Regenstrief Institute
Better Care. Better Health.

AMIA 2017 Summit in CRI
CRI Year-In-Review

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Disclosures

- Co-founder and CMO: Signet Accel LLC
- Board of Scientific Counselors, NLM
- Recently on IJMI and JAMIA editorial boards
- Consultant to various universities, research organizations

Approach to this presentation

- Mixed approach to article identification:
  - Started with structured approach
    - (akin to ACP “update” sessions)
  - Augment with “what seemed interesting” approach
- Learned a lot from doing this last five years
  - Tracked manuscripts throughout the year
  - Intended to spread work out…

    …still worked down to the wire

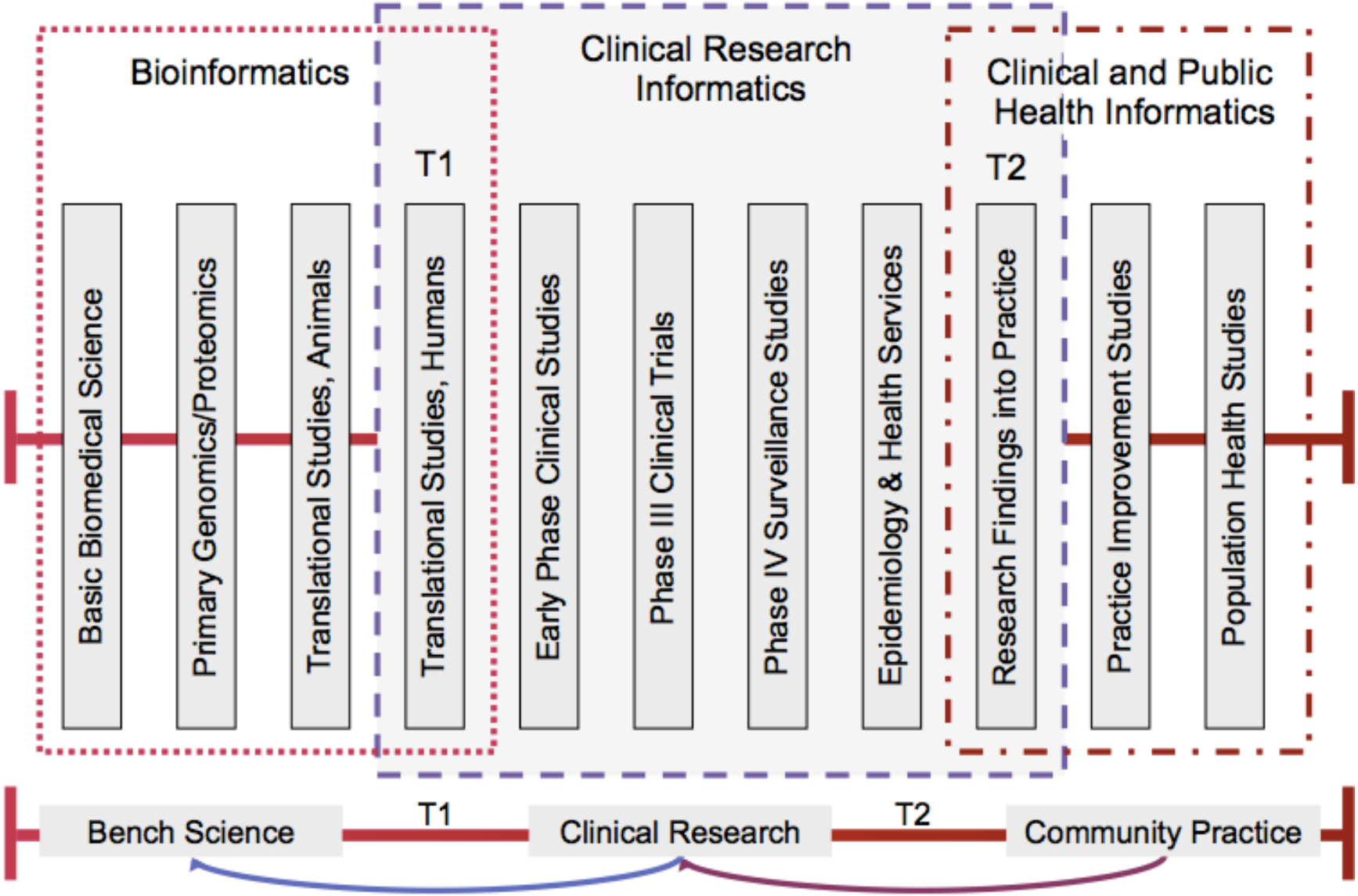
- So, what was my approach…

Source of Content for Session

- Literature review:
  - Initial search by MESH terms:
    - "Biomedical Research"[Mesh] AND "Informatics"[Mesh] AND "2016/01/01"[PDat] : "2017/02/01"[Pdat]
    - Resulted in **458** articles
    - Limiting to English and Abstracts: **374**
  - Additional articles found via:
    - Recommendations from colleagues
    - Other keyword searches using terms like:
      - Clinical Trials, Clinical Research iInformatics, Translational, Data Warehouse, Research Registries, Recruitment, Learning Health System
    - Yielding **426** total, from which **201** were CRI relevant
  - From those, I've selected **~47** representative papers that I'll present here (*briefly*)

Clinical and Translational Research & Informatics: T1, T2, and Areas of Overlap for Informatics

Shaded CRI Region is Main Area of Focus



Embi & Payne, JAMIA 2009

Session caveats

- What this is not…
  - A systematic review of the literature
  - An exhaustive review

- What this is…
  - My best attempt at *briefly* covering *some* of the representative CRI literature from the past year
  - A snap-shot of excellent CRI activity over past year+
  - What I thought was particularly notable

Topics

- Grouped **47** articles into several CRI categories (admittedly, not *all* CRI areas)
  - Data Sharing, and Re-Use
  - CRI Methods and Approaches
  - Recruitment and Eligibility
  - EHRs and Learning Health Systems
  - PROs, PHRs, and Patient Perspectives
  - Education and Training in CRI
  - Policy & Perspectives
- In each category, I'll highlight a few key articles and then given a quick(er) "shout out" to others
- Conclude with notable events from the past year

Apologies up front

- I’m CERTAIN I’ve missed a lot of great work
- I’m REALLY SORRY about that

Clinical Data Sharing and Re-Use for Research

A Harmonized Data Quality Assessment Terminology and Framework for the Secondary Use of Electronic Health Record Data

(Kahn MG, et al. eGEMs 2016)

- **Data quality essential to all we do…**
- **Objective:** Harmonized data quality (DQ) assessment terms, methods, and reporting practices can establish a common understanding of the strengths and limitations of electronic health record (EHR) data for operational analytics, quality improvement, and research.
  - Existing published DQ terms harmonized to a comprehensive unified terminology with definitions and examples and organized into a conceptual framework to support a common approach to defining whether EHR data is 'fit' for specific uses.

A Harmonized Data Quality Assessment Terminology and Framework for the Secondary Use of Electronic Health Record Data (Kahn MG, et al. eGEMs 2016)

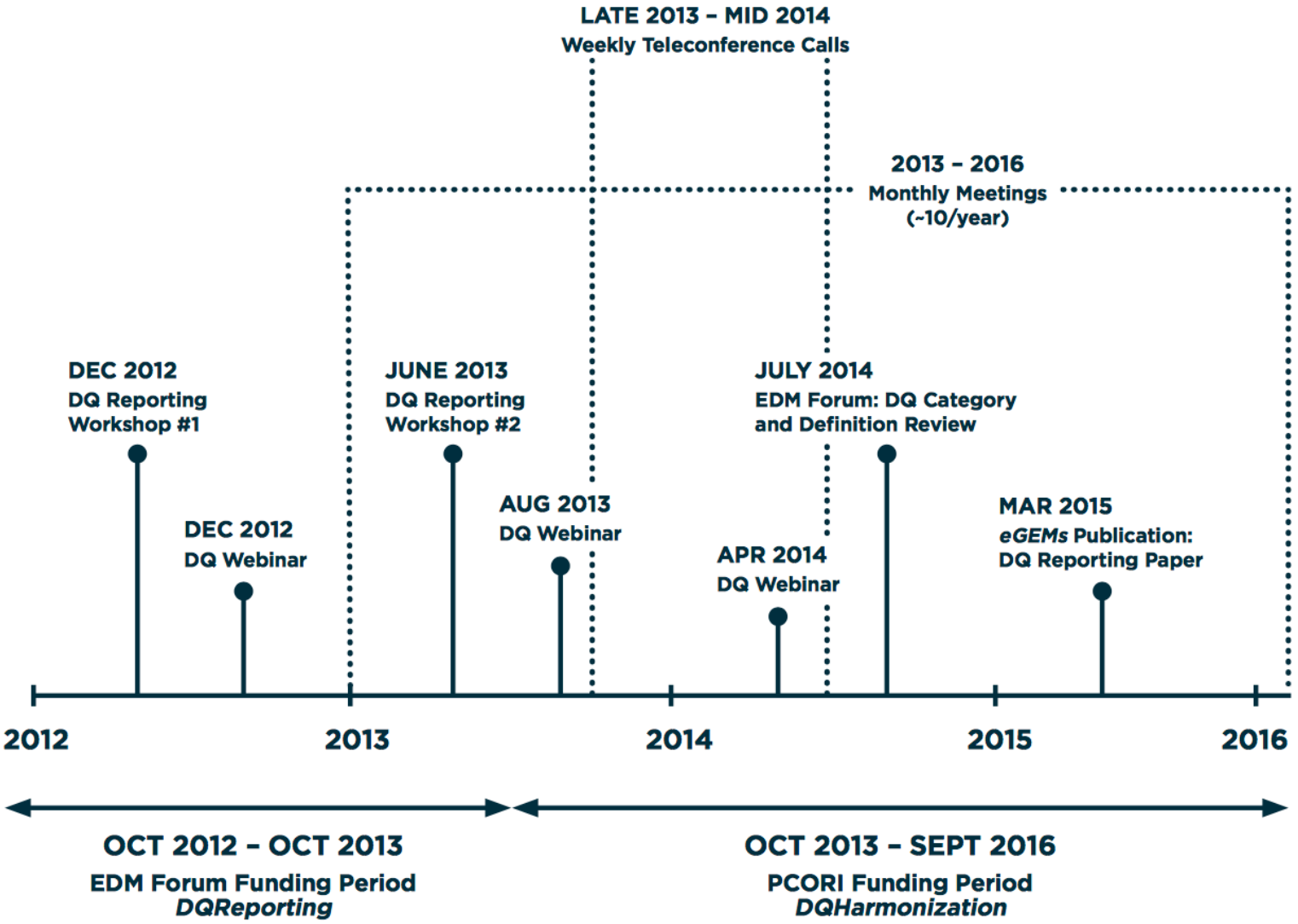
- **Methods:** DQ publications, informatics and analytics experts, managers of established DQ programs, and operational manuals from several mature EHR-based research networks were reviewed to identify potential DQ terms and categories.
  - Two face-to-face stakeholder meetings to vet an initial set of DQ terms and definitions that were grouped into an overall conceptual framework.
  - Feedback received from data producers and users -> draft set of harmonized DQ terms and categories. Iterative refinement.
  - Harmonized terminology and logical framework's inclusiveness was evaluated against ten published DQ terminologies.

- Follow-up manuscript to prior work (highlighted last year) on DQ reporting by group…

A Harmonized Data Quality Assessment Terminology and Framework for the Secondary Use of Electronic Health Record Data

(Kahn MG, et al. eGEMs 2016)

Figure 1. Timeline of Significant Events in Developing the Harmonized DQ Terminology



A Harmonized Data Quality Assessment Terminology and Framework for the Secondary Use of Electronic Health Record Data

(Kahn MG, et al. eGEMs 2016)

- **Results:** Existing DQ terms harmonized and organized into a framework by defining
- Three DQ categories:
  - (1) Conformance
  - (2) Completeness
  - (3) Plausibility and
- Two DQ assessment contexts:
  - (1) Verification
  - (2) Validation.
- Conformance and Plausibility categories were further divided into subcategories.

A Harmonized Data Quality Assessment Terminology and Framework for the Secondary Use of Electronic Health Record Data (Kahn MG, et al. eGEMs 2016)

Table 1. Harmonized DQ Terms, Definitions, and Examples: Organized by Verification and Validation Contexts Within Categories and Subcategories

VERIFICATION		VALIDATION	
DEFINITION	**EXAMPLE**	**DEFINITION**	**EXAMPLE**
CONFORMANCE: DO DATA VALUES ADHERE TO SPECIFIED STANDARDS AND FORMATS?			
VALUE CONFORMANCE			
a. Data values conform to internal formatting constraints. b. Data values conform to allowable values or ranges.	a. Sex is only one ASCII character. b. Sex only has values "M," "F," or "U."	a. Data values conform to representational constraints based on external standards.	a. Values for primary language conform to ISO standards.
RELATIONAL CONFORMANCE			
a. Data values conform to relational constraints. b. Unique (key) data values are not duplicated. c. Changes to the data model or data model versioning.	a. Patient medical record number links to other tables as required. b. A medical record number is assigned to a single patient. c. Version 1 data does not include medical discharge hour.	a. Data values conform to relational constraints based on external standards.	a. Data values conform to all not-NULL requirements in a common multi-institutional data exchange format.
COMPUTATIONAL CONFORMANCE			
a. Computed values conform to computational or programming specifications.	a. Database- and hard-calculated Body Mass Index (BMI) values are identical.	a. Computed results based on published algorithms yield values that match validation values provided by external source.	a. Computed BMI percentiles yield identical values compared to test results and values provided by the CDC.
COMPLETENESS: ARE DATA VALUES PRESENT?			
a. The absence of data values at a single moment in time agrees with local or common expectations. b. The absence of data values measured over time agrees with local or common expectations.	a. The encounter ID variable has missing values. b. Gender should not be null. c. Medical discharge time is missing for three consecutive days.	a. The absence of data values at a single moment in time agrees with trusted reference standards or external knowledge. b. The absence of data values measured over time agrees with trusted reference standards or external knowledge.	a. The current encounter ID variable is missing twice as many values as the institutionally validated database. b. A drop in ICD-9CM codes matches implementation of ICD-10CM
PLAUSIBILITY: ARE DATA VALUES BELIEVABLE?			
UNIQUENESS PLAUSIBILITY			
a. Data values that identify a single object are not duplicated.	a. Patients from a single institution do not have multiple medical record numbers.	a. Data values that identify a single object in an external source are not duplicated.	a. An institution's CMS facility identifier does not refer to a multiple institutions.

A Harmonized Data Quality Assessment Terminology and Framework for the Secondary Use of Electronic

Table 1. Harmonized DQ Terms, Definitions, and Examples: Organized by Verification and Validation Contexts Within Categories and Subcategories (Cont'd)

VERIFICATION		VALIDATION	
DEFINITION	**EXAMPLE**	**DEFINITION**	**EXAMPLE**
ATEMPORAL PLAUSIBILITY			
a. Data values and distributions agree with an internal measurement or local knowledge. b. Data values and distributions for independent measurements of the same fact are in agreement. c. Logical constraints between values agree with local or common knowledge (includes "expected" missingness). d. Values of repeated measurement of the same fact show expected variability.	a. Height and weight values are positive. a. Counts of unique patients by diagnoses are as expected a. Distribution of encounters per patient or medications per encounter distributions are as expected b. Serum glucose measurement is similar to finger stick glucose measurement. b. Oral and axillary temperatures are similar. c. Sex values agree with sex-specific contexts (pregnancy, prostate cancer). d. Height values are similar when taken by two separate nurses within the same facility using the same equipment.	a. Data values and distributions (including subgroup distributions) agree with trusted reference standards or external knowledge. b. Similar values for identical measurements are obtained from two independent databases representing the same observations with equal credibility. c. Two dependent databases (e.g., database 1 abstracted from database 2) yield similar values for identical variables.	a. HbA1c values from hospital and national reference lab are statistically similar under the same conditions. a. Distribution of patients with cardiovascular disease diagnoses are similar to CDC rates for the same age and sex groups a. Readmission rates by age groups for Medicare patients agree with CMS values b. Diabetes ICD-9CM and CPT codes are similar between two independent claims databases serving similar populations. c. Recorded date of birth is consistent between EHR data and registry data for the same patient.
TEMPORAL PLAUSIBILITY			
a. Observed or derived values conform to expected temporal properties. b. Sequences of values that represent state transitions conform to expected properties. c. Measures of data value density against a time-oriented denominator are expected ***based on internal knowledge***.	a. Admission date occurs before discharge date. b. Date of an initial immunization precedes date of a booster immunization. c. Similar counts of patient observations between extraction-transformation-load cycles. c. Counts of emergency room visits by month shows expected spike during flu season. c. Medications per patient-day are as expected	a. Observed or derived values have similar temporal properties across one or more external comparators or gold standards. b. Sequences of values that represent state transitions are similar to external comparators or gold standards. c. Measures of data value density against a time-oriented denominator are expected ***based on external knowledge***.	a. Length of stay by outpatient procedure types conforms to Medicare data for similar populations. b. Immunization sequences match the CDC recommendations. c. Counts of emergency room visits by month shows spike during flu season that are similar to local health department reports. c. Medications per patient-day matches claims data.

Notes: The lettering in each column can be used to map each definition to its corresponding example. Not every definition has a corresponding example.

Extract, Transform, Load ETL (ETL); International Organization for Standardization (ISO); Electronic Health Record (EHR) Data; International Classification of Diseases, Ninth and Tenth Revisions (ICD-9CM and ICD-10CM); Current Procedural Terminology (CPT); Centers for Medicare & Medicaid Services (CMS); Centers for Disease Control and Prevention (CDC).

A Harmonized Data Quality Assessment Terminology and Framework for the Secondary Use of Electronic Health Record Data

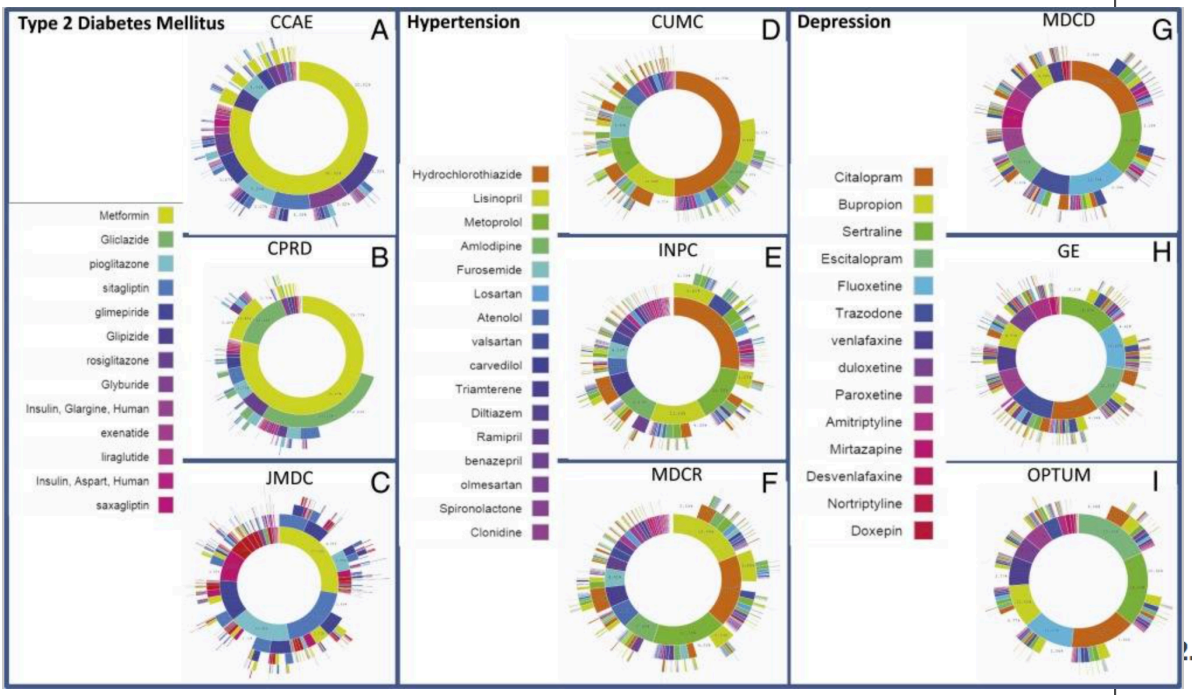
(Kahn MG, et al. eGEMs 2016)

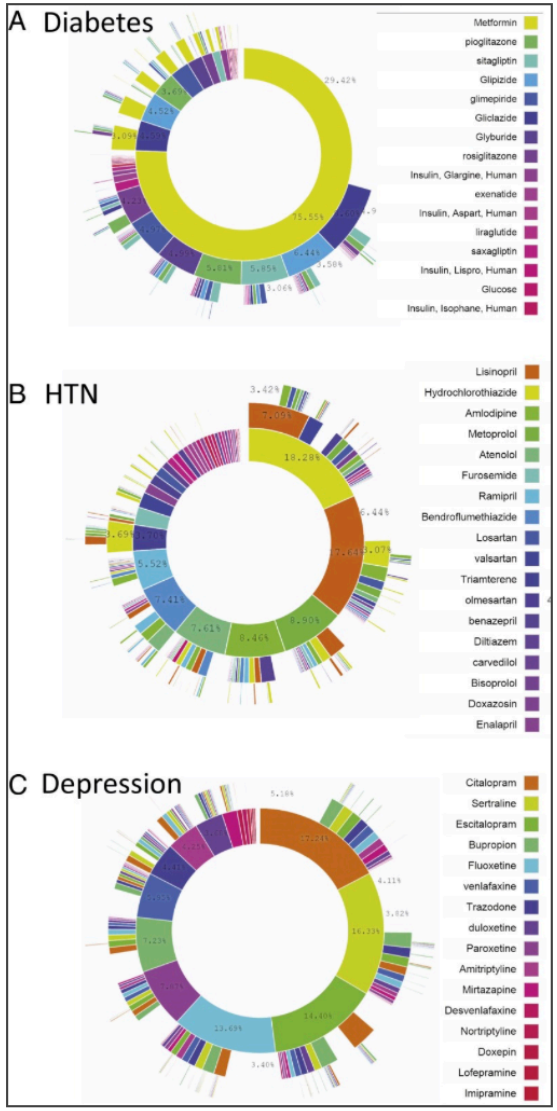
- Existing DQ concepts, community input, and expert review informed the development of a distinct set of terms, organized into categories and subcategories.
  - Result: DQ terms that encompassed a wide range of disparate DQ terminologies.
  - Operational definitions developed to provide guidance for implementing DQ assessment procedures.
  - The resulting structure is an inclusive DQ framework for standardizing DQ assessment and reporting.
  - Beyond EHR data: the new terminology may be applicable to a wide range of electronic health data such as administrative, research, and patient-reported data.
- **Conclusion: A consistent, common DQ terminology, organized into a logical framework, is an initial step in enabling data owners and users, patients, and policy makers to evaluate and communicate data quality findings in a well-defined manner with a shared vocabulary.**

Characterizing treatment pathways at scale using the OHDSI network. (Hripcsak G, et al. Proc Natl Acad Sci. 2016)

- Observational research critically important and growing.
- Understanding the diversity of populations and the variance in care is key to high quality observations research.
- The Observational Health Data Sciences and Informatics (OHDSI) collaboration created an international data network with **11 data sources** from **4 countries**, including EHRs and administrative claims data on **250 million patients**.
- Treatment pathways were elucidated for type 2 diabetes mellitus, hypertension, and depression.
  - Pathways revealed that the world is moving toward more consistent therapy over time across diseases and across locations, **but** significant heterogeneity remains among sources, pointing to challenges in generalizing clinical trial results.
  - Diabetes favored a single first-line medication, metformin, to a much greater extent than hypertension or depression.
  - About 10% of diabetes and depression patients and almost 25% of hypertension patients followed a treatment pathway that was unique within the cohort.
  - **Large-scale international observational research is feasible.**

Characterizing treatment pathways at scale using the OHDSI network. (Hripcsak G, et al. Proc Natl Acad Sci. 2016)



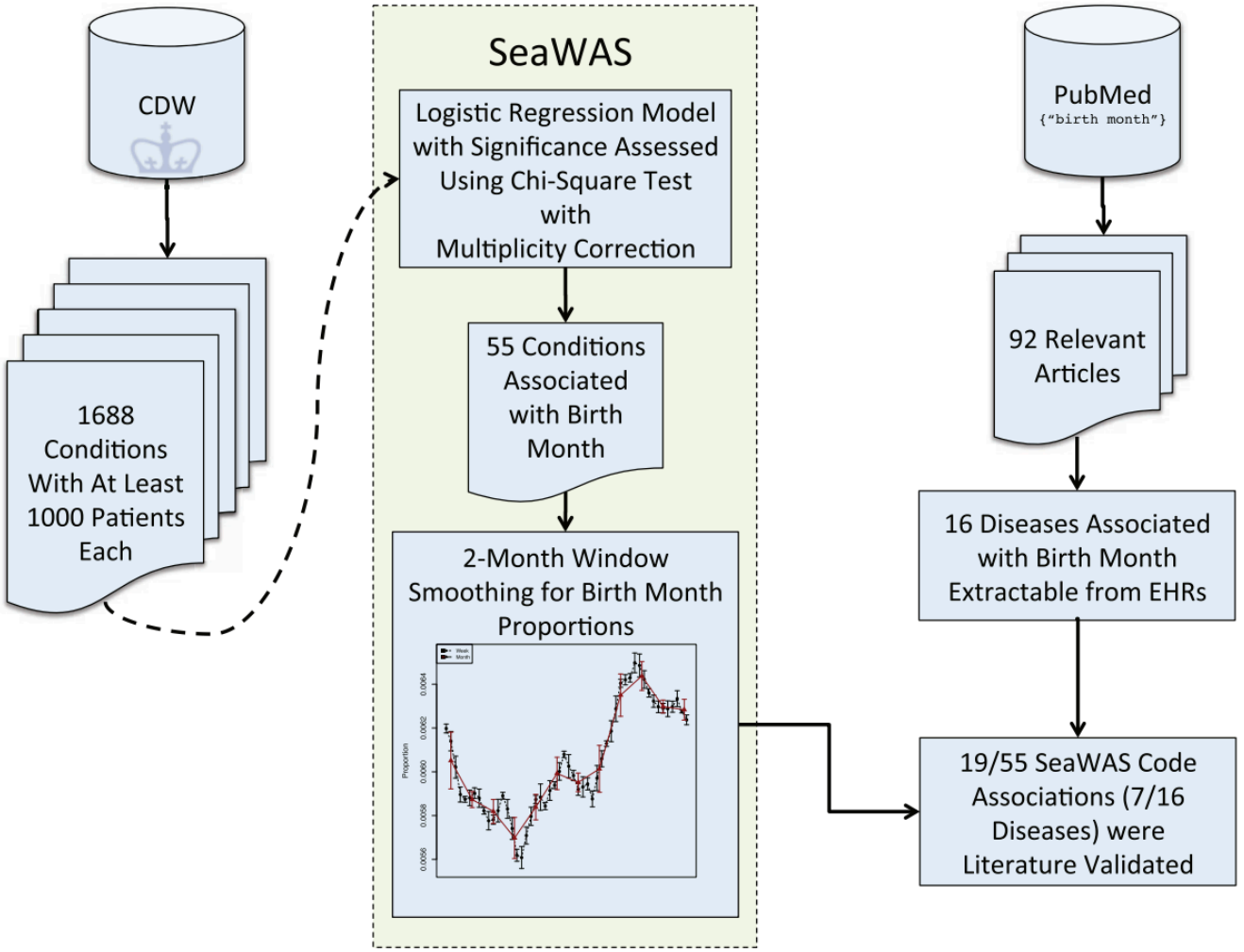


Treatment pathways for all data sources. For each disease, diabetes (*A*), hypertension (*B*), and depression (*C*), and across all data sources, the inner circle shows the first relevant medication that the patient took, the second circle shows the second medication, and so forth. Only four levels are shown, but up to 20 medications were recorded. For example, 76% of diabetes patients started with metformin, and 29% took only metformin.

[Characterizing treatment pathways at scale using the OHDSI network](#)
Proc Natl Acad Sci U S A. 2016 Jul 5;113(27):7329-7336.

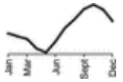
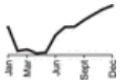
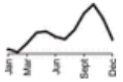
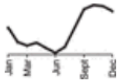
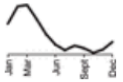
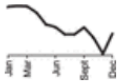
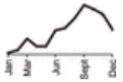
Last year: Birth Month Affects Lifetime Disease Risk: A Phenome Wide Study (Bowland, MR, et al. JAMIA. 2015)

Figure 1: Overview of the SeaWAS algorithm. The algorithm takes all 1688 conditions as initial input, finds significant associations over all months, then it models each birth month's association with the condition by smoothing the birth month proportions using a 2-month window. We then extracted all relevant birth month articles from PubMed (n = 92) and mapped the results to extractable codes from electronic health records. SeaWAS found 7 of the 16 diseases reported as associated with birth month in the literature corresponding to 19/55 associated codes.



Birth Month Affects Lifetime Disease Risk: A Phenome Wide Study (Bowland, MR, et al. JAMIA. 2015)

- **Results:** We found 55 diseases that were significantly dependent on birth month.
- Of these 19 were previously reported in the literature ($P < .001$), 20 were for conditions with close relationships to those reported, and
- 16 were previously unreported. We found distinct incidence patterns across disease categories.

EHR Condition in SeaWAS	N	Passed Internal Validation?	Adjusted P^1	Seasonal Pattern	Birth Month Risk	
					High	Low
Other (n = 7)						
Acute upper respiratory infection	112 487	Yes	<0.001		October	May
Bruising	8904	Yes	0.015		December	April
Nonvenomous insect bite	7435	Yes	0.001		October	February
Venereal disease screening	69 764	Yes	0.003		October	June
Primary malignant neoplasm of prostate	20 353	Yes	0.002		March	October
Malignant neoplasm of overlapping lesion of bronchus and lung	2714	Yes	0.014		February	November
Vomiting	30 495	No	0.029		September	January

Birth Month Affects Lifetime Disease Risk: A Phenome Wide Study (Bowland, MR, et al. JAMIA. 2015)

- **Conclusions:** Lifetime disease risk is affected by birth month.
- Seasonally dependent early developmental mechanisms may play a role in increasing lifetime risk of disease.

This year: **Hypothesis-Free Search for Connections between Birth Month and Disease Prevalence in Large, Geographically Varied Cohorts.**
(Boris JP. AMIA Annu Symp Proc. Feb 2017)

- Replicate and extend the Season-wide Association Study (SeaWAS) of Boland, et al. using Explorys database
- Used methodology similar to that implemented by Boland on three geographically distinct cohorts, for a total of **11.8 million individuals derived from multiple data sources.**

- Some important differences noted that are illustrative of why we need to do this work…

This year: **Hypothesis-Free Search for Connections between Birth Month and Disease Prevalence in Large, Geographically Varied Cohorts.**

(Boris JP. AMIA Annu Symp Proc. Feb 2017)

- Confirmed 11 out of 16 literature-supported birth month associations as compared to 7 of 16 for SeaWAS.
- Of the 9 novel cardiovascular birth month associations discovered by SeaWAS, they were able to replicate 4.
- **None of the novel non-cardiovascular associations discovered by SeaWAS emerged as significant relations in our study.**
- We identified **30** birth month disease associations not previously reported, but…
  - Of those, only 6 associations were validated in more than one cohort.
- Suggestion: differences in cohort composition and location can cause consequential variation in results of hypothesis-free searches

- Why we need larger data sets and replication
- This is CRI science!!

Other notable papers in this (Sharing/Reuse) category:

- **Common data elements for secondary use of electronic health record data for clinical trial execution and serious adverse event reporting**
  (Bruland P, et al. BMC Medical Research Methology. 2016)
  - **Objective:** Determine the most commonly used data elements in clinical trials and their availability in hospital EHR systems to enable re-use
  - **Methods:** Case report forms for 23 clinical trials in differing disease areas analyzed. Involved academic and trial experts from the European pharmaceutical industry, data elements compiled for all disease areas and with special focus on the reporting of adverse events. Part of the EHR4CR project.
  - **Results:** 133 unique data elements. 50 elements congruent with a published data inventory for patient recruitment and 83 new elements were identified for clinical trial execution, including adverse reporting.
  - **Conclusions:** Helpful advance to know what data elements are frequently available even as more specialized elements are not. Informs changes to systems to enable re-use

Other notable papers in this (Sharing/Reuse) category:

- Report of data re-use in specific specialty domains is **exploding**.
- One set of examples from recent issue in a Rheumatology journal:
  - Michaud K. **The National Data Bank for Rheumatic Diseases (NDB).** Clin ExpRheumatol. 2016
  - Hetland ML, et al. **Using an electronic platform interactively to improve treatmentoutcome in patients with rheumatoid arthritis: new developments from the DANBIOregistry.** Clin Exp Rheumatol. 2016
  - Bergstra SA, et al. **Ten years of METEOR (an international rheumatoid arthritis registry): development, researchopportunities and future perspectives**. Clin Exp Rheumatol. 2016
  - Francisco M, et al. **Overview of the American College of Rheumatology's Electronic Health Record-Enabled Registry: The Rheumatology Informatics System for Effectiveness (RISE).** Clin Exp Rheumatol. 2016

CRI Methods and Approaches

A data-driven concept schema for defining clinical research data needs

(Hrubya GW, et al. IJMI. 2016)

- **Objectives:** The Patient, Intervention, Control/Comparison, and Outcome (PICO) framework is an effective technique for framing a clinical question.
- Aim to develop the counterpart of PICO to structure clinical research data needs.

- **Methods:** Data-driven approach to abstracting key concepts representing clinical research data needs by adapting and extending an expert-derived framework (Carpenter) originally developed for defining cancer research data needs..

A data-driven concept schema for defining clinical research data needs

(Hrubya GW, et al. IJMI. 2016)

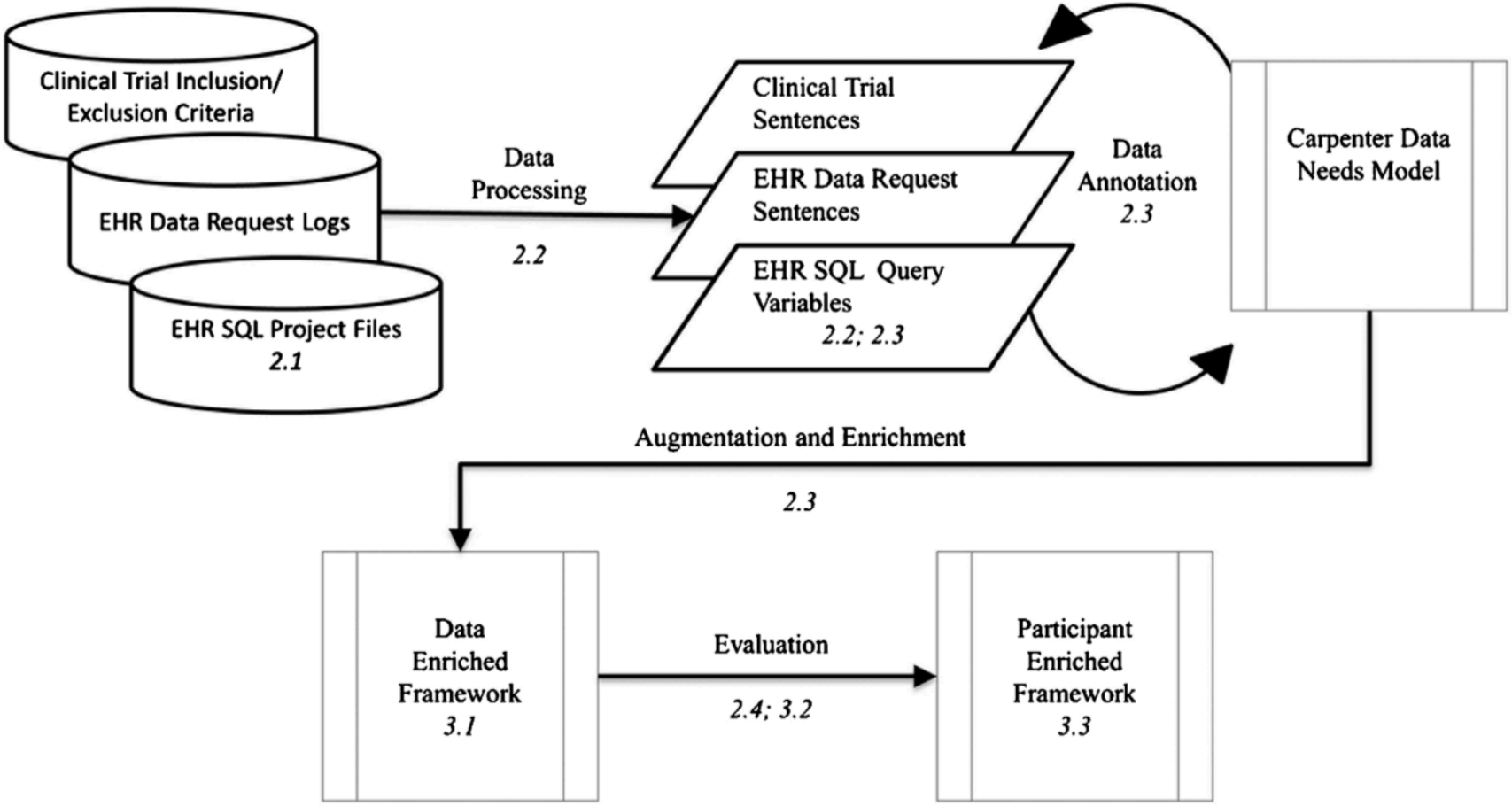


Fig. 1. Research Design. The corresponding section from both the methods and results sections are noted with an italicized number.

A data-driven concept schema for defining clinical research data needs

(Hrubya GW, et al. IJMI. July 2016)

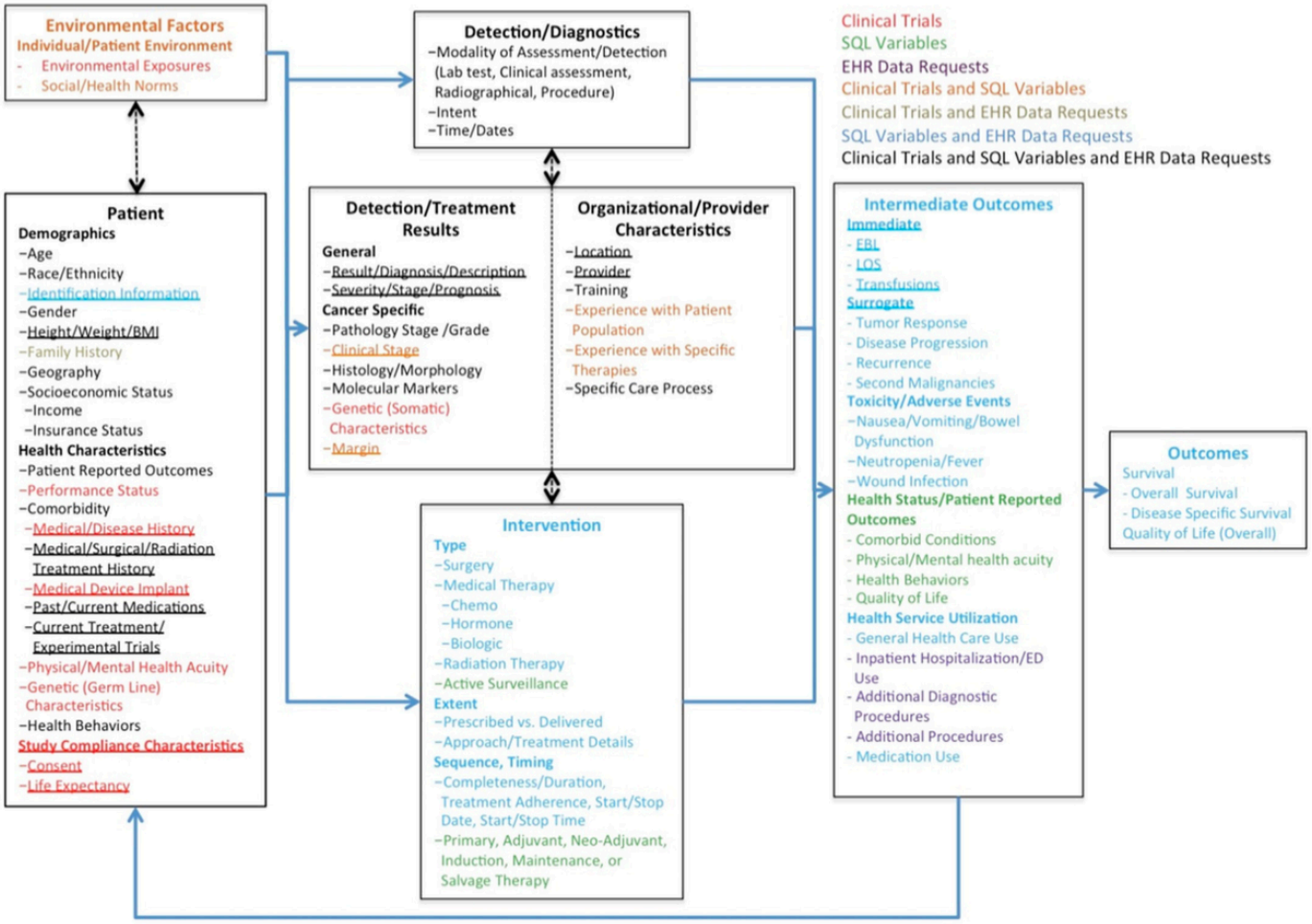


Fig. 3. The data-enriched schema with 72 classes. The blue directed edges represent the temporal order as the patient moves through the care continuum. The cyclical nature of this graph implies the patient can re-enter the care cycle. The bi-directional edges indicate an association between the sections. New additions to the schema are underlined, and colour-coded classes correspond to the dataset that contains the class. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

A data-driven concept schema for defining clinical research data needs

(Hrubya GW, et al. IJMI. July 2016)

- **Results:** Data-driven schema preserved 68% of the 63 classes from the original (qualitatively developed) framework and covered 88% (73/82) of the classes proposed by evaluators.
- Class coverage for participants of different backgrounds ranged from 60% to 100% with a median value of 95% agreement among the individual evaluators.

- **CONCLUSIONS:** Informs improvements to research data needs communication between researchers and informaticians.

Other notable papers in this (Methods/Approaches) category:

- **An Outcome-Weighted Network Model for Characterizing Collaboration**
  Carson MB, et al. PLoS One 2016
  - Developed *Shared Positive Outcome Ratio* (SPOR), a novel parameter that quantifies the concentration of positive outcomes between a pair of healthcare providers over a set of shared patient encounters.
  - Graph analytics of the impacts of collaboration, showing that analysis of EHR data can find interactions that are missed by conventional in person interviews and that some collaborations impact quality more than others.

- **Validating the extract, transform, load process used to populate a large clinical research database** (Denney MJ, et al. IJMI. Oct 2016**)**
  - Nice case study of necessary but often challenging validation of EHR data for re-use in research

Other notable papers in this (Methods/Approaches) category:

- **Applying probabilistic temporal and multisite data quality control methods to a public health mortality registry in Spain: a systematic approach to quality control of repositories** (Saez C, et al. JAMIA. 2016)
  - Presentation of a systematic approach to assessing temporal and multisite variability
  - Changes in protocols, differences in populations, biased practices, or other systematic DQ problems affected data variability.
  - Even if semantic and integration aspects are addressed in data sharing infrastructures, probabilistic variability may still be present.
  - Solutions include fixing or excluding data and analyzing different sites or time periods separately.

- **The INTEGRATE project: Delivering solutions for efficient multi-centric clinical research and trials** (Kondylakis H. et al. JBI 2016)
  - Presentation of how the INTEGRATE consortium has approached important challenges such as the integration of multi-scale biomedical data in the context of post-genomic clinical trials, the development of predictive models and the implementation of tools to facilitate the efficient execution of postgenomic multi-centric clinical trials in breast cancer. Lessons learned also discussed.

Other notable papers in this (Methods/Approaches) category:

- **From Excessive Journal Self-Cites to Citation Stacking: Analysis of Journal Self-Citation Kinetics in Search for Journals, Which Boost Their Scientometric Indicators.** **(**Heneberg P. PLoS One. 2016)
  - Bibliometric indicators increasingly affect careers, funding, and reputation of individuals, their institutions and journals themselves.
  - In contrast to author self-citations, little is known about kinetics of journal self-citations.
  - Hypothesis: there will be a generalizable pattern within particular research fields or across multiple fields.
    - Analyzed self-cites to 60 journals from three research fields: (multidisciplinary sciences, parasitology, and **information science**)
  - Also hypothesized that kinetics of journal self-citations and citations received from other journals of the same publisher may differ from foreign citations.
    - Analyzed the journals published the American Association for the Advancement of Science, Nature Publishing Group, and Editura Academiei Române.
  - Findings…

Other notable papers in this (Methods/Approaches):

- **From Excessive Journal Self-Cites to Citation Stacking: Analysis of Journal Self-Citation Kinetics in Search for Journals, Which Boost Their Scientometric Indicators.** (Heneberg P. PLoS One. 2016)
- Findings: although the kinetics of journal self-cites is generally faster compared to foreign cites, it shows some field-specific characteristics.
  - Particularly in **information science** journals, the initial increase in a share of journal self-citations during post-publication year 0 was **completely absent**.
  - Self-promoting journal self-citations of top-tier journals have rather indirect but negligible direct effects on bibliometric indicators, affecting just the immediacy index and marginally increasing the impact factor itself as long as the affected journals are well established in their fields.
  - In contrast, other forms of journal self-citations and citation stacking may severely affect the impact factor, or other citation-based indices.
  - …

Other notable papers in this (Methods/Approaches):

- **From Excessive Journal Self-Cites to Citation Stacking: Analysis of Journal Self-Citation Kinetics in Search for Journals, Which Boost Their Scientometric Indicators.** **(**Heneberg P. PLoS One. 2016)
- Findings: (continued)
  - Identified network consisting of three Romanian physics journals *Proceedings of the Romanian Academy*, *Series A*, *Romanian Journal of Physics*, and *Romanian Reports in Physics*, which displayed low to moderate ratio of journal self-citations, but which **multiplied recently their impact factors, and were mutually responsible for 55.9%, 64.7% and 63.3% of citations within the impact factor calculation window to the three journals**, respectively.
  - They did not receive nearly any network self-cites prior impact factor calculation window, and their network self-cites decreased sharply after the impact factor calculation window.
  - **Journal self-citations and citation stacking requires increased attention and elimination from citation indices.**

From Excessive Journal Self-Cites to Citation Stacking: Analysis of Journal Self-Citation Kinetics in Search for Journals, Which Boost Their Scientometric Indicators.

Heneberg P. PLoS One. 2016

Fig 1. Kinetics of journal self-cites and foreign cites.

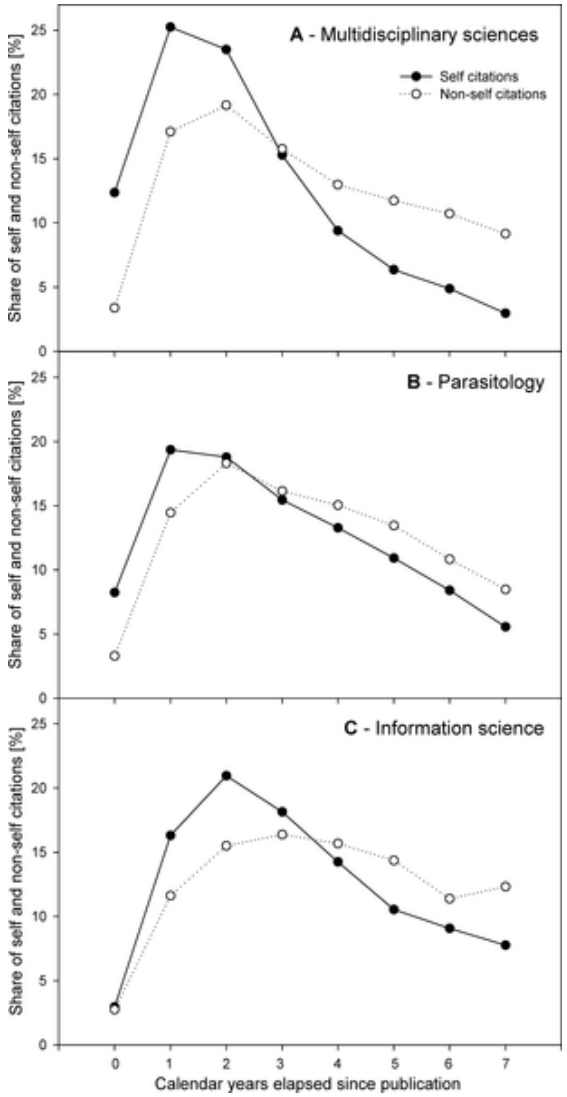
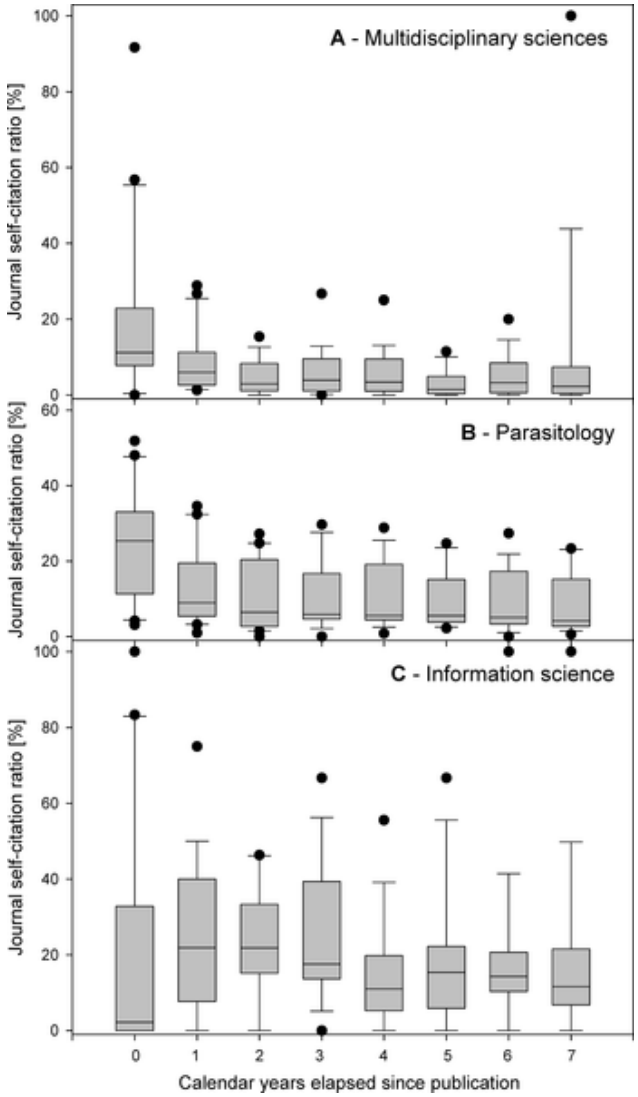


Fig 2. Share of journal self-cites among total cites.

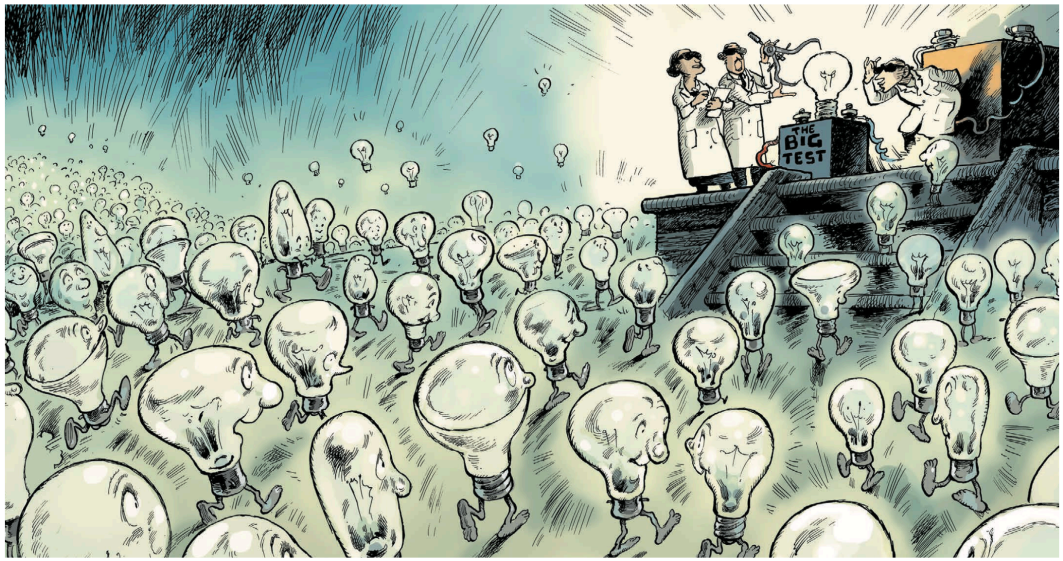


Other notable papers in this (Methods/Approaches) category

- **Two related to Reproducibility:**
- **Reproducible Research Practices and Transparency across the Biomedical Literature.** Iqbal SA, et al. PLoS Biol. 2016.
  - Studied random sample of 441 biomedical journal articles published in 2000–2014. Only one study provided a full protocol and none made all raw data directly available. Replication studies were rare (*n* = 4), and only 16 studies had their data included in a subsequent systematic review or meta-analysis.
  - **The majority of studies did not mention anything about funding or conflicts of interest.**
  - The percentage of articles with no statement of conflict decreased substantially between 2000 and 2014 (94.4% in 2000 to 34.6% in 2014); the percentage of articles reporting statements of conflicts (0% in 2000, 15.4% in 2014) or no conflicts (5.6% in 2000, 50.0% in 2014) increased.
  - Articles published in journals in the clinical medicine category versus other fields were almost twice as likely to **not** include any information on funding and to have private funding.

Other notable papers in this (Methods/Approaches) category

- **No publication without confirmation.** Mogil JS & Macleod MR. Nature 2017.
  - **Propose a new kind of paper that combines the flexibility of basic research with the rigor of clinical trials.**



Other notable papers in this (Methods/Approaches) category

- **Bias in the reporting of sex and age in biomedical research on mouse models. (**Flórez-Vargas O. et al. Elife. 2016)
- Text mining to study 15,311 research papers in which mice were the focus of the study.
  - Finding: Only about 50% of the papers published in 2014 reported these two variables.
  - Multiple levels of sex-bias:
    - Strongest male-bias was observed in cardiovascular disease models
    - Strongest female-bias was found in infectious disease models.
  - Conclusions: text mining can contribute to the ongoing debate about the reproducibility of research, and confirm the need to continue efforts to improve reporting of experimental methods
  - Challenges with gender documentation aren't just a human thing

Participant Recruitment and Eligibility

Sense and readability: participant information sheets for research studies.

(Ennis L, et al. Psychiatry. 2016)

- **BACKGROUND:** Informed consent in research is partly achieved through the use of information sheets. There is a perception however that these information sheets are long and complex. The recommended reading level for patient information is grade 6, or 11-12 years old.
- **AIMS:** To investigate whether the readability of participant information sheets has changed over time, whether particular study characteristics are related to poorer readability and whether readability and other study characteristics are related to successful study recruitment. Method: We obtained 522 information sheets from the UK National Institute for Health Research Clinical Research Network: Mental Health portfolio database and study principal investigators. Readability was assessed with the Flesch reading index and the Grade level test.

Sense and readability: participant information sheets for research studies.

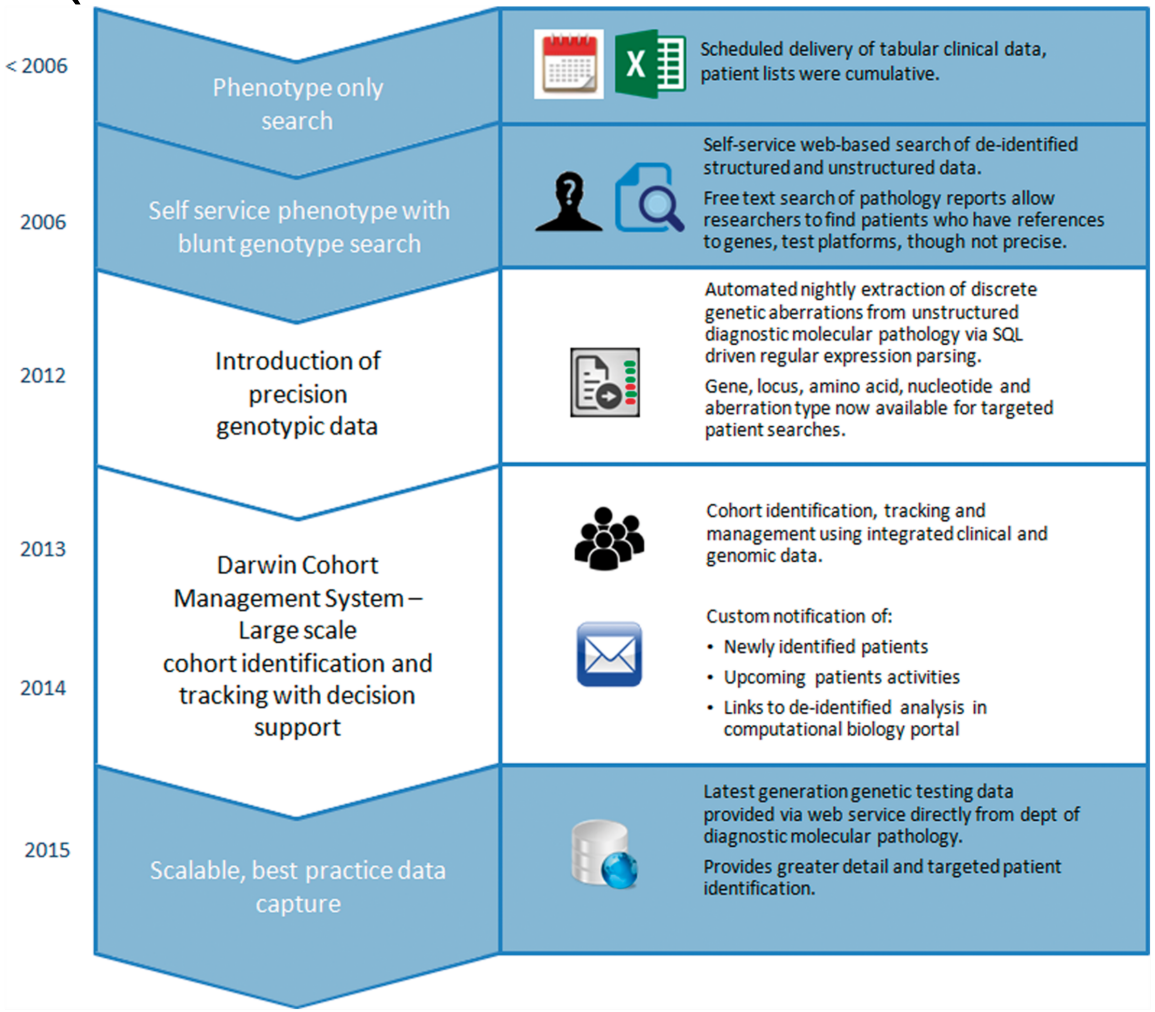
(Ennis L, et al. Psychiatry. 2016)

- **RESULTS:** Information sheets increased in length over the study period. The mean grade level across all information sheets was 9.8, or 15-16 years old. A high level of patient involvement was associated with more recruitment success and studies involving pharmaceutical or device interventions were the least successful. The complexity of information sheets had little bearing on successful recruitment.
- **CONCLUSIONS:** Information sheets are far more complex than the recommended reading level of grade 6 for patient information. The disparity may be exacerbated by an increasing focus on legal content.
- Researchers would benefit from clear guidance from ethics committees on writing succinctly and accessibly and how to balance the competing legal issues with the ability of participants to understand what a study entails.

Automated eligibility screening and monitoring for genotype-driven precision oncology trials (Eubank MH, et al. JAMIA 2016)

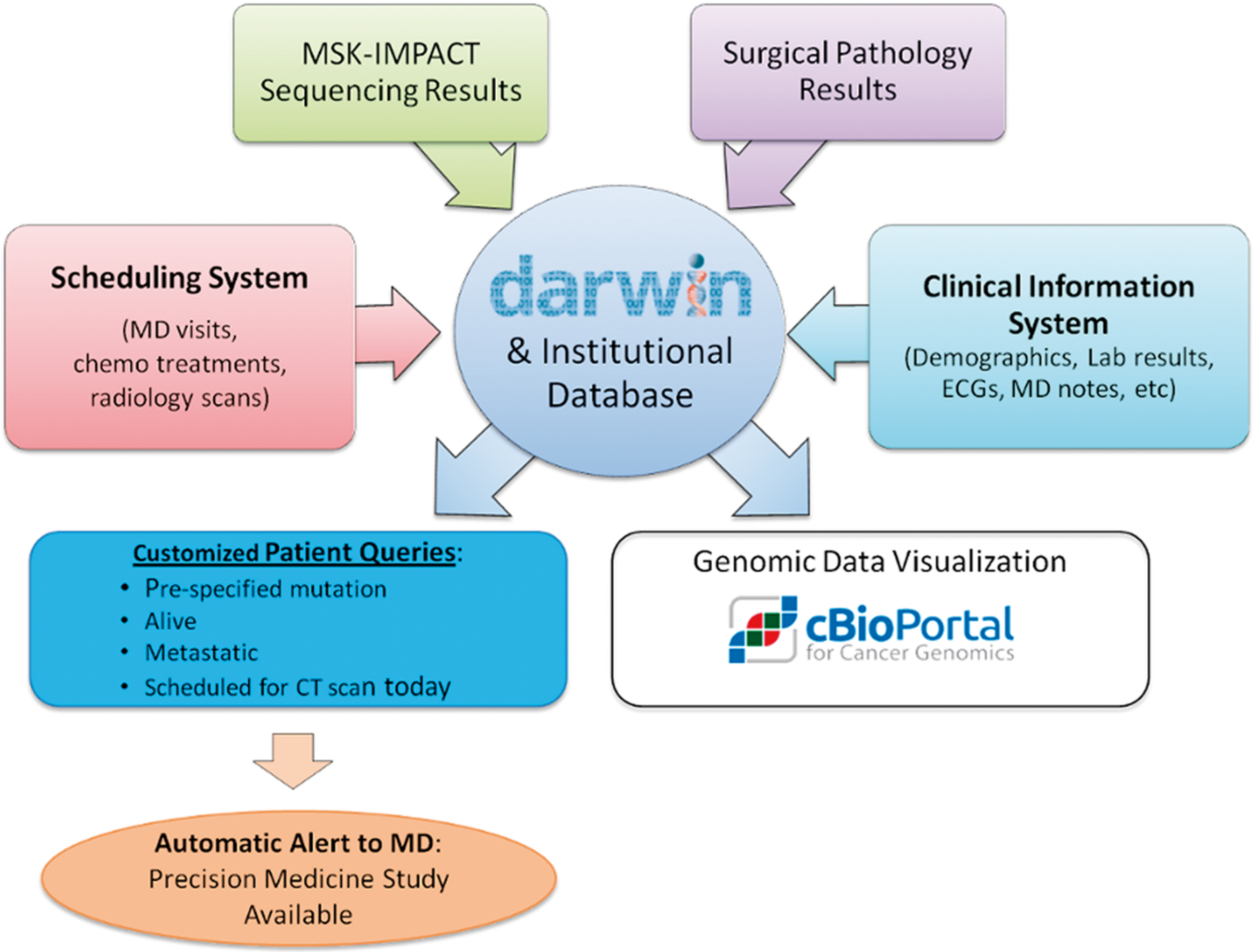
- The Information Systems Department at Memorial Sloan Kettering Cancer Center developed the DARWIN Cohort Management System (DCMS). The DCMS identifies and tracks cohorts of patients based on genotypic and clinical data. It assists researchers and treating physicians in enrolling patients to genotype-matched IRB-approved clinical trials.
- The DCMS sends automated, actionable, and secure email notifications to users with information about eligible or enrolled patients before their upcoming appointments. The system also captures investigators input via annotations on patient eligibility and preferences on future status updates.
- As of August 2015, the DCMS is tracking 159,893 patients on both clinical operations and research cohorts. 134 research cohorts have been established and track 64,473 patients. 51,192 of these have had one or more genomic tests including MSK-IMPACT, comprising the pool eligible for genotype-matched studies.

Automated eligibility screening and monitoring for genotype-driven precision oncology trials (Eubank MH, et al. JAMIA 2016)



Timeline of the Darwin Cohort Management System Development

Automated eligibility screening and monitoring for genotype-driven precision oncology trials (Eubank MH, et al. JAMIA 2016)



Application Components and Data Flows

Other notable papers in this (Recruitment) category:

- **Design, development and deployment of a Diabetes Research Registry to facilitate recruitment in clinical research**
  (Tan MH, et al. Cont Clin Trials. 2016)
  - After 5 years, the DRR has over 5000 registrants. DRR matches potential subjects interested in research with approved clinical studies using study entry criteria abstracted from their EHR. By providing large lists of potentially eligible study subjects quickly, the DRR facilitated recruitment in 31 clinical studies.
- **Towards a privacy preserving cohort discovery framework for clinical research networks.** (Yuan J, et al. JBI 2017)
  - Conclusion: PPCD services can be designed for clinical research networks. The security construction presented in this work specifically achieves high privacy guarantees by preventing both threats originating from within and beyond the network.

PROs, PHRs, and Patient Perspectives

Active Use of Electronic Health Records (EHRs) and Personal Health Records (PHRs) for Epidemiologic Research: Sample Representativeness and Nonresponse Bias in a Study of Women During Pregnancy

(*Bower JK, et al. eGEMs 2017.)*

- **Introduction:** Growing use of EHRs, PHRs presents opportunities for population health researchers.
- Objective: to characterize PHR users and examine sample representativeness and nonresponse bias in a study of pregnant women recruited via the PHR.
- **Design:** Demographic characteristics were examined for PHR users and nonusers.
- Enrolled study participants (responders, n=187) were then compared with nonresponders and a representative sample of the target population.

Active Use of Electronic Health Records (EHRs) and Personal Health Records (PHRs) for Epidemiologic Research: Sample Representativeness and Nonresponse Bias in a Study of Women During Pregnancy

(*Bower JK, et al. eGEMs 2017.)*

- **Results:** PHR patient portal users (34 percent of eligible persons) were older and more likely to be White, have private health insurance, and develop gestational diabetes than nonusers. 11 percent (187/1,713) completed a self-administered PHR-based questionnaire.
- Participants: more likely to be non-Hispanic White (90 percent versus 79 percent) and married (85 percent versus 77 percent), and were less likely to be Non-Hispanic Black (3 percent versus 12 percent) or Hispanic (3 percent versus 6 percent).
- Responders and nonresponders were similar regarding age distribution, employment status, and health insurance status. Demographic characteristics were similar between responders and nonresponders.
- **Discussion:** Small study, low response rate. But… overall, early evidence that: PHR may be an efficient method for recruiting and conducting observational research with additional benefits of efficiency and cost-effectiveness, but much watch demographic differences, at least for now

Integrating community-based participatory research and informatics approaches to improve the engagement and health of underserved populations.
(Unerti KM, et al. JAMIA 2016)

- **OBJECTIVE:** Compared 5 health informatics research projects that applied community-based participatory research (CBPR) approaches with the goal of extending existing CBPR principles to address issues specific to health informatics research.
- **METHODS:** Conducted a cross-case analysis of 5 diverse case studies with 1 common element: integration of CBPR approaches into health informatics research. Qualitatively examined cases for success factors and barriers, and identified common patterns across cases.

Other notable papers in this (PRO, PHRs, and Perspectives) Category:

- **Integrating community-based participatory research and informatics approaches to improve the engagement and health of underserved populations.** (Unerti KM, et al. JAMIA 2016)
  - Qualitative assessment across 5 studies:
  - CBPR approaches can be helpful, particularly in engaging populations that are typically underserved by health care and in designing patient-facing technology.
- **Opportunities and challenges in the use of personal health data for health research.**
  (Beitz MJ et al. JAMIA 2016)
  - Huge opportunities for leverage trackables, etc.
  - Challenges to the use of PHD for research were identified in six areas: data ownership; data access for research; privacy; informed consent and ethics; research methods and data quality; and the unpredictable nature of the rapidly evolving ecosystem of devices, apps, and other services that leave "digital footprints."
  - Individuals reported willingness to anonymously share PHD if it would be used to advance research for the good of the public.
  - Potential for major ways to transform how health research is conducted.

Other notable papers in this (PRO, PHRs, and Perspectives) Category:

- **Patient Perspectives on Sharing Anonymized Personal Health Data Using a Digital System for Dynamic Consent and Research Feedback: A Qualitative Study Monitoring Editor**
  (Spencer K, et al. JMIR 2016.)

- **Objective:** To explore patient perspectives on the use of anonymized health care data for research purposes.

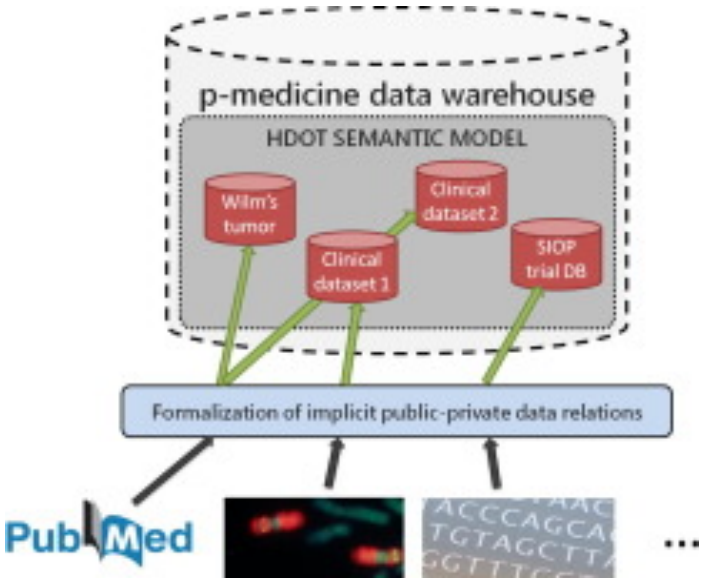
- To evaluate patient perceptions of a Dynamic Consent model and electronic system to enable and implement ongoing communication and collaboration between patients and researchers.

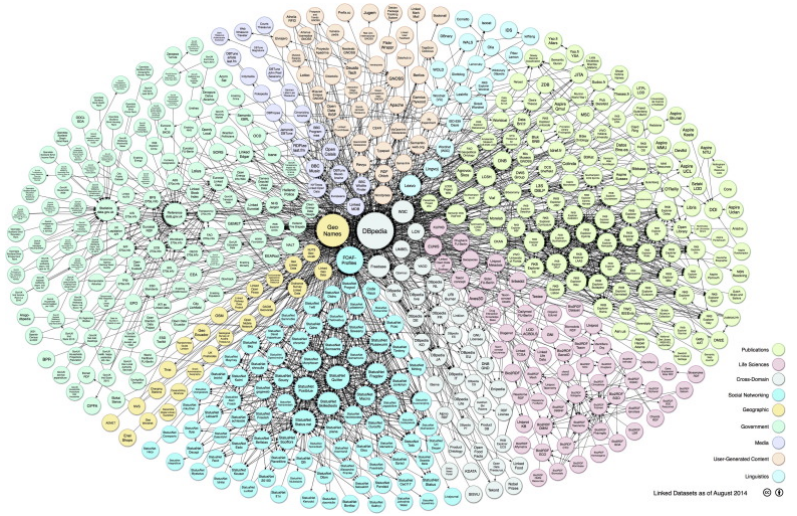
- **Conclusions:** Patients from a range of socioeconomic backgrounds viewed a digital system for Dynamic Consent positively, in particular, feedback about data recipients and research results.

- Implementation of a digital Dynamic Consent system promising, more study needed

Other notable papers in this (PRO, PHRs and Perspectives) category:

- A method and software framework for enriching private biomedical sources with data from public online repositories. (Anguia A, et al. JBI 2016)
  - This paper presents a framework that automatically locates public data of interest to the researcher and semantically integrates it with existing private datasets.
  - The framework has been designed as an extension of traditional data integration systems, and has been validated with an existing data integration platform from a European research project by integrating a private biological dataset with data from the National Center for Biotechnology Information (NCBI).





Other notable papers in this (PRO, PHRs and Perspectives) category:

- **Perceptions and Attitudes towards Medical Research in the United Arab Emirates: Results from the Abu Dhabi Cohort Study (ADCS) Focus Group Discussions** (Obaid YE, et al. PLoS One. 2016)
- Findings: Participants join research studies for varied, complex reasons, notably altruism and personal relevance.
- Authors propose specific actions to enhance participant recruitment, retention and satisfaction in the ADCS. Also identified opportunities to improve the research experience through improved study materials and communication to participants and the broader community.
- Adds to our understanding of perspectives from across globe and across cultures. Confirms many similarities to prior such studies

EHRs and Learning Health Systems

Collecting, Integrating, and Disseminating Patient-ReportedOutcomes for Research in a Learning Healthcare System.

(Harle C, et al. eGEMs. 2016)

- **Introduction:** Advances in health policy, research, and information technology have converged to increase the electronic collection and use of patient-reported outcomes (PROs).
- **Case Description:** A novel information system for electronic PROs and lessons learned in implementing that system to support research in an academic health center.
- The able software and processes that comprise the system serve three main functions:
  - (i) collecting electronic PROs in clinical care,
  - (ii) integrating PRO data with non-patient generated clinical data, and
  - (iii) disseminating data to researchers through the institution's research informatics infrastructure, including the i2b2 (Informatics for Integrating Biology and the Bedside) system.

Collecting, Integrating, and Disseminating Patient-Reported Outcomes for Research in a Learning Healthcare System. (Harle C, et al. eGEMs. 2016)

Figure 1. Process of Collecting Electronic PROs, Integrating PRO Data with Other Clinical Data, and Disseminating Research Data to Researchers

1. Electronic PRO collection

A. Patient completes PRO assessment using tablet computer

Sample question from computer-adaptive testing assessment implemented in CHOIR software

B. PRO assessment automatically scored and sent to patient's EHR as discrete results

```
MSH|^~\&|CHOIR|UF|EPIC|UF|201502231524||ORU^R01|20150223152420000055984|P|2.1
PID|1||14111264^^^^MR||Test^Gravy||19550215|U|||||||||20000055984
OBR|1||CHOIR1|CHOIR^Patient Reported Health
Outcomes^GVCHOIR|||201502231524|||FINAL|||201502231524||999999^PROVID|||||201502231524|||F
OBX|1|NM|6001^Pain Intensity Least - PROMIS^GVCHOIRLRR||5||Moderate||||F|||201502231524
...
OBX|6|NM|5965^PROMIS Fatigue^GVCHOIRLRR||54|||||F|||201502231524
OBX|7|NM|5966^PROMIS Sleep Disturbance^GVCHOIRLRR||51|||||F|||201502231524
OBX|8|NM|5967^PROMIS Anxiety^GVCHOIRLRR||70|||||F|||201502231524
...
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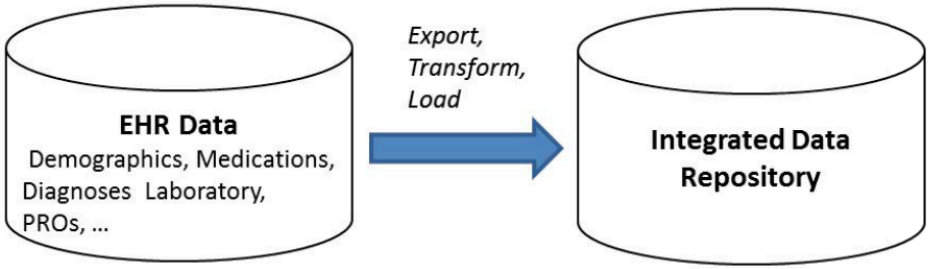
Snippet of HL7v2.1 message sent from CHOIR to Epic EHR laboratory/results interface

2. integration of PRO data with other clinical data



3. Data dissemination to researchers

A. *I2b2 web client for patient counts or cohort discovery*

B. *Research data request process for detailed IDR data*

Collecting, Integrating, and Disseminating Patient-Reported Outcomes for Research in a Learning Healthcare System. (Harle C, et al. eGEMs. 2016)

Table 1. Summary of Outcomes Assessed During System Design, Implementation, and Six Months Postimplementation

SYSTEM FUNCTION	OUTCOMES
Collecting electronic PROs in clinical care	• Two practices adopted and using system. • Automated identification of patients who qualified to complete assessments reduced concerns about workflow disruption. • Patients typically completed questionnaires in less than 10 minutes. • Eighty-four percent of patients said they would be comfortable reporting outcomes using a tablet computer. • Patients completed 309 total PRO assessments.
Integrating PRO data with other clinical data not reported by the patient	• PRO results consistently loaded into the EHR after patients reported them. • PROs results are a standard part of regular data loads from clinical information systems to the research information systems (i.e., IDR).
Disseminating data to researchers	• Two research studies actively acquiring PRO data via i2b2 and data request process. • Average of 9.5 i2b2 queries per month involving PRO data. • Average of 519 i2b2 queries per month involving any clinical data.

Collecting, Integrating, and Disseminating Patient-Reported Outcomes for Research in a Learning Healthcare System.

Table 2. Strategies and Lessons Learned in Collecting, Integrating, and Disseminating Patient-Reported Outcomes

STRATEGIES	LESSONS LEARNED
Strategy 1: Use of multiple interfaced technologies rather than a single system, such as the EHR, to support PROs	• The system benefitted from functionality not available in the EHR, including computer-adaptive PRO assessments and an easy-to-use interface for patients. • More resources were required during start-up and for ongoing maintenance due to using multiple and less mature technologies.
Strategy 2: Use of standardized approaches to measuring, exchanging, and disseminating PROs	• Using standardized and validated PROMIS measures likely increased the data's usefulness for internal researchers and future inter-institutional research partnerships. • PROMIS measures are not fully mapped to data standards for reporting results (e.g., LOINC). • PROMIS measure scores are not well understood by clinicians for use in patient care. • Using accepted HL7 messaging standards to communicate between systems will reduce the complexity of future system maintenance, upgrades, and other required changes.
Strategy 3: Use of technologies and processes that aligned with existing clinical-research information management strategies	• The implementation benefitted from broad institutional support for collecting electronic PROs and from the institution's interest in increasing the use of electronic clinical data in research generally. • Institutional strategies and processes evolve. Thus, to be successful, the PRO system must adapt to new organizational information technology strategies and requirements.

Collecting, Integrating, and Disseminating Patient-ReportedOutcomes for Research in a Learning Healthcare System.

(Harle C, et al. eGEMs. 2016)

- **Strategies:** Successful design and implementation was driven by three overarching strategies.
- First, selected and implemented multiple interfaced technologies to support PRO collection, management, and research use.
- Second, aimed to use standardized approaches to measuring PROs, sending PROs between systems, and disseminating PROs.
- Finally, we focused on using technologies and processes that aligned with existing clinical research information management strategies within our organization.
- **Conclusion:** Early lessons for implementers and researchers enhance the scale and sustainable use of systems for research use of PROs.

Physicians' perception of alternative displays of clinical research evidence for clinical decision support – A study with case vignettes (Slager SL, Weir CR, et al. Jour Biomed Informatics**.** Jan 2017)

- **Objective:** To design alternate information displays that present summaries of clinical trial results to clinicians to support decision-making; and to compare the displays according to efficacy and acceptability.

- **Methods:** A 6-between (information display presentation order) by 3-within (display type) factorial design.
- Two alternate displays were designed based on Information Foraging theory:
  - a narrative summary that reduces the content to a few sentences; and
  - a table format that structures the display according to the PICO (Population, Intervention, Comparison, Outcome) framework.
  - The designs were compared with the summary display format available in PubMed.
  - Physicians were asked to review five clinical studies retrieved for a case vignette; and were presented with the three display formats.

Physicians' perception of alternative displays of clinical research evidence for clinical decision support – A study with case vignettes (Slager SL, Weir CR, et al. Jour Biomed Informatics. Jan 2017)

AFIB

58 year old male with recent onset AFIB who shows at the ED with an acute episode. You are considering vernakalant as an option to cardiovert this patient and would like to review the evidence on its efficacy and safety.

Please click the link below to find the information you need, then return to this survey.

Atrial Fibrillation

Fig. 1. Atrial fibrillation vignette.

Results: 5

1. Effect of dietary fish oil on atrial fibrillation after cardiac surgery.
Farquharson AL, Metcalf RG, Sanders P, Stuklis R, Edwards JR, Gibson RA, Cleland LG, Sullivan TR, James MJ, Young GD.
Am J Cardiol. 2011 Sep 15;108(6):851-6. doi: 10.1016/j.amjcard.2011.04.036. Epub 2011 Jul 15.
PMID: 21762871
Similar articles

2. A randomized active-controlled study comparing the efficacy and safety of vernakalant to amiodarone in recent-onset atrial fibrillation.
Camm AJ, Capucci A, Hohnloser SH, Torp-Pedersen C, Van Gelder IC, Mangal B, Beatch G; AVRO Investigators.
J Am Coll Cardiol. 2011 Jan 18;57(3):313-21. doi: 10.1016/j.jacc.2010.07.046.
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Similar articles

3. Vernakalant hydrochloride: A novel atrial-selective agent for the cardioversion of recent-onset atrial fibrillation in the emergency department.
Stiell IG, Dickinson G, Butterfield NN, Clement CM, Perry JJ, Vaillancourt C, Calder LA.
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4. Usefulness of vernakalant hydrochloride injection for rapid conversion of atrial fibrillation.
Pratt CM, Roy D, Torp-Pedersen C, Wyse DG, Toft E, Juul-Moller S, Retyk E, Drenning DH; Atrial Arrhythmia Conversion Trial (ACT-III) Investigators.
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5. Pharmacokinetics of novel atrial-selective antiarrhythmic agent vernakalant hydrochloride injection (RSD1235): influence of CYP2D6 expression and other factors.
Mao ZL, Wheeler JJ, Clohs L, Beatch GN, Keims J.
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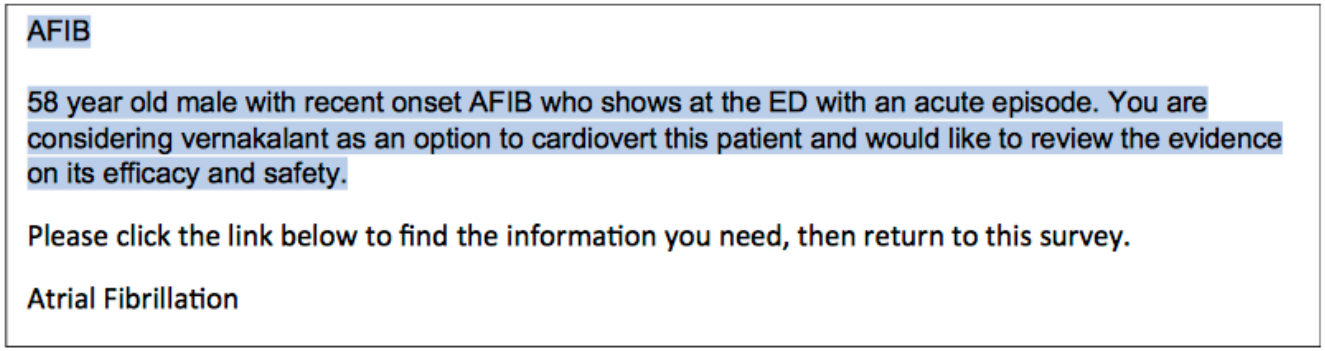
Similar articles

Fig. 2. PubMed summary display format for atrial fibrillation. Participants had to click on each article title to read the study abstract.

Physicians' perception of alternative displays of clinical research evidence for clinical decision support – A study with case vignettes (Slager SL, Weir CR, et al. Jour Biomed Informatics. Jan 2017)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Atrial Fibrillation

Fig. 1. Atrial fibrillation vignette.

- The scenario
- Three displays tested with each subjects…

Physicians' perception of alternative displays of clinical research evidence for clinical decision support – A study with case vignettes (Slager SL, Weir CR, et al. Jour Biomed Informatics. Jan 2017)

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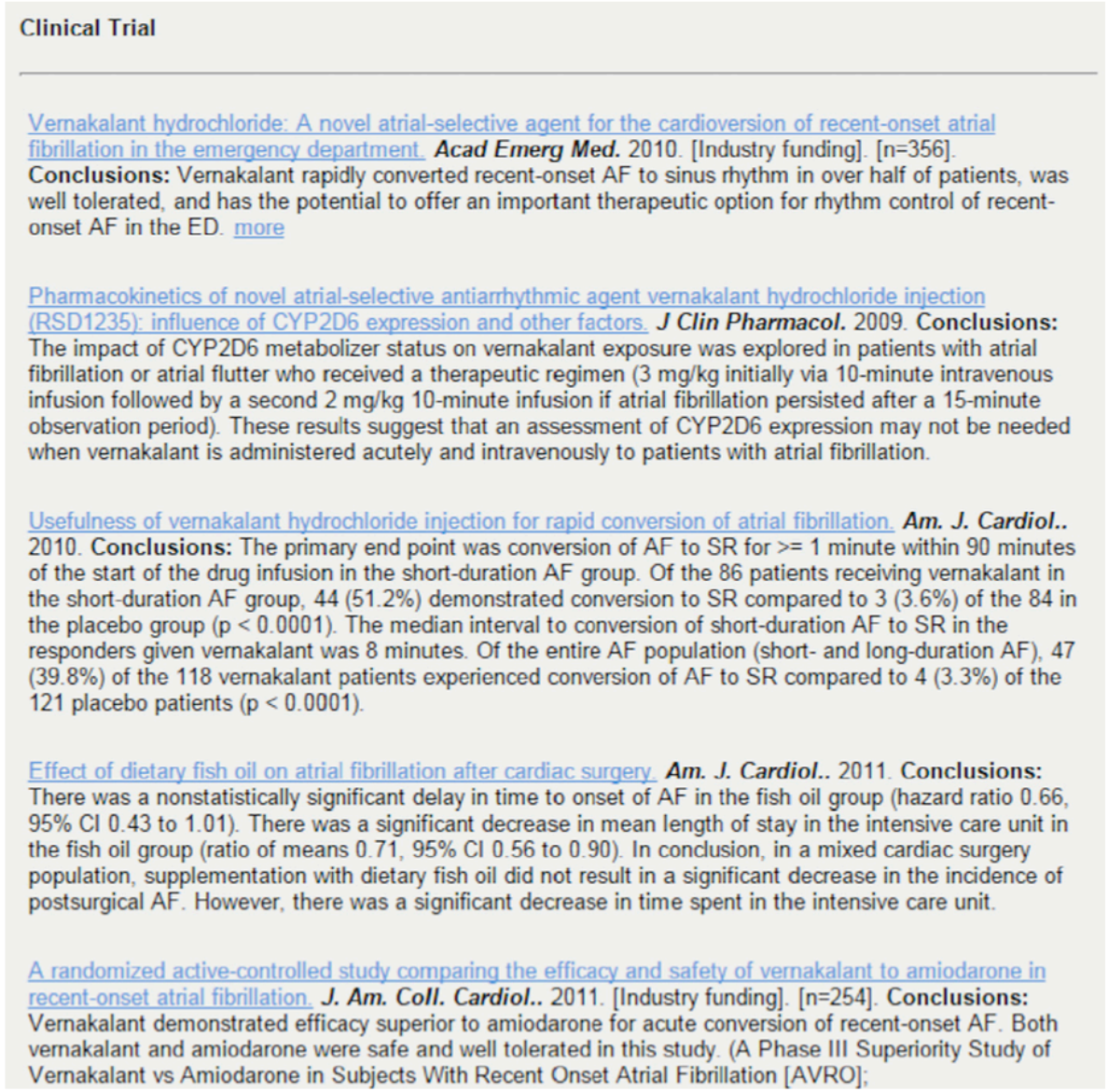

Clinical Trial

Vernakalant hydrochloride: A novel atrial-selective agent for the cardioversion of recent-onset atrial fibrillation in the emergency department. ***Acad Emerg Med.*** 2010. [Industry funding]. [n=356]. **Conclusions:** Vernakalant rapidly converted recent-onset AF to sinus rhythm in over half of patients, was well tolerated, and has the potential to offer an important therapeutic option for rhythm control of recent-onset AF in the ED. more

Pharmacokinetics of novel atrial-selective antiarrhythmic agent vernakalant hydrochloride injection (RSD1235): influence of CYP2D6 expression and other factors. ***J Clin Pharmacol.*** 2009. **Conclusions:** The impact of CYP2D6 metabolizer status on vernakalant exposure was explored in patients with atrial fibrillation or atrial flutter who received a therapeutic regimen (3 mg/kg initially via 10-minute intravenous infusion followed by a second 2 mg/kg 10-minute infusion if atrial fibrillation persisted after a 15-minute observation period). These results suggest that an assessment of CYP2D6 expression may not be needed when vernakalant is administered acutely and intravenously to patients with atrial fibrillation.

Usefulness of vernakalant hydrochloride injection for rapid conversion of atrial fibrillation. ***Am. J. Cardiol..*** 2010. **Conclusions:** The primary end point was conversion of AF to SR for >= 1 minute within 90 minutes of the start of the drug infusion in the short-duration AF group. Of the 86 patients receiving vernakalant in the short-duration AF group, 44 (51.2%) demonstrated conversion to SR compared to 3 (3.6%) of the 84 in the placebo group ($p < 0.0001$). The median interval to conversion of short-duration AF to SR in the responders given vernakalant was 8 minutes. Of the entire AF population (short- and long-duration AF), 47 (39.8%) of the 118 vernakalant patients experienced conversion of AF to SR compared to 4 (3.3%) of the 121 placebo patients ($p < 0.0001$).

Effect of dietary fish oil on atrial fibrillation after cardiac surgery. ***Am. J. Cardiol..*** 2011. **Conclusions:** There was a nonstatistically significant delay in time to onset of AF in the fish oil group (hazard ratio 0.66, 95% CI 0.43 to 1.01). There was a significant decrease in mean length of stay in the intensive care unit in the fish oil group (ratio of means 0.71, 95% CI 0.56 to 0.90). In conclusion, in a mixed cardiac surgery population, supplementation with dietary fish oil did not result in a significant decrease in the incidence of postsurgical AF. However, there was a significant decrease in time spent in the intensive care unit.

A randomized active-controlled study comparing the efficacy and safety of vernakalant to amiodarone in recent-onset atrial fibrillation. ***J. Am. Coll. Cardiol..*** 2011. [Industry funding]. [n=254]. **Conclusions:** Vernakalant demonstrated efficacy superior to amiodarone for acute conversion of recent-onset AF. Both vernakalant and amiodarone were safe and well tolerated in this study. (A Phase III Superiority Study of Vernakalant vs Amiodarone in Subjects With Recent Onset Atrial Fibrillation [AVRO];

Fig. 3. Narrative summary display for a case vignette on atrial fibrillation.

Physicians' perception of alternative displays of clinical research evidence for clinical decision support – A study with case vignettes (Slager SL, Weir CR, et al. Jour Biomed Informatics. Jan 2017)

Vernakalant hydrochloride: A novel atrial-selective agent for the cardioversion of recent-onset atrial fibrillation in the emergency department. ***Acad Emerg Med***. 2010.			
Population	**Primary Outcome**	**Study arm/results**	**Conclusion**
Adults with recent-onset AF (> 3 to <= 48 hours) presenting to the ED (n=290)	Conversion to sinus rhythm within 90 minutes	59.4% vernakalant vs. 4.9% placebo	Vernakalant rapidly converted recent-onset AF to sinus rhythm in over half of patients, was well tolerated, and has the potential to offer an important therapeutic option for rhythm control of recent-onset AF in the ED.

Pharmacokinetics of novel atrial-selective antiarrhythmic agent vernakalant hydrochloride injection (RSD1235): influence of CYP2D6 expression and other factors. ***J Clin Pharmacol***. 2009.			
Healthy volunteers and patients with atrial fibrillation or atrial flutter	Maximum plasma concentration	Little difference in vernakalant maximum plasma concentration or area under the plasma concentration-time curve from the start of the first infusion to 90 minutes between CYP2D6 poor metabolizers and extensive metabolizers.	Gender, age, and renal function did not have a clinically significant influence on the pharmacokinetics of vernakalant. An assessment of CYP2D6 expression may not be needed when vernakalant is administered acutely and intravenously to patients with atrial fibrillation.

Usefulness of vernakalant hydrochloride injection for rapid conversion of atrial fibrillation. ***Am J Cardiol***. 2010.			
AF or atrial flutter with arrhythmia duration of >3 hours to <=45 days (n=276)	Conversion of AF to SR	39.8% vernakalant vs. 3.3% placebo ($p<0.0001$) Transient dysgeusia and sneezing were the most common adverse events.	Vernakalant demonstrated a rapid and high rate of conversion for short-duration AF and was well tolerated.

Effect of dietary fish oil on atrial fibrillation after cardiac surgery. ***Am J Cardiol***. 2011.			
Postsurgical AF after CABG and valve procedures (n=200)	Incidence of AF in the first 6 days after surgery	47 of 97 in the control group vs. 36 of 97 in the fish oil group developed AF (OR 0.63, 95% CI 0.35 to 1.11	Supplementation with dietary fish oil did not result in a significant decrease in the incidence of postsurgical AF. However, there was a significant decrease in time spent in the intensive care unit.

A randomized active-controlled study comparing the efficacy and safety of vernakalant to amiodarone in recent-onset atrial fibrillation. ***J Am Coll Cardiol***. 2011.			
Adult patients with AF (3 to 48 h duration) eligible for cardioversion (n=254)	Conversion from AF to sinus rhythm within the first 90 min	60 of 116 (51.7%) vernakalant vs. 6 of 116 (5.2%) amiodarone ($p < 0.0001$).	Vernakalant demonstrated efficacy superior to amiodarone for acute conversion of recent-onset AF. Both vernakalant and amiodarone were safe and well tolerated in this study.

Fig. 4. PICO tabular display format for a case vignette on atrial fibrillation.

Physicians' perception of alternative displays of clinical research evidence for clinical decision support – A study with case vignettes (Slager SL, Weir CR, et al. Jour Biomed Informatics**.** Jan 2017)

- **Results:** 20 physicians completed the study. Overall, participants rated the table display more highly than either the text summary or PubMed's summary format (5.9 vs. 5.4 vs. 3.9 on a scale between 1 [strongly disagree] and 7 [strongly agree]).

- **Conclusion:** The table format reduced physicians' perceived cognitive effort when quickly reviewing clinical trial information and was more favorably received by physicians than the narrative summary or PubMed's summary format display.

- As we work to translate knowledge into practice, this kind of work is very informative.

Other notable papers in this (EHRs/LHS) category:

- **'Learn From Every Patient': Implementation and Early Results of a Learning Health System** (LP Lowes et al. Dev Med Child Neurol. 2016)
  - Pragmatic example in Pediatric setting of operationalizing a LHS model for a particular condition.
- **Creating Local Learning Health Systems: Think Globally, Act Locally.** (Smoyer WE, et al. JAMA 2016)
  - Viewpoint on considerations from multi-stakeholder perspective on operationalizing LHS at local site
  - Realignment/rethinking of roles, resources, etc.
- **Patient-Centered Network of Learning Health Systems: Developing a resource for clinical translational research** (Rutten, LJF, et al. J. Clin Trans Science. 2017)
  - PCORI supported CDRN focused on enabling the PCORNET vision – with an LHS focus. Description of the network.
  - Another example of LHS thread weaving through what we do in CRI.

Other notable papers in this (EHRs/LHS) category:

- **Clinician Engagement For Continuous Learning. (**Platt R, et al. National Academy of Medicine Perspectives. 2017.)
  - A discussion paper that advances the vision of a continuously learning health system, focusing on actions to foster more active engagement of front-line clinicians.
  - Spoiler alert: they should be involved in design of research studies!

BOX 1
Characteristics of a Continuously Learning Health System

Science and Informatics

- ***Real-time access to knowledge*** **—** A learning health care system continuously and reliably captures, curates, and delivers the best available evidence to guide, support, tailor, and improve clinical decision making and care safety and quality.
- ***Digital capture of the care experience*** **—** A learning health care system captures the care experience on digital platforms for real-time generation and application of knowledge for care improvement.

Patient-Clinician Relationships

- ***Engaged, empowered patients*** **—** A learning health care system is anchored on patient needs and perspectives and promotes the inclusion of patients, families, and other caregivers as vital members of the continuously learning care team.

Incentives

- ***Incentives aligned for value*** **—** In a learning health care system, incentives are actively aligned to encourage continuous improvement, identify and reduce waste, and reward high-value care.
- ***Full transparency*** **—** A learning health care system systematically monitors the safety, quality, processes, prices, costs, and outcomes of care, and makes information available for care improvement and informed choices and decision making by clinicans, patients, and their families.

Care

- ***Leadership-instilled culture of learning*** **—** A learning health care system is stewarded by leadership committed to a culture of teamwork, collaboration, and adaptability in support of continuous learning as a core aim.
- ***Supportive system competencies*****—** In a learning health care system, complex care operations and processes are constantly refined through ongoing team training and skill building, systems analysis and information development, and creation of the feedback loops for continuous learning and system improvement.

Adapted from Institute of Medicine, Best Care at Lower Cost: The Path to Continuously Learning Health Care in America, 2013.

CRI Education and Training

Core informatics competencies for clinical and translational scientists: what do our customers and collaborators need to know? (Valenta et al. JAMIA 2016)

- Long tradition (since 2006) of developing and updating core competencies for Clinical and Translational Science (CTS) trainees.
- By 2009, 14 competency domains, including biomedical informatics, had been identified and published.
- Still, most programs have limited education (Figure 1)
- Given rapid changes, update needed
- Robus and inclusive process to put forth a new set of competencies
- Endorsed by AMIA Clinical Research Informatics Workgroup of AMIA.
- A model for development and revision of competencies over time.

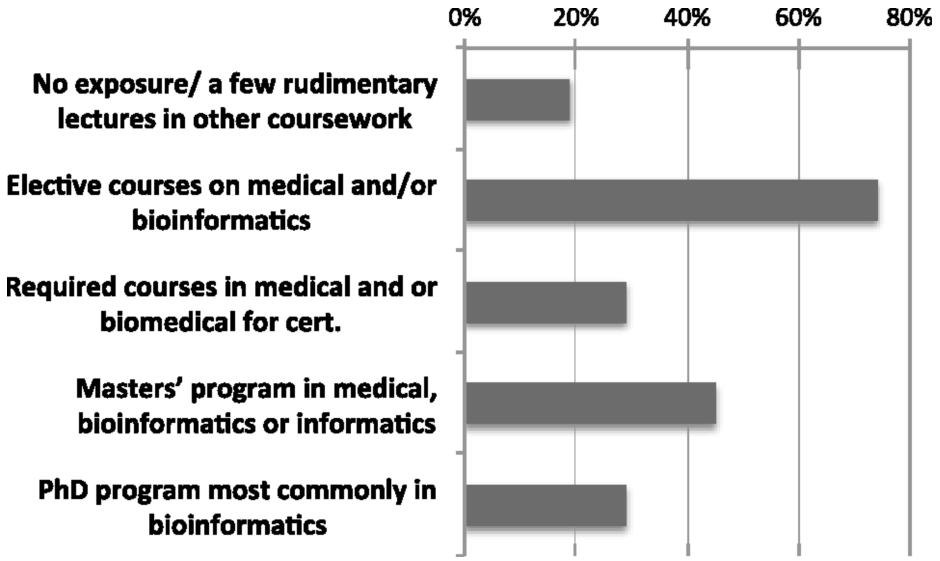

Figure 1: Survey of Education committee participants regarding which scenario best describes the training available at their institution for C & T scientists (multiple answers allowed). Percentages based on 31 responding sites. Duplicate answers from the same site were omitted.

Other articles in: CRI Education and Training

- **Analysis of professional competencies for the clinical research data management profession: implications for training and professional certification.** (Zozus MN, et al. JAMIA 2017)
  - Survey of CRDMs over 91 professional competencies
  - Findings scope the profession, serve as a foundation for the next revision of the Certified Clinical Data Manager exam.
  - Helps inform the content of graduate degree programs or tracks in areas including CRI
- **A scoping review of competencies for scientific editors of biomedical journals.** (Galipeau J, et al. BMC Med. 2016)
  - Scoping review is the first attempt to systematically identify possible competencies of editors.
  - Step toward developing minimum set of core competencies for scientific editors of biomedical journals – next steps: a training needs assessment, a Delphi exercise, and a consensus meeting.

Other articles in: CRI Education and Training

- **Data literacy training needs of biomedical researchers.** (Federer LM, et al. J Med Libr Assoc. 2016)
  - Small sample, but interesting study on data literacy among NIH-associated researchers and staff
  - Conclusion: Most respondents did not have any formal training in data literacy. Respondents considered most tasks highly relevant to their work but rated their expertise in tasks lower.
  - Oh, and, librarians are awesome and underutilized to rectify this!
- **The training of next generation data scientists in biomedicine (**Garmire LX, et al. Pac Symp Biocomput. 2016)
  - Context: growing need for training related specifically to BD2K efforts – particularly K01 mentored scientist career awards
  - Addresses specific trainings needed in representative data science areas, in order to make the next generation of data scientists in biomedicine.

CRI Policy & Perspectives:

CRI Policy & Perspectives:

- **Health IT vendors and the academic community: The 2014 ACMI debate**
  - McCray et al. JBI April 2016.

- **Crossing the health IT chasm: considerations and policy recommendations to overcome current challenges and enable value-based care (**Adler-Milstein J, et al. JAMIA 2017)

- **Pragmatic (trial) informatics: a perspective from the NIH Health Care Systems Research Collaboratory.** Richesson RL et al.
  - 4 broad categories of informatics-related challenges:
    - (1) using clinical data for research, (2) integrating data from heterogeneous systems, (3) using electronic health records to support intervention delivery or health system change, and (4) assessing and improving data capture to define study populations and outcomes.
    - These challenges impact the validity, reliability, and integrity of PCTs.
    - Informs work to enable PCTs and LHS.

CRI Policy & Perspectives:

- **Intersection of CRI and Precision Health Informatics:**
  - Million Veteran Program: A mega-biobank to study genetic influences on health and disease
    - John Michael Gaziano, et al. J. Clin. Epid. 2016
- **An informatics research agenda to support precision medicine: seven key areas**
    - Tenenbaum JD et al. JAMIA 2016Clinical Research Informatics for Big Data and Precision Medicine.
- **Clinical Research Informatics for Big Data and Precision Medicine.**
    - Weng C, Kahn MG. Yearb Med Inform. 2016

CRI Policy & Perspectives:

- ***Information Needs and Organizational Dynamics***
- **Data management in clinical research: Synthesizing stakeholder perspectives**
  - Johnson SB, JBI 2016
- **Key cost drivers of pharmaceutical clinical trials in the United States.**
  - Sertkaya A, et al. Clin Trials. 2016
- **Retooling institutional support infrastructure for clinical research**
  - Snyder DC, Cont Clin Trials. 2016

CRI Policy & Perspectives:

- ***Data Access and Policy Factors***
- **Health information exchanges—Unfulfilled promise as a data source for clinical research**
  - Parker C, et al. IJMI 2016
- **Facilitating biomedical researchers' interrogation of electronic health record data: Ideas from outside of biomedical informatics**
  - Hruby G et al. JBI 2016
- **Reconsidering Anonymization-Related Concepts and the Term "Identification" Against the Backdrop of the European Legal Framework.**
  - Sariyar M, Schlünder I. Biopreserv Biobank. 2016.

Notable CRI-Related Events

- Launch of new journal:
  - Learning Health Systems – C. Friedman, Editor-in-Chief

- Yearbook of Medical Informatics
  - **Clinical Research Informatics Contributions from 2015.**
    - Daniel C, Choquet R. 2016

COMMENTARIES

The forgetting health system
Enrico Coiera
Version of Record online: 21 MAR 2017 | DOI: 10.1002/lrh2.10023
Abstract | Article | PDF(290K) | References | Request Permissions

Learning in the health care enterprise
William B. Rouse, Michael M.E. Johns and Kara M. Pepe
Version of Record online: 10 MAR 2017 | DOI: 10.1002/lrh2.10024
Abstract | Article | PDF(339K) | References | Request Permissions

EXPERIENCE REPORTS

Knowledge management in the era of digital medicine: A programmatic approach to optimize patient care in an academic medical center
Jane L. Shellum, Rick A. Nishimura, Dawn S. Milliner, Charles M. Harper Jr. and John H. Noseworthy
Version of Record online: 13 FEB 2017 | DOI: 10.1002/lrh2.10022
Abstract | Article | PDF(680K) | References | Request Permissions

RESEARCH REPORTS

The implications and impact of 3 approaches to health information exchange: community, enterprise, and vendor-mediated health information exchange
Jordan Everson
Version of Record online: 6 JAN 2017 | DOI: 10.1002/lrh2.10021
Abstract | Article | PDF(150K) | References | Request Permissions

TECHNICAL REPORTS

Embedding data provenance into the Learning Health System to facilitate reproducible research
Vasa Curcin
Version of Record online: 27 DEC 2016 | DOI: 10.1002/lrh2.10019
Abstract | Article | PDF(961K) | References | Request Permissions

EXPERIENCE REPORTS

A tale of two cities: Developing health information platforms for a learning health system in Austin and in New Orleans
Anjum Khurshid
Version of Record online: 28 NOV 2016 | DOI: 10.1002/lrh2.10017
Abstract | Article | PDF(665K) | References | Request Permissions

Notable CRI-Related Events

- Common Rule changes:
  - Finalized Jan 19, 2017
  - Key provisions:
    - Does NOT require consent for biospecimens
    - New flexibilities to use single IRBs for multi-institutional research studies;
    - Enables broad consent for future research using stored identifiable data
    - New exemptions for secondary research involving identifiable private information.

Notable CRI-Related Events

- NIH news:
  - NLM events
    - New Director – Dr. Patti Brennan
  - NCATS activity
    - CTSA Coordinating Center
    - CD2H Informatics Coordinating Center opportunity

Notable CRI-Related Events

- **More form NLM: final rule for ClinicalTrials.gov**
  - Final Rule for Clinical Trials Registration and Results Information Submission (42 CFR Part 11).
  - The final rule clarifies and expands requirements for submitting clinical trial registration and results information to ClinicalTrials.gov
  - The final rule is intended to make it clear to sponsors, investigators, and the public which trials must be reported, when they must be reported, and whether compliance with requirements has been achieved.
  - Effective: January 18, 2017; Compliance: April 18, 2017.
- **Uncertainty about ONC/CMS efforts…**
  - Meaningful use, MACRA, MIPS, etc.
  - Impact on EHRs/use, and therefore impacts to CRI

Notable CRI-Related Events

- NIH budget increase requested…
  - President has proposed an overall budget increase of $825 million for the NIH in fiscal year 2017 compared with 2016. That money would be reserved for three efforts: the NCI's "moonshot" initiative, the Precision Medicine Initiative cohort program, and the BRAIN program.

Notable CRI-Related Events

- ~~NIH budget increase requested…~~
  - ~~President has proposed an overall budget increase of $825 million for the NIH in fiscal year 2017 compared with 2016. That money would be reserved for three efforts: the NCI's "moonshot" initiative, the Precision Medicine Initiative cohort program, and the BRAIN program.~~
- Sorry – that was last year's slide…
- Proposed cut of $5.8B next year
- As of this morning: NIH budget to be reduced by $1.2B in 2017

In Summary…

- Informatics approaches in CRI continue to accelerate
  - **Much** more activity than in years past
  - I'm sure it will only continue!
- CRI *maturing* and clearly driving science
- Multiple groups/initiatives converging on common needs to advance the field
- CRI initiatives and investments beginning to realize the vision of the "*learning health system*"
- Despite uncertainty, no question CRI is and will remain relevant
- A **very** exciting time to be in CRI!

Thanks!

Special thanks to those who suggested articles/events to highlight, particularly:

- Neil Sarkar
- Justin Starren
- Rachel Richesson
- Philip Payne
- Chunhua Weng
- Adam Wilcox
- Jeff Smith

Thanks!

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Slideshow, files: http://www.embi.net/