대한비뇨기종양학회
대한전립선학회
비뇨기계기초의학연구회

공동심포지엄

| 일시 | 2019년 1월 19일(토) 08:30~12:40

| 장소 | 삼성서울병원 암병원 B1 대강당

대한비뇨기종양학회 The Korean Urological Oncology Society

대한전립선학회 The Korean Prostate Society

비뇨기계기초의학연구회 Korean Society of Urological Research

대한비뇨기종양학회-대한전립선학회-비뇨기계기초의학연구회

공동심포지엄

인사말

안녕하십니까?

2019년 황금돼지띠를 시작하는 연초에 대한비뇨기종양학회-대한전립선학회-비뇨기계기초의학연구회 공동심포지엄을 준비하여 여러분을 초대하고자 합니다.

세 단체가 함께 뜻을 모아 공동심포지엄을 개최하게 되어 매우 뜻깊게 생각합니다. 2019년 1월 19일 삼성서울병원 암병원 대강당에서 개최되는 이번 공동심포지엄은 전립선암과 관련된 Biomarker, Genomic analysis, Big data analysis와 최신 기술의 세션으로 프로그램을 구성하였습니다.

더불어 전립선 암 연구 분야의 젊은 연구자들의 강의 세션을 구성하여 국내에서 활발히 진행되고 있는 전립선 관련 연구의 임상 경험을 공유할 수 있는 자리를 마련하였습니다.

부디 이번 공동심포지엄이 유익한 학문적 정보를 나누는 상호 교류의 자리가 될 수 있도록 회원 여러분들의 많은 참여 부탁드립니다.

2019년 1월

대한비뇨기종양학회 회장 **전성수**

대한전립선학회 회장 **이지열**

비뇨기계기초의학연구회 회장 **이상돈**

대한비뇨기종양학회-대한전립선학회-비뇨기계기초의학연구회

공동심포지엄

| 일시 | 2019년 1월 19일(토) 08:30~12:40
| 장소 | 삼성서울병원 암병원 B1 대강당

프로그램

08:30-08:50	Registration	
08:50-09:00	Opening remark	대한비뇨기종양학회 회장 **전성수**
	축사	대한비뇨기과학회 회장 **이규성**
09:00-10:00	**Session 1. New biological markers in assessing the prostate cancer aggressiveness**	**좌장: 이상돈** (부산의대)
	Critical roles of *hMAGEA2* in prostate cancer and development of cancer animal model	**박 송** (DGIST)
	Identification of novel biomarkers for diagnosis of metastatic prostate cancer	**이상규** (경북대 약대)
	Urine-based liquid biopsy: non-invasive and sensitive AR-V7 detection in urinary EVs from patients with prostate cancer	**구자윤** (부산의대)
10:00-10:40	**Session 2. Genomic analysis through comprehensive DNA panels**	**좌장: 변석수** (서울의대)
	Feasibility of ctDNA in cancer	**조영남** (국립암센터)
	ctDNA to predict prognosis of prostate cancer	**조은해** (녹십자지놈)
10:40-11:00	Coffee break	
11:00-12:00	**Session 3. A nationwide population-based study using data from the Korean national health insurance system**	**좌장: 전성수** (성균관의대)
	Medical Travel among Prostate cancer patients	**김재헌** (순천향의대)
	National practice patterns and direct medical costs for prostate cancer in Korea across a 10 year period	**강호원** (충북의대)
	Lifestyle risk prediction model for prostate cancer in a Korean population	**김성한** (국립암센터)
12:00-12:40	**Session 4. The latest technology in future perspectives**	**좌장: 김청수** (울산의대)
	Surgical simulation in Urology	**고영휘** (영남의대)
	Digital health and future technology	**이건명** (충북대학교)
12:40	Closing remark	비뇨기계기초의학연구회 회장 **이상돈**

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목차

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Session 1

New biological markers in assessing the prostate cancer aggressiveness

좌장: 이상돈 (부산의대)

Critical roles of *hMAGEA2* in prostate cancer and development of cancer animal model — **박 송** (DGIST)

Identification of novel biomarkers for diagnosis of metastatic prostate cancer — **이상규** (경북대 약대)

Urine-based liquid biopsy: non-invasive and sensitive AR-V7 detection in urinary EVs from patients with prostate cancer — **구자윤** (부산의대)

Critical roles of *hMAGEA2* in prostate cancer and development of cancer animal model

Song Park

Core Protein Resource Center, DGIST, Daegu, Republic of Korea

The human melanoma-associated antigen A2 (*hMAGEA2*) genes are a sub-family of cancer/testis antigens (CTAs). The *hMAGEA* family of genes is composed of *hMAGEA1* to *hMAGEA12*. Because of their high sequence homology, MAGEA proteins are considered functionally redundant. However, the role of *hMAGEA2* in prostate cancer is still poorly understood. Hence, we investigated whether the expression of *hMAGEA2* is associated with prostate cancer progression. We confirmed the upregulation of *hMAGEA2* expression in human prostate tissue samples. In addition, using *hMAGEA2* knockdowned prostate cancer cell lines, PC3M and 22RV1, we found *hMAGEA2* contributed cell proliferation and colony formation ability. We also observed that knockdown of *hMAGEA2* dramatically decreases cell migration and invasion in transwell assays. Additionally, we confirmed the EMT (Epithelial-mesenchymal transition) marker genes in *hMAGEA2* knockdowned PC3M and 22RV1 cells. Additionally, we performed a microarray analysis to confirm at changes in overall gene expression. Animal models are also important for cancer research. Thus, we are in the process of crossing *hMAGEA2* overexpressed transgenic mice with TRAMP mice to confirm the occurrence of prostate cancer in animal cancer model. these results suggest that *hMAGEA2* plays an important role prostate cancer progression.

Identification of novel biomarkers for diagnosis of metastatic prostate cancer

이 상 규
경북대 약대

Prostate cancer (PCa) is the development of cancer in the prostate, which is located in front of the rectum and below the bladder. PCa is one of the most commonly occurring genital cancer in men. In 2017, the American Cancer Society estimated about 164,690 new cases of PCa, comprising about 57% of all new cases of cancer in the genital system. PCa was originally considered a cancer of the elderly, but patients of below 55 years of age diagnosed with PCa is increasing over 10% in the U.S today. PCa is the leading cancer type for most new cases and the third-highest for cancer deaths. The number of PCa patients is expected to increase because of the aging and expanding population. Although the five-year survival rate of localized PCa is >99%, the outlook is poor once PCa advances. Numerous reports have demonstrated the metastasis of cancer represents the main cause of malignancy, leading to diverse changes in metastatic regulatory factors. Silent information regulator 2-like proteins (sirtuins) are highly conserved proteins with nicotinamide adenine dinucleotide (NAD)-dependent deacylase activity, which includes the class III histone deacetylase enzyme. There are seven sirtuins in mammals, SIRT1 to SIRT7, that have different subcellular localization as well as a variety of different functions. Sirtuins have key roles in normal and disease cells, like cancer cells. Some scientists have insisted that sirtuins can regulate glutaminolysis and glycolysis, which are related to cancer metabolism. Sirtuins are also known to influence genomic instability by regulating the cell cycle, DNA repair, cell survival, and apoptosis. Among of 7 SIRTs, SIRT5 is defined as NAD^+-dependent lysine deacetylase, demalonylase, desuccinylase and deglutarylase. SIRT5 play a role in tumorigenesis by regulating desuccinylation involved in specific enzymes activities.

Here, we demonstrated that SIRT5 levels in T3 grade PCa patients is decreased compared to normal and T2 grade patients using sandwich ELISA. From proteomic analysis results, we speculate that SIRT5 can regulate phosphatidylinositol 3-kinase regulatory subunit beta (PIK3R2) activation, which is a class 1 regulatory subunit of PI3K linked to the Akt/NF-*kB* pathway by directly binding PI3K. Furthermore, we

demonstrated that mRNA level of *IL-1B* was dramatically increased in PC-3/SIRT5 KO. This indicates that NF-*kB* positively regulates transcription of IL-1*B* to induce prostate cancer metastasis. Our work demonstrates that SIRT5 may be used as a biomarker and as a therapeutic target for inhibiting NF-*kB* in PCa.

Urine-based liquid biopsy: non-invasive and sensitive AR-V7 detection in urinary EVs from patients with prostate cancer

구 자 윤
부산의대

Androgen-receptor splice variant 7 (AR-V7) is associated with castration-resistant prostate cancer (CRPC) and resistance to anti-androgen therapy. Despite its clinical importance, the lack of efficient methods for AR-V7 analysis remains a challenge for broader use of this biomarker in routine clinical practice. Herein, we suggest a practical and non-invasive liquid biopsy method for analysis of AR-V7 in the RNA of urinederived extracellular vesicles (EVs) without the need for blood withdrawal. Urine-derived EVs were isolated by a lab-on-a-disc integrated with six independent nanofiltration units (Exo-Hexa) allowing simultaneous processing of six individual samples. Rapid enrichment of EVs (<30 min) from each 4 mL urine sample was followed by mRNA extraction, and AR-V7 and androgen receptor full-length (AR-FL) mRNA levels in the urinary EVs were quantified by droplet digital polymerase chain reaction (ddPCR) as absolute concentrations (copies per mL). Higher AR-V7 and lower AR-FL expressions were detected in urine-derived EVs from 14 patients with CRPC than in those from 22 patients with hormone-sensitive prostate cancer. Additionally, we found that AR-V7 transcript levels and the AR-V7/AR-FL ratio in urinary EVs were higher in patients with advanced prostate cancer. This study is the first to report that RNA of urine-derived EVs is a reliable source for AR-V7 expression analysis. The proposed method for quantifying AR-V7 in urinary EVs prepared by a lab-on-a-disc is therefore a simple and promising approach to liquid biopsy with great potential for therapeutic impact on prostate cancer.

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Session 2

Genomic analysis through comprehensive DNA panels

좌장: 변석수 (서울의대)

Feasibility of ctDNA in cancer	**조영남** (국립암센터)
ctDNA to predict prognosis of prostate cancer	**조은해** (녹십자지놈)

Feasibility of ctDNA in cancer

Youngnam Cho

Biomarker Branch, National Cancer Center

The exploration and analysis of circulating cancer biomarkers (i.e., circulating tumor cells (CTCs), circulating cell-free DNA (cfDNA), and exosome) is of great significance for the early detection and screening of cancer. In contrast to tissue biopsy, tumor-specific biomarkers provide a minimally invasive procedure for establishing therapeutic strategies by tracing the molecular events that are closely implicated with cancer development, progression, and metastasis. Because circulating cancer biomarkers are recognized as promising biomarkers for the diagnosis and prognosis of several epithelial cancers, many efforts are directed toward the development of efficient isolation and analysis techniques. However, at present, the lack of efficient strategies to directly isolate them from the plasma has become a great hindrance to their potential clinical use. Here, we present blood-based assays that can efficiently isolate, detect, and analyze tumor-related circulating markers. The real-time cancer monitoring allows us to understand dynamic pictures of molecular disease changes that could be useful to guide cancer screening and treatment decisions.

References

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Keywords: cancer, circulating tumor cells, circulating cell-free DNA, exosome, liquid biopsy, conducting polymer, mutation detection

ctDNA to predict prognosis of prostate cancer

조 은 해
GC Genome

전립선암은 다양한 임상적인 결과와 분자적 특징을 가진 암종으로 바이오마커에 근거하여 치료방법을 최적화할 수 있다. 하지만 종양의 조직검사는 병소내나, 전이병소간 유전체의 이질성을 가지기 때문에 전반적인 종양의 유전체적 변화를 포괄적으로 반영하지 못하고, 수시로 획득할 수 없으므로 환자의 실시간 상태를 반영할 수 없다. 혈장에서 분리된 ctDNA (circulating tumor DNA)는 tumor burden이 충분하다면 전반적인 암세포의 유전적 변화를 실시간으로 검출할 수 있다는 장점을 가지고 있다. 액체생검을 이용한 전립선암의 유전체적 분류는 각 환자의 적합한 치료법을 예측하고, 모니터링하여, 적정 시기에 치료방법을 변경하는 데 큰 역할을 하리라 기대된다. ctDNA의 혈중량이 증가할수록 진행성 전립선암의 예후와의 상관성이 보고된 바 있으며, 특히 AR receptor amplification이나 돌연변이는 호르몬 치료에 대한 저항성 마커로써 이용될 수 있다. 또한 혈액 또는 소변에서 유리된 ctDNA를 Whole genome sequencing을 통해 분석할 경우, genomic instability가 심할 경우 환자의 좋지 않은 예후와 연관됨이 보고된 바 있다. 본 연제에서는 주로 whole genome sequencing을 통한 전립선암의 연구경험 및 ctDNA의 최신 연구경향을 공유하고자 한다.

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Session 3

A nationwide population-based study using data from the Korean national health insurance system

좌장: 전성수 (성균관의대)

Medical Travel among Prostate cancer patients	**김재헌** (순천향의대)
National practice patterns and direct medical costs for prostate cancer in Korea across a 10 year period	**강호원** (충북의대)
Lifestyle risk prediction model for prostate cancer in a Korean population	**김성한** (국립암센터)

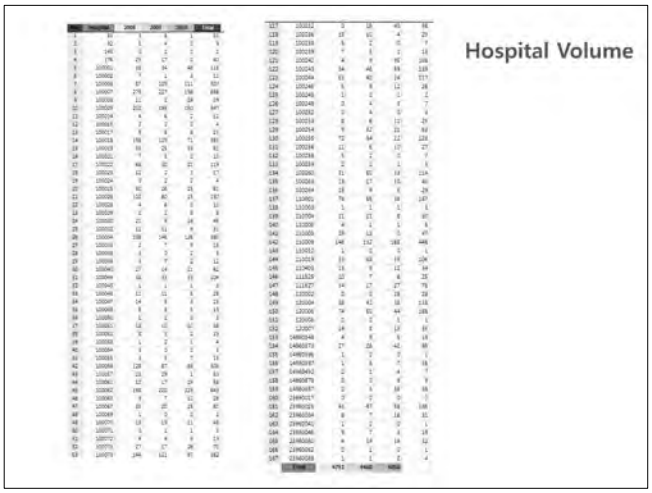
Medical Travel among Prostate cancer patients

Jae Heon Kim

Soonchunhyang University Seoul Hospital

Medical Travel Issue

- A part of volume study
- Hospital volume (Annual), Surgeon volume (Annual), Patient volume (Annual), Doctor/Surgeon density
- Travel = or ≠ Centralization

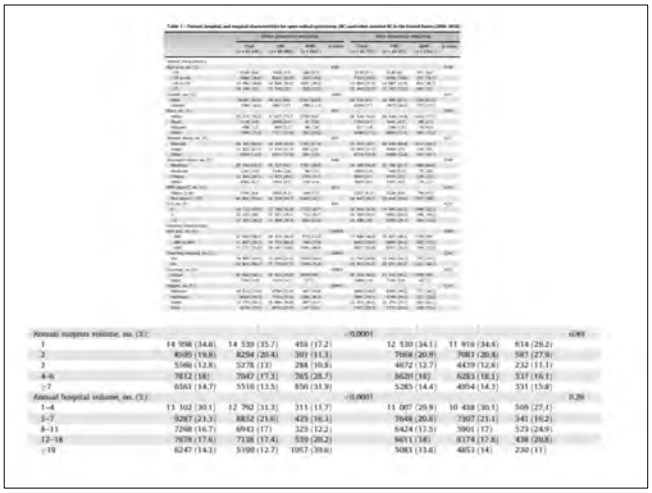


Hospital volume was defined as the annual number of procedures (patients) linked to the same hospital site code (pseudonyms).

Overall hospital volume was calculated separately for each procedures.

As no evidence-based categorization of hospital volume exists, hospitals were grouped empirically into quintiles

Comparative effectiveness according to Procedure types
: Peri or Post-operative outcomes or complications
Direct or Indirect Cost
=> Cost-effectiveness study



Vol. 187, 1632-1638, May 2012
Printed in U.S.A.
DOI:10.1016/j.juro.2011.12.071

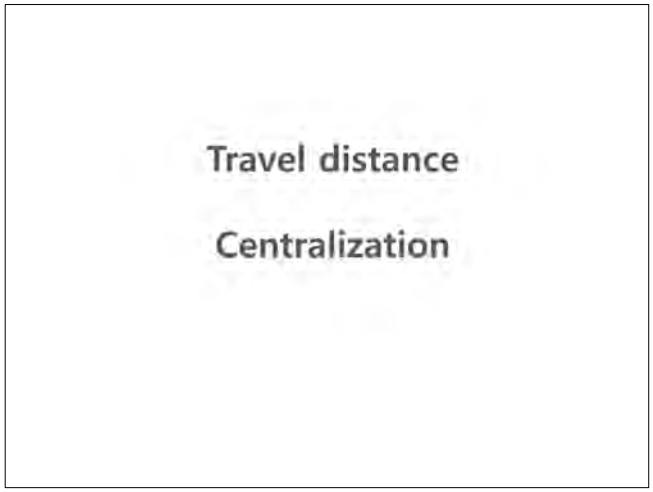
Hospital Volume, Utilization, Costs and Outcomes of Robot-Assisted Laparoscopic Radical Prostatectomy

Hua-yin Yu, Nathanael D. Havelone, Stuart R. Lipsitz, Keith J. Kowalczyk, Paul L. Nguyen and Jim C. Hu*

Abbreviations and Acronyms

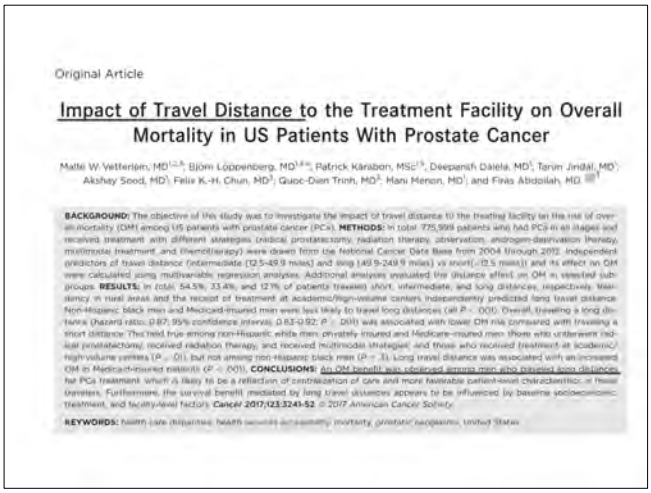
Purpose: Although robot-assisted laparoscopic radical prostatectomy has been aggressively marketed and rapidly adopted, there is a paucity of population based utilization, outcome and cost data. High vs low volume hospitals have better outcomes for open and minimally invasive radical prostatectomy (robotic or laparoscopic) but to our knowledge volume outcomes effects for robot-assisted laparoscopic radical prostatectomy alone have not been studied.
Materials and Methods: We characterized robot-assisted laparoscopic radical prostatectomy outcome by hospital volume using the Nationwide Inpatient Sample during the last quarter of 2008. Propensity scoring methods were used to assess outcomes and costs.
Results: At high volume hospitals robot-assisted laparoscopic radical prostatectomy was more likely to be done on men who were white with an income in the highest quartile and age less than 50 years than at low volume hospitals (each $p < 0.01$). Hospitals at above the 50th volume percentile were less likely to show miscellaneous medical and overall complications ($p = 0.01$). Low vs high volume hospitals had longer mean length of stay (1.9 vs 1.6 days) and incurred higher median costs ($12,754 vs $8,623, each $p < 0.01$).
Conclusions: Demographic differences exist in robot-assisted laparoscopic radical prostatectomy patient populations between high and low volume hospitals. Higher volume hospitals showed fewer complications and lower costs than low volume hospitals on a national basis. These findings support referral to high volume centers for robot-assisted laparoscopic radical prostatectomy to decrease complications and costs.

For another article on a related topic see page 1861.



Travel distance

Centralization



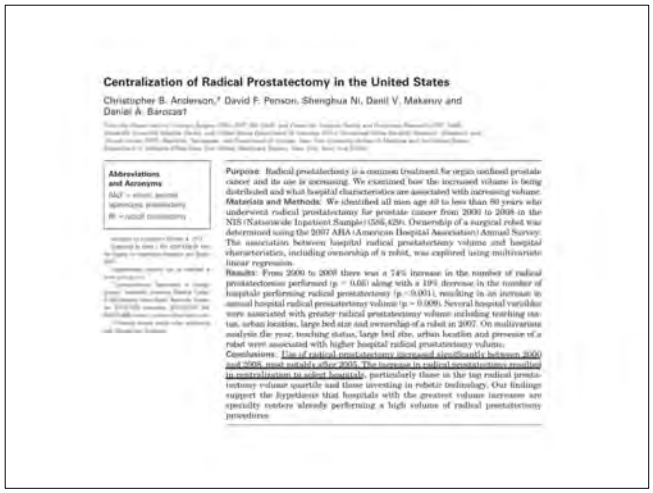
Original Article

Impact of Travel Distance to the Treatment Facility on Overall Mortality in US Patients With Prostate Cancer

Mattè W. Vetterlein, MD[1,2,3]; Björn Loppenberg, MD[1,4,5]; Patrick Karabon, MSc[1,3]; Deepansh Dalela, MD[1]; Tarun Jindal, MD[1]; Akshay Sood, MD[1]; Felix K.-H. Chun, MD[3]; Quoc-Dien Trinh, MD[2]; Mani Menon, MD[1]; and Firas Abdollah, MD[1]

BACKGROUND: The objective of this study was to investigate the impact of travel distance to the treating facility on the risk of overall mortality (OM) among US patients with prostate cancer (PCa). **METHODS:** In total, 775,999 patients who had PCa in all stages and received treatment with different strategies (radical prostatectomy, radiation therapy, observation, androgen-deprivation therapy, multimodal treatment, and chemotherapy) were drawn from the National Cancer Data Base from 2004 through 2012. Independent predictors of travel distance (intermediate (12.5-49.9 miles) and long (≥49.9-249.9 miles) vs short (<12.5 miles)) and its effect on OM were calculated using multivariable regression analyses. Additional analyses evaluated the distance effect on OM in selected subgroups. **RESULTS:** In total, 54.5%, 33.4%, and 12% of patients traveled short, intermediate, and long distances, respectively. Tendency in rural areas and the receipt of treatment at academic/high-volume centers independently predicted long travel distance. Non-Hispanic black men and Medicaid-insured men were less likely to travel long distances (all $P < .001$). Overall, traveling a long distance (hazard ratio, 0.87; 95% confidence interval, 0.83-0.92; $P < .001$) was associated with lower OM risk compared with traveling a short distance. This held true among non-Hispanic white men privately insured and Medicare-insured men (those who underwent radical prostatectomy, received radiation therapy, and received multimodal strategies) and those who received treatment at academic/high-volume centers ($P < .01$), but not among non-Hispanic black men ($P = .3$). Long travel distance was associated with an increased OM in Medicaid-insured patients ($P < .001$). **CONCLUSIONS:** An OM benefit was observed among men who traveled long distances for PCa treatment, which is likely to be a reflection of centralization of care and more favorable patient-level characteristics. In these centers, furthermore, the survival benefit mediated by long travel distances appears to be influenced by baseline socioeconomic, treatment, and facility-level factors. *Cancer* 2017;123:3243-52. © 2017 American Cancer Society.

KEYWORDS: health care disparities, health services research, mortality, prostatic neoplasms, United States



Centralization of Radical Prostatectomy in the United States

Christopher B. Anderson,* David F. Penson, Shenghua Ni, Danil V. Makarov and Daniel A. Barocas†

Abbreviations and Acronyms

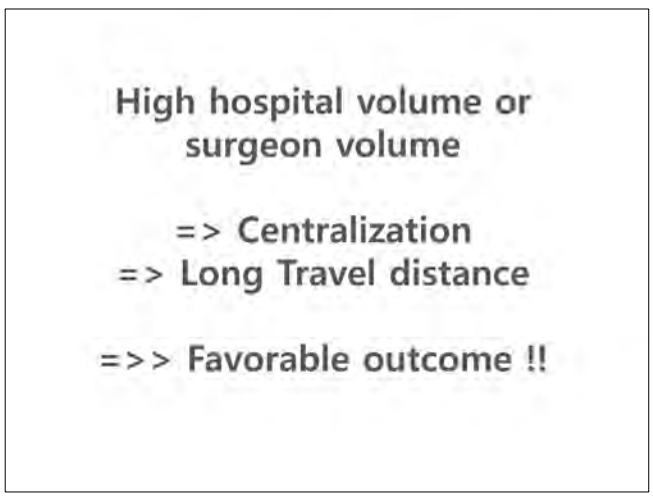
Purpose: Radical prostatectomy is a common treatment for organ confined prostate cancer and its use is increasing. We examined how the increased volume is being distributed and what hospital characteristics are associated with increasing volume.
Materials and Methods: We identified all men age 40 to less than 80 years who underwent radical prostatectomy for prostate cancer from 2000 to 2008 in the NIS (Nationwide Inpatient Sample) (568,429). Ownership of a surgical robot was determined using the 2007 AHA (American Hospital Association) Annual Survey. The association between hospital radical prostatectomy volume and hospital characteristics, including ownership of a robot, was explored using multivariate linear regression.
Results: From 2000 to 2008 there was a 74% increase in the number of radical prostatectomies performed ($p = 0.08$) along with a 19% decrease in the number of hospitals performing radical prostatectomy ($p < 0.001$), resulting in an increase in annual hospital radical prostatectomy volume ($p = 0.009$). Several hospital variables were associated with greater radical prostatectomy volume including teaching status, urban location, large bed size and ownership of a robot in 2007. On multivariate analysis the year, teaching status, large bed size, urban location and presence of a robot were associated with higher hospital radical prostatectomy volume.
Conclusions: The of radical prostatectomy increased significantly between 2000 and 2008, most notably after 2005. The increase in radical prostatectomy resulted in centralization to select hospitals, particularly those in the top radical prostatectomy volume quartile and those investing in robotic technology. Our findings support the hypothesis that hospitals with the greatest volume increases are specialty centers already performing a high volume of radical prostatectomy procedures.

Trends in Radical Prostatectomy: Centralization, Robotics, and Access to Urologic Cancer Care

Karyn B. Stitzenberg, MD, MPH[1,2]; Yu-Ning Wong, MD, MSCE[3]; Matthew L. Nielsen, MD[1,2]; Brian L. Egleston, MPP, PhD[3]; and Robert G. Uzzo, MD[1]

BACKGROUND: Robotic surgery has been widely adopted for radical prostatectomy. We hypothesized that this change is rapidly shifting procedures away from hospitals that do not offer robotics and consequently increasing patient travel. **METHODS:** A population-based observational study of all prostatectomies for cancer in New York, New Jersey, and Pennsylvania from 2000 to 2009 was performed using hospital discharge data. Hospital procedure volume was defined as the number of prostatectomies performed for cancer in a given year. Straight-line travel distance to the treating hospital was calculated for each case. Hospitals were contacted to determine the year of acquisition of the first robot. **RESULTS:** From 2000 to 2009, the total number of prostatectomies performed annually increased substantially. The increase occurred almost entirely at the very high-volume centers (>106 prostatectomies/year). The number of hospitals performing prostatectomy fell 37% from 2000 to 2009. By 2009, the 9% (21/244) of hospitals that had very high volume performed 57% of all prostatectomies, and the 35% (86/244) of hospitals with a robot performed 85% of all prostatectomies. The median travel distance increased 54% from 2000 to 2009 ($P < .001$). The proportion of patients traveling ≥15 miles increased from 24% to 40% ($P < .001$). **CONCLUSIONS:** Over the past decade, the number of radical prostatectomies performed has risen substantially. These procedures have been increasingly centralized at high-volume centers, leading to longer patient travel distances. Few prostatectomies are now performed at hospitals that do not offer robotic surgery. *Cancer* 2012;118:5462. © 2011 American Cancer Society.

KEYWORDS: prostatectomy, robotic surgery, centralization, RALP, prostate cancer, surgical volumes



High hospital volume or surgeon volume

=> Centralization
=> Long Travel distance

=>> Favorable outcome !!

Factors Associated With Adoption of Robotic Surgical Technology in US Hospitals and Relationship to Radical Prostatectomy Procedure Volume

Gabriel L. Barbash, MD, MPH, Bernard Friedman, PhD,† Sherry A. Glied, PhD,‡ and Claudia A. Steiner, MD, MPH§*

Objective: Robotic technology has diffused rapidly despite high error and limited additive reimbursement by major payers. We aimed to identify the factors associated with hospitals' decisions to adopt robotic technology and the consequences of those decisions.

Methods: This observational study used data on hospitals and market areas from 2003 to 2009. Included were hospitals in census-based statistical areas within states in the State Inpatient Database that participated in the American Hospital Association annual surveys and performed radical prostatectomies. The likelihood that a hospital would acquire a robotic facility and the rates of radical prostatectomy relative to the prevalence of robots in geographic market areas were assessed using multivariable methods.

Results: Hospitals in areas where a higher proportion of other hospitals had already acquired a robot were more likely to acquire one ($P = 0.017$), as were those with fewer than 300 beds ($P < 0.0001$) and teaching hospitals ($P < 0.0001$). There was a significant association between years with a robot and the change in the number of radical prostatectomies ($P < 0.001$). More radical prostatectomies were performed in areas where the number of robots per 100,000 men was higher ($P < 0.0001$). Adding a single robot per 100,000 men in an area was associated with a 30% increase in the rate of radical prostatectomies.

Conclusion: Local area robot competition was associated with the rapid spread of robot technology in the United States. Significantly more radical prostatectomies were performed in hospitals with robots and in markets areas of hospitals with robotic technology.

Keywords: diffusion of medical technologies, robot-assisted surgery, hospital competition, radical prostatectomy

The rapid pace of adoption of this technology is difficult to understand. Despite high adoption and operating costs, neither surgeons nor hospitals routinely receive higher reimbursement for performing robot-assisted procedures. Most leading payers, including Medicare, Cigna, United Healthcare, and many Blue Cross/Blue Shield plans, have considered robotic assistance incidental to the primary surgical procedure and not as separately billable.[4]

If surgery is profitable for a hospital, that hospital may purchase robots to attract surgeons who, in turn, bring their patients to the hospital. Prior research has shown that hospitals are most likely to purchase technologies to attract patients in areas where they face competition from other hospitals. Aggressive direct-to-consumer marketing by hospitals and the surgical robot manufacturer may create a patient demand for robotic prostate surgery. Consistent with this consumer-driven hypothesis, Stitzenberg et al[5] reported that patients traveled longer distances to hospitals in which robot-assisted surgery was performed.

The aims of this study were to identify hospital and area characteristics associated with robot acquisition and the relationship between robot acquisition and the subsequent volume of radical prostatectomies. We hypothesized that competition from other facilities with robots was a major determinant in the decision to acquire a robot and that the number of hospitals with robots in an area was associated with the volume of radical prostatectomies performed on local male residents in that area.

METHODS

Annals of Surgery • Volume 259, Number 1, January 2014

Robotic prostatectomy is associated with increased patient travel and treatment delay

Matthew J. Maurice, MD,[a] Hui Zhu, MD,[a,b] Simon P. Kim, MD,[c] Robert Abouassaly, MD[c]

Abstract

Introduction: New technologies may limit access to treatment. We investigated radical prostatectomy (RP) access over time since robotic introduction and the impact of robotic use on RP access relative to other approaches in the modern era.

Methods: Using the National Cancer Data Base, RPs performed during the rise of early (2004–2008) and late (2010–2011) robotic dissemination were identified. The primary endpoints, patient travel distance and treatment delay, were compared by era, and for 2010–2011, by surgical approach. Analyses included multivariable and multinomial logistic regression.

Results: 138 476 cases were identified, 32% from 2004–2008 and 68% from 2010–2011. In 2010–2011, 74%, 21%, and 4.3% of RPs were robotic, open, and laparoscopic, respectively. Treatment in 2010–2011 and robotic approach were independently associated with increased patient travel distance and longer treatment delay ($p<0.001$). Men treated robotically had 1.3–1.7 times higher odds of travelling medium-to-long range distances and 1.2–1.3 higher odds of delays 90 days or greater compared to those treated open ($p<0.001$). Laparoscopic approach was associated with increased patient travel and treatment delay, but to a lesser extent than the robotic approach ($p<0.001$). In high-risk patients, treatment delays remained significantly longer for minimally invasive approaches ($p<0.001$). Other factors associated with the robotic approach included referral from an outside facility, treatment at an academic or high-volume hospital, higher income, and private insurance. Potential limitations include the retrospective observational design and lack of external validation of the primary outcomes.

Conclusions: The robotic approach is associated with increased travel burden and treatment delay, potentially limiting access to surgical care.

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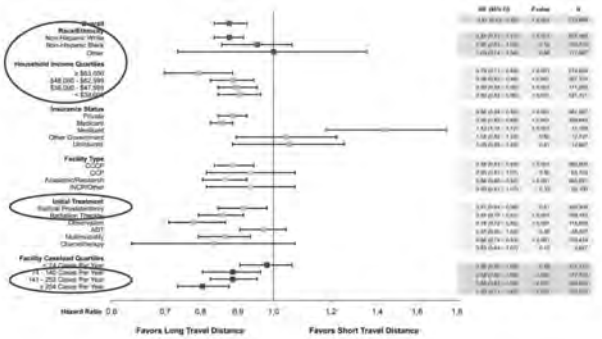


High hospital volume or surgeon volume

=> Centralization

=> Long Travel distance

SES factors
Surgery
: Robotic surgery

=>> Favorable outcome !!

Redefining and Contextualizing the Hospital Volume-Outcome Relationship for Robot-Assisted Radical Prostatectomy: Implications for Centralization of Care

Boris Gershman, Sarah K. Meier, Molly M. Jeffery, Daniel M. Moreira, Matthew K. Tollefson, Simon P. Kim, R. Jeffrey Karnes and Nilay D. Shah*

http://dx.doi.org/10.1016/j.juro.2017.01.063
Vol. 198, 62-69, July 2017
Printed in U.S.A.

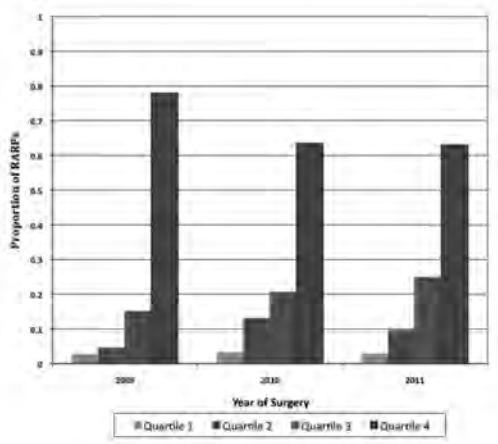
Abbreviations and Acronyms

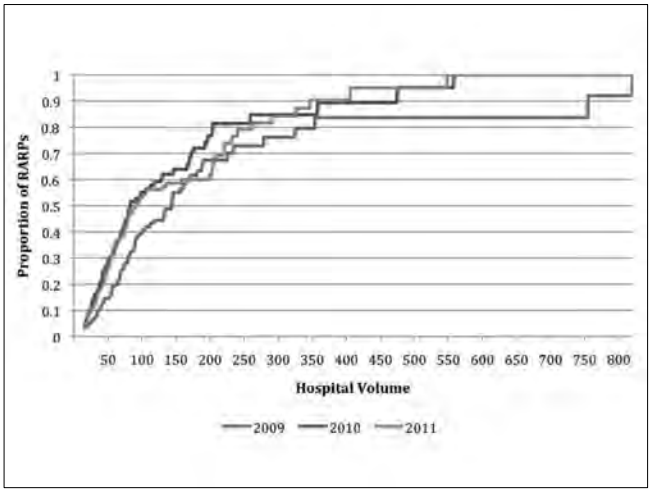
Purpose: Robot-assisted radical prostatectomy has undergone rapid dissemination driven in part by market forces to become the most frequently used surgical approach in the management of prostate cancer. Accordingly, a critical analysis of its volume-outcome relationship has important health policy implications. Therefore, we evaluated the association of hospital robot-assisted radical prostatectomy volume with perioperative outcomes, and examined the distribution of hospital procedure volume to contextualize the volume-outcome relationship.

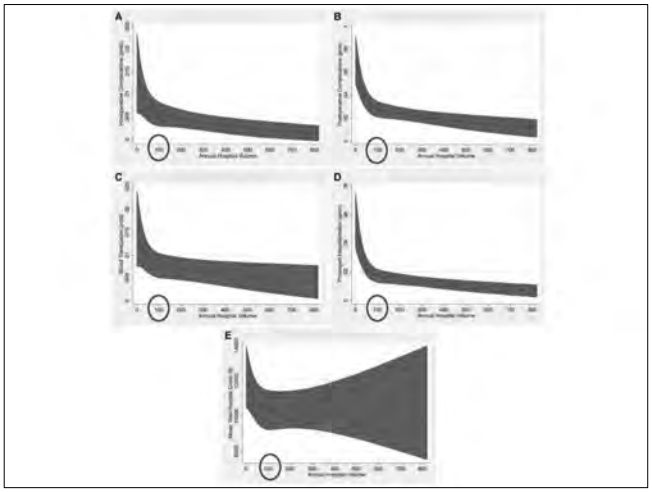
Materials and Methods: We identified 140,671 men who underwent robot-assisted radical prostatectomy from 2009 to 2011 in NIS (Nationwide Inpatient Sample). The associations of hospital volume with perioperative outcomes and total hospital costs were evaluated using multivariable logistic regression and generalized linear models.

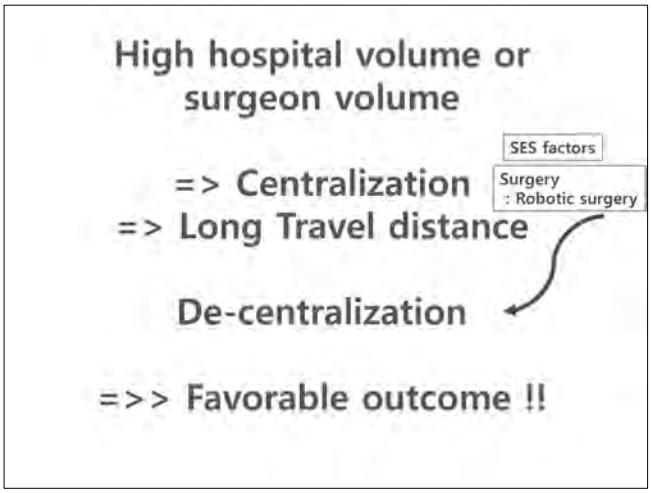
Results: In 2011, 70% of hospitals averaged 1 robot-assisted radical prostatectomy per week or less, accounting for 28% of surgeries. Compared to patients treated at the lowest quartile hospitals, those treated at the highest quartile hospitals had significantly lower rates of intraoperative complications (0.6% vs 1.4%), postoperative complications (4.8% vs 13.9%), perioperative blood transfusion (1.3% vs 4.0%), prolonged hospitalization (4.1% vs 13.8%) and mean total hospital costs ($12,647 vs $15,394, all P_{trend} <0.001). When modeled as a nonlinear continuous variable, increasing hospital volume was independently associated with improved rates of each perioperative end point up to approximately 100 robot-assisted radical prostatectomies per year, beyond which there appeared to be marginal improvement.

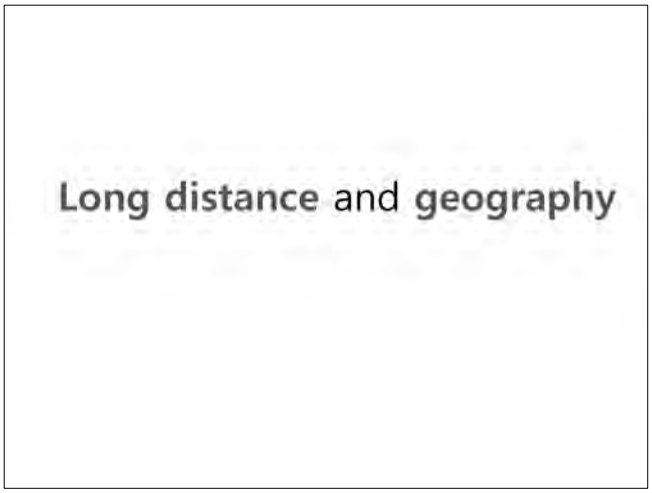
Conclusions: Increasing hospital robot-assisted radical prostatectomy volume was associated with improved perioperative outcomes up to approximately 100 surgeries per year, beyond which there appeared to be marginal improvement. A substantial proportion of these procedures is performed at low volume hospitals.











Scientific Letter

Association Between Travel Distance and Choice of Treatment for Prostate Cancer: Does Geography Reduce Patient Choice?

Vinayak Muralidhar, MD, MSc, Brent S. Rose, MD, Yu-Wei Chen, MD, MS, Michelle D. Nezolosky, BA, and Paul L. Nguyen, MD

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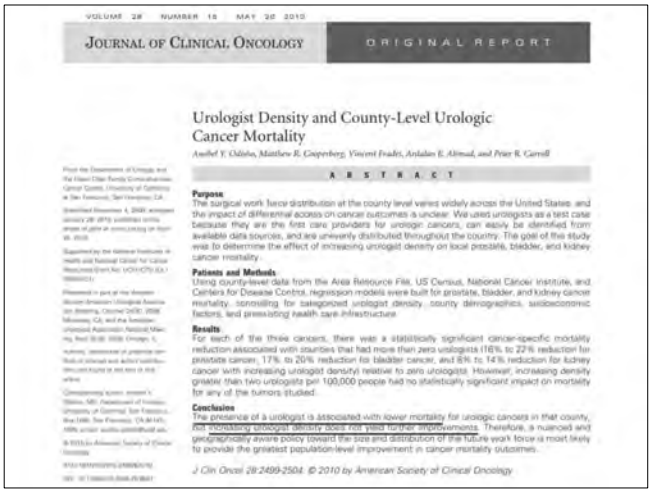


VOLUME 28 NUMBER 15 MAY 20 2010

JOURNAL OF CLINICAL ONCOLOGY ORIGINAL REPORT

Urologist Density and County-Level Urologic Cancer Mortality

Anobel Y. Odisho, Matthew R. Cooperberg, Vincent Fradet, Arsdalan E. Ahmad, and Peter R. Carroll

ABSTRACT

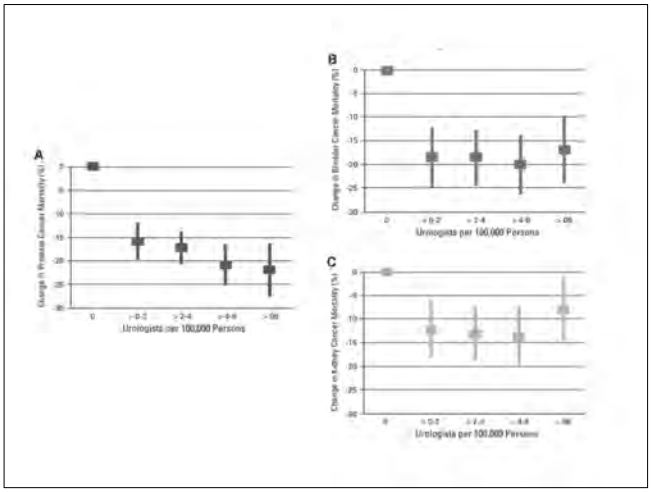
Purpose
The surgical work force distribution at the county level varies widely across the United States, and the impact of differential access on cancer outcomes is unclear. We used urologists as a test case because they are the first care providers for urologic cancers, can easily be identified from available data sources, and are unevenly distributed throughout the country. The goal of this study was to determine the effect of increasing urologist density on local prostate, bladder, and kidney cancer mortality.

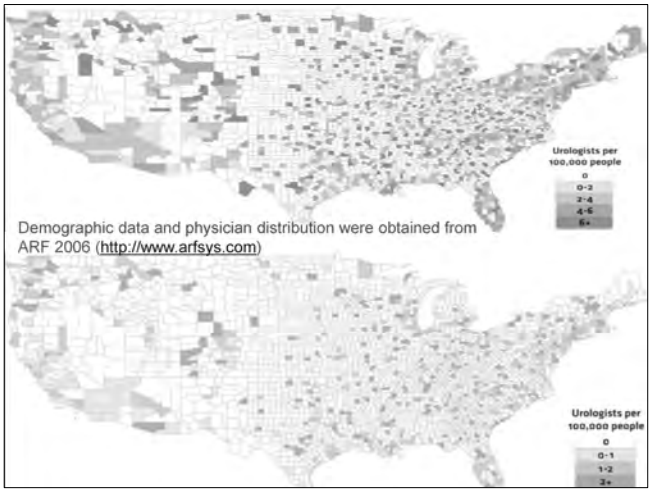
Patients and Methods
Using county-level data from the Area Resource File, US Census, National Cancer Institute, and Centers for Disease Control, regression models were built for prostate, bladder, and kidney cancer mortality, controlling for categorized urologist density, county demographics, socioeconomic factors, and preexisting health care infrastructure.

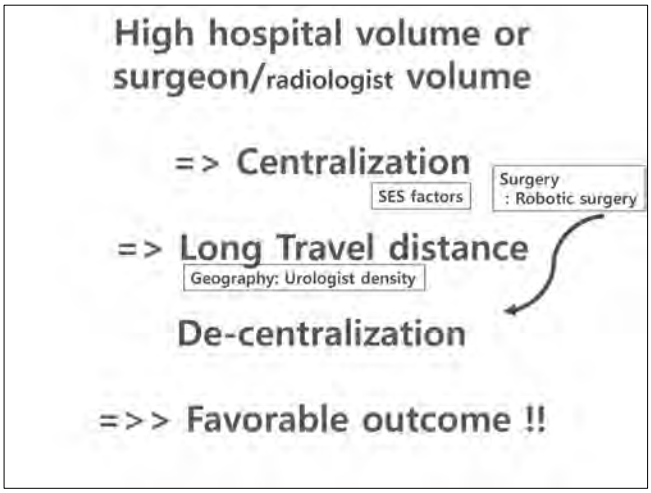
Results
For each of the three cancers, there was a statistically significant cancer-specific mortality reduction associated with counties that had more than zero urologists (16% to 22% reduction for prostate cancer, 17% to 20% reduction for bladder cancer, and 8% to 14% reduction for kidney cancer with increasing urologist density) relative to zero urologists. However, increasing density greater than two urologists per 100,000 people had no statistically significant impact on mortality for any of the tumors studied.

Conclusion
The presence of a urologist is associated with lower mortality for urologic cancers in that county, but increasing urologist density does not yield further improvements. Therefore, a nuanced and geographically aware policy toward the size and distribution of the future work force is most likely to provide the greatest population-level improvement in cancer mortality outcomes.

J Clin Oncol 28:2499-2504. © 2010 by American Society of Clinical Oncology








Original Article
Open Access

Medical Travel among Non-Seoul Residents to Seek Prostate Cancer Treatment in Medical Facilities of Seoul

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Won-Joo Kim, MD, PhD
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Purpose

Materials and Methods

Results

Conclusion

Key words

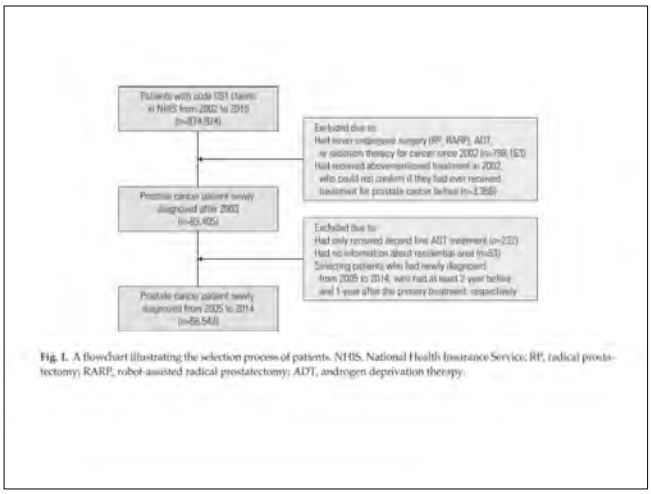
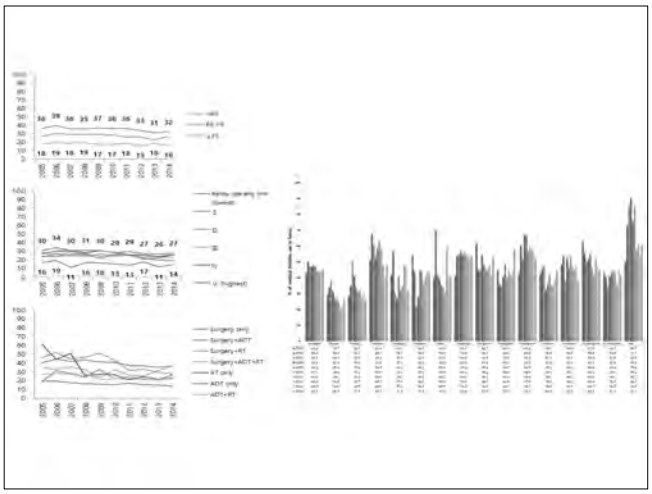


Fig. 1. A flowchart illustrating the selection process of patients. NHIS, National Health Insurance Service; RP, radical prostatectomy; RARP, robot-assisted radical prostatectomy; ADT, androgen deprivation therapy.



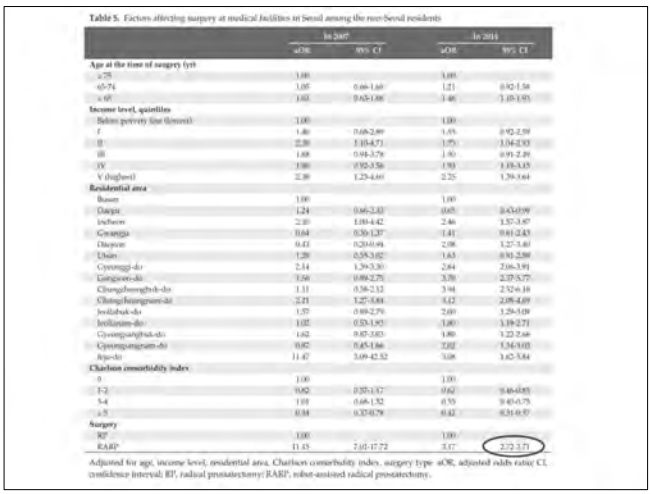


Table 5. Factors affecting surgery at medical facilities in Seoul among the non-Seoul residents

	In 2007		In 2014	
	aOR	95% CI	aOR	95% CI
Age at the time of surgery (yr)				
≥75	1.00		1.00	
65-74	1.05	0.69-1.61	1.21	0.92-1.58
≤64	1.02	0.63-1.66	1.46	1.10-1.93
Income level, quintiles				
Below poverty line (lowest)	1.00		1.00	
I	1.46	0.68-2.89	1.55	0.92-2.59
II	2.20	1.10-4.71	1.75	1.04-2.93
III	1.68	0.91-3.79	1.30	0.91-2.09
IV	1.90	0.92-3.56	1.91	1.18-3.15
V (highest)	2.39	1.23-4.61	2.25	1.39-3.64
Residential area				
Busan	1.00		1.00	
Daegu	1.24	0.66-2.43	0.65	0.43-0.99
Incheon	2.10	1.08-4.42	2.46	1.57-3.87
Gwangju	0.64	0.30-1.27	1.41	0.81-2.43
Daejeon	0.43	0.20-0.94	2.08	1.27-3.40
Ulsan	1.20	0.58-2.62	1.63	0.91-2.89
Gyeonggi-do	2.14	1.39-3.30	2.84	2.06-3.91
Gangwon-do	1.56	0.89-2.75	3.38	2.37-4.77
Chungcheongbuk-do	1.31	0.58-2.52	3.94	2.52-6.18
Chungcheongnam-do	2.21	1.27-3.84	3.12	2.08-4.69
Jeollabuk-do	1.57	0.89-2.79	2.69	1.79-3.98
Jeollanam-do	1.02	0.53-1.95	1.80	1.19-2.71
Gyeongsangbuk-do	1.62	0.87-3.03	1.80	1.22-2.66
Gyeongsangnam-do	0.92	0.45-1.86	2.02	1.34-3.03
Jeju-do	11.47	3.09-42.52	3.08	1.62-5.84
Charlson comorbidity index				
0	1.00		1.00	
1-2	0.92	0.57-1.47	0.62	0.46-0.83
3-4	1.01	0.68-1.52	0.59	0.45-0.75
≥5	0.84	0.57-0.79	0.42	0.31-0.57
Surgery				
RP	1.00		1.00	
RARP	11.43	7.01-17.72	3.17	2.72-3.71

Adjusted for age, income level, residential area, Charlson comorbidity index, surgery type. aOR, adjusted odds ratio; CI, confidence interval; RP, radical prostatectomy; RARP, robot-assisted radical prostatectomy.

Summary

The proportion of non-Seoul resident patients who choose medical travel for localized PCa could be even higher and also show no significant change per year.

Relatively young patients with high income status are more likely to seek active treatment in medical facilities located in Seoul.

Future health policies are needed to control this high medical travel proportion among non-Seoul residents and to improve the utilization rate of non-Seoul medical facilities

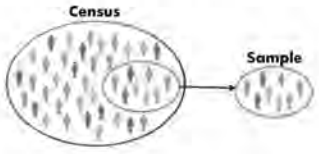
National practice patterns and direct medical costs for prostate cancer in Korea across a 10 year period

Ho Won Kang

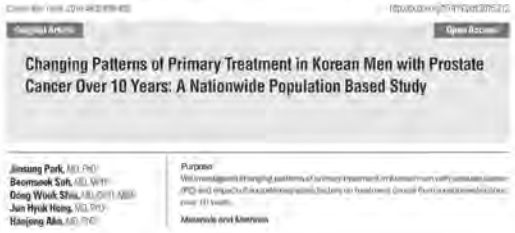
Department of Urology, Chungbuk National University Hospital

Background (I)

- To document national practice patterns and medical costs in the entire Korean PCa population, a complete enumeration study is warranted.
- A complete enumeration study was conducted to evaluate trends in national practice patterns and direct medical costs for PCa in Korea over a 10-year retrospective period using data from the Korean National Health Insurance System (KNHI).



Background (II)



Changing Patterns of Primary Treatment in Korean Men with Prostate Cancer Over 10 Years: A Nationwide Population Based Study

Jinsung Park, MD, PhD
Beomseok Seh, MD, MPH
Dong Wook Shin, MD, DrPH, MBA
Jun Hyuk Hong, MD, PhD
Hanjong Ahn, MD, PhD

- Undergone active treatments for newly diagnosed PC From 2003 to 2013 (n= 1382)
- 2% nationwide random sample of Korean National Health Insurance.
- Time trends in primary treatment of PC and impact of sociodemographic factors on primary treatment choice

Background (III)

BJUI

Treatment costs of prostate cancer in the first year after diagnosis: a short-term cost of illness study for France, Germany, Italy, Spain and the UK

RESEARCH ARTICLE

Cost of illness of the prostate cancer in Japan—a time-trend analysis and future projections

BJUI

The economic burden of prostate cancer

Estimating the Cost of Illness of Prostate Cancer in Iran

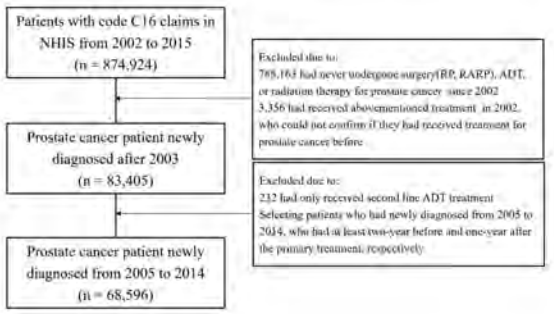
Background (III)

- When costs were inflated to 2010 levels, the total estimated expenditure on PCa was mounted to 106.7 – 179.0 million euros in the European countries (UK, Germany, France, Italy, Spain and the Netherlands) and 9,862 billion US dollars in 2006.
- The mean annual costs per patient in the USA were $10,612 in the initial phase after diagnosis, $2,134 for continuing care and $33, 691 in the last year of life
- Data from government office statistics of Japan have shown that estimated cost of illness of PCa was 174.5 billion yen in 2002, 246.9 billion yen in 2005, 286.0 billion yen in 2008, and 307.3 billion yen in 2011
- In Korea?

Methods

- This study was supported by the Korean Prostate Society, and National Health Insurance Service (NHIS) of Korea.
- Claim data from 874,924 patients with code C61, indicating PCa according to the International Classification of Diseases, 10th edition, Clinical Modification (ICD-10-CM) from 2002 to 2015 were screened.
- Undergone primary active treatment for PCa from 2003 onwards (n= 83,405).
- Availability of claim information for a minimum of 2 years before and 1 year after the primary treatment (n= 68,596).

Methods



Methods

- Reimbursement codes for RP were 'R3950', 'R3960', and 'RZ512'
- RARP was defined operationally as the absence of a surgery code despite the presence of a general anesthesia code ('L1211') and a postoperative pathology examination code (code 'C5500', 'C5500', 'C5501', 'C5502', 'C5503', 'C5504', 'C5505', 'C5506', 'C5507', 'C5508', 'C5509', 'C5911', 'C5912', 'C5913', 'C5914', 'C5915', 'C5916', 'C5917', 'C5918', or 'C5919').
- In the present study, 'cost' refers to direct medical costs, excluding indirect costs secondary to the PCa and out-of-pocket expenditure not covered by the health insurance premium.
- The cost of RARP was assumed to be seven million won.
- All cost estimates are reported in 2015 Korean won.

Result (I) Demographic trends

❖ **Annual incidence of Korean prostate cancer patients**

Characteristic	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total (N)	3548	4313	5080	6225	6873	7262	8449	8825	8929	9092

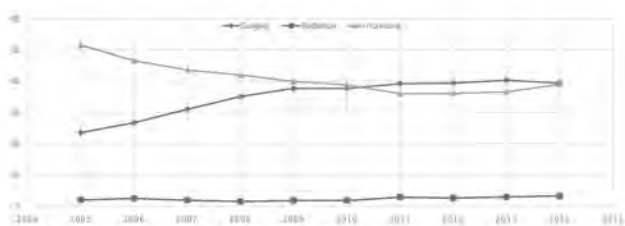
Result (I) Demographic trends

❖ **Demographic feature**

Characteristic	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total (N)	3548	4313	5080	6225	6873	7262	8449	8825	8929	9092
Age (yr)										
Mean±SD	70.0±8.5	70.1±8.5	70.0±8.8	69.9±8.8	69.9±8.8	69.9±8.8	70.0±8.7	70.1±8.8	70.1±8.8	70.5±8.8
<50	39 (1.1)	56 (1.3)	56 (1.1)	65 (1.0)	73 (1.1)	83 (1.1)	82 (1.0)	67 (0.8)	75 (0.8)	75 (0.8)
50–64	809 (22.8)	992 (23.0)	1153 (22.7)	1446 (23.2)	1497 (21.8)	1607 (22.1)	1922 (22.9)	2017 (22.9)	2064 (23.1)	2006 (22.1)
65–74	1585 (44.7)	1958 (45.4)	2379 (46.8)	2966 (47.6)	3333 (48.5)	3462 (47.9)	3939 (46.8)	3957 (44.8)	4072 (45.6)	4062 (44.7)
≥75	1115 (31.4)	1307 (30.3)	1492 (29.4)	1748 (28.1)	1970 (28.7)	2090 (28.8)	2496 (29.5)	2784 (31.5)	2720 (30.5)	2949 (32.4)
Residential area										
Metropolitan	2124 (59.9)	2523 (58.5)	2916 (57.4)	3613 (58.0)	4046 (58.8)	4223 (58.2)	4971 (58.8)	5193 (58.8)	5311 (59.5)	5350 (58.8)
Urban	873 (24.6)	1074 (24.9)	1431 (28.2)	1695 (27.2)	1829 (26.6)	1954 (26.9)	2241 (26.5)	2278 (25.8)	2358 (26.4)	2515 (27.7)
Rural	524 (14.8)	588 (13.6)	733 (14.4)	917 (14.7)	1004 (14.6)	1085 (14.9)	1234 (14.6)	1354 (15.3)	1208 (13.5)	1368 (15.0)
Unknown	27 (0.8)	135 (3.1)	-	-	-	-	3 (0.0)	-	52 (0.6)	59 (0.6)
Income level, quintiles										
Below poverty line (lowest)	628 (17.7)	615 (14.3)	339 (6.7)	356 (5.7)	407 (5.9)	438 (6.0)	521 (6.2)	493 (5.6)	572 (6.4)	459 (5.0)
II	326 (9.2)	451 (10.5)	571 (11.2)	673 (10.8)	808 (11.8)	864 (11.9)	967 (11.4)	975 (11.0)	1026 (11.5)	1108 (12.1)
III	337 (9.5)	380 (8.8)	581 (11.4)	814 (13.1)	720 (10.5)	710 (9.8)	947 (10.0)	898 (9.7)	921 (10.3)	946 (10.4)
IV	396 (11.2)	501 (11.6)	731 (14.4)	832 (13.4)	918 (13.4)	994 (13.7)	1128 (13.4)	1215 (13.8)	1184 (13.3)	1238 (13.6)
V (highest)	631 (17.8)	765 (17.7)	925 (18.2)	1214 (19.5)	1240 (18.0)	1377 (19.0)	1621 (19.2)	1657 (18.8)	1724 (19.3)	1776 (19.5)
	1230 (34.7)	1606 (37.2)	1933 (38.1)	2536 (40.7)	2780 (40.4)	2880 (39.7)	3265 (39.8)	3629 (41.1)	3502 (39.2)	3560 (39.4)
Charlson comorbidity index										
Mean±SD	3.9±3.6	3.9±3.8	3.8±3.4	4.0±3.5	4.2±3.5	4.2±3.4	4.2±3.5	4.4±3.5	4.4±3.5	4.4±3.6
0	616 (17.4)	584 (13.5)	607 (11.9)	701 (11.3)	673 (9.8)	682 (9.4)	741 (8.8)	747 (8.5)	748 (8.4)	752 (8.3)
1–2	1030 (29.0)	1394 (32.3)	1758 (34.6)	1984 (31.9)	2117 (30.8)	2256 (31.1)	2648 (31.3)	2551 (28.9)	2609 (29.2)	2649 (29.1)
3–4	637 (18.0)	804 (18.6)	1073 (21.1)	1357 (21.8)	1586 (23.1)	1703 (23.5)	1966 (23.3)	1990 (22.5)	2067 (23.1)	2159 (23.7)
≥5	1265 (35.7)	1531 (35.5)	1642 (32.7)	2183 (35.1)	2497 (36.3)	2621 (36.1)	3094 (36.6)	3537 (40.1)	3505 (39.3)	3531 (38.9)

Result (II) Primary treatment

❖ **Monotherapy**



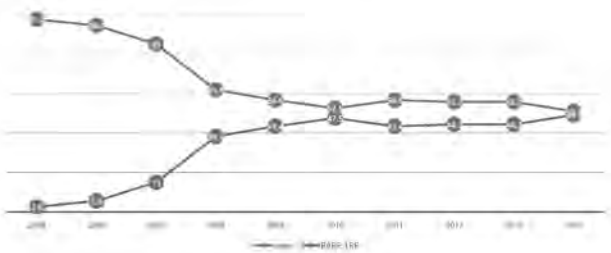
Result (II) Primary treatment

❖ **Monotherapy + Combination**

Characteristic	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total (n)	3546	4313	5080	6225	6873	7262	8449	8625	8929	8092
Primary treatment										
Surgery only	835 (23.5)	1153 (26.7)	1576 (31.0)	2187 (35.1)	2582 (37.7)	2738 (37.7)	3314 (39.2)	3478 (39.4)	3595 (40.3)	3585 (39.4)
Surgery+ADT	74 (2.1)	124 (2.9)	186 (3.7)	297 (4.8)	336 (4.9)	334 (4.6)	387 (4.6)	380 (4.1)	350 (3.9)	368 (4.0)
Surgery+RT	170 (4.8)	208 (4.8)	274 (5.4)	278 (4.5)	368 (5.3)	360 (5.1)	399 (4.7)	427 (4.7)	333 (3.7)	325 (3.5)
Surgery+ADT+RT	52 (1.5)	81 (1.9)	96 (1.9)	110 (1.8)	127 (1.8)	131 (1.8)	167 (2.0)	202 (2.3)	173 (1.9)	178 (2.0)
RT only	68 (1.9)	105 (2.4)	99 (1.9)	88 (1.4)	114 (1.7)	109 (1.5)	139 (1.6)	123 (1.4)	156 (1.7)	186 (2.3)
ADT only	1831 (51.6)	2011 (46.6)	2216 (43.6)	2613 (42.0)	2745 (39.9)	2820 (38.8)	3044 (36.0)	3185 (36.1)	3271 (36.6)	3344 (39.0)
ADT+RT	518 (14.6)	631 (14.6)	639 (12.6)	652 (10.5)	661 (9.7)	715 (9.8)	907 (10.7)	1050 (11.9)	951 (10.7)	904 (9.9)

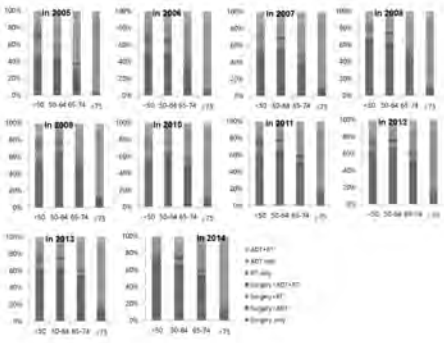
Result (II) Primary treatment

❖ **Surgery**



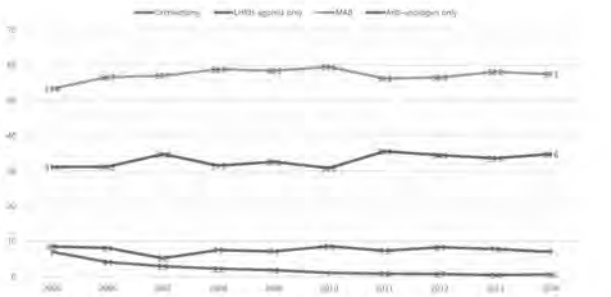
Result (II) Primary treatment

❖ **Surgery**



Result (II) Primary treatment

❖ **ADT**



Result (III) Direct cost

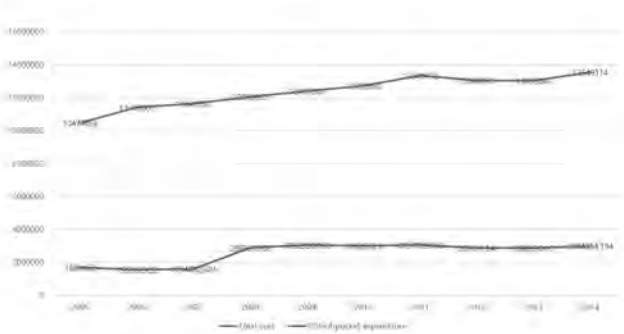
❖ **Direct medical costs and proportion of patient's co-payment**

Characteristic	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1 yr before	2956 (27.8)	3307 (23.0)	3532 (22.0)	3793 (22.2)	3854 (22.3)	4020 (21.0)	4206 (20.4)	4183 (20.2)	4058 (20.1)	4141 (19.7)
1st yr	9077 (16.1)	9890 (13.7)	10088 (16.7)	10448 (24.0)	10752 (24.6)	11025 (23.6)	11568 (22.9)	11305 (22.0)	11299 (22.0)	11741 (22.1)
2nd yr	6220 (13.9)	6886 (14.6)	5897 (15.1)	5802 (13.7)	5811 (12.7)	5944 (12.1)	5563 (12.8)	5544 (12.9)	5793 (12.4)	
3rd yr	5711 (14.9)	5662 (15.2)	5534 (14.3)	5650 (13.0)	5521 (12.9)	5178 (13.4)	5191 (13.4)	5193 (13.3)		
4th yr	5473 (15.7)	5534 (14.4)	5261 (13.5)	5273 (13.4)	4985 (13.7)	5023 (13.9)	5152 (13.8)			
5th yr	5491 (14.5)	5525 (13.8)	5098 (13.7)	5034 (14.2)	4978 (14.1)	5148 (14.3)				
6th yr	5437 (14.8)	5211 (15.2)	4767 (15.8)	4903 (16.5)	4900 (15.7)					
7th yr	5324 (14.8)	5070 (15.2)	4800 (16.0)	4816 (16.2)						
8th yr	4952 (16.1)	4847 (15.8)	4912 (15.9)							
9th yr	4959 (16.4)	5057 (15.9)								
10th yr	5079 (16.4)									

(*1000 KRW)

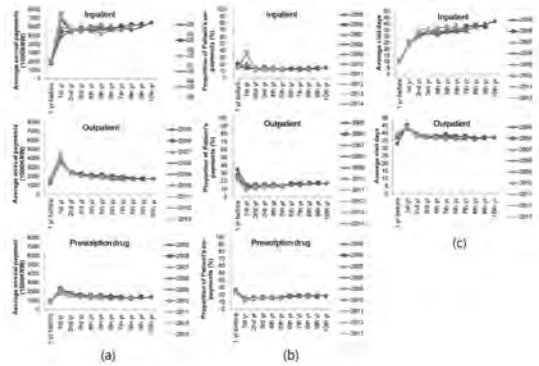
Result (III) Direct cost

❖ **Average annual medical cost for prostate cancer**

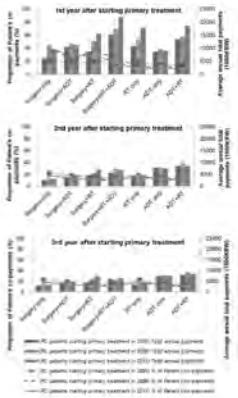


Result (III) Direct cost

❖ **Annual cost from the first year to 10 years post-diagnosis**



Result (III) Direct cost



Conclusion (I) Demographic trends

- The number of PCa patients showed a steady annual increase across the 10 year study period, with an approximately 2.6-fold increase in the total number being observed in 2014. However, the rate of increase has steadily declined over the 10 year study period.
- Over the 10 year study period, the proportion of patients with comorbidity (Charlson comorbidity score ≥3) increased.

Conclusion (II) National practice patterns

- In 2014, surgery and ADT were the most common first-line treatment, with 47.9% of patients undergoing surgery (16% increase in comparison with 2005).
- Surgery as a monotherapy was performed in 23.5% of patients in 2005, and in 39.4% of patients in 2014. Proportion of surgery was increased in all age groups, particularly in patients over 75 years of age.
- The use of RARP rose sharply after 2008, showing a similar rate to open RP in 2014.
- RT monotherapy showed an almost 2-fold increase during the 10 year study period (1.9% in 2005 vs. 3.2% in 2014), the use of RT as part of a collaborative, multimodal approach showed a slight decrease (20.9% in 2005 vs. 14.4% in 2014).

Conclusion (II) Medical cost

- Total treatment costs in the first 12 months post-diagnosis were around 10,719,000 Korean won (KRW). Average annual treatment costs thereafter were around 5,320,000 KRW.
- Out-of-pocket expenditure was highest in the first year after diagnosis (16.1% in 2005 and 22.1% in 2014), and ranged from 12% to 17% thereafter.
- RT as monotherapy or as part of a collaborative, multimodal approach was the most expensive form of management. However, from 2008 onwards, out-of-pocket expenditure of patients in the 12 months post-diagnosis was highest for surgery.

Lifestyle risk prediction model for prostate cancer in a Korean population

김 성 한
국립암센터

오늘날 한국인들의 암발생률을 보면 2015년 국립암센터 발간 암 통계 지표에서는 전립선암이 차지하는 비율은 2012년 기준 27%로 1999년도의 8.5%에 비해 3배 이상으로 증가했으며 전체 암발생에서는 남성에서 5위를 차지하고 있다. 다시 말하자면 남성 한국인에서 전립선암의 발생률을 가파르게 상승하고 있는 호발암이다. 이는 한국에서만 국한된 암발생 특징이 아닌 전세계적인 발생률 형태라고 할 수 있다. 미국의 경우는 남성암에서는 전립선암은 1위를 차지하고 있으며, 유럽권에서도 전립선암은 남성 암발생률면에서 가파르게 증가하고 있는 암이다.

전립선암의 발생률은 인종, 지형, 생활 습관, 연령 등 다양한 사회경제학적, 그리고 지리학적 영향을 받는 암종이다. 북미에서는 전립선암이 가장 높은 발생률을 보이지만 남아시아에서는 가장 낮은 발생률을 보인다. 한국의 경우 2015년 암통계를 보면 12.3%의 연간 발생률 상승을 보고하고 있어, 한국인도 서양처럼 전립선암의 발생이 호발하는 나라라고 할 수 있겠다. 이런 전세계적인 전립선암의 발생률 상승은 1990년도에 보편화된 혈중 PSA측정기법의 발견의 영향이 가장 크지만 그 외에도 서양 식습관과 생활습관 변화, 고령인구의 증가, 운동 부족, 흡연률 증가 등등 다양한 환경 적 영향인자들 때문이기도 하다.

인종적인 영향면에서 전립선암은 아프리카계 미국계가 공격적인 성향의 나쁜 예후를 보이며 아시아권의 한국인과 일본인에서도 분화도가 나쁜 암종이 많다는 보고가 알려져 있어, 한국인들의 일평생 전립선암에 걸릴 확률과 실제 그 발생률이 어떨지에 대한 의문과 연구들이 단편적으로 이뤄져 왔다. 한국은 기타 여러 나라들과 비교할 때 특징적 사회보건의료 시스템을 갖추고 있다고 할 수 있다. 예를 들면, 조기 검진/ 생애주기 검진, 낮은 의료 비용, 전국민의 의료보험 의무화, 높은 CT/MRI 등의 영상 검사 기기 보급률 및 국민보험공단 데이터 시스템은 이런 암 발생률을 알아보기에 적합한 사회구조를 가지고 있다.

하지만 아직까지 한국인의 생애주기적 암발생률과 치료 패턴에 대한 대규모 연구가 이뤄지지 못한 점과, 현재 국가 검진 체계에서의 필수 검사 항목에서 전립선암이 들어가 있지는 못한 점에서 본 연구진의 생애주기 동안의 한국인들의 전립선암의 발생 연구는 그 가치가 있다고 할 수 있겠다. 본 연구는 국립보험공단 자료에 암 생존자료를 붙여서 만든 자료를 이용하여 전립선암의 발생률과 치료 특징들을 알아보았다. 총 1,179,172명의 남성 한국인들이 1996년부터 1997년에 암으로 진단된 적이 없는 건강인을 대상으로 8년간 추적관찰 한 결과를 보고하였다. 그 결과 0.22%인 846명이

전립선암으로 진단받았고, 평균 44.3세(표준편차,10.1년)에 진단받았다. 그 결과 전립선암 발생에 대한 위험 예측 모델을 구성하였고 그 내부 인자들로는 age, height, body mass index, glucose levels, family history of cancer, the frequency of meat consumption, alcohol consumption, smoking status, and physical activity 들이 유의한 인자들로 구성되었다.

본 연구는 한국인에서 생애주기적 관찰시 발생할 전립선암의 예측 모델을 일반 생활 습관 인자들로 최초로 제공했으며, 이를 통해 생애주기적 생활인자들이 미치는 전립선암 발생을 예측할 수 있는 자료로서 전립선암 선별검사 및 보건 검진 자료 계획 수립의 중요한 기초 자료가 될 것으로 생각한다.

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대한비뇨기종양학회
대한전립선학회
비뇨기계기초의학연구회

공동심포지엄

Session 4

The latest technology in future perspectives

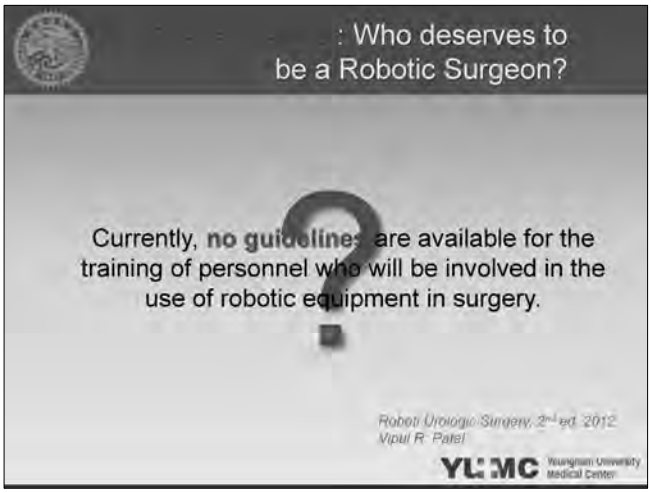
좌장: 김청수 (울산의대)

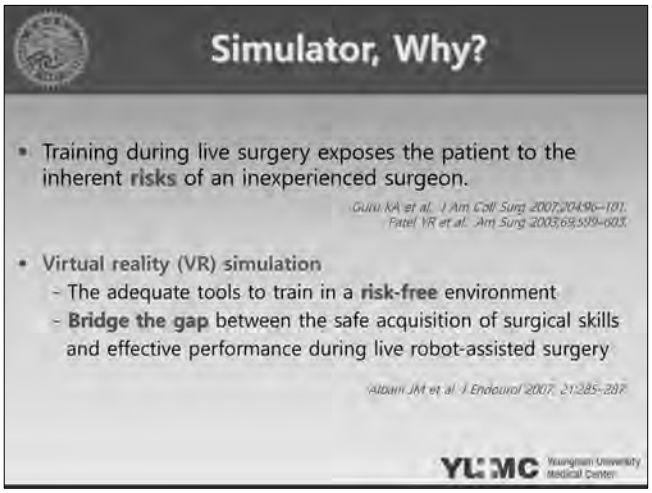
Surgical simulation in Urology	**고영휘** (영남의대)
Digital health and future technology	**이건명** (충북대학교)

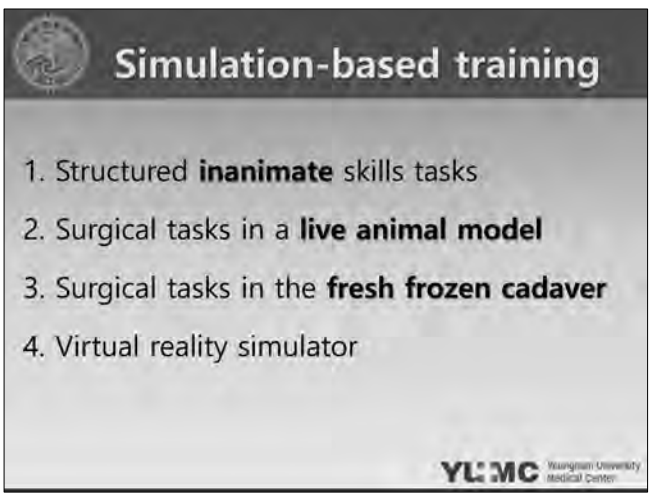
Surgical simulation in Urology

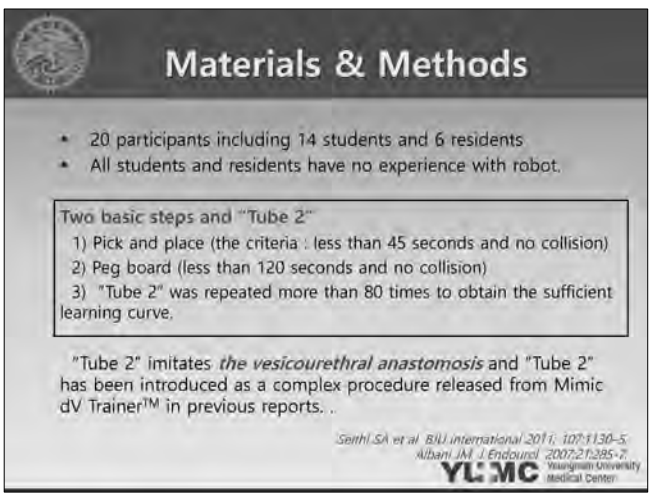
Young Hwii Ko

Yeungnam University



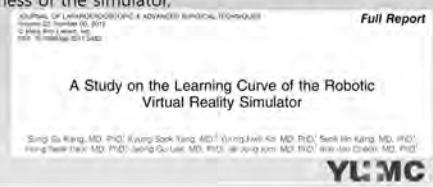






Summary of Findings

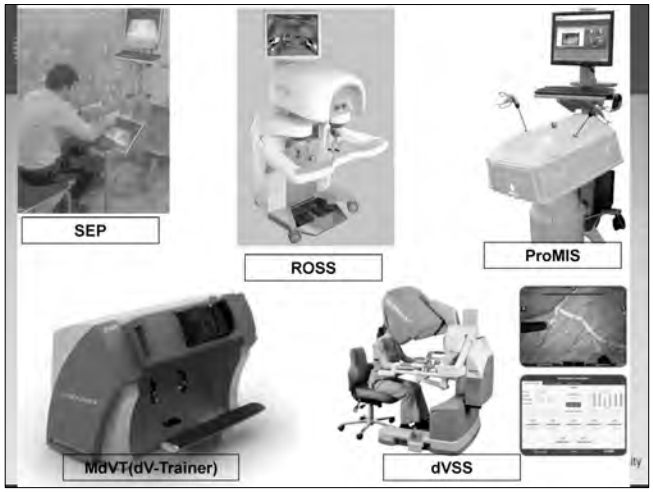
- Robotic virtual reality simulator improves technical performance *within 4 hours*, but the other side of it is that usefulness of the simulator might be limited after that.
- Even though the simulator improves the technical performance, *the development of more various applications* to reflect the real operation course will be needed to improve and maximize the usefulness of the simulator.



Full Report

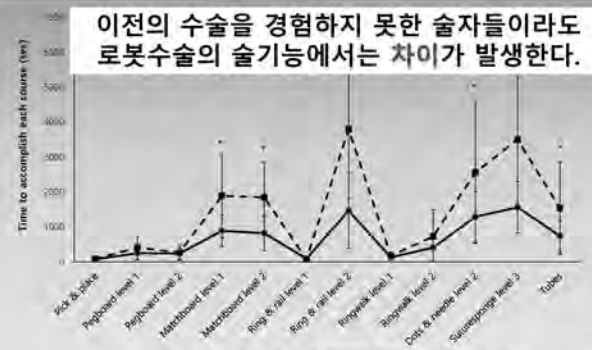
A Study on the Learning Curve of the Robotic Virtual Reality Simulator

Youngnam University Medical Center



There exist differences between a novice group....

이전의 수술을 경험하지 못한 술자들이라도 로봇수술의 술기능에서는 차이가 발생한다.



Youngnam University Medical Center

	Total participants (n=43)		Hands-on training following RVS (n=10)		RVS only (n=33)		Pvalue	
	Time (min)	Attempt	Time (min)	Attempt	Time (min)	Attempt	Time (min)	Attempt
Gender							0.766	
Male	28		7		21			
Female	15		3		12			
Age (range)	27 (23-35)		27 (24-32)		26 (23-35)		0.419	
Endowrist manipulation category	91.03	34	133.15	45.5	88.77	33	0.184	0.313
Pick & place	0.85	1	0.76	1	0.87	1	0.133	0.313
Peg board level 1	3.95	3	4.58	3.5	3.80	3	0.810	0.788
Peg board level 2	3.10	2	4.52	2	2.37	2	0.921	0.766
Matchboard level 1	18.40	6	33.23	12	17.17	5	0.204	0.166
Matchboard level 2	19.20	7	24.95	10	19.20	7	0.371	0.435
Ring & rail level 1	0.89	1	0.96	1	0.87	1	0.921	0.487
Ring & rail level 2	43.41	11	56.71	12	39.38	10	0.099	0.356
Ring walk level 1	2.47	2	2.31	1	2.56	2	0.745	0.542
Ring walk level 2	5.55	2	6.73	3	5.40	2	0.581	0.661
Advanced needle driving category	76.00	18	90.48	19	71.23	17	0.386	0.788
Dots & needles level 2	22.86	6	32.07	7	22.62	6	0.435	0.561
Suture sponge level 3	32.35	7	45.11	8.5	31.10	7	0.249	0.313
Tubes	14.13	4	12.75	3.5	16.45	4	0.702	0.620
Divided by course time								
Prolonged 6 courses	171.75	43	214.51	52	170.78	42	0.112	0.313
Fast 6 courses	19.18	12	19.53	14.5	17.61	12	0.699	0.810
Total	195.18	54	239.18	67.5	194.91	52	0.157	0.341

Background

단순 연습과정보다는 복잡 연습과정이 로봇수술의 술기능을 익히는데 중요하다.

Variable								
Age	0.154	-54.986	0.262	-			0.792	
Gender	0.09	-216.048	0.4	-			0.833	
Total time	0.581	0.049	0.01	0.015-0.084	0.581	0.049	0.01	0.015-0.084
Total attempt	0.408	6.978	0.047	0.123-13.835			0.932	
Time to prolonged 6 courses	0.524	0.05	0.018	0.011-0.089	0.524	0.05	0.018	0.001-0.089
Time to fast 6 courses	0.202	0.225	0.108	-			0.214	
Attempt to prolonged 6 courses	0.336	6.603	0.079	-0.966-14.591			0.295	
Attempt to fast 6 courses	0.209	23.254	0.184	-			0.449	

Ko et al. J Surg Educ. 2016 Jan-Feb;73(1):166-72

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ORIGINAL REPORTS

The Surgical Skill of a Novice Trainee Manifests in Time-Consuming Exercises of a Virtual Simulator Rather Than a Quick-Finishing Counterpart: A Concurrent Validity Study Using an Urethrovesical Anastomosis Model

Phil Hyun Song and Young Hwii Ko

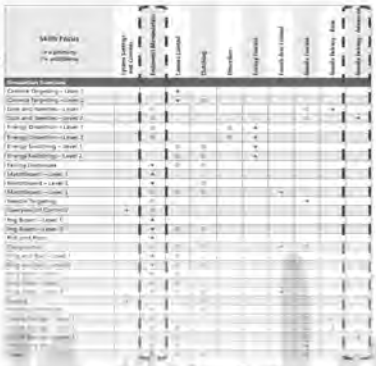
Department of Urology, College of Medicine, Yeungnam University, Daegu, Korea

J Surg Educ. 2016 Jan-Feb;73(1):166-72

Youngnam University Medical Center

Background

- Current **da Vinci surgical system (dVSS)** virtual simulator provides **12 primary exercises** in the endowrist manipulation and advanced needle driving category.
- Little is known regarding which simulator curricula affect actual surgical performance in practice.



Purpose & Methods

- Utilizing these 6 exercises as 'core' exercises, we developed a **three-phase simulator curriculum**

Phase I	X	To assess baseline skill	Accomplish most	All 9 exercises of primary endowrist manipulation category	Score, Time
Phase II	O	To measure skills	Reach target score over 80%	Five selected & time-consuming exercises	Score, time, number of attempt
Phase III	X	To measure final achievement	Complete completion of both ends by minimal #	Dry-lab simulating urethrovesical anastomosis during RARP	Console time to complete completion

- Our hypothesis is that there would be no difference in performance of surgical console **in final phase** after completion of this curriculum, regardless of baseline robotic proficiency.

YUMC robotic simulation training curriculum

Phase 1 : Initial assessment phase for basic skill using robot simulator (1일차)
- 10분간의 동일한 oral introduction : 기구 커고 끄는 법, 간단 조작법
- 9개의 Endowrist manipulation 기본과정 연습 을 한번씩 시행하여 초기 로봇술기능 측정

Phase 2 : Individualized training phase using robot simulator (2-3일차)
- 6개의 time consuming training course를 80% 이상이 될 때까지 반복수행
  1) March board level 1, 2) March board level 2 3) Ring & rail level 2
  4) Dots & needle level 2 5) Suture sponge level 3 6) Tubes
- * 이들 중 실제 모델과 가장 유사한 tube는 3회 이상 (비연속적) 80% 이상이 될 때까지 반복 수행

Phase 3: Re-evaluation for robotic skill using real robot device (4일차)
- 한번의 가화로 urethrovesical anastomosis model 시행 후 console time 측정

YUMC Yeungnam University Medical Center

Purpose

- 본 연구에서는 이 6개의 고난이도 연습과정을 이용하여 계발된 **교육 커리큘럼의 유효성**을 확인하고자 하였는데, 이 과정을 이수한 참여자들은
  1) 초기에 측정된 술기능과 관계없이
  2) 최종 **콘솔시간**에서 차이가 없을 것을

가정하였다.

YUMC Yeungnam University Medical Center

Results : 30 trainees, mean age 26

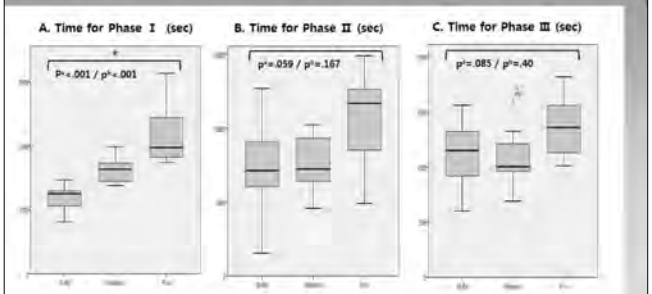
Phase I	Pick & place	Peg board1	Peg board2	Matchboard1	Matchboard2	Ring & rail1	Ring & rail2	Ring walk 1	Ring walk 2	Total in Phase 1
Mean Score	91.4	86.3	78.3	69.6	53.5	73.9	39.4	74.7	69.9	697.9
Mean Time (sec)	54.2	108.6	198.7	236.5	210.2	85.8	473.1	126.1	185.1	27.4 minutes

Phase II	Match board1	Match board2	Ring & rail2	Dots & needles2	Suture sponge3	Tubes	Total in phase2
Mean final score	85.1	84.8	84.1	80.3	67.2	84.1*	85.1*
Mean Attempt	5.4	4.4	6.4	7.5	7.8	5.0	34.3
Mean Time (sec)	684.0	601.2	1594.2	1749.1	2788.3	1289.4	142.4 minutes

Phase III

Mean Time (sec) 19.9 minutes

- Using scores from phase I, trainees were divided into three groups (**skillful vs. moderate vs. poor**), 10 in each group



*: comparison between three groups
**: comparison between two groups (skillful vs. poor)

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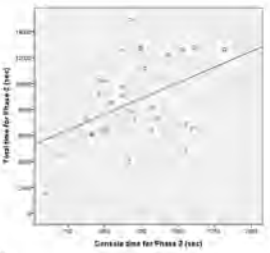
Results & Conclusion

	B	standard error	t	P
Sex	170.104	106.668	1.595	
Age	-25.592	13.020	-1.966	
Score in phase 1	-.742	.808	-.919	
Time in phase 1	.066	.143	.459	
Attempt in phase 2	-16.698	9.491	-1.759	
Time in phase 2	.086	.040	2.135	.044



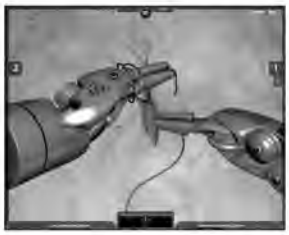
- **A** distinctively **different** baseline performance in initial assessment
- However, it was overcame **by repeated training** focused on core exercises,
- generating **similar surgical performance** in urethrovesical anastomosis model at the end of the study.

Accepted for publication in 2018 04 Int J Urol

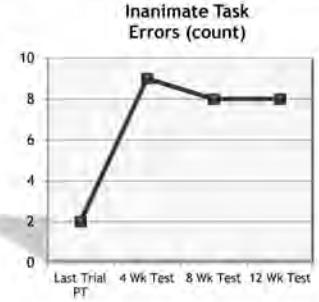
Where to Begin With Simulation

Three considerations for simulation practice that may drive benefits:

1. **Use it often.**
2. **Work toward expert benchmarks.**
3. **Continue use as a warm-up activity.**



1. Use it Often



- **Skills can degrade over time if not exercised.**[1]
- **Simulation increases touch points to help maintain skills.**

[1]Jenson CE, Gill K, Lendvay T, Guy M. Skill Acquisition And Maintenance of the da Vinci Robot. World Robotic Gynecology Congress in (WRGLat). Washington, DC, May 5-6, 2011.

2. Aim for Expert Benchmarks

- **Studies show training to expert benchmarks can lead to improved operative performance.**[1,2]

[1]Seymour NE et al. Virtual Reality Training Improves Operating Room Performance. Annals of Surgery. 2002; 236(4):458-464.
[2]Fenoglio B et al. Simulation-based Mastery Learning Improves Patient Outcomes in Laparoscopic Inguinal Hernia Repair. Annals of Surgery. 2011; 254(3):503-511.

2. Aim for Expert Benchmarks (cont'd)

Comparison of performance metric medians between groups

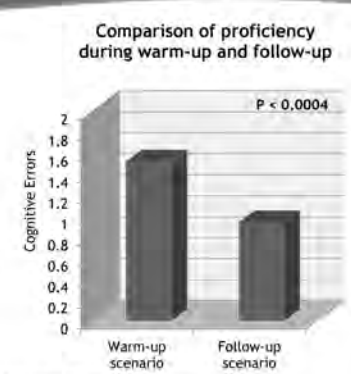
Metric	N	Overall Score
Expert (>100 cases)	14	88.4
Intermediate (50 – 100 cases)	23	75.6
Novice (0 cases)	17	62.8
P-Value (Expert-Intermediate)		0.0004
P-Value (Expert-Novice)		<0.0001

- **The da Vinci Skills Simulator has proven validity for distinguishing different types of users.**[1]

[1]Hung, J.J., Defender P., Pad, MB et al. Face, Content and Construct Validity of a Novel Robotic Surgery Simulator. The Journal of Urology, 2011; 186:1019-1025.

3. Continue Use as Warm-up

- **Warm-up activities can be relevant for improving surgical skills.**[1]
- **Simulation provides a platform for warm-up.**



[1]Kahol K, Satava RM, Ferrara J, Smith M. Effect of Short-Term Pretrial Practice on Surgical Proficiency in Simulated Environments: A Randomized Trial of the "Preoperative Warm-up" Effect. J Am Coll Surg. 2009; 208:755-761.

Cost effectiveness?

Da Vinci Skills Simulator	RobotiX Mentor	dV- Trainer
Console: $500,000 (sunk cost)	Simulator: $137,000	Simulator: $110,000
Simulator: $80,000		

JSLS 2018;22:

YUMC Yeungnam University Medical Center

Future Direction

the procedure specific complex software

- Face validity
- Content validity
- Construct validity
- Concurrent validity
- Predictive validity

Validation

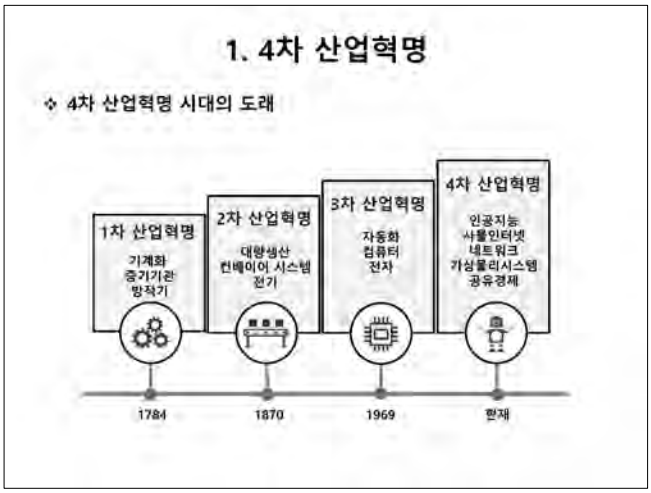
- Face validity: the extent to which the examination resembles the situation in the real world.
  → **realistic?**
- Content validity: the extent to which the intended content domain is being measured by the assessment exercise
  → **useful as training tool?**
- Construct validity: One inference of construct validity is the extent to which a test discriminates between various levels of expertise.
  → **novice vs. expert?**

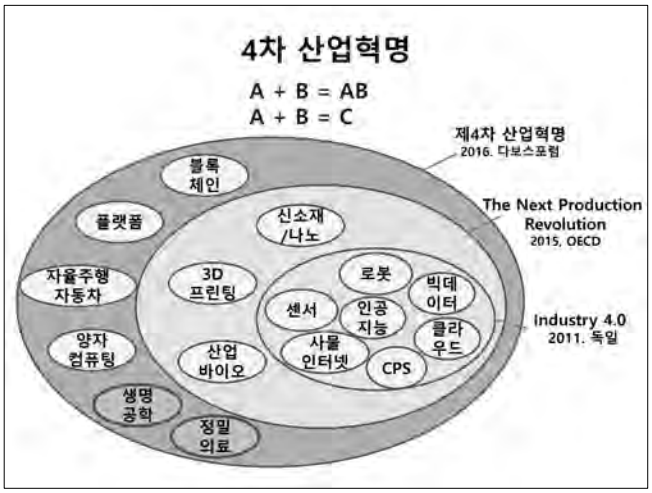
Concurrent validity: the extent to which the results of the test correlate with the gold standard tests known to measure the same domain.
→ **correlates with dry-lab?**

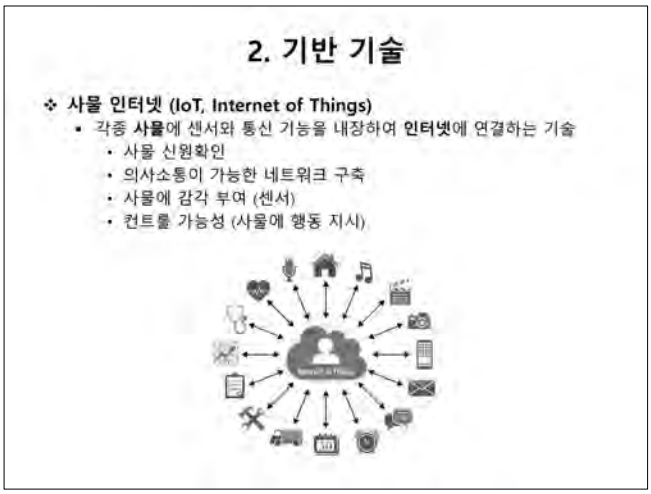
Predictive validity: the extent to which an assessment will predict future performance.
→ **predicts OR performance?**

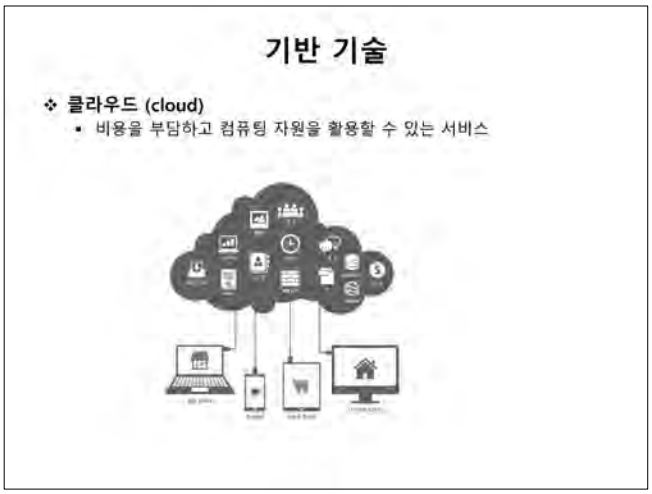
Digital health and future technology

이 건 명
충북대학교 소프트웨어학과









기반 기술

❖ **고속 인터넷**
- 언제 어디서나 고속 인터넷의 접속 상태 유지

기반 기술

❖ **빅데이터(Big data)**
- 데이터의 규모가 일반 소프트웨어를 통해서는 참을 만한 시간 내에 **획득, 저장, 정리, 검색, 공유, 분석**하기 곤란한 정도인 데이터의 모음
- 21세기 산업의 원유 역할

기반 기술

❖ **블록체인(blockchain)**
- **분산 원장**(distributed ledger, 分散 元帳: 공공거래장부) 구현
- 인터넷 거래의 해킹을 방지하기 위한 거래 기록과 승인이 컴퓨터 네트워크상의 참여자들 공동으로 검증 및 공유
- 모든 것이 거래 가능한 자산으로 전환
- **활용 사례**
  - **가상 화폐 :** 비트코인(bitcoin), 이더리움(Ethereum)
  - **공증 서비스**
  - **스마트 계약**
- 디지털 경제의 핵심 기술

기반 기술

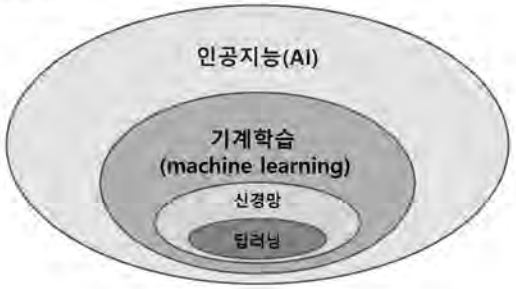
❖ **주문형 경제(on-demand economy) / 공유 경제**
- **플랫폼 (platform)**
  - 외부 생산자와 소비자가 상호작용하면서 가치를 창출하게 해 주는 것에 기반을 둔 비즈니스
  - 개방적인 인프라 제공 및 거버넌스 구축

기반 기술

❖ **인공지능**
- 의식적으로 하는 인간의 행동을 컴퓨터가 하도록 하는 것
- **사람의 지식 활용**
  - 전문가 시스템
- 데이터를 보고 컴퓨터가 스스로 학습하는 것 : **기계학습**

기반 기술

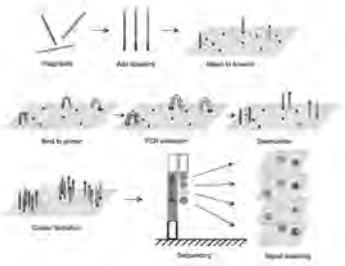
❖ **인공지능**



기반 기술

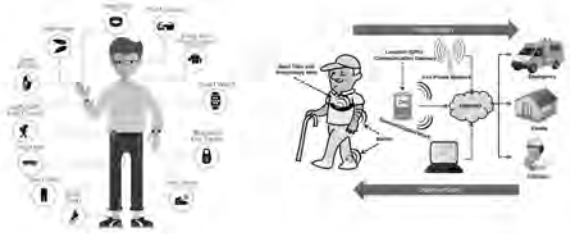
❖ **고성능 NGS 기술**
- 2일 이내 최대 60여명(3TB)의 전장유전체(WGS) 분석
- $100/person 비용
- 정밀의료의 기반 정보 제공

Illumina NovaSeq 6000 System



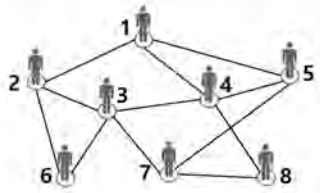
기반 기술

❖ **센서 기술**
- 빛, 소리, 화학물질, 온도 등과 같은 물리적 신호들의 크기 검출
- **웨어러블 센서**(wareable sensors)
  - 다양한 비침습형 센서 / 식입형(implantable) 센서
  - BAN(Body Area Network)
  - 연속적인 모니터링



기반 기술

❖ **소셜 네트워크**(social network)
- 개인 간의 연결관계 망
  - 개인, 의료 서비스 제공자, 지능형 정보 에이전트
- 건강관련 정보 공유 ⇒ 비교 / 격려 및 동기 부여



3. 디지털 헬스

❖ **디지털 헬스(Digial Health)**
- 헬스, 헬스케어, 생활, 사회를 **디지털 기술(ICT 기술) 결합**하여 **헬스케어 제공**의 **효율성 제고**와 **개인화된 정밀의료** 제공 (US FDA)

디지털 헬스

❖ **기존 의료 체계**
- **간헐적** 건강 검진 또는 **질병시** 검진
- **단속적** 건강 상태 파악
- **제한적** 정보 기반의 의료

❖ **디지털 헬스**
- **지속적**이고 **실시간적** 건강 상태 데이터 수집
- 집단 및 개인 **유전체** 정보 활용
- 집단 및 개인 **임상 데이터** 활용
- 개인화된 **정밀의료**
- **분석, 진단, 모니터링, 관리, 예측, 예방**

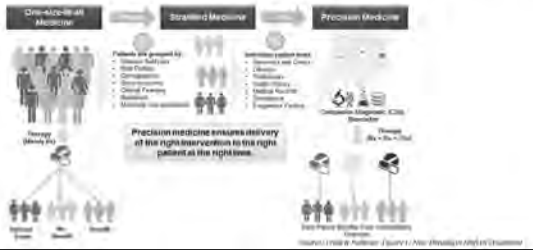
디지털 헬스

❖ **디지털 헬스**
- **디지털 혁명 + 유전체 혁명 (Paul Sonnier)**

디지털 헬스

❖ **디지털 헬스**
- **지속 연결 케이**(connected care in continuum) + **정밀의료**

- **정밀의료 (precision medicine)**
  - 대규모 유전정보, 임상 데이터, 생활습관, 환경 등 건강정보를 토대로 최적화된 개인 맞춤형 진단, 치료, 관리 프로토콜



디지털 헬스

❖ **기대 효과**
- 헬스케어 제공에서의 비효율성 축소
- 접근성 개선
- 비용 절감
- 헬스케어 품질 개선
- 개인 중심의 헬스 서비스 제공
- 환자 개별 특성에 맞는 개인화된 의료 제공

디지털 헬스

❖ **디지털 헬스 관련 분야**
- mHealth (Mobile Health)
- Health Information Technology (HIT)
- Wearables
- Telehealth
- Telemedicine/Telecare
- Connected care
- Connected health
- Personalized medicine
- Wireless health
- health data
- ePatient
- eHealth
- ...

디지털 헬스 시장 (기술 분류)

❖ **Telehealthcare**
- **Telecare**
  - Activity Monitoring
  - Remote Medication Management
- **Telehealth**
  - LTC(Long Term Care) Monitoring
  - Video Consultation

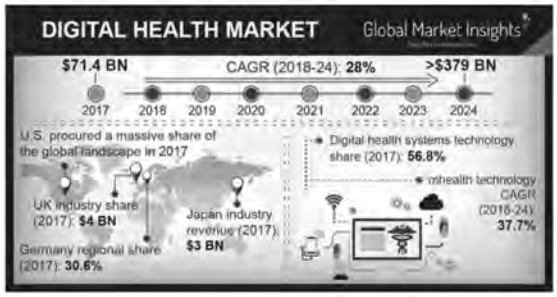
❖ **mHealth**
- **Wearables**
  - BP Monitor
  - Glucose Meter
  - Pulse Oximeter
  - Sleep Apnea Monitors
  - Neurological Monitors
  - Others
- **Apps**
  - Medical Apps
  - Fitness Apps

❖ **Health analytics**

❖ **Digital health systems**
- **Electronic Health Records** (EHR)
- ***e*-prescribing systems**

디지털 헬스 시장

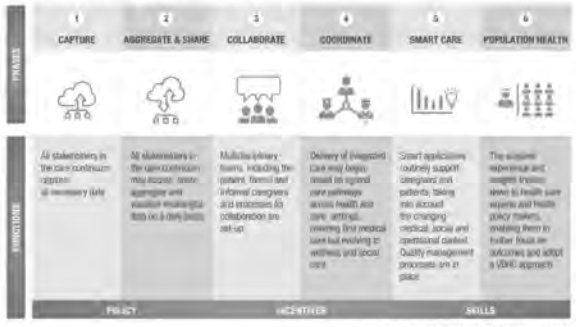
❖ **시장 규모**
- 2017년 대비 5.3 배 증가



Global Market Insights, Oct. 2018

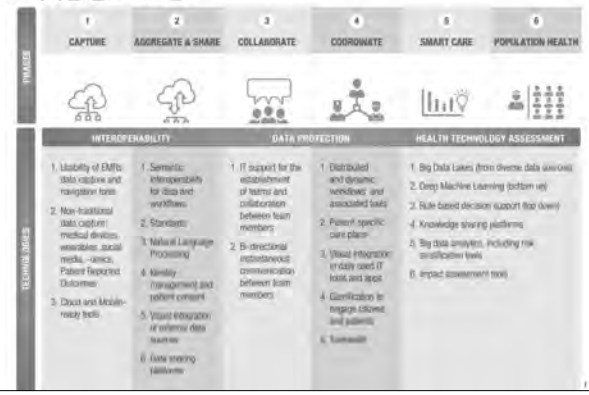
4. 디지털 헬스 관련 기술

❖ **디지털 헬스 로드맵**
- **COCIR**(European Coordination Committee of the Radiological, Electromedical and Healthcare IT Industry), 2017



디지털 헬스 관련 기술

❖ 디지털 헬스 로드맵



디지털 헬스 관련 기술

❖ 디지털 헬스케어 플랫폼

uk.tunstall.com

디지털 헬스 관련 기술

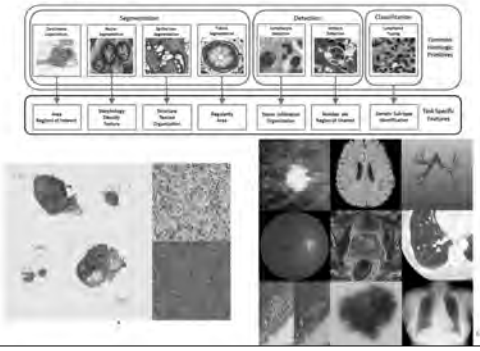
❖ 헬스 데이터의 수집, 분석, 관리 및 진단

디지털 헬스 관련 기술

디지털 헬스 관련 기술

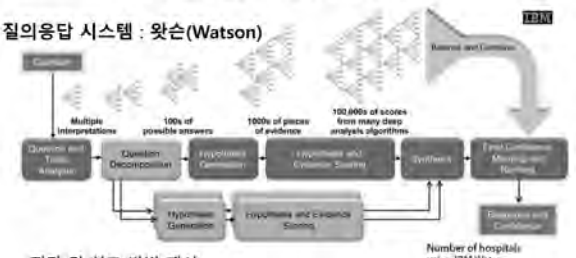
❖ 인공지능/기계학습 기술

▪ 진단 지원



디지털 헬스 관련 기술

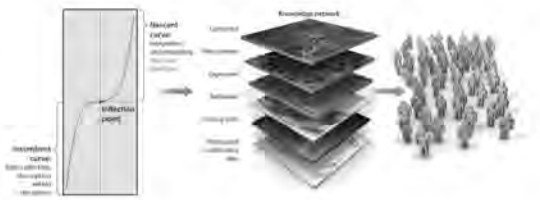
❖ 질의응답 시스템 : 왓슨(Watson)



- 진단 및 치료 방법 제시
  - Texas MD Anderson 암센터와 계약 파기
  - Memorial Sloan Kettering 암센터와 진행중
- Mayo Clinic, Johnson & Johnson, Bumrungard 병원
- 국내 6개 병원 도입 : 80% 내외 전문의 편정과 일치
- 동물질환 관리

디지털 헬스 관련 기술

❖ **유전체 정보**
- 유전체 시퀀싱 비용 : $27억(2003) ⇒ $100(2017)
- 집단 유전체(population genomes) 데이터베이스 활용
- 개인 유전체 활용 헬스케어



디지털 헬스 관련 기술

❖ **블록체인**
- 디지털 헬스 데이터의 저장 및 공유관리
  - EMR, EHR
  - Environment data
  - Lifelog data, etc.
- 데이터의 소유권과 관리권
- 보안 (비밀성 및 무결성)
- 결재 및 청산

디지털 헬스 관련 기술

❖ **사물 의료 인터넷 (Internet of Medical Things, IoMT)**
❖ **의사를 지원하는 채봇(chatbot)**
❖ **의료 진단 분야의 인공지능 기술의 도입 심화**
❖ **클라우스 기반의 디지털 헬스 서비스**
❖ **의료 빅데이터 애널리틱스**
❖ **소비자 참여를 위한 헬스 콘텐츠 (질의 응답)**
❖ **헬스케어 로봇**
❖ …

디지털 헬스 관련 기술

❖ **환자**
- 자기결정권이나 권리의식 강화
- 지능형 서비스를 통한 양질의 진단 및 치료 정보 취득
- 정보 공유 및 데이터 기반의 의료 서비스 선택
- 환자 참여 진료팀 요구

❖ **의료서비스 제공자**
- 기술발전과 함께 의료 환경의 급격한 변화
- **경쟁력 강화**
  - 선제적인 기술 도입과 시스템 개선
  - 타분야와 협업
  - 기술 및 사회 변화에 예민한 반응
  - 수세적 방어 ⇨ **공세적 영역확장**

감사합니다

Q & A

대한비뇨기종양학회
대한전립선학회
비뇨기계기초의학연구회

공동심포지엄

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대한전립선학회
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