Research Potential of Electronic Dental Records

Heiko Spallek, PhD, DMD, MSBA, University of Sydney
Mark Genuis, PhD, ICE Health Systems
Lynn Johnson, PhD, University of Michigan
Julian Fisher, PhD, DMD, Hannover Medical School
Introductions

• Mark Genuis, PhD, ICE Health Systems
• Lynn Johnson, PhD, University of Michigan
• Julian Fisher, MIH, DMD, Hannover Medical School
• Heiko Spallek, PhD, DMD, MSBA, University of Sydney
Disclosures

**Lynn**
- U-M sponsoring institution with Internet2
- No financial compensation
- COI/COC filed with U-M

**Heiko**
- No financial compensation
- Unrestricted travel support to attend ADEA/AADR/IADR meetings in 2017 and 2018
- Outside Earnings Declaration filed with USyd

**Mark**
- President and CEO of ICE Health Systems

**Julian**
- No financial compensation
- Unrestricted travel support to attend ADEA/AADR/IADR meetings in 2016, 2017 and 2018
- Outside Earnings Declaration filed with Hannover University
Agenda

- Introduction — Who is in the audience? (Heiko)
- Demo — An EHR that Supports Research (Mark)
- Collaboration — EHR Design by Committee? (Lynn)
- Research — What data to collect? (Heiko)
- Health Policy — Shifting from EDR to EHR - what does this mean for research? (Julian)
- Q/A
Demonstration
Supporting Research via Records

• Enable broad range of data into the system
  – All data must be organized for access
Supporting Research via Records

• Enable broad range of data into the system
  – All data must be organized for access
• Support data standards (structure data)
  – and easy sharing of standards across the global community
Supporting Research via Records

• Enable broad range of data into the system
  – All data must be organized for access
• Support data standards (structure data)
  – and easy sharing of standards across the global community
• Support global standards for critical elements (e.g., diagnostic and treatment terminology/codes)
Supporting Research via Records

- Enable broad range of data into the system
  - All data must be organized for access
- Support data standards (structure data)
  - and easy sharing of standards across the global community
- Support global standards for critical elements (e.g., diagnostic and treatment terminology/codes)
- Easy and rapid (real-time) access to data
  - clinicians, researchers and policymakers can interrogate data in real time
Supporting Research via Records

- Enable broad range of data into the system
  - All data must be organized for access
- Support data standards (structure data)
  - and easy sharing of standards across the global community
- Support global standards for critical elements (e.g., diagnostic and treatment terminology/codes)
- Easy and rapid (real-time) access to data
  - clinicians, researchers and policymakers can interrogate data in real time
- Building block for a Learning Health System
Product Structure

- Health Policy Systems Research
- Patient Portal
- Professional Collaborations

Practice Dashboard

- Provider Dashboard & Educational
- Patient Chart & Record (Dashboard)
Content Sharing

Secure Content Sharing (reports, insurance plans, forms, note templates…)

- Patient Portal
- Professional Collaborations
- Practice Dashboard
  - Provider Dashboard & Educational
  - Patient Chart & Record (Dashboard)
- Practice Dashboard
  - Provider Dashboard & Educational
  - Patient Chart & Record (Dashboard)
- Practice Dashboard
  - Provider Dashboard & Educational
  - Patient Chart & Record (Dashboard)
- Practice Dashboard
  - Provider Dashboard & Educational
  - Patient Chart & Record (Dashboard)
Why a Collaboration?

- EHR is foundational tool to improve personal & population health.
- Vision of researchers drives software development.
- Continually refine and expand a system to support education, research and patient care in healthcare.
Current Collaborators
Governance through Working Groups; Work Accomplished

Advisory Board

- Caries Codes
- Caries Chart
- Dx Codes
- Telehealth
- Two-Factor Authentication
- Single Sign-On
- Legal Agreements
- Security, Initial Review
- Ortho Chart
- Perio Chart
- Business Intelligence
- Data Migration
- Billing
- Interoperability
Governance through Working Groups; Current Work
Founding Principles

- Efficient clinical experiences
- Support learning
- Excellence in collaboration & communication
- Foremost software engineering practices
- Exceed security regulations
- Standards to support research
- Dynamic data access/Business Intelligence
- Robust interoperability
Exceed Security Regulations
Exceed Security Regulations
Standards
Dynamic Data Access/Business Intelligence
Robust Interoperability

Shibboleth

Google SSO

Epic

MiPACS

fitbit

Glick Medical Support System
Research Vision
Atul Gawande on the potential of information for health

kinds of information that matter to your health and well-being over time, information about the state of ...

• your internal systems, e.g. imaging, lab-test results
• your living conditions / social determinants, e.g. housing, environment
• the care you receive, e.g. medications, treatments
• your behaviors, e.g. sleep, exercise

“The potential of this information is so enormous it is almost scary.”

What data can we collect?

Classes of data
1. structured in traditional databases
2. unstructured, e.g. images, video, voice, GIS
3. Internet of Things (IoT)

https://www.apple.com/researchkit/
https://www.apple.com/healthcare/
https://www.apple.com/researchkit/
Internet of Medical Things (IoMT)

1. Attach the AliveCor Heart Monitor

- LOGO DIRECTION
- TOP OF DEVICE

Examples of AliveCor Heart Monitor usage:
- Monitoring heart rate
- Patient interface with ECG analysis options
- Print, Email, PDF export for documentation
Internet of Dental Things

WORLD’S FIRST CONNECTED ELECTRIC TOOTHBRUSH W/ 3D MOTION SENSORS

Data gets pushed via Bluetooth®
Traditional EHRs

What EHRs Do Right
- Billing
- Legibility
- Availability
- Result reporting
- Order entry
- Alerts and reminders

What EHRs Do Wrong
- Alerts and reminders (alert fatigue)
- Data entry (tedious, redundant)
- Incompleteness
- Data overload (note bloat)
- Poor navigability

Dental Records:
- WORN—write once read never
How information systems should support the information needs of general dentists in clinical settings: suggestions from a qualitative study

 Mei Song1*, Heiko Spallek1, Deborah Polk2, Titus Schleyer1, Teena Wali1

Abstract

Background: A major challenge in designing useful clinical information systems in dentistry is to incorporate clinical evidence based on dentists' information needs and then integrate the system seamlessly into the complex clinical workflow. However, little is known about the actual information needs of dentists during treatment sessions. The purpose of this study is to identify general dentists' information needs and the information sources they use to meet those needs in clinical settings so as to inform the design of dental information systems.

Methods: A semi-structured interview was conducted with a convenience sample of 18 general dentists in the Pittsburgh area during clinical hours. One hundred and five patient cases were reported by these dentists. Interview transcripts were coded and analyzed using thematic analysis with a constant comparative method to identify categories and themes regarding information needs and information source use patterns.

Results: Two top-level unmet information needs were identified: foreground and background information needs. Foreground information needs include: (1) timely access to information on various subjects, (2) better visual representations of dental problems, (3) access to patient-specific evidence-based information, and (4) accurate, complete and consistent documentation of patient records. Background information needs include: (1) electronic dental records (EDRs) are rarely utilized, (2) little use is made of electronic sources, (3) source use depends on the nature and complexity of patient information, (4) patient education and professional development, and (5) patient education and professional development. Major themes of dentists' unmet information needs are related to clinical information tasks, patient education, and professional development.

Conclusions: Dentists with poor visual representation support staff remain. EDRs are rarely utilized, and patient-specific evidence-based information are mostly unmet. While patient records and the most used information sources, electronic sources other than electronic dental records, were used during patient visits, for future development of dental information or clinical decision support systems, developers should consider integrating high-quality, up-to-date clinical evidence into user-friendly, easily accessible EDRs as well as supporting dentists' resource use patterns as identified in the study.
Data can …

Guide the scientific decision-making process for
  – public health officials
  – Other sectors (to address SDH)
  – Public oral health service
  – private practitioners

  – support clinicians who want to see the whole human being
  – help us to focus on health outcomes and understand differential consequences
  – inform consumers about choices
Current Barriers …

Smartphone can do MANY things. EHR can do FEW things (= mostly a billing diary).

- Lack of interoperable systems.
- EHRs’ lack of flexibility, e.g. mobile access in disaster situation.
- Tapping on a plastic-covered keyboard with gloved hands...

“building a value-enabling Health IT ecosystem—largely not knowledge barriers, but execution barriers”

Adler-Milstein, Embi, Blackford Middleton, Sarkar, Smith: Crossing the health IT chasm: considerations and policy recommendations to overcome current challenges and enable value-based care, JAMIA doi: 10.1093/jamia/ocx017

"ensuring that electronic repositories become valuable resources rather than expensive investments that are quickly ignored”

Informatics Tools

"Medical thinking has become vastly more complex, mirroring changes in our patients, our health care system, and medical science. The complexity of medicine now exceeds the capacity of the human mind."


- analytics tools ranging, e.g. machine learning, deep learning, neural networks, etc.
- aggregation of data in cloud-based storage systems
- standardization, reduction of customization
- permit patients access to their data in a computable format*
- improve interoperability in a context of Application Programming Interfaces (APIs)*
- simplify clinical documentation for reimbursement and quality measurement*
- more readily engage patients in research*
- foster an ecosystem of safe, effective and secure health applications*

*Adler-Milstein, Embi, Blackford Middleton, Sarkar, Smith: Crossing the health IT chasm: considerations and policy recommendations to overcome current challenges and enable value-based care, JAMIA doi: 10.1093/jamia/ocx017
What can be done with Big Data?

By integrating claims, clinical, socio-demographic and care management data, you receive both a retrospective and prospective view of your patients and your patient populations.

Clinical data of nearly 50 MILLION PATIENTS

Longitudinal claims data of 20 YEARS

Claims data covering over 109 MILLION LIVES

- Identify at-risk patients earlier
- Preserve patient health
- Reduce costs
- Prevent complications

Mayo Clinic (59,000 employees) + UnitedHealth Group ($122 billion corporation) + Optum Labs:

$300m research study over 5 years:
repeated in hours, same result
Data Availability in Clinical Setting

Four perspectives

- **Patient**: Provision of tools/data to engage patients and make them part of the decision making process about their care

- **Clinicians**: Provision of all relevant data to allow clinicians to make the right decisions about patient care and reflect on their practice

- **Services**: to use data to support system efficiency and resource allocation as well as improve safety and quality

- **Policy Makers**: Access to data to make decisions regarding value of care and safety and quality, e.g. “oversight” of data such as trends that emerge when connecting various data sources
Health systems—at any level of scale—become learning systems when they can, continuously and routinely, study and improve themselves.

Perspective: Jan 3, 2013
“Code Red and Blue — Safely Limiting Health Care’s GDP Footprint”
Arnold Milstein, M.D., M.P.H.

...U.S. health care needs to adopt new work methods, outlined in the Institute of Medicine’s vision for a learning health system...
Electronic Medical Record (EMR)
Electronic Dental Record (EDR)

Integration for
• safe and efficient patient care, e.g. allergies, medication
• health profession education based on interprofessional education principles
• biomedical research that acknowledges that the mouth is part of the body

If you want to bring healthy lives and healthy mouths together, you also need to bring EMRs and EDRs together!

Sample research questions
- Is maintaining a full dentition important for older patients?
- Does pre-chemo dental therapy help?
- What role does the dentition play in dialysis outcomes?
- Does a healthy dentition improve overall health?
How can we accelerate 17 years to 17 months
A Health System That Can Learn

• Every patient’s characteristics and experience are available for study

• Best practice knowledge is immediately available to support decisions

• Improvement is continuous through ongoing study

• This happens routinely, economically and almost invisibly

• All of this is part of the culture
Data FAIRness & Knowledge FAIRness

- Deliberate and evolutionary process of infrastructure co-production in which the full spectrum of stakeholders are directly engaged.
- Purposefully collected data outside of care experience can be important components of the learning process.

Future EHR

What would an EHR system look like that dentists suddenly can’t live without?

Paraphrased from:
When lead engineer of I.B.M.’s Watson’s health team, Eric Brown, was asked what the equivalent of the “Jeopardy!” victory would be in medicine, he responded:
“It’ll be when we have a technology that physicians suddenly can’t live without,”
http://www.nytimes.com/2015/03/22/opinion/sunday/why-health-care-tech-is-still-so-bad.html?_r=0
Shift from EDR to EHR

Symbolic of trend EDR to EHR; mouth into body eg SDG 3 and NCDs

Catalysts and drivers for change: JF to give brief summary and examples
  ● Health service
  ● Health workforce education
  ● Reframing SDG 2030 agenda where is OH?
What does this mean for OH research?

Allows us measure and understand the problem from a systems perspective - to collect and analyse oral health data at 3 levels: clinical, community and national policy in coherent and consistent manner.

More effectively identify population health needs to guide national health plans that integrates oral health as part of dynamic ‘real time’ process with other health professions and other sectors.

Eg Dental caries evidence on sugar guided WHO guidelines which are normative basis for national health policy.

Eg NCD real time data of risk factors from the chairside and extended oral health workforce.
Oral health workforce education

EHR at 3 levels will support shift to health education systems (lancet report / UN Commission)

Population health needs will guide HWF competencies and will:

Assist aligning health worker competencies and performance, as well as organizational capacity and capabilities

Build and strengthen the evidence base for socially accountable transformative education and necessary reforms

Assist with development of accreditation standards
Research Potential of Electronic Dental Records

Heiko Spallek, PhD, DMD, MSBA, University of Sydney
heiko.spallek@sydney.edu.au

Mark Genuis, PhD, ICE Health Systems
mgenuis@icehealthsystems.com

Lynn Johnson, PhD, University of Michigan
lynjohns@umich.edu

Julian Fisher, PhD, DMD, Hannover Medical School
Fisher.Julian@mh-hannover.de