Successful Implementation of EMR: Perspective of Change Management

HEE HWANG, MD, CIO

SNUH
SEOUL NATIONAL UNIVERSITY
BUNDANG HOSPITAL

SNUBH's Journey with BESTCare

BESTCARE
Next Generation HIS

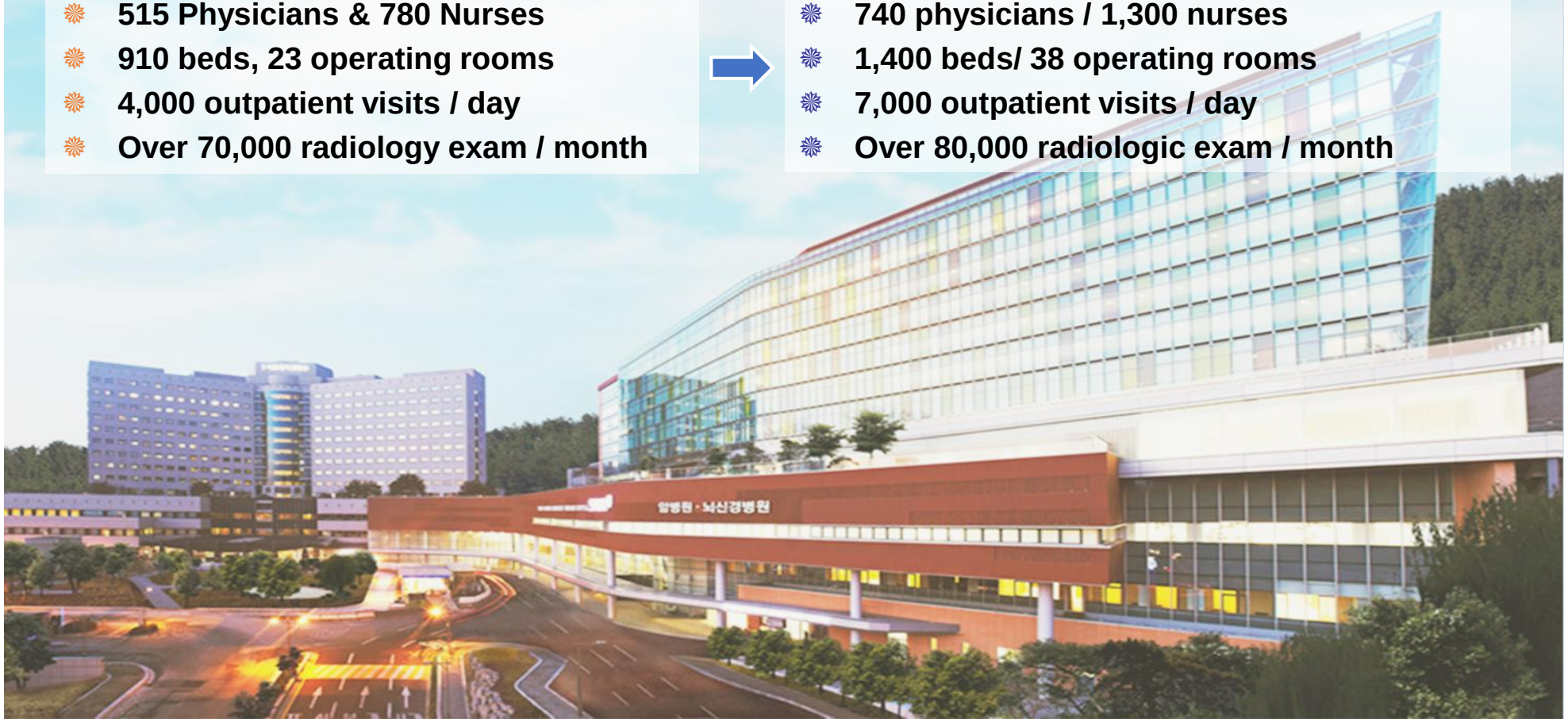
Seoul National University Bundang Hospital

2010

- 515 Physicians & 780 Nurses
- 910 beds, 23 operating rooms
- 4,000 outpatient visits / day
- Over 70,000 radiology exam / month

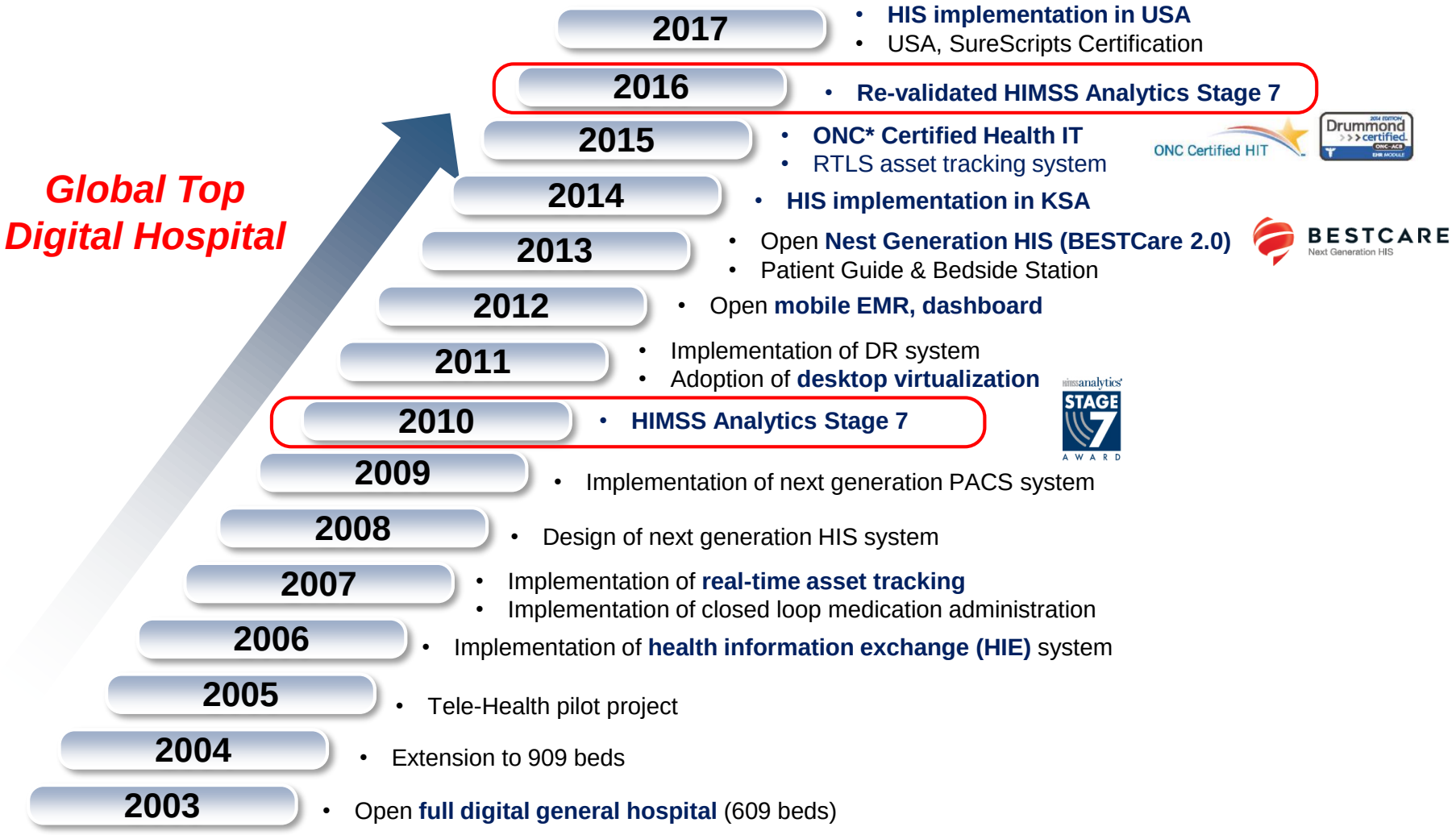
2017

- 740 physicians / 1,300 nurses
- 1,400 beds/ 38 operating rooms
- 7,000 outpatient visits / day
- Over 80,000 radiologic exam / month



BESTCARE
Next Generation HIS

IT Adoption Status



** ONC : Office of the National Coordinator for Health Information Technology - Health IT Certification Program in U.S*

Harvard Business Review

Harvard Business Review

How Big Data Impacts Healthcare

THE SPEED AND SCALE of the challenges and demands facing the healthcare industry are unprecedented. Yet in this period of rapid change, solutions are emerging that not only surmount those issues but also open new avenues to higher-value care. Cost pressures are making evidence-based medicine the industry catch phrase. At the same time, advances in genetics, biomedics, and computing technology are ushering in an era of more effective personalized medicine and treatments tailored to patients' individual characteristics.

Exploiting these opportunities requires the savvy use of data, which has been a long-term challenge for healthcare providers, who work with some of the most complex and disconnected data sets of any industry. "Most of the data systems are for billing, and they aren't used to improve the quality of care," explains Jason Jones, executive director for clinical intelligence and decision support at Kaiser Permanente, a healthcare provider and not-for-profit health plan that serves approximately 9.1 million members in eight states and the District of Columbia.

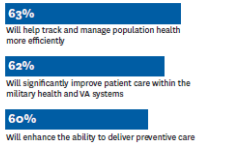
Yet healthcare organizations on the forefront of efficiency are already reaping the benefits of big data (a catchall term for the masses of structured and unstructured data flowing through organizations as well as the tools for analyzing the information). They have adopted IT platforms that simplify processes and IT systems while expanding and improving the scope and spread of care at a lower total cost of operation. The evolving IT platforms link disparate pools of data within and outside healthcare organizations and present the information with visualization tools that put actionable insights into the hands of caregivers and patients, enabling providers to invent new healthcare practices as needed. The benefits of this approach, according to a recent MeriTalk survey of 150 federal IT and business executives from healthcare-related agencies, include IT simplification; more evidence-based, value-conscious medicine; better preventive care; and improved, more personalized treatment. figure 1

What is driving the push for big data? It's simple: the demand to create more value in healthcare. "The healthcare system of today is based on fee-for-service and reimbursement for activity, with little or no connection to value," says Daniel Garrett, partner and leader of PwC's Healthcare IT practice. "The current IT platforms simply automate that longtime, inefficient approach. The IT platforms of tomorrow need to serve the new health economy, which centers on patient outcomes and reimbursement for creating value."

Figure 1

Many Benefits of Big Data

Federal IT and business executives from healthcare-related agencies peg the benefits of big data:



SOURCE MERITALK, MARCH 2014, "THE BIG DATA CURE"

Sponsored by SAP

A single healthcare platform simplifies IT and lowers total cost of operation

One great advantage of the new-generation IT platform is that it can harness all the disparate information within clinical, laboratory, claims, and other systems. The key: in-memory computing technology, which can analyze huge data sets rapidly and provide a single source of truth for transactions and analyses.

Consider MemorialCare Health System in Fountain Valley, California, a $2.2 billion not-for-profit integrated health system that operates six hospitals and 200 care sites. The organization constructed a data mart that includes more than 50 data points for each of more than 20 million medications. The data mart was able to answer detailed questions such as "Which patients received drug X last year?" and "What is the average dose and duration of a particular drug?"

However, standard data warehouse tools couldn't drill into the entire data set quickly enough to provide the deep insights caregivers needed. After MemorialCare implemented in-memory computing, the entire data set was able to load and filter in less than a second. "This is enabling our clinicians and informaticists to more readily explore the data, test theories, and look for correlations and associations that would otherwise be hidden," says Dan Exley, executive director of data strategy and reporting at MemorialCare.

Over time, the new health IT platform will extend its scope and spread to patients, says James N. Weinstein, CEO and president of Dartmouth-Hitchcock, an academic medical center. "The simplification of information provided by new IT platforms should allow patients to make informed decisions," he says. "Right now they have less information about their healthcare than they do about their breakfast cereal."

Simpler, more readily available information could cut the cost of healthcare while improving its quality, according to a recent Health Research Institute survey. figure 2 "Many consumers have high deductibles, and they are actively looking to reduce costs and improve quality," Weinstein says. Emerging Internet technologies could help. The survey found, for example, that patients would likely choose nontraditional forms of healthcare, such as at-home urinalysis tests using a device attached to a smartphone, if they cost less—and if they knew about them.

Figure 2

Patients Taking Charge of Health Choices

Percentage of patients that would do a specific task if costs were lower.

SOURCE HEALTH RESEARCH INSTITUTE, APRIL 2014, "HEALTHCARE'S NEW ENTRANTS: WHO WILL BE THE INDUSTRY'S AMAZON.COM?"

Inventing new healthcare practices as needed for a much lower cost of care

The ability to rapidly analyze structured and unstructured data sets is improving patient care at Seoul National University Bundang Hospital (SNUBH), a South Korean facility with some 1,800 beds and 3,100 medical workers. There, doctors are using in-memory computing to improve preoperative care. Availing themselves of real-time feedback enabled by the technology, they have been able to reduce the usage of antibiotics before surgery. Not only does the reduction cut costs and help prevent the growth of drug-resistant bacteria, it is a matter of "huge clinical significance to the patient," says Dr. Hee Hwang, CIO at SNUBH.

Other health systems are using new computing technology to pull together data scattered across not only different departments but also multiple organizations. "Some organizations, like MemorialCare, are strengthening existing partnerships and implementing technology that provides patients with care that is more integrated across the continuum than ever before," says MemorialCare's Exley. "Integrating data across *all* of the providers that patients might choose is a critical capability."

This level of coordination can pay significant dividends. Dartmouth-Hitchcock's Weinstein points to his organization's work with the High Value Healthcare Collaborative (HVHC), a collective of 70,000 physicians and 7 million patients across the U.S. In its first project, HVHC found strikingly different costs and processes for total knee replacements among four hospital sites, with one site performing markedly better than the others. When the site's best practices were shared with the other three, all four cut their lengths of stay for knee-replacement procedures by a full day.

HVHC has now turned its focus to sepsis, a severe inflammation that kills millions every year. "With the big data tools," says Exley, whose hospital is part of the group, "physicians will be able to access data in real time and plug it into predictive algorithms that calculate the chance of a patient becoming septic based on age, gender, family history, genetic markers, and other unique factors."

Real-time, highly personalized medical insights from any source enhance preventive care

Making information easy for caregivers to consume and act on is another key to a successful IT platform. At SNUBH, for example, each doctor and nurse is able to configure the systems to relay the precise clinical information that is of value to them. There are currently 3,000 different end-user configurations in use among the nurses and doctors. The ability to connect systems and display targeted information also enabled the hospital to better coordinate care. In some departments, it previously took 48 hours to provide a patient referral. By pulling real-time data from different locations and displaying it in easy-to-use ways, the hospital reduced referral wait times to four to six hours.

Speed, however, is no advantage unless the data retrieved are also relevant and accurate. "If all we do is help people make the wrong decisions faster, that won't be a net business or care benefit," says Jones of Kaiser Permanente. "If you don't couple that speed with the right statistical tools, it can be hard to discern what you need to pay attention to amid the random noise."

To illustrate his point, Jones cites a situation in which a large number of patients who were treated for pneumonia at one Kaiser Hospital and discharged were apparently readmitted to another Kaiser facility soon afterward. A three-month investigation revealed that the problem wasn't with the hospital's care but with its data. The patients had been moved to another facility to accommodate a construction project at the hospital where they were originally admitted, but the IT system had recorded them as discharged. The complex chain of interactions involved in delivering care had masked that simple explanation.

To avoid such mix-ups, Jones says, the IT platform must combine speed with visualization tools and guided analytics that can turn data into insight. A study of 40 hospitals and 30 insurers by tech consultancy IDC indicates that healthcare organizations are working toward just that goal—prioritizing analytics for a wide range of patient care. figure 3

Figure 3

Applying Analytics

Hospitals' top goals for using analytics, according to a survey of 40 hospitals and 30 insurers:

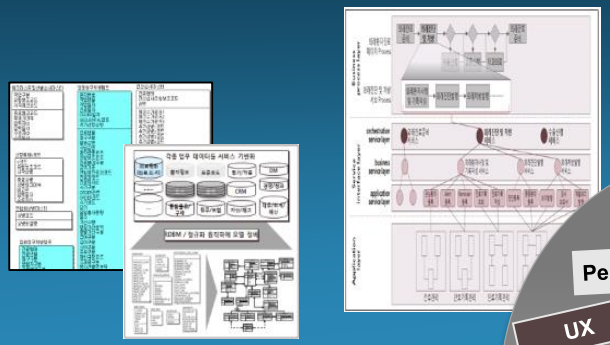
SOURCE INFORMATION WEEK, MARCH 2013, "HEALTHCARE ORGANIZATIONS GO BIG FOR ANALYTICS"

Conclusion and recommendations

Healthcare's future is still under construction, but it's already clear that designing the healthcare IT platform of tomorrow entails reimagining not only how data is used but how healthcare is delivered. "We need to remove the barriers of time and space between the patient, the doctor, and the healthcare administrator," PwC's Garrett says. "It's about not just crunching a lot of data, but inserting that data at key moments when healthcare is delivered and consumed." And the linchpin of the entire approach will be a single innovation platform that delivers real-time and personalized medical insights while reducing costs across the continuum of care.

Major Considerations of BESTCare 2.0

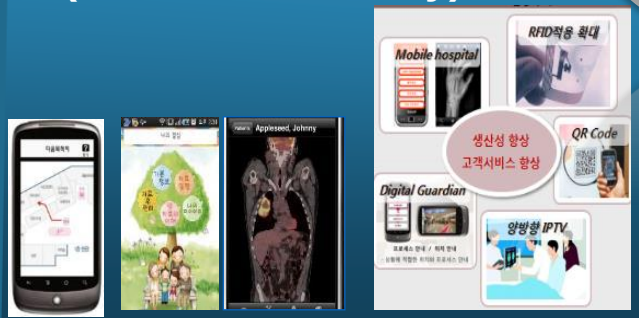
1. SOA-based Modeling



2. Value based Care

CDW
Personalize
Terminology
UX
Sharing
Multi-tasking
CDSS
Summary sheet
Privacy/Security
IT Governance
Flexible
Patient Portal
Mobile

3. Continuum of Care (N-Device, Mobility)

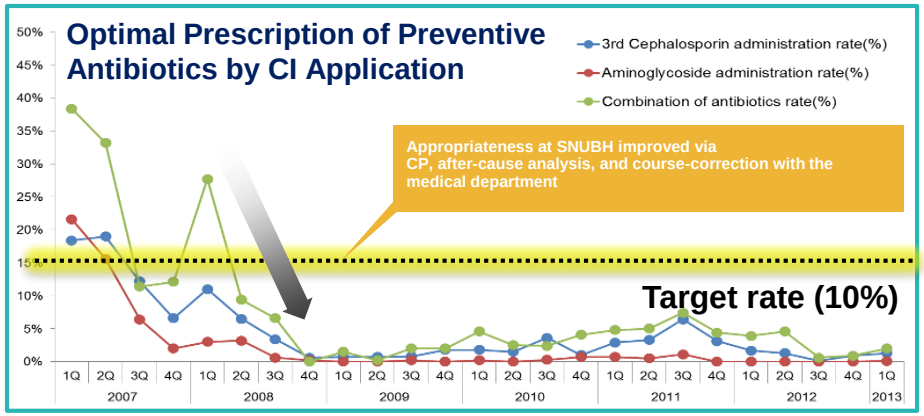


4. Data-Driven Hospital

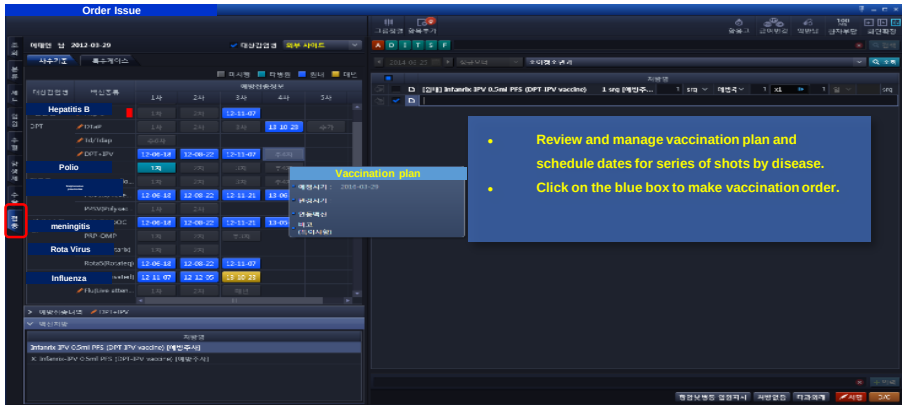
ICD-10
INTERNATIONAL CLASSIFICATION OF DISEASES
RXNORM
SNOMED CT
LOINC®

Value based care

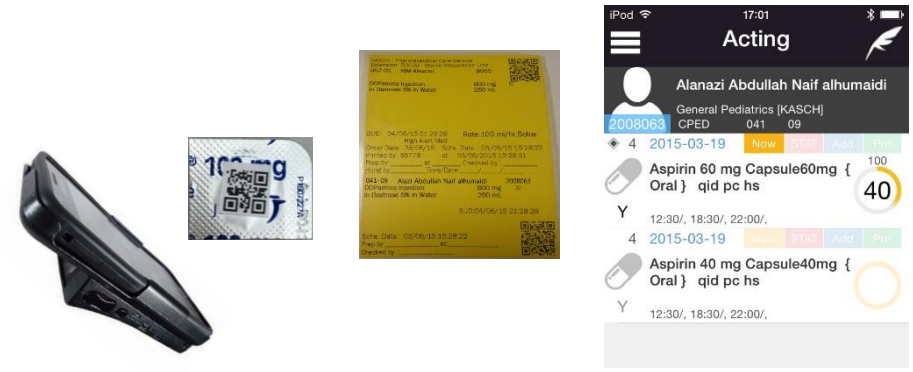
① Clinical Indicators



② Clinical Decision Support System



③ Closed Loop Medication Administration



④ Clinical Pathway

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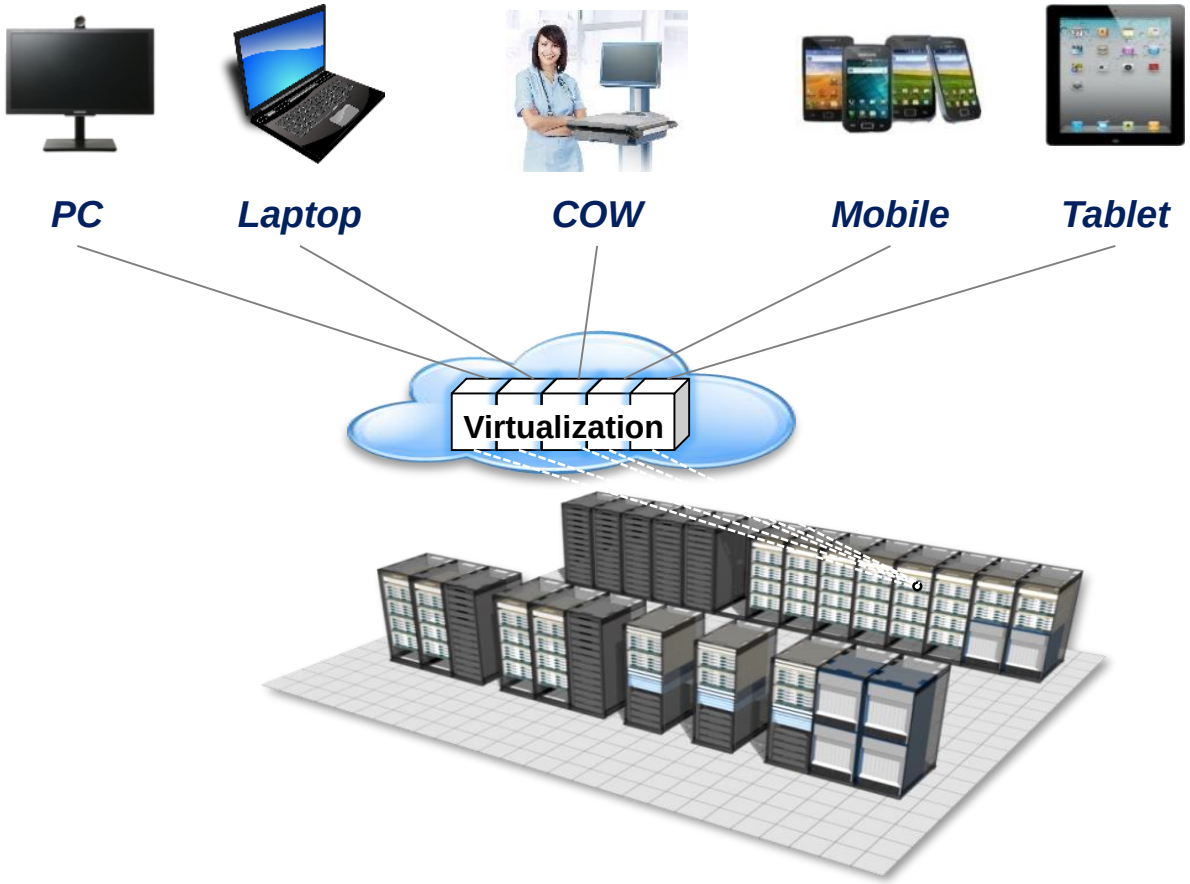
Continuum of Care (N-device, Mobility)

"Any-time, Any-where, Any-device"



BESTCARE
Next Generation HIS

Smart Hospital Solutions

Mobile EMR

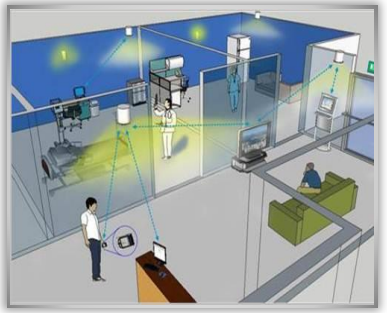
Dashboard

Bedside Station

e-Consent

Patient Portal

Diabetes Mgmt.

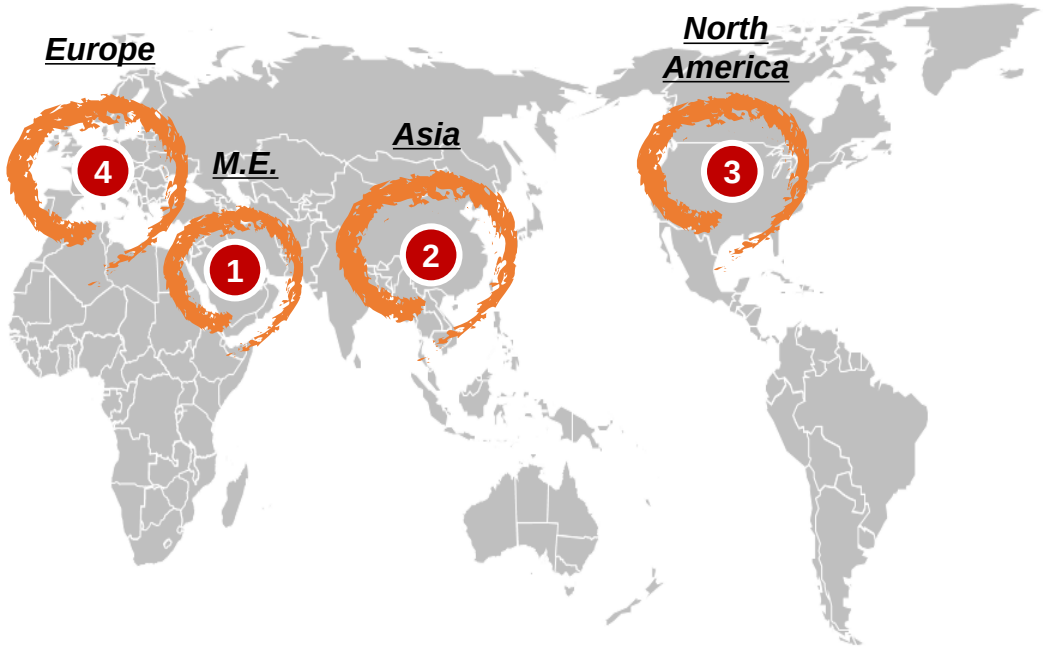


Patient Guide

RTLS

(Real Time Location System)

Global Expansion



1 Middle East

- **In KSA (’14 ~ ‘17)**
  - MNG-HA[1] hospitals & RCHSP[2]
- **In UAE (’14)**
  - SKSH[3]
- **Entering other M.E. by JV (’16)**

2 Asia

- **Entering into China (’17)**
  - Developed china ver. BESTCare 2.0
  - On-going implementation in Wuxi New District Phoenix Hospital

3 North America

- **Preparation for entering US**
  - ONC HIT[4] certified
  - Achieved various global recognitions
- **In USA (’17)**
  - Aurora Behavioral Healthcare Hospitals

4 Europe

- **Planning to enter EU (’17)**
  - Tapping to Enter
  - UK & Ireland

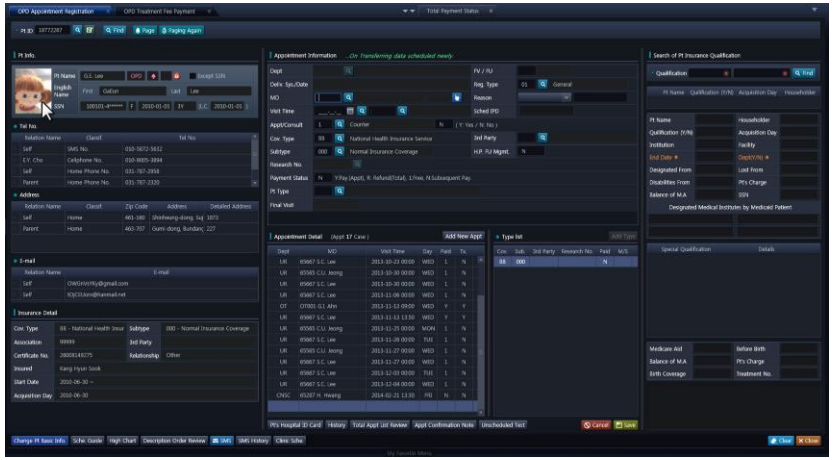
1) Ministry of National Guard, Health Affairs 2) Jubail Royal Commission Hospital 3) Sheikh Khalifa Specialist Hospital
3) Certified Health IT Product List by The Office of the National Coordinator for Health Information Technology

Globalized BESTCare 2.0

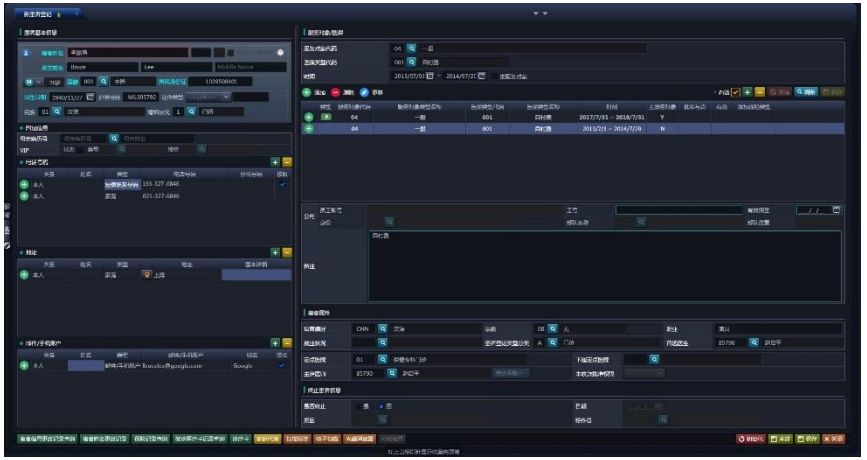
“Korea Version”

“KSA Version”

“English Version”



“China Version”



BESTCARE
Next Generation HIS

Global Recognition

ezCaretech (BESTCare 2.0) is ranked as top 6 among multiregional hospital EMR vendors who have contract with hospitals outside of the U.S

"10 popular EMR vendors ranked by KLAS in 2017"

Ranking	Vendor Name
No.1	Epic
No.2	Cerner
No.3	InterSystems
No.4	Agfa HealthCare
No.5	Dedalus and Medasys
No.6	***ezCaretech***
No.7	DXC Technology
No.8	Meditech
No.9	Everis
No.10	Allscripts

1) Press released (July 13, 2018) by Becker's Hospital Review based on KLAS research report

Change Management

BESTCARE
Next Generation HIS

Organization at SNUBH

Head of Next G. HIS (SNUBH CMO)

PM of Next G. HIS (SNUBH CIO)

PMO	
Informatics Office	Manager JH Yoon
Chief PL	Manager EY Jo
Chief Coordi.	RN. HJ Park

Physician Working Group
Dr. MK Kim
Dr. TH Kim
Dr. CW Jung
Dr. WJ Jung
Dr. YJ Jo
Dr. SY Yoo
Dr. ES Kim
Dr. YH Choi
Dr. TH Kim
Dr. TS Kim

Full Time Participants	
Physicians	28
Medical Staffs	5

Subcommittee	
Area	***Chief***
UX Mobile	Dr. KH Lee
Modeling	Dr. KH Lee
Security	Dr. JM Kim
CDSS	Dr. TS Kim
PACS	Dr. TJ Kim
TEST Rehearsal/ Education	Dr. KH Lee
ERP	Manager JH Yoon
Standardi-zation	Dr. SS Byeon
CDW/CI	Dr. CW Jung
CP/CPG	Dr. JY Hyeon
HIE	Dr. JH Kim
Infra/I/F	Manager JH Yoon
Certification /IPR	Dr. SY Yoo

Subcom-mittee & Working Group Collabo-ration

Medical Staff Working Group			
Dept.	***Chief***	***Dept.***	***Chief***
Nurse	EJ Jung	Pharmacy	ES Lee
Health Screening	HR Lee	Rehabili-tation	YY Goo
Radiology	KH Min	Pathology	DH Hwang
Oncology	JH Park	Nutrition	HS Yeom
PLUS	BN Lee	Admin.	DH Yoo
Public Health	BC Park	Financial Planning	WS Shin
Logistics	MS Jo	HR	IS Ha
Education	SS Bae	Referral	JS Lee
Information	YA Lee	Insurance	GN Jeon
Nuclear Medicine	IW Lee	Building Extension	SH Seol
Laboratory	YS Jung	Accounting	SM Jung
QA	JH Lee	PR	SK Min

Physician Subcommittee

Subcommittee Composition

Total Members: 32

- **Chairman (Physician) : K.H. Lee**
- **IT Module Analyst : K.H. Choi**

No.	Department	Name	No.	Department	Name
1	Pulmo	YJ Cho	16	Pediatrics	JW Kwon
2	Cardio	IY Oh	17	Urology	CW Jung
3	Gastro	HJ Cho	18	Neuropsych	TH Kim
4	Allergy	SH Kim	19	Neuro	JE Kim
5	Infec. Diseases	ES Kim	20	Anesthesiology	HJ Shin
6	Hematology	JW Kim	21	Emergency	JH Lee
7	GS	GH Jung	22	Radiology	NJ Sung
8	TS	TH Kim	23	Radiation Onco	KY Um
9	NS	YH Kim	24	Nuclear Med.	HY Lee
10	OS	KM Lee	25	Laboratory	TS Kim
11	PS	BK Kim	26	Pathology	HJ Park
12	OBGY	KD Kim	27	Rehabilitation	EJ Yang
13	Derma	JW Shin	28	Dentistry	YH Choi
14	Ophthalmology	EJ Lee	29	FM	JS Han
15	ENT	WJ Jung	30	Health Promotion	HY Kim

Main Activities

Weekly 62 Meetings

22 Unit Tests

1. **Collect requests from all physicians**
2. **Discuss and analyze requests at the Council**
3. **Classify requests by use-case categories**
4. **Clarify user requests**
5. **Decide implementation plan at the Council**

- ***Review & Check System Functionality***
- ***Participate in Test for Solution Improvement***
- ***Continuously educate and train end-users***

Nurse Subcommittee

Subcommittee Composition

Total Members: 9

- **Chairman (Nurse) : E.J. Jung (Team Leader)**
- **IT Module Analyst : H.A. Kim**

No.	Department	Name
1	Ward 41	HY Hwang (Chief Nurse)
2	Ward 61	YA Song (Chief Nurse)
3	Ward 105	HA Lee (Chief Nurse)
4	Psychiatry Ward	MJ Lee (Chief Nurse)
5	ICU	MJ Lee (Chief Nurse)
6	Delivery Room	KH Park (Chief Nurse)
7	ER	YS Lim (Chief Nurse)

Main Activities

Weekly 85 Meetings

Weekly Nursing Information System meeting

UI Review, unit test per every 2 weeks

Education, Research, Collaboration with other departments

1. **Collect requests**
2. **Review & analyze requests**
3. **Decide on accepting requests**

- ***Review & Check System Functionality***
- ***Participate in Test for Solution Improvement***
- ***Continuously educate and train end-users***

Exam. & Auxiliary Subcommittee

Subcommittee Composition

Total Members: 23

- ***Manager & Information Admin of Exam. & Auxiliary Departments***

No.	Department	Name
1	Nursing	EJ Jung
2	Pharmacy	ES Lee
3	Medical Record	YA Lee
4	Nutrition	HS Yeom
5	Diagnostics	YS Jung
6	Nuclear Med.	IW Lee
7	Radiology	KH Min
8	Pathology	DH Hwang
9	Special. Diagnostic	ES Han
10	Rehabilitation	YY Koo
11	Radiation Onco.	JH Park
12	Health Promotion	HR lee
13	QA	JH Lee
14	PLUS	BN Lee
15	Registration	DH Yoo

No.	Department	Name
16	Insur. Review	GN Chun
17	Stock mgmt	MS Cho
18	HR/Payment	IS Ha
19	Finance	SM Chung
20	Education	SS Bae
21	Budget	WS Shin
22	Public Relations	SK Min
23	Medical Collab.	JS Lee

Main Activities

Ad-hoc meetings

Total 77meetings for Payment & Insurance

Total 287 meetings for Exam. & Support Dept.

1. **Collect requests from information admin of each dept.**
2. **If the requests impacts another sub-system, the final decision is made by the BESTCare TFT.**

- ***Review & Check System Functionality***
- ***Participate in Test for Solution Improvement***
- ***Continuously educate and train end-users***

Integration Test & Real-Situation Simulation

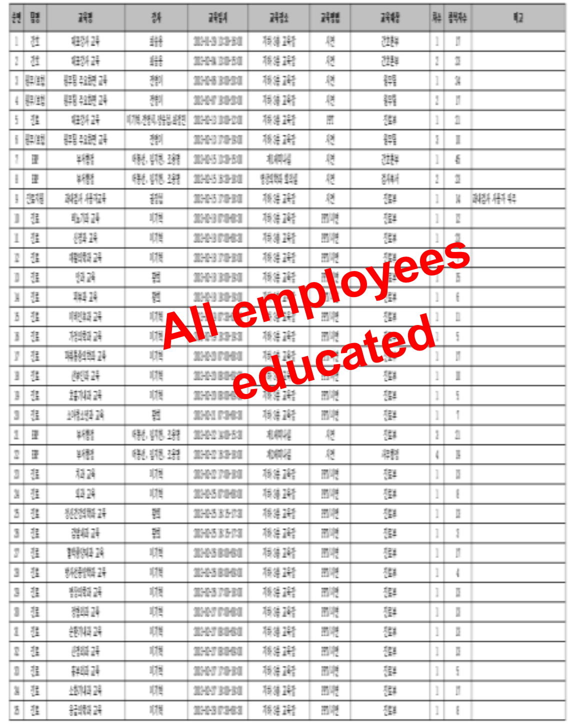
Total 22 Test & Real-Situation Simulation
Integration Test : 11 / Real-Situation Simulation: 5 / Parallel Test : 6

Section	Events	Date	Cases	Participators
Internal Integration Test	1st	06.11.2012	26	63
	2nd	15.11.2012	40	70
	3rd	27.11.2012	64	77
	4th	08.12.2012	50	74
	5th	21.12.2012	40	69
	6th	12.01.2013	50	76
	7th	18.01.2013	50	76
	8th	31.01.2013	45	83
	9th	14.02.2013	45	79
Total			**410**	**667**
Integration Test	1st	24.01.2013	60	141
	2nd	05.02.2013	80	173
Real-Situation Simulation	1st	21.02.2013	150	269
	2nd	07.03.2013	150	312
	3rd	23.03.2013	300	393
	4th	03.04.2013	200	413
	5th	10.04.2013	100	339
Total			**1,040**	**2,040**
Parallel Test	1st	25.03.2013	173	**All Employees**
	2nd	26.03.2013	157	
	3rd	27.03.2013	161	
	4th	28.03.2013	183	
	5th	29.03.2013	175	
	6th	08.04.2013	139	
Total			**988**	

End User Education

- **Purpose : Improve skill and familiarizing with the program**
- **Period : Jan. 29th, 2013 ~ Apr. 19th, 2013 (3 month)**
- **Method : Presentation, Demonstration, Exercise**
- **Trainee : All Employees**
  (Physician, Nurse, Technician, Pharmacist, Officer)
- **Trainer**
  - Physician in charge of information from each dept.
  - Head Nurse
  - Technician & Officer in charge of information from each dept.

Education Record



Stabilization

TFT	Members	Main functions	Host Department
Committee of medical information	13	• Deliberation and decision making of adopting and installing medical information system	Dept. of Medical Informatics
Committee of Medical Records Management	13	• Deliberation and decision making of documentation, utilization, authority, terminology, and format for medical record	Dept. of Medical Informatics (Medical Record)
Committee of Personal Information Protection	15	• Deliberation and decision making of plan establishment, policy management, and Implementation for personal information protection	Dept. of Medical Informatics
BESTCare TFT	23	• Deliberation and decision making of operation, maintenance, and development for HIS (Medical Treatment/Nursing/Other Auxiliary Dept./Administration and Insurance Dept. /General Management) : CDW/CI, Security, CDSS, CP, HIE, PACS, UX, SH, IF	Dept. of Medical Informatics
HIE TFT	18	• Collection of opinions and feedback on health information exchange with cooperative hospitals and clinics • Monitoring current status of medical information exchange • Discussion of information exchange activation, computer program development	Dept. of Medical Informatics
CP TFT	20	• Discussion of definition, application and development for CP • Monitoring CP and providing feedback to the relevant department • Discussion and review of development for new contents	Dept. of Management Innovation
CI TFT	12	• Development of item for new CI • Management of goal and definition for CI • Continuous CI monitoring: Providing feedback to the relevant department	Dept. of Management Innovation

Super User's Role as key-player

Super User's Role

- **Collection of opinions and feedback from end users (after A. Hospital open)**
- **Deliberation and decision making of requirements and functions about each module**
- **Deliberation and decision making of operation policy**
- **Educating & training end users for the program**
- **Discussion about implementation plan and goal with project team**

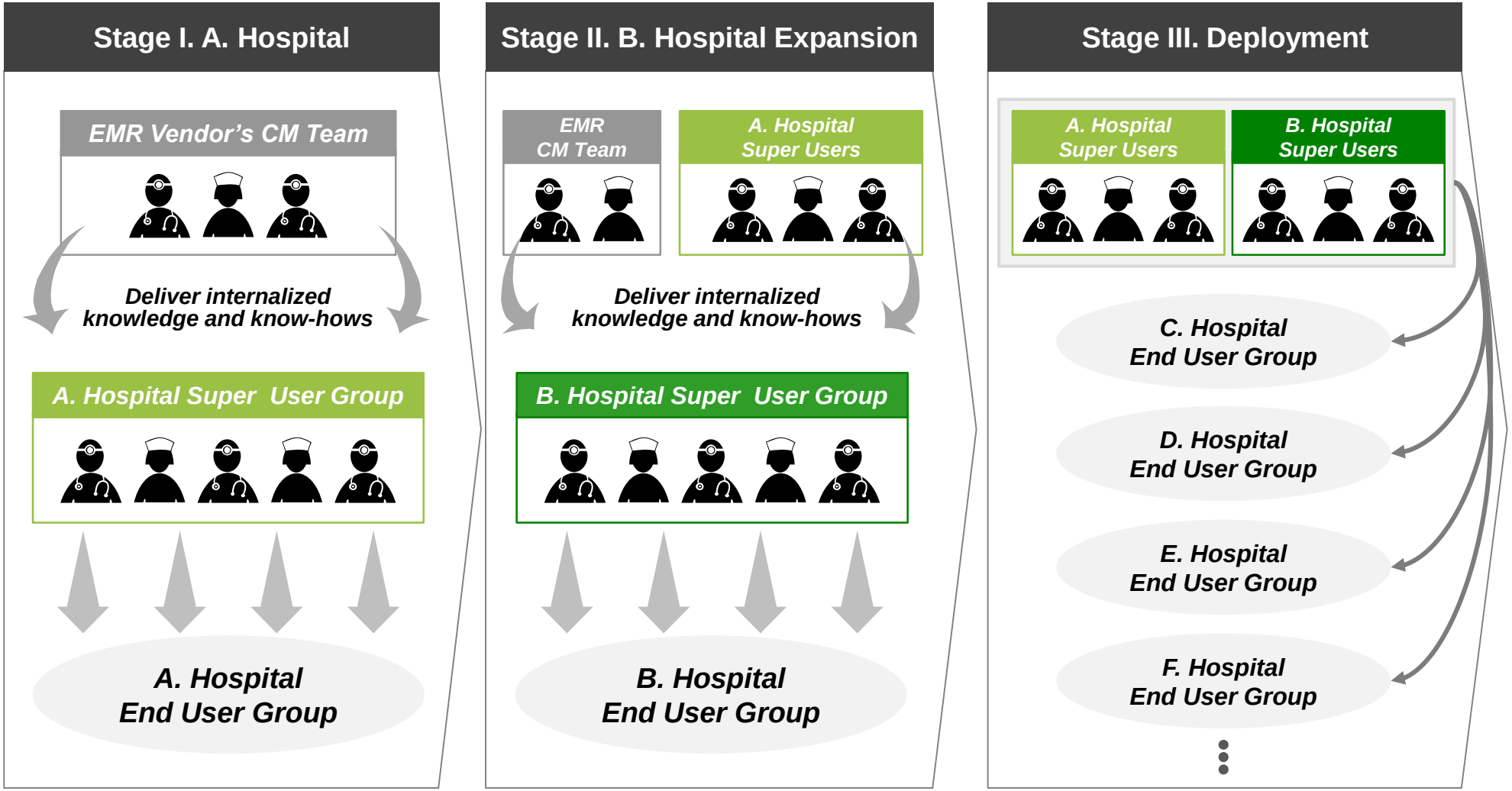
Short term plan

- ✓ **First & Best Digital Hospital**

Long term plan

- ✓ **To Spread BESTCare 2.0A System to all Hospitals under the same umbrella**
- ✓ **To achieve an accreditation as a proof of IT excellence**

Internalization & Incubation



Budget

Category	Budget(%)
Gap Analysis	10%
Implementation	50%
Configuration	10%
Test	3%
Training(Change Management)	7%
Data Migration & Interface	10%
Go-live Support	10%
Total Budget	**100%**

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A novel concept for integrating and delivering health information using a comprehensive digital dashboard: An analysis of healthcare professionals' intention to adopt a new system and the trend of its real usage

Keehyuck Lee (M.B.A., M.D.)[a,b,d,1], Se Young Jung (M.D.)[b,d,1], Hee Hwang (M.D., Ph.D.)[a,d,e,*], Sooyoung Yoo (Ph.D.)[a,d], Hyun Young Baek[a,d], Rong-Min Baek (M.D., Ph.D.)[c,d], Seok Kim (M.P.H.)[a,d]

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ABSTRACT

Objective: To introduce a new concept of medical dashboard system called BESTBoard. Such a system was implemented in all wards in a tertiary academic hospital to explore the development process, core designs, functions, usability and feasibility.

Methods: The task-force team made user interface designs for 6 months based on a need analysis. Hardware configuration and software development was carried out for 3 months. We conducted a survey of 383 physicians and nurses to determine the usability and feasibility of the system.

Results: In March 2012, the system was installed in all wards, including the intensive care units, emergency rooms, operation rooms, and even delivery rooms. Healthcare professionals had access to all information of EHRs optimized for a large 55-inch touchscreen. The satisfaction rate of BESTBoard users was high, with a mean of 3.3 points. Voluntary users tended to consider BESTBoard as a good system that is useful for team round visits, interdisciplinary team approach, and collecting the status of the hospital rooms. Elderly users didn't tend to think of BESTBoard as a useful tool for interdisciplinary team approach and collecting the status of the hospital rooms. Greater expectations regarding work performance affected the users' attitudes positively. A positive attitude toward using the system resulted in consistent real usage and health care professionals' satisfaction with the new dashboard system.

Conclusions: A new concept of hospital dashboard system proved to be feasible and useful in delivering health information to healthcare professionals. A positive attitude and an expectation regarding work performance were important factors for intention to use the system. This finding can serve for developing new systems to present health information effectively. Further studies will be needed to evaluate the extent to which BESTBoard can have a positive impact on clinical care outcomes and work performance.

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A study of user requests regarding the fully electronic health record system at Seoul National University Bundang Hospital: Challenges for future electronic health record systems

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ABSTRACT

Objective: Although the adoption rates for Electronic Health Records (EHRs) are growing, significant opportunities for further advances in EHR system design remain. The goal of this study was to identify issues that should be considered in the design process for the successful development of future systems by analyzing end users' service requests gathered during a recent three-year period after a comprehensive EHR system was implemented at Seoul National University's Bundang Hospital in South Korea.

Methods: Data on 11,400 service requests from end users of the EHR system made from 2008 through 2010 were used in this study. The requests were categorized as program modification/development, data request, insurance-fee identification/generation, patient-record merging, or other. The authors further subcategorized the requests for program modification/development into the following nine areas of concern: (1) indicators and statistics, (2) patient safety and quality of care, (3) special task-oriented functionalities, (4) ease of use and user interface, (5) system speed, (6) interoperability and integration, (7) privacy and security, (8) customer service, and (9) miscellaneous. The system users were divided into four groups—direct care, care support, administrative/insurance, and general management—to identify each group's needs and concerns.

Results: The service requests for program modification/development, data request, insurance-fee identification/generation, patient-record merging, and other issues constituted approximately 49.2%, 33.9%, 11.4%, 4.0%, and 1.5% of the total data set, respectively. The number of data-request service requests grew over the three years studied. Different groups of users were found to have different concerns according to their activities and tasks. Within the program-modification/development category, end users were most frequently concerned with ease of use and user interface (38.1% of the total) and special task-oriented functionalities (29.3% of the total) in their use of the EHR system, with increasing numbers of requests in both categories over the three years. Users in the direct-care group differed from the other groups in that they most frequently submitted requests related to ease of use and user interface, followed by special functionalities, patient safety and quality care, and customer service, while users in other groups submitted requests concerning ease of use and user interface and special functionalities with a similarly high frequency.

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Acceptability and feasibility of the Leapfrog computerized physician order entry evaluation tool for hospitals outside the United States

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ABSTRACT

Background: Computerized physician order entry (CPOE) with clinical decision support is expected to deliver many benefits in terms of patient safety. The Leapfrog tool was developed to allow hospitals to assess their medication-safety related decision support. To explore the approach's generalizability, we examined its acceptability and feasibility through an evaluation using this tool in four Korean hospital systems.

Methods: Four hospitals with locally developed CPOE systems participated, and a cross-sectional study design was used with the approval of the Leapfrog Group and the institutional review board at each hospital site. The hospitals were tertiary and academic institutions with long experience of advanced CPOE. From January 21 to 28, 2014, web-based tests were conducted at each site following the given instructions, and the results were self-reported. We measured each system's response rate, category completion rate, and time to complete the evaluation. Additionally, we compared the evaluation results of the four systems with scores from five US systems, as was reported in another study.

Results: The four systems underwent the tests, and the overall category completion rates ranged from 67.9% to 75.5%. The times to finish the tests were tolerable and within the allowed test timeframe. One system did not pass the deception analysis, which checks for false positives, due to a conflict with another type of alert checking for the presence of a medical diagnosis for documentation purposes. The other three systems scored at the completed the evaluation stage, with scores ranging from 21.6% to 36.5%. Of the nine error categories, Drug-Allergy was an area of strength for all systems, whereas the categories of Therapeutic duplication, Drug-Labs, and Drug-Age were areas of weakness for all. In comparison with the US systems, gaps were identified, and further improvement is needed.

Conclusions: The acceptability of the CPOE evaluation tool was moderate, but the feasibility was sufficient to operate the test outside the US, and the results revealed many opportunities for improvement in the Korean systems, as was the case when this application was introduced in the US.

1. Introduction

Computerized physician order entry (CPOE) with clinical decision support (CDS) has been promoted in part because of the evidence that it can improve medication safety. In the US, physician adoption of CPOE for medication orders has increased to 80%, almost doubling since 2009, as the result of a major federal national program focused on increasing the use of health information technology, with the support of numerous political

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Analysis of the factors influencing healthcare professionals' adoption of mobile electronic medical record (EMR) using the unified theory of acceptance and use of technology (UTAUT) in a tertiary hospital

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Abstract

Background: Although the factors that affect the end-user's intention to use a new system and technology have been researched, the previous studies have been theoretical and do not verify the factors that affected the adoption of a new system. Thus, this study aimed to confirm the factors that influence users' intentions to utilize a mobile electronic health records (EMR) system using both a questionnaire survey and a log file analysis that represented the real use of the system.

Methods: After observing the operation of a mobile EMR system in a tertiary university hospital for seven months, we performed an offline survey regarding the user acceptance of the system based on the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technology Acceptance Model (TAM). We surveyed 942 healthcare professionals over two weeks and performed a structural equation modeling (SEM) analysis to identify the intention to use the system among the participants. Next, we compared the results of the SEM analysis with the results of the analyses of the actual log files for two years to identify further insights into the factors that affected the intention of use. For these analyses, we used SAS 9.0 and AMOS 21.

Results: Of the 942 surveyed end-users, 48.3 % (23.2 % doctors and 68.3 % nurses) responded. After eliminating six subjects who completed the survey insincerely, we conducted the SEM analyses on the data from 449 subjects (65 doctors and 385 nurses). The newly suggested model satisfied the standards of model fitness, and the intention to use it was especially high due to the influences of Performance Expectancy on Attitude and Attitude. Based on the actual usage log analyses, both the doctors and nurses used the menus to view the inpatient lists, alerts, and patients' clinical data with high frequency. Specifically, the doctors frequently retrieved laboratory results, and the nurses frequently retrieved nursing notes and used the menu to assume the responsibilities of nursing work.
(Continued on next page)

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