

Precision Medicine IT/IS

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What is Penn Medicine?



The University of Pennsylvania Health System was created in 1993 and consists of four hospitals (Hospital of the University of Pennsylvania, Presbyterian Medical Center, Pennsylvania Hospital, Chester County Hospital, Lancaster General), a faculty practice plan, a primary care provider network, two multi-specialty satellite facilities, home care, hospice and a nursing home.

Licensed Beds	2,524*
Total Employees	31,293*
IT Employees	550
IT Operating Budget	\$160 million
Operating Revenue	\$4.9 Billion
Adult Admissions	83,994
Outpatient Visits	2,837,864~
Physicians	4,046~

Total Figures as of FY14
**Includes CCA, CCH, CORP, CPUP, HCBS, LG*
+ Includes CCA/CHCA
+ Includes CHOP
~ Includes physicians with privileges at more than one hospital.



Established in 1765 as the nation's first medical school, the Perelman School of Medicine is celebrating its 250th anniversary this year. The School has ranked among the top five medical schools in the United States for the past 17 years, according to U.S. News & World Report's survey of research-oriented medical schools.

Penn Medicine is an internationally recognized leader in discoveries that advance science. Sixty-seven Penn Medicine researchers are Members of the Institute of Medicine of the National Academy of Sciences

Faculty	5,200+
Students	1,400+
Departments	28
Centers & Institutes	24
Sponsored Awards	\$638 million

Total Figures as of FY14



Penn and Precision Medicine

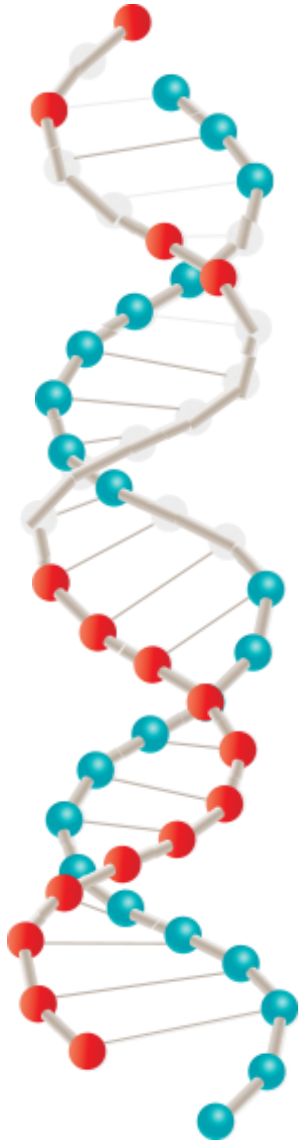
- ♦ **Strategy - focus on high acuity patients needing advanced diagnostic, therapeutic and procedural services**
 - Serve a region by being the destination for tertiary and quaternary care
- ♦ **Top Priority of Penn Medicine's 5-Year Strategic Plan**
 - *Lead in Delivering Individualized Medicine*

- ♦ **Actions to Achieve Goal**

- *Center for Personalized Diagnostics* – in-house oncology diagnostic lab for liquid / solid tumors
- *Institute for Biomedical Informatics*
- Large bio-bank focused on disease-based initiatives
- *Center for Precision Medicine* – focused investment in demonstration of personalized medicine approach *beyond* oncology
- Significant investment in advanced IT infrastructure

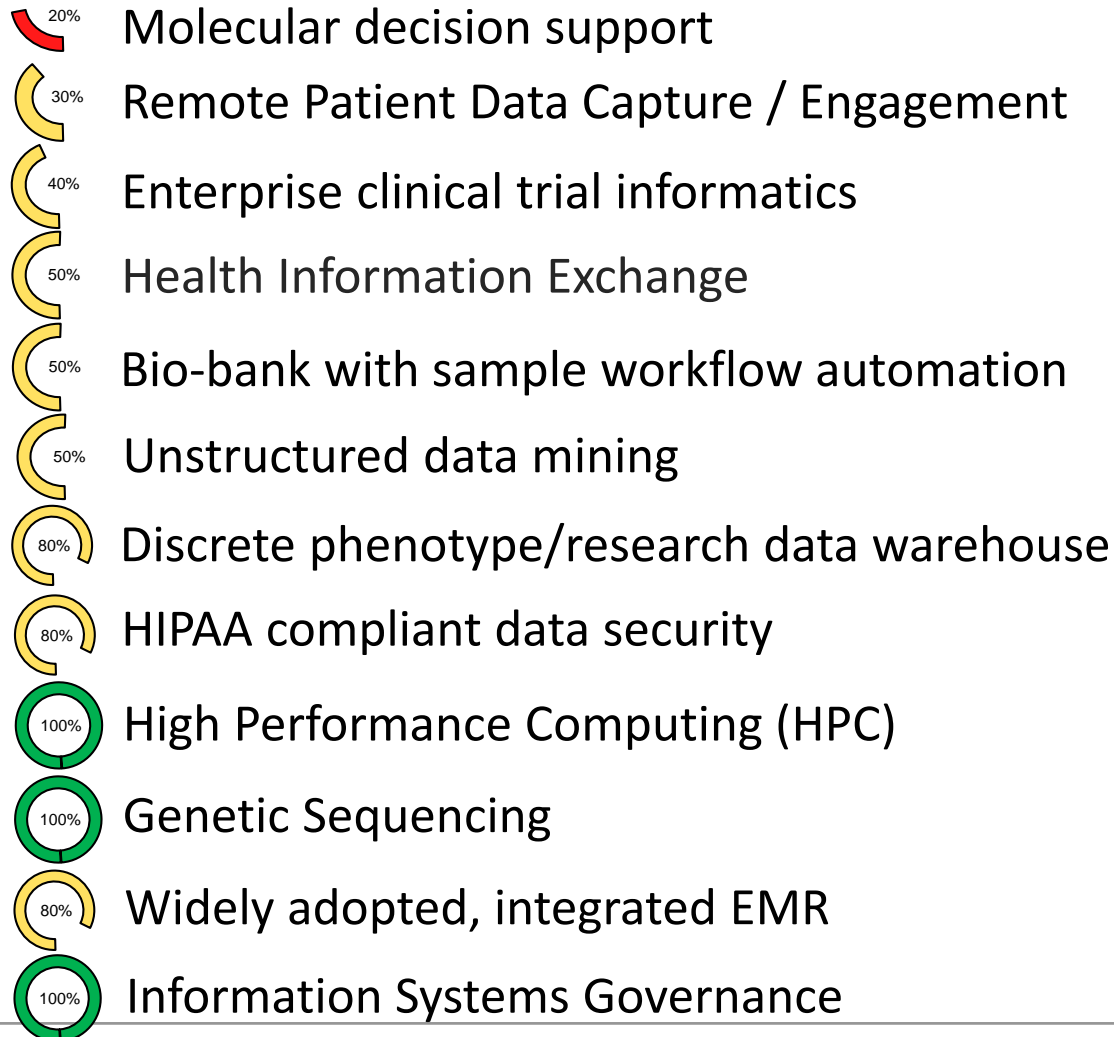


Precision Medicine Technology Ingredients



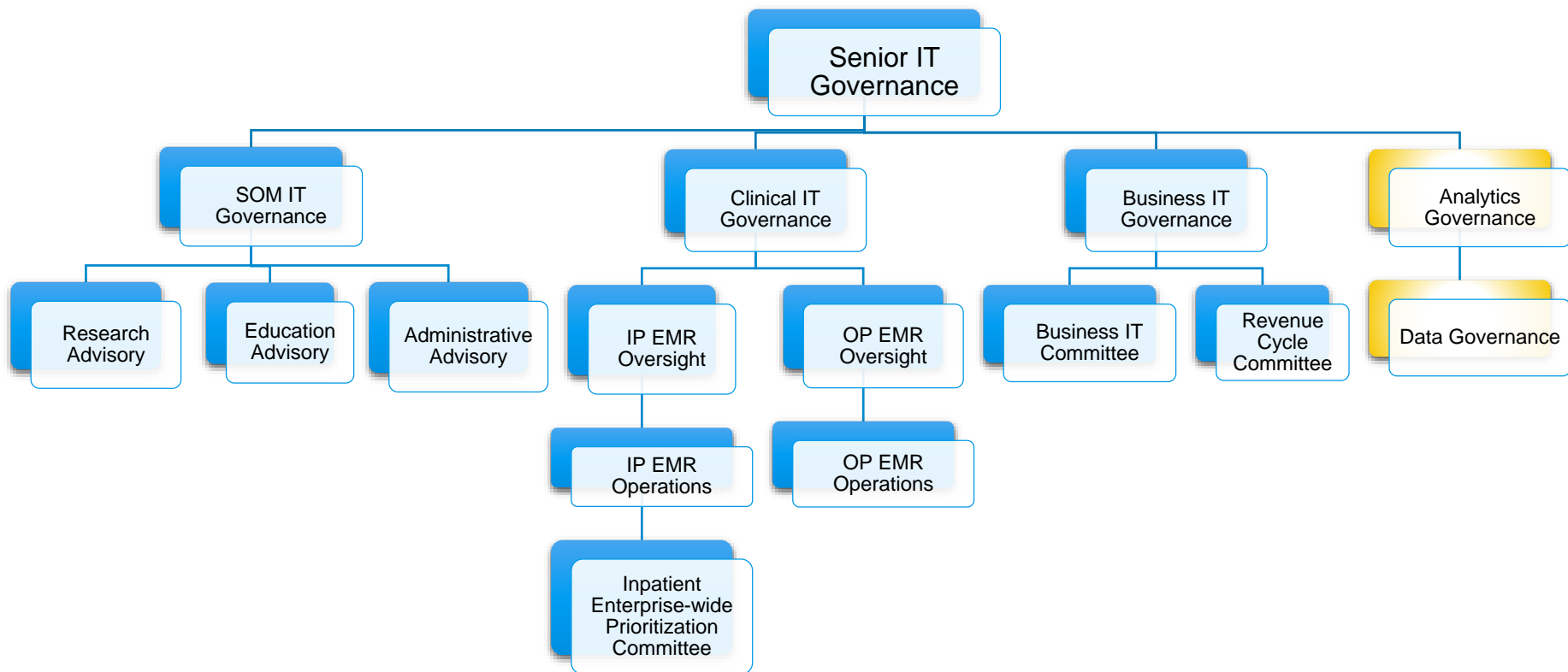
High Performance Computing (HPC) Data Warehouse

Big Data Analytics, Machine Learning, Artificial Intelligence, Cloud Computing, Mobile Health, Wearable Devices, Telemedicine, Patient Engagement, Clinical Decision Support, Regulatory Compliance, Data Security, Privacy, and Ethics.



Penn Medicine IT Governance

- One integrated Information Systems team for health system and school
- Faculty and staff at all levels participate in a robust IT governance structure and process
- Most committees meet monthly with project coordinators managing meeting agendas and follow ups



Translational Medicine Speed

A common IS infrastructure, toolset and organizational approach will speed translation.

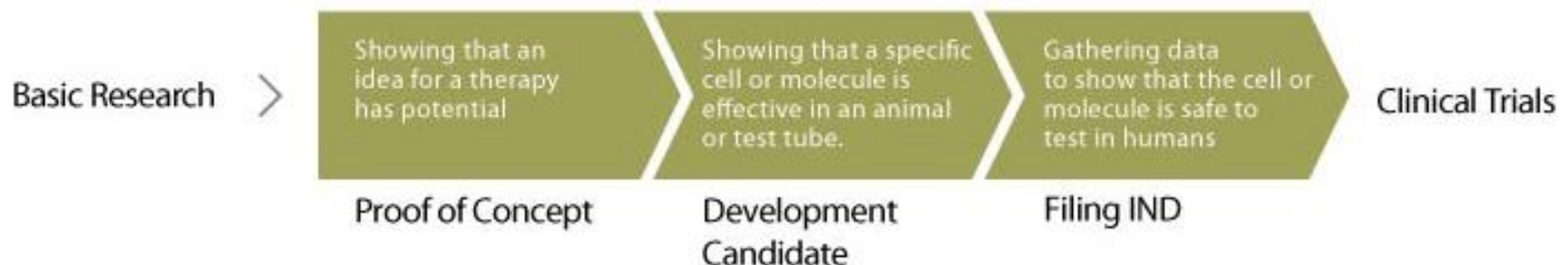
Bench

- ♦ De-identified data
- ♦ Likely starts in animals
- ♦ Not 24 x 7 x 52
- ♦ Academic freedom
- ♦ Not designed to scale

Bedside

- ♦ PHI
- ♦ Human based
- ♦ CLIA certified
- ♦ HIPPA / HITECH
- ♦ CFR Part 11

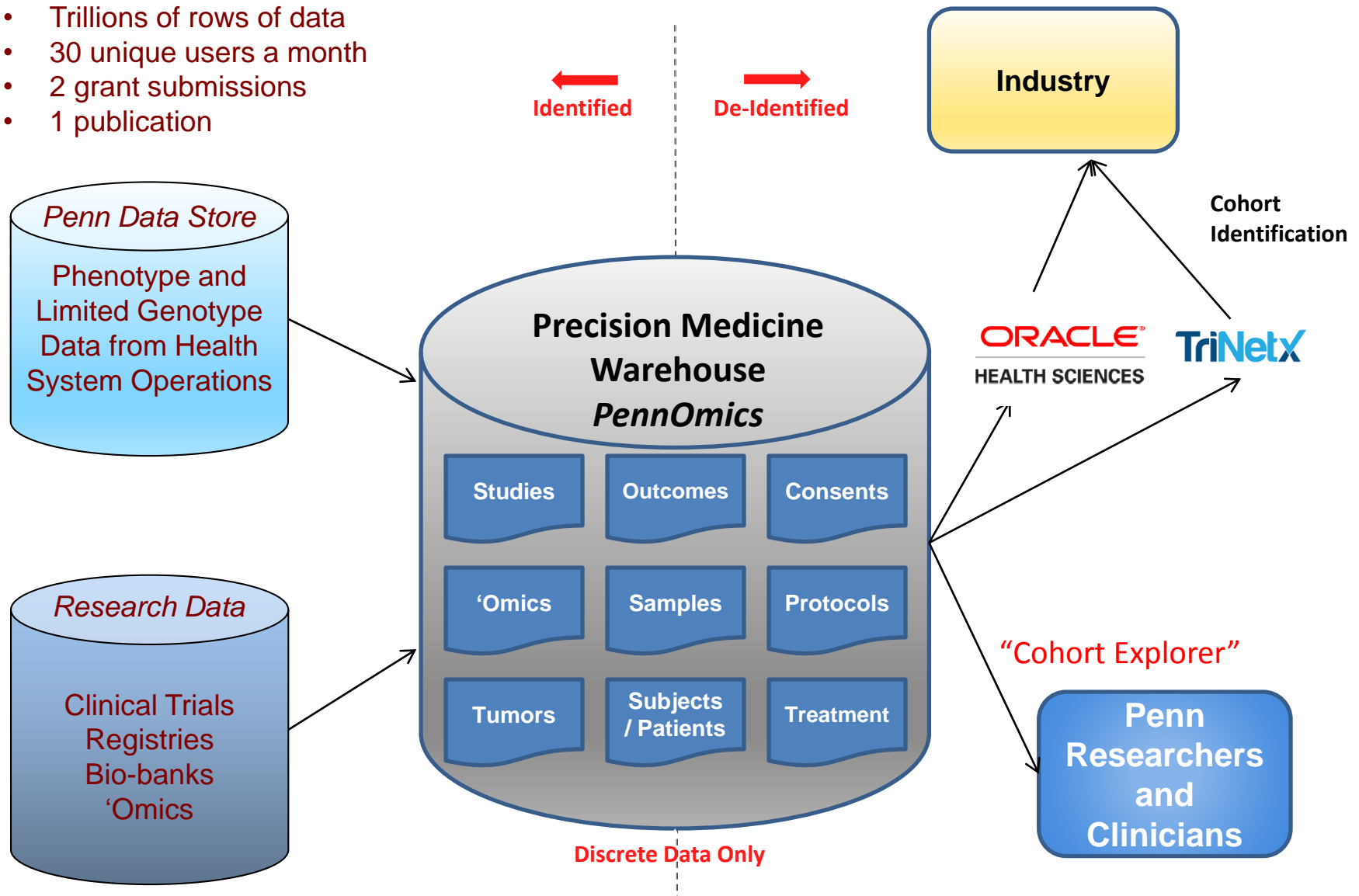
Therapy Development Pipeline



- California Institute for Regenerative Medicine

Research Data Warehouse

- Trillions of rows of data
- 30 unique users a month
- 2 grant submissions
- 1 publication



Collect Patient Generated Data and Engage the Patient

- ◆ **360,000+ patients enrolled in MyPennMedicine patient portal**

- Web and mobile

- ◆ **60% use it regularly**

- ◆ **Engaging patients in their care**

- Surveys
- Pre-visit questionnaires

- ◆ **Biometrics**

- Apple HealthKit in use
- ResearchKit on deck

- ◆ **Targeted trial recruitment**

- Alerts in portal

Surveys available

EQ-5D	Neurosurgery
SINO-NASAL OUTCOME TEST (SNOT-22)	Otolaryngology
HISTORY OF PRESENT ILLNESS - OTO KENNEDY	Otolaryngology
OSWESTRY DISABILITY (ODI) QUESTIONNAIRE	
ACHD MEDICAL HISTORY QUESTIONNAIRE	ACHD
PROMIS	
PHQ2	
MPM TRAVEL MED PRE-TRAVEL WORKSHEET	
GIM WELLNESS SURVEY	
PAIN MED NEW PATIENT MPM PAIN SURVEY	Pain Med
PENN SLEEP CENTER QUESTIONNAIRE [409]	Sleep
AMC QUESTIONNAIRE	Coumadin Clinic
CARDIAC SURGERY FOLLOW UP	Cardiac Surg
UROLOGY NEW PATIENT MEDICAL HISTORY QUESTIONNAIRE [5508]	Urology
PATIENT SATISFACTION INDEX (PREOP)	Neurosurgery
SURGERY MPM POV1 QUESTIONNAIRE	Surgery
KOOS	Ortho
HOOS	Ortho
Short Sleep	Sleep
TCE	ONC
Derm Research	DERM
Rheum Research	RHEUM
PROMIS 29	Rehab
Pain Disability Index	Rehab
PMR Post Procedure	Rehab
OPHTHALMOLOGY	Oph
HVC Close Encounter	HVC
Neuro Close Encounter	Neurology
PHQ4	Onc
MPM PSYCH MU QUESTIONNAIRE [869]	Psych

NEXT: Derive More Discrete Data Using NLP

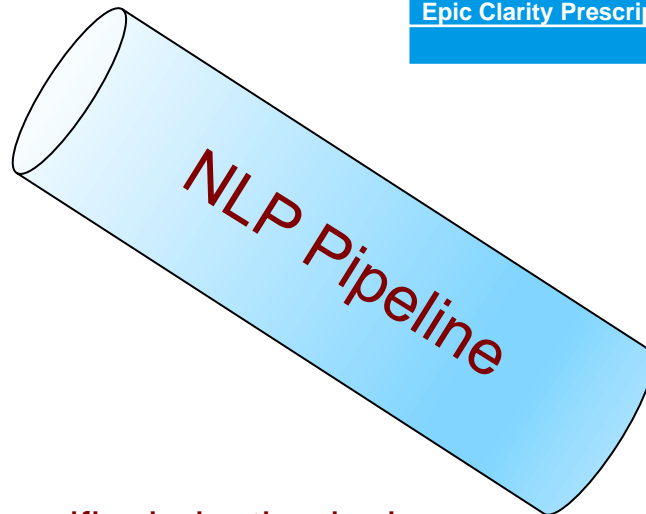
Unstructured Text

Any Source

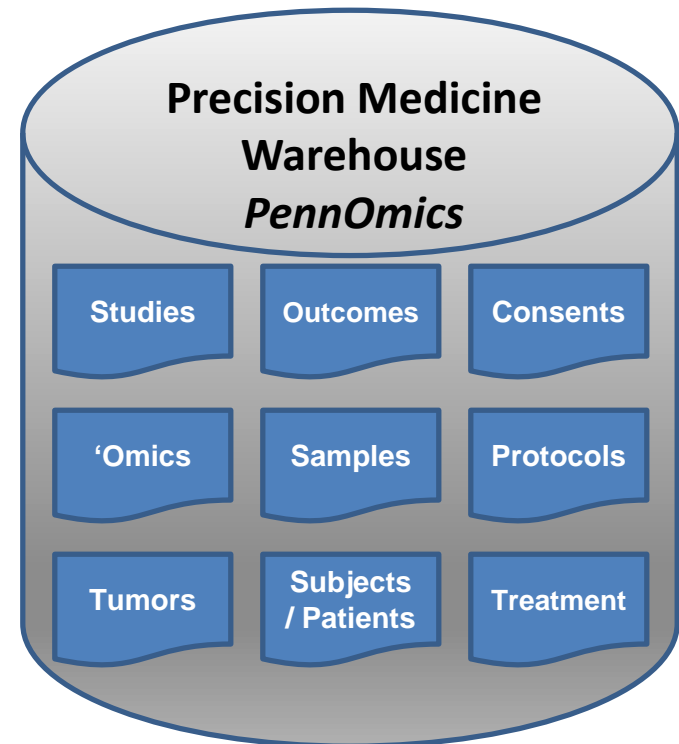


**30,984,529,950
Searchable
Words!**

	Unstructured Records in PennSeek	Un + Structured Records in PennSeek
Epic Clarity Encounters	16,239,933	18,125,122
RIS Radiology Accession Reports	11,364,298	11,364,317
PDS Demographics	0	4,766,075
PDS Pathology	766,912	2,304,408
ProSolv Cardiology—echo	180,118	283,505
Horizon Cardiology—cath	39,309	33,767
Athena Service Desk Tickets	472,013	474,488
Epic Clarity My Penn Med Msgs	268,900	268,900
Epic Clarity In-Clinic Meds	0	1,517,621
Epic Clarity Prescriptions	0	84,851,981
	29,292,045	123,950,618



1. Build disease specific derivation logic
2. Derive “facts” from unstructured text
3. Feed into PennOmics / HSN / TriNetX as new observation types
4. Improve inclusion/exclusion criteria for trials or cohort identification



NEXT: Enterprise Clinical Trial Informatics

♦ Integrate EMR (Epic) with CTMS (Velos)

- Registration feed from Epic to Velos to ease enrollment
- Study initiation interface from Velos to Epic
- 2-way enrollment status interface
- All of the above based on IHE standards

♦ Improve research billing

- Migrate to all Epic based in 2017
- Eases compliance



♦ Point of care recruiting

- Best Practice Alerts (BPA) in Epic using clinical rules for matching

♦ Other recruiting techniques

- Patient searchable web directory of Penn clinical trials
- Direct patient contact using matching against clinical data warehouse

NEXT: Molecular Decision Support

◆ Provider's ideal solution

- EMR based
- Not a standalone application appearing in an EMR window
- Discrete genetic markers stored in EMR
 - Germ line
 - Somatic over time
- Actionable rule based alerts
 - Pharmacogenetics
 - Oncology drug regimens to order
 - Cardiology treatments
 - Place orders
- Annotations, metadata and references
- Best clinical trials available
- Patients like mine
- Report sharable with patients
- Ongoing monitoring for new actionable variants



Questions?

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