

Starting **U**niversity **C**linical **C**areers **E**fficiently, **S**cholarly, and **S**uccessfully

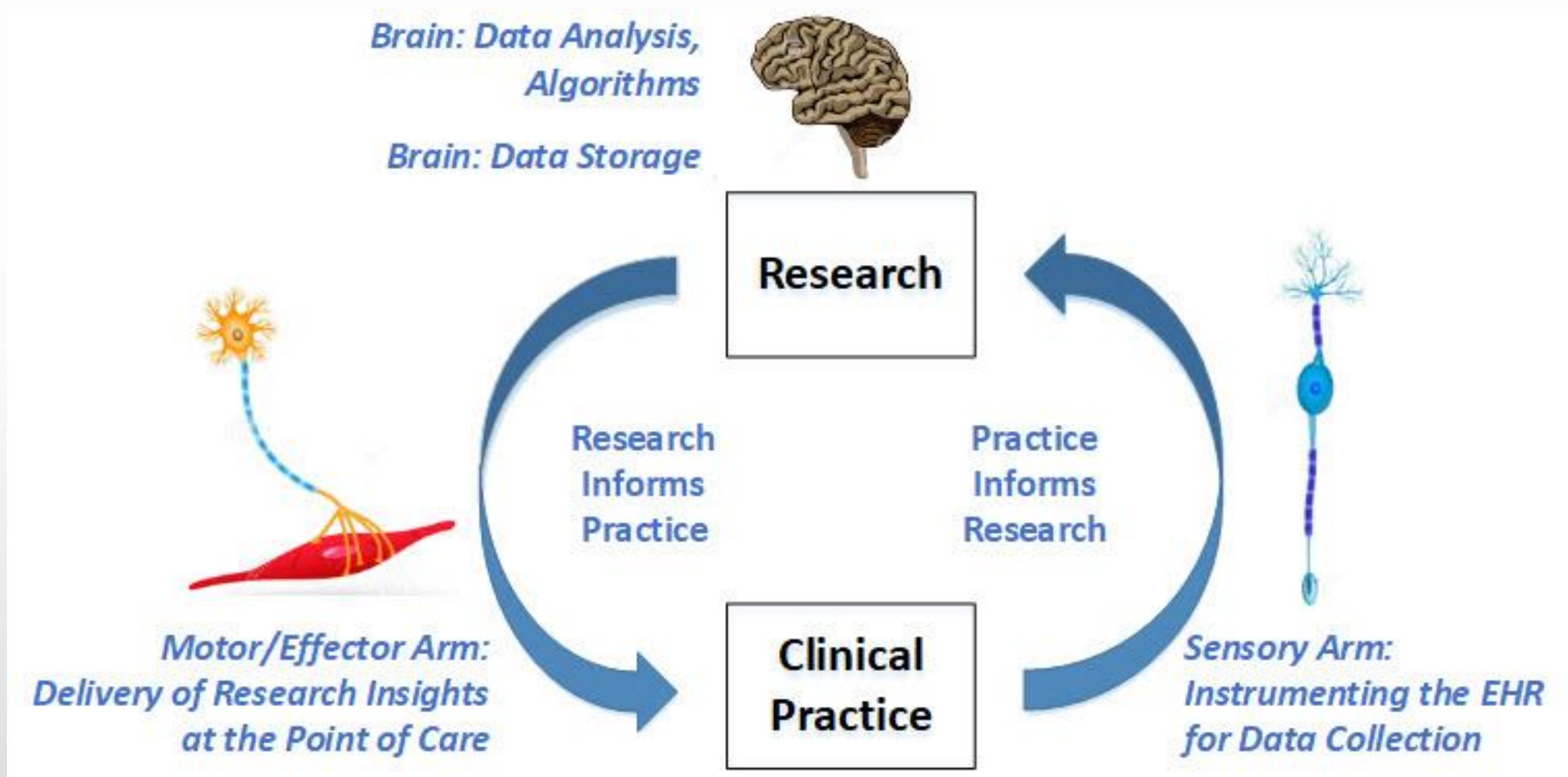
Mining Epic for Scholarship

DuWayne Willett, M.D.

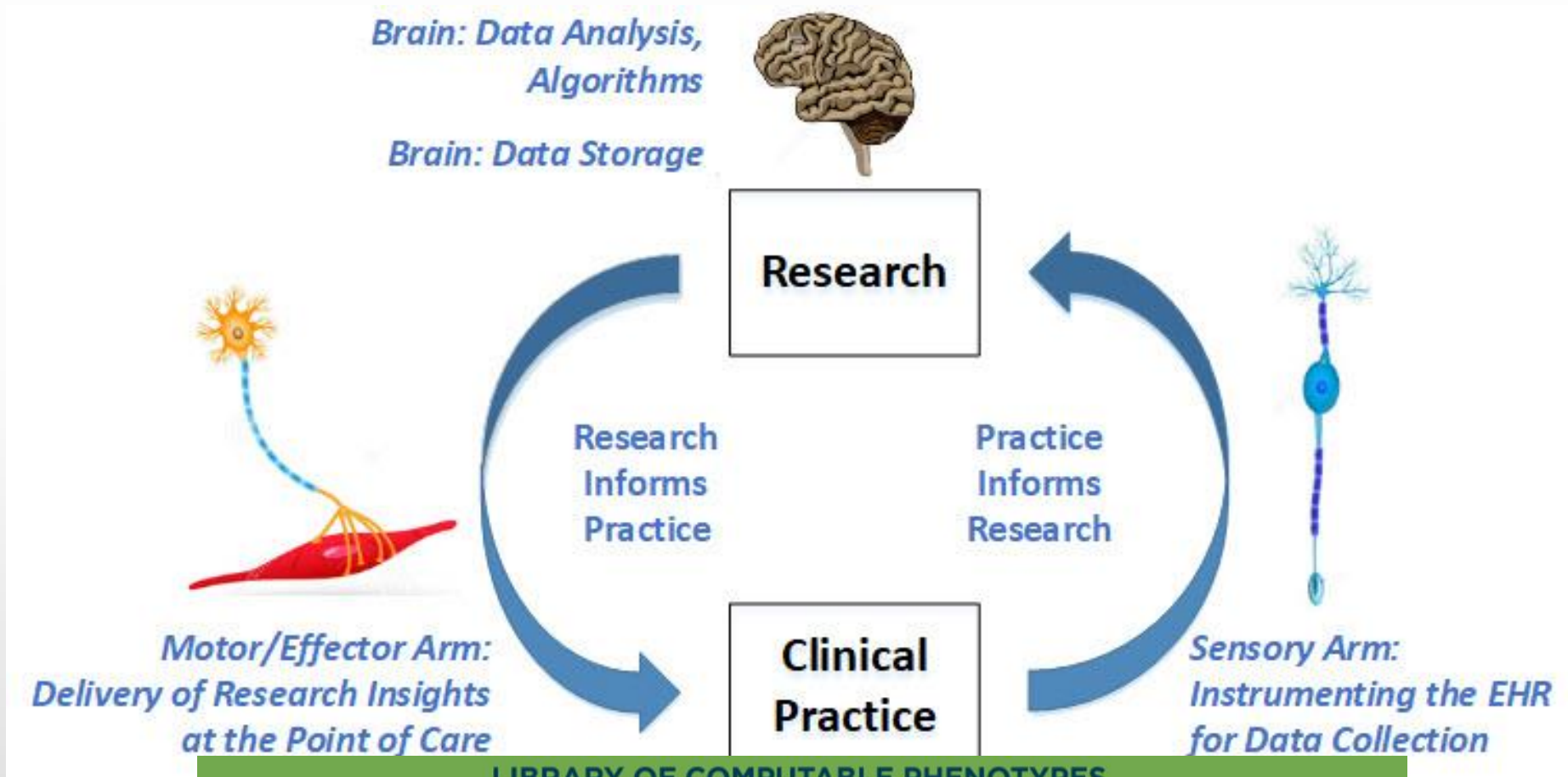
Chief Medical Informatics Officer

Professor of Internal Medicine

Learning Health System Informatics: Nervous System Analogy*



Learning Health System Informatics: Nervous System Analogy

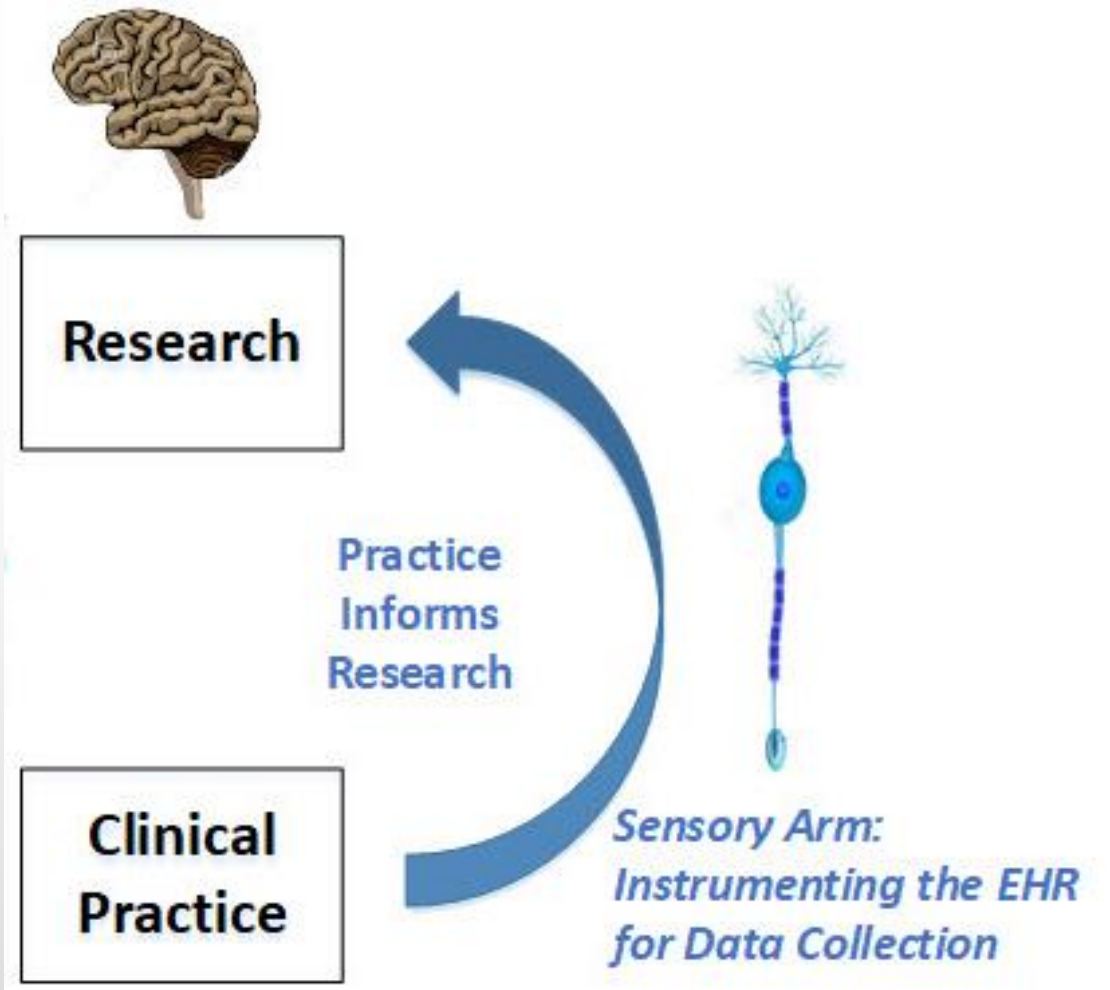


LIBRARY OF COMPUTABLE PHENOTYPES

Definition | Purpose | Metadata | Validation results | Data features | Implementation experience

>250 Diagnosis groupers
>100 Disease Registries

“Sensory Neurons” Getting Data Out of Epic



- Creating new data collection tools
 - Patient-reported outcomes
 - Clinic staff data collection:
 - Flowsheets
 - Custom result components
 - SmartForms

Patient-Reported Outcome (PRO) MyChart Questionnaire

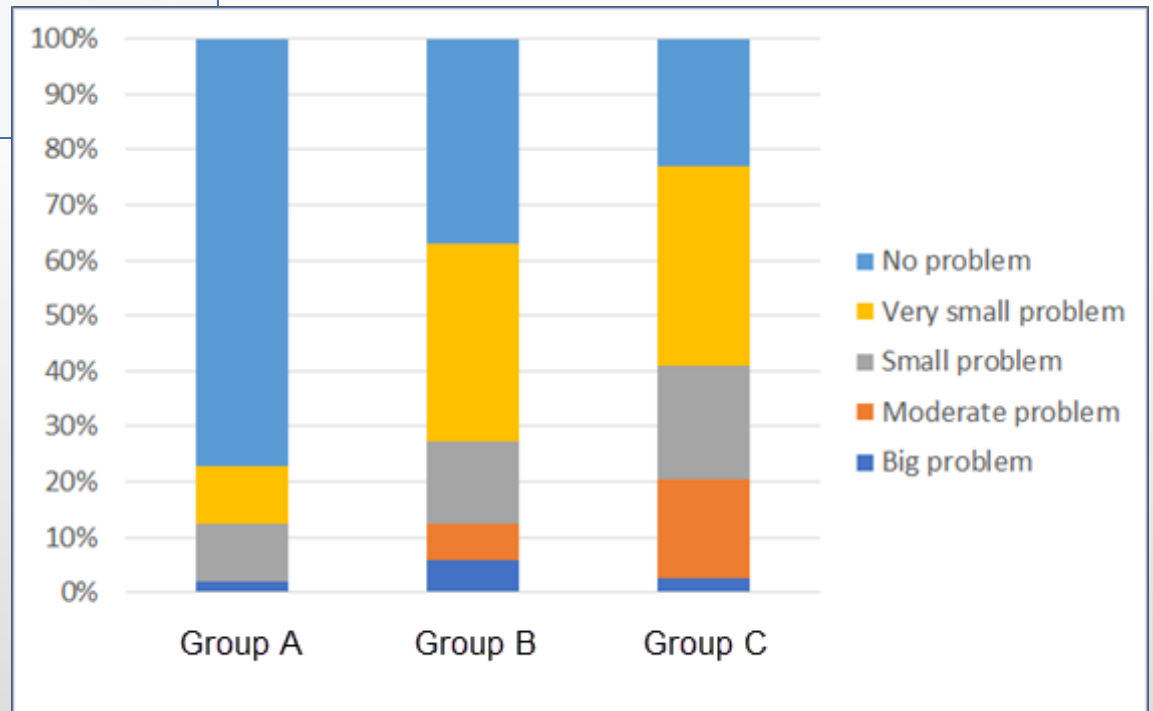
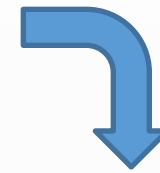
Urology Prostate Cancer EPIC (The Expanded Prostate Cancer Index Comp...

Please answer the following questions and click the **Continue** button.



How big a problem, if any, has dripping or leaking urine been for you during the past 4 weeks?

No problem Very small problem Small problem Moderate problem Big problem

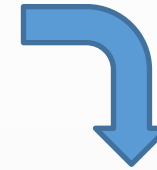


Custom Data Capture: Condition-Specific Form

Kidney Cancer Problem Form

Familial Kidney Cancer Syndrome?

Recurrence (or additional primary RCC)?



Kidney Cancer Problem Form

Familial Kidney Cancer Syndrome?

Recurrence (or additional primary RCC)?

Location(s)

- Ipsilateral kidney
- Renal bed
- Contralateral adrenal gland
- Lungs
- Bone
- Contralateral kidney
- Ipsilateral adrenal gland
- Retroperitoneal lymph nodes
- Liver
- Other

Ipsilateral kidney - date of occurrence

Ipsilateral kidney - date of resolution

Treatment(s)

Biopsy

Biopsy Status Done Pending Not necessary

“Brain”: Data Storage and Analysis

*Brain: Data Analysis,
Algorithms*

Brain: Data Storage



Research

Research
Informs
Practice

Practice
Informs
Research

- Data Analysis, Algorithms:
 - Data Querying and Extracts
 - Statistical Analysis
 - Predictive Model Development:
 - Statistics methods
 - Machine Learning, AI
- Data Storage
 - Data Warehousing
 - Study Databases

Congenital Heart Disease Registry Dashboard Using SlicerDicer



OMOP Data Contents and Processing

(covering UTSW's 23 years on Epic)

Automated nightly updates of full EHR data into the OMOP common data model (CDM), on Epic's "Caboodle" data platform

OMOP Clinical Tables

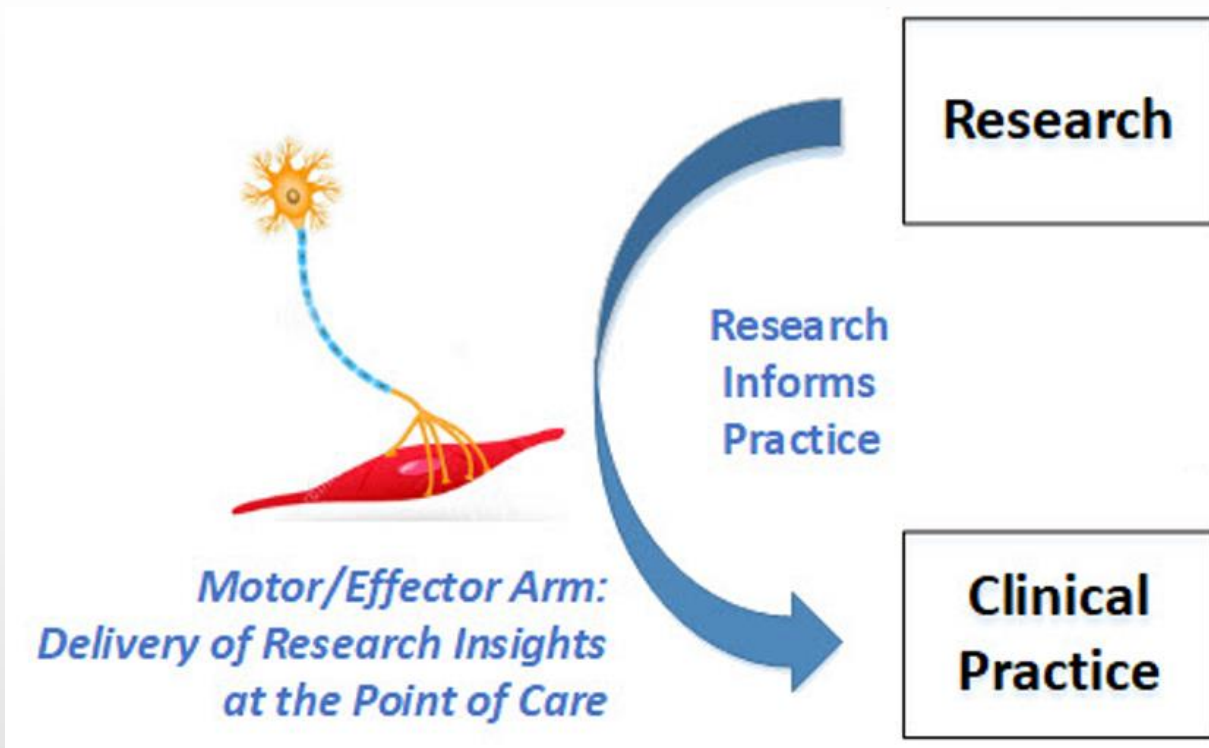
Table Name	Source(s)	Row Count	Processing
CONDITION_OCCURRENCE	Encounter/Billing Dx; Problem List; PMHx	257,480,105	41m
DEATH	Patients; Hospital D/C	48,158	2m
DEVICE_EXPOSURE	Flowsheets (O2 delivery method)	1,507,381	11m
DRUG_EXPOSURE	Med Orders (Rx); Med Administrations	122,522,468	1h 16m
MEASUREMENT	Lab Values; Flowsheets (vitals)	461,974,391	2h 17m
NOTE	Clinical Notes (full text)	97,620,869	16m
OBSERVATION	Social Hx (smoking); "History of" Dx's	61,100,656	15m
OBSERVATION_PERIOD	Encounters	8,572,555	5m
PERSON	Patients	6,992,588	2m
PROCEDURE_OCCURRENCE	Billed procedures; Surgical procedures	15,417,422	4m
VISIT_DETAIL	Hospital ADT Events	2,313,167	<1m
VISIT_OCCURRENCE	Encounters	57,537,103	17m

OMOP Health System & Vocabulary Tables

Type	Table Name	Row Count
Health System	CARE_SITE	2,985
Health System	LOCATION	6,993,892
Health System	PROVIDER	367,181
Vocabulary	CONCEPT	9,110,551
Vocabulary	CONCEPT_ANCESTOR	81,501,898
Vocabulary	CONCEPT_CLASS	417
Vocabulary	CONCEPT_RELATIONSHIP	59,919,626
Vocabulary	CONCEPT_SYNONYM	3,791,481
Vocabulary	DOMAIN	50
Vocabulary	DRUG_STRENGTH	2,976,841
Vocabulary	RELATIONSHIP	690
Vocabulary	SOURCE_TO_CONCEPT_MAP	509
Vocabulary	VOCABULARY	121

“Motor Neurons”

Injecting Knowledge/Interventions Into Epic



- Clinical decision support:
 - BPAs, order sets, etc.
- Data Link
- Predictive models within Epic
- “Care paths”
 - powerful new tool (motor and sensory)

Predictive Modeling Within Epic

The screenshot displays the 'Regression Editor' interface in Epic's Predictive Analytics Admin. The interface is divided into several sections:

- Basic Information:**
 - ID: 134500
 - Model name: UTSW EARLY DETECTION OF SEPSIS
 - Display name: Early Detection of Sepsis
 - Model type: Regression
 - Parent model: EARLY DETECTION OF SEPSIS [34500]
 - Description: Probability of a patient currently being septic. This model is designed to execute for all currently admitted adult patients in the Emergency and Hospital settings.
 - Output type: Percentage Probability
- Regression Configuration:**
 - Function type: Classification
 - Normalization: Logistic
 - Let y_j be the result of evaluating the j th formula in the regression table. The normalized result p_j is then

$$p_j = 1 / (1 + \exp(-y_j))$$
- Source Configuration:**
 - Source type: Extension
 - Database: EPT
 - Extensions:
 - UTSW Demographics - Early Detection of Sepsis [187700]
 - UTSW Medications - Early Detection of Sepsis [187703]
 - UTSW Lab Results - Early Detection of Sepsis [187704]
 - UTSW Comorbidities - Early Detection of Sepsis [187705]
- Inputs:**

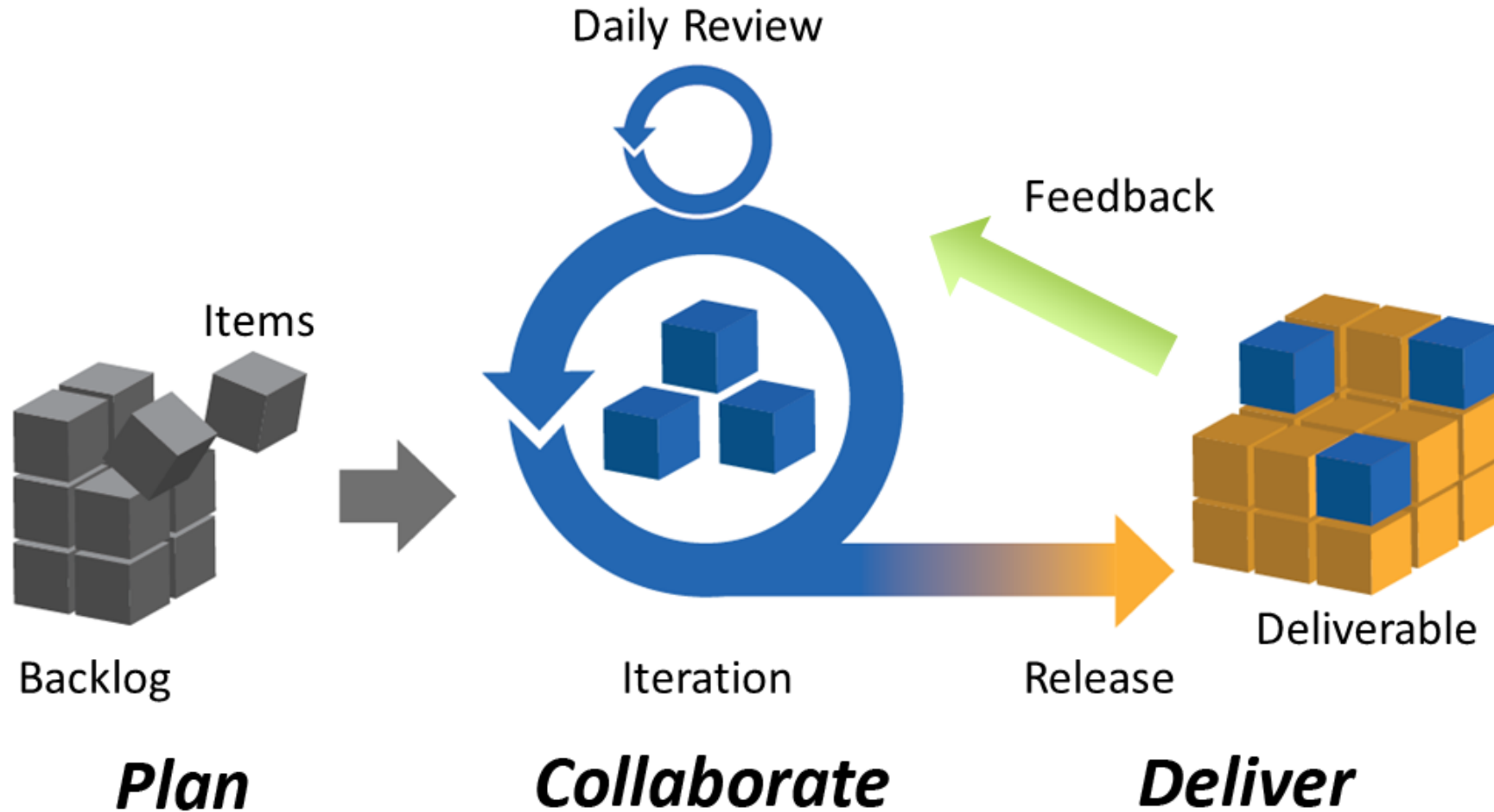
Click an input to highlight how it is used by the model

Mnemonic	Continuous?
Dx of CAD_SRC	No
Dx of CHF_SRC	No
Dx of CKD_SRC	No
Dx of CLD_SRC	No
Dx of COPD_SRC	No
Dx of Diabetes_SRC	No
Dx of HIV_SRC	No
Dx of Hypertension_SRC	No
Dx of Obesity_SRC	No
Age_SRC	Yes
Ethnicity Unknown_SRC	No
Is Married_SRC	No
Is Male_SRC	No
Meets SIRS Pulse_SRC	No
Meets SIRS Respirations_SRC	No
Meets SIRS Temperature_SRC	No
- Formula:**

RISK OF SEPSIS

$$y = -5.18$$
 - +0.012 (Dx of CAD is 1)
 - +0.063 (Dx of CHF is 1)
 - +0.216 (Dx of CKD is 1)
 - +0.13 (Dx of CLD is 1)
 - +0.085 (Dx of COPD is 1)
 - +0.232 (Dx of Diabetes is 1)
 - +0.145 (Dx of HIV is 1)
 - +0.352 (Dx of Hypertension is 1)
 - +0.074 (Dx of Obesity is 1)
 - +0.007 (Age)
 - +0.02 (Ethnicity Unknown is 1)
 - 0.023 (Is Married is 1)
 - +0.053 (Is Male is 1)
 - +0.815 (Meets SIRS Pulse is 1)
 - +0.405 (Meets SIRS Respirations is 1)
 - +0.946 (Meets SIRS Temperature is 1)
 - +0.527 (Meets SIRS WBC is 1)
 - +0.832 (Bands High is 1)
 - +0.134 (Bands Normal is 1)
 - 0.012 (Base Excess Arterial Normal is 1)
 - 0.066 (Creatinine Normal is 1)
 - 0.083 (Hematocrit Low is 1)

Agile Process for Delivering EHR Features



Additional Information and Resources

1. UTSW Health System Informatics
 - CMIO Team
 - Deputy CMIOs
 - Department/Divisional Medical Informatics Officers
2. Clinical Informatics Center
 - M.S. Program
 - Clinical Informatics Fellowship
 - CTSA Grant
 - Informatics Coordinating Office

Your Health Informatics Team

Associate CMIO



Mujeeb Basit

Associate CMIO



Ling Chu

Assistant CMIO



Sam McDonald

Deputy CMIOs:

- **Waddah Arafat**
Cancer Informatics
- **Jyoti Balani**
Pathology Informatics
- **Trent Bryson**
Anesthesiology and
Peri-op Informatics
- **Joe Ji**
Surgical Informatics
- **Suhani Goyal**
Hospital Medicine Informatics
- **Justin Rousseau**
Neuroscience Informatics
- **Rob Turer**
Cogito Analytics

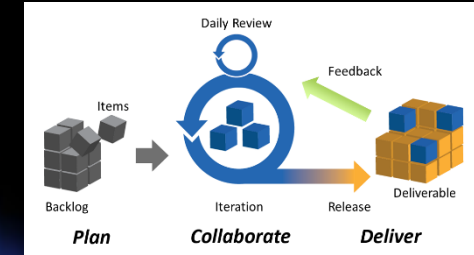
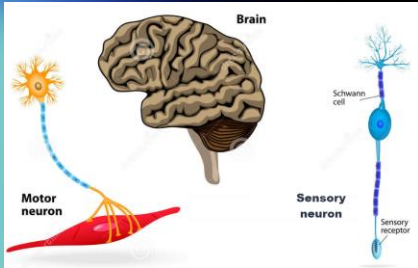
CHIO



Duwayne Willett

Mining EPIC for Scholarship

Summary of Key Points



EHR can play a role in the Learning Healthcare System

“Sensory neurons” – getting data out of EHR for analysis

“Motor neurons” – putting data/interventions into practice

Making it happen: Agile feature development; informatics support

Starting University Clinical Careers Efficiently, Scholarly, and Successfully

Questions? Email me!



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