

Electronic Health Records

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CBB 7400


Learning Objectives

- Define Electronic Health Records (EHR)
- Examine the history of EHR
- Analyze the promotion of EHR adoption (e.g. meaningful use)
- Identify the key components of the EHR
- Discuss EHR information exchange and interoperability

WHAT IS AN ELECTRONIC HEALTH RECORD?

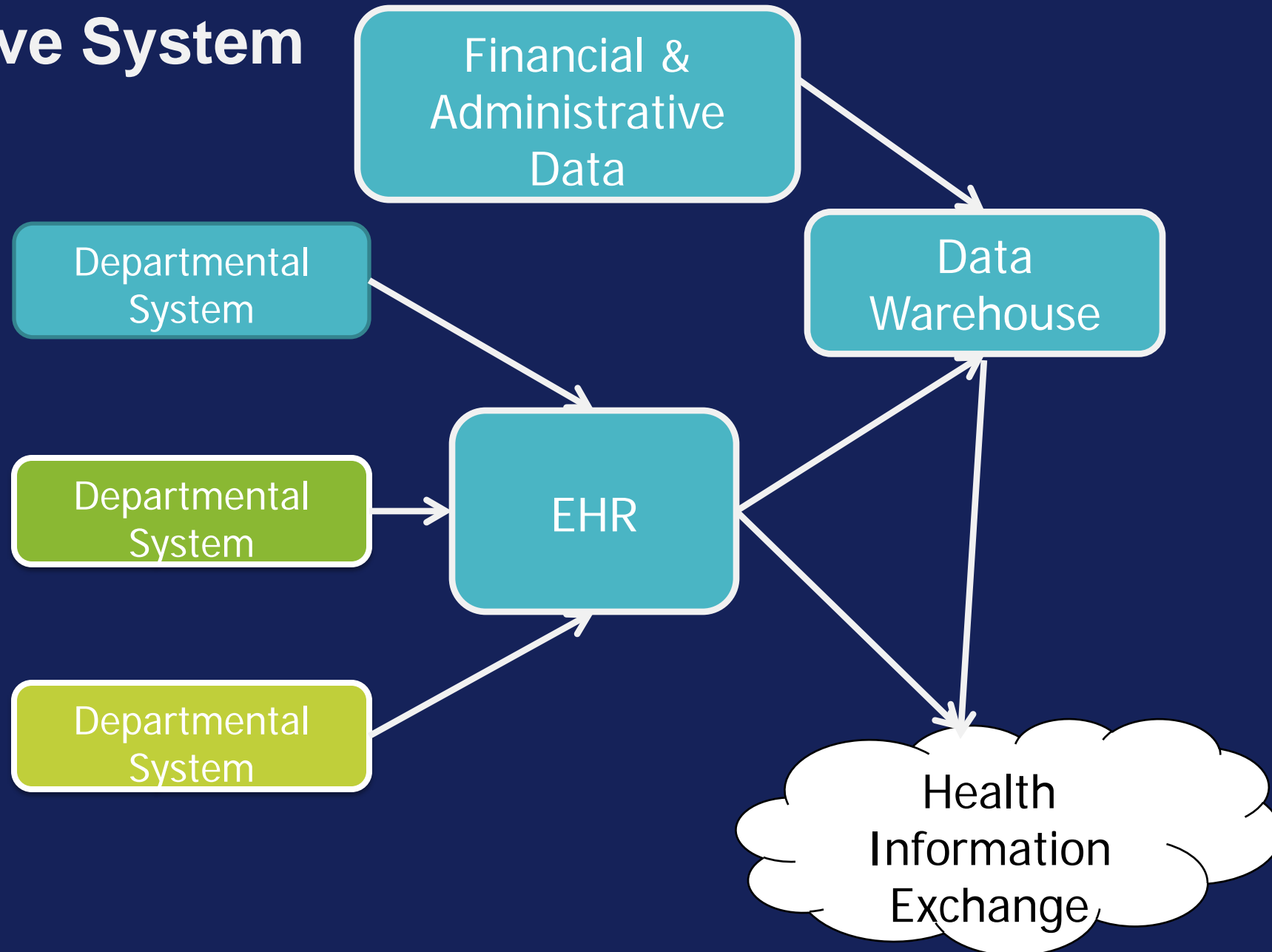
HIMSS Definition: EHR (EMR, CBPR)

A longitudinal electronic record of patient health information generated at one or more encounters in a care delivery setting.



Included in this information are patient demographics, vital signs, progress notes, problems, medications, past medical history, immunizations, laboratory data and radiology reports.

Integrative System



EHRs as Change Agents

EHR Adoption/Implementation

EHR improvement and change

- Clinical decision support
- Usability
- New Features



Things to Think About



Producers and users of electronic health data, information, and knowledge



Structured vs unstructured data in EHRs



Where are Standards used in EHRs



How do EHRs facilitate decision making processes



Evaluating success and failure of new systems or components of EHRs

Rogers Diffusion of Innovation



How new ideas are spread among groups of people



Innovations are not adopted by all individuals in a social system at the same time



Useful for a change agent to be able to identify which category certain individuals belong to

Diffusion of Innovation Categories

Innovators are the first individuals to adopt an innovation. Innovators are willing to take risks, youngest in age, have the highest social class



Early Adopters have the highest degree of opinion leadership. Typically young, high social status, advanced education



Early Majority adopt an innovation after a varying degree of time; tend to be slower in the adoption process, have above average social status, contact with early adopters, and seldom hold positions of opinion leadership



Late Majority adopt an innovation after the average member of the society; approach an innovation with a high degree of skepticism have below average social status, very little opinion leadership



Laggards are the last to adopt an innovation. little to no opinion leadership. an aversion to change-agents and tend to be advanced in age. focused on "traditions", likely to have lowest social status, lowest financial fluidity

SEGMENT 1 SUMMARY

WHY ADOPT AND USE ELECTRONIC HEALTH RECORDS?

Paper-Based Record



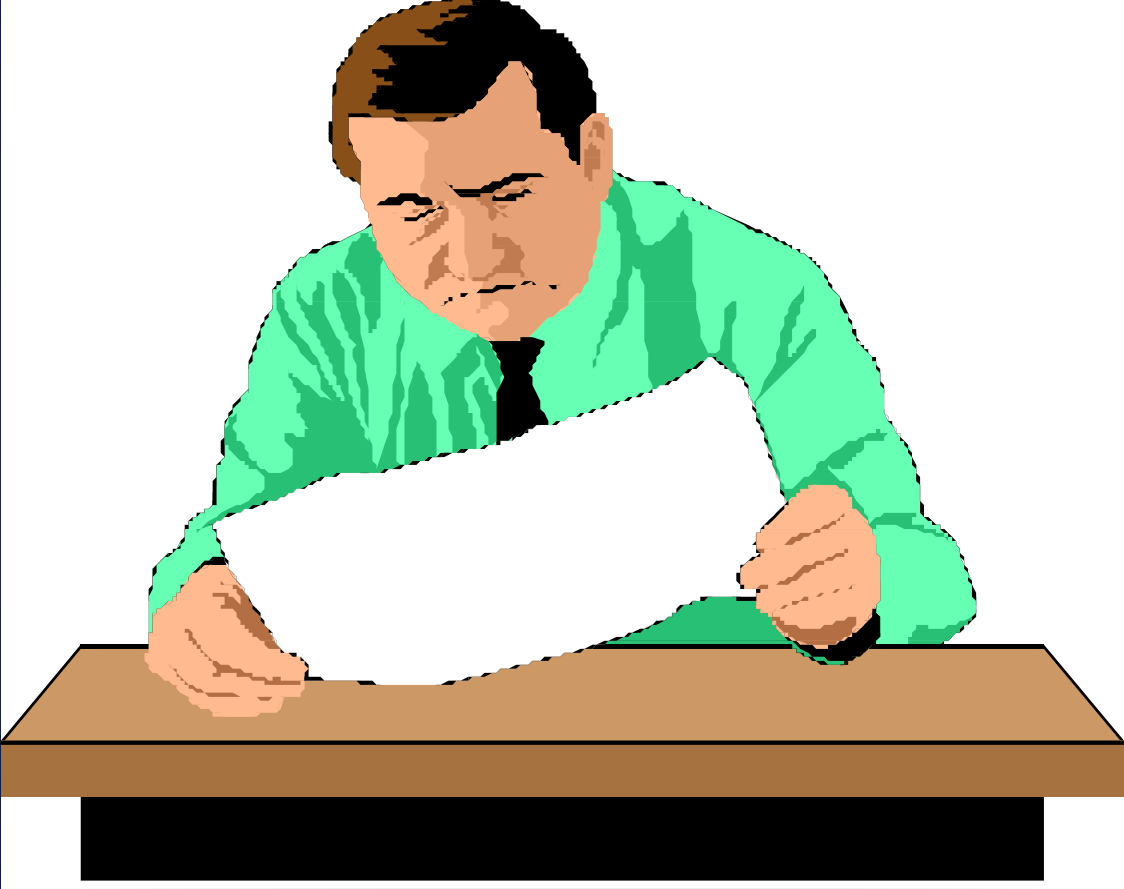
Source: U.S. Navy photo by Photographer's Mate 3rd Class Jason T. Poplin, Public domain, via Wikimedia Commons

Strengths of Paper-Based Record

- Familiar
- Portable
- No down-time due to technical failures
- Flexible recording
- Can be browsed and scanned



Weaknesses of Paper-Based Record



- Unavailable
- Missing data
- Illegible
- Difficult to aggregate data

Advantages of EHR

Accessible

Legible

Flexible
organization
and search

Facilitates data
aggregation

On-line info can
trigger decision
support

Why EHR?

- More informed decision-making
- More efficient and convenient delivery of care
- Reductions in adverse events
- Increased efficiencies related to administrative tasks
- Research

Handy patients enterprise edition

File Edit View Help

David (8 month and 10 day)
John (2 years and 3 month)

Mother: Teacher
Father: Financial advisor
Parents: Married

Last: Anderson P
First: David Boy
Birth: 5 January 2009
Age: 8 month and 10 days Patient nb: 3

Forms
Meeting (Doctor)
Full status (Doctor)
Assistant
Billing
Reports
Statistics

Sheets
O: Neurologic
O: Vascular
O: Cardiac
O: Respiratory
O: Abdomen
Exams
Radiology
Summary
Patient documents
Letter

SOAP Sum T
R-V T, P, PC
Admission Agenda

Meetings
2 month checkup 5 Mar 09 2m.0d
1 month checkup 5 Feb 09 1m.0d
Respiration problem 22 Jan 09 17d
10 days checkup 13 Jan 09 8d
Control for return at home 9 Jan 09 4d
Birth 5 Jan 09 0d

Diagnosis
General
My Diagnosis
Social

New documents
Abdomen palpat - 15 Sep 2009
Cardiac auscul - 15 Sep 2009

To do
Send checkup

Notes
Father ask many questions, add 10 minutes to consultation

Current doctor: Dr Herman

Menu 1 Menu 2 Menu 3 Search

Digestive

Thursday, 22 Jan 2009

Digestive inspection
Normal

Digestive auscultation
Normal abdomen noises

Digestive palpation
Little pain on the right lower area

Liver
No hepatomegaly.

Rectal

Page 1/1
Draw
Mark
Color
Pen
8

Documents manager

Previous page Next page

Source: GPL <<http://www.gnu.org/licenses/gpl.html>> , via Wikimedia Commons

Disadvantage(s)

EHR enforces the centrality of market principles in clinical medicine

Redefines the clinician's role to be less of a medical expert and more of an administrative bureaucrat

Transforms the patient into a digital entity with standardized conditions, treatments, and goals, without a personal narrative.

SEGMENT 2 SUMMARY

EHR HISTORICAL BACKGROUND

Historical Background - 1991



Windows version 3.0

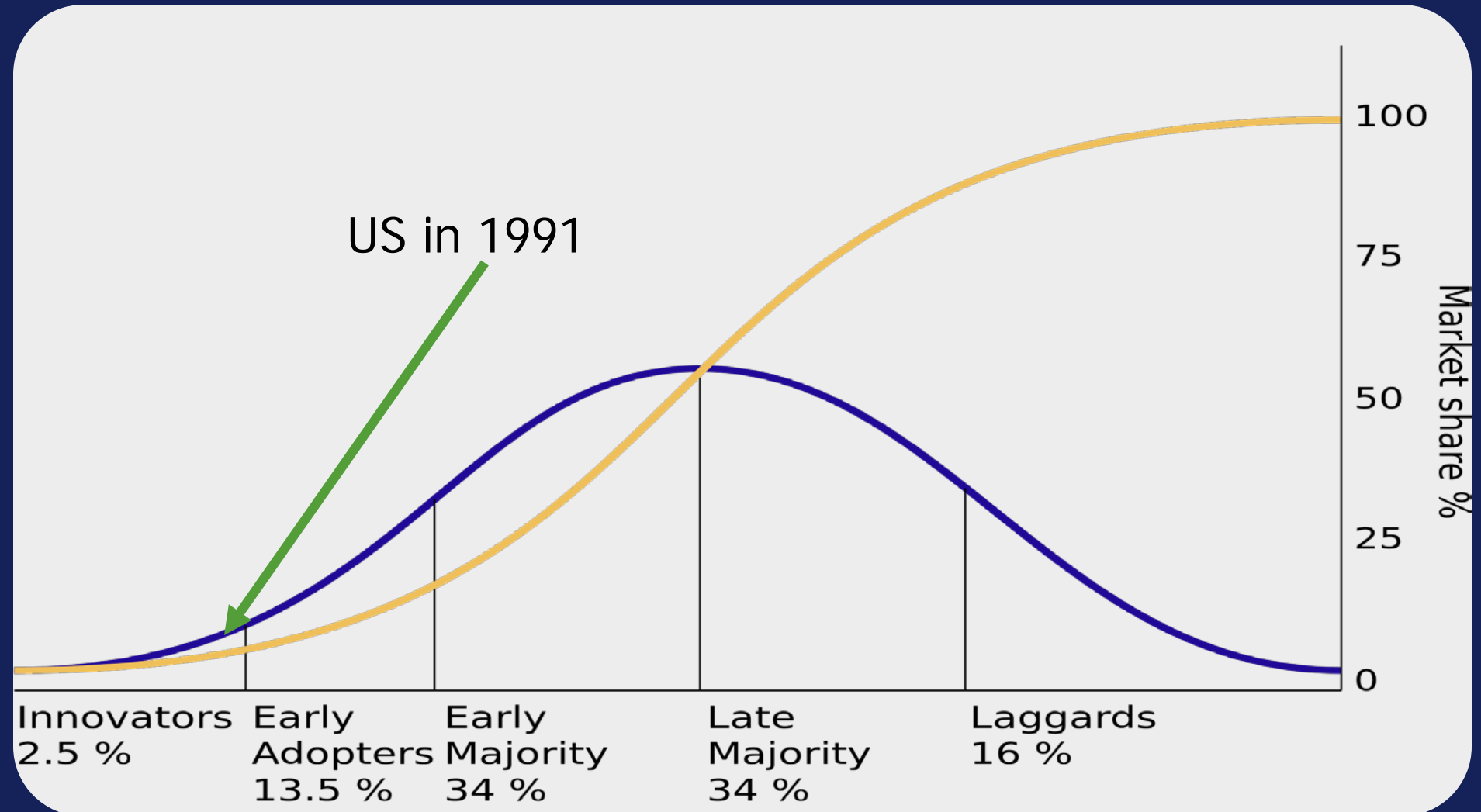


Internet but no World Wide Web



A countable number of EHR installations

Diffusion of Innovation



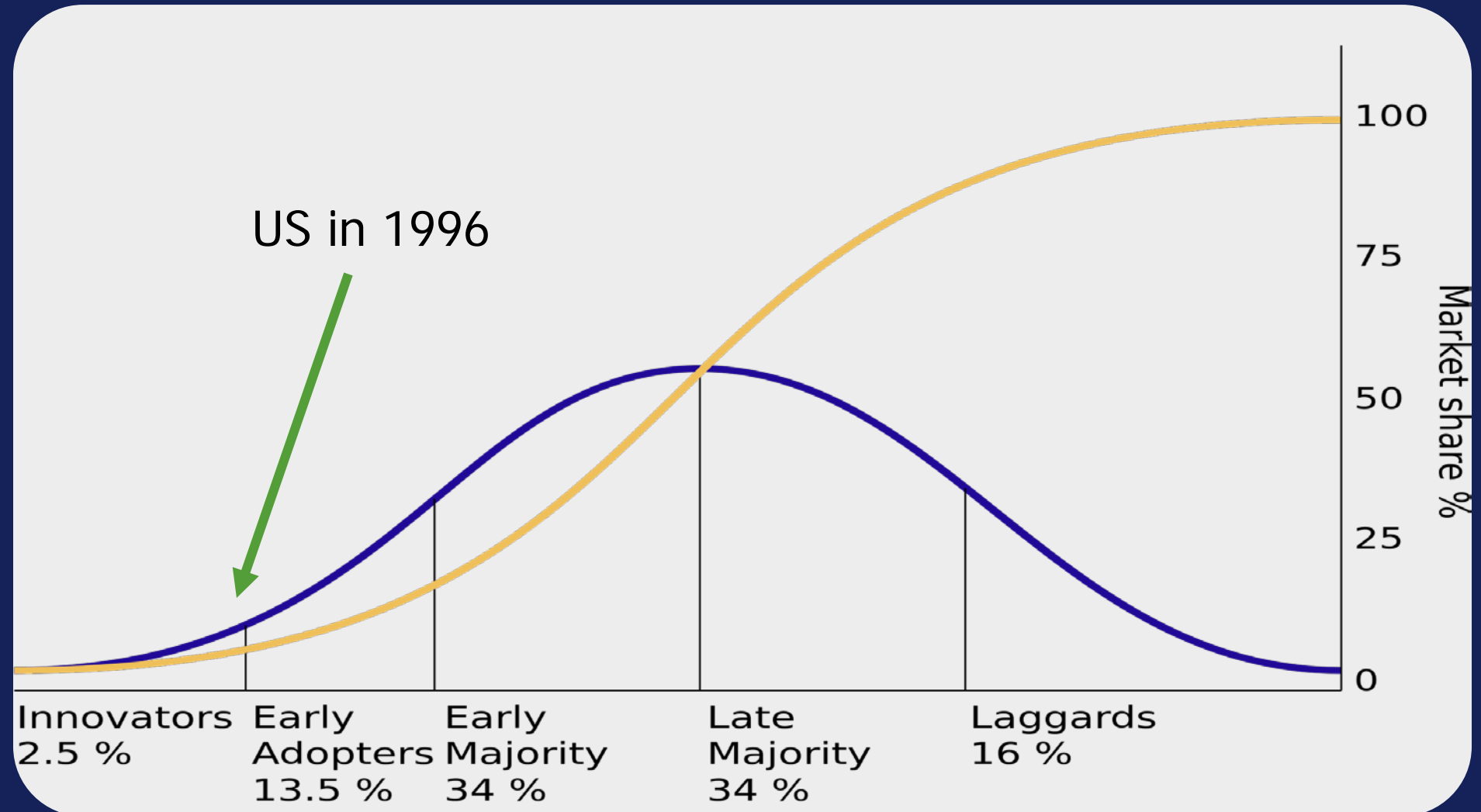
1996

Technology

- Windows 95
- Internet use growing 118% per year

IOM: “Health care professionals and organizations should adopt the computer-based patient record as the standard for medical and all other records related to patient care.”

Diffusion of Innovation



IOM

To Err is Human (1999)

Crossing the Quality Chasm (2001)

American health care delivery system was in need of fundamental change

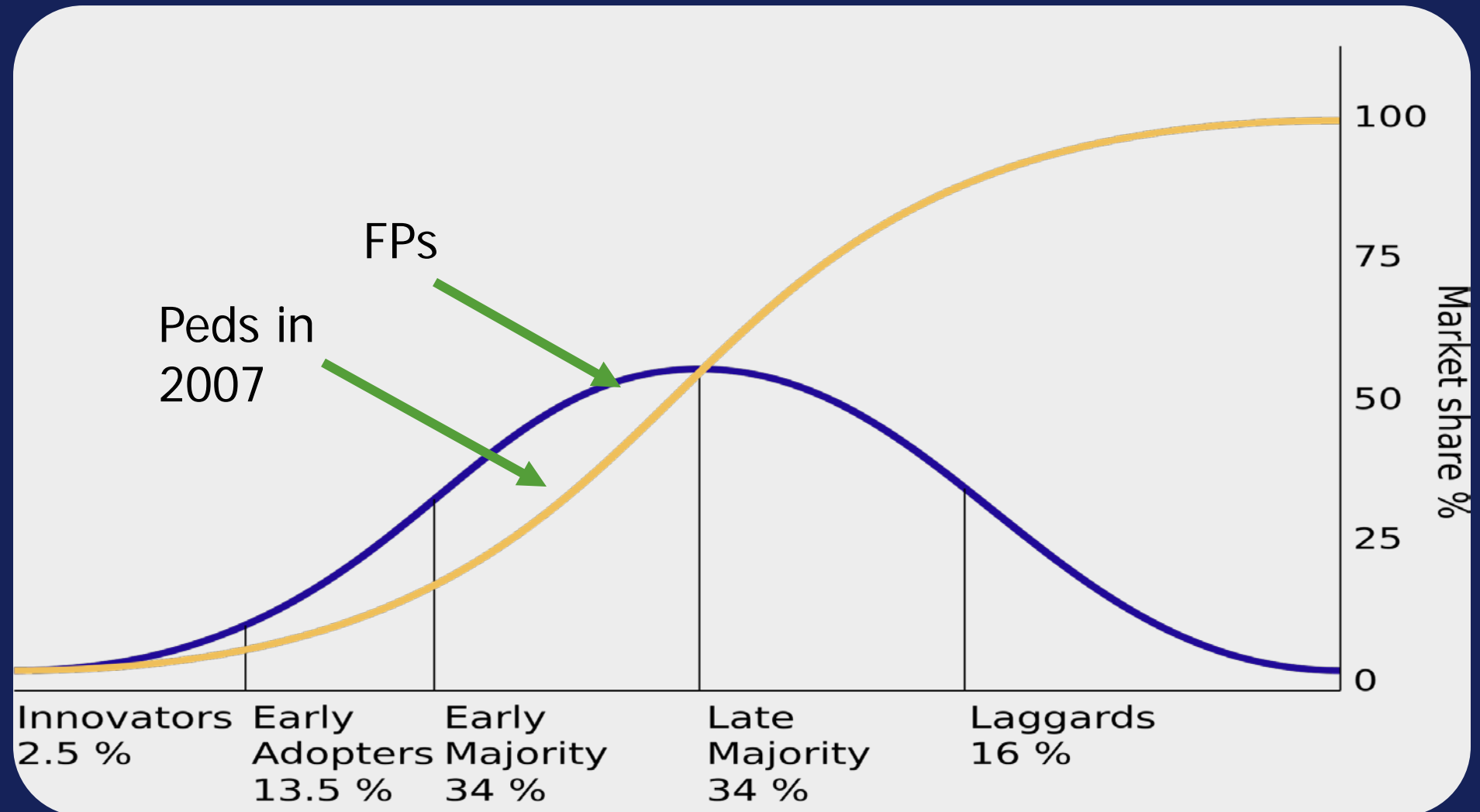
- Errors (45-90,000 deaths/yr)
- Access (40 million without health insurance)
- Resource waste
- “Era of Brownian motion in health care”

“System frequently falls short in its ability to translate knowledge into practice”

Early 2000s

- *2004 - Decade of Health Information Technology*
 - EHRs for all Americans within 10 years
- National Coordinator for Health Information Technology
- American Health Information Communities- advisory workgroups
- Certification of ambulatory systems
- Adoption of standards for interoperability

Diffusion of Innovation



DesRoches, NEJM 2008

- National Survey of 2758 physicians in 2007-08
- Office setting

Table 3. Rates of Adoption of Electronic Health Records by Physicians, with Adjustment for the Characteristics of the Physicians and Their Practices.*

Variable	Fully Functional System (N=117)	Standard Error	Basic System (N=330)	Standard Error	No Basic or Fully Functional System (N=2160)	Standard Error	P Value
<i>percent</i>							
All physicians	4	1	13	1	83	<1	
Sex							0.76
Male	4	1	13	1	83	1	
Female	4	1	13	1	83	2	
Race or ethnic group†							0.99
Hispanic or Latino	4	1	13	2	83	3	
White	4	1	13	1	82	1	0.84
Black	5	2	14	4	80	6	0.72
Asian	5	2	14	3	82	5	0.82
Other	3	2	10	4	87	6	0.45
Medical specialty							<0.001
Primary care	6	1	15	1	80	1	
Not primary care	4	<1	11	1	86	1	
No. of years in practice							0.009
1–9	5	1	15	2	80	2	
10–19	5	1	14	1	81	1	
20–29	5	1	14	1	82	1	
≥30	3	1	10	1	87	1	
No. of physicians in practice							<0.001
1–3	2	<1	7	1	91	1	
4–5	3	1	11	1	86	2	
6–10	6	1	17	2	77	2	
11–50	8	1	22	2	71	3	
>50	17	3	33	3	50	5	
Clinical setting							0.008
Hospital or medical center	5	1	15	1	80	1	
Office not attached to a hospital or medical center	4	<1	12	1	85	1	
Other	4	1	13	3	83	4	
Location							0.92
Urban	4	<1	13	1	83	1	
Rural	4	1	13	1	83	2	
Region							0.002
Northeast	4	1	11	1	86	2	
Midwest	4	1	13	1	83	2	
South	4	1	12	1	84	1	
West	6	1	16	1	78	2	

* Percentages were calculated with the use of multivariable analysis, applying a cumulative logit model to predict the adoption of an electronic-records system, with adjustment for all variables listed in the table. The analysis was adjusted for nonresponse. The total number of respondents does not include 151 who provided incomplete responses. Percentages (which sum across rows) may not total 100 because of rounding.

† Respondents could select more than one race or ethnic group.

American Recovery and Reinvestment Act of 2009 (ARRA)

- The Health Information Technology for Economic and Clinical Health (**HITECH**) **Act**, was enacted in **2009** to **promote the adoption and meaningful use** of health information technology.
- ~\$27,000,000,000 (BILLION) for health information technology over 10 years

“Meaningful Use”

Meaningful use (MU) defines minimum U.S. government standards for using electronic health records and for exchanging patient clinical data

Its rules determine whether or not a healthcare provider may receive federal funds.

“Meaningful Use”

Three Stages

- Stage 1 (2010) focused on promoting adoption of EHRs.
- Stage 2 (2012) increases thresholds of criteria compliance and introduces more clinical decision support, care-coordination requirements and rudimentary patient engagement rules
- Stage 3 (2014-2016) focuses on robust health information exchange as well as other more fully formed meaningful use guidelines introduced in earlier stages.

Incentive

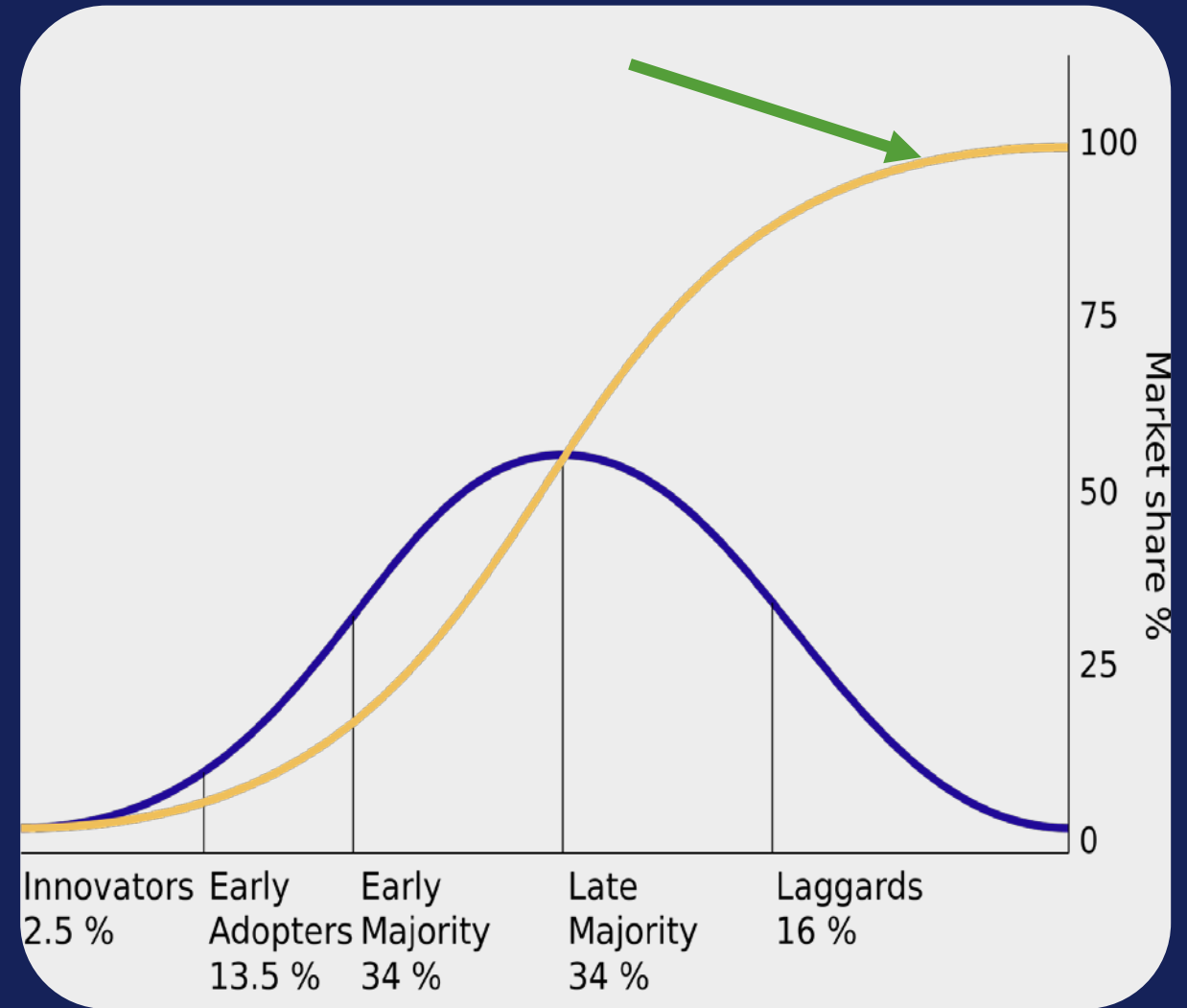
- Centers for Medicare & Medicaid Services (CMS) **provides a reimbursement incentive** for physician and hospital providers who are successful in becoming “meaningful users” of an electronic health record (EHR).
 - \$44,000 per provider thru Medicare
 - \$63,750 per provider through Medicaid
- These incentive payments begin in 2011 and gradually phase down.
- Starting in 2015, providers are expected to have adopted and be actively utilizing an EHR in compliance with the “meaningful use” definition or they will be subject to financial penalties under Medicare.

Example Meaningful Use Objectives

Objective	Measure
Maintain up-to-date problem list of current and active diagnoses	Over 80% have at least one entry recorded as structured data
Record smoking status for patients 13 years of age or older	Over 50% of patients 13 years of age or older have smoking status recorded as structured data

Today

- Almost all hospitals and 80% of office-based practices use certified EHR
- 87% of patients have access to their EHR
- Majority of providers can share info
- Of 500 studies examining use of health IT, 84% showed that deploying (EHR) had a positive effect on quality of care, safety, and efficiency.



McGinn TG. JAMA Intern Med 2013

Jones SS. HIT systematic review. Ann Intern Med 2014.

SEGMENT 3 SUMMARY

A Miracle?

No other sector of US economy of similar size (1/6 of GDP) and complexity (>5000 hospitals, >500,000 physicians) has undergone such rapid computerization

(Halamka and Tripathi, NEJM 2017)

Burden for EHR Vendors

- Must meet complex certification requirements
 - imposed direct costs and high opportunity costs
- Development resources diverted to programming complex certification requirements



Effect on Physician Patient Interaction

Downside – Unintended Consequences

- Reduced time for provider-patient interaction
- New and burdensome data entry tasks transferred to front-line clinicians
- Lengthened clinical workdays
- Interoperability has languished
- Decreased clinician satisfaction with their work-lives

Payne TH. EHR 2020 Task Force JAMIA. 2015

Downside – Unintended Consequences

Health care providers bore brunt of transformation

Frustration with poor usability

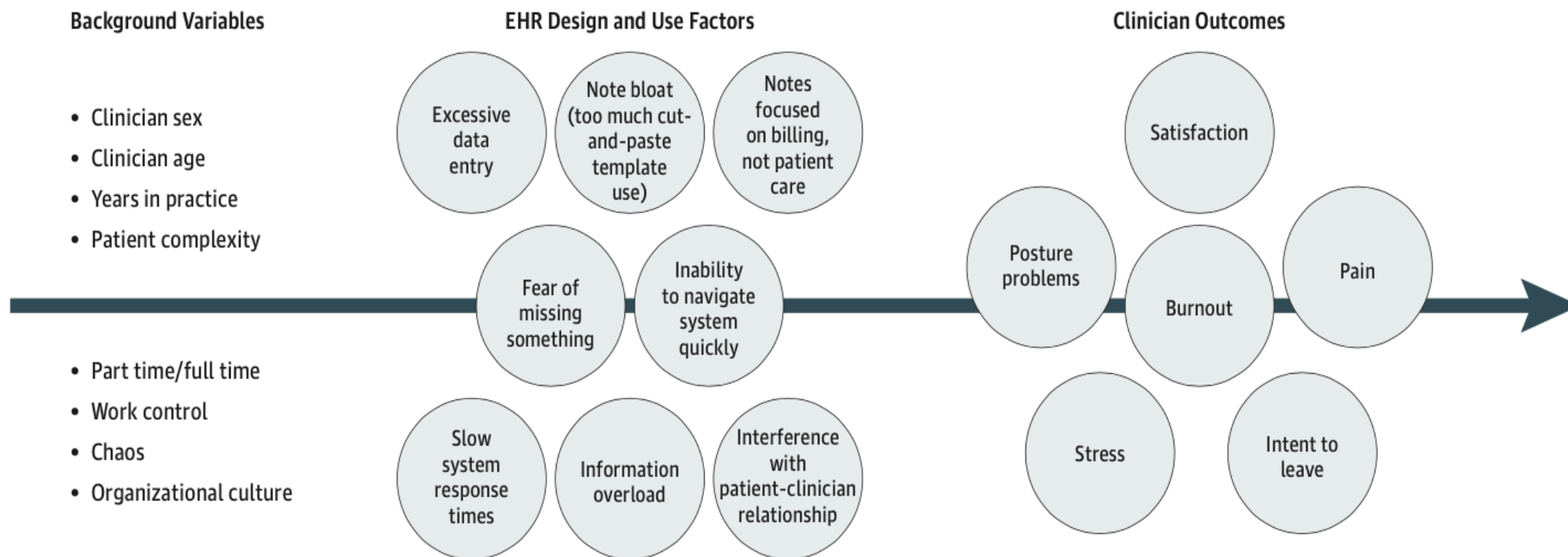
Attempt to drive cultural change with legislation

Downside – Unintended Consequences

“Physicians expected to provide high-quality empathic care in a 12-minute visit while weaning themselves from paper-based workflows, entering numerous structured data elements required for meaningful use, rolling out new HIPAA privacy notices, implementing security protections, learning and incorporating new ICD10 codes, convincing patients to use patient portals, all while avoiding safety and malpractice issues.”

“Instead of being a gift horse that reduced clinician burden, EHR became an expensive Trojan horse loaded with new regulatory requirements”

Figure. Conceptual Framework of Association of Work Conditions and Electronic Health Record (EHR) Design and Use Factors With Clinician Outcomes



SEGMENT 4 SUMMARY

FUNCTIONAL COMPONENTS OF THE EHR

Integrated Patient Views



Demographics

Labs

Past Medical
History

Past Surgical
History

Prescriptions

Problem List

Clinician Order Entry

Legible transmission to intended recipient

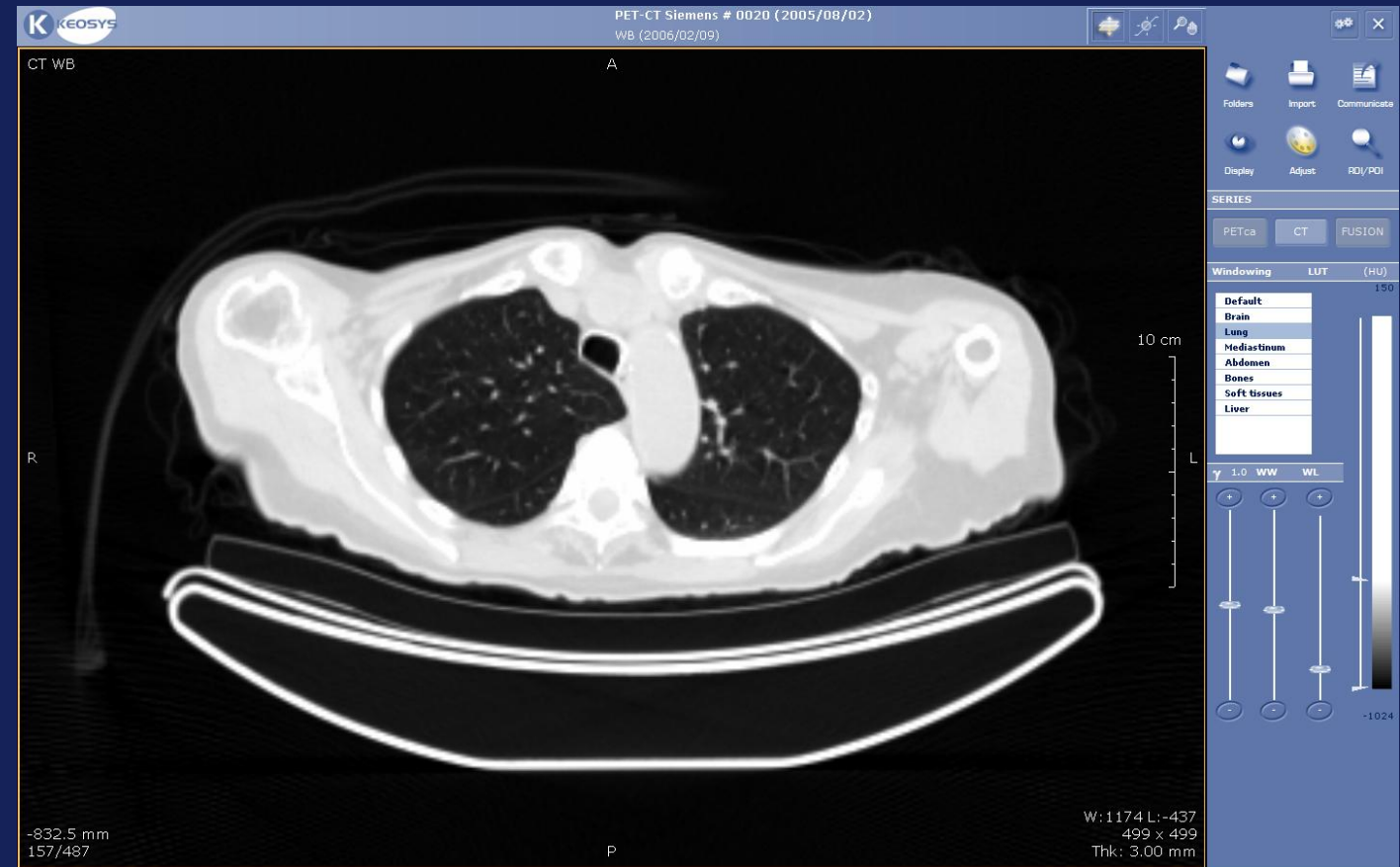
Provide opportunities for decision support

Adaptable and scalable



PACS Integration

Picture Archiving and Communication System



A chest image displayed via a PACS

Source: Mco44, Public domain, via Wikimedia Commons

Clinical Decision Support



Documentation
template



Alert



Reminder



Flowchart

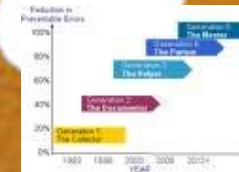
Order set
Facilitator



Infobutton



Calculator



Flowsheet

Access to Knowledge Resources

Links to Institutional Policies

Lab Thresholds

Links to Web Resources (e.g. UpToDate)

Care Plans and Pathways/Guidelines

Integrated Communication and Reporting Support

Emails within HER



Communication of Results via Smart Phones



Text Messages to and from Patients



SEGMENT 5 SUMMARY

EHR INFORMATION EXCHANGE AND INTEROPERABILITY

Challenges to Sharing Patient Information

Organizational and Technical

- **Maintaining privacy:** commercial, governmental, criminal misuses of data; security breaches by hackers; misuse by competitors
- **Standards:** data representation, message exchange
- **Trust:** legal agreements, indemnification
- **Funding, governance**

Network Architecture Options

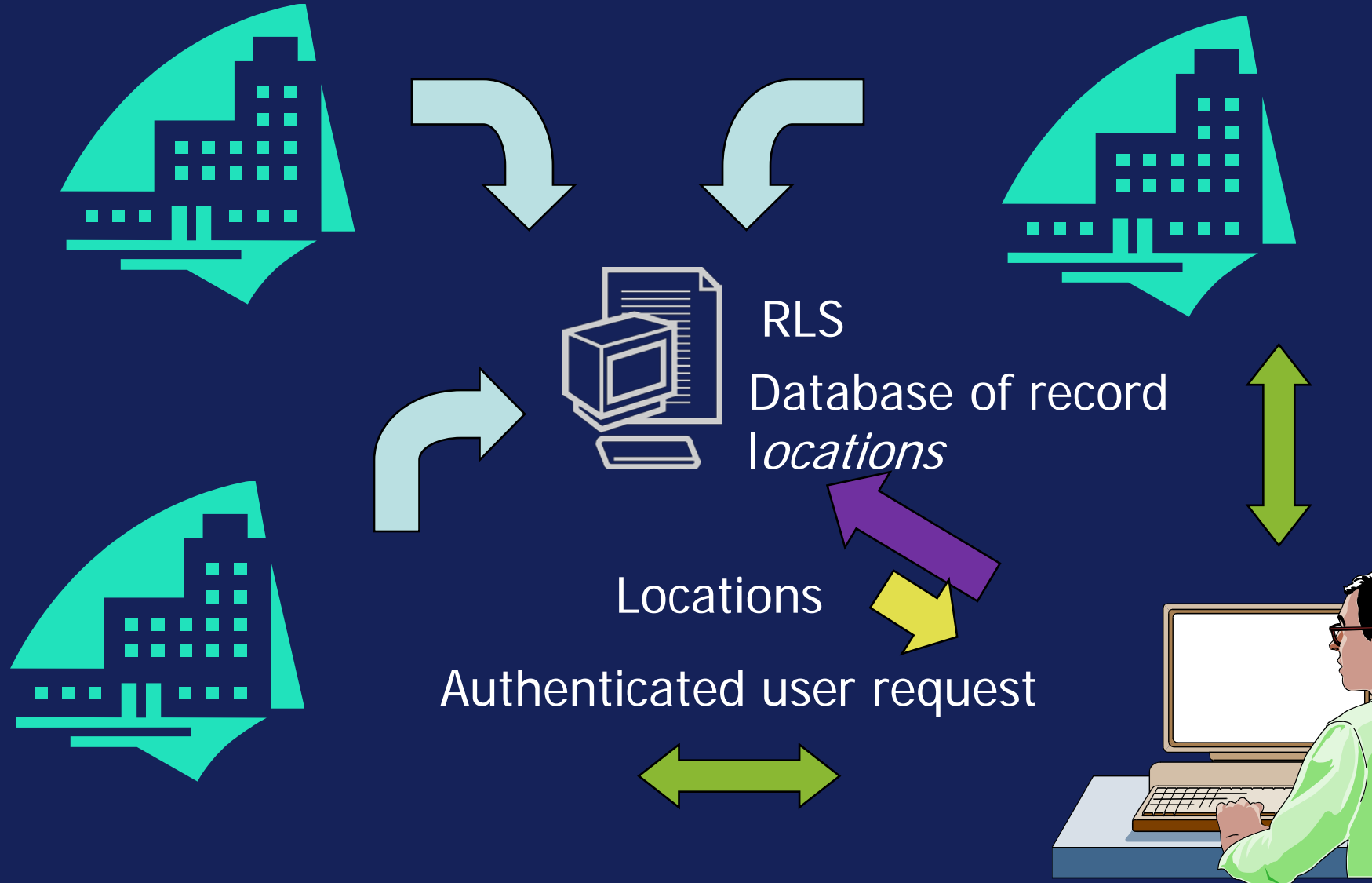
Central

- All organizations store data in a central database
- Requires transformation of data to a single format
- Requires new database operation center
- Single point of failure
- Fast responses but expensive

Federated

- Organizations store data in current databases but provide an index to a central Record Locator Service
- Organizations remain responsible for release of data
- Lower costs to initiate and maintain, but may be slow

How a Record Locator Service Works



Interoperability

- Epic's Care Everywhere is a patient record CDA exchange platform available to Epic's EHR customers
- When all customers licensed for EpicCare are live, Care Everywhere will be used by 276,000 providers at over 26,500 clinics, 800 retail clinics and 1,050 hospitals.
- They will cover a patient population of approximately 173 million—over 54% of the U.S. population.

New Understandings

- Information Technology has enormous potential to improve the quality of health care with regard to all six quality components...
- EHR is a catalyst, not an end in itself
- EHR implementation projects are really Quality Improvement projects

Questions



What information system functionalities did you observe in the (a) inpatient and (b) outpatient settings



Data sources



Were the systems you observed used "meaningfully"?



Data confidentiality



Data collection; structured and unstructured data



Efficiency



Clinician-patient relationship



Genetic information

SEGMENT 5 SUMMARY