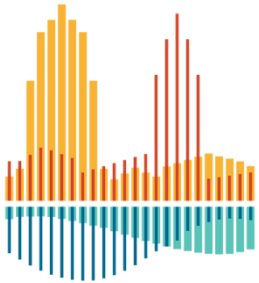
Electronic Health Records and Research Possibilities



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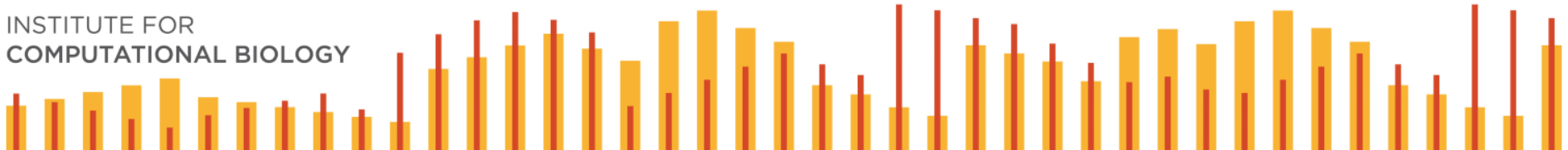
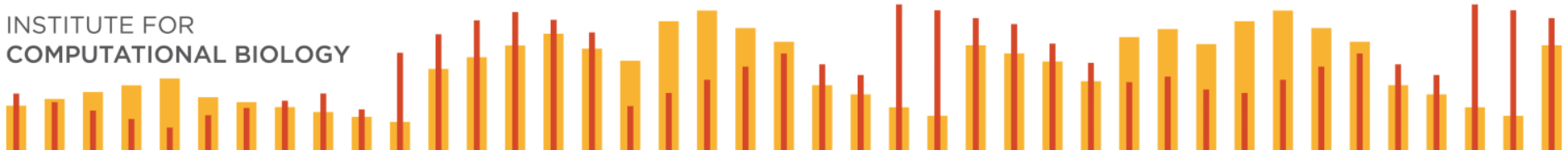
What are Electronic Health Records?

- A digital version of a patient's paper chart
- Used to track changes in a patient's health over time, documenting medical history, diagnoses, and laboratory test results
- Ideally available across multiple clinics, institutions, states, and countries



Electronic Health Record Systems

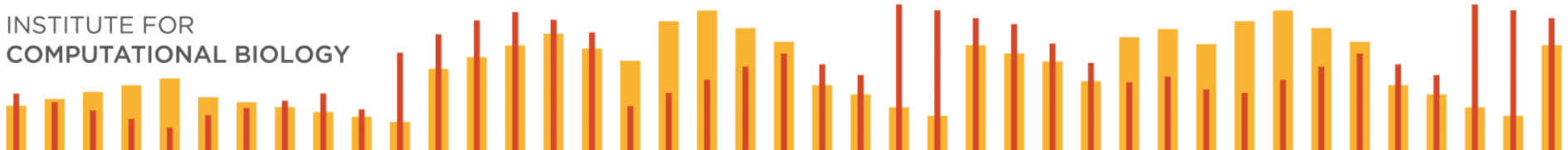
- Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009
- Incentivizes the nationwide adoption of EHR systems in the US
- While there are standards and commonalities, EHR systems are very heterogeneous
- Examples include Epic Systems, Allscripts, Meditech, Cerner, IBM, McKesson, Siemens, GE Healthcare



Electronic Health Record Components

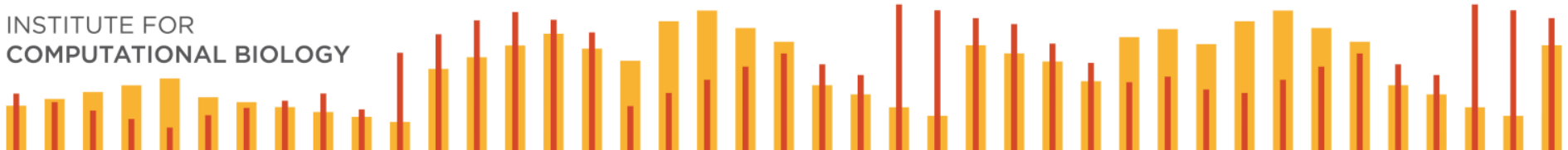
- Structured Elements
- Pseudo-Structured Text
- Unstructured Text

EHR elements can differ between systems and clinics



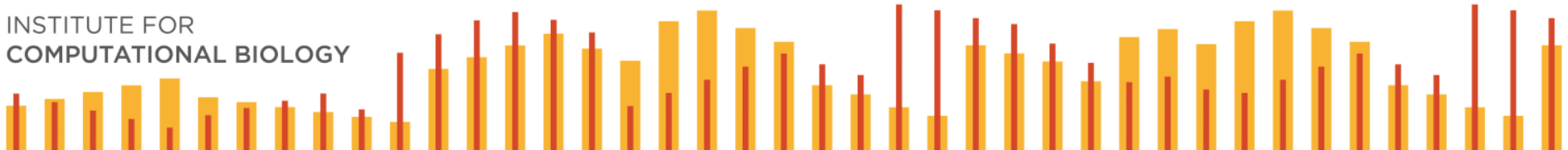
Structured Elements

- Demographic information
  - Date of birth, race/ethnicity, gender
- Vital Signs
  - Heart rate, blood pressure, height, weight, body temperature
- Some Laboratory Values
  - WBC, insulin, glucose, glomerular filtration rate (GFR)
- Billing and Procedure codes
  - ICD9/10, CPT, ICD-O-3



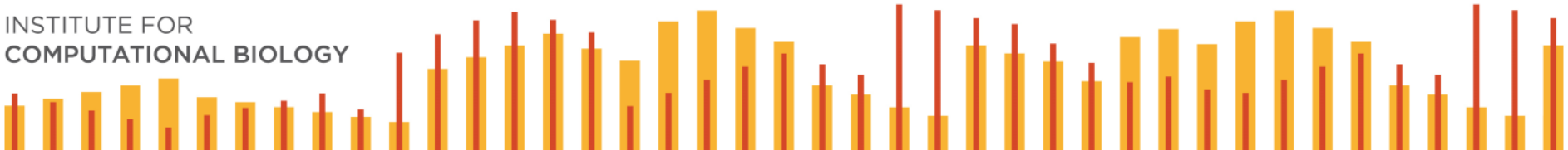
Pseudo-structured Text

- Free text documents with a loosely standardized format
- History and Physical Examination (HPE)
- *“… approximately 10 months status post bilateral bunionectomy with metatarsal head resections 2 through 5 bilaterally. She denies any pain in her feet although she is a little upset that she has had a recurrence of her bilateral hallux valgus, left worse than the right. ”*
- *“She does have some residual hallux valgus, worse on the left then on the right, but this is not uncommon following bunionectomy. We discussed the fact that her bunions were so bad to begin with, that her feet actually look pretty good.“*
- Problem List / Known significant medical conditions and procedures / Allergies



Unstructured Text

- Clinical communications (phone calls, prescription refills, etc)
- Discharge notes
- Clinic-specific notes
- Laboratory / Procedure reports (CT scan, colonoscopy, etc)
- “Medical flotsam”

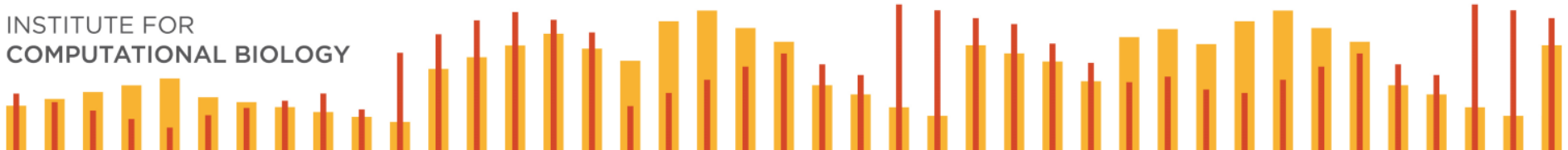


The EHR Existential Crisis

At some point in everyone's life, they realize that…

- Their parents don't know everything.
- Their doctor doesn't know everything.
- Their medical record may be wrong.

EHRs are very useful, but they can be noisy and inaccurate.



Example: Body Mass Index

Height and Weight are the most ubiquitous measures reported in an EHR

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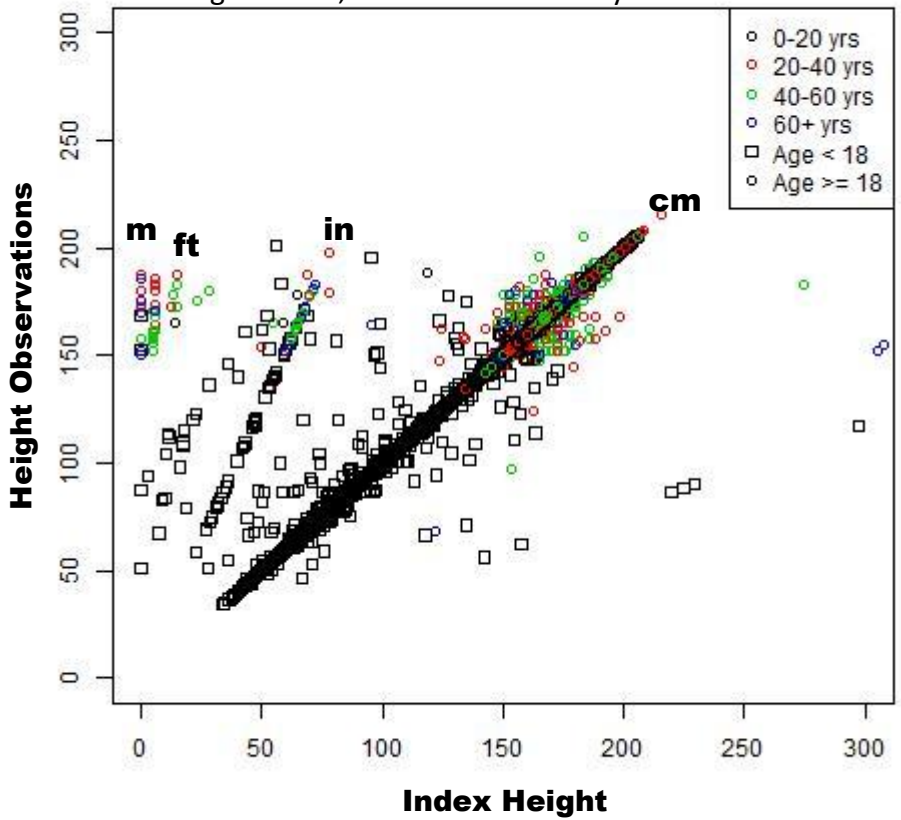

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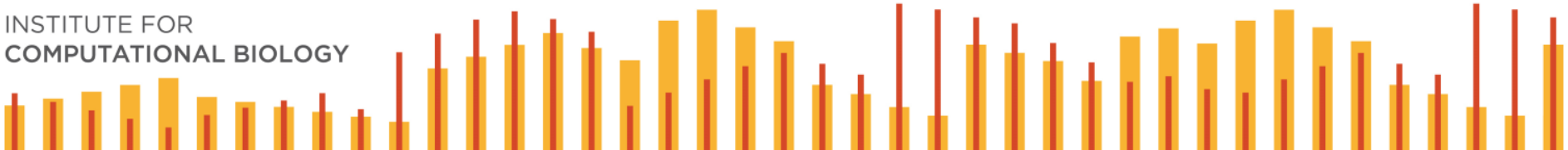
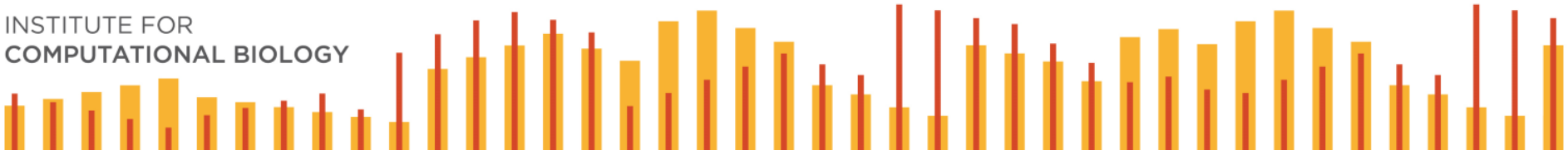
More Structure does not Imply Higher Accuracy

- As with BMI, units are important and are not always enforced
- Problem lists from the Free Text often include past conditions that may not be captured by the current clinical care system
- Diagnosis and Procedure codes are used for **billing**. Billing does not always reflect scientific reality



Clinical Versus Research Use

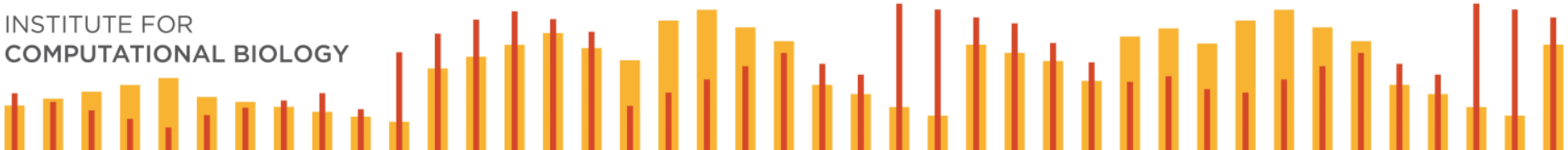
- In clinical practice, records and values are examined individually
  - Errors are easy to spot and ignore
  - Aggregate data is synthesized by experts in the context of a patient
- In research, records and values are examined in aggregate
  - Errors are not so easy to identify
  - Data points are examined outside the context of the patient



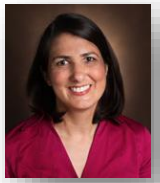
EHR Research Opportunities

How do we:

- Generate consistent representations of diseases (or *harmonize*) across multiple different clinical systems?
- Properly capture race, demographic, occupational, and social factors within EHR systems?
- Restructure and visualize the massive amounts of data available within EHR systems?



EHRs Provide New Opportunities for Research



- Can we identify new genetic risk factors for disease?
- Can we develop a more detailed understanding of disease architecture and shared components of disease?
- Can we aid physicians and improve patient care?

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