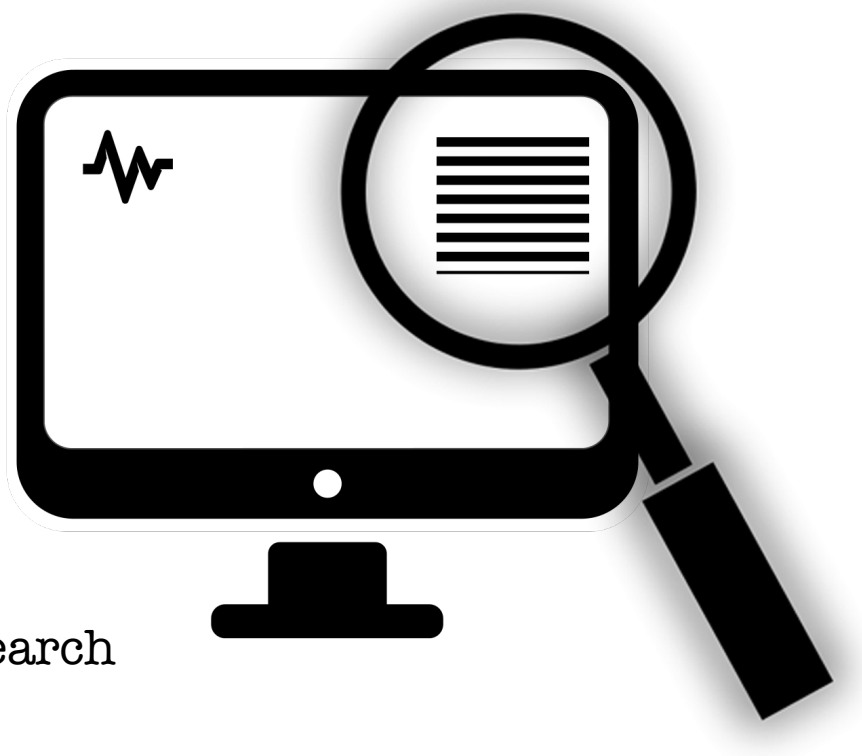
EMERSE

Electronic Medical Record Search Engine



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Comprehensive Cancer Center
Michigan Institute for Clinical & Health Research

University of Michigan

March 30, 2016

Don't confuse these lookalikes

EMERSE

eMERGE

Free text

Not going away

Needed to preserves the complexity and nuances of each particular patient—the **phenotype**

Clinicians revert to free text entry even when coded options available

Free text

Needed to support research

"...information extraction from unstructured clinical narratives is essential to most clinical applications....structured data alone is insufficient in resolving eligibility criteria for recruiting patients onto clinical trials for chronic lymphocytic leukemia (CLL) and prostate cancer." [PMID: 25717416]

Information Retrieval (IR) Systems

Users often already familiar with them

General purpose search engines may not work well in medical setting

Few search engines tailored for medical setting

EMERSE

Developed at the University of Michigan

In use for a decade

Constant enhancements

Designed for **researchers**, not informaticians

Widespread use for a variety of purposes

It's kind of like...


EMERSE helps
solve this problem

We need it because
we have **a lot** of documents

We need it because
we have **a lot** of documents

Definition: "A lot"

[uh - lot]

pronoun

1. a number that exceeds 100 million

Key points

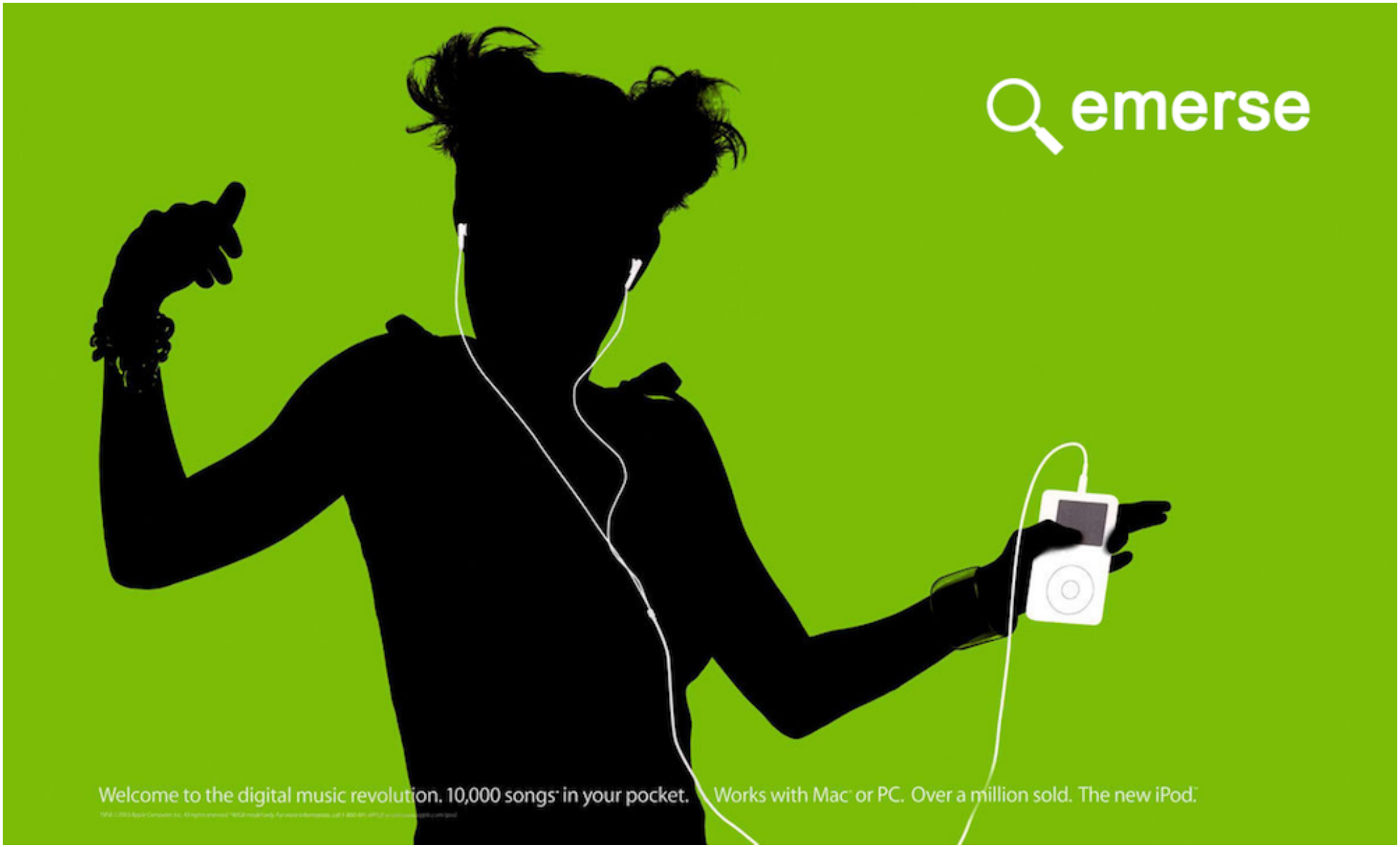
Easy to use

Powerful

Free for academic use

Works with data from almost any EHR (eg, Epic)

A major focus has been **design** and **usability**



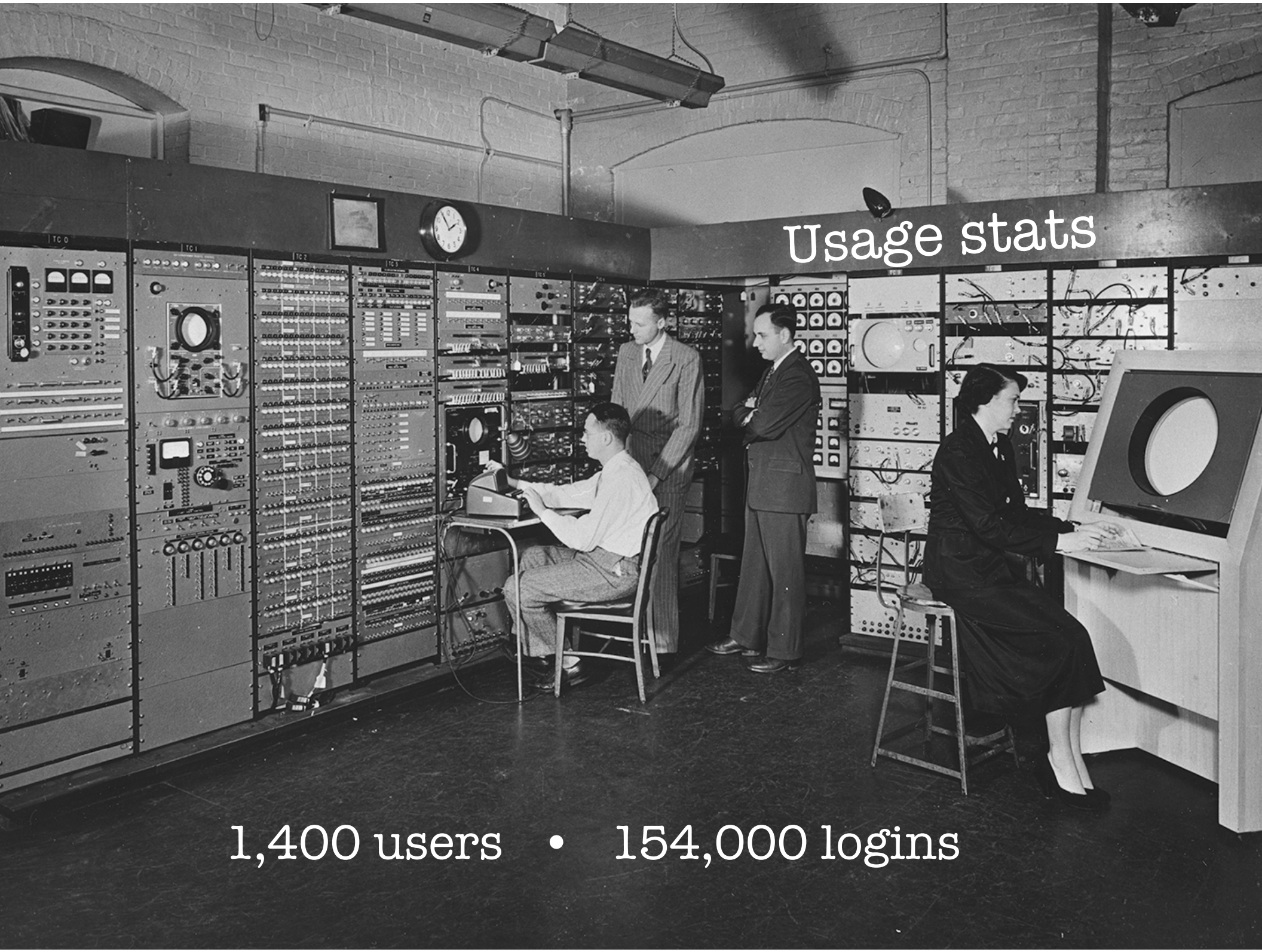
EMERSE users are **happy** users

Really!

"Just a quick **thank you** from Dr. Alva and myself after our first EMERSE experience."

"Just wanted to say **thank you** for all of your hard work creating the EMERSE system. It's fantastic! I never would have been able to complete my study without EMERSE, and for that I am very grateful."

"Just wanted to **thank you** for designing and sharing EMERSE with our health system."


Usage stats
1,400 users • 154,000 logins

Many uses

Many uses

- Research
- Clinical
- Operations

Many uses

- Research
  - Cohort identification
  - Eligibility determination
  - Data abstraction
- Clinical
- Operations

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  - Clinician ?'s in the clinic
  - Prior authorizations
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  - Cohort identification
  - Eligibility determination
  - Data abstraction
- Clinical
  - Clinician ?'s in the clinic
  - Prior authorizations
- Operations
  - Infection Control
  - Risk Management
  - Quality Improvement
  - Billing & Coding

Important to Research Mission

Supporting many IRB-approved studies at the University of Michigan

920 studies since July 2008

Half of all studies are **clinical trials**

Research

Allows for studies that were previously not possible or practical

Prevalence and natural history of pineal cysts in adults

Clinical article

Wajd N. Al-Holou, M.D.,[1] Samuel W. Terman, B.S.,[1] Craig Kilburg, M.D.,[1] Hugh J. L. Garton, M.D., M.H.Sc.,[1] Karin M. Muraszko, M.D.,[1] William F. Chandler, M.D.,[1] Mohannad Ibrahim, M.D.,[2] and Cormac O. Maher, M.D.[1]

Departments of [1]Neurosurgery and [2]Radiology, University of Michigan, Ann Arbor, Michigan

Object. We reviewed our experience with pineal cysts to define the natural history and clinical relevance of this common intracranial finding.

Method. The study population consisted of 48,417 consecutive patients who underwent brain MR imaging at a single institution over a 12-year interval and who were over 18 years of age at the time of imaging. Patient characteristics, including demographic data and other intracranial diagnoses, were collected from cases involving patients with a pineal cyst. We then identified all patients with pineal cysts who had been clinically evaluated at our institution and who had at least 6 months of clinical and imaging follow-up. All inclusion criteria for the natural history analysis were met in 151 patients.

Results. Pineal cysts measuring 5 mm or larger in greatest dimension were found in 478 patients (1.0%). Of these, 162 patients were male and 316 were female. On follow-up MR imaging of 151 patients with pineal cyst at a mean interval of 3.4 years from the initial study, 124 pineal cysts remained stable, 4 increased in size, and 23

Research

EMERSE could help standardize research processes in collaborative networks

Hypertension, obesity and prostate cancer biochemical recurrence after radical prostatectomy

R Asmar[1], **JL Beebe-Dimmer**[2,3], **K Korgavkar**[1], **GR Keele**[2,3], and **KA Cooney**[1,4]
[1]Department of Internal Medicine, University of Michigan Medical School and Comprehensive Cancer Center, Ann Arbor, MI, USA

185 search terms used

APPENDIX: EMERSE search terms

The following search terms were used in our query to identify subjects with hypertension:

hypertension
hypertensive
"anti-hypertensive"
"antihypertensive"
"high blood pressure"
"high B.P."
"high BP"
"elevated blood pressure"
"elevated B.P."
"elevated BP"
HTN

The following search terms were used in our query to identify subjects with diabetes:

diabetes
diabetic
T2DM
NIDDM
IDDM
DM

List of medications (generic and brand name) was included in the search, allowing subjects to be identified as hypertensive or diabetic based on the medications they were taking.

"ACEinhibitor"
"ACE inhibitor"
ACEI
ACE-I
ARB
CCB
"calcium channel blocker"
HCTZ
hydrochlorothiazide
hydrodiuril
clonidine
catapress
catapres
aldactone
spironolactone
minoxidil
hydralazine
apresoline
lasix
furosemide
metoprolol
lopressor
atenolol
tenormin
labetalol
normodyne
trandate


Reproducible Searches

118 publications have used EMERSE

ASBMT
American Society for Blood and Marrow Transplantation

TNF-Inhibition with Etanercept for Graft-versus-Host Disease Prevention in High-Risk HCT: L… TNFR I Levels Correlate with Better Ou…

Sung W. Choi,[1] Patrick Stiff,[2] Kenneth Cooke,[3] James L. M. Fe…
…Kitko,[1] Pavan Reddy,[1] Gregory Yanik,[1] Shin Mineis…
…nguer,[5] Attaphol Pawarode,[1] Edward Peres…
…Scott Smith,[2] John E. Levine[1]

Clinical course of sepsis in children with acute leukemia admitted to the pediatric intensive care unit*

Kanakadurga Singer, MD, MA; Perla Subbaiah, PhD; Raymond Hutchinson, MD; Folafoluwa Odetola, MD, MPH; Thomas P. Shanley, MD

Objective: To describe the clinical course, resource use, and mortality of patients with leukemia …

…notropic and/or vasopressor drugs ($p = .01$), and renal replace-
…nt therapy ($p = .028$) than nonsepsis admission. There was
…her mortality among children with sepsis than other diagnos…
…% vs. 17%, $p = .004$). Also, mortality among chil…
…sis was higher among those with acute lym…
…(60% vs. 44%) compared with acu…
…inistration of stress dose st…
…ality (50% vs. 17%…
…e lymphob…

The Factors Associated With High-Quality Communication for Critically Ill Children

abstract

OBJECTIVE: Timely, high quality communication with families is essential to family-centered decision-making. Quality communication is represented by widespread documentation of prognostic, goals-of-care conversations (PGOCC) in the pediatric intensive care unit (PICU) and should occur without variation by patient characteristics.

AUTHORS: Jennifer K. Walter, MD, PhD, MS,[a] Brian D. Benneyworth, MD, MS,[b] Michelle Housey, MPH,[c] and Matthew M. Davis, MD, MAPP[d,e]

[a]Division of General Pediatrics, C…
Philadelphia, Univer…
Philadel…

Junctional Ectopic Tachycardia After Infant Heart Surgery: Incidence and Outcomes

Jeffrey D. Zampi · Jennifer C. Hirsch · James G. Gurney · Janet E. Donohue · Sunkyung Yu · Martin J. LaPage · …nger · John R. Charpie

…epted: 25 April 2012 / Published online: 15 May 2012
…edia, LLC 2012

…opic tachycardia (JET) is an …ost exclusively after open heart …rrent literature on JET has not …e highest risk of both developing … infants after open cardiac surgery was 14.3 %. From multivariate analyses, complete repair of tetralogy of Fallot [adjusted odds ratio (AOR) 2.0, 95 % CI 1.12–3.57] and longer aortic cross clamp times (AOR 1.02, 95 % CI

Chiari malformation Type I and syrinx in children undergoing magnetic resonance imaging

Clinical article

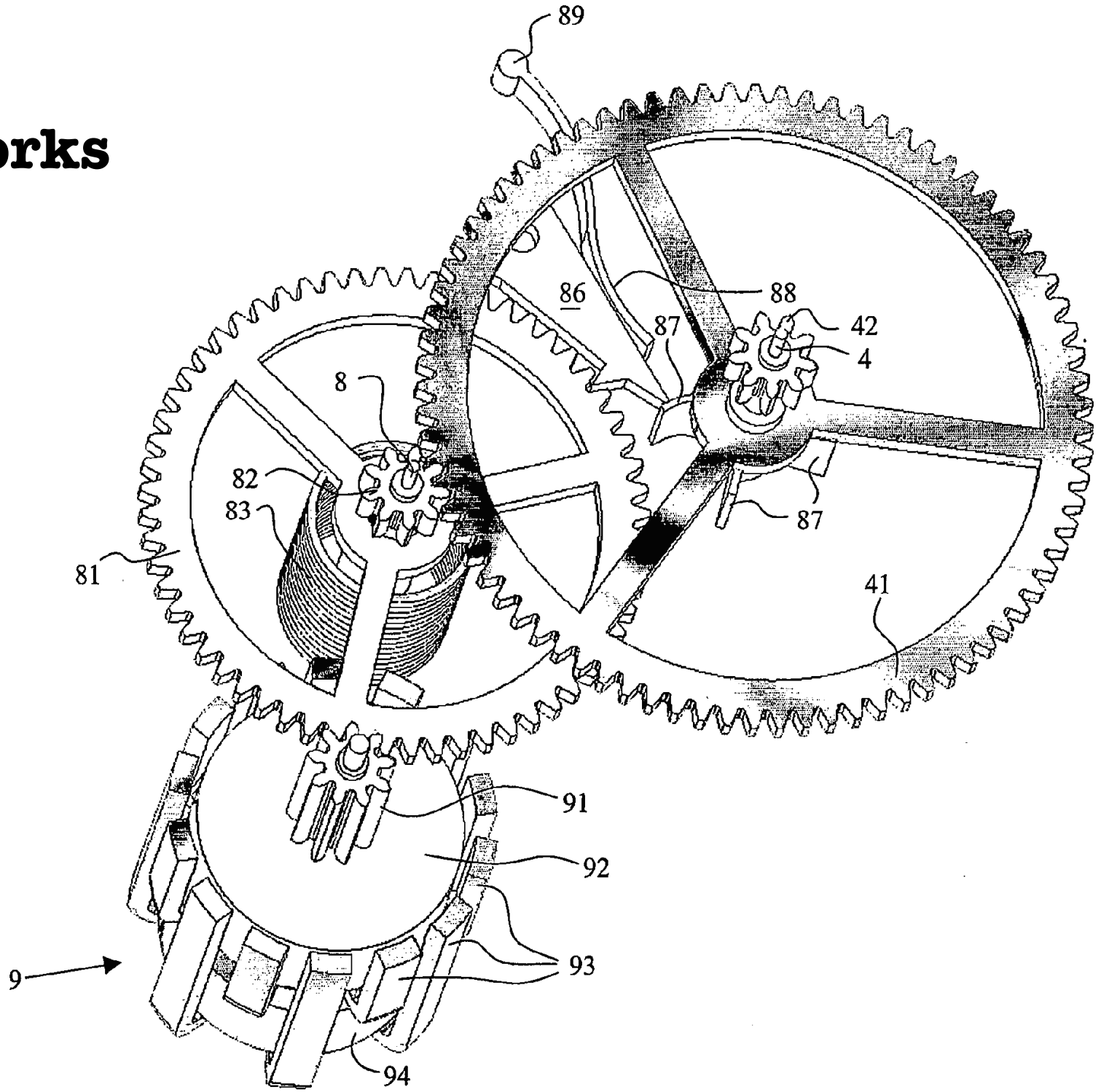
JENNIFER STRAHLE, M.D.,[1] KARIN M. MURASZKO, M.D.,[1] JOSEPH KAPURCH, B.S.,[1] J. RAJIV BAPURAJ, M.D.,[2] HUGH J. L. GARTON, M.D.,[1] AND CORMAC O. MAHER, M.D.[1]

Departments of [1]Neurosurgery and [2]Radiology, University of Michigan, Ann Arbor, Michigan

Cancer Registry

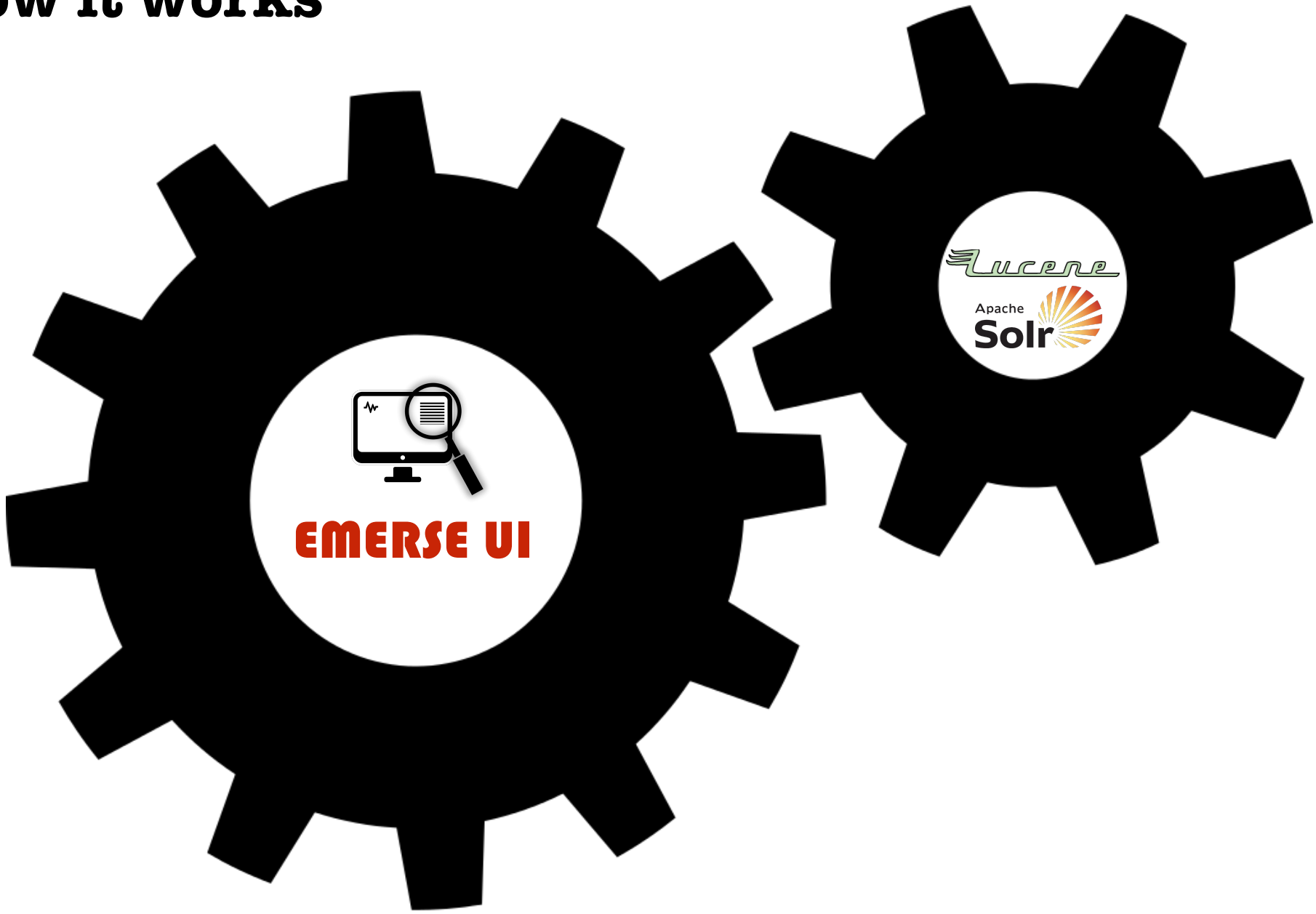
Use EMERSE for rapid identification of hard to find information such as genetic and biomarker testing

How it works



How it works

How it works



Informatics Community : Collective Achievements

Four Exemplar Success Stories

VIVO connect • share • discover

REDCap™ Research Electronic Data Capture

EMERSE

CTSA Clinical & Translational Science Awards ®

VA HEALTH CARE Defining EXCELLENCE in the 21st Century

THE WHOLE IS GREATER THAN THE SUM OF ITS PARTS

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Supporting information retrieval from electronic health records: A report of University of Michigan's nine-year experience in developing and using the Electronic Medical Record Search Engine (EMERSE)

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[b] School of Information, University of Michigan, Ann Arbor, MI, USA
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ABSTRACT

Objective: This paper describes the University of Michigan's nine-year experience in developing and using a full-text search engine designed to facilitate information retrieval (IR) from narrative documents stored in electronic health records (EHRs). The system, called the Electronic Medical Record Search Engine (EMERSE), functions similar to Google but is equipped with special functionalities for handling challenges unique to retrieving information from medical text.

Materials and methods: Key features that distinguish EMERSE from general-purpose search engines are discussed, with an emphasis on functions crucial to (1) improving medical IR performance and (2) assuring search quality and results consistency regardless of users' medical background, stage of training, or level of technical expertise.

Results: Since its initial deployment, EMERSE has been enthusiastically embraced by clinicians, administrators, and clinical and translational researchers. To date, the system has been used in supporting more than 750 research projects yielding 80 peer-reviewed publications. In several evaluation studies, EMERSE demonstrated very high levels of sensitivity and specificity in addition to greatly improved chart review efficiency.

Discussion: Increased availability of electronic data in healthcare does not automatically warrant increased availability of information. The success of EMERSE at our institution illustrates that free-text EHR search engines can be a valuable tool to help practitioners and researchers retrieve information from EHRs more effectively and efficiently, enabling critical tasks such as patient case synthesis and research data abstraction.

Conclusion: EMERSE, available free of charge for academic use, represents a state-of-the-art medical IR tool with proven effectiveness and user acceptance.

1. Background and significance

In addition to improving patient care delivery, the widespread adoption of electronic health records (EHRs) in the U.S. has created unprecedented opportunities for increased access to clinical data, enabling multiple secondary use purposes such as quality assurance, population health management, and clinical and translational research. The broader use of clinical data for discovery, surveillance, and improving care provides great potential to transform the U.S. healthcare system into a self-learning vehicle—or a "Learning Health System"—to advance our knowledge in a wide range of clinical and policy domains [1,2].

However, the benefits of electronically captured clinical data have yet to be fully realized for a number of reasons. Foremost is the continued popularity of free-text documentation in EHRs. While structured data at the time of entry is desirable, unstructured clinical documentation is likely to persist due to the need by clinicians to express their thoughts in a flexible manner and to preserve the complexity and nuances of each patient [3,4]. Recent studies have shown that clinicians often revert to

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1532-0464/

By Carrie Printz

EMERSE Data Tool Aids Researchers, Clinicians in Information Searches

Some of the most important sources of information for researchers gathering data about patients are physicians' clinical notes. Yet manually poring through these notes can be extremely time-consuming.

Researchers at the University of Michigan have developed a tool that speeds up the process considerably. Introduced in 2005, the Electronic Medical Record Search Engine, or EMERSE, is a data query system that works with free text (unstructured) clinical documents in an electronic health record (EHR) system. Since then, researchers have continually improved and updated the search engine and soon hope to make it available to other academic medical centers at no cost.

"We have a lot of clinical data available, but the most detail is in the rich clinical information in these clinicians' notes, such as nuances in the patient's history and the thinking behind the physician's decision-making," says David Hanauer, MD, associate professor of pediatrics at the University of Michigan at Ann Arbor, who developed the system.

Examples of such detail include information about biomarkers, side effects, infections, and clinical outcomes that would be highly valuable in translational research, he notes. EMERSE, which has tens of millions of documents and can integrate them from multiple sources, has been used in a wide variety of applications and in about 700 to 800 studies. It's been used successfully by the university's billing and coding team for complex case reviews, as well as by the university's compliance office, risk management, and infection control departments.

Dr. David Hanauer

The EMERSE data query system speeds searches through clinical notes stored in patients' electronic health records.

The software can keep all the clinical notes organized per patient and can search hundreds of patients' records at once. In addition, it searches for a huge list of terms and acronyms, such as multiple words associated with smoking (tobacco, cigars, etc.) and abbreviations like ROM for range of motion.

"Historically, people have had to open up every note and read through them all manually," Dr. Hanauer says. "It's very hard to scale up unless you have a program team that might be able to run some database queries for you, but they would be very simplistic."

He and colleagues have attempted to get the word out about EMERSE through their website, and a video demonstration on the Clinical and Translational Science Awards (CTSA) website.

Scripps Tests New Mobile Data Delivery System

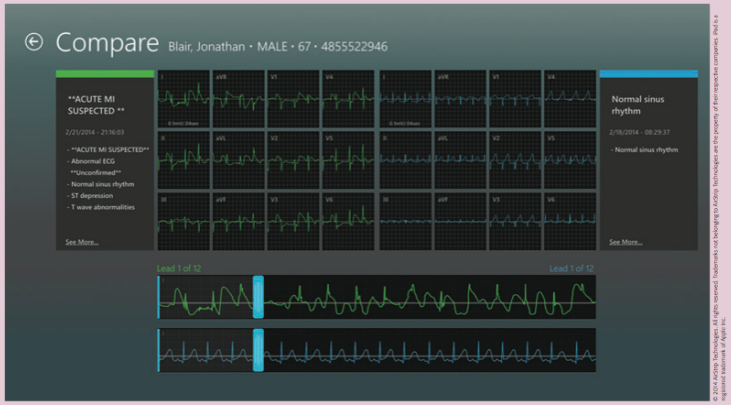
Physicians at Scripps Memorial Hospital La Jolla in California recently completed the pilot study of a software system that securely delivers critical care data from multiple hospital-based patient-monitoring systems to mobile devices.

Known as AirStrip ONE, the system provides physicians and other healthcare professionals with real-time access to patients' vital signs via iPads and smartphones. It has been tested on postoperative patients following open-heart surgery, patients who had experienced trauma, and patients in the hospital's critical care unit.

"I can quickly see what is on the patient's monitor and the history of what was on the monitor," says Scott McCaul, MD, medical director of the hospital's critical care unit, who helped assess the technology in the pilot study.

Typically, if physicians are not with the patient, they must rely on a nurse or other health care professional to interpret information on the monitors, he notes. With AirStrip ONE, Dr. McCaul says he can access those details directly.

"As a physician, you're not present everywhere, but you're getting calls from everywhere," he says. "The quicker you're able to assess the problem, the less delay and the better outcome for the patient."

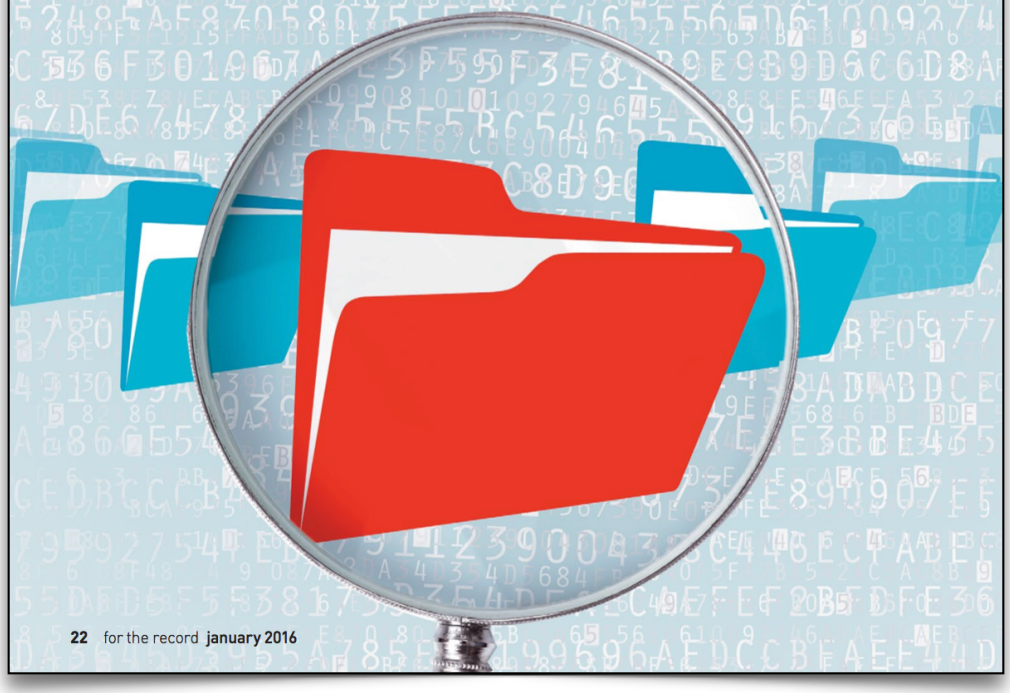


AirStrip ONE allows physicians to monitor patients' vital signs on iPads and other mobile devices.

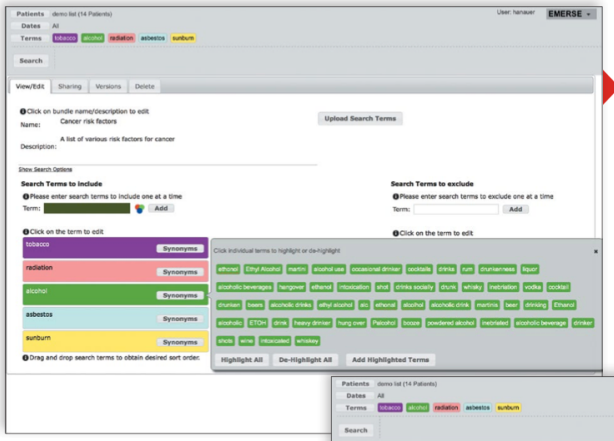
As of press time, results had not been released on the 60-day pilot study, but clinical leaders were considering whether to expand the system's use to study how it might improve hospitalized patient care.

DOI: 10.1111/cts.12250

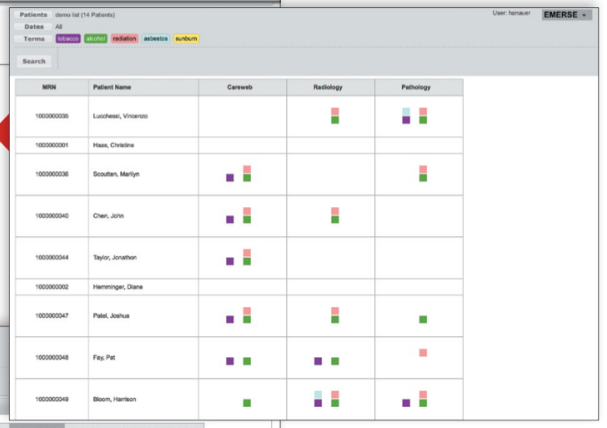
HIM Ingenuity *on* Display



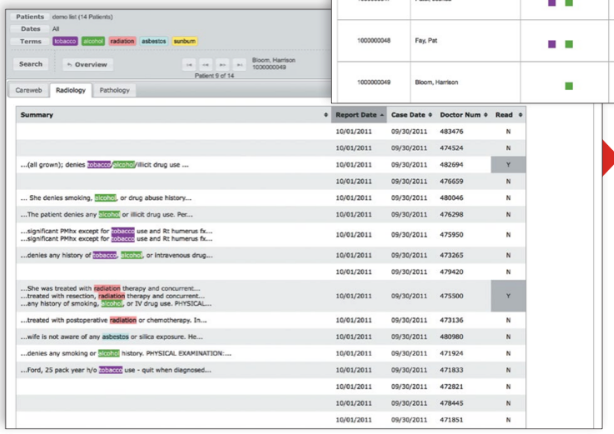
Examples of EMERSE in Action



The Bundles, or saved search, screen is where users can build a list of terms in a saved search that can be reused and shared with other users. It allows for customized color-coding. This image shows a large set of related concepts and synonyms being suggested to the user after entering the term "alcohol." These additional terms can help expand the scope of the search to ensure that all of the appropriate concepts are highlighted.



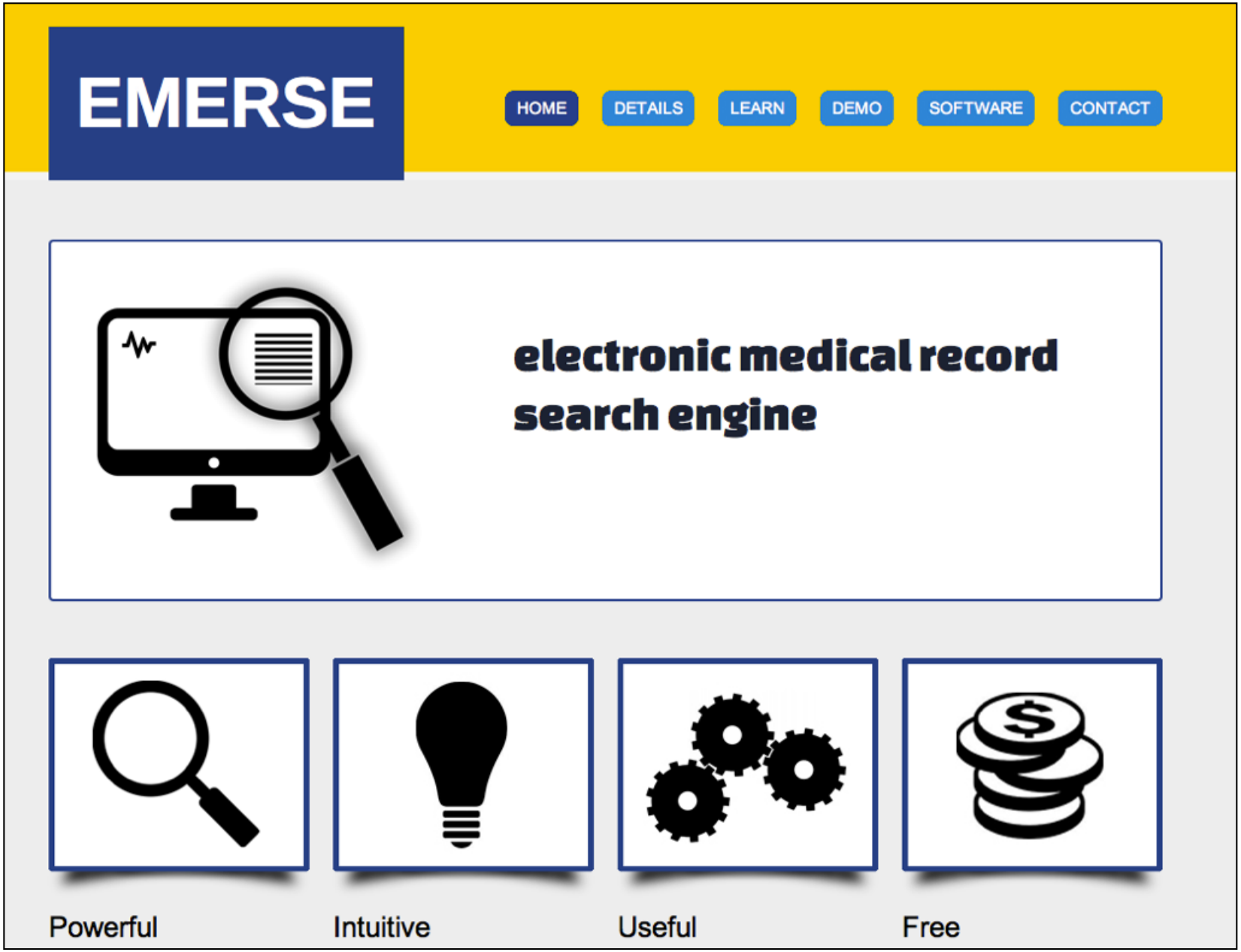
The Mosaic view of EMERSE features each patient (rows) and document sources (columns) with colors shown in each cell representing the terms that were found in the patient notes. For example, for the top patient, four concepts were found in the pathology data source: tobacco, alcohol, asbestos, and radiation. Note: Patient names are fictitious.



The Summaries view of EMERSE is reached by clicking on one of the cells seen in the Mosaic view. Each row represents a clinical document from a specific patient and a specific document source. Concepts that are found are highlighted and shown in brief snippets so the context can be reviewed. This helps users quickly scan the results to find the document(s) of interest. Clicking on a row takes the user to the note itself, with all of the terms still highlighted.

— PHOTOS COURTESY OF DAVID HANAUER, MD, MS, OF THE UNIVERSITY OF MICHIGAN HEALTH SYSTEM

project-emerse.org

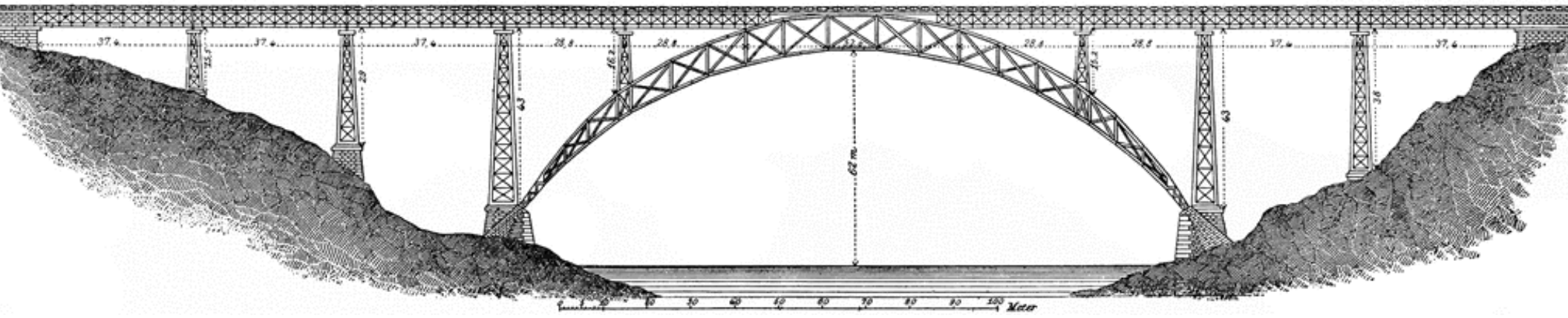


Support

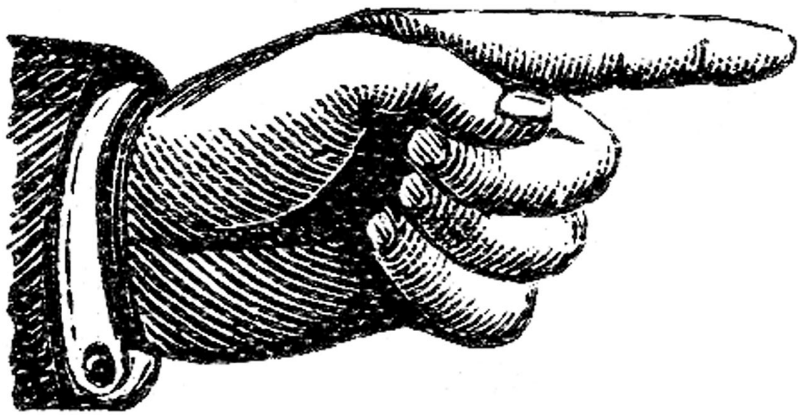
1. UM Comprehensive Cancer Center Informatics Core (NCI)

2. Michigan Institute for Clinical and Health Research (CTSA)

3. UM Medical Center Information Technology



Interested in EMERSE?



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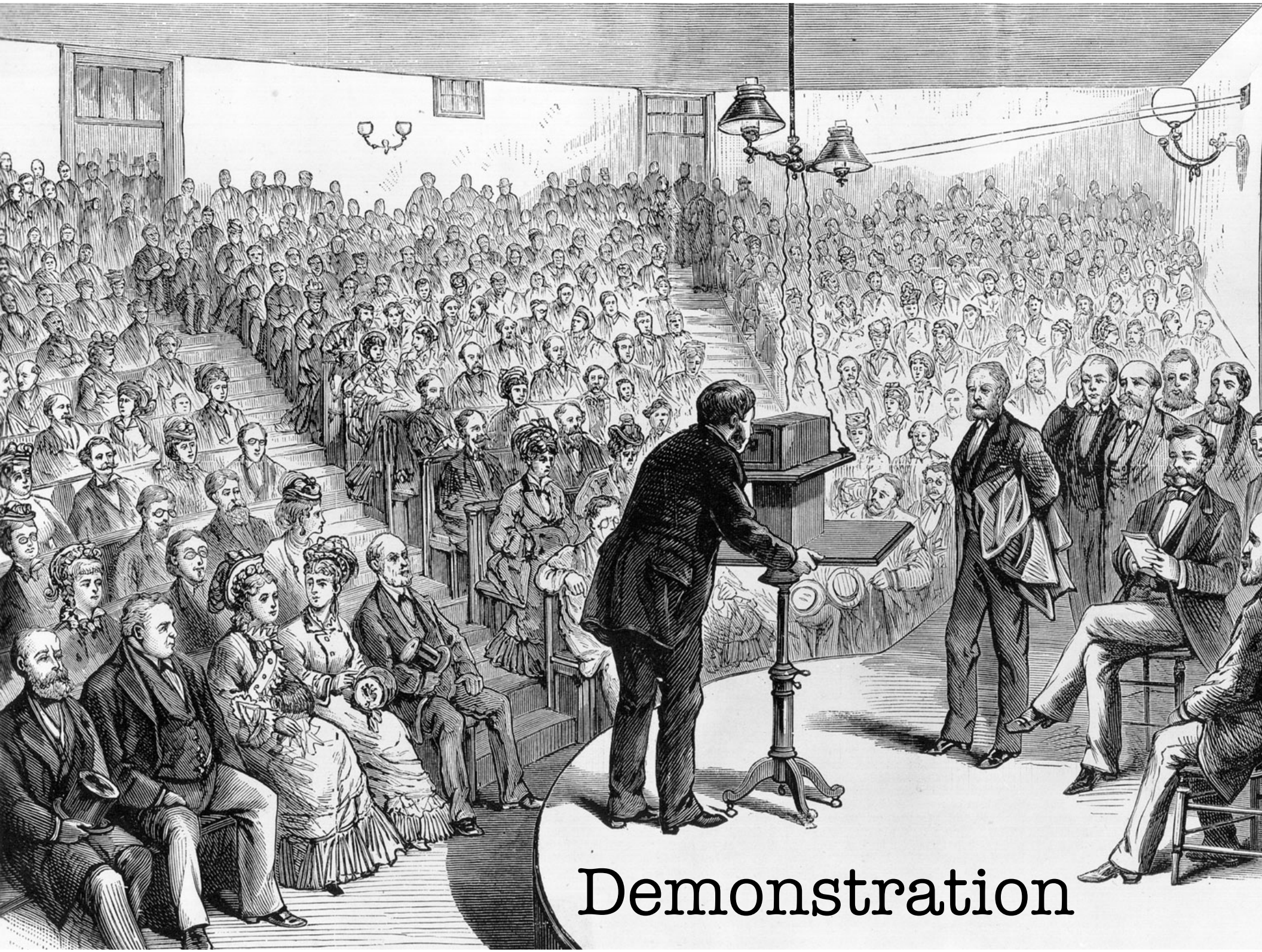
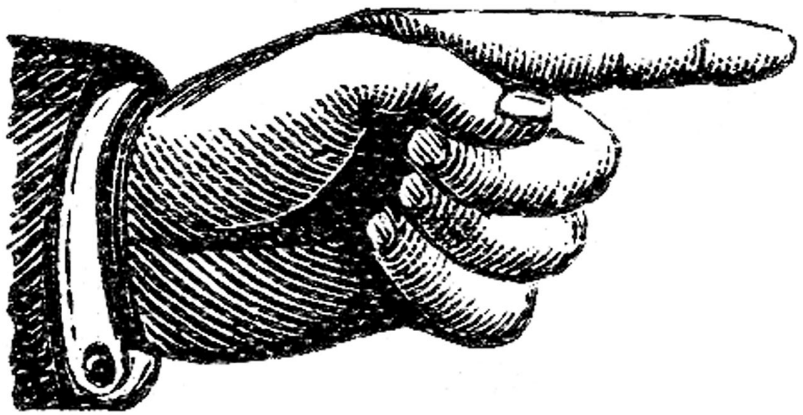

Demonstration

Interested in EMERSE?



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