Korean Experiences on

Implementation of Electronic Medical Record

February. 2015

Korea Medical Holdings Ltd.
Ministry of Health and Welfare, Republic of Korea

1 Current Healthcare Environment

Health Facts about Korea (2012)

- GDP per capita: **32,400 US $**
- **Life expectancy: 81.3 yrs (OECD avg. 80.2 yrs, Peru 77 yrs)**
- **Infant mortality per 1,000 population: 2.9 (OECD avg. 4.0, Peru 18)**
- **Fertility rate per a woman: 1.2 (OECD avg. 1.7, Peru 2.4)**
- **Health Expenditure: 7.6% of GDP (OECD avg. 9.5%, Peru 5%)**
  - Public expenditure: **54.5% (OECD avg. 72.3%, Peru 59%)**
  - Per capita spending (PPP): **2,291 US$ (OECD avg. 3,484, Peru 555)**
- **Healthcare Resources**
  - **MD 2.1, Nurse 4.8** per 1,000 population **(OECD avg. 3.2, 8.8 respectively, Peru 1.1, 1.5)**
  - Hospital beds per 1,000 population: **10.3 (OECD avg. 4.8, Peru 1.5)**
  - CT Scanner 37.1 and MRI 23.5 per 1 million population (OECD avg. 23.7, 13.9)
  - 3,219 Hospitals (public: 13%) / 57 thousand Clinics/ 3,470 Public Health Centers
- **Social health insurance since 1980s**
- **Challenges**
  - **Increasing healthcare cost**
  - **Ageing population** to need chronic disease management programs & systems
  - Increasing **awareness on quality and safety** issue

(OECD Health Data, 2014)

Health Delivery System – Overall Figures

Healthcare Delivery System

Residents

Primary care

Private Practice (27,104)
Public Health Center: [3,700]

Secondary care

Hospital (1,891) &
General Hospital (312)

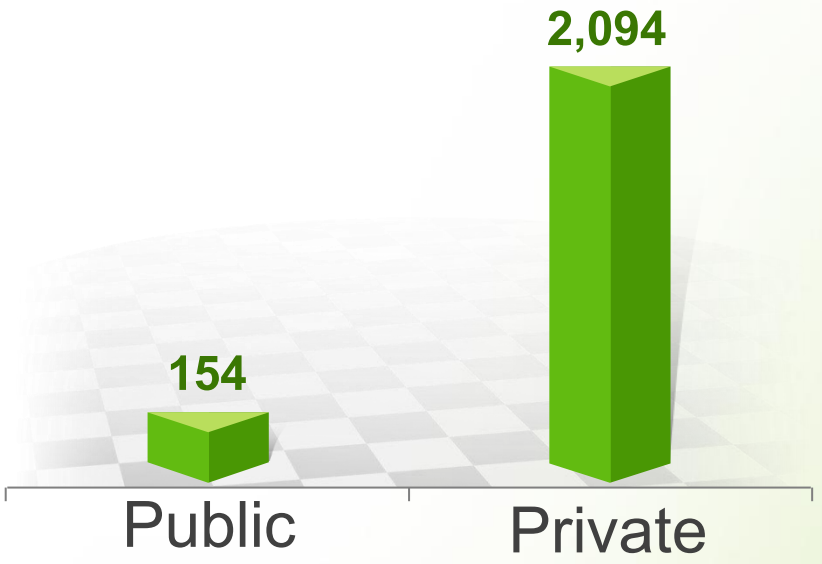
Tertiary care

Tertiary Hospital (44)

Hospital Beds

- Public Hospitals: 13%
- Private Hospitals: 87%

No. of Public & Private Hospitals



Strengths of the Korean Delivery System

Korea has made **significant progress in a short period** of time,
becoming one of the **most advanced countries in medical systems**

Korea's rapid enhancement in medical qualities

1955~1961
Beneficiary country

Minnesota Program

- Minnesota medical school supported Seoul National University
- Trainings in Korea/US
- Designed curriculum for the medical education in Korea

2011~
Supporting country

Korea Medical Academy

- Managed by the ministry of health & welfare
- Intensive training programs for doctors from foreign countries

Key strengths & enablers

1. Clinical Excellency

- "**Ranked # 12** in the number of published papers"

Intensive trainings & active associations

2. Quality and Safety

- Effectively supported surroundings
- "Many hospitals are **JCI accredited**"

Standardized protocols & optimized layout

3. Efficiency

- Efficient operational system
- "The second country holding **HIMSS Analytics Level 7**"

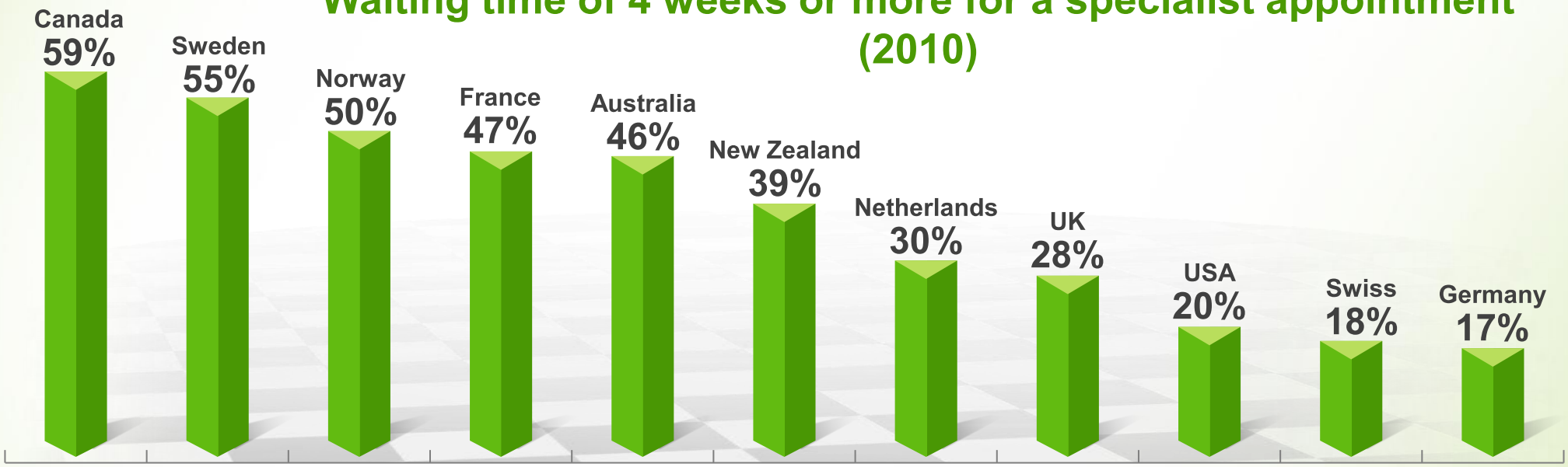
Fully-integrated IT & well-structured organization

Health Delivery System – Accessibility

Korea

Time from First Reservation to Consultation with Doctors

Waiting time of 4 weeks or more for a specialist appointment (2010)

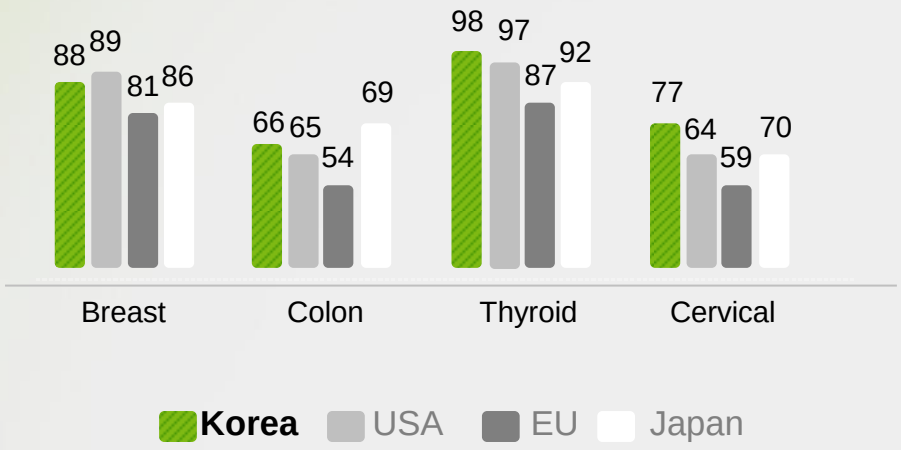


Excellence in Oncology

Korea's clinical capabilities are excellent in oncology on the basis of the effective multi-disciplinary collaboration

Supporting facts

High 5-year cancer survival rate (%)



- Korea's cancer treatment capabilities are **on par with those of the advanced countries**.

Excellence enabler

Multi-disciplinary Team

Diagnosis
- Primary physician
- Diagnostic radiology
- Clinical/Lab. Pathology

Treatment
- Surgical oncology
- Radiation
- Nursing & Pharmacy

Support
- Nutritional support
- Pain management
- Emotional/Religious
- Hospice cares

Exemplary case

Severance cancer center & SNU cancer center

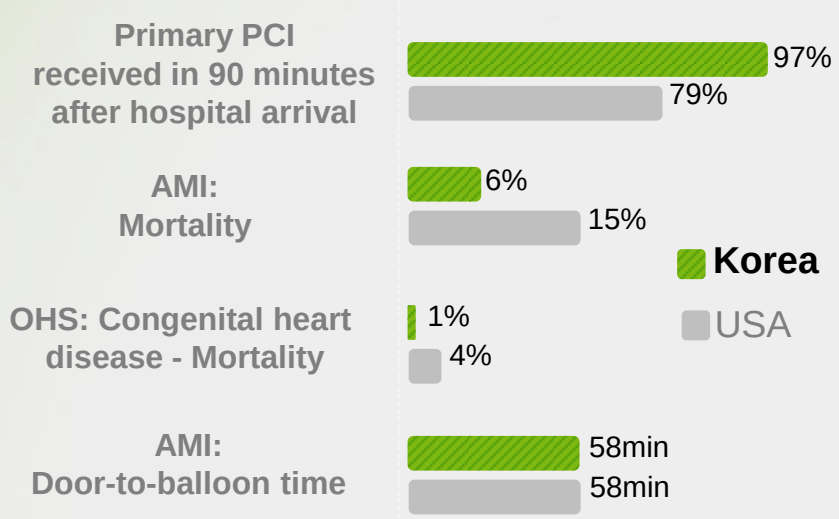
- **Patient-centered faculty collaboration**
- **Active collaboration between front-line medical services /R&D**
- **"One-stop cancer care system" – from diagnosis to treatment within 5 days**

Excellence in Cardiology

Korea's clinical capabilities are excellent in cardiology in terms of the medical contents, patient safety, and operational efficiency

Supporting facts

Comparison of the best–class hospital in Korea and US (2011)



- Korea's capabilities in cardiology are **almost on par with those of U.S.** in terms of **time-efficiency and safety**

Excellence enabler

1. Well-trained medical staffs

- Intensive and systematic training
- Trainer-Trainee mentoring program

2. Excellent combination of advanced skills and up-to-date equipment

3. Close collaboration between cardiologist and cardiac surgeon

Exemplary case

Severance , Samsung and SNU Cardio Center

- **Highly-advanced capabilities in cardiovascular diagnosis due to close collaboration and up-to-date equipment**
- **Multi-disciplinary team: diagnostic imaging dept., cardiology & cardiothoracic surgeons, and pediatric cardiology composes one team**

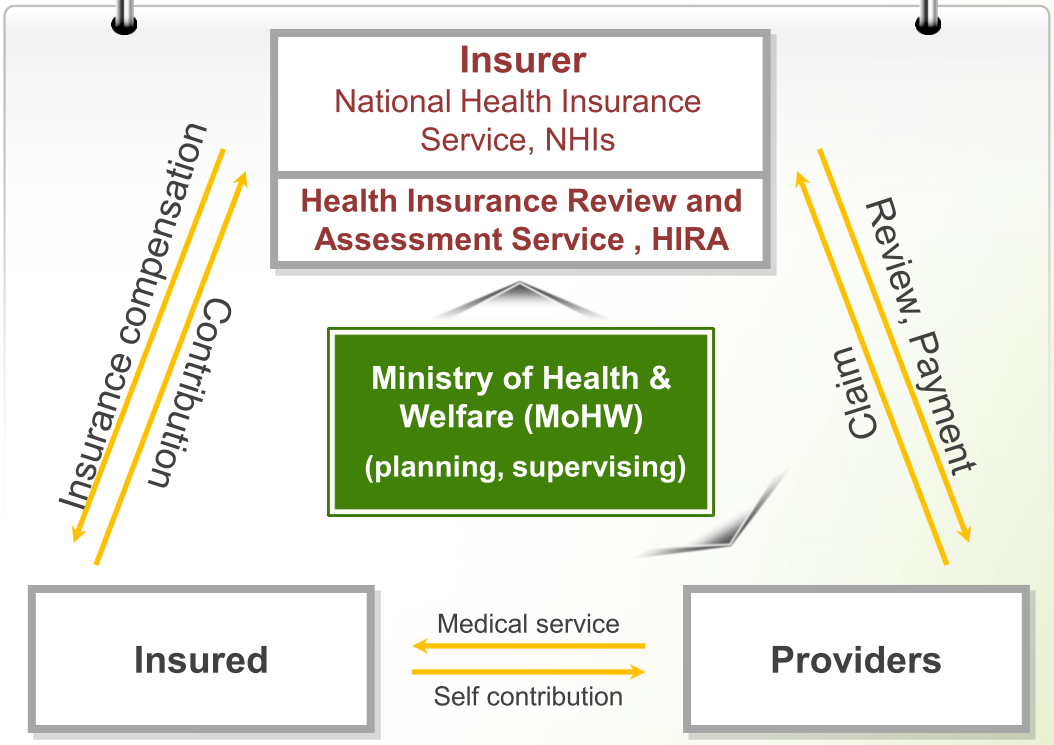
Health Financing System – History & Governing Bodies

Korean health financing system is the single payer system. National Health Insurance Programs are operated by Ministry of Health and Welfare, and two public institutions, NHIS(National Health Insurance Service) and HIRA(Health Insurance Review & Assessment Service)

History

- **1963.** Enacted Medical Insurance act
- **1977.** Started Medical Insurance Program for the employees in large companies(500+)
- **1988.** Started Local Medical Insurance in rural areas
- **1989.** Started Local Medical Insurance in urban areas
- **1999.** Enacted National Health Insurance Act.
- **2000.** Established the NHIS & HIRA integrating social health Insurance institutions

The Single Public Insurer



Health Financing System – Coverage

Population

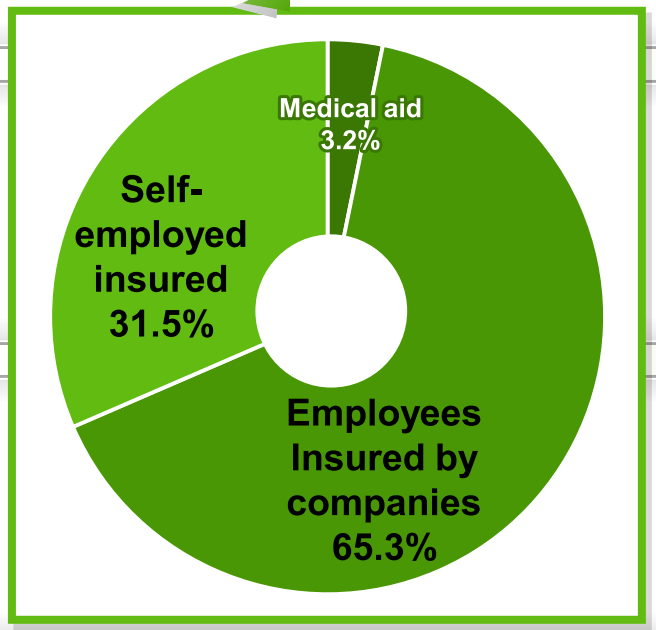
- **96.8% of the total population (49.4 million people)**
  - Medical Aid for the low income families (3.2% of the total population)
    - ✓ Families living below the minimum standard
    - ✓ Others including patriots, veterans & their family members

Benefit

- **Inpatient: 80% or more**
- **Outpatient: 60%~70%**

Annual Expenditure

- **50 trillion KRW (45 billion USD)**
  - Medical Aid: 5.0 trillion KRW (4 billion USD)



Performance

- Achieved **universal coverage in 1989 (taking 12 Yrs)**
- **Largest national program** involving 83,000 Institutions
  (Hospitals: 2,700, Clinics: 59,000, Pharmacy and others: 21,000)
- Processing **1.4 billion claims**

Health Financing System – Key Features

Single payer system since 2000

- National Health Insurance Service (NHIS)
- Mandatory participation of both the insured and providers

Private dominant provider system

- 93.8% of Health care providers in private sector
- Follows the market mechanism
- No Gatekeeper

Benefit Coverage

- Public health Insurance for Basic coverage
- Private Insurance beyond the basic coverage

Payment system

- Fee-for-Service based payment system
- DRG for 7 diseases, Per-diem for long-term care and mental hospital

2 e-Health Plan of Korean Government

e-Health plan – Vision

Vision

Anywhere, anytime access to electronic health records (EHR) and decision supports in secure way **to improve the quality, safety and efficiency of health care by 2015**

Goals

- Achieve **widespread adoption of EMRs among hospitals and clinics** to improve quality, safety, and efficiency of care
- Establish **sharable lifetime EHR system** to improve quality of care and reduce redundancy of care

Strategy

- **Implement EMR and EHR throughout public hospitals and clinics** and demonstrate feasibility and benefits of HIT adoption
- **Facilitate HIT adoption in private sectors** through various incentives (e.g. pilot projects, fee schedule, technical support)
- **Ensuring standards for interoperability** and essential reusable technologies for next-generation EMR through R&D activities

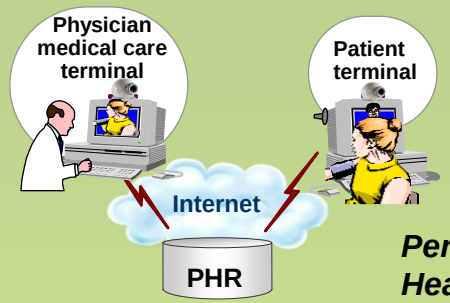
e-Health plan – Strategic Direction

Health and Wellness

-Getting the right information to the right place at the right time

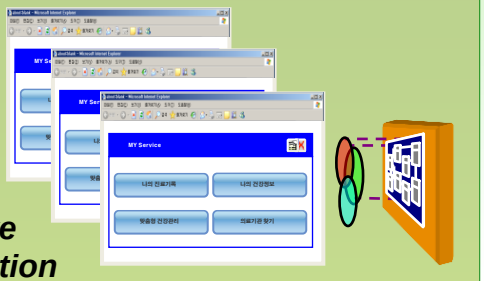
- Facilitate expansion of PHR
- Enhance informed consumer choice
- Develop e-booking system.
- Enhance consumer accessibility

PHR & Tele-Health



Personalize Health Mgt.

Population Health



Improve Population Health

- Monitoring service on chronic diseases
- Develop public health surveillance
- Streamline quality and health status monitoring
- Develop medical knowledge DB

- Develop EHR & HIT for public health org.
- Incentivize EHR adoption for private hosp.
- Provide secure medical service based on clinical decision support

Inform Healthcare Organization

HIT

Interconnect Healthcare Systems

iEHR

- Develop national health information network
- Develop HIE system
- Develop image exchange system
- Encourage use of e-prescription system

e-Health plan – Healthcare Transformation Programs

Anywhere Anytime Access to EHR and Health Data
to ensure quality, safety and efficiency of healthcare

Infrastructure

- Health Information Standards
- Networks
- Privacy & Security

National Information Service

- Public Health Surveillance CDC
- NHI Information System
- Blood Bank System
- Public Health Program Supports

Health Information Exchange

HIT adoption in Hospitals and Clinics

- Hospital Information System
- PHC IT System: Centralized

Governance

- Law and Policy
- Organization and Resource
- Funding

e-Health Plan – National Service System

MOHW | Public | Related org | NHIC | ...

HIRA | Patient org | KFDA | Pharmacist

Quality management system
- Integrated national quality assessment
- Automated collection of quality information

Disease management system
- Disease management
- Other disease surveillance

Public health surveillance system
- Infectious disease management
- Prevention/ Immunization
- Bio terror prevention

Internal Portal

Evidence-based research support
- Medical R&D tool
- Information link

Clinical research support info

Healthcare information

National integrated public health DW

Public Portal

Public health center information system
- Health business management system
- Public healthcare system

3 Information System of Public Health Center

Public Health Center (PHC) – Roles & Responsibilities

1. Regional Responsibility

- Assist socially or economically marginalized groups' (low-income, elderly, disabled) access to healthcare

2. Service Delivery for Disease and Health Management

- Anti-Smoking, Sobriety, Exercise, Nutrition Services
- Oral Health, Mental Health, Rehabilitation, Chronic Disease Management

3. Infectious Disease Management and Control

4. Family Health Services

5. Air Quality, Food Hygiene, etc.

Public health center (PHC) – Fragmented Systems before 2007

Inefficient workflow and low policy effectiveness due to lack of integrated information system

Individual Systems(~ 2007)

Public

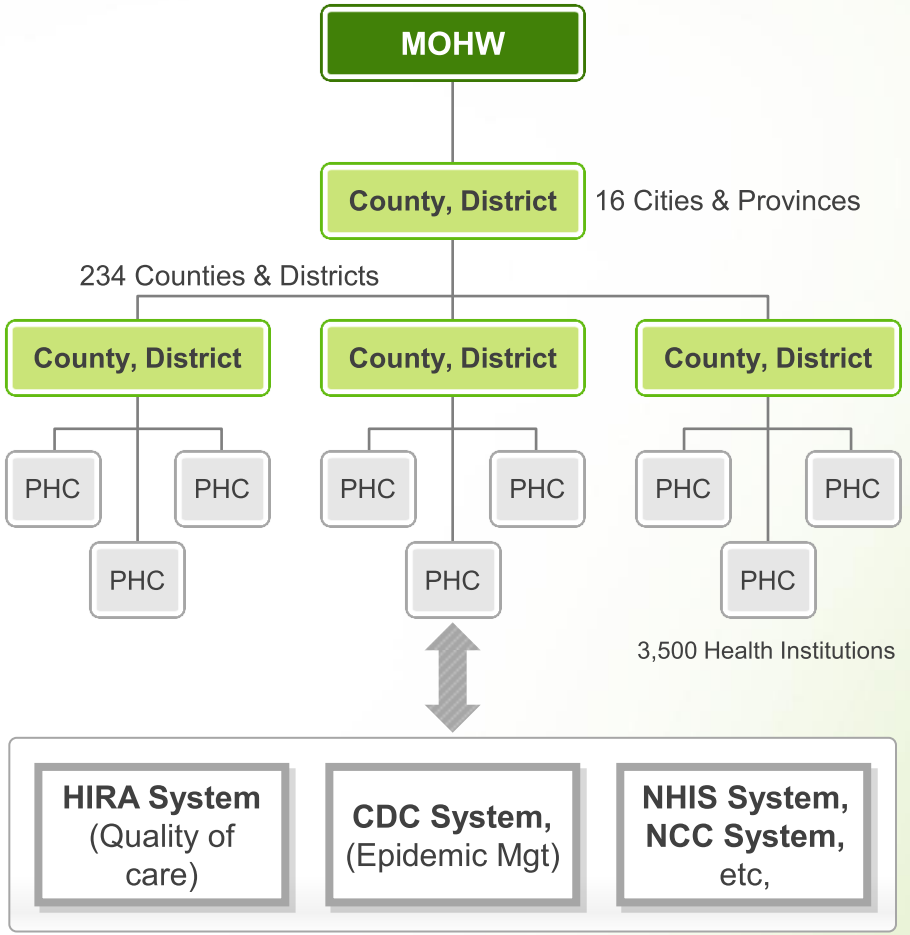
- **Inefficient communication** in public service
- **Duplicated care services** due to various information systems
- Lack of information of **patient's medical treatment history**

PHC

- **Paper-oriented** work (about 60%)
- **Unsystematic management** due to fragmented system (Development/Operation)
- **Inefficient linkage for information exchange** in-and-between organizations

Policy-makers

- **Inadequate statistical information**
- **Lack of decision making support tools** for policy development



Linkage with related institutions

Public health center (PHC) – Centralized IT systems from 2008

Improved Effectiveness after the Introduction of integrated system

Integrated System(2008~)

Public

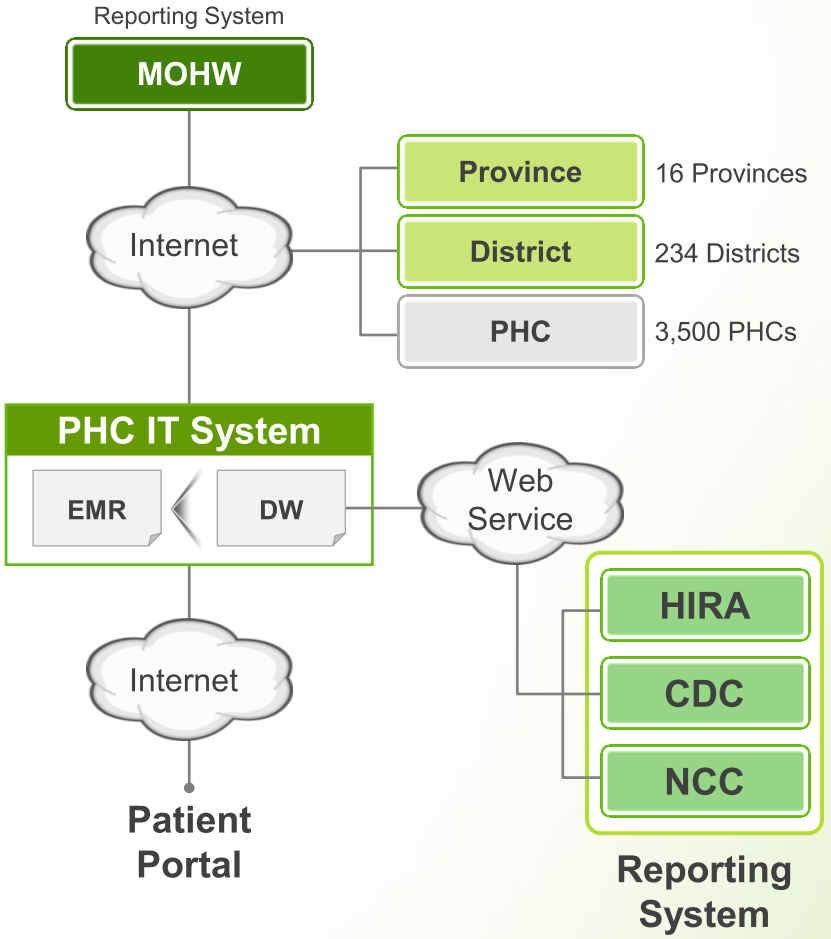
- **Improved accessibility to health information** and patient's medical history through the **public portal site**
- **Exchange health information** to prevent overtreatment or duplicated treatment
- **Improved searching of medical treatment history** (continuity of care)

PHC

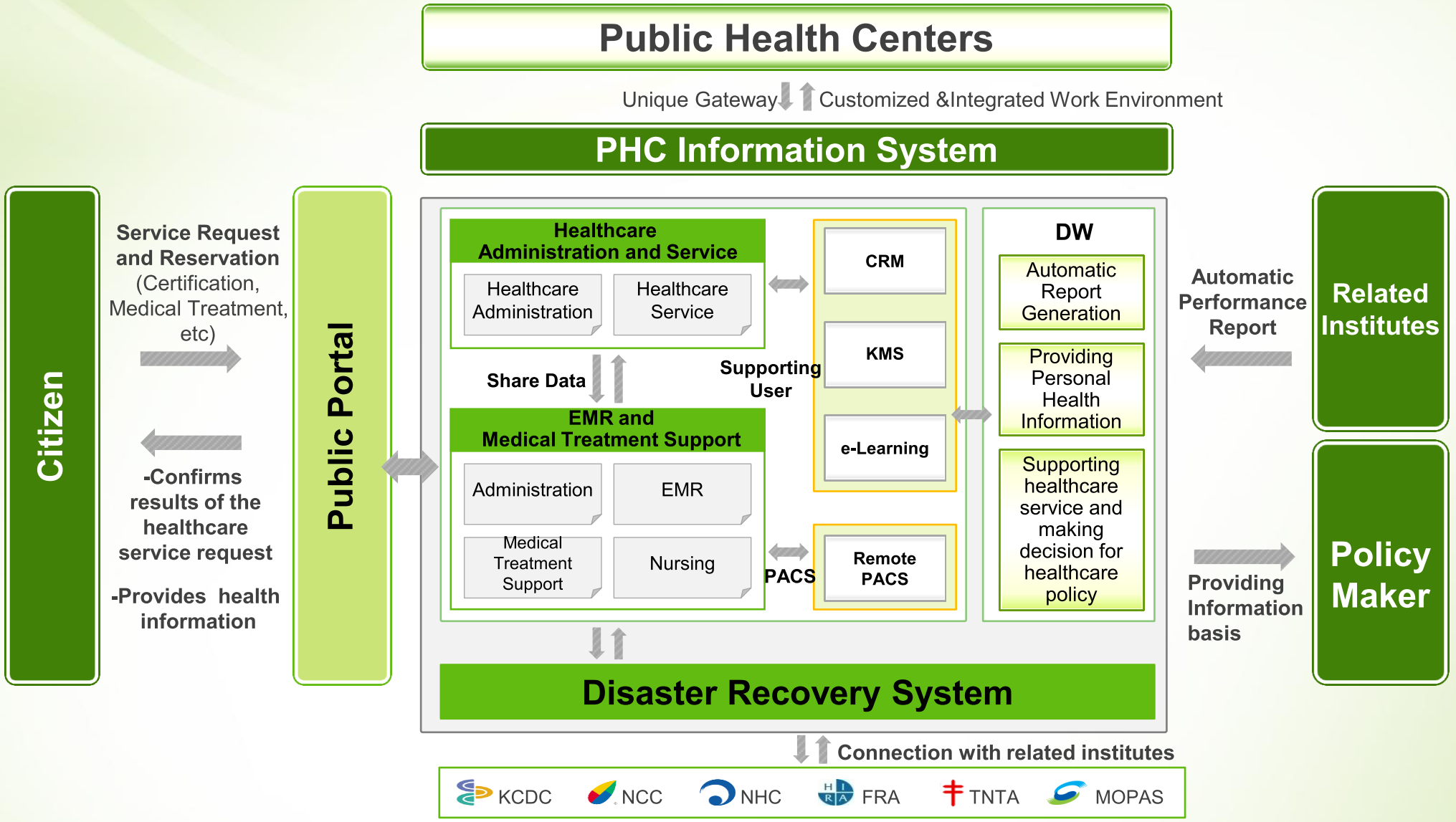
- **100% computerization** and office automation in PHCs
- **Ensured service quality** by maintaining the Integrated System
- **Linkage with other institutions** to improve efficiency of workflow

Policy-makers

- **Automated record/statistics reporting** for policy making and decision making
- **Elevated healthcare services in rural areas**



PHC system – Overall System Architecture



PHC system – Detailed Functions

Healthcare Administration and Service

▪Healthcare Administration

Certification	Rural Healthcare
Public Health Doctor	Health Clinic

▪Data Warehouse

Formal Statistics	Non-Formal Statistics
Performance Report	

▪Healthcare Service

Elderly Care	Rehabilitation	Oriental Medicine
Chronic Disease	Visiting Health	Medical Examination
Mental Health	Oral Health	Mother and Child Health
Infection	Amendment Health	Nutrition
Examination Agency	Examination Claim	Common Business

Standardized Electronic Medical Record System

▪Administration

Code	Outpatient	Hospitalization
Administration		Insurance Claim

▪Nursing

Nursing Management	Nursing Record

▪EMR

Medical Record	Doctor Document	Prescription	Statistics

▪Medical Treatment Support

Clinical Pathology	Pharmacy	Physical Therapy	Stock	PACS

PHC system – Operation & Benefits

- **Customer**
  - ✓ **Total about 3,700 Centers**
    - Public Health Medical Center, Public Health Center, Public Health Sub Center, Primary Health Care Post
- **Current Condition Operation(2013)**

Health Service
- Ca. 11,870,000 Beneficiaries(26,880,000 cases)

Care Service
- Ca. 2,540,000 Beneficiaries(11,700,000 cases)

Issue Certificates
- 4,800,000 times (Health examination result, etc

- **Staffing**
  - ✓ **Operation Team : 22 engineers**
  - ✓ **System Maintenance, Self-development, Improvement of function**

- **Expected Results**
  - ✓ **Selecting and supporting a clinician**
    - prevent medical malpractice
  - ✓ **Various statistical data and gathered data in a single system**
    - helpful for scientific policy establishment
  - ✓ **With Promoting the advancement of health and medical service and medical information**
    - national competitiveness is enhanced

- **Return of Investment(ROI)**

(unit : $)

IT Performance Evaluation (2009)	Total	12.2 million
	Budget Reduction	**5.4 million**
	Cost Efficiency	**6.8 million**

4 EMR System for Hospitals

Hospital EMR – Evolution of Hospital Information System (HIS)

Korea

(unit: $)

(GDP per head)

25,000
20,000
15,000
10,000
5,000
0

Introduction of **National Public Insurance(1976)**

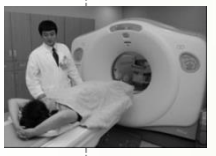
Govt. support for **new medical school(1979)**

Introduction of **Health Screening System(1976)**

Introduction of **National Public Health Screening System (2000)**

Launch **National Early Cancer Detection System(2004)**

Introduced and rapidly adapted **EMR & some HIE**



1970 | 1975 | 1980 | 1985 | 1990 | 1995 | 2000 | 2005 | 2010~

Hospital Info. System

Phase

Setting-up Regulation

Computerizing Hospital Information

Industrializing Healthcare info.

Subject

Complex manual operation

Minimization of manual operation

Integrity of clinical Info.

Patient's Convenience

Evidence based Medicine

Function

Billing

Budget & Execution

History of patients' visits

Nursing schedule

Order communication

Point-of-care

Just-in-time stock on site

Clinical decision support

Mobile patient's escort

Patients' training

Clinical research

Clinical trial mgmt.

Bio-informatics

Disease. Mgmt.

Hospital EMR – Adoption Rate

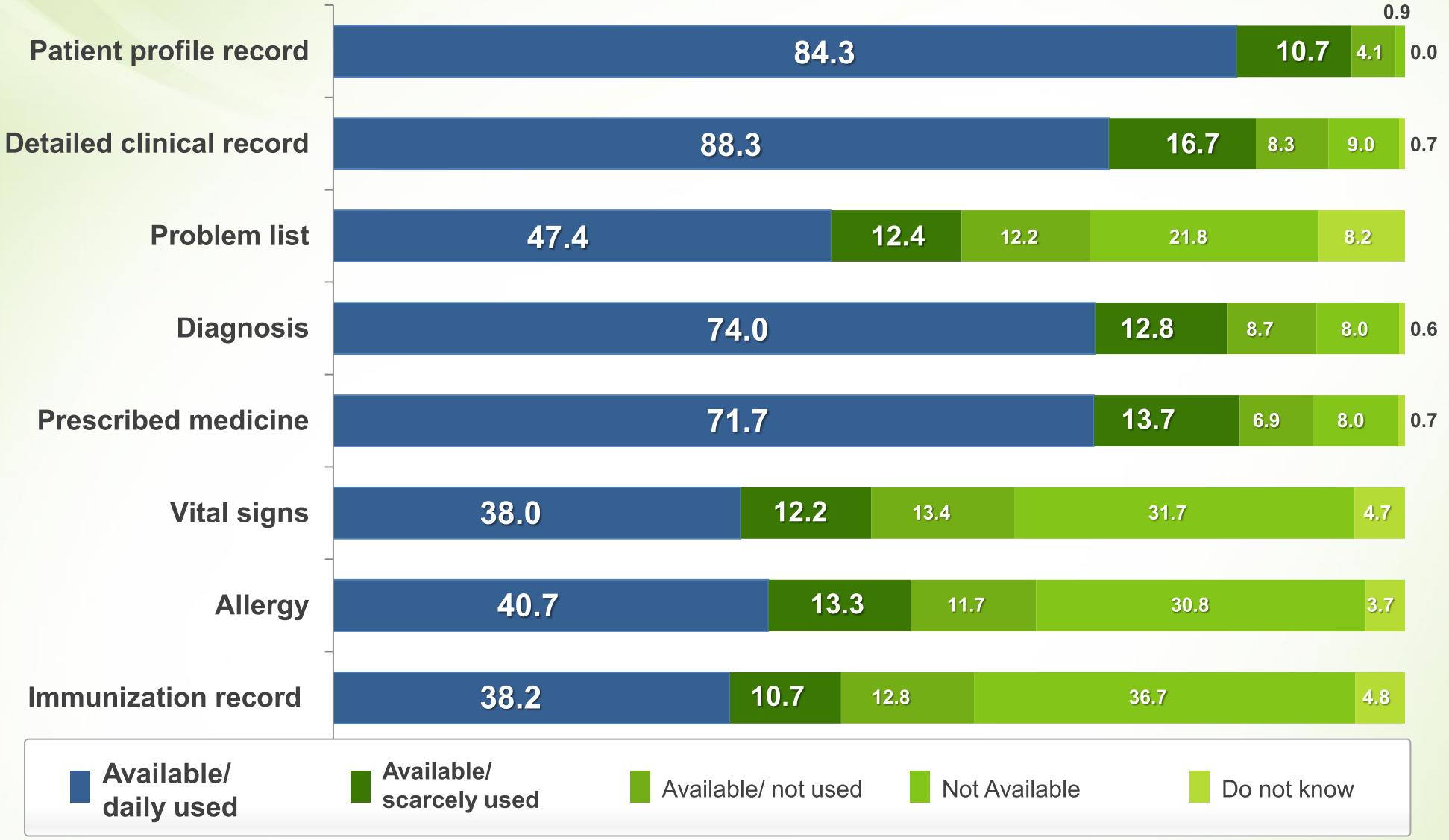
Adoption rate of EMR

	All	Exclude Dentist	Europe (exclude dentist)
Total	92.1%	95.7%	
Hospitals	95.4%	96.4%	93.9%
Clinics	91.9%	95.7%	84.0%

Adoption rate of hospital grade

	All	Exclude Dentist
Tertiary hospitals	100%	100%
General hospitals	98.9%	98.9%
Hospitals	94.6%	95.8%
Clinics	91.9%	95.7%

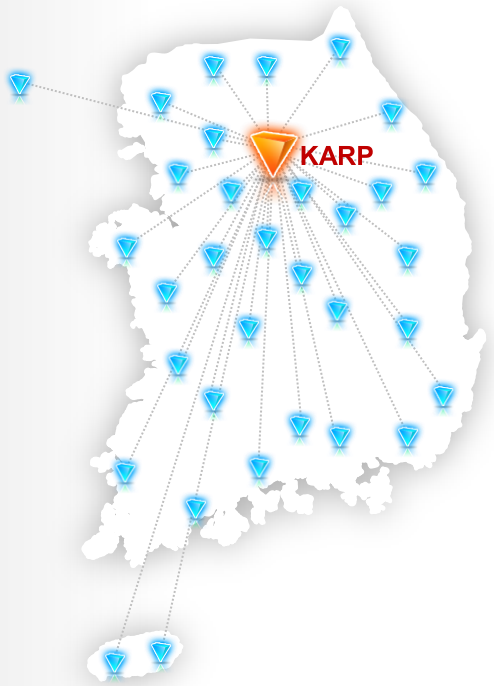
Hospital EMR – Utilization Ratio of Health Information



Hospital EMR – Regional Public Hospitals (Medium size)

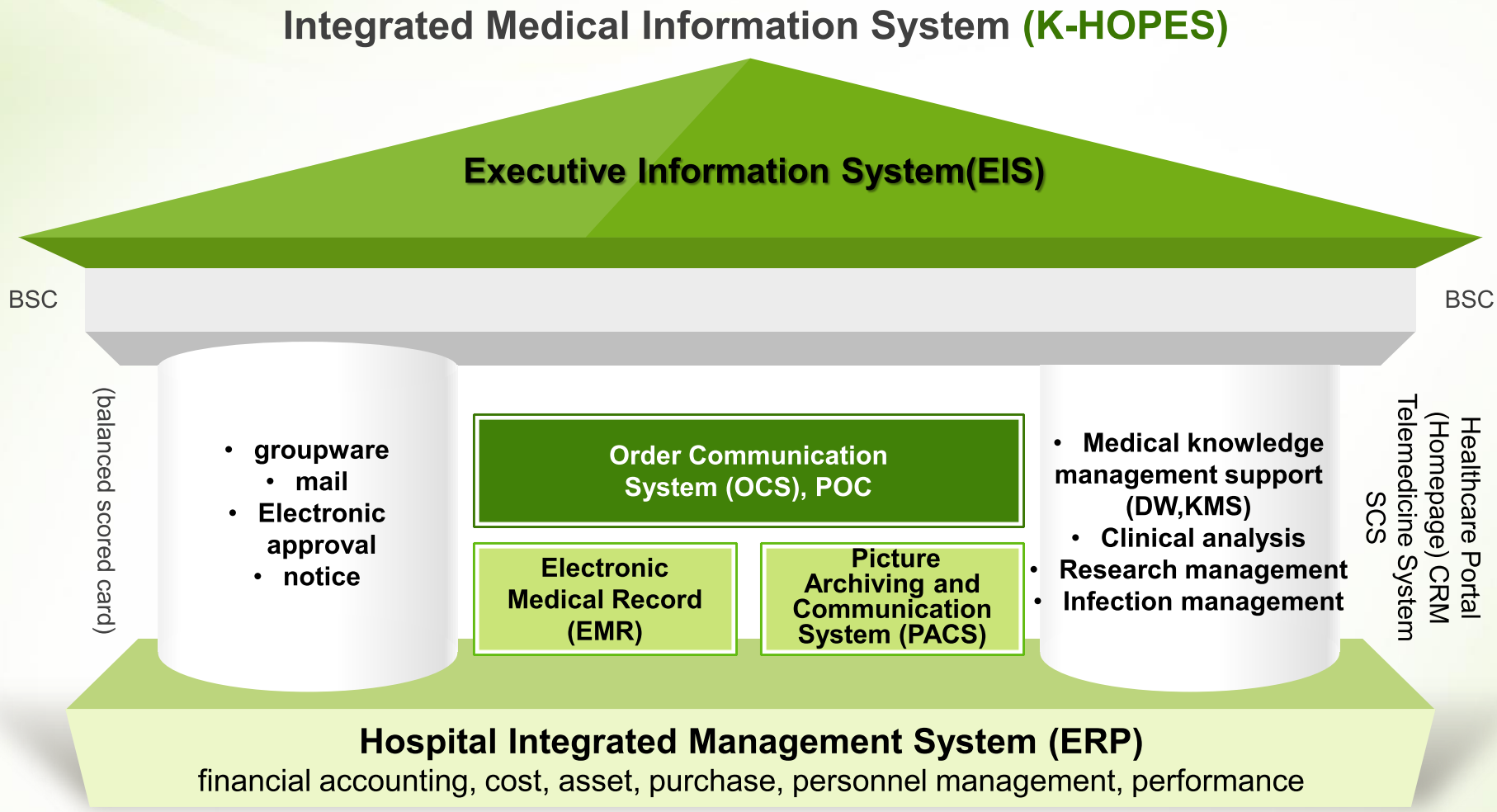
- **Establishment & Management**
  - Regional Medical Hospital Establishment and Management Act
  - Investment from local governments
  - Supervised by the MOHW
- **Major Function**
  - Health promotion of local residents
  - Local residence treatment and care
  - Prevention-oriented disease management
  - Preventing & curing contagious diseases
  - Free medical services for essential health and medical aid program
  - Performing public health policy
  - Monitoring public health status
  - Training medical staffs, technicians, and local people
- **Regional Distribution(35 Hospitals)**
  - Less 300 beds: 27 hospitals , Over 300: 8 hospitals

- **Resources**
  - No. of Beds: 8,000 (General 6,500 / Special 1,500)
  - No. of Employees: 7,000 (Doctors 800 / Nurses 2,800)
- **Performance**
  - Total patients: 6.9 Mil. (Inpatient: 2.7 Mil, Outpatient: 4.2 Mil.)



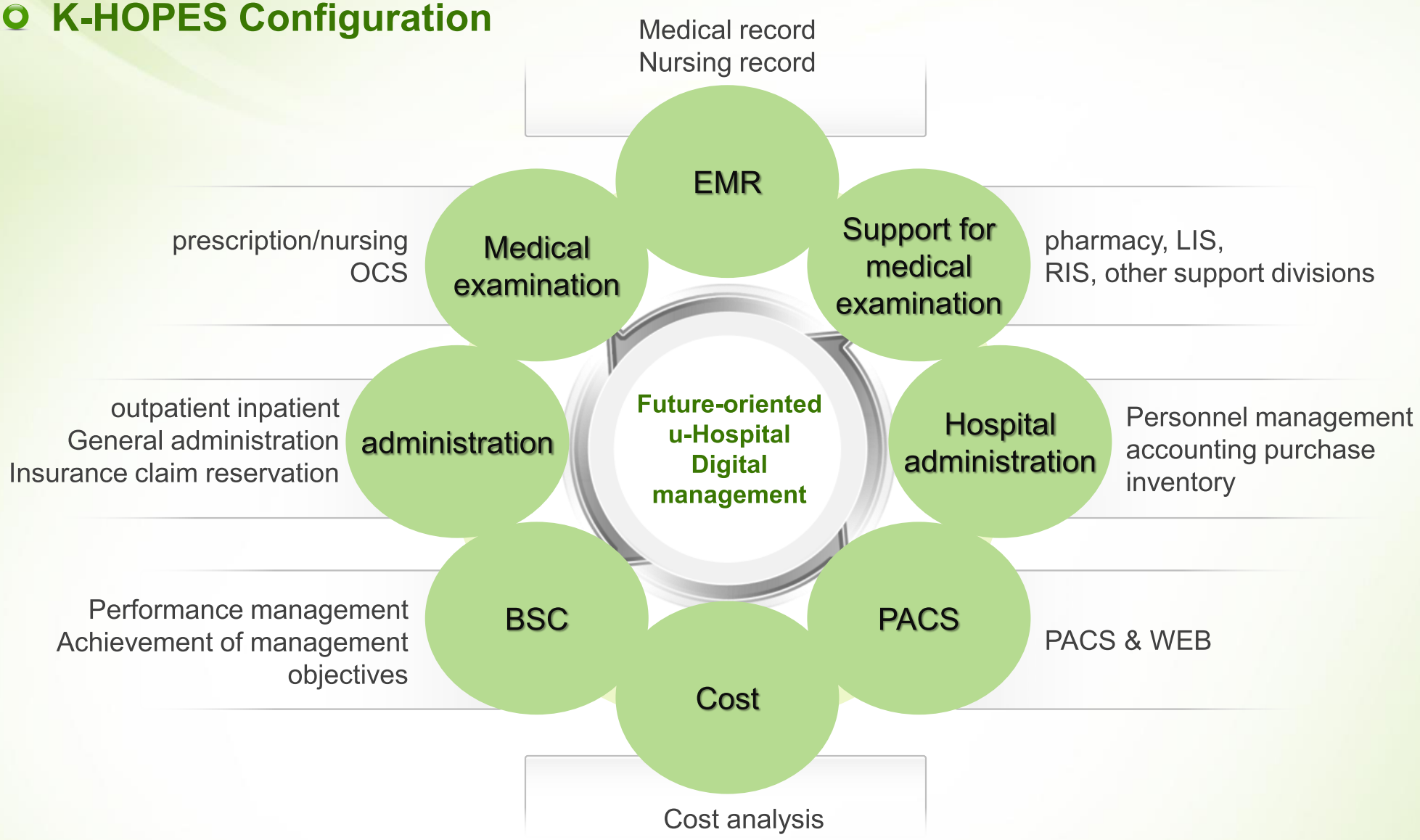
Regional Public Hospital EMR – Integrated Medical Information System (K-HOPES)

Application architecture



Regional Public Hospital EMR – Integrated Medical Information System (K-HOPES)

K-HOPES Configuration



Regional Public Hospital EMR – Integrated Medical Information System (K-HOPES)

Stable low-cost system

- **Functionally integrated with OCS/PACS** of the association which guarantees stable operation
- **Minimize additional cost** of integrating public medical information system by **applying standard codes and standard forms**

HL7 and changeable terms

- Based on **standard terms and forms**, and possible to be **adjusted to the real situation** of the hospital
- **Provide flexible system structure** and can be applied to university hospitals

Future-oriented integrated medical information system

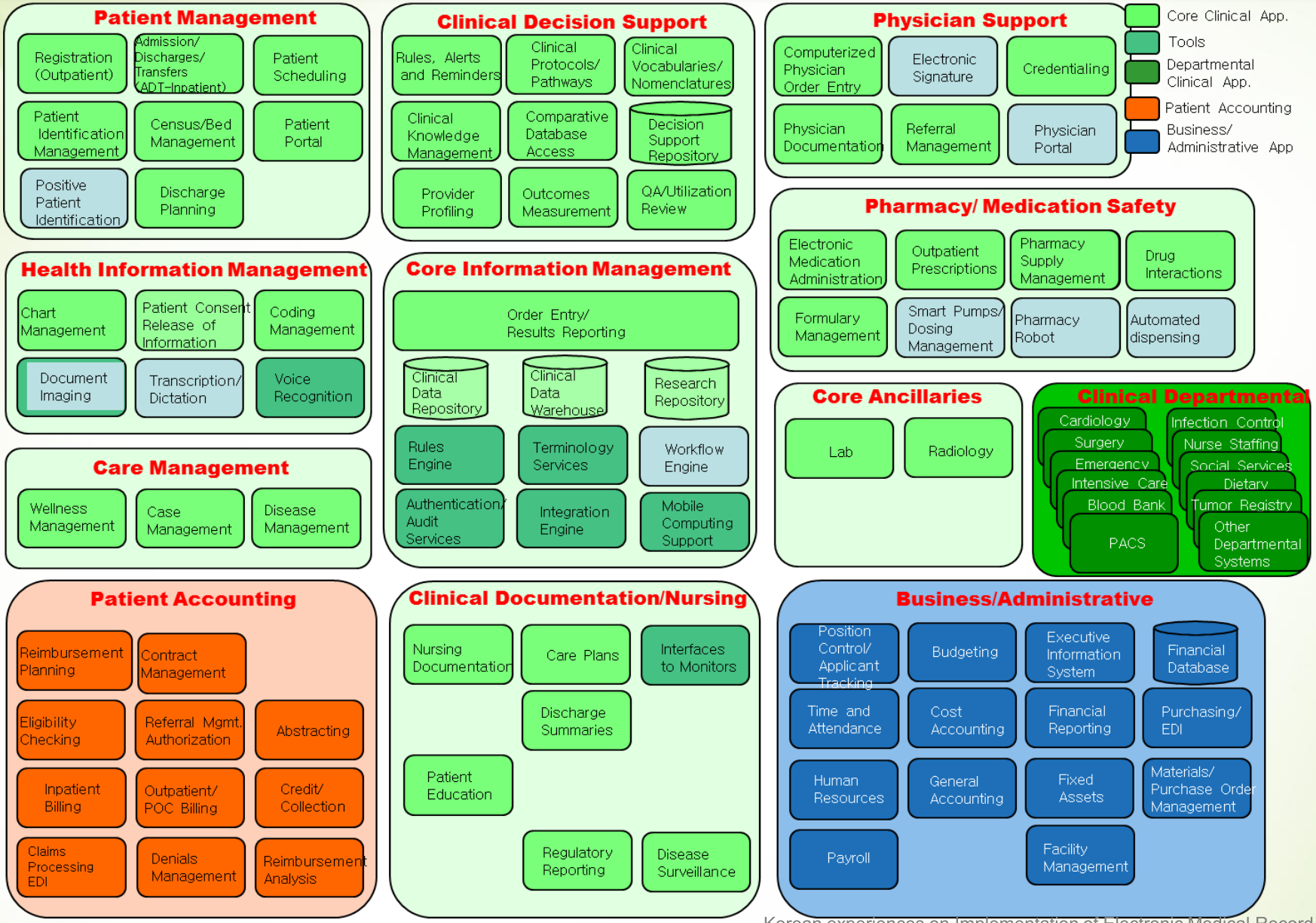
Realization of 4-LESS /ubiquity

- Aim at true digital hospitals by realizing **Slipless, Filmless, Paperless, Chartless**
- **Raise the level of medical examination** by medical information services available anytime and anywhere
- Comprehensive management of local residents' health through **home care services, telemedicine and medical interpretation**

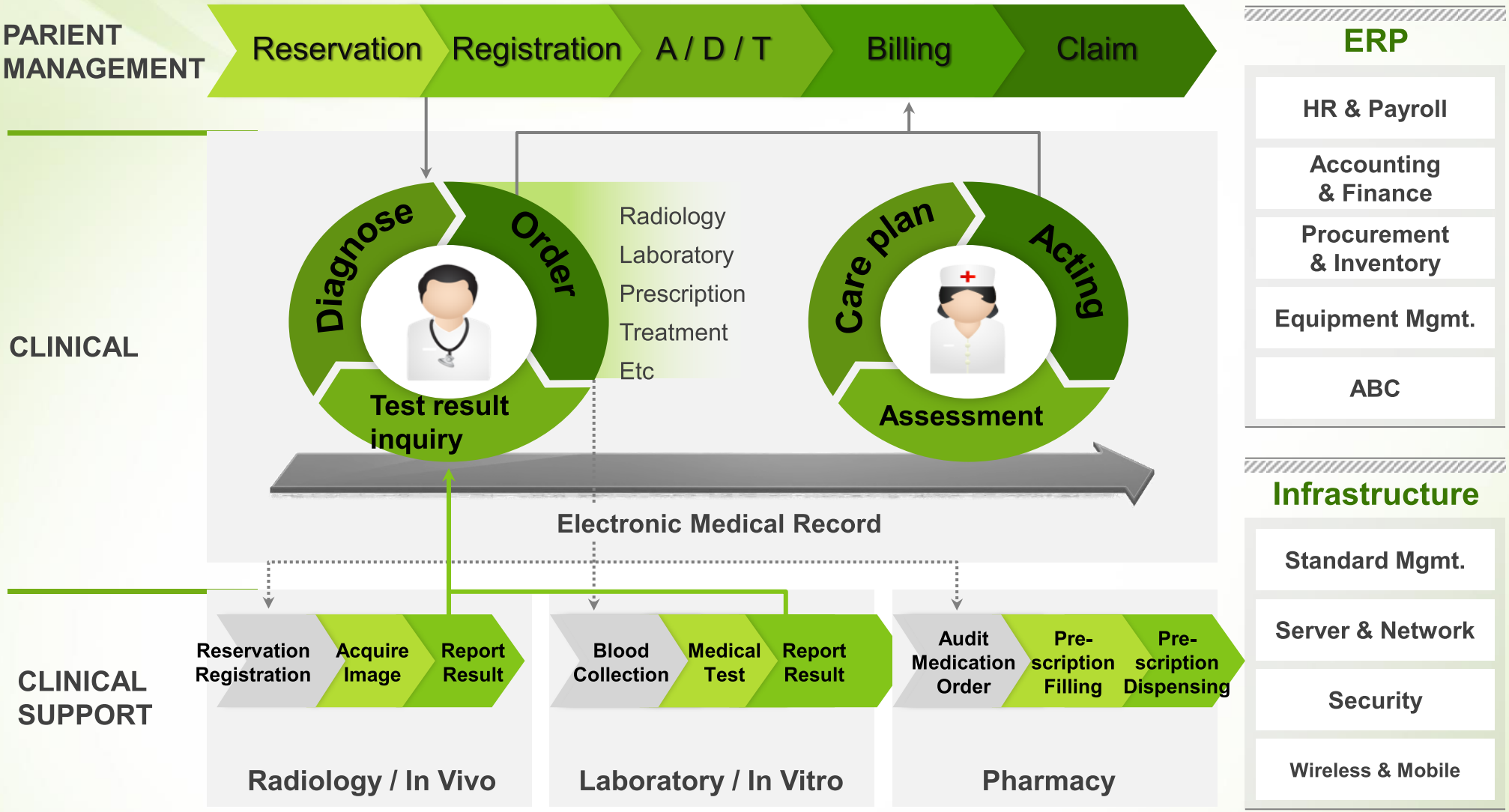
Maximized operational efficiency

- Help **computation system play a pivotal role** in the operation in order to maintain consistent operational system
- **No need to have storage space** of film, chart, etc.
- Easy storage and **search of medical information**

Hospital EMR – Overall Functionalities



Hospital EMR – Hospital Information System Model



Hospital EMR – Patient Management System

- ADT
- Insurance Claim
- Billing
- Other Admin. Process

Admission/ Discharge/Transit (ADT)

- Patient basic information management
- Outpatient reservation
- Admission registration
- DSC(Day Surgery Center) reception
- Emergency reception
- Certificate and receipt issuance

Insurance Claim

- Fee management
- Pre-billing review
- Consolidated billing review
- Follow-up control & management
- Integrated account-receivable management

Billing

- Outpatient billing
- Inpatient billing
- DSC billing
- Emergency billing
- Home-nursing billing
- Account receivable management
- Profit management

Other Administration Process

- Volunteer/work
- Community services and agencies
- VOC

Hospital EMR – Clinical Systems(CS)

- CPOE/EMR
- Nursing
- Dialysis
- Radiation Treatment
- Refer
- Operation Theatre

Computerized Physician Order Entry (CPOE)/EMR

- Doctor prescription
- Patient management
- Medical data management
- Electronic chart

Nursing

- Inpatient nursing
- Outpatient nursing
- Emergency nursing
- Surgery nursing, etc.

Dialysis

- Blood dialysis
- Peritoneum dialysis

Radiation Treatment

- Prescription management
- Reception/operation management
- Image management statistics

Refer

- In-referral management
- Out-referral management

Operation Theatre

- Operation schedule
- Anesthesia management
- Operative notes

Hospital EMR – Clinical Support System

- Radiology & In Vivo
- Laboratory & In Vivo
- Pharmacy
- Health Promotion
- Medical Record Management
- Nutrition

Radiology & In Vivo

- Reservation/reception
- Examination information
- Clinical document mgmt.
- Result mgmt.
- Statistics mgmt.

Radiology, In Vivo, Endoscope, etc

Laboratory & In Vitro

- Reception for blood collection
- Examination info.
- Result mgmt.
- Statistics mgmt.
- Equipment mgmt.

Laboratory, In Vitro, Pathology, etc

Pharmacy

- Pharmacy information
- General prescription
- Special prescription
- Medicine inventory management
- Consultation

Health Promotion

- Reservation/billing
- Health check-up
- Patient flow control
- Consultation result
- Health evaluation report

Medical Record Management

- Information analysis/ statistics
- Incomplete record management

Nutrition

- Meal service management
- Nutrition consultation management

Hospital EMR – Hospital Administration System(HAM)

- HR & Payroll
- Accounting/Finance
- Procurement & Inventory Mgmt.
- Equipment Mgmt.
- ABC
- EIS

HR & Payroll

- HR & Payroll mgmt.
- Other HR parts
- Family healthcare
- Welfare healthcare

Accounting/Finance

- Invoice mgmt.
- Pended record mgmt.
- Tax mgmt.
- Asset mgmt.
- Banking
- Budget mgmt.
- Fixed asset

Procurement & Inventory Mgmt.

- Purchasing order & claims mgmt.
- Construction mgmt.
- Order mgmt.
- Material receipt mgmt.
- Delivery mgmt.
- Payment mgmt.
- Stock mgmt.
- Integrated medicine procurement mgmt.

Equipment Mgmt.

- Resource and material mgmt. planning
- Equipment repair mgmt.
- Medical equipment utilization mgmt.
- Parts mgmt.
- History mgmt.
- Work mgmt.
- Medical equipment inspection

ABC (Activity-based Costing)

- ABC work processing
- Basic info. Generation
- Profit generation
- Cost generation
- Basic statistics
- Statistics/total verification
- Search profit info.

EIS

- Patient statistics
- Treatment statistics
- Treatment record
- Medical record
- HR status
- Management statistics
- Department statistics

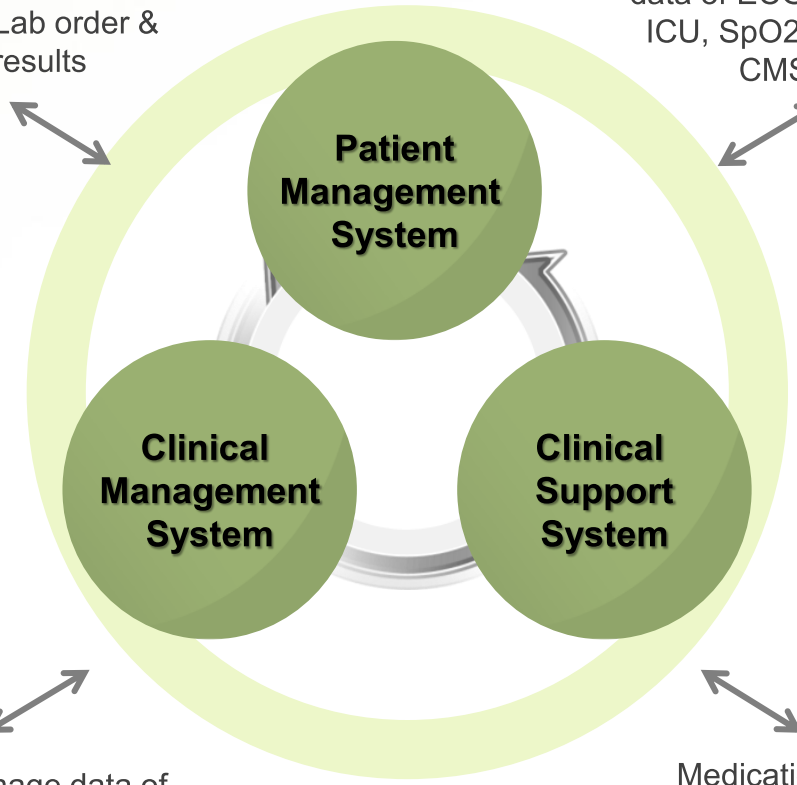
Hospital EMR – Medical Equipment Integration

Laboratory

ECG, Patient Monitor, SpO2

Lab order & results

HL7, XML data of ECG, ICU, SpO2, CMS



Clinical Device

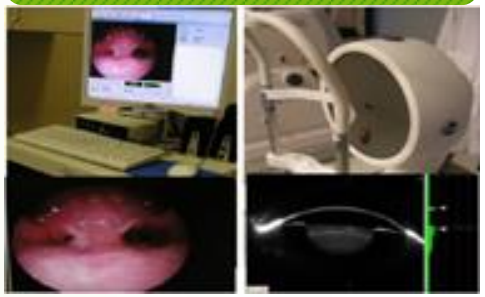


Image data of ophthalmology, Neurology and Urology, etc.

Medication order info

Automatic Tablet Counter

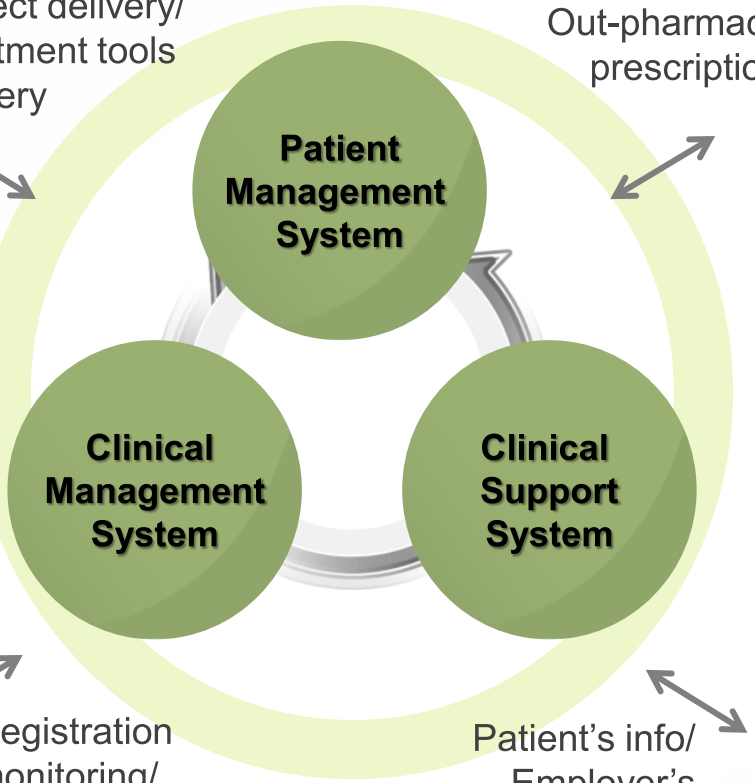
Hospital EMR – Facility Integration

Auto Track

Medicine delivery/ Emergency test subject delivery/ Treatment tools delivery

Automated Reception/ Billing

Registration/ AR/ Out-pharmacy prescription



Wail-list Dashboard

Registration monitoring/ Treatment monitoring/ Medical exam monitoring

Patient's info/ Employer's info

Smart Card

Hospital EMR – Smart Hospital as a Trend

HOSPITAL	SMART	Smart Hospital Sys.
Clinic	Always-on	Hospital Information System(HIS)
Education	+ Collaboration	
Research	+ Comfortable	Treatment, Research, Korean Hospital, Education, Management
Mgmt.	+ Seamless	
	Transformation	

"Always-On-Hospital"

- m-EMR, m-PACS
- Facility and Medical Equipment Monitoring
- Building Energy Management (BEMS)

"Collaborative Medical Staffs"

- Conference (Tele-presence)
- Consultation via UC※
- Patient Referral(Telemedicine)

※ UC(Unified Communication)

"Seamless Mobile Care"

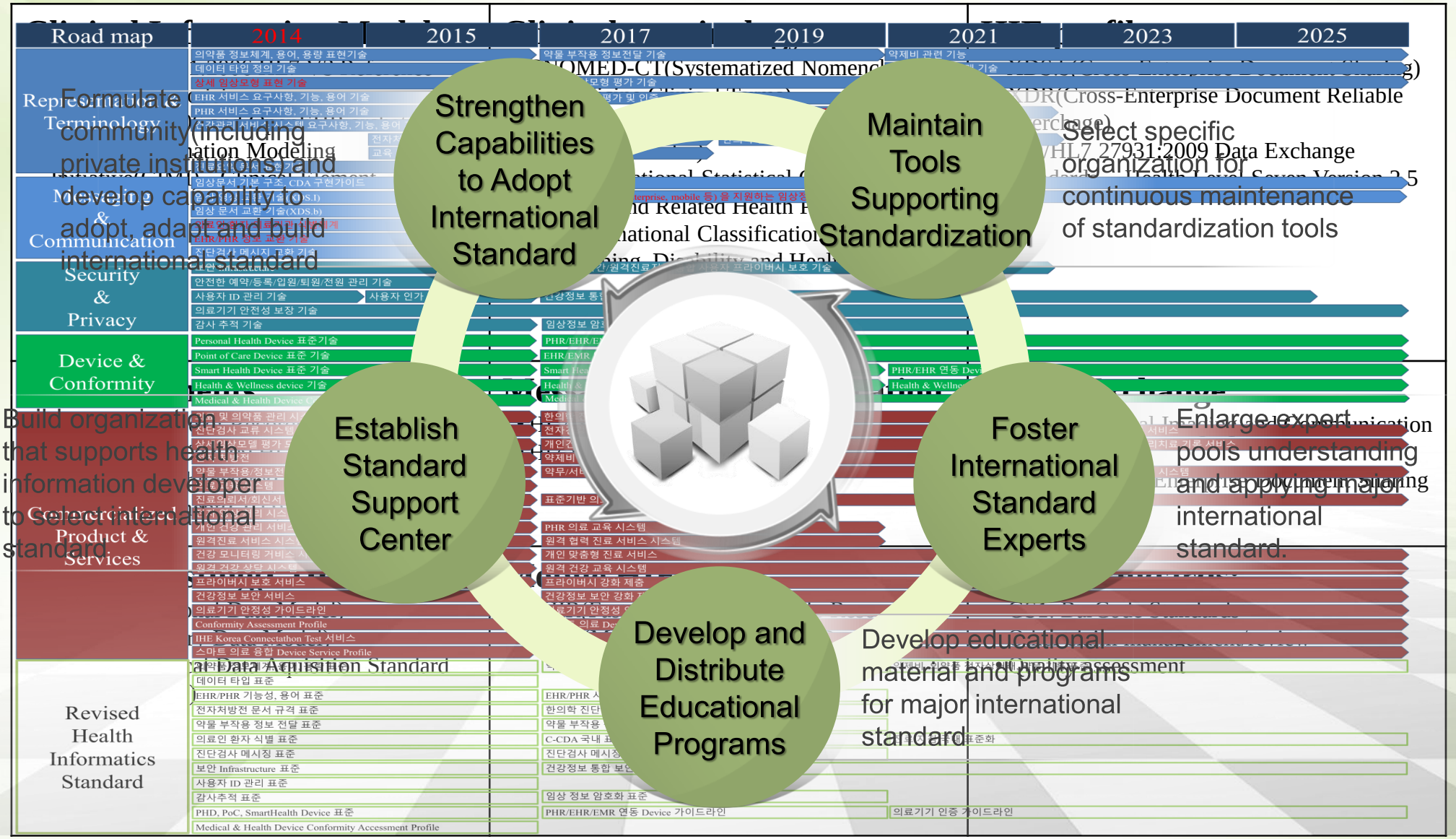
- Remote Patient Care
  - At Home
  - On Travel
  - In Emergency

"Comfortable Patient Care"

- Digital Concierge & Ward
  - Patient Escort
  - Mobile Payment
  - Patient Education
- Patient Identification with Smart Tag

5 Lessons Learned from Korean Experiences

Lessons learned – Standardization for Health IT



Lessons Learned – Technical & Financial Supports

Support EMR Implementation of Hospitals and clinics

Needs for supporting EMR adoption

- **Increase the synergy of EMR projects**
  - Private hospitals participation rate = 90%
- **Poor level of voluntary EMR introduction**
  - No direct benefit for the EMR investment to physicians and hospitals
  - Lack of capability to manage EMR projects

Direct/indirect supports by government

- **Financial support**
  - Selected 20~30% hospitals every year(matching fund)
- **Technology & policy support**
  - Provision of standardized hospital info system: expected savings is 10% of total expenditure
  - EMR certification system: functionalities assurance
  - consulting services
- **Support pilot project of private hospitals cluster**

Public/Private Health Information Sharing

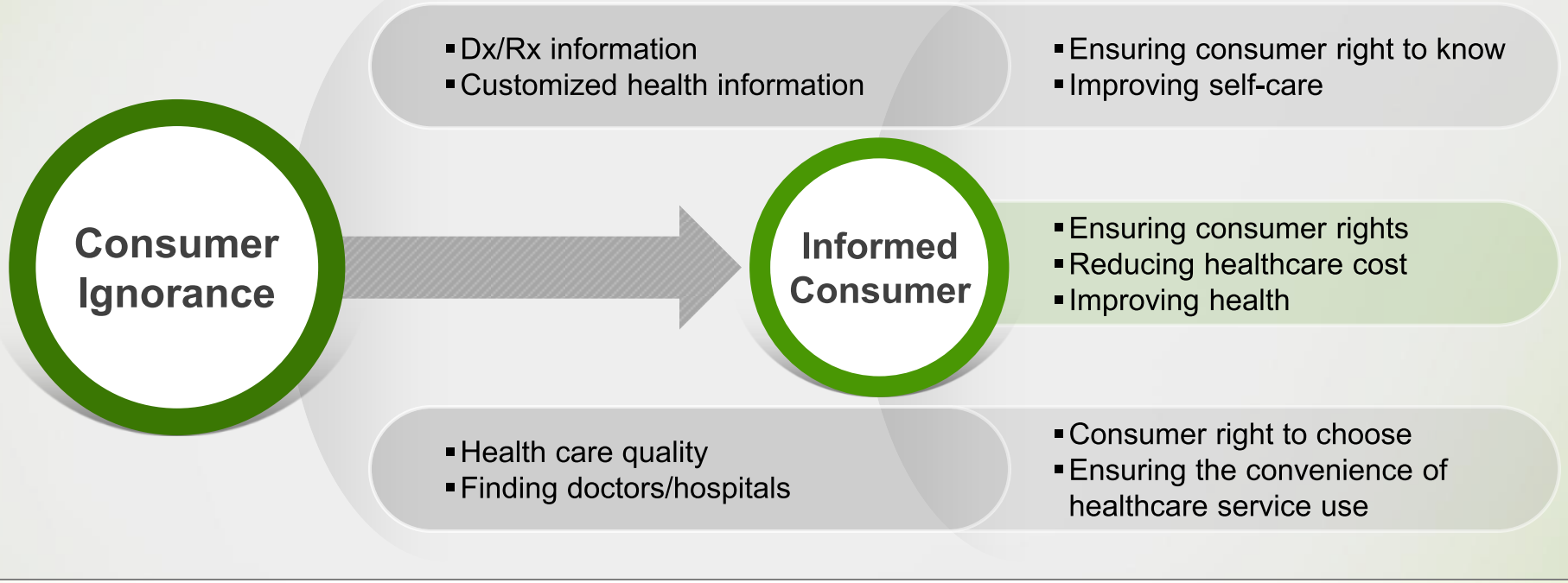
Health information sharing upon consumer consent by assuring interoperability

Lessons learned – Customer Focus

Consumer Survey

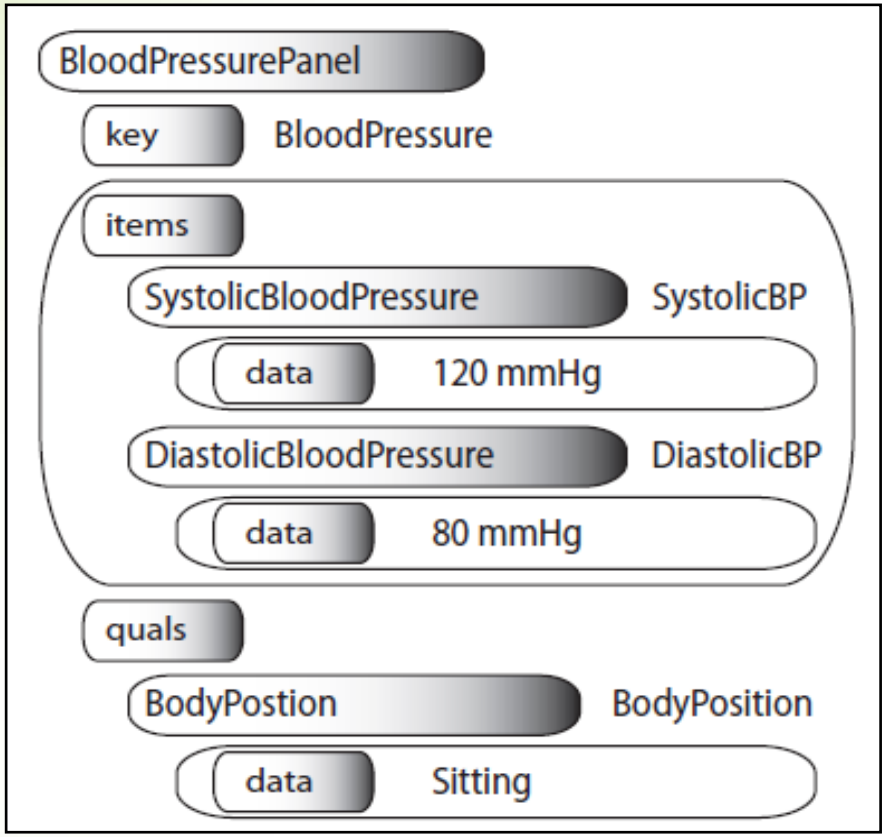
Need for lifetime EHR	Expected benefit of lifetime EHR	Information to be provided
▪ Necessary or definitely necessary : 86.1%	▪ Accurate Dx & Tx : 34.5% ▪ Avoid redundant tests : 33.0%	▪ Disease of patients : 40.8% ▪ Disease prevention & health promotion : 26.2%

Consumer Empowerment through lifetime EHR

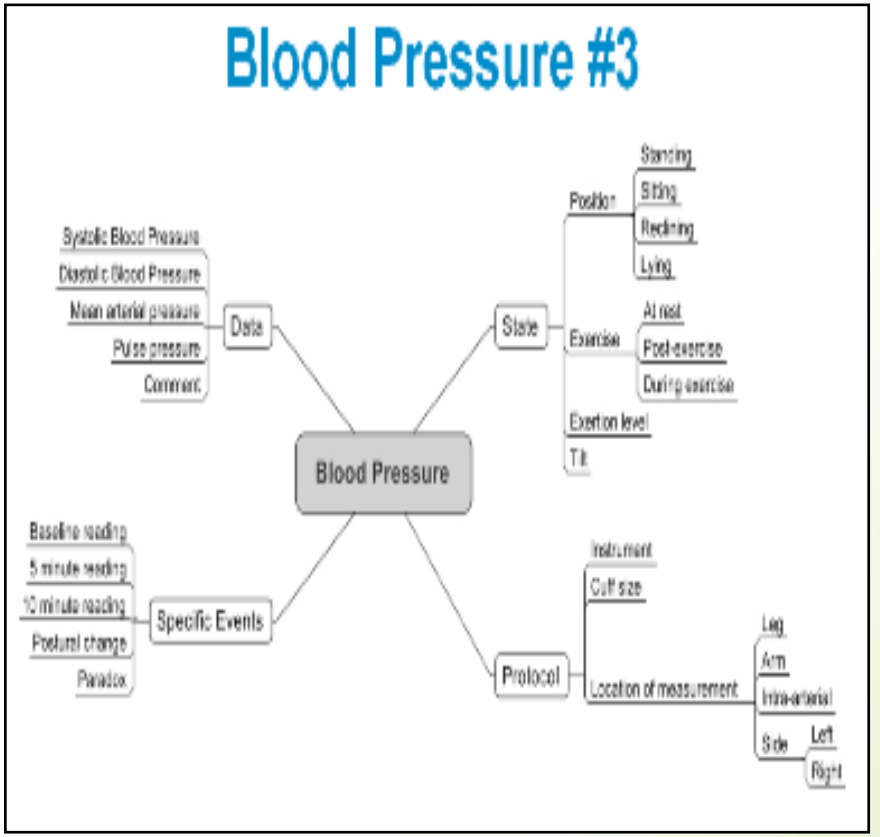


Lessons Learned – Data Modeling and Structured Data Entry

Clinical Element Model (CEM)



openEHR archetype

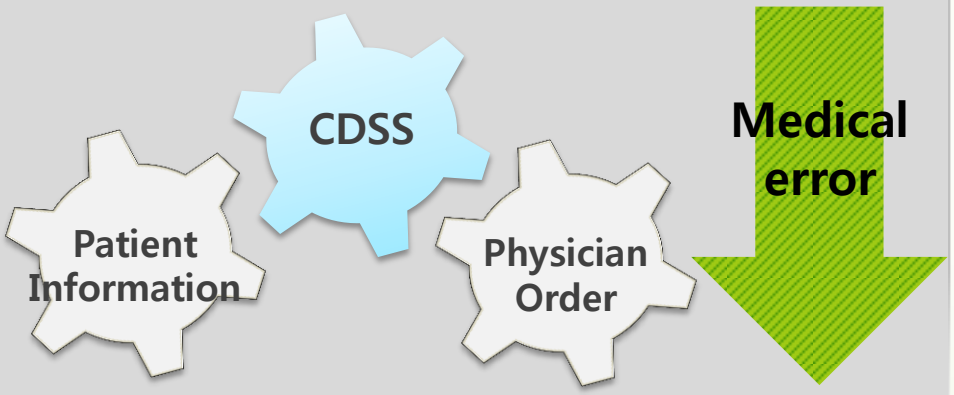


Lessons Learned – Clinical Decision Supports

Decision Making without Decision Support

- Hard to build knowledge base
- Lack of good and inexpensive applications for CDSS implementation
- Lack of awareness on CDSS

Wide-spread Adoption of Clinical Decision Support System(CDSS)



- **National Knowledge repository**
  - rules, guidelines, Drug DB
- **Open source CDSS environments**
  - engine, editor, repository
- **Value demonstration**

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Thank You for Your Attention