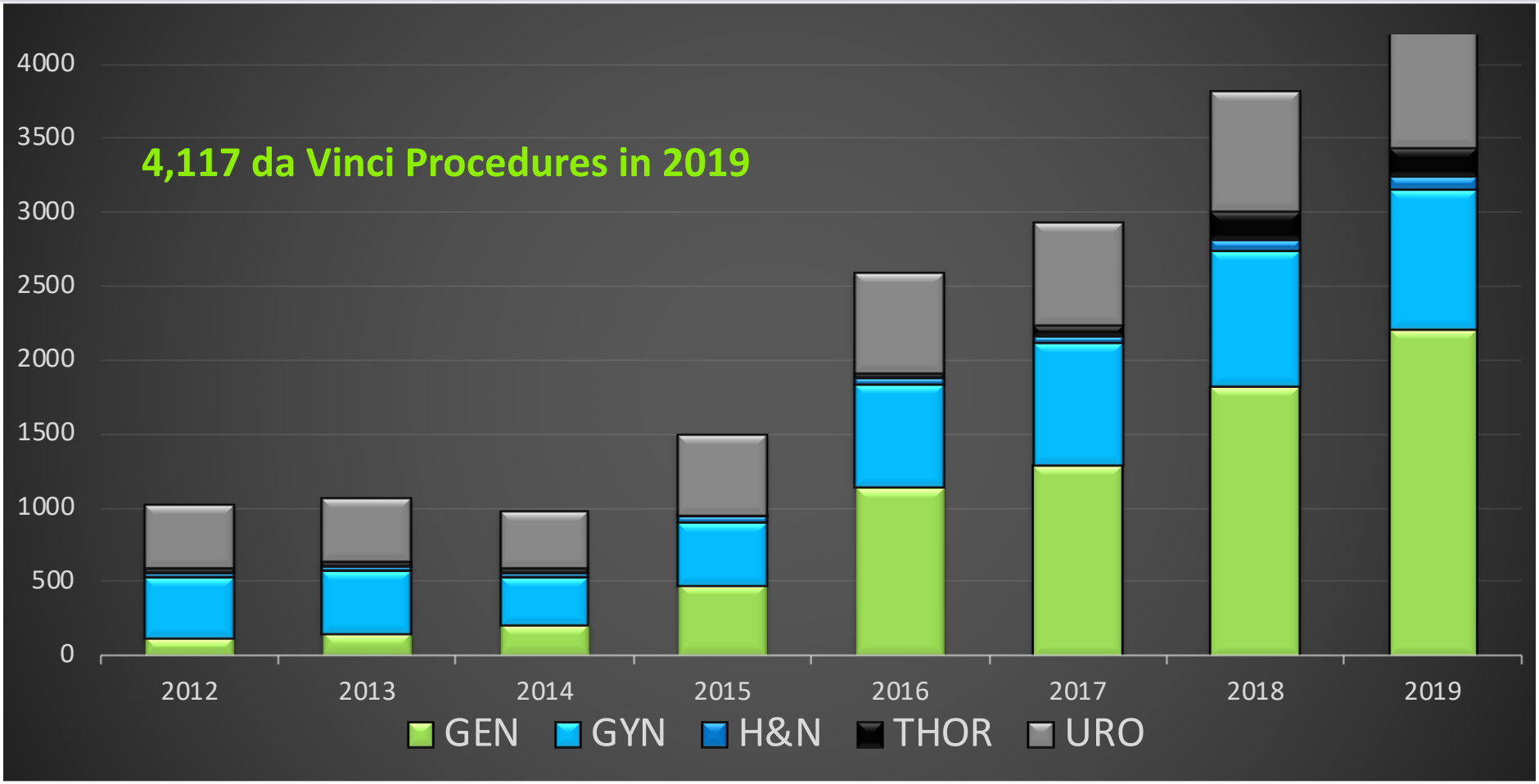
US Gov't da Vinci Technology Platform Footprint

- 62 VA da Vinci Robotic Programs
  - 11 Si Platform Systems
  - 65 Xi Platform Systems
  - 1 SP Platform System
  - 70 / 76 have Dual Surgeon Consoles
- 22 DoD da Vinci Robotic Programs
  - 10 Army, 2 Navy, 5 Air Force, 4 DHA, 1 DHHS
  - 7 Si Platforms
  - 23 Xi Platforms
  - 29/30 have Dual Surgeon Consoles

(gulfmedical.com, n.d.)

The DoD/VA is contracted with da Vinci product systems to utilize the product in providing healthcare to patients.

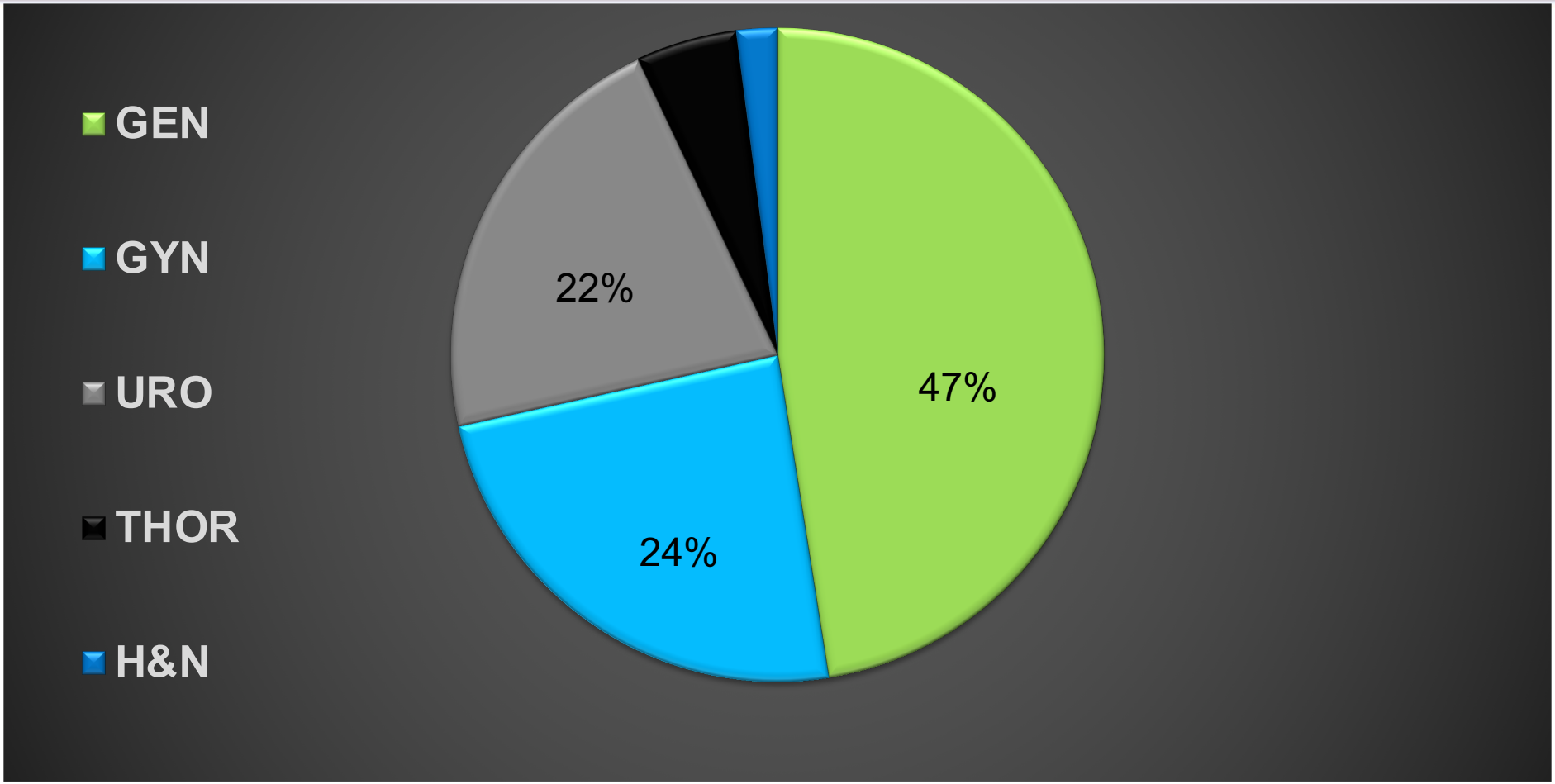
DoD da Vinci Procedure Evolution (2012 – 2019)



GEN- General; H&N- Head and Neck;
THOR- Thoracic; URO- Urology

(Tyler, 2020)

DoD da Vinci Procedure Mix



(Tyler, 2020)

Keesler Program Evolution

- First Xi hospital in USAF
- Initially External Resource Sharing Agreement (ERSA) based – great starting point
  - Community hospital partnerships extremely helpful
- Designed with private sector model adapted to MTF with end goal in mind
  - Robotics committee in place pre-delivery
  - Team training complete
  - Total practice model goal from outset
- Started with 3 surgeons (CR and Urology)
  - Now 14 surgeons and 4 product lines
  - Consistently one of highest cases/quarter/robot programs in federal sector

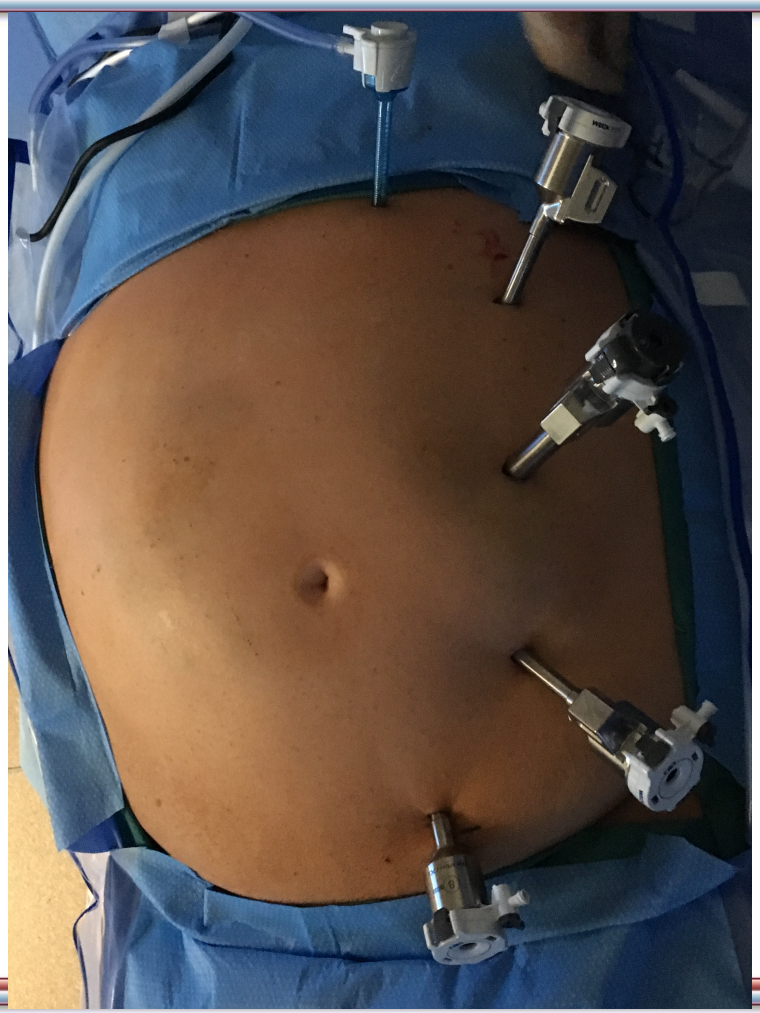
Why Robotics for Surgeons?

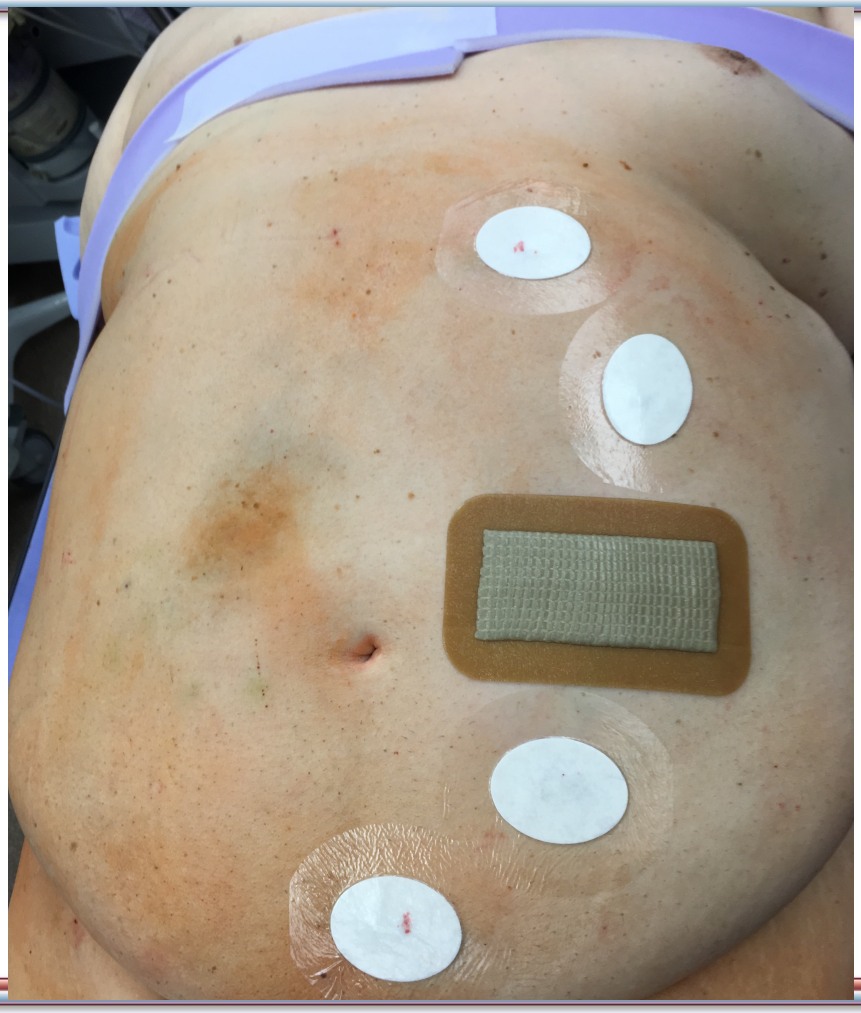
- Different for everyone, Not just marketing
- My opinion:
  - Visualization
  - Wristed movements (precision)
  - Fluorescence
  - Biggest benefit = most difficult cases
- Under-discussed benefits:
  - Ergonomics
  - **Own First Assist** = more minimally invasive surgery (MIS) in more hands
  - Suggestion of improved short term outcomes (bladder, sexual function)
  - Equivalent Oncologic outcomes
  - Easier than laparoscopy (lap) in high body mass index (BMI) (recent data to show lap < open)

More MIS for More Patients

(Tyler, n.d.)

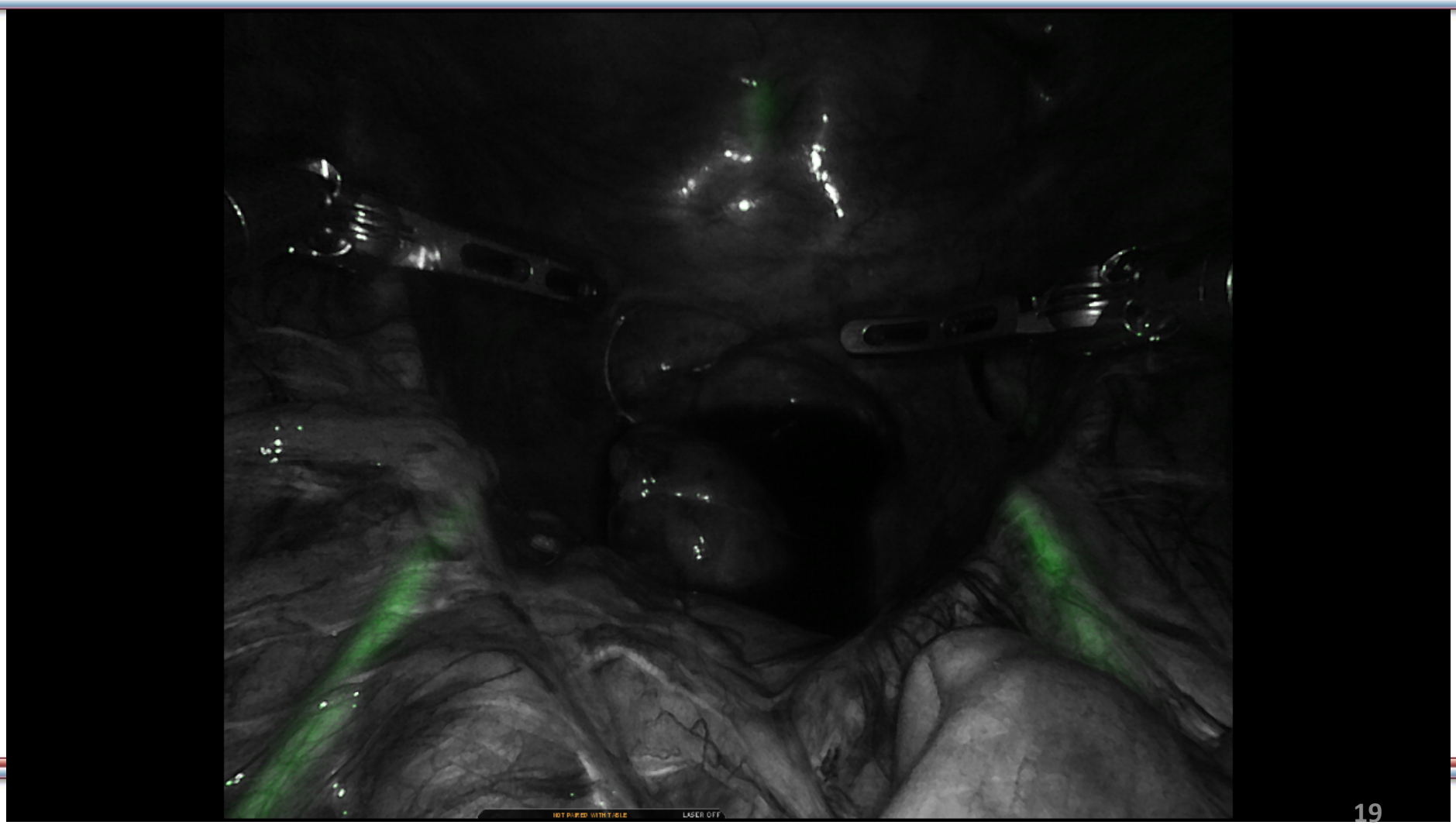
Surgical Photos





(Tyler, n.d.)

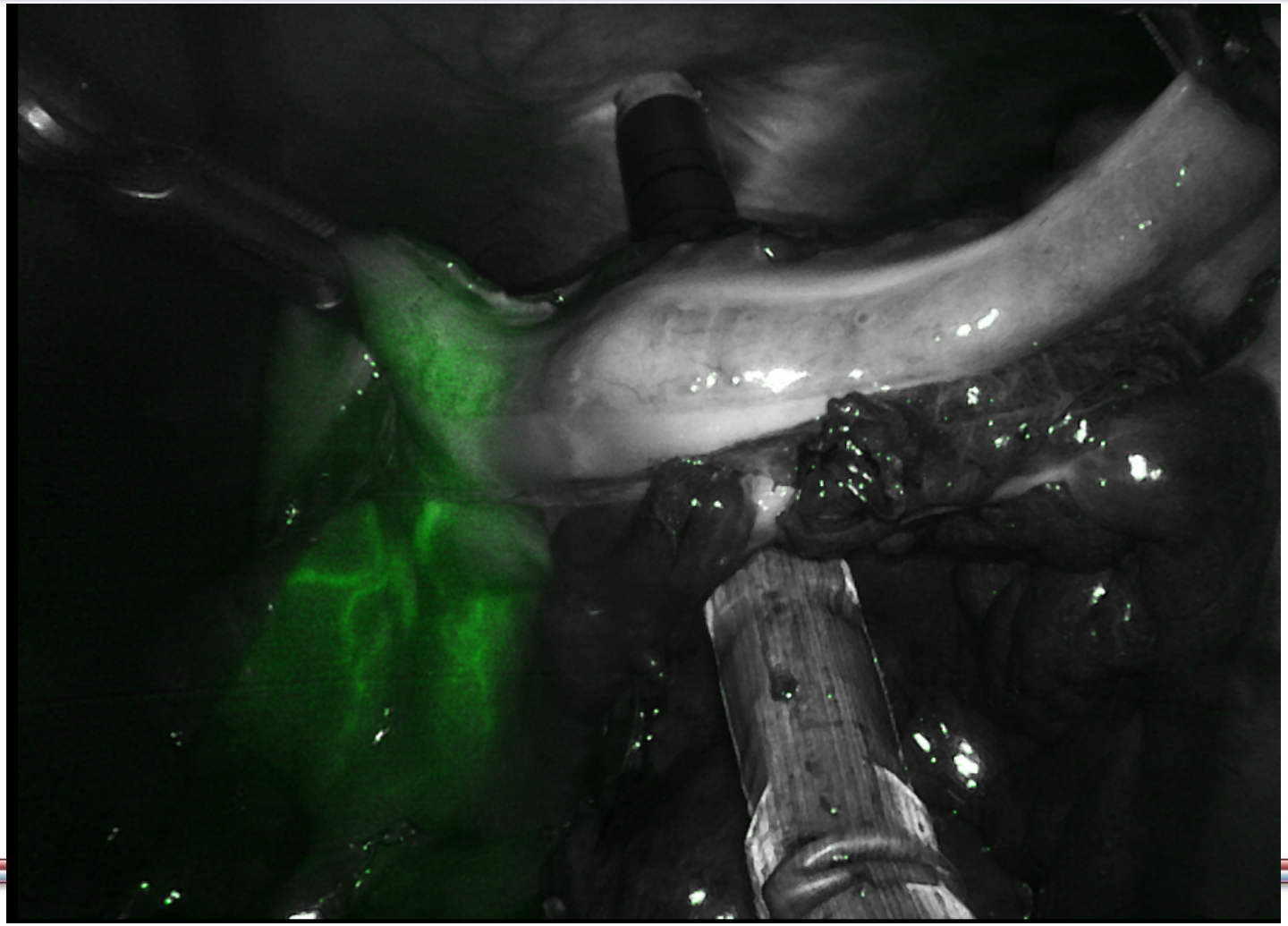
Fluorescence



(Tyler, n.d.)

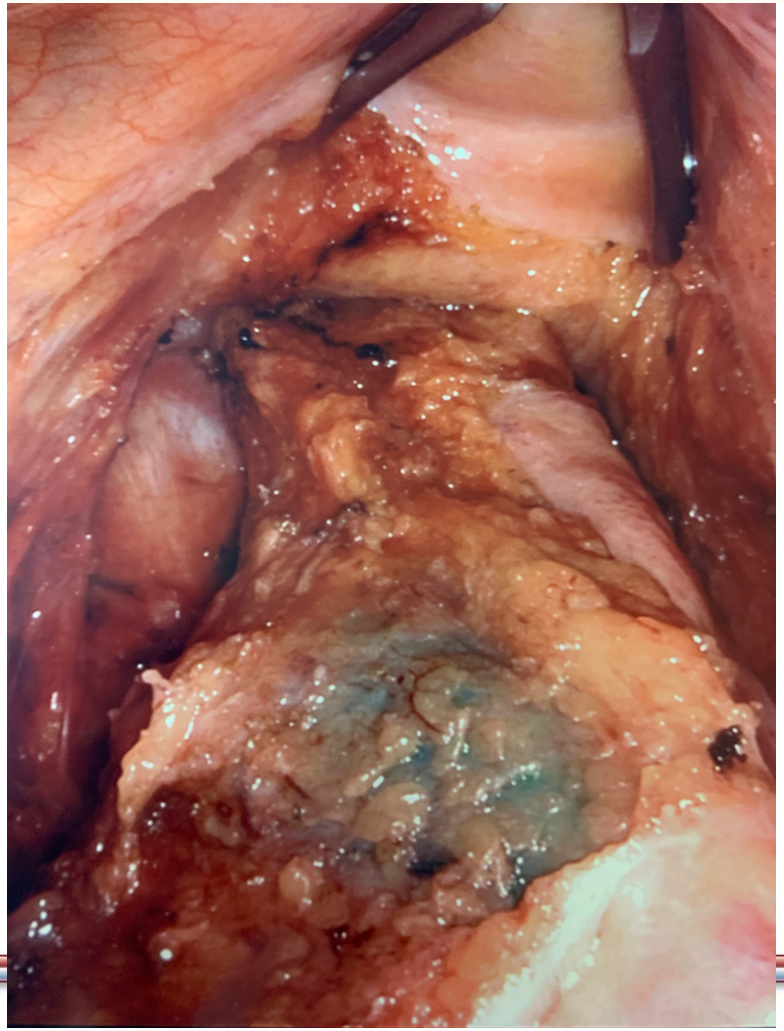
Perfusion Assessment

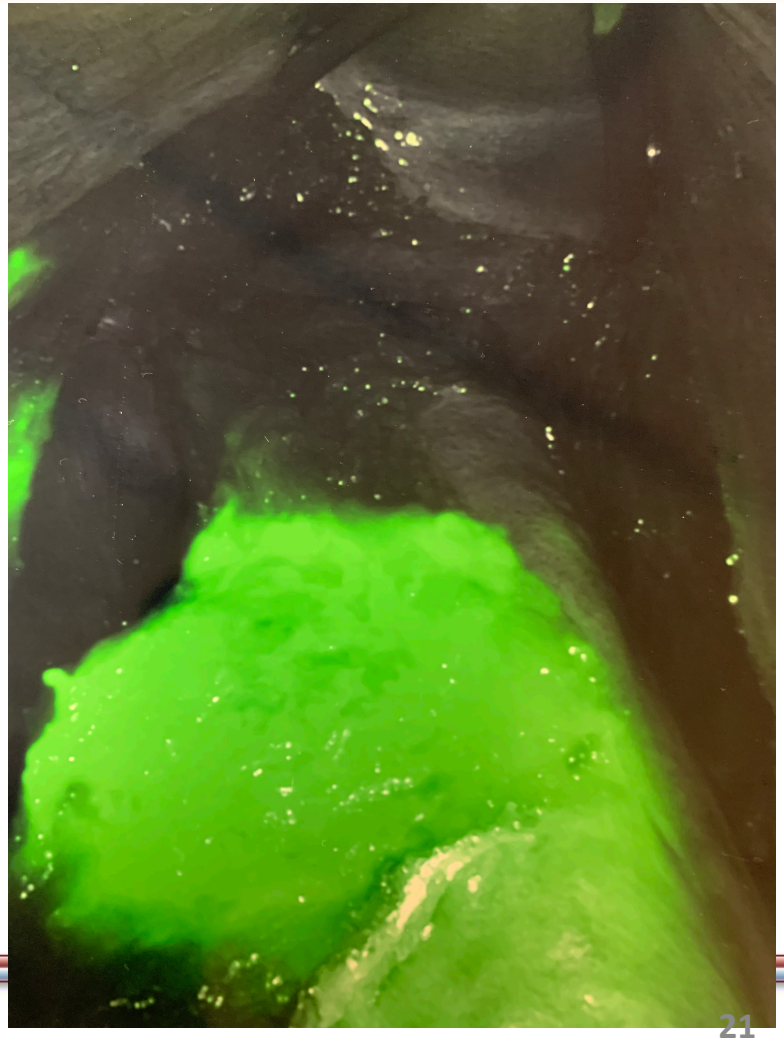
- Fluorescence assessment of all Left-sided colon resections routinely – will become Standard of Care



(Tyler, n.d.)

Tattoo





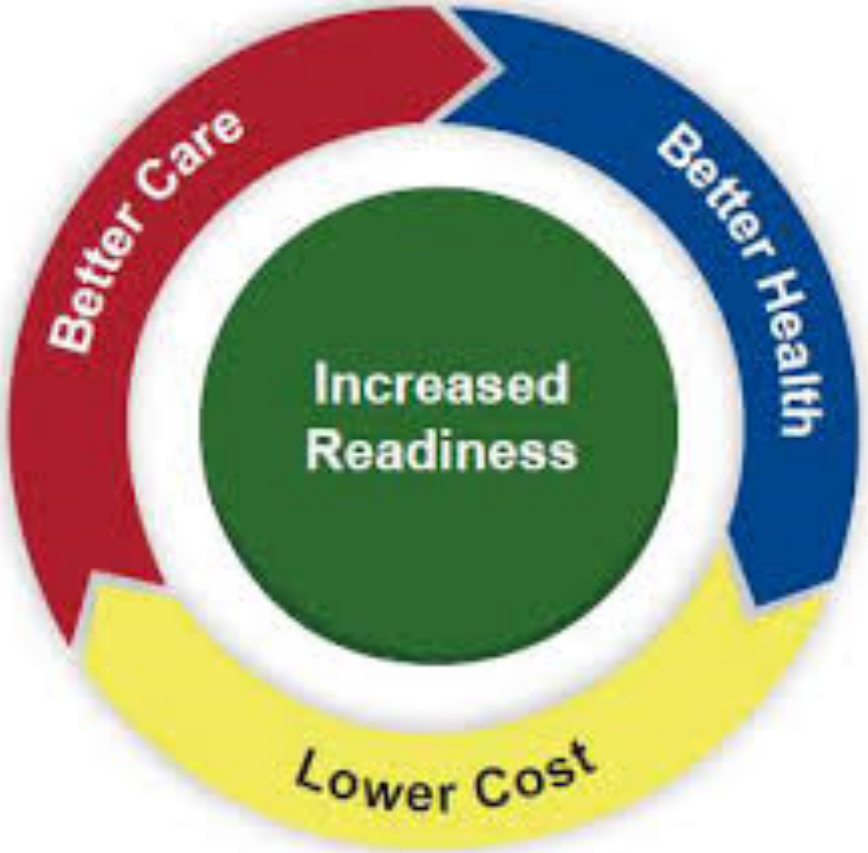
(Tyler, n.d.)

Why Robotics for DoD/DHA?

- OUTCOMES
- Impact on total costs of care
  - Value-based purchasing (VBP)
  - Cost-consequence avoidance
- "We aren't private sector"
  - We are competing to keep patients at our MTFs
  - Volume → Readiness
- Recruitment/Retention
  - Surgeons want to use this technology
  - Graduate Medical Education (GME) trainees want to learn robotics

DHA Quadruple Aim

- Better Care
- Better Health
- Lower Cost
- Increased Readiness



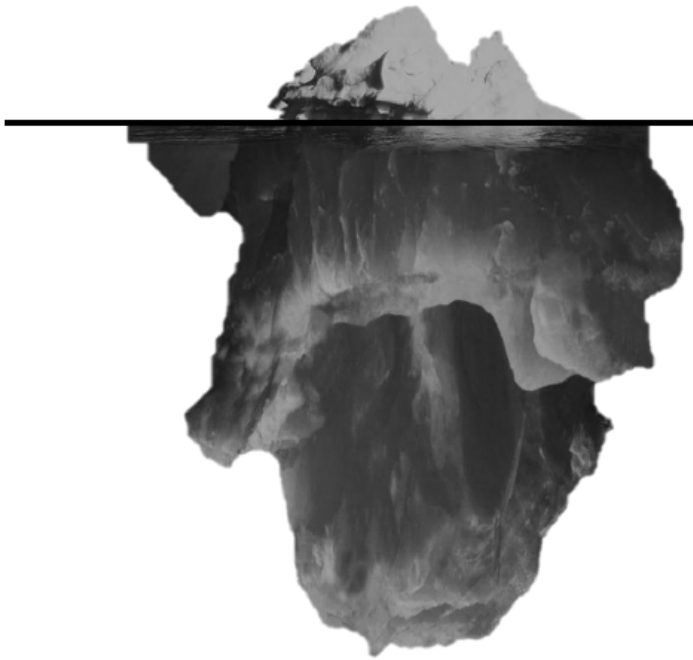
(health.mil, n.d.)

Air Force Medicine

Spend a little, Save a lot

Costs

Comprehensive Cost of Care



DIRECT COST

- Instrument and accessory costs
- Capital costs
- OR time & Overhead costs

DOWNSTREAM COSTS

- Length of stay
- Conversions
- Complications
- Readmissions
- Surgical site infections (SSI)

Cost

Avoidable downstream costs to the organization

Below the water….

LENGTH OF STAY (per day)

$1,553[5]

General Ward

$4,738[5]

ICU

CONVERSION (per occurrence)

$3,162[6]

Low Complexity

$7,812[6]

High Complexity

READMISSION (per occurrence)

$11,087[7]

Low Complexity

$14,718[8]

High Complexity

COMPLICATION (per occurrence)

0.1-0.5 x DRG[9]

Low Grade

0.9-2.5 x DRG[9]

Mid-Grade

4.7 x DRG[9]

High Grade

SURGICAL SITE INFECTION (per occurrence)

$20,785[10]

My Robotic CR Data

- 171 CR procedures, 34 GS
  - ❑ 30% of total cases were on Si
- Of non-emergent CR cases: 90% robot, 5% lap, 5% open

Case Type	% of cases
Colon Cancer	24%
Rectal Cancer	26%
Crohn's/Ulcerative Colitis	16%
Diverticulitis	12%
Pelvic Floor Recon	12%

More Data

- Mean BMI: 28.4, range 16.6-67
- Conversions: 4, 2.0%
- Leak rate: 3/167 (1.8%)
  - All diverted ultralow low anterior resection (LAR) with coloanal in radiated pelvis (ileostomy at index operation)
  - None required reoperation
- Oncologic Data:
  - Average nodal yield: 15.5
  - Incidence of positive margin (including CRM- circumferential radial margin) = 0

	Robot	Lap	Open
Mean LOS	**3.9**	**4.7**	**7.6**
SSI rate	**6.2**	**8.7**	**8.7**

  - Since transversus abdominis plane (TAP) block implementation: mean length of stay (LOS) 2.3 days, median 2

How does Robotic Surgery align with DHA Operational Readiness?

- Robotics = Readiness Enhancer
- Why? – Recruitment and Retention
  - Technical Skills
  - Recapture volume back into MTF (Keesler GYN example) in current low volume environment (at home and deployed)
  - Surgeons with more fulfilling/satisfying in-garrison practice more likely to stay in
  - Retention has a DIRECT impact on readiness
    - Many (most) of our surgeons are first-time deployers
    - Health Professions Scholarship Program (HPSP) 4 year commitment may deploy once, if at all
    - Retention = better corporate/institutional knowledge/experience
    - Surgeons WANT this technology incorporated into their practice
    - GME impacts
- Improved recovery?
  - MIS Surgery speeds Recovery Time – deployability impact?
- The Future: with 5G….
  - Potential for downrange robotics at Role 3?
  - Telementoring/teleproctoring – subspecialty surgeons can engage remotely

Obstacles to Robotics in DoD

- Significant differences between private sector and DoD
- Personnel Turnover and Operations Tempo (OPSTEMPO)
  - Deployment and Permanent Change of Station (PCS) cycle prevents development of lasting corporate/institutional knowledge
- Access to Training
  - Applies to surgeons, nurses, Operating Room (OR) technicians
  - Impetus to found Institute for Defense Robotic Surgical Education (InDoRSE)- DoD specific training site
- Command Interest/Buy In
  - Very little awareness/knowledge of robotics
- Volume: most DoD surgeons 20-30% of civilian peers, can prolong learning curve for both surgeons, staff, and facility

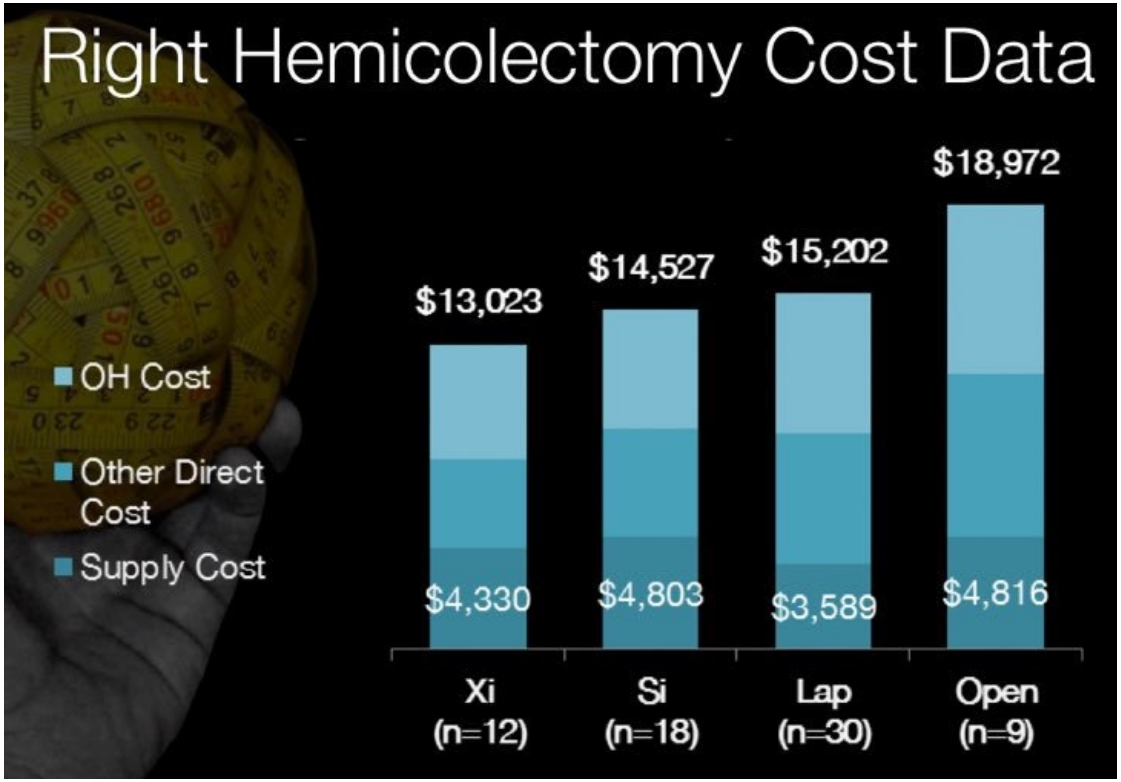
Institute for Defense Robotic Surgical Education

- Prior to InDoRSE (Keesler AFB), fully dependent on Intuitive for training at their own sites (Sunnyvale, CA, Houston, TX, Atlanta, GA)
  - Approximately 3500-4000 dollars per trainee
  - ONLY trains surgeon and first assist
- InDoRSE founded in 2017 with single Xi robot, now with two
  - Post training productivity: over 120 surgeons, nearly 250 OR nurses and techs from 20+ facilities across Army, Navy, Air Force, VA
  - Trainees have gone home to do over 1500 robotic cases
  - Unlike Intuitive sites, training is TEAM BASED (overcomes OPSTEMPO obstacle)
  - Over 1 million education cost savings to federal govt so far, now in QPP

What About Cost?

Right Colon Cost Analysis

- Again, is it more expensive? Cost best determined locally AND by surgeon, by case
- Mark Soliman data:

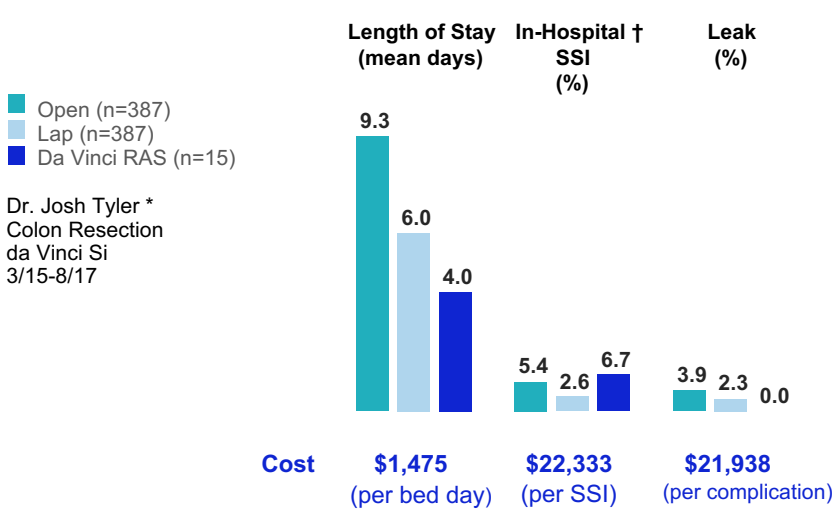


(Soliman, n.d.)

Clinical Outcomes and Potential Cost Avoidance
Colon Resection (My Si and Xi vs. published Open/Lap)

Defense Health Agency

Da Vinci Si: better vs. Open/Lap

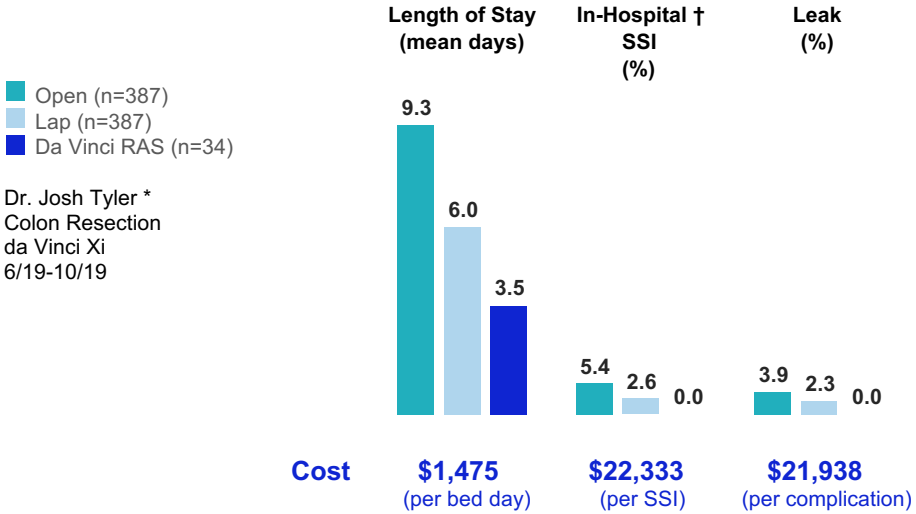


Estimated Cost Avoidance Per Procedure
$8,383 vs. Open
$2,539 vs. Lap

Estimated Total Cost Avoidance
$125,742 vs. Open
$38,084 vs. Lap

*Dr. Josh Tyler provided da Vinci Si data for Colon Resection 3/15-8/17
Note: Comparisons were made among unmatched patient populations.
†SSI rates are for Organ Space SSI only, while authors also reported Superficial SSI and Deep SSI.
(Benlice et al., 2016)

Da Vinci Xi: even better



Estimated Cost Avoidance Per Procedure
$10,617 vs. Open
$4,773 vs. Lap

Estimated Total Cost Avoidance
$360,964 vs. Open
$162,273 vs. Lap

*Dr. Josh Tyler provided da Vinci Xi data for Colon Resection 6/19-10/19
Note: Comparisons were made among unmatched patient populations.
†SSI rates are for Organ Space SSI only, while authors also reported Superficial SSI and Deep SSI.
(Benlice et al., 2016).

PN 1055365-US Rev A 12/2018

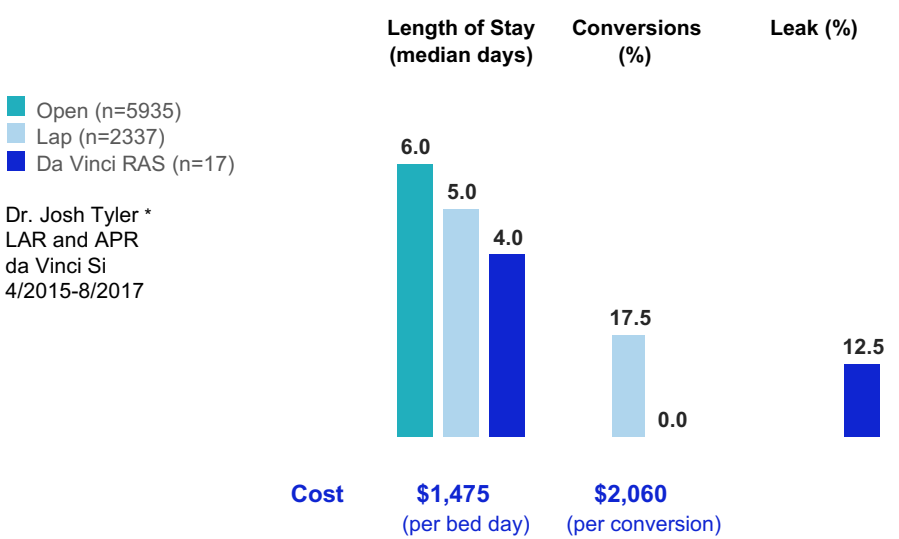
References & Methodology

Clinical Outcomes and Potential Cost Avoidance

Rectal Resection – LAR/APR (My Si and Xi vs. published* Open/Lap)

Defense Health Agency

Da Vinci Si: better vs. Open/Lap



Estimated Cost Avoidance Per Procedure

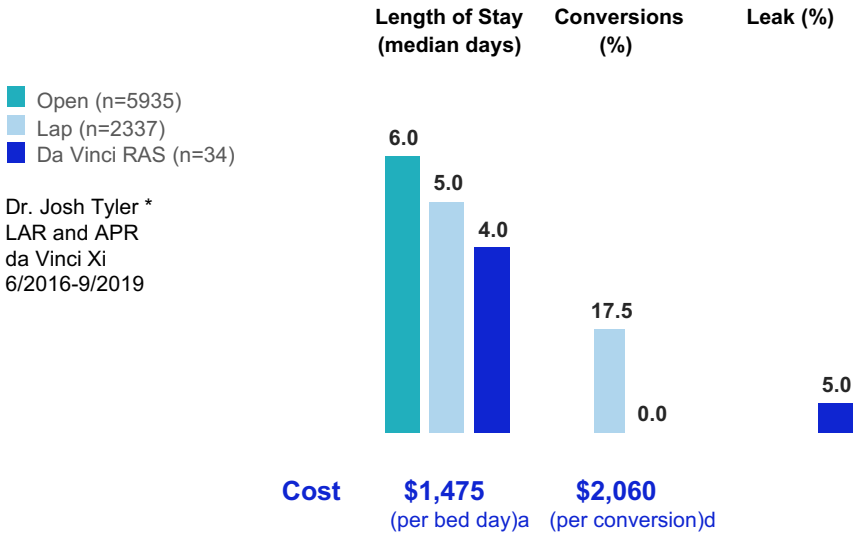
$2,950 vs. Open
$1,836 vs. Lap

Estimated Total Cost Avoidance

$50,150 vs. Open
$31,204 vs. Lap

*Dr. Josh Tyler provided da Vinci Si data for LAR and APR 4/2015-8/2017
Note: Comparisons were made among unmatched patient populations.
Reference: (Midura et al., 2015)
Only for Conversions: (Speicher et al., 2015)
*Midura et al. reported Median LOS days, and did not report Leak rate.

Da Vinci Xi: even better



Estimated Cost Avoidance Per Procedure

$2,950 vs. Open
$1,836 vs. Lap

Estimated Total Cost Avoidance

$100,300 vs. Open
$62,407 vs. Lap

*Dr. Josh Tyler provided da Vinci Xi data for LAR and APR 6/2016-9/2019
Note: Comparisons were made among unmatched patient populations.
Reference: (Midura et al., 2015)
Only for Conversions: (Speicher et al., 2015)

Data presented for robotic-assisted surgery reflect a single surgeon 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 Surgical using cost modeling methodology based on national averages and have not been published or peer-reviewed.

PN 1055365-US Rev A 12/2018

References & Methodology

Data is King

- Data drives efficiencies, quality improvement, and ultimately cost savings
  - Allows DHA and MTFs to define value/Return on Investment (ROI)
- DoD Cost accounting methodology historically poor
- Data Collection disjointed between Armed Forces Health Longitudinal Technology (AHLTA) (global), Essentris (local), S3 (local)
- Lack of connectivity prohibits data monitoring

Progressing to Narcotic-Free Colectomy

- Optimal outcome = robot + Enhanced Recovery After Surgery (ERAS) protocol
  - ❑ Smaller extraction incisions, less pain
- Non-narcotic adjuncts/multimodal analgesia
- **Pre-op**: 1 gram PO Tylenol, Gabapentin in holding
- **Intra-op**: Lidocaine drip, lap TAP blocks with Exparel
- **Post-op**: 4 doses IV Tylenol, continue Gabapentin
- Since implementation, approximately 35% of pts require no narcotics perioperatively

Total Practice Robotics

- GOAL: 24/7 robot access
  - **Volume** (surgeon and facility) critical
  - Leverage improved outcomes/value of system delivering ROI
  - Understand simple vs complex case metrics/demands
- How do you get there?
  - Learning curve: Surgeon, Case, Institution, Team
- Components (all complex and symbiotic):
  - Access to robot
  - Surgeon Interest
  - Administration Support
  - Trained OR staff
    - Everyone has base level of skills for simple, key personnel for complex

Robotic Program Success

- **Be Invested at the hospital**
- Defined based on local hospital AND local market
- Critical Components:
  - Robotics Steering Committee
  - Robotics Director AND Coordinator
- Throughput metrics/efficiency
  - Regular audit
- Institutional process

What's Next for DoD/DHA Robotics?

- Near term (FDA approved):
  - Mako robot (Stryker) – robot total joint replacement
  - Ion robot (Intuitive Surgical) – remote guided lung biopsy
  - Senhance (Transenterix) – abdominal surgery
- Future platforms (investigational):
  - Cambridge Medical Robotics (CMR) – Versius
  - Medtronic - Hugo
  - Many many more to come
- Integration of Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI) into clinical realm
  - Already happening

Key Takeaways

- Robotics = here to stay
- My hands: robot > lap
- Will improve even more with added technology
- Success/outcomes more heavily dependent on team than ever (Robotics program, techs, nurses, hospital)
- **Data critical**: efficiency, cost containment, value, outcomes
- Will impact outcomes/cost, recruitment, and retention

References

Benlice, C., Aytac, E., Costedio, M., Kessler, H., Abbas, M. A., Remzi, F. H., & Gorgun, E. (2016). Robotic, laparoscopic, and open colectomy: a case-matched comparison from the ACS-NSQIP. *The International Journal of Medical Robotics and Computer Assisted Surgery*, *13*(3), e1783. https://doi.org/10.1002/rcs.1783

Midura, E. F., Hanseman, D. J., Hoehn, R. S., Davis, B. R., Abbott, D. E., Shah, S. A., & Paquette, I. M. (2015). The effect of surgical approach on short-term oncologic outcomes in rectal cancer surgery. *Surgery*, *158*(2), 453–459. https://doi.org/10.1016/j.surg.2015.02.020

Speicher, P. J., Englum, B. R., Ganapathi, A. M., Nussbaum, D. P., Mantyh, C. R., & Migaly, J. (2015). Robotic Low Anterior Resection for Rectal Cancer. *Annals of Surgery*, *262*(6), 1040–1045. https://doi.org/10.1097/sla.0000000000001017

QUESTIONS?

(USAF, n.d.)

How to Obtain CE/CME Credit

To receive CE/CME credit, you must register by 0745 ET on 25 September 2020 to qualify for the receipt of CE/CME credit or certificate of attendance. You must complete the program posttest and evaluation before collecting your certificate. The posttest and evaluation will be available through 8 October 2020 at 2359 ET. Please complete the following steps to obtain CE/CME credit:

1. Go to URL: https://www.dhaj7-cepo.com/content/clinical-communities-speaker-series-military-health-care-select-promising-practices-24-sept
2. Click on the REGISTER/TAKE COURSE tab.
   a. If you have previously used the CEPO CMS, click login.
   b. If you have not previously used the CEPO CMS click register to create a new account.
3. Follow the onscreen prompts to complete the post-activity assessments:
   a. Read the Accreditation Statement
   b. Complete the Evaluation
   c. Take the Posttest
4. After completing the posttest at 80% or above, your certificate will be available for print or download.
5. You can return to the site at any time in the future to print your certificate and transcripts at https://www.dhaj7-cepo.com/
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