HIEs – What is Needed Next?
Meaningful Use's Impact, and 2 Related NLM Studies

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Practical Solutions for Health Information Exchange and Quality Analytics

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Turning Discovery Into Health

Disclaimer

❑ The ideas and positions expressed here are my own and do not necessarily represent those of NLM, NIH, or HHS.

What I will talk about today

❑ The evolution of EMRs from Hospital-based (Institution) to Region-based (Health Information Exchanges).

❑ Meaningful Use regulations: Benefits to HIEs.

❑ Two studies we have done at NLM, and their implications for meaningful use and HIEs.

In 1972, the three hopes

1. Clinicians would have instant access to all of their patients' medical data in an electronic medical record.

   o More information = better choices = better care.

2. With all of the data, the computer could place guard rails on care processes (clinical decision support).

   o Like automatic pilot - avoid mistakes

   o More direct pathways ⟶ cheaper and better care.

3. Data facilitates research. Cash in on data analytics for discovery.

   o NIH Big Data to Knowledge (BD2K) initiative
     https://commonfund.nih.gov/bd2k/index.aspx

   o Sorensen HT. **When the Entire Country is a Cohort**. Talk presented at NLM Medical Informatics Lecture Series; 2013 Jun 11; Bethesda, MD.
     http://videocast.nih.gov/summary.asp?live=12855

Where we are today

❑ Within hospitals we are very close to those goals *for the clinical data produced in the hospital.*

❑ HL7 version 2.x was the enabler.

  ❖ Connected laboratory, pharmacy, scheduling, radiology, dictation, and other systems to the medical record repository and to the registration system, and

  ❖ Permitted the delivery of clinical data from all of those systems to the medical record system.

❑ A key ingredient to HL7's success was the fact that institutions used, or could enforce, the use of one set of identifiers for laboratory tests, dictated reports, and medications across the organization.

But success just in the hospital falls short

- ❑ **It does not provide <u>all</u> relevant data for patient care, because that data is not all produced in the hospital.**
- ❑ **It provides no help to care beyond that hospital.**
- ❑ **It does not provide all of the clinical data needed for decision support.**
- ❑ **It is only useful for research, surveillance, and quality measurement of events that occur and play-out within the framework of one hospital stay.**

The patient's clinical record is divided up among many care sites and settings.

The fundamental challenge is to collect it, and do what all the king's horses, and all the king's men, could not do with Humpty Dumpty.

The fragmentation of the patients course.

- Based on prescriber's name, the average patient may have as many as 4.3 different providers per year – most with separate record systems.

- Over a 3-year period in Indiana, 2.8 million patients visited ERs an average of 2.6 times.

  - For 40% of the hospital Emergency Department (ED) visits, the patient had data at one or more other hospitals.

  - Many more probably had data in office practices and nursing home systems about which this study had no data.

Finnell JT, Overhage JM, Grannis S. All health care is not local: an evaluation of the distribution of Emergency Department care delivered in Indiana. *AMIA Annu Symp Proc.* 2011;2011:409-16. Epub 2011 Oct 22.

Data is somewhere else.

❑ 48% of upper income and 37% of lower income patients who saw a doctor in the last year also changed doctors in the last year.

   o *J. Health and Social Behavior*. 1976. 17:328-39.

❑ Patients get at least 1/3rd of their flu shots outside of office practices and hospitals – 18% from pharmacies and 15% from their work place – these don't get into the patients' primary care charts.

❑ Average patients have 4 visits per year – about ½ to primary care and ½ to one or more specialists who will only occasionally have access to the same record.

   o *Annals Fam Med* 2005; 3(3):215-22

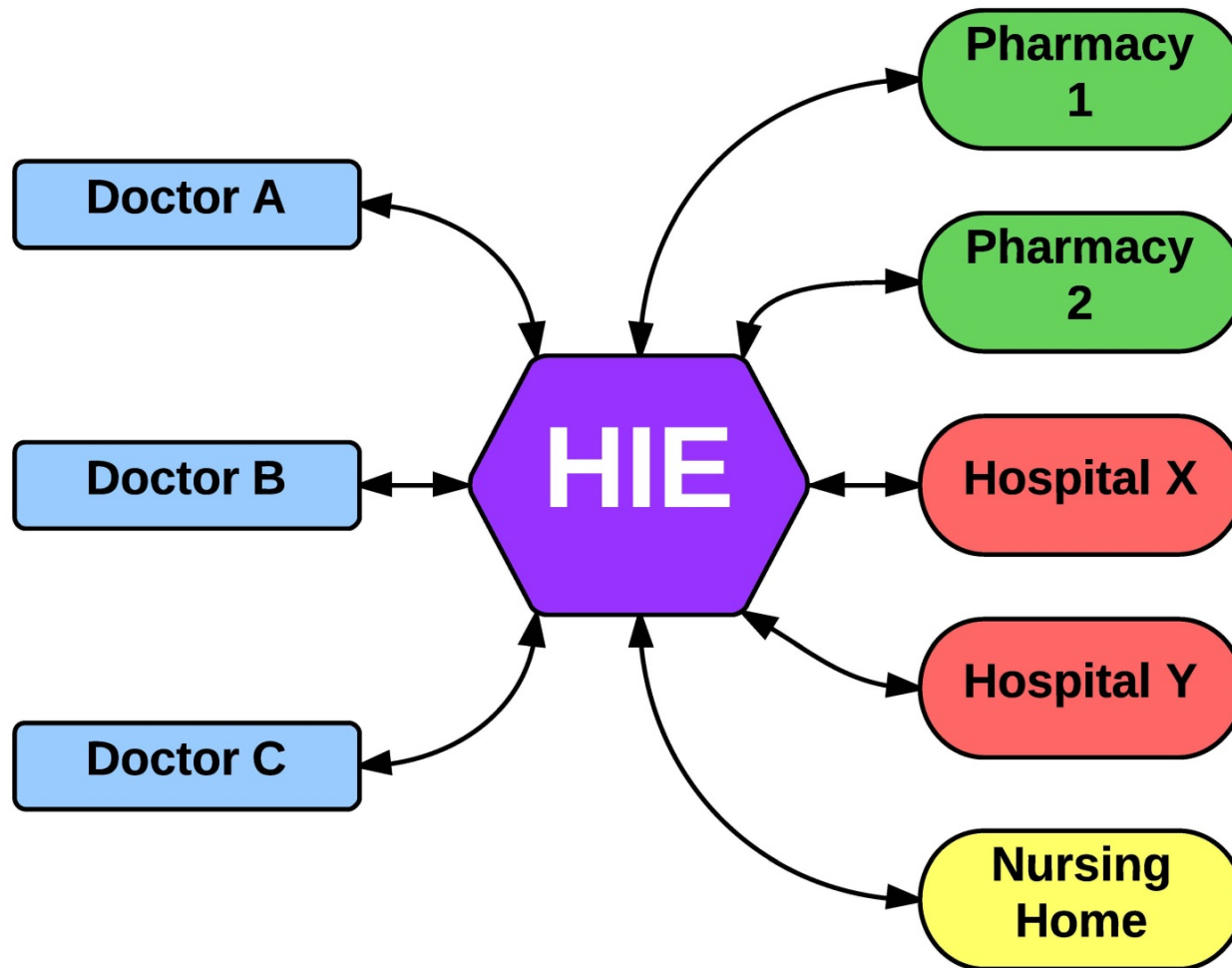   o *N Engl J Med* 2001; 345:1312-1317

How to pull all of the needed patient data into one unified whole.
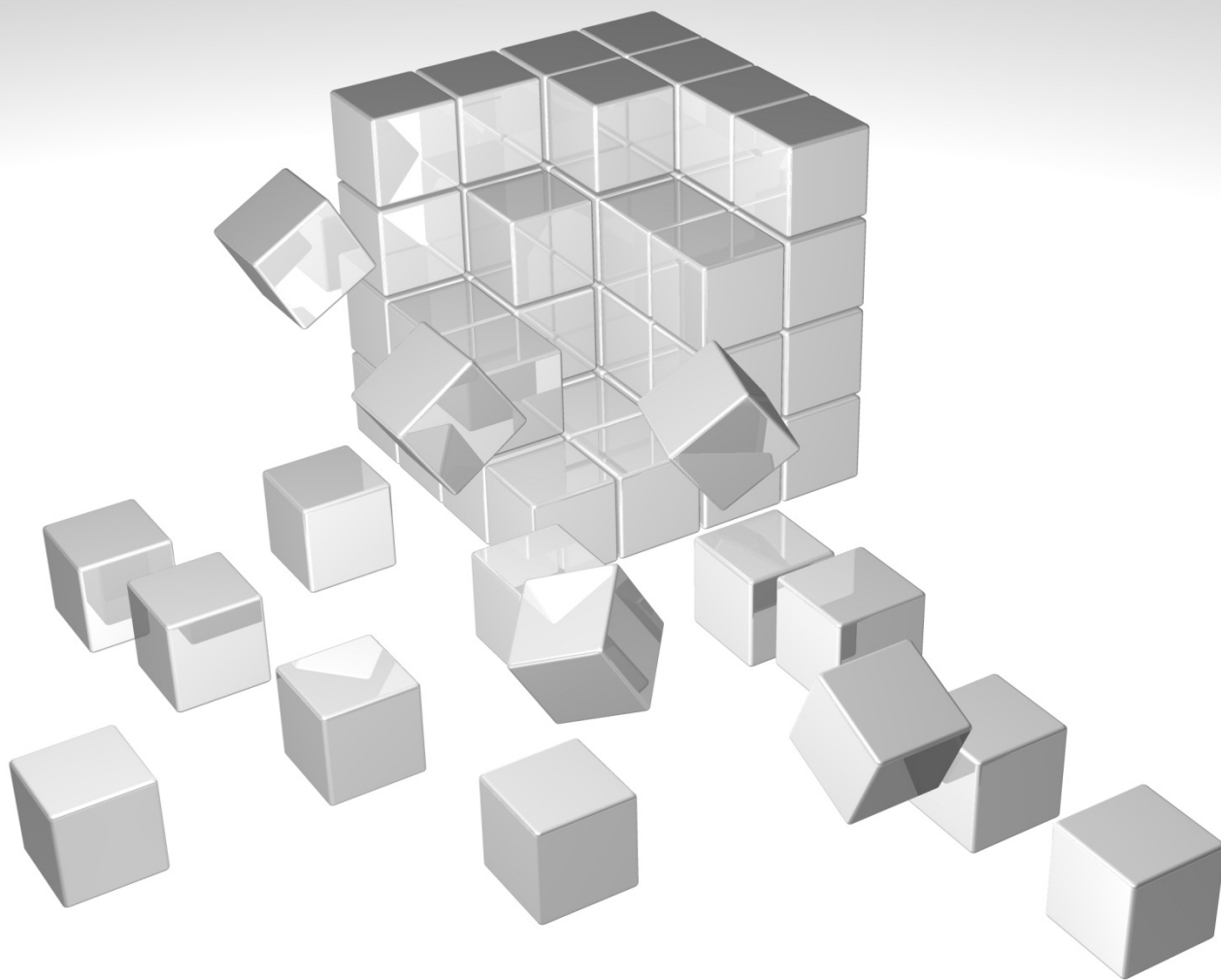
One choice is to connect everything-to-everything within a region.
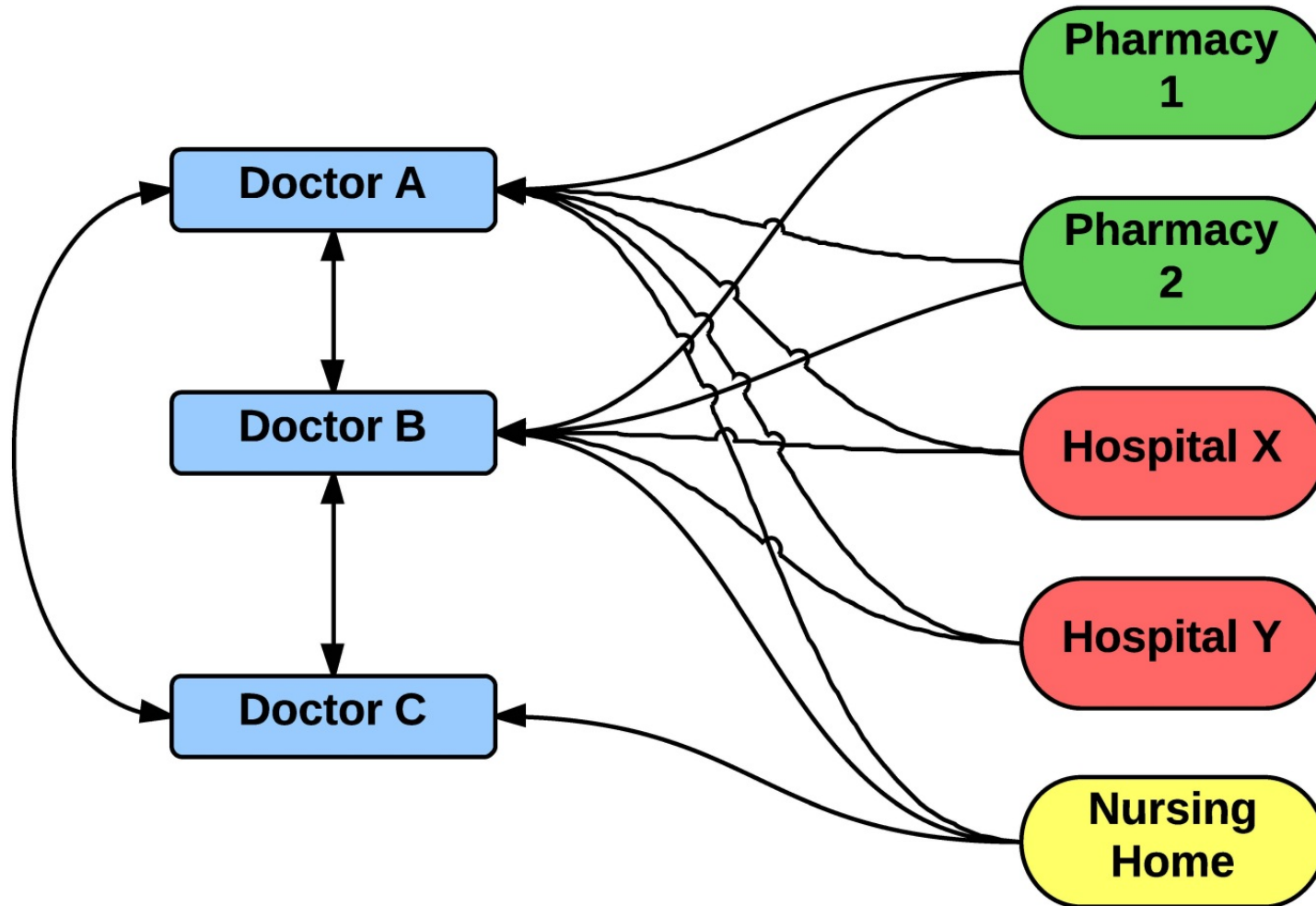
The other choice is to connect everything within a region to one thing (an HIE).

The second option is much more efficient.*

❑ Assuming N independent sources.

  ❖ The first approach requires N(N-1) connections and mappings between source A and Source B.

  ❖ The second requires N connections and mappings.

❑ So, for a state like Indiana, counting only the 138 hospitals:

Network Structure	# Required Connections & Mappings
No HIE (everything-to-everything)	**18,906**
With HIE (everything to one)	**138**

❑ The overhead could be tempered by internet-based NwHIN DIRECT Project and the adoption of universal standards.

* Simborg DW. Local area networks: why? What? What if? MD Comput. 1984;1(4):10-20. PMID: 6571290

To make any of this work, we also need:
Standard structures to move the information.

❑ HL7 messages (or HL7 documents) that provide the standard structures for representing the data and for shipping it around.

❖ HL7 v2 messaging is ubiquitous.

o Indiana has 138 hospitals.

- Of these, **120 are part of the IHIE**.
- **All were able to deliver HL7 v2 messages to the HIE**; 2 Veterans hospitals choose to deliver HL7 CDA.
- Many of the 18 non-members also support HL7.
- **~2000 HL7 message streams now flowing.**

```
MSH|^~\&||GA0000||VAERS PROCESSOR|2001
PID|||1234^^^^SR~1234-12^^^^LR~0072
NK1|1|Jones^Jane^Lee^^RN|VAB^Vaccine
NK1|2|Jones^Jane^Lee^^RN|FVP^Form com
ORC|CN|||||||||||1234567^Welby^Marcus^J
OBR|1|||^CDC VAERS-1 (FDA) Report|||200
OBX|1|NM|21612-7^Reported Patient Age^
OBX|1|TS|30947-6^Date form completed^L
OBX|2|FT|30948-4^Vaccination adverse ev
OBX|3|CE|30949-2^Vaccination adverse ev
OBX|4|CE|30949-2^Vaccination adverse ev
OBX|5|NM|30950-0^Number of days hospit
OBX|6|CE|30951-8^Patient recovered^LN|
OBX|7|TS|30952-6^Date of vaccination^L
OBX|8|TS|30953-4^Adverse event onset da
OBX|9|FT|30954-2^Relevant diagnostic te
OBR|2|||30955-9^All vaccines given on d
OBX|1|CE30955-9&30956-7^Vaccine type^I
OBX|2|CE|30955-9&30957-5^Manufacturer^
```

❑ Messaging standards are already available for shipping data. So, just reroute the flows within the hospitals and send the messages to the HIE.

To make any of this work, we also need:
Standard codes to represent the information.

❑ The big problem is standardizing the codes for identifying tests, reports, and other clinical content.

   ❖ Hospitals create their own codes (e.g. service codes) for this purpose.

   ❖ But local codes are idiosyncratic and not understandable outside of a given hospital.

❑ With standard vocabularies and codes to represent data that are not simple numeric or text, the data become interchangeable.

The work

❑ It requires a few days to re-work each message to a standard form for a given HIE.

❑ But the big and most difficult part of the effort is the mapping of the local codes from a given organization to universal codes such as LOINC.

❖ The laboratory is the hardest because it includes so many different tests and the names are short and incomplete.

❖ Can take 3-5 months to map one laboratory system.

ONC specifications and Meaningful Use (MU) standards to the rescue.

ONC clarified what code systems to use for what concepts.

❑ The ONC HIT Standards committee's Vocabulary Task Force and Clinical Quality Measures Workgroup recommended in their Sept 9, 2011 report:

- ❖ LOINC for coding all clinical observations, reports and surveys and measurements. (Think of LOINC as the question.)

- ❖ SNOMED CT for coding problems and the answers to most LOINC multiple choice questions. (Think of SNOMED as the answer.)

- ❖ RxNorm for coding drugs and drug allergies and other kinds of allergies.

- ❖ http://www.healthit.gov/sites/default/files/standards-certification/HITSC_CQMWG_VTF_Transmit_090911.pdf

Standards

Health IT Policy Committee

A Public Advisory Body on Health Information Technology to the National Coordinator for Health IT

September 9, 2011

Farzad Mostashari, MD, ScM
National Coordinator for Health Information Technology
Department of Health and Human Services
200 Independence Avenue, SW
Washington, DC 20201

Dear Dr. Mostashari:

The HIT Standards Committee's (HITSC) Clinical Quality Measures Workgroup (CQMWG) and Vocabulary Task Force (VTF) jointly developed recommendations on the assignment of code sets to clinical concepts [data elements] for use in quality measures.

The CQMWG and VTF held a series of joint meetings to develop the set of recommendations. This letter transmits the recommendations to the Department of Health and Human Services (HHS) on the assignment of code sets to clinical concepts for use in quality measures. On August 17, 2011, the CQMWG and VTF reported on and discussed their findings with the HITSC, which were subsequently approved as outlined below.

All 3 of the major code systems are supported by NLM

❑ LOINC http://loinc.org

    ❖ Try it: http://search.loinc.org

❑ SNOMED CT   http://www.ihtsdo.org/snomed-ct/

    ❖ I-Magic for translating SNOMED CT to ICD-10

        ○ Try it: http://imagic.nlm.nih.gov

❑ RxNorm   http://www.nlm.nih.gov/research/umls/rxnorm/

        ○ Try it http://rxnav.nlm.nih.gov/

MU2 requires the following by regulation

- ❑ LOINC for identifying individual labs tests.
  - ❖ Tests reported to public health.
  - ❖ Tumor registry reporting.
  - ❖ Vital signs and other observations contained in HL7's CDA.
- ❑ SNOMED CT for:
  - ❖ answers to categorical lab observations,
  - ❖ Problem lists,
  - ❖ surgical procedures, and more.
- ❑ CVX for immunizations.
- ❑ RxNorm for identifying prescriptions.
  - ❖ RxNorm ingredient codes for allergies and adverse reactions.

These rules go a long way toward filling the gap

❑ With standardized codes, the data in HL7 messages (and CDA documents) about some studies will be computer-understandable without heavy mapping work.

Virtuous feedback from all of this

- ❑ Script standard for e-Prescribing will now accept RxNorm, and the drug knowledge vendors map to RxNorm.
- ❑ Referral laboratories had been using LOINC before MU, but MU has increased their commitment.
- ❑ Instrument and test kit manufacturers are now mapping their internal test codes to LOINC (all of the major international vendors, e.g. Roche, Siemens, Ortho).
- ❑ Effect = The mapping challenge shrinks for
  - ❖ HIEs.
  - ❖ Hospital labs
    - ○ They will be able to find the LOINC codes for send-outs from their referral lab(s) and for most of their in-house tests from their instrument/test kit vendors.

More Widespread Use of Coding Standards

❑ **Reduces the Mapping Challenge for**

❖ **HIEs, and**

❖ **Hospital labs**

○ They will be able to find the LOINC codes for send-outs from their referral lab(s) and for most of their in-house tests from their instrument/test kit vendors.

Two asides

In defense of HIEs and a movie .

In defense of HIEs

❑ Adler-Milstein, et al, Ann Intern Med 2011, presented a negative view of the economics of HIE's.

❖ They emphasized in dismal tones that 30% percent are in financial trouble, 30% treading water, and 30% paying their own way.

❑ But compared to other business start-ups, those statistics for HIEs are not bad.

❖ According to the Small Business Administration*:

○ 30% of business start-ups fail in 1st or 2nd year;

○ 50% of business start-ups fail by the 5th year.

* http://www.sba.gov/sites/default/files/sbfaq.pdf

In defense of HIEs (2)

❑ They represent network economies. As they grow, they create efficiencies and demand, but it takes a while.

❑ The enormous premiums – placed on web/network businesses before they have made any money – hint at the potential.

❑ Their efficiency depends on standards.

  ❖ The costs of hand-mapping codes is daunting.

  ❖ The new federal standards will eliminate some of this problem (at least for labs and medications, and problem lists). Now HIEs can show their stuff.

A feature-length documentary film about HIEs
Orchestrated by Kevin Johnson, MD, Chair of biomedical informatics at Vanderbilt University

- **http://hie.hiptn.org** – footage, and some HIE process animations
- **http://No-Matter-Where.org** – first trailer

Two relevant studies of ours.

First study – Utility of national prescription database to Hospital Emergency Department

❑ We hooked up Surescripts (40+ PBMs and 85% of the commercial insurance covered prescriptions) to a local ED.

❑ Sent the hospital's HL7 ADT message to a Mirth system that forwarded to Surescripts and waited for response(s), then produced an attractive summary of the prescription history.
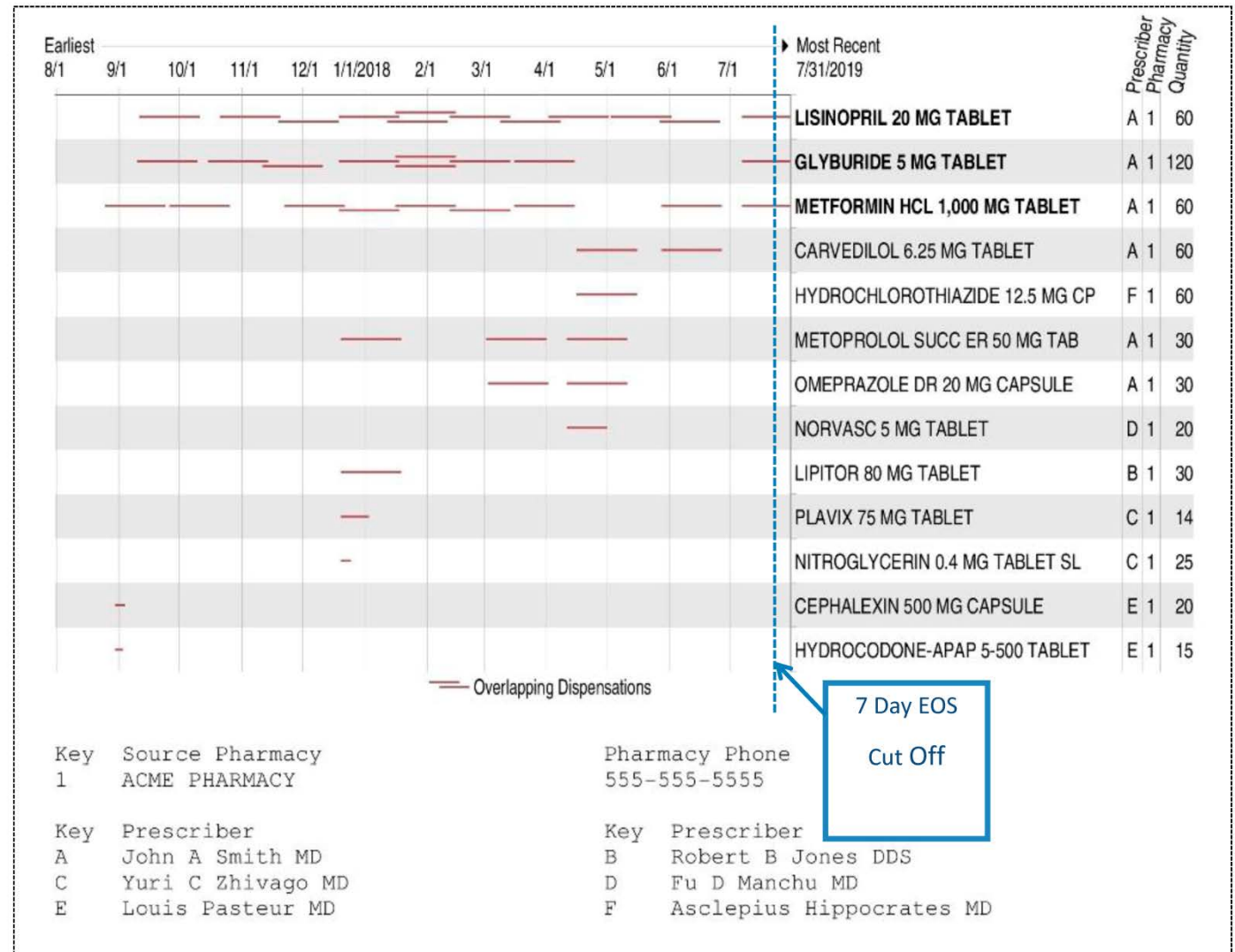
One (fictitious) patient's dispensing history.

- Each red, horizontal line represents a single new prescription or refill dispensing, and its length represents the calculated duration of the supply dispensed.

- This example patient had 6 different prescribers (fictitious names shown), and 13 medications (of which the first 3 were considered recent and names shown in bold).

Study 1 results

- ❑ When Surescripts carried any electronic prescription information on a patient it carried more medications than the manual history (88% versus 75% of all known prescribed meds).

- ❑ Pharmacists confirmed with patients that they were really taking the meds that the patient forgot to mention in their manual histories.

- ❑ The electronic prescription records were:
  - ❖ Faster (1 sec vs. 5 minutes-4 hours),
  - ❖ Had more complete drug names (20% of ED history had no dose or strength), and
  - ❖ Facilitated med reconciliation amazingly per Pharmacists.

Study 1 results more

❑ So when Surescripts has any medication records for a patient it has most of them (and more than the manual history provided).

❑ But… Surescripts had no information about 40% of all patients taking medications.

❑ Pharmacists said:

  ❖ For those patients who had Surescripts records, med reconciliation became magically easier and faster.

Fung KW, Kayaalp M, McDonald CJ. **Comparison of electronic pharmacy prescription records with manually collected medication histories in an Emergency Department.** Ann Emerg Med., 2013 May 17. pii: S0196-0644(13)00352-1. doi: 10.1016/j.annemergmed.2013.04.014. [Epub ahead of print]

Implications for HIEs

❑ HIEs could do the same (or better) by capturing all of the prescriptions written by physicians in its scope.

❑ In theory, it should be easy to copy every message sent to a pharmacy to the HIE and thus accumulate the profiles across a region.

Work for MU

❑ Encourage participation of all prescription dispensers – including federal sources (Medicare Part D and Medicaid) – in existing, or new parallel consortia to increase percent of patients covered from 60% to 100%.

❑ NLM has open source software that would work.

Second study – Effect of EMRs on Provider efficiency

❑ Most time motion studies of individual data entry have reported slower with EMR than without.

  ❖ But those did not account for more likely efficient data gathering and review.

❑ However, one large time-motion study of the overall effect of EMR adoption* showed:

  ❖ no increase in net in-clinic time, and

  ❖ no decrease in patient volume.

* Pizziferri L, Kittler AF, Volk LA, Honour MM, Gupta S, Wang S, Wang T, Lippincott M, Li Q, Bates DW. **Primary care physician time utilization before and after implementation of an electronic health record: a time-motion study**. J Biomed Inform. 2005 Jun;38(3):176-88. Epub 2004 Dec 14. PMID: 15896691

Lots of physician complaints

❑ Hear them all the time at meetings

   ❖ "It follows me everywhere."

   ❖ "It's eating my life."

   ❖ A chairman of medicine: "My primary care faculty are looking for work to keep them out of the clinic."

❑ Is it really a problem?

We did a small survey

❑ Surveyed 9 family practice physicians from clinic at one academic center.

  ❑ Arch Intern Med, 2011 May 23;171(10):897-903. PMID: 21263079: PMC3101297.

❑ Providers all had 2 or more years of experience with computer.

❑ Key questions regarded effect on <u>free time</u> including home and weekends before and after EMR adoption.

❑ They reported <u>46 minutes</u> of free time lost per clinic day!

❑ Doing lots of chart work from home at nights and on weekends.

❑ Even with only 9 subjects, the results were significant.

We are analyzing results of a larger survey, conducted by the American College of Physicians, for a study about EMR time costs

❑ 410 internists responded.

❑ Qualitative response re: EMR effect on free time:

59%	"less" or "much less" free time
36%	no effect on free time
15%	"more" or "much more" free time

❑ Quantitative estimate of effect on free time:

❖ On average, physicians *lost* <u>42 minutes</u> of free time per clinic day.

What was slower with EMR?

	Function	% of Respondents
A	Nothing	10%
B	Writing prescriptions	24%
C	Inbox function	32%
D	Reading the notes that other physicians enter	32%
E	Finding and reviewing clinical records	35%
F	Ordering and scheduling tests	40%
G	**Writing visit notes**	**64% !!**

Some surprises

❑ We expected note writing to be slower – nearly 2/3^{rds} of the respondents complained that it was slower.

❑ But we were surprised that nearly a third of the respondents reported that these 2 functions were slower with EMR than in the manual system:

   o D (**Reading other MD notes**) and

   o E (**Finding and reviewing clinical notes**)

❑ Some of their free text comments shed light on these apparent paradoxes.

Reasons it was harder to read other providers' notes

❑ The use of templates often led to stereotypic, repetitive, uninformative, and bulky (lots of little detail that was un-important) notes.

❑ Conveyed little sense of what was really going on.[1]

❑ Cutting and pasting lab results into notes, or re-use of previous note as the current note, made them bulky and harder to see the wheat for the chaff. [2,3]

❑ These issues have also been reported by others:

1. Weir CR, Hammond KW, Embi PJ, Efthimiadis EN, Thielke SM, Hedeen AN. **An exploration of the impact of computerized patient documentation on clinical collaboration**. *Int J Med Inform*. 2011 Aug;80(8):e62-71.

2. Thielke S, Hammond K, Helbig S. **Copying and pasting of examinations within the electronic medical record.** Int'l J Med Inf. 2007;76S:S122-8.

3. Wrenn JO, Stein DM, Bakken S, Stetson PD. **Quantifying clinical narrative redundnancy in an electronic health record**. J Am Med Inform Assoc 2010;17:49e53. doi:10.1197/jamia.M3390

Reasons it was harder to find clinical data and reports

❑ Physicians had to hand-enter test results in some systems…Uggh!

❑ Document scanning of reports and notes was a major culprit.

  o Not because they were scanned, but because they contained no computer-readable report name or date.

  o In paper charts, such reports would be grouped by test report type and within report type by report date.

  o They would be in random date scanned order (at best) in EMR.

❑ In some systems, it was hard to compare the current result with the previous. (A shame, because it is not hard to provide that capability.)

Houston, we may have a problem

❑ We had always thought of the EMR as being an efficiency improvement tool for the physician.

❑ Survey results indicate that the EMR can reduce efficiency.

Finding reports: Implications for HIE

❑ The problems providers expressed with finding lab test results and other reports highlights the need for universal codes for the test or report name.

❑ If scanned documents are the only way:

  ❖ Hand-labeling of the report date and universal name will be needed to give physicians ways to find the reports of interest AND assess changes over time.

  ❖ OCR'ing all scanned documents would help reduce the problem if the EMR system had the right kind of search capability

For perspective

❑ Under MU2, only laboratory tests are required to be delivered in structured form with standardized coded test names.

Study Type	Medicare Part B Costs − 2011*
Laboratory tests	$7 Billion
Radiology studies	About $12 Billion
Cardiac echoes	More than $1 Billion
EKGs	Nearly $1 Billion
Endoscopies (upper+lower)	Nearly $1 Billion

* Excludes costs for inpatient and private insurance coverage.

❑ We will never get past the barrier of huge interfacing costs if we leave so much out.

Implications for MU: Finish the work of pulling existing electronic data into the EMR

❑ It is not a medical record without the other kinds of study reports.

- ❖ Would be good to require other diagnostic services and dictation systems to send clean HL7 messages, with:
  - o The usual header information, and a study date
  - o Report and test names labeled with universal LOINC codes.
- ❖ These are mostly already delivered by HL7 messages in hospitals.
- ❖ Just add LOINC codes and send using the same mechanism set up for sending Lab results.

Implications for MU2

❑ CDA could fill some of the gap

    ❖ Does include medication lists and important text reports, e.g. discharge summary, a coded name.

    ❖ But worry that there is no process for pushing them to the responsible providers or to "copy to's". And don't think they are required to use one set of universal codes for non-lab studies.

        o Anyone know?

    ❖ They *can* be shipped within v2 HL7 messages.

MU2 requires more note writing work

❑ All notes must be text-searchable.

- o No handwriting – Maybe a sliver of escape valve.
- o Providers or licensed office staff must do the note writing and order entry.
  - Scribes as currently defined are forbidden – there is a small escape.

❑ For transitions of care and consult notes - extra new work:

- o Functional status, including:
  - Activities of daily living,
  - Cognitive and disability status
- o Care plans

Not good

❑ These goals are all based on lore – not science.

❑ Will add expense and reduce efficiency.

❑ Will steal more provider time from the patient.

❑ Will drive primary care physicians to other pursuits.

❑ **I believe lay enthusiasts have imbued routine notes with more value than they have:**

 ❖ Many are "notes to self".

 ❖ Have short informational half life - Superseded by results of testing and the patient course.

Provider time is a scarce resource – Don't squander it!

❑ Providers *should* enter prescriptions – on good systems, they don't mind and provides many advantages

❑ Same with orders and allergies and visit dx's and problems, because they are highly leveraged and help get the patient out of office faster.

❑ Should rethink the requirements to enter <u>all</u> notes as typed documents

   ❖ Entering the notes is time-costly, and the end product is often lousy.

   ❖ Will already have orders, allergies, and meds in coded/structured format.

Note writing needs much more study [1,2]

❑ We need more research on note writing , its use and value to patient care

  ❖ How often and what parts are ever read by anybody?

  ❖ What are the minimum facts that should be coded rather than free text by problem?

  ❖ When does the content obfuscate and when does it communicate?

1. Weir CR, Hammond KW, Embi PJ, Efthimiadis EN, Thielke SM, Hedeen AN. **An exploration of the impact of computerized patient documentation on clinical collaboration**. *Int J Med Inform*. 2011 Aug;80(8):e62-71.

2. Weir CR, Nebeker JJ, Hicken BL, Campo R, Drews F, Lebar B. **A cognitive task analysis of information management strategies in a computerized provider order entry environment**. *J Am Med Inform Assoc*. 2007 Jan-Feb;14(1):65-75.
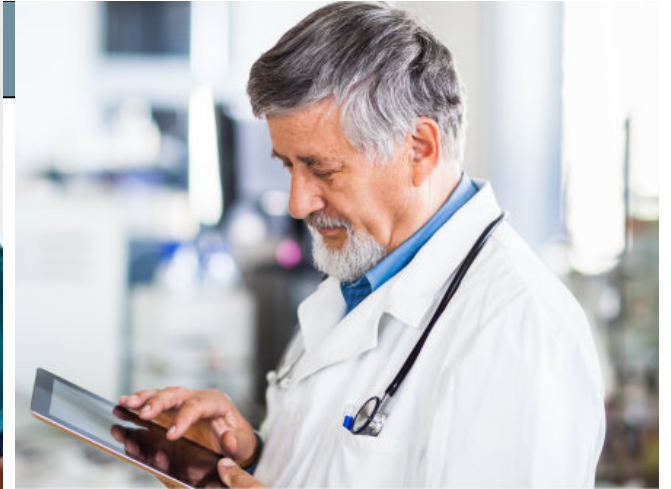
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Thank you!
Questions?