Improving the design and usability of electronic health records (EHR) and clinical decision support (CDS) for clinicians, patients, and families

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- ## No disclosures

WIHSE
Wisconsin Institute for Healthcare Systems Engineering

- UW College of Engineering
- Fosters collaboration between practitioners and researchers in health care and engineering
- Design better systems in health care

Moving beyond static survivorship care plans: A systems engineering approach to population health management for cancer survivors

Amye J. Tevaarwerk MD, Jennifer R. Klemp PhD, MPH,
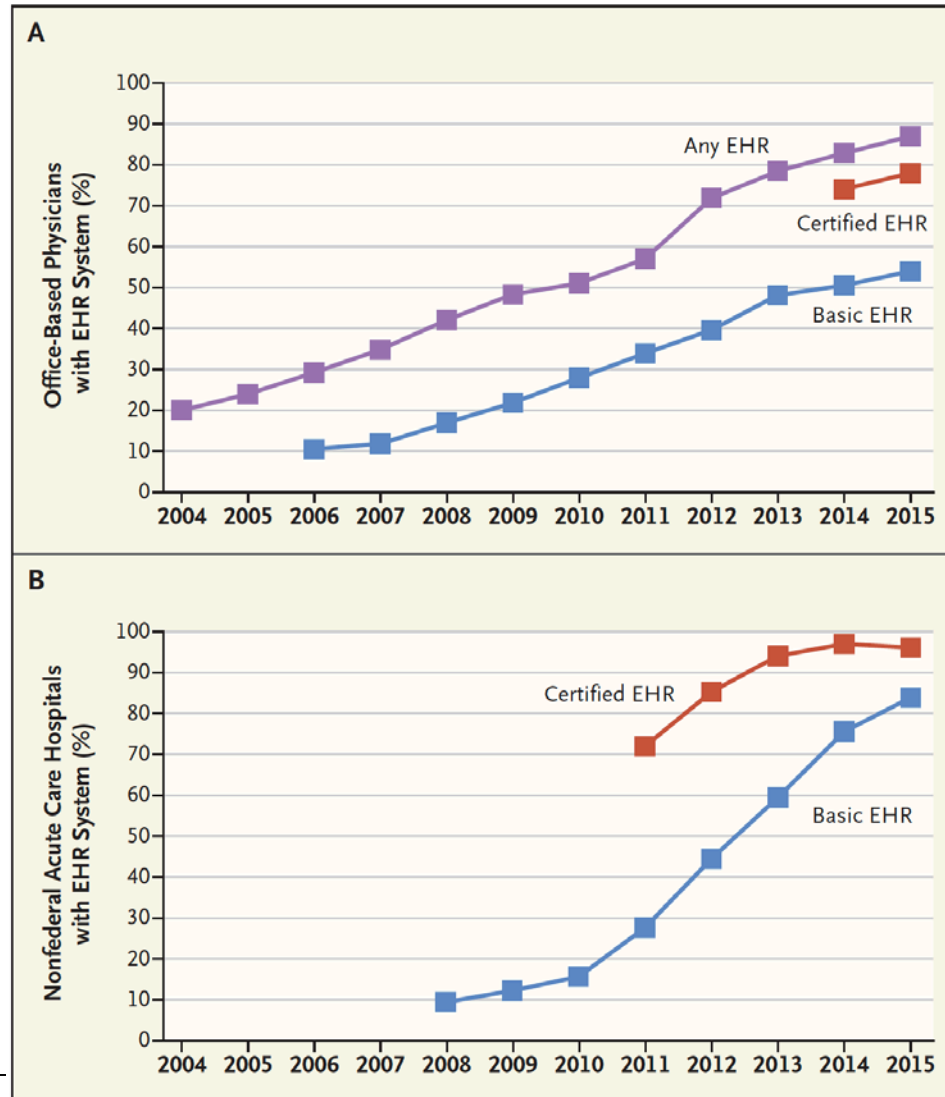Gijsberta J. van Londen MD, MS, Bradford W. Hesse PhD, Mary E. Sesto PT, PhD

Cancer

Overview

- Intent – goals/objective
- Reality – impact on clinician and patient
- Usability evaluation – inform EHR/CDS design
- Case Vignette

Achieving High Performing EHR/CDS Systems

Rapid Pace of EHR Growth

Washington et al., 2017

Increased Clinician Involvement (Physician Example)

- Board Certification in Clinical Informatics (~1700)
- Clinical Informatics Fellowships have emerged
- Vendor training
  - Physician (primarily) builder training = 4488
    - Specialists = ~2244 self-identified

Specialty	% specialists participating (denominator=2244)
Oncology	3.6%
Cardiology	6.3%
Gastroenterology	1.4%
Anesthesiology	7.7%

SYSTEM

- EHR system must fully integrate with PMS.
- EHR system must be reliable with virtually no down-time.
- EHR system must be very fast and use a secure, wireless intra-office connection.
- EHR system must be compatible with systems used by local hospitals, consultant specialists, labs, and imaging facilities with easily adaptable interfaces.
- EHR system must be compliant with present technology standards for reporting of data to MCOs and Medicare.
- EHR system must be expandable to a multi-site use and allow for growth in the size of practice.
- EHR system must be redundant with disaster recovery procedure that is easily accomplished.

VENDOR

- Vendor must be a financially stable/viable company with strong presence in the local healthcare community and experience with small, primary care practices.
- Vendor must have reputation for exceptional customer service and support.
- Vendor must provide sufficient training of present and future staff in an efficient, cost-effective manner.
- Vendor must have availability and expertise to assist us in adapting the EHR to changing requirements for reporting, billing or clinical needs.

BILLING

- EHR system needs to maintain or improve present AR time.
- EHR system must provide easy coding assistance and provide documentation to support codes.

- EHR system should be user-friendly and allow for generation of reports to track trends in charges, AR, payer mix, denials, etc.
- EHR system should facilitate "clean claims" and limit denials.
- EHR system should adapt easily to changes in requirements for claims submission.

OFFICE STAFF

- EHR should allow for and promote eventual goal of having all communication with patients, medical specialists' offices, labs, imaging facilities and MCOs accomplished electronically rather than by phone in order to enhance efficiency and documentation.
- EHR should be user-friendly and require minimal training for new employees.
- EHR should be efficient with very few clicks to most-frequently used screens/functions.
- EHR should support multi-resource scheduling easily and efficiently.
- EHR should improve workflow for all functions including patient check-in, proscription refills, management of referrals, record requests, appointment scheduling, etc.

CLINICAL DATA MANAGEMENT

- EHR should have adaptable systems for disease management and programs targeting improvements in patient care as well as pay-for-performance goals.
- EHR should have easily generated reports of patients by diagnosis, visit type, demographics, etc.
- EHR should allow for easy reporting of data to MCOs, Medicare, and PHO.

MEDICAL RECORDS AND DOCUMENT MANAGEMENT

- EHR should allow for rapid scanning of documents.
- EHR should generate work notes, school excuses, immunization records, etc.
- EHR should allow for efficient completion and management of multiple forms from outside agencies that need to be completed by our providers, such as WIC forms, PT1 transportation forms, DMV forms, school physicals, etc.
- EHR should allow for maintaining a patient education "library" with materials that are easily accessed and printed for patients.

COSTS

- Systems should help us save transcription costs.
- Systems should save on payroll costs eventually as system efficiencies are achieved and workforce shrinks by attrition.
- System should decrease cost for supplies, courier services, and paper management.
- System should increase revenue through MCO and Medicare incentive programs.

Goals and Objectives for EHR Implementation

CLINICIAN

- documentation should be user-friendly and easily adaptable
- easy to read
- remote access
- accommodates multiple visit types
- see and review results and labs requiring urgent attention for providers who are not in the office.
- block their inbox when not in office
- efficient means for communication with specialists.
- streamline communication with patients
- interface with labs for electronic receipt of results as well as electronic order entry.
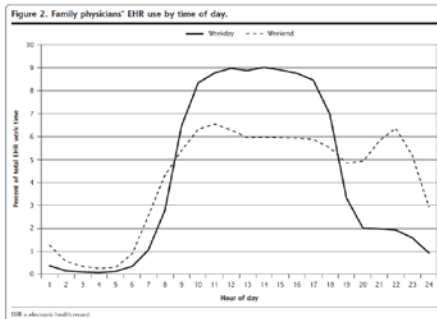- digital photography

PATIENT

- improve patient access
- improve patient satisfaction
- undertake all communication with the office electronically, if they choose
- give insurance, demographic information, and eventually some clinical history online before their *office* visits

Reality: The Bad…

Sinsky et al., 2013

Figure 2. Family physicians' EHR use by time of day.

-Arndt et al., 2017

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WHY DOCTORS HATE THEIR COMPUTERS

Digitization promises to make medical care easier and more efficient. But are screens coming between doctors and patients?

By Atul Gawande

Online patient websites for EHR access among vulnerable populations: portals to nowhere? -Tieu et al., 2017

Reality: The Good…

Electronic Health Records Associated With Lower Hospital Mortality After Systems Have Time To Mature -Lin et al., 2018

SCP: % with errors
EHR-leveraged SCP
-10% error rate
External software-based SCP
-46% error rate

 -Tevaarwerk et al., 2017

SEIPS

"Usability is the effectiveness, efficiency and satisfaction with which specific users can achieve a specific set of tasks in a particular environment."
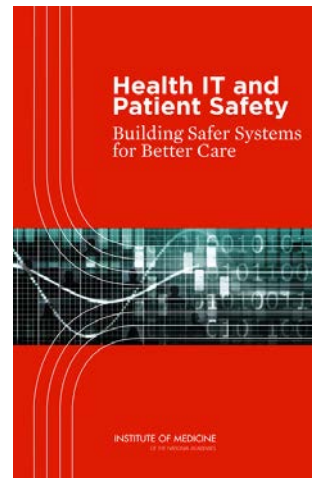
-ISO 9241

Principles of Usability

- **C**
- **V**
- **N**
  v
- **N**

- Minimize **memory** load
- Informative **feedback**
- **Flexibility** & efficiency

Zhang et al., 2003

- Users in **control**
- Help & **documentation**

Inform Design Standards

Health IT and Patient Safety
Building Safer Systems for Better Care

INSTITUTE OF MEDICINE

NISTIR 7769
Human Factors Guidance to Prevent Healthcare Disparities with the Adoption of EHRs

NISTIR 7741
NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records

NISTIR 7804
Technical Evaluation, Testing, and Validation of the Usability of Electronic Health Records
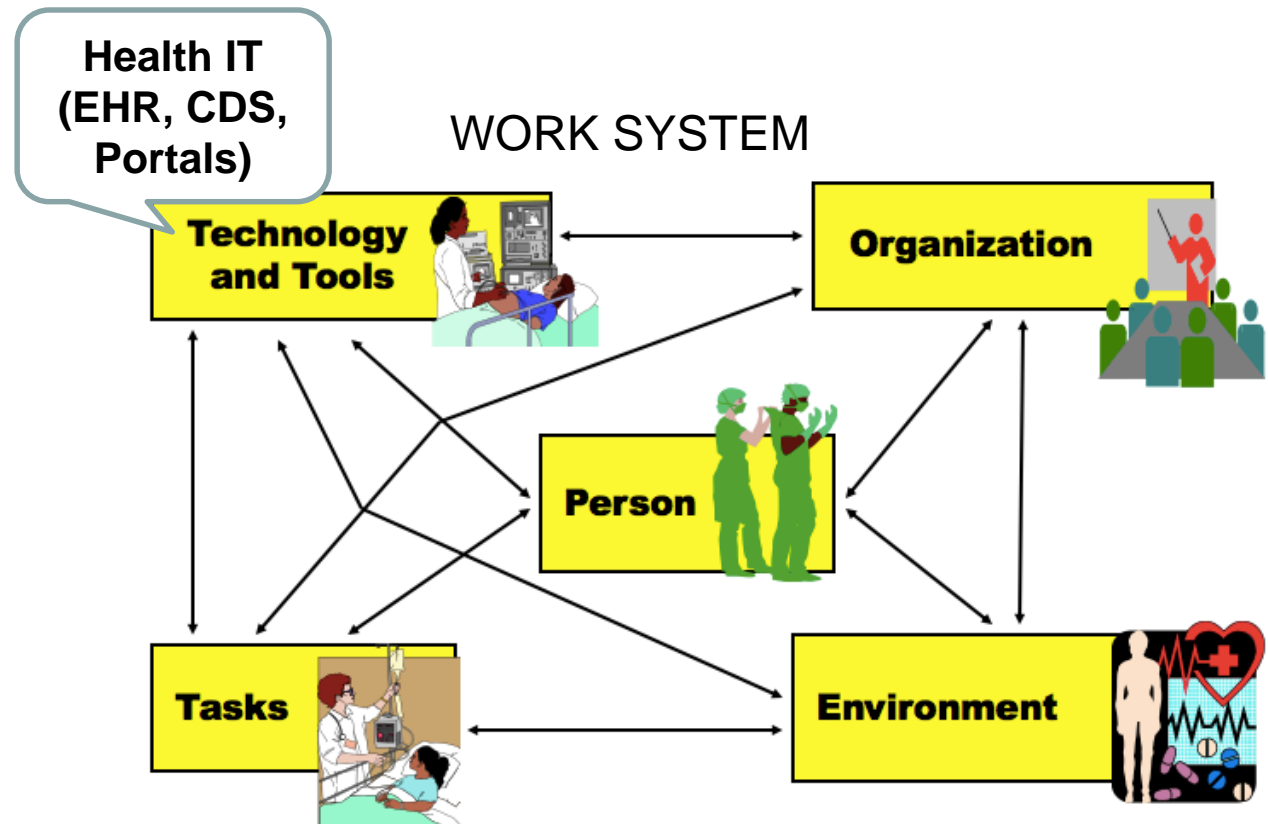
CQPI

The System Matters
(cannot evaluate EHR in a silo)

"Alt... **is sim...** **disp...** ...red des... ...g of how... ...d task... ...e to guid...

Tasks need to represent real world complexity of work performed by clinicians and patients

Ratwani et al., JAMIA 2016

SEIPS Model of Work System and Patient Safety*
(Systems Engineering Initiative for Patient Safety)

- Human-centered design*

- Applied: infection control, surgical readmissions, primary care, pediatric trauma, and oncology**

- Systems engineering approach to leveraging the EHR to improve population health of cancer survivors

Health IT (EHR, CDS, Portals)

WORK SYSTEM

Technology and Tools

Organization

Person

Tasks

Environment

Carayon et al., 2006, 2014

**Sesto et al, 2011; Donohue et al, 2014; Donuhue et al, 2017; Tevaarwerk et al, 2018; Swiecichowski et al, 2018; Hua et al, 2019; Morken et al, 2019

*refer to bibliography

SEIPS

Vignette – Entering scheduling information

BARRIERS:
technology did not support team based tasks;

co
te
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o
sc
pa
su
schedules;
inefficient work processes

Address and disseminate information on near misses and unintended harms

# Applying the Science: Application of Usability Standards by Vendors
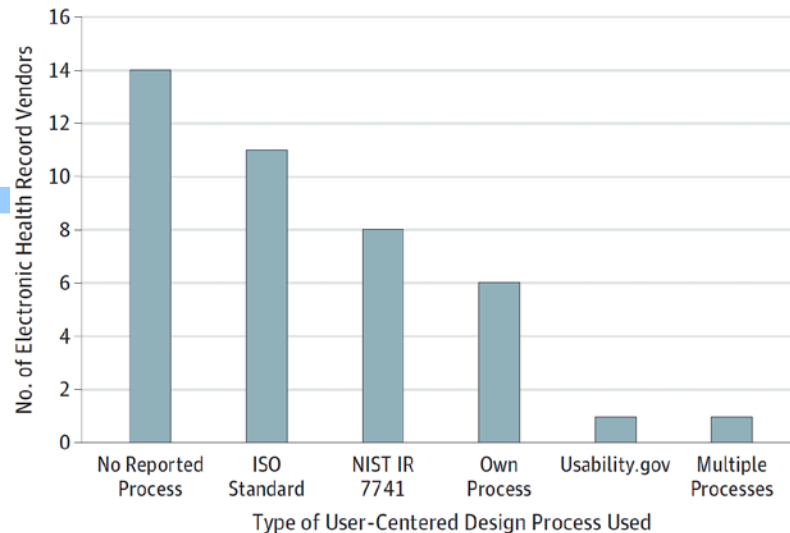
- 34% did not report process

- 63% used < 15 participants with clinical backgrounds; National Institute of Standards and Technology recommends 15 participant minimum (ONC endorsed)

- Usability evaluation processes exist, but applied variably
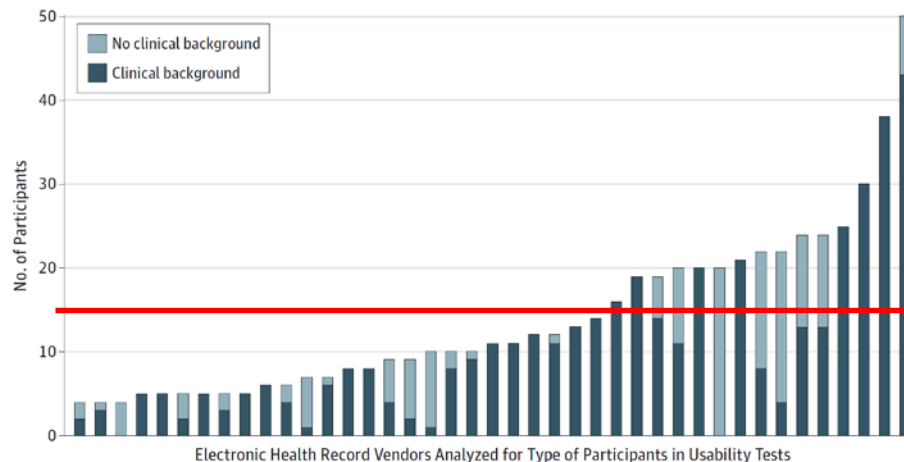
Ratwani et al., JAMA, 2015

Applying the Science: EHR use in the "real world"

Number of clicks by site and vendor
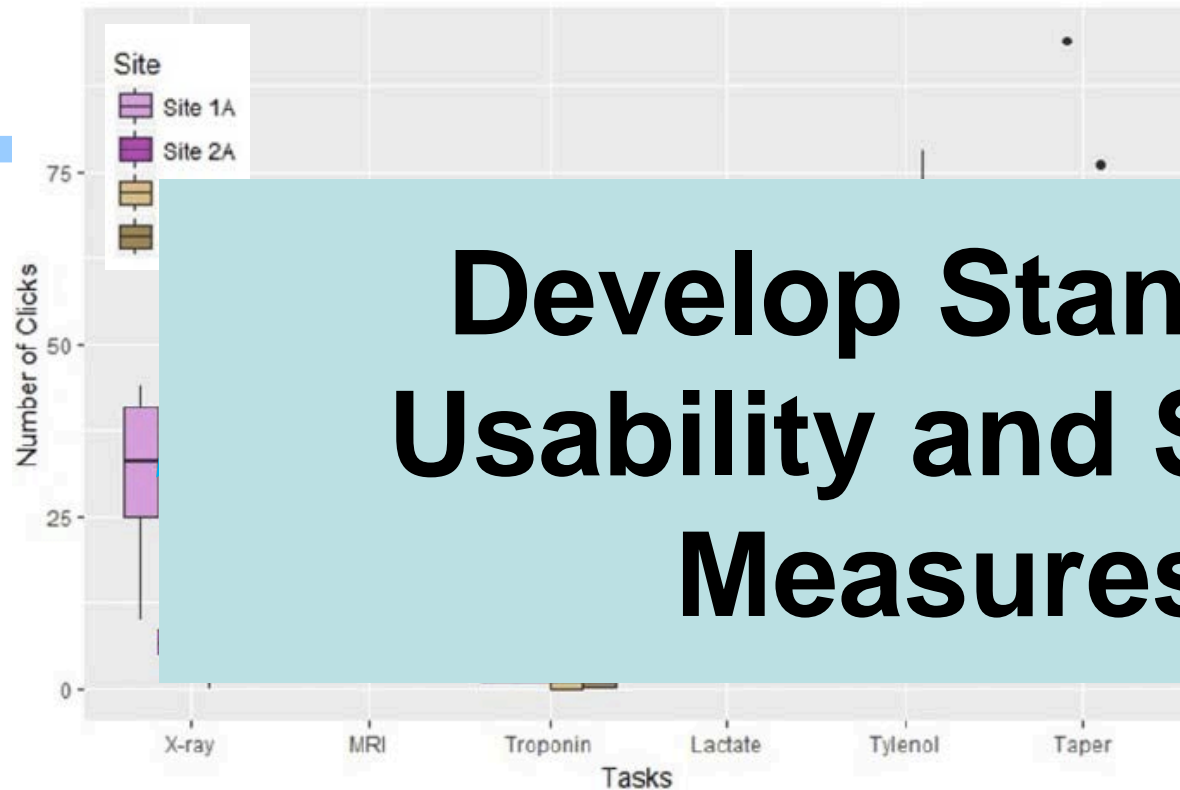
- Variability can be introduced from site customization

- "...r

- ...n, in ...esign ... critical to usable and safe products."

Develop Standard Usability and Safety Measures

Ratwani et al., JAMIA, 2018

EHR is a tool…

Physician Burnout in the Electronic Health Record Era: Are We Ignoring the Real Cause?

Legend: U.S. / International

UK, UAE, SGP, AUS, NL, DK

X-axis: Average Characters per Ambulatory Note, n
Y-axis: Institutions, n
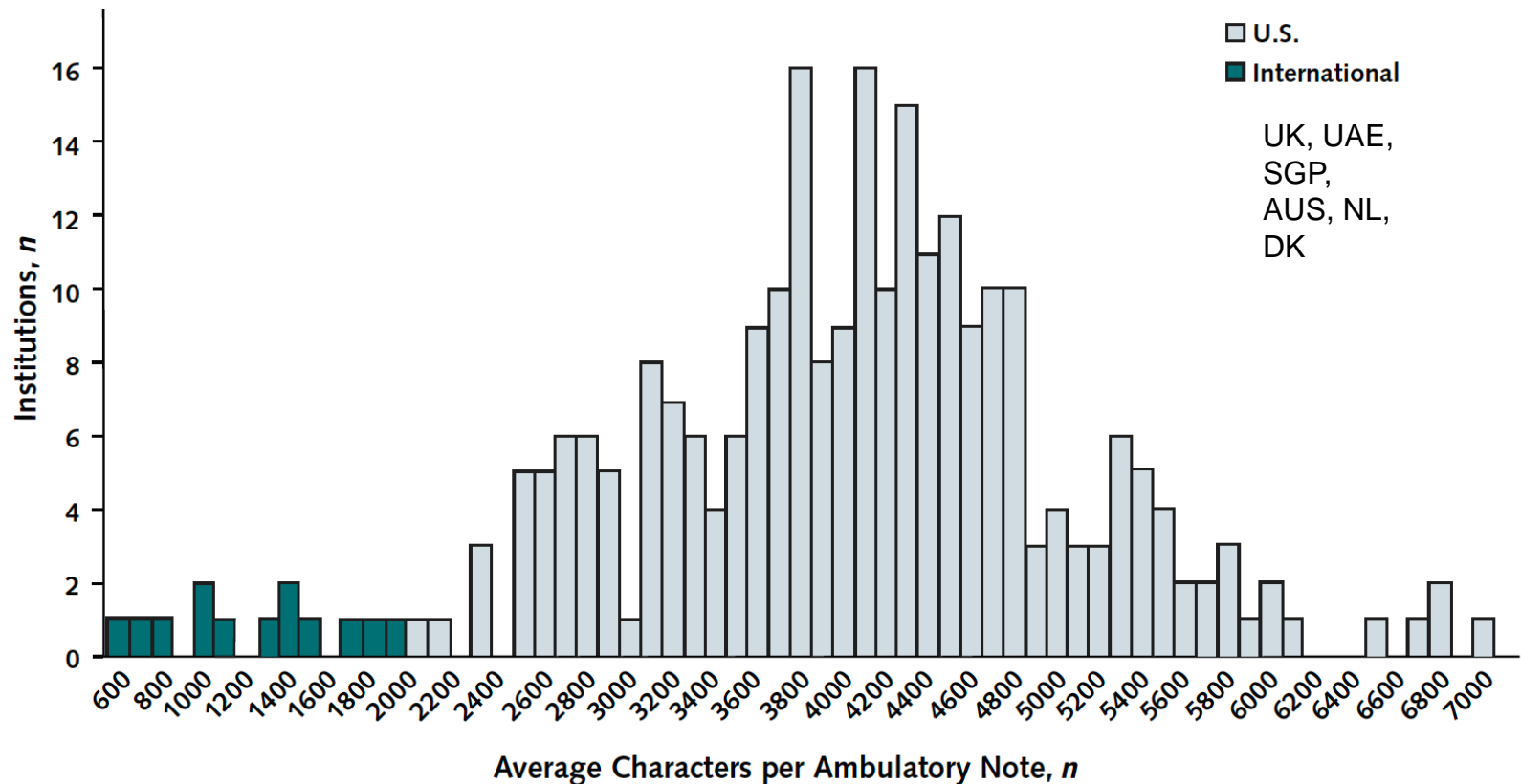
"The **highly trained U.S. physician**, however, has become a data-entry clerk, required to **document** not only **diagnoses, physician orders, and patient visit notes** but also an increasing amount **of low-value administrative data**"

American Medical Informatics Association (AMIA)
reco_____d
Hun____

*"be _____bling
clin_____and
adm_____*

Address Documentation Requirements Affecting Usability and Workload

https://www.amia.org/sites/default/files/AMIA-
Response-to-ONC-HIT-Burden-Reduction-Strategy.pdf

Guidance and Information on EHR Safety and Usability

American Medical Association and
MedStar Health National Center for Human Factors
https://ehrseewhatwemean.org

A Decade of HIT Usability Challenges and the Path Forward

Ratwani et al., 2019

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No one stakeholder can do this alone: the challenges demand a multi-level approach - vendors, clinicians, patients, health care organizations, policy makers, researchers

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Wisconsin Institute for Healthcare Systems Engineering

Questions?
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SEIPS

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