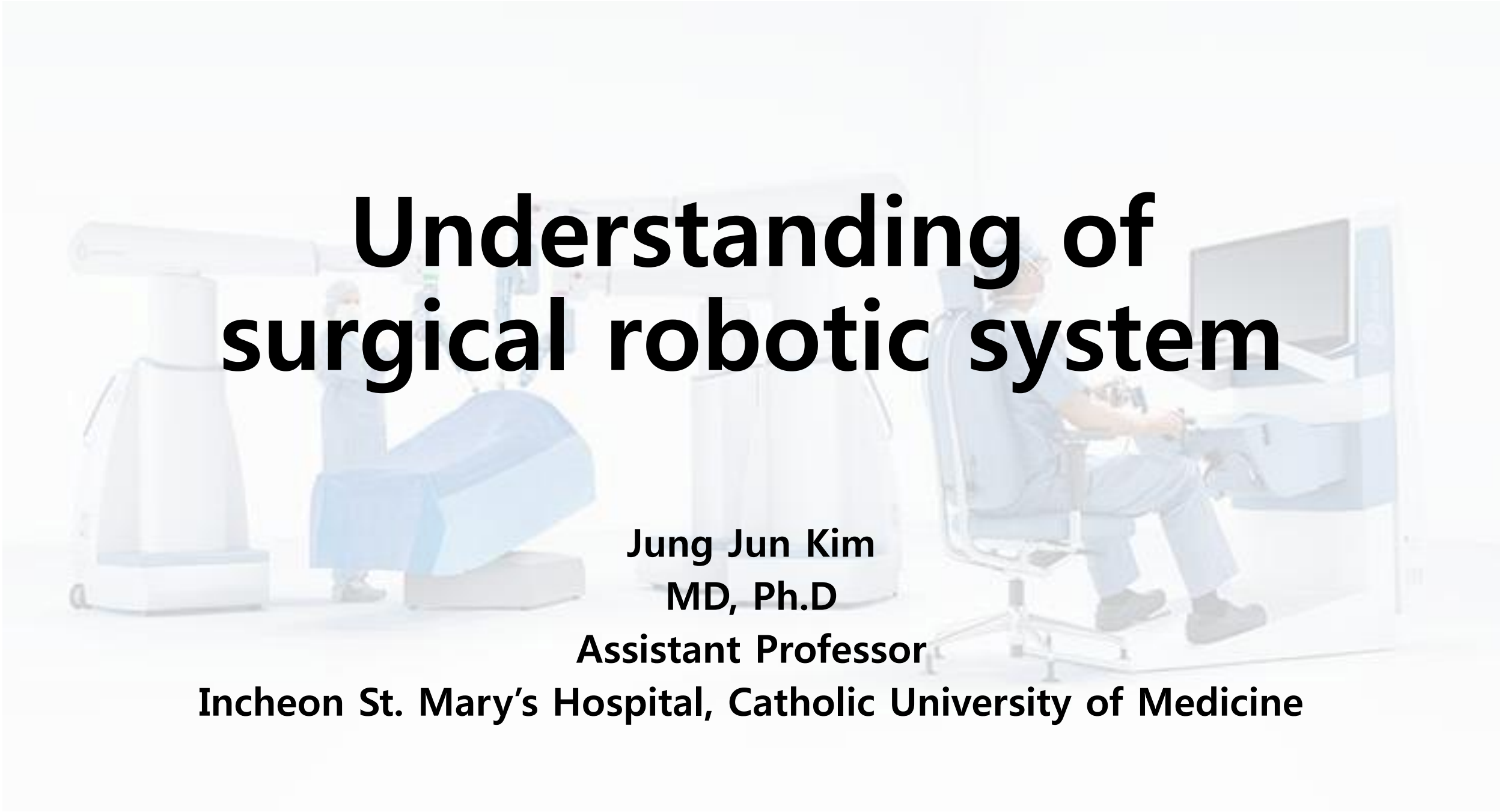


Understanding of surgical robotic system

Jung Jun Kim

MD, Ph.D

Assistant Professor

Incheon St. Mary's Hospital, Catholic University of Medicine

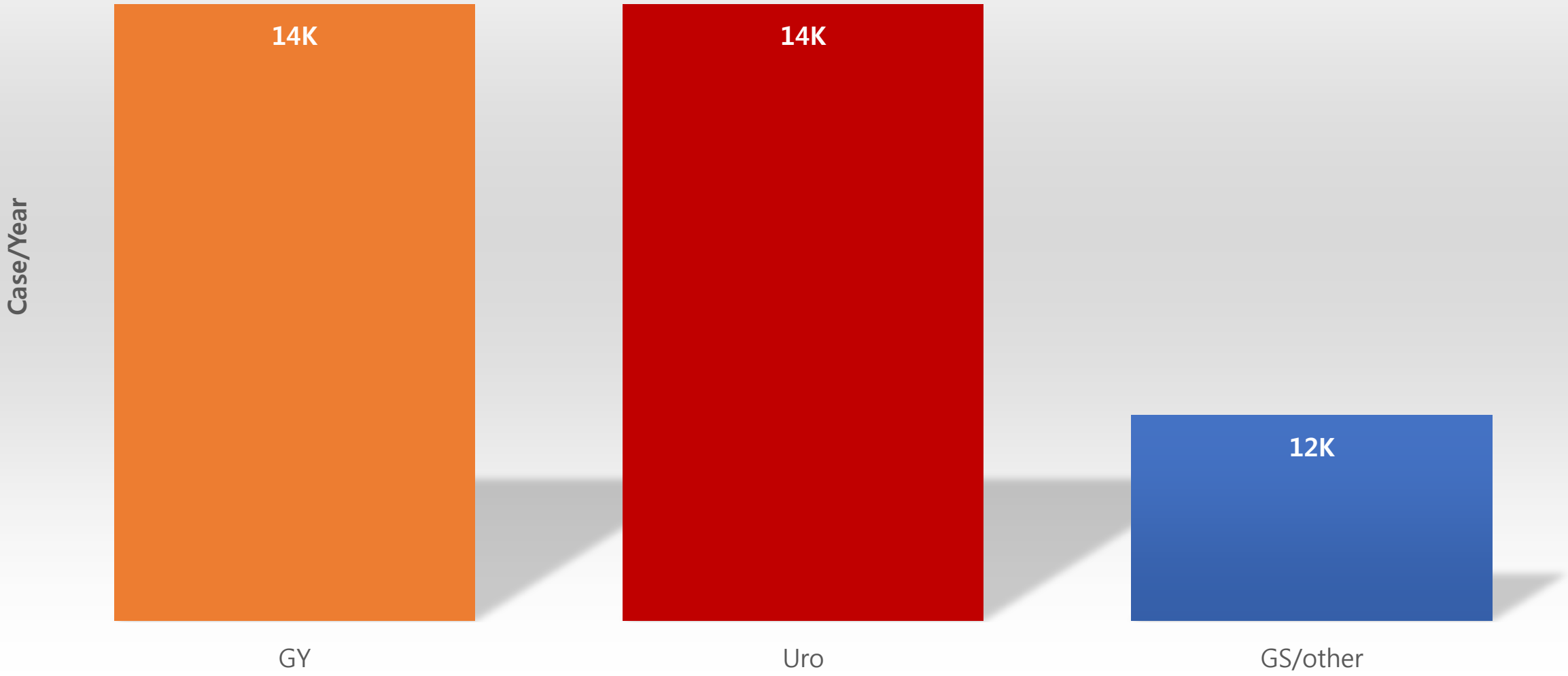
Disclosure

- Presenter - 2011 KUA board
  - Robotic fellowship for 5 years with experts
  - Works at ICSM (tertiary but community H.) since 2019
  - 300 RAS, last year

- Non of financial or research interest conflict with Any RAS Manufacture
- Few of the presented numbers could be unofficial and/or confidential

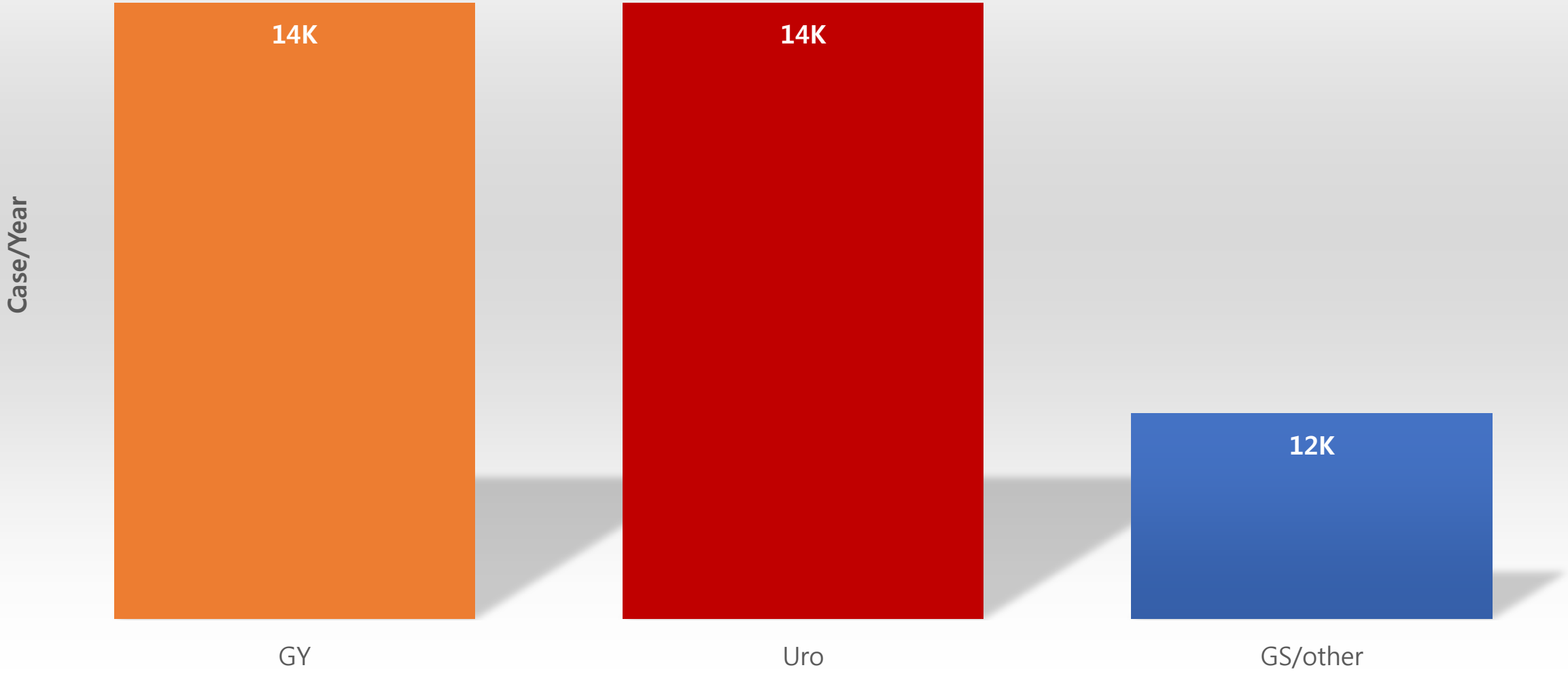

7 : 7 : 6

daVinci Surgery in Korea (2011)



daVinci Surgery in Korea (2011)

Urology is not a leader of RAS anymore.



0.1M

Open Surgery

1.6M

Laparoscopic Surgery

3% of all surgery (worldwide)

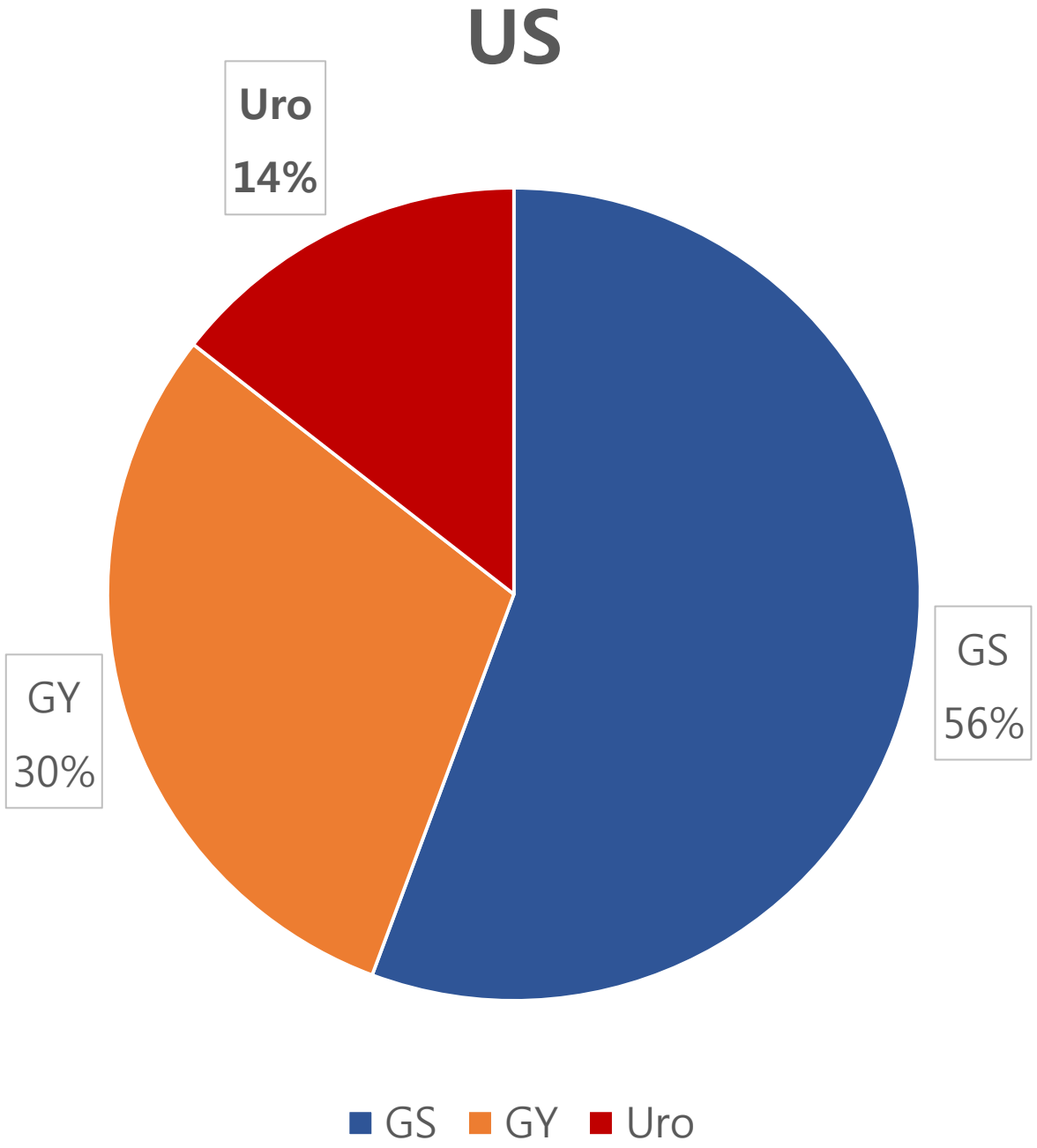
Many Others Competing or Investing to Compete:

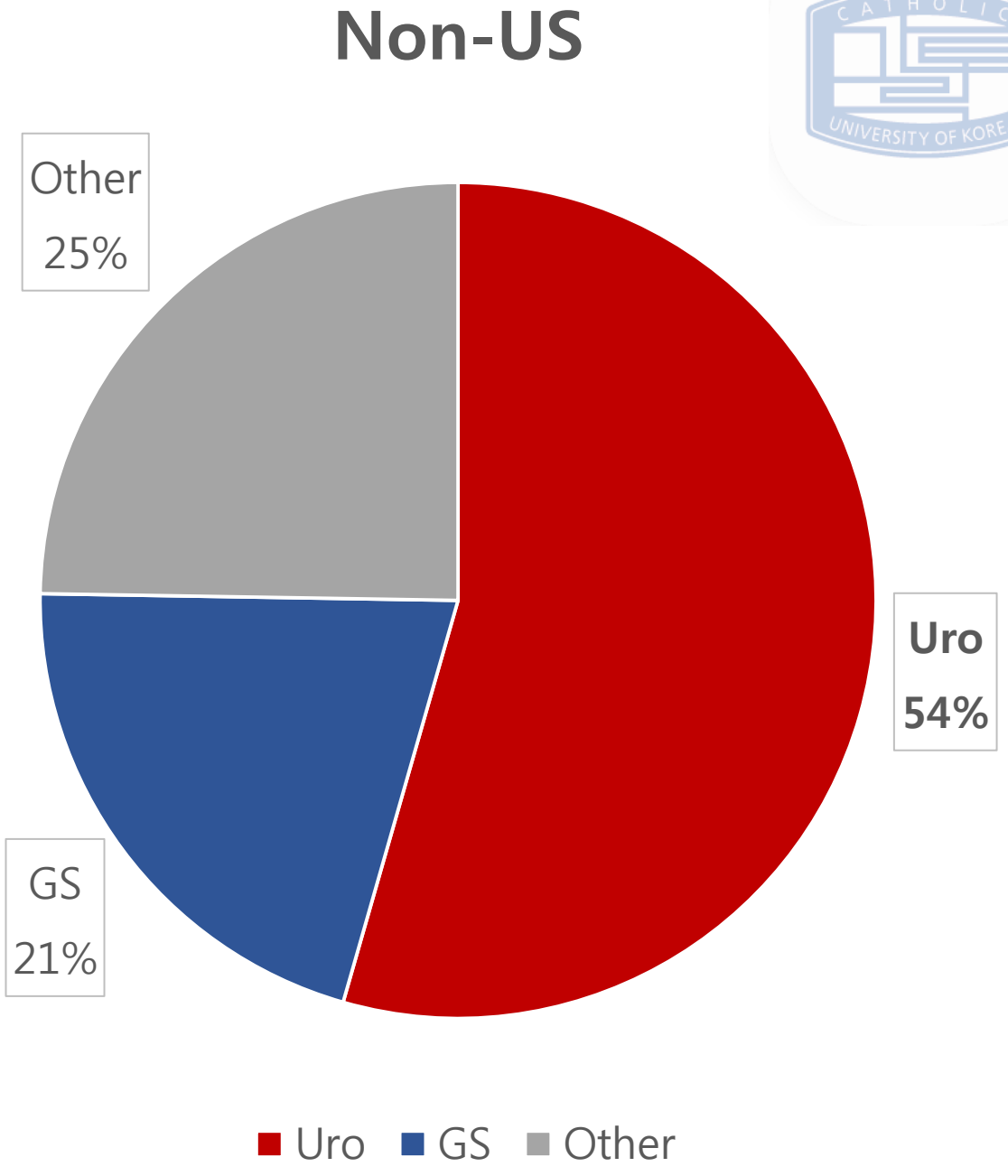
Worldwide Stats of daVinci Surgery (official)

	Overall	US	Non-US
2021	**1594000**	**1109000**	**485000**
2020	1243000	876000	367000
2019	1229000	883000	346000
Increase/year	19%	18%	20%

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the fiscal year ended December 31, 2021


US
Uro
14%
GS
56%
GY
30%
GS
GY
Uro


Non-US
Other
25%
Uro
54%
GS
21%
Uro
GS
Other

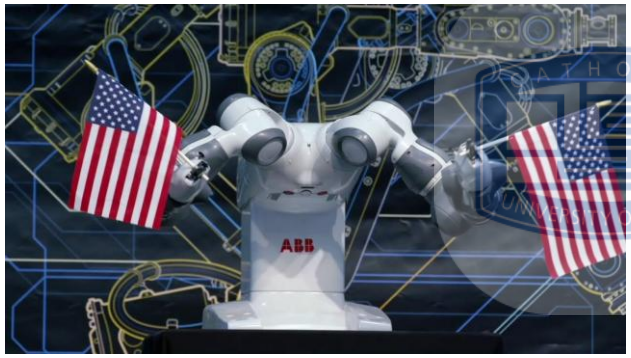
	GS	GY	Uro
US	589000	316000	153000
Increase/year	30%	20%	10%

	Uro	GS	Other
Non-US	264000	101000	120000
Increase/year	20%	20%	20%

Korean data (unofficial)

	GY	Uro	GS/other
Korea	14000	14000	12000
Increase/year	35%	15%	20%

The Dominance of US



- USFDA approved daVinci for most of the urologic, gynecologic, general surgery
- USFDA gave warning only to oncological breast surgery
- USFDA is conservative to other RAS manufactures competing Intuitive
- Medicare covers most of the indications
- **About 8%** of all surgery performed by daVinci in US
- Not much space to expand in Urology (0.2M/year)

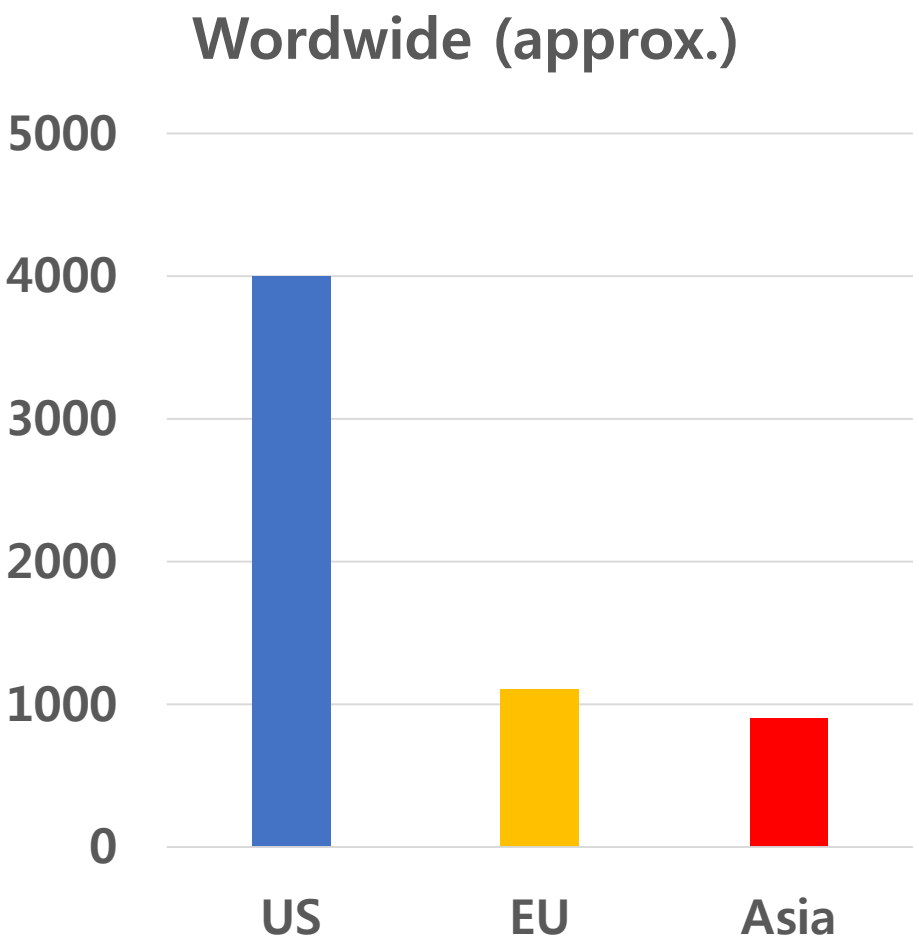
The Emerging of Korea

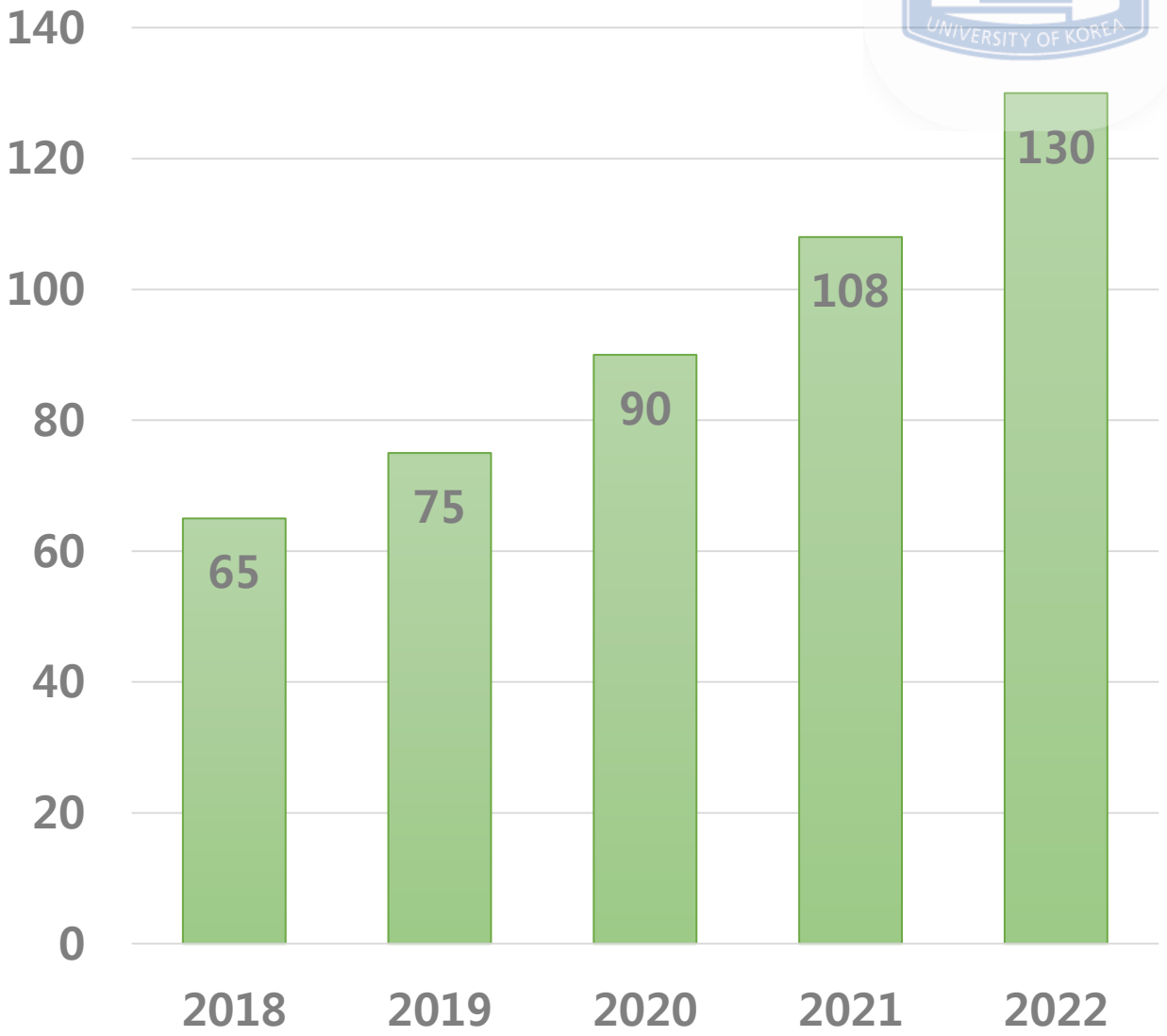
- KFDA approved daVinci, Revo-I, even SP for most of the urologic, gynecologic, general surgery
- The reimbursement issue
- Medical device regulating law is no more friendly to new devices
- Indeminity insurance has been the initial force for emerging
- **About 2%** of all surgery performed by daVinci (40K)
- Not much space to expand in Urology (14K/year), however, for GS/GY..
- At least, more platform will be available for most of the general hospital in near future

The Share of RAS in Korea (unofficial)

	RAS	All Surgery	%
Pca	**11000**	**13500**	**81.5%**
RCC	**2500**	**4500**	**55.6%**
TCC, reconstruction, other	**500**	**2000**	**25.0%**

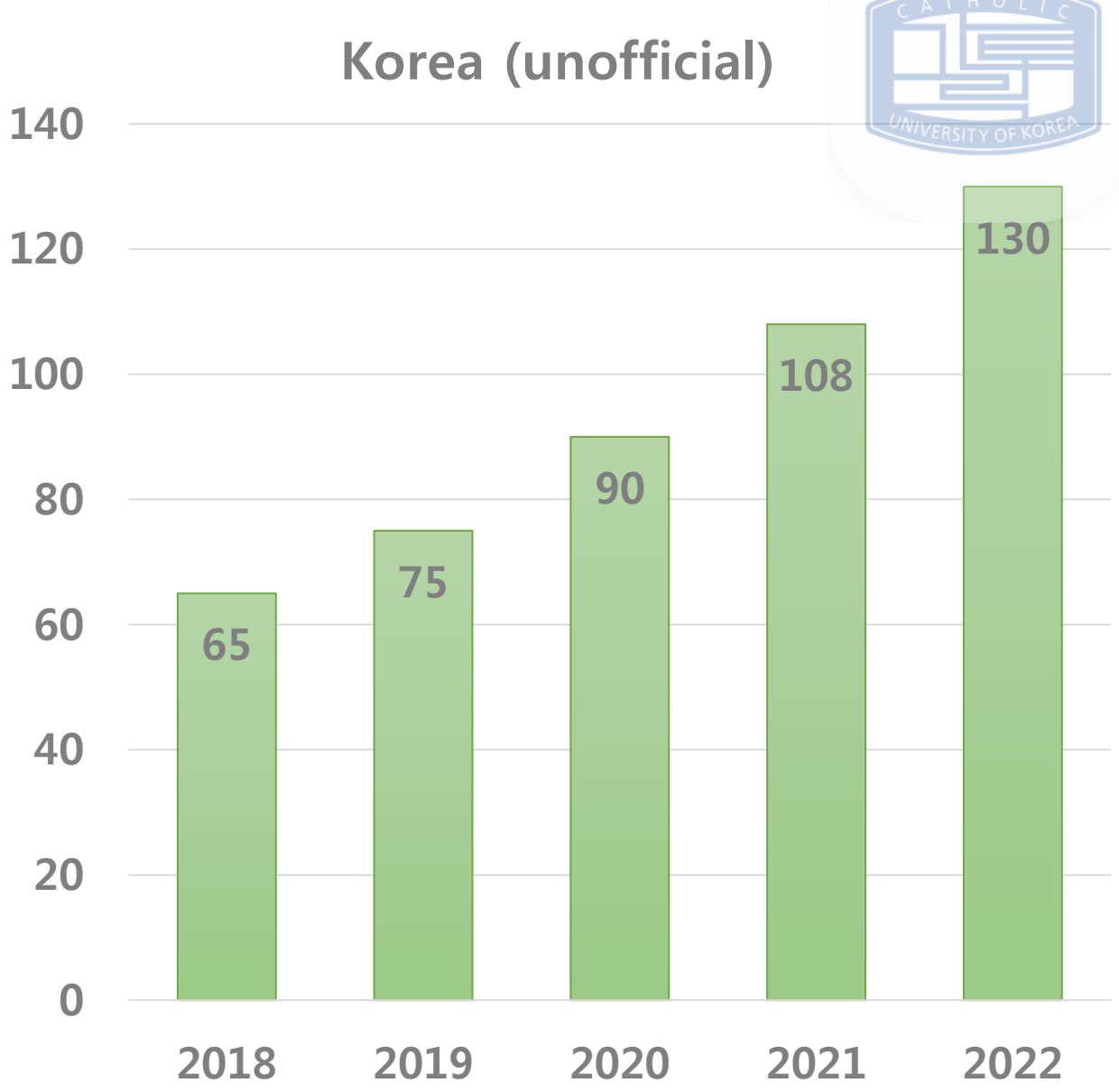
Platform of daVinci





Platform of RAS

Type	N
X/Xi/Si	115
SP	15
Revo-i	4



Workload per Platform (average)

Region	Case/platform
Wordwide	200
US	200
Korea	300+
UK/other	100-150


Regardless of reimbursemt,
The destiny
And the only way..
MARVEL
DOCTOR
STRANGE

The future of urologist

- 3000 urologists in Korea
- 1000 urology local clinics
- 350 general hospital, 221 urology department₩
- 80 GH already have robotics
- Most of the GH have Gyn
- Gyn robotics will expand 4 times to urology
- The monopoly cession will accelerate the supply
- Current non RAS trained doctor may not change to robot surgeon

ROBOTIC-MANAGEMENT FOR RENAL CELL CARCINOMA WITH VENOUS SYSTEM INVOLVEMENT AT A COMMUNITY HOSPITAL: CASE SERIES

28 FEBRUARY 2022 | DOWNLOAD AS | PDF

9 MINS

Guidelines
- Clinical Guidelines
- Best Practices Statements
- Position Statements
- Policy Statements
- White Papers
- Other Clinical Guidance

Home › Guidelines › Guidelines › Other Clinical Guidance › Robotic Surgery (Urologic) SOP

Robotic Surgery (Urologic) Standard Operating Procedure (SOP)

1. Purpose

Computer assisted surgery using remote tele-presence manipulators is widely referred to as robot assisted or robotic surgery. Since the term is used extensively in the press as well as medical journals, the term "robotic surgery" will be used in this document. The purpose of this document is to formulate standard operating practices for institutions to use during the process of credentialing of urologists for privileges to perform robotic surgery. The robotic approach involves the application of robotic technologies used primarily during laparoscopic surgery.

Since robotic technology is used mostly as a tool during laparoscopic surgery, surgeons performing robotic surgery must also be credentialed for privileges to perform laparoscopic surgery. The American Urological Association, Inc.® (AUA) recommends that privileges to perform laparoscopic urological procedures be granted by hospitals only to individuals who meet specific criteria. The surgeon must be proficient with the operative steps of the procedure that is being performed laparoscopically and must be proficient in the management of complications that may occur in association with performing the laparoscopic procedure. Surgeons privileged to perform laparoscopic urologic procedures must also have experience in laparoscopy that is acquired through previous clinical experience or through previous instruction. Lastly, surgeons privileged to perform laparoscopic urologic procedures should have completed an experience in supervised performance of laparoscopic urologic procedures. With laparoscopic urologic procedures performed with or without robotic technologies, institution's must continue to evaluate evidence of the urologist's competence for individual surgical procedures.

The standard operating practices were initially developed in 2009 and revised in April 2013, October 2014, and December 2016.

The New AUAnet

Website Tip!

While viewing Guideline Statements on a desktop computer, use the left navigation to jump to different parts of the page.

Additional Information

- Archived Documents
- Standard Operating Procedures Overview
- Definition Statement
- COI Disclosure
- Topic Submission
- White Paper SOP
- 2018 AQUA Non-QPP Measures

4. Minimum Requirements for Granting Urologic Robotic Privileges

Part 4 A and Part B or C mandatory.

A. Training in Urology

i. Completion of an Accreditation Council for Graduate Medical Education (ACGME) accredited urology residency program and American Board of Urology eligibility or certification.

ii. Training in urology that is recognized as equivalent to item i, by the institution may be adequate.

B. Robotic Surgical Training in Residency and/or Fellowship Programs

i. Robotic surgery is now included in the American Urological Association's (AUA) Core Curriculum for urology residencies. The majority of residencies in urology have adequate training in robotic surgery. The program director must provide credentials to document satisfactory training and confirm competence of the urologist to independently perform robotic surgery. A urologist completing a residency and/or fellowship training program should complete a minimum of 20 cases; these can be pediatric and/or adult robotic surgical cases, but the trainee must have console time for a key portion of the procedure with at least 10 cases.

ii. "A curriculum involving exercises using virtual reality simulators is recommended."

C. No Residency or Fellowship Training in Urologic Robotic Surgery

Several practicing urologists have had no formal training in robotic surgery as described in Part 4B. These physicians should complete a structured training program before being granted privileges. The curriculum/requirement may include the following:

i. Completion of the AUA's *Fundamentals of Urologic Robotic Surgery* module and completion of the post-test for that module with a score of at least 80% correct

한경 사회

비즈니스위크·포브스 MBA 랭킹...왜 한국대학원은 한 곳도 없을까

포브스는 'MBA 졸업 이후 5년간 평균 연봉이 MBA 입학 전보다 얼마나 올랐나'라는 한 가지 기준만 본다.

The Training of RAS in US

- The resident applicant feels the necessity of RAS training and consider it as an important component for application (2021 Mayo recruit)
- Not only a dry and wet lab program supported by the institution, but also the 5-day private training program is also popular (expensive)
- AUA declared the necessity of RAS training (2015)
- At least 20 console surgery is recommended during training
- The importance of PROCTOR !

Robotic Training Centers in the U.S. – Residency Training

Most U.S. Surgical Residency Programs provide Robotic Training:

- Urology
- General Surgery
- Gynecology

***Residency programs that offer robotic surgery training is important to recruiting residents.

Phase 1
Introduction to da Vinci surgical systems

Phase 2
Da Vinci Skills Drills Training

Phase 3
Intra-operative and advanced skills application

Phase 4
Participation in cases with da Vinci systems
(Training Equivalency Certificate Pathway)

Universal Standardized Training for Robotic Surgery

****No Standardized Training for Robotic Surgery has current been developed and universally accepted!**

What should the Training Standards Include?

- ✓ System Technical Information
- ✓ System Setup & Troubleshooting
- ✓ Core Psychomotor Skill Development
- ✓ Competency Validation

TRAINING CURRICULUM

UT Health San Antonio

Considerations

No national standardized curriculum	Institution training program
No current validation of robotic training	Effort on data collection
No uniform credentialing	Promote standardize credentialing

The Training of RAS in Korea

- >80 Medical center already have RAS (N more than training hospital)
- Only few resident expose to RAS during program (due to SA, fellow..)
- Only few fellows have opportunity to perform console
- Bedside assistant is not enough for training
- Few fellow feels that they could play a role as a robot surgeon
- Most of post-oncology fellows feel a lack of RAS training after fellowship
- Resident applicant anticipate the expected income rise after program

Knowledge & Skills Required for Robotic Surgical Practice

Cognitive
- Theoretic Knowledge

- MIS Basic Concepts
- General platform knowledge

Technical
- Aptitude

- Technical Platform Knowledge
- Troubleshooting skills

Psychomotor
- Application

- Application of Skills
- Competency

Robotic Training Centers in the U.S.

Industry Training

(1–2 Day Course)

Intuitive Surgical

- Sunnyvale, California
- Houston, Texas
- Atlanta, Georgia

CMR Surgical

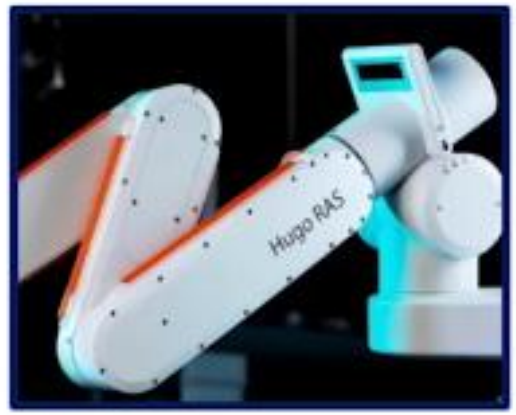
- Celebration, Florida

*Not approved for use in the United States

Medtronic

- Celebration, Florida

*Not approved for use in the United States



Features

- Heavy system orientation
- Some simulation
- Some animate model work

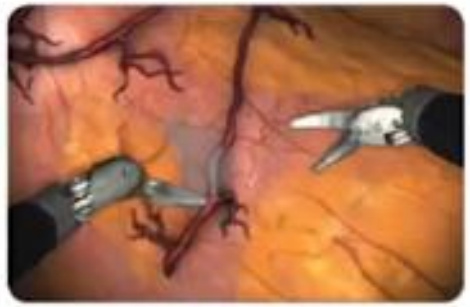
Evaluation & Performance
(Simulation)

Advantages

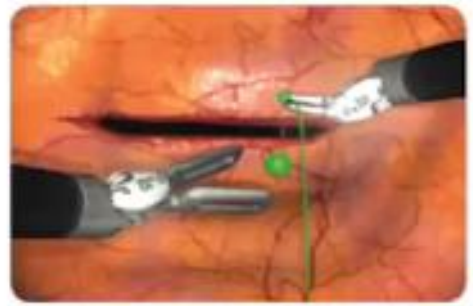
- Cost effective
- Safe *(risk free practice)*
- Objective performance evaluation
- Reproduceable exercises
- Accessible
- Effective skill development & maintenance

EndoWrist® manipulation
Develop *EndoWrist®* dexterity when working with one, two, or three *da Vinci®* Surgical System instruments.

Camera and clutching
Improve camera control and learn to use the clutch effectively. Train while using different motion-scaling settings.



Energy and dissection
Learn to properly apply monopolar and bipolar energy. Practice dissection and manage bleeding.

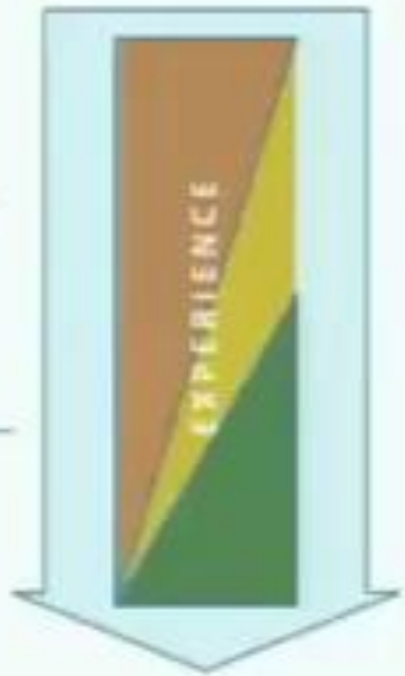


Suturing and knot tying
Improve suturing and knot tying skills with a variety of scenarios. Practice with a range of geometries common to surgery.

Training Curriculum: MENTORSHIP

UT Health San Antonio

LIVE CASE OBSERVATION	Familiarize with the "robot space" Familiarize with the procedure Learn the communication of robotics
BED SIDE ASSISTANCE	Understand mechanic of the robot arms and tower control Familiarize with robot boot position and range of motion Arms docking and undocking – emergent undocking
SURGEON CONSOLE	Supervision Positioning of the patient, ports site: f(complexity of the case) Step wise progression of defined tasks (procedure specific!?) Team training and communication



Develop an algorithm for training surgeons with a stepwise progression

1st Regional Davinci Workshop With KUA/INTUITIVE

Advancing what's possible in minimally invasive care

2022 Mar 24th

Current indications in UROLOGY

(QUITE) ESTABLISHED

- Radical prostatectomy
- Partial Nephrectomy
- Pyeloplasty

(MORE) DEBATED

- Radical cystectomy
  - Urinary diversions
- Nephro-Ureterectomy
- Radical nephrectomy
- Adrenalectomy
- Others (ex. Simple prostatectomy)

Prospective of Healthcare System

$$\frac{\text{Efficacy + Safety + Patient's Experience}}{\text{Cost + Resources}} = \text{Social Value}$$

Prospective of Excellence

$$\frac{\text{Efficacy + Safety + Patient's Experience}}{\text{Cost + Resources}}$$

= Market Value

= Cost, according to

The debate of ‘cost-effectiveness’

- Each healthcare system have some extent of insurance coverage
- Korea have another type of healthcare system covers RAS
- The DRG is one of the reason even US also debates this issue
- EU have far different healthcare system with US

다빈치 로봇수술 제외국 보험현황 (2021년 기준)

1. 주요 국가 로봇수술 급여 현황 요약

국가	로봇수술에 대한 급여 적용(전립선절제술, 부분신장절제술 기준)
미국	복강경 수가 적용
영국	개복, 복강경 수술 대비 특별 가산 적용 - 전립선절제술: 개복수술 대비 약 1.7 배, 복강경수술 대비 약 1.5 배 - 부분신장절제술: 개복,복강경 수술 대비 약 1.4 배
프랑스	복강경 수가 적용
독일	복강경 수가 적용
이탈리아(롬바르디, 투스카니, 베네토)	복강경 수가 적용
일본	개복, 복강경 수술 대비 특별 가산 적용 - 전립선절제술: 개복수술 대비 약 2.3 배, 복강경수술 대비 약 1.2 배 - 부분신장절제술: 개복수술 대비 약 1.7 배, 복강경수술대비 약 1.1 배
대만	복강경 수가로 급여 적용 후 나머지 로봇 비용은 비급여
중국(상하이)	개복, 복강경 수술 대비 특별 가산 적용 - 전립선절제술, 부분신장절제술: 복강경수술 대비 약 5.2 배

Prospective of Management

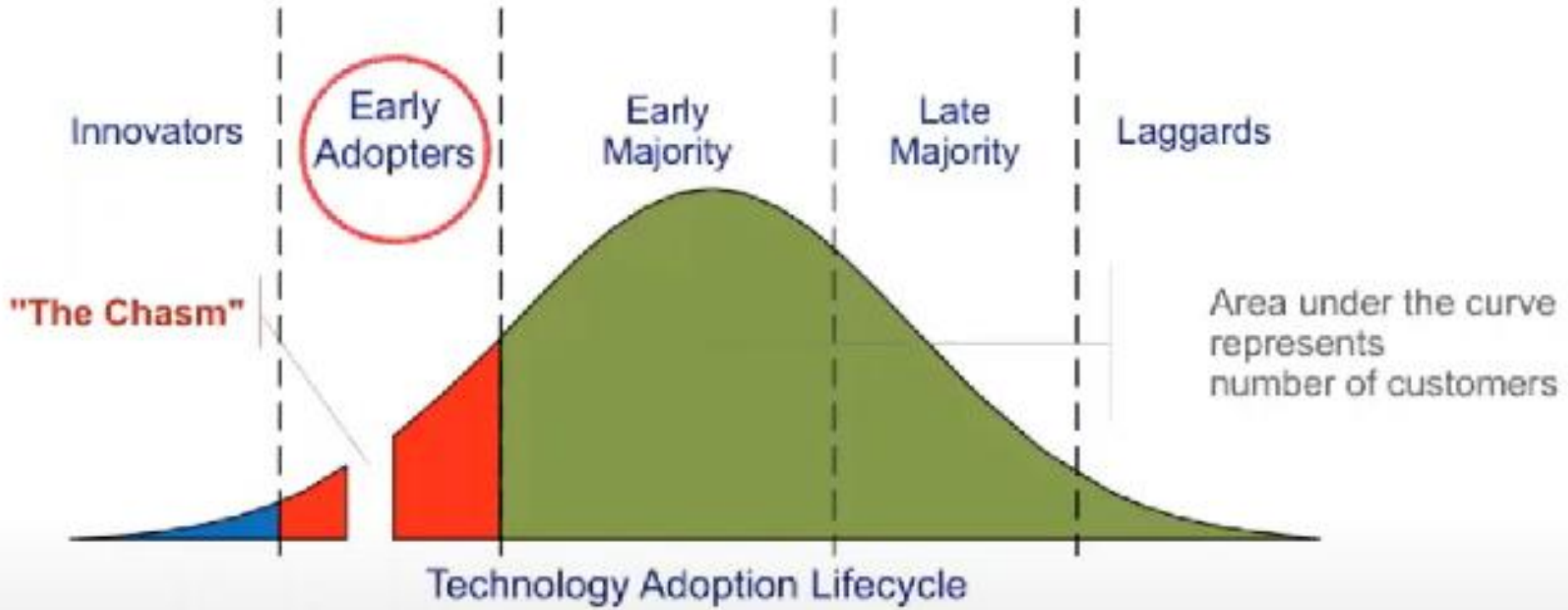
$$\frac{\text{Efficacy + Safety + Patient's Experience + Cost}}{\text{Resources}}$$

= Efficiency

Guidelines on Robotic- and Single-site Surgery in Urolog

A.S. Merseburger (chair), U. Nagele, T.R.W. Herrn
O. Traxer, I. Kyriazis, S.F. Shariat, E.N. Liat

European Association of Urology



"*Diffusion of Innovations*" by sociologist Everett Rogers in 1962

PLOS ONE

PLoS One. 2019; 14(1): e0210401.
Published online 2019 Jan 8. doi: 10.1371/journal.pone.0210401

PMCID: PMC6324816
PMID: 30620766

Comparison of oncological and perioperative outcomes of open, laparoscopic, and robotic nephroureterectomy approaches in patients with non-metastatic upper-tract urothelial carcinoma

Hakmin Lee, Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft,[1] Hak Ju Kim, Investigation, Methodology, Validation,[1] Sang Eun Lee, Data curation, Formal analysis, Resources,[1] Sung Kyu Hong, Data curation, Formal analysis, Methodology,[1] and Seok-Soo Byun, Conceptualization, Visualization, Writing – original draft[1,2,*]

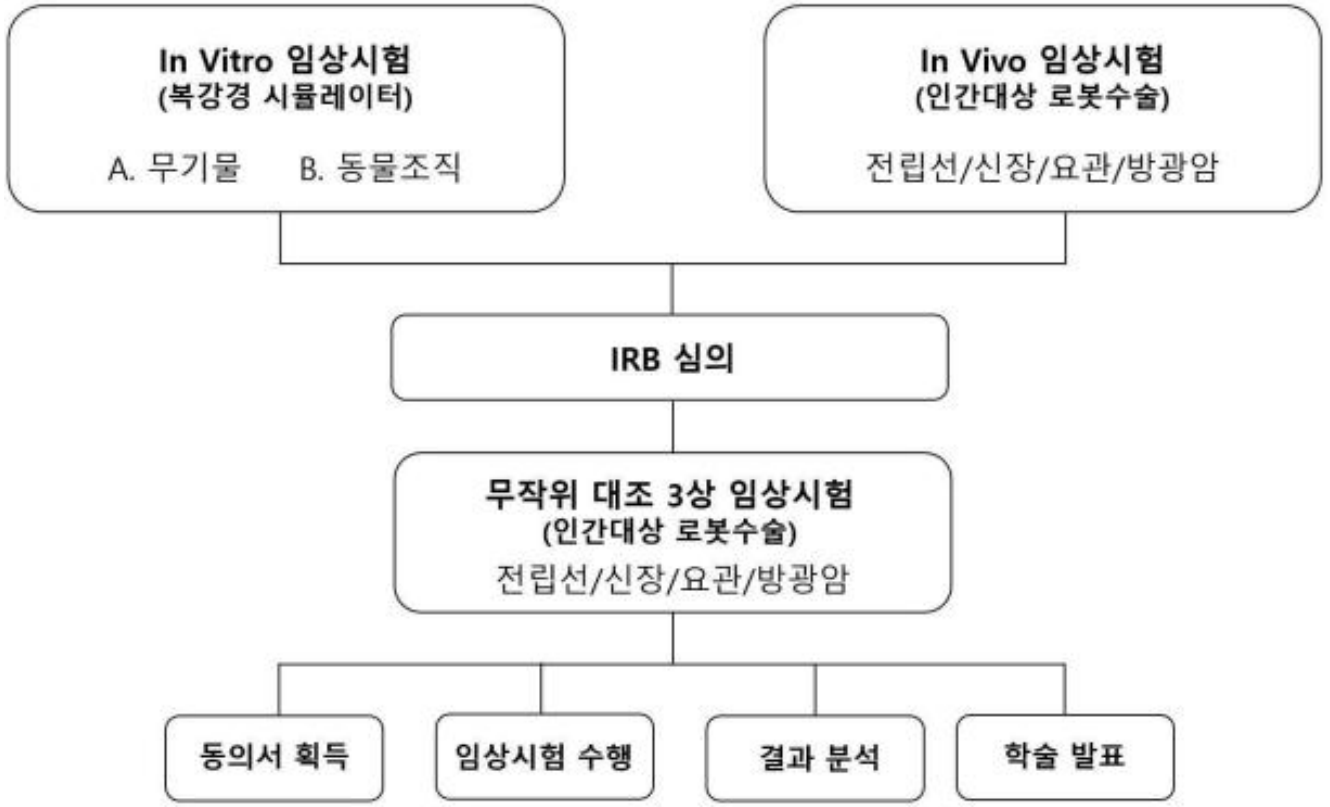
Sarah P. Psutka, Editor

▸ Author information ▸ Article notes ▸ Copyright and License information Disclaimer

Phase III RCT of RAS (incl. SP) is available in Korea

1. 사업 개요

주관기관	주관기관명	가톨릭대학교 산학협력단	대표	전신수
주관연구책임자	소속	가톨릭대학교 인천성모병원 비뇨의학과	성명	김정준
참여기업	기업명	㈜유원메디텍	대표	신영수
담당자	소속	마케팅	성명	민슬기
제품	품목명	소혈관용이식형클립 (3등급)	제품명	VasoClip®
사업 수행기간	2020. 02. 24. ~ 2020. 11. 20.			



<제품 평가 수행 체계도>

IT > 바이오/과학

로펌이 분석한 尹 정부 바이오헬스 정책… “디지털 의료산업 커진다”

‘바이오헬스 한류시대’ 강조한 윤석열 당선인
재활로봇 건보치료·코로나 백신치료제 개발 활성화
디지털병원·디지털의료 등 원격의료 시장 확대 기대

전효진 기자

입력 2022.03.14 14:35

앞서 윤 당선인은 정책공약집을 통해 ▲인공지능(AI) 반도체·로봇 ▲ 양자(퀀텀) ▲ 탄소중립 ▲항공우주 ▲바이오헬스를 ‘5대 메가테크’로 규정하고 이를 육성하겠다고 약속한 바 있다.

- **Expiry of existing key patents in 2019 may soon change this *status quo*, and stimulate a new era of robotic master–slave systems.**

Revo-I

Current "unmet needs" in robotic surgery

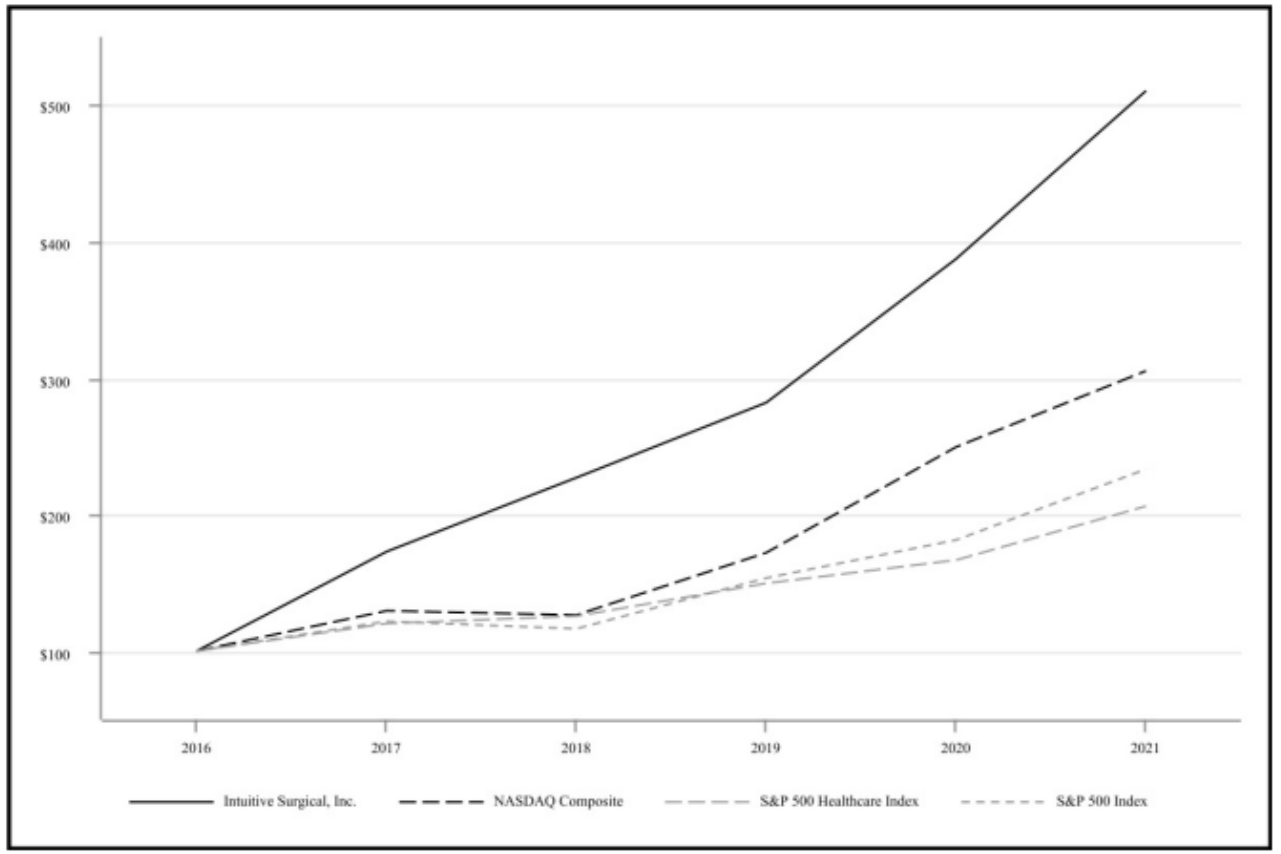
Namdarian B and Dasgupta P, Curr Opin Urol 2018

- Difficult theatre communication between primary surgeon and OR team members because of closed console
- Access – multiple ports with moderately large size
- Limitations of arm clashing and rigidity of placement
- Not all laparoscopic or open instruments available
- No tactile feedback
- Cost

CMR surgical Verisus

Metronic Hugo

COMPARISON OF CUMULATIVE TOTAL RETURN AMONG INTUITIVE, NASDAQ COMPOSITE, S&P HEALTHCARE INDEX, AND S&P 500 INDEX



Intuitive

Nasdaq

S&P 500 Healthcare

	December 31,					
	2016	2017	2018	2019	2020	2021
Intuitive Surgical, Inc.	$ 100.00	$ 172.64	$ 226.56	$ 281.54	$ 387.01	$ 509.91
Nasdaq Composite	$ 100.00	$ 129.64	$ 125.96	$ 172.18	$ 249.51	$ 304.85
S&P 500 Healthcare Index	$ 100.00	$ 120.00	$ 125.63	$ 149.10	$ 166.14	$ 206.29
S&P 500 Index	$ 100.00	$ 121.83	$ 116.49	$ 153.17	$ 181.35	$ 233.41

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the fiscal year ended December 31, 2021

Intuitive

Collapse

NASDAQ: ISRG
Intuitive Surgical, Inc.

Today's Change
(1.09%) US$3.15
Current Price
US$291.82

1W 1M 3M 1Y **5Y** MAX **Price** Vs S&P

KEY DATA POINTS

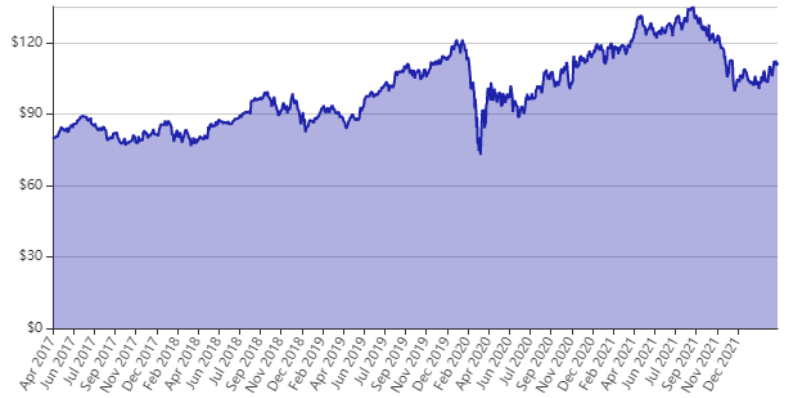
Market Cap	$104B
Day's Range	US$286.12 - US$293.56
52wk Range	US$253.19 - US$369.69
Volume	1,329,185
Avg Vol	1,979,387
P/E (ttm)	60.30

Medtronic

Collapse

NYSE: MDT
Medtronic plc

Today's Change
(0.55%) US$0.61
Current Price
US$112.33



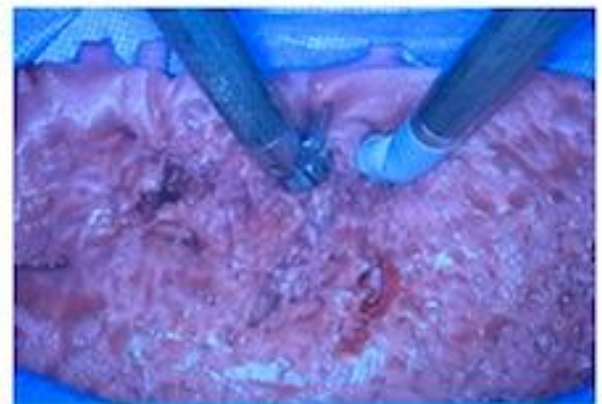
1W 1M 3M 1Y **5Y** MAX **Price** Vs S&P

KEY DATA POINTS

Market Cap	$150B
Day's Range	US$110.89 - US$113.12
52wk Range	US$98.38 - US$135.89
Volume	6,668,569
Avg Vol	6,487,363
P/E (ttm)	30.58

ROBOTIC SYSTEMS

INSTRUMENTATION + IMPLANTS



VISUALIZATION + NAVIGATION

DATA + ANALYTICS

Prepare

Touch Surgery™ App

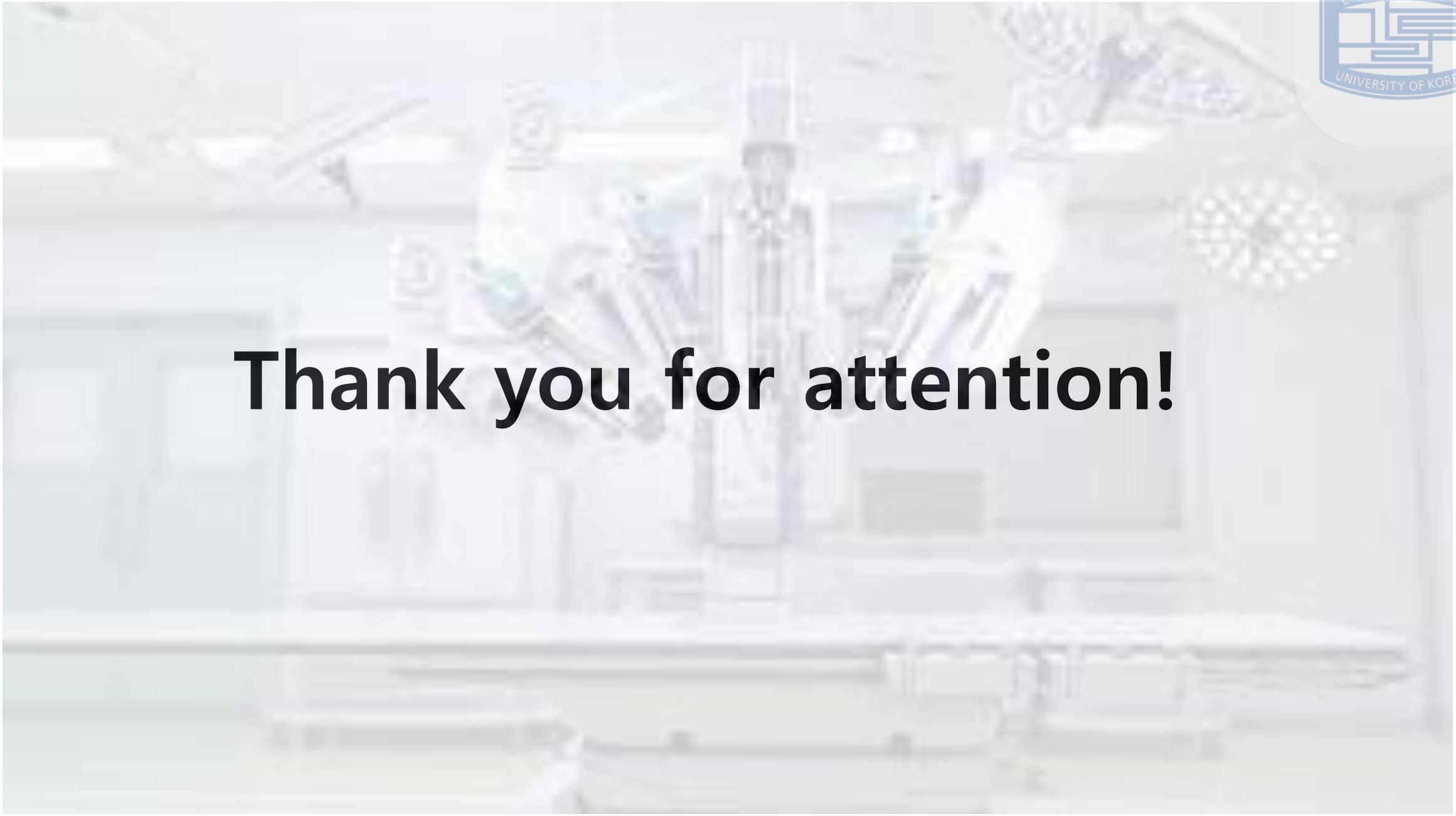
Analyze

Touch Surgery™ Enterprise

Medtronic

Summary

- The RAS is not the future, but the present.
- RAS accounts for 3% of the whole surgery, will expand excessively to primary care.
- The current training program should cover RAS for reducing the error due to lack of RAS training.
- Console training is essential and mandatory.
- The cession of monopoly will accelerate the advancement.
- Korea should participate in the RAS industry and the new government is ready to go.



Thank you for attention!