

Accelerating Evidence Generation for Genomic Technologies in a Learning Health Care System

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HARVARD
MEDICAL SCHOOL



Harvard Pilgrim
Health Care Institute

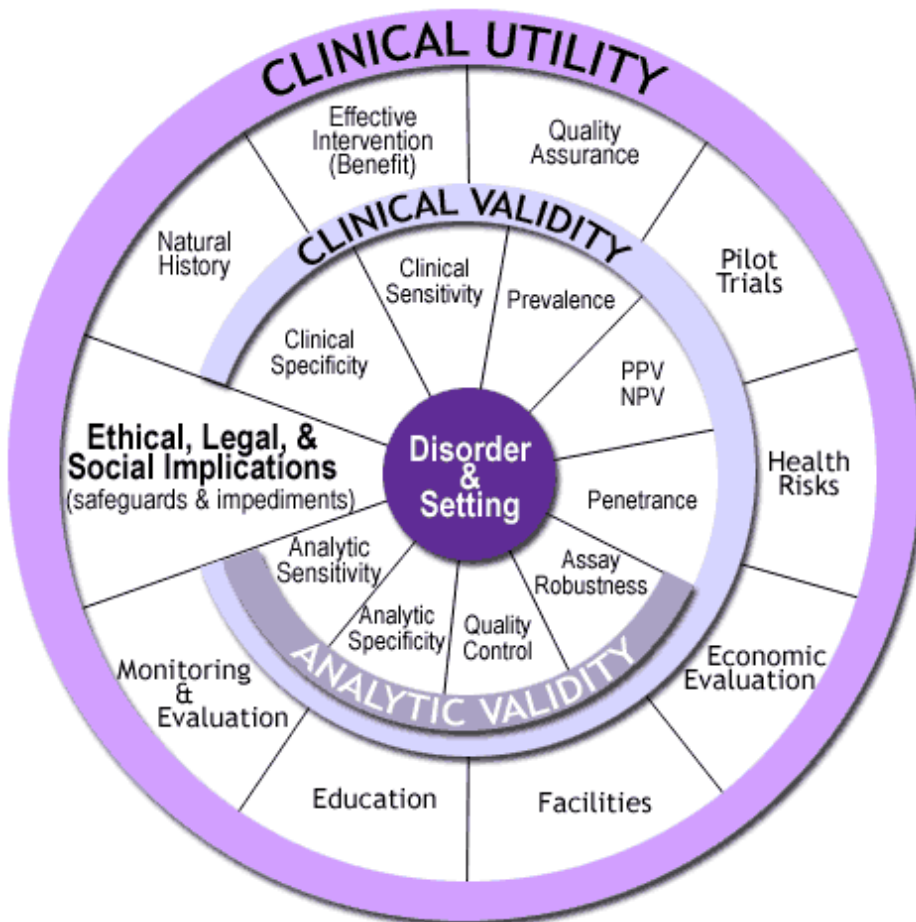
Acknowledgements/Disclosure

- ❑ Co-authors: Marc Williams, Geoff Ginsburg, Darren Toh, Jeff Brown, Muin Khoury
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- ❑ Disclosure: An epidemiologist for FDA's Sentinel program

Background

- Limited evidence available on the effect of using genomic tests on health outcomes
 - Very few RCTs
 - No funding for RCTs for genomic tests
 - RCTs take too long
 - High cost of archiving specimens from therapeutic clinical trials

Purpose of the Model



Analytical Validity	Is the test accurate and reliable?
Clinical Validity	Is the test result medically meaningful?
Clinical Utility	Does the test improve healthcare & health?
Risk classification	% patient reclassified based on test
Therapeutic choice	% patients in whom treatment altered
Patient outcome	Effect on outcomes e.g., adverse effects, QoL
Economic Validity	Cost benefit & cost effectiveness

CDC's ACCE model; <http://www.cdc.gov/genomics/gtesting/ACCE/>

Green

- FDA label requires use of test to inform choice or dose of a drug
- CMS covers testing
- Clinical practice guideline based on systematic review supports testing

Yellow

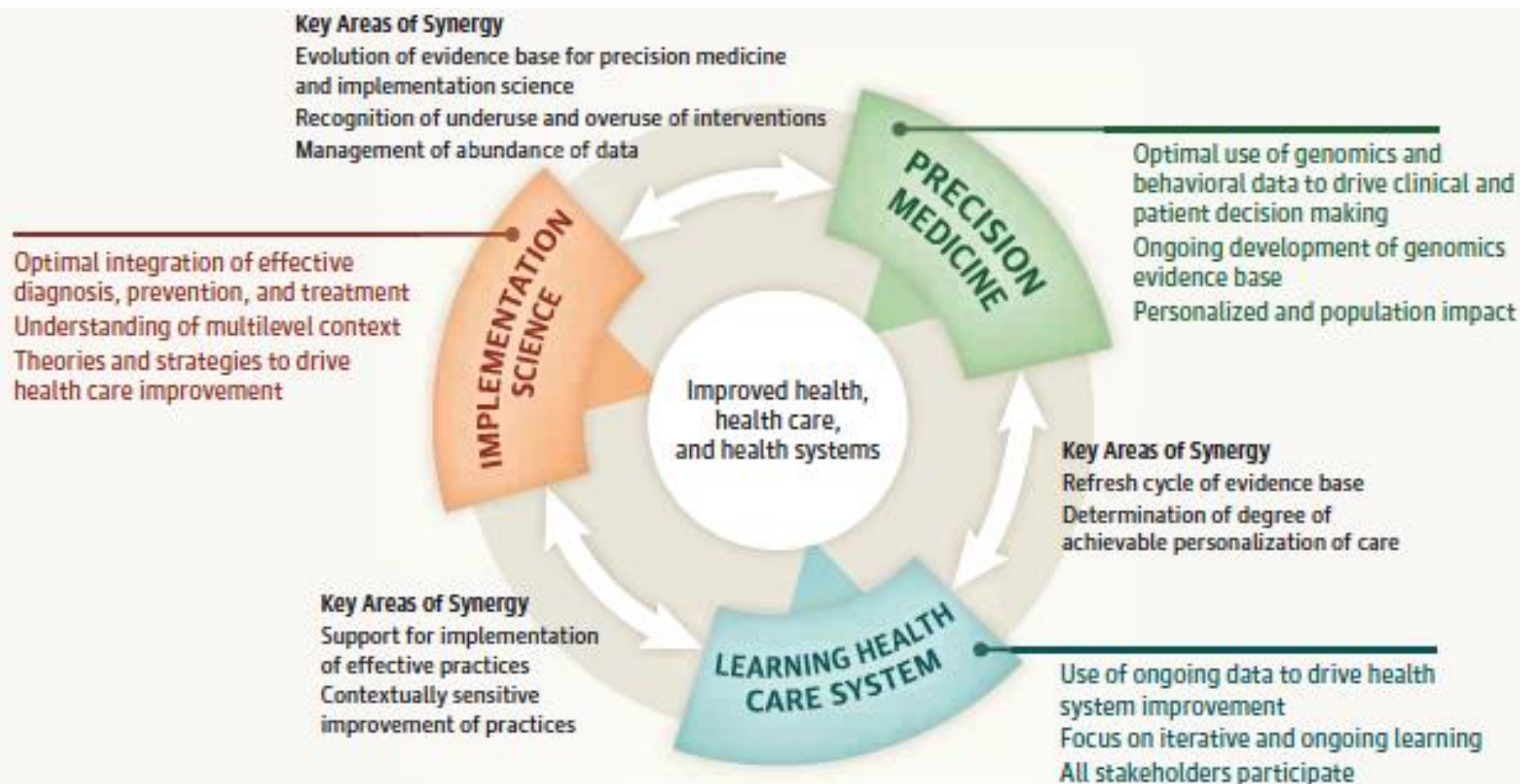
- FDA label mentions biomarker*
- CMS coverage with evidence development
- Clinical practice guideline, not based on systematic review, supports use of test
- Clinical practice guideline finds insufficient evidence but does not discourage use of test
- Systematic review, without clinical practice guideline, supports use of test
- Systematic review finds insufficient evidence but does not discourage use of test
- Clinical practice guideline recommends dosage adjustment, but does not address testing

Red

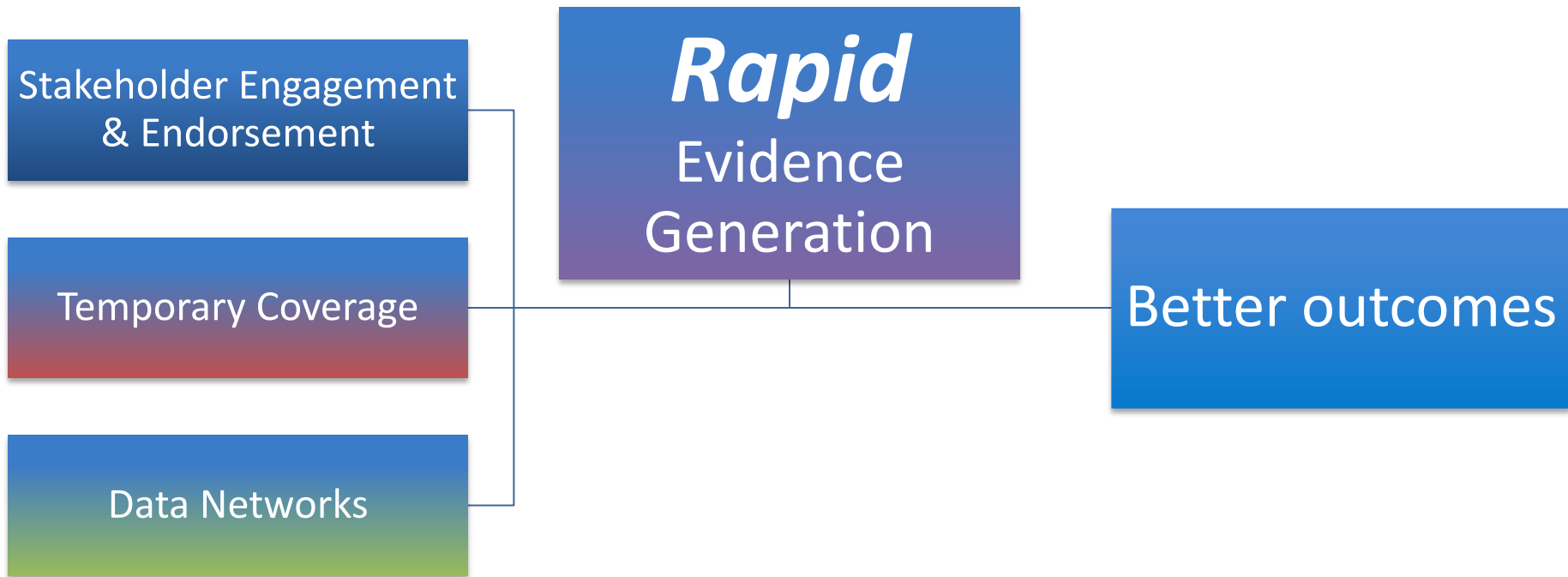
- FDA label cautions against use
- CMS decision against coverage
- Clinical practice guideline recommends against use of test
- Clinical practice guideline finds insufficient evidence and discourages use of test
- Systematic review recommends against use
- Systematic review finds insufficient evidence and discourages use
- Evidence available only from published studies without systematic reviews, clinical practice guidelines, FDA label or CMS labels coverage decision

*Can be reassigned to Green or Red if one or more conditions in these categories apply

Learning Health Care System



Three Building Blocks of the Model



Stakeholder Engagement & Endorsement

Temporary Coverage

- Manufacturers
- Payers (& employers who decide on insurance benefits)

Leveraging Data Networks

- Manufacturers
- Payers
- Health systems
- EHR vendors
- Providers
- Patients
- Researchers
- Government agencies

Temporary Coverage

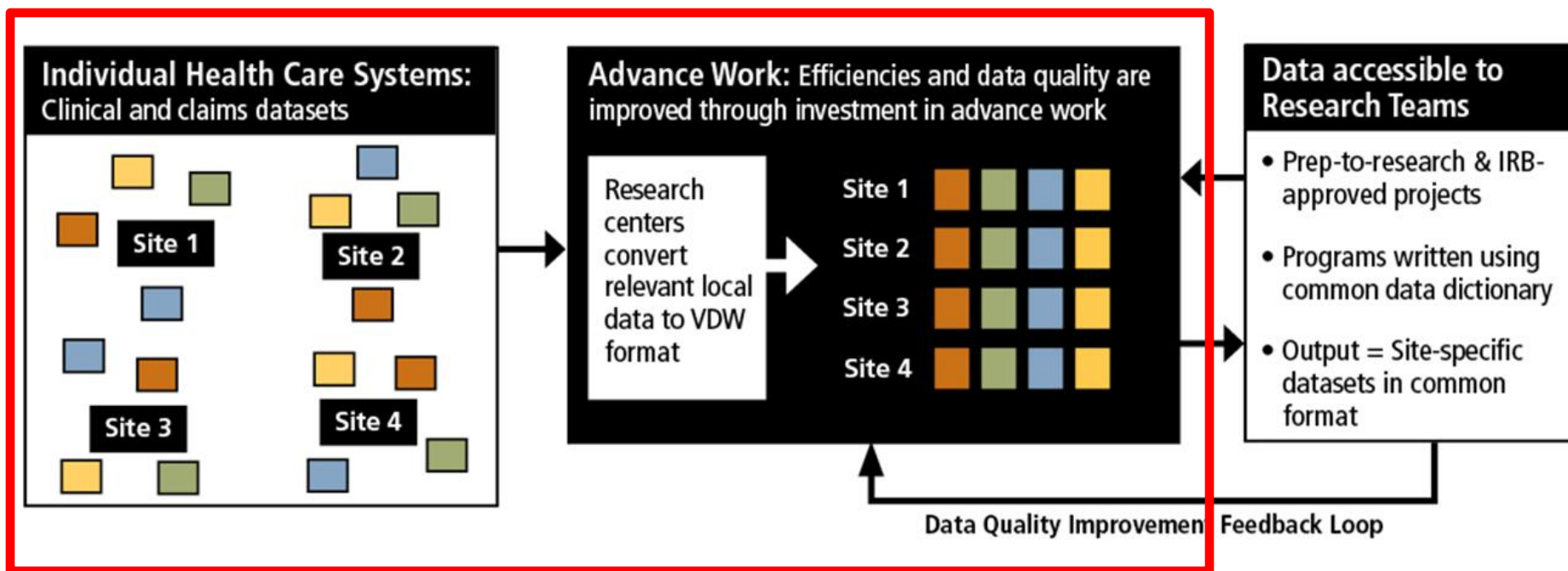
Risk-sharing agreements / Value-based contracts between manufacturers & payers

- Use of genomic tests captured by claims & EHR data systems
- Not the same as CMS' coverage with evidence development programs
 - Patients must participate in a registry or trial
 - Slow recruitment & data collection
- Costs for evidence generation shared by manufacturers and payers
- Example: Biologics and Biosimilars Collective Intelligence Consortium is a non-profit, collaborative scientific public service initiative

Leveraging Existing Data Networks

- Avoid limitations of multi-site research
 - Pulling together data elements needed from each site on a project by project basis is time-consuming & expensive
 - Each system has its own data specs
 - Data sharing might be a concern
- Data networks (& analytical toolbox) exist
 - Data networks take time & money to develop
 - Sentinel: ~223 million individuals
 - PCORnet: ~10 million individuals

Harmonized multiple databases



Time & money to develop

PCORnet Common Data Model v3.1

PCORnet Common Data Model v3.1

New to v3.1

DEMOGRAPHIC
PATID
BIRTH_DATE
BIRTH_TIME
SEX
SEXUAL_ORIENTATION
GENDER_IDENTITY
HISPANIC
RACE
BIOBANK_FLAG

Fundamental basis

ENROLLMENT
PATID
ENR_START_DATE
ENR_END_DATE
CHART
ENR_BASIS
DISPENSING
DISPENSINGID
PATID
PRESCRIBINGID (optional)
DISPENSE_DATE
NDC
DISPENSE_SUP
DISPENSE_AMT
DEATH
PATID
DEATH_DATE
DEATH_DATE_IMPUTE
DEATH_SOURCE
DEATH_MATCH_CONFIDENCE
DEATH_CAUSE
PATID
DEATH_CAUSE
DEATH_CAUSE_CODE
DEATH_CAUSE_TYPE
DEATH_CAUSE_SOURCE
DEATH_CAUSE_CONFIDENCE

Data captured from processes associated with healthcare delivery

VITAL
VITALID
PATID
ENCOUNTERID (optional)
MEASURE_DATE
MEASURE_TIME
VITAL_SOURCE
HT
WT
DIASTOLIC
SYSTOLIC
ORIGINAL_BMI
BP_POSITION
SMOKING
TOBACCO
TOBACCO_TYPE
CONDITION
CONDITIONID
PATID
ENCOUNTERID (optional)
REPORT_DATE
RESOLVE_DATE
ONSET_DATE
CONDITION_STATUS
CONDITION
CONDITION_TYPE
CONDITION_SOURCE
PRO_CM
PRO_CM_ID
PATID
ENCOUNTERID (optional)
PRO_ITEM
PRO_LOINC
PRO_DATE
PRO_TIME
PRO_RESPONSE
PRO_METHOD
PRO_MODE
PRO_CAT

Data captured within multiple contexts: healthcare delivery, registry activity, or directly from patients

ENCOUNTER
ENCOUNTERID
PATID
ADMIT_DATE
ADMIT_TIME
DISCHARGE_DATE
DISCHARGE_TIME
PROVIDERID
FACILITY_LOCATION
ENC_TYPE
FACILITYID
DISCHARGE_DISPOSITION
DISCHARGE_STATUS
DRG
DRG_TYPE
ADMITTING_SOURCE
DIAGNOSIS
DIAGNOSISID
PATID
ENCOUNTERID
ENC_TYPE (replicated)
ADMIT_DATE (replicated)
PROVIDERID (replicated)
DX
DX_TYPE
DX_SOURCE
DX_ORIGIN
PDX
PROCEDURES
PROCEDURESID
PATID
ENCOUNTERID
ENC_TYPE (replicated)
ADMIT_DATE (replicated)
PROVIDERID (replicated)
PX_DATE
PX
PX_TYPE
PX_SOURCE
LAB_RESULT_CM
LAB_RESULT_CM_ID
PATID
ENCOUNTERID (optional)
LAB_NAME
SPECIMEN_SOURCE
LAB_LOINC
PRIORITY
RESULT_LOC
LAB_PX
LAB_PX_TYPE
LAB_ORDER_DATE
SPECIMEN_DATE
SPECIMEN_TIME
RESULT_DATE
RESULT_TIME
RESULT_QUAL
RESULT_NUM
RESULT_MODIFIER
RESULT_UNIT
NORM_RANGE_LOW
NORM_MODIFIER_LOW
NORM_RANGE_HIGH
NORM_MODIFIER_HIGH
ABN_IND
PRESCRIBING
PRESCRIBINGID
PATID
ENCOUNTERID (optional)
RX_PROVIDERID
RX_ORDER_DATE
RX_ORDER_TIME
RX_START_DATE
RX_END_DATE
RX_QUANTITY
RX_QUANTITY_UNIT
RX_REFILLS
RX_DAYS_SUPPLY
RX_FREQUENCY
RX_BASIS
RXNORM_CUI

Data captured from healthcare delivery, direct encounter basis

PCORNET_TRIAL
PATID
TRIALID
PARTICIPANTID
TRIAL_SITEID
TRIAL_ENROLL_DATE
TRIAL_END_DATE
TRIAL_WITHDRAW_DATE
TRIAL_INVITE_CODE

Associations with PCORnet clinical trials

HARVEST
NETWORKID
NETWORK_NAME
DATAMARTID
DATAMART_NAME
DATAMART_PLATFORM
CDM_VERSION
DATAMART_CLAIMS
DATAMART_EHR
BIRTH_DATE_MGMT
ENR_START_DATE_MGMT
ENR_END_DATE_MGMT
ADMIT_DATE_MGMT
DISCHARGE_DATE_MGMT
PX_DATE_MGMT
RX_ORDER_DATE_MGMT
RX_START_DATE_MGMT
RX_END_DATE_MGMT
DISPENSE_DATE_MGMT
LAR_ORDER_DATE_MGMT
SPECIMEN_DATE_MGMT
RESULT_DATE_MGMT
MEASURE_DATE_MGMT
ONSET_DATE_MGMT
REPORT_DATE_MGMT
RESOLVE_DATE_MGMT
PRO_DATE_MGMT
REFRESH_DEMOGRAPHIC_DATE
REFRESH_ENROLLMENT_DATE
REFRESH_ENCOUNTER_DATE
REFRESH_DIAGNOSIS_DATE
REFRESH_PROCEDURES_DATE
REFRESH_VITAL_DATE
REFRESH_DISPENSING_DATE
REFRESH_LAB_RESULT_CM_DATE
REFRESH_CONDITION_DATE
REFRESH_PRO_CM_DATE
REFRESH_PRESCRIBING_DATE
REFRESH_PCORNET_TRIAL_DATE
REFRESH_DEATH_DATE
REFRESH_DEATH_CAUSE_DATE

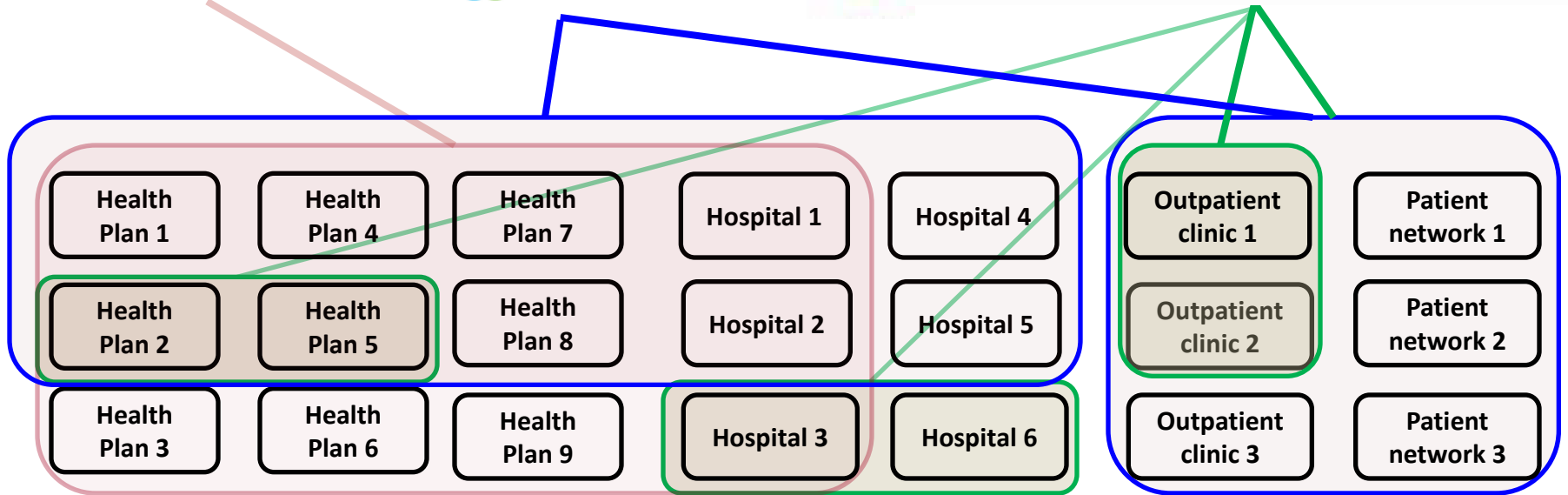
Process-related data

Multiple Networks Sharing Infrastructure

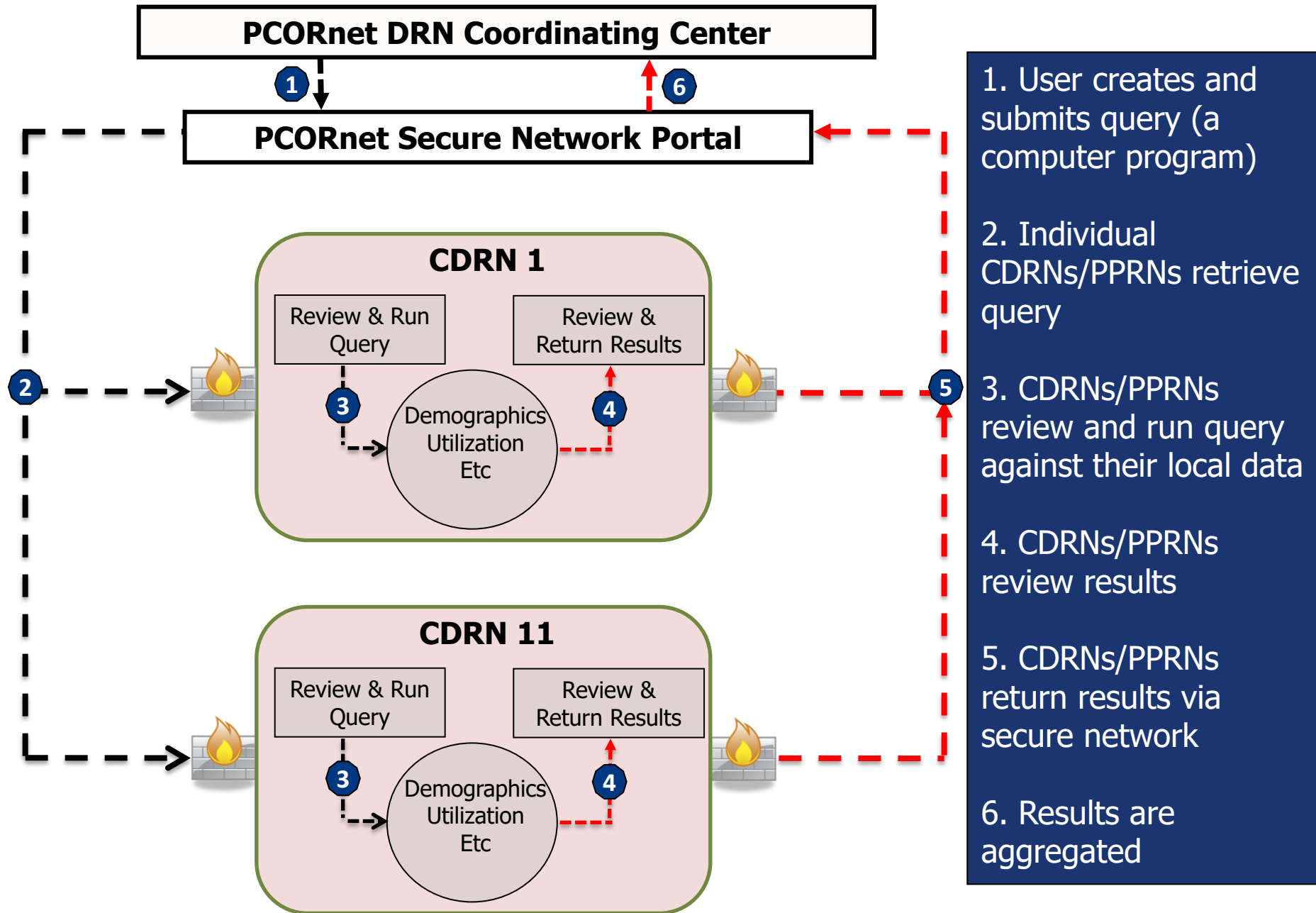
Sentinel

pcorner

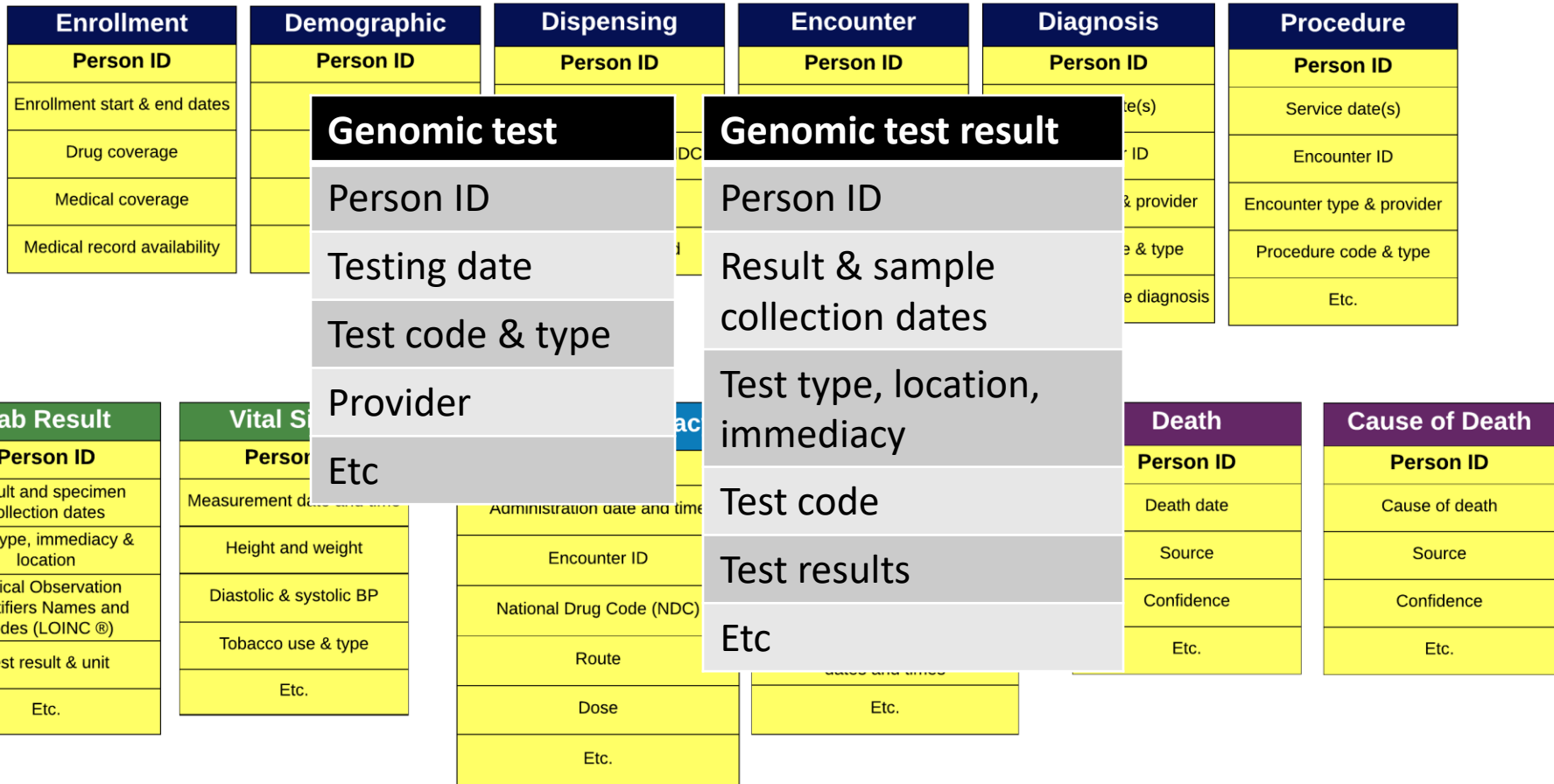
NIH Distributed Research Network



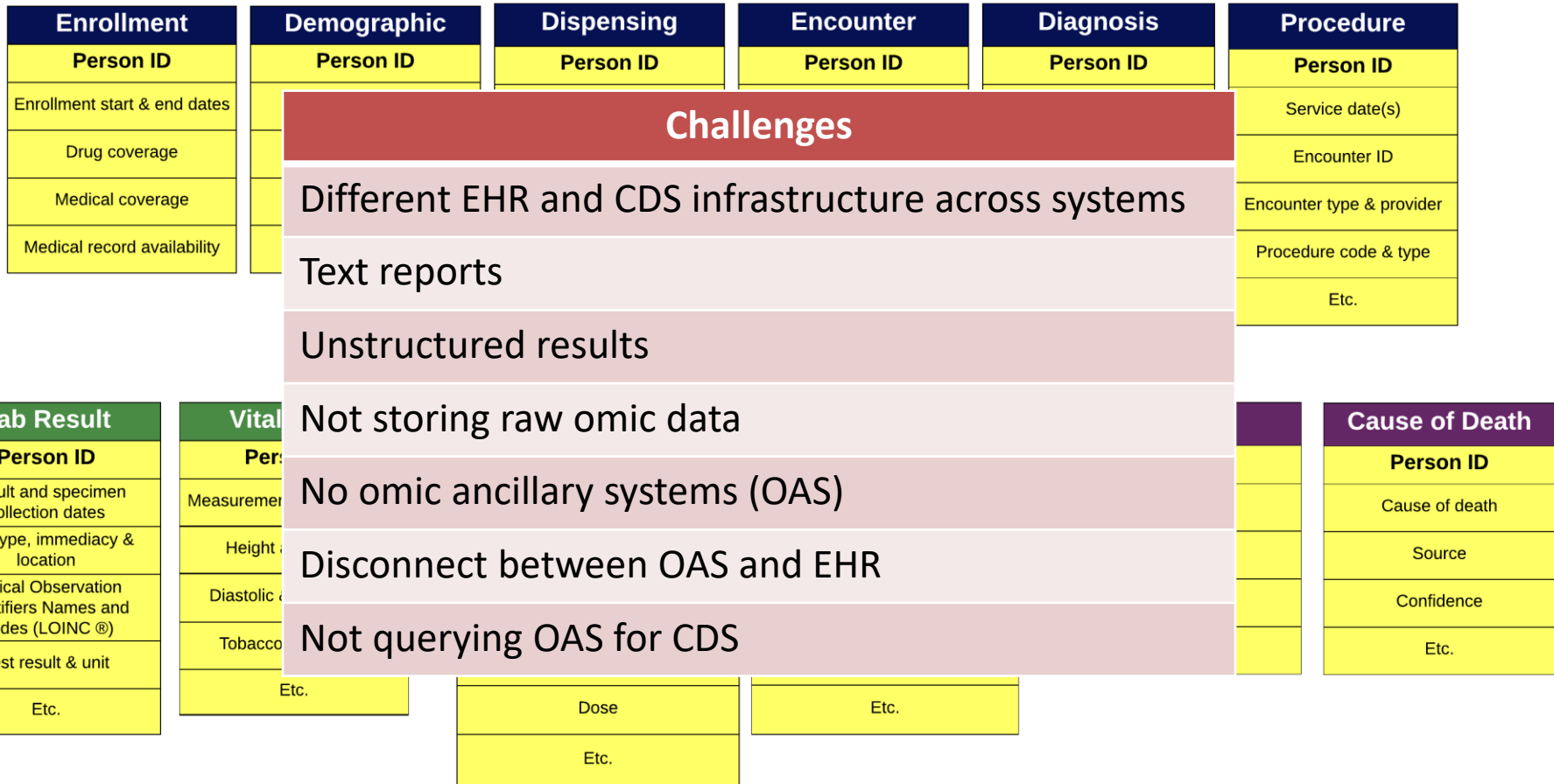
- ❑ Each organization can participate in multiple networks
- ❑ Each network controls its governance and coordination
- ❑ Other networks can participate
- ❑ Networks share infrastructure, data curation, analytics, lessons, security, software development



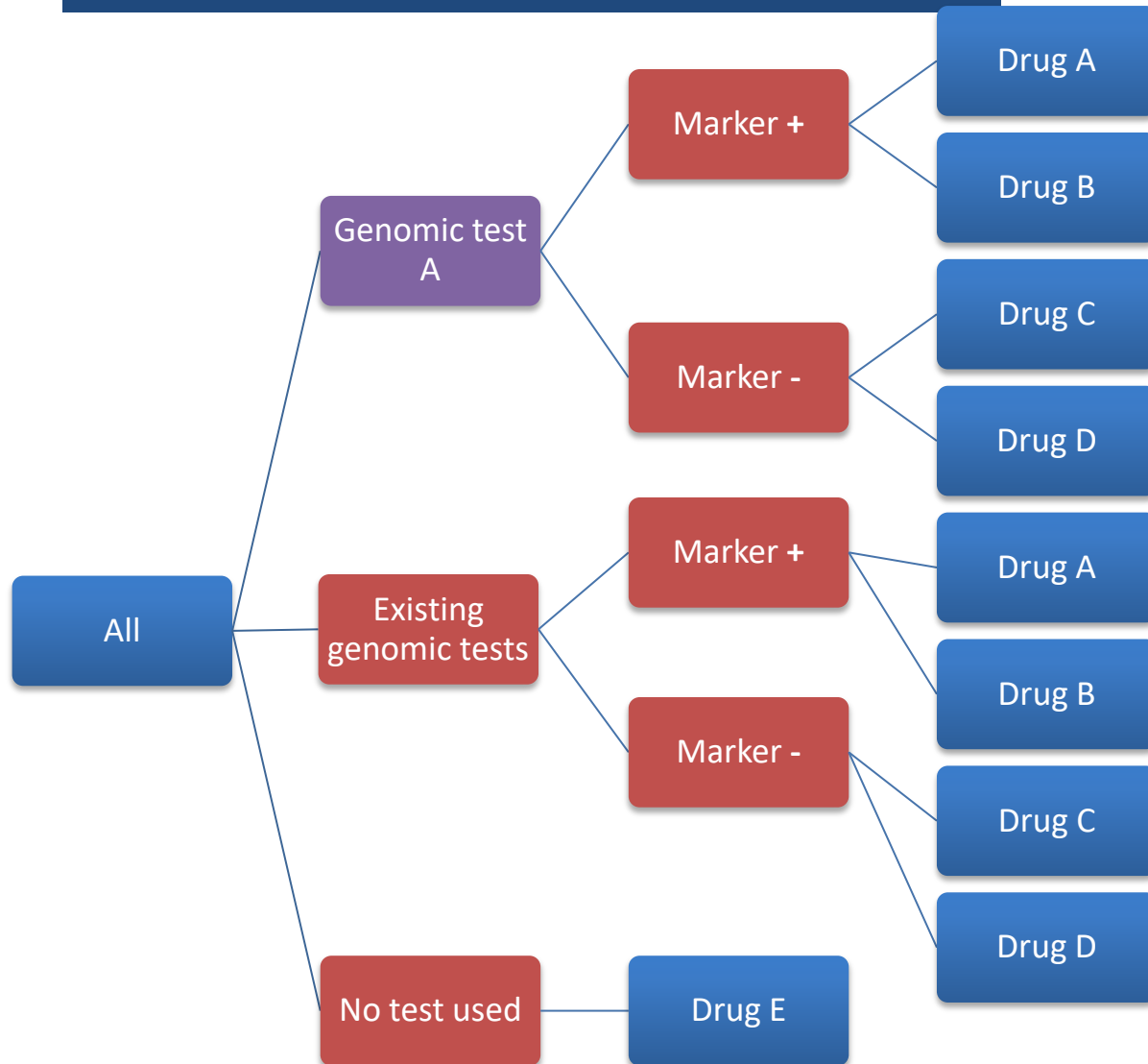
Sentinel Common Data Model v6.0



Sentinel Common Data Model v6.0



Generating Evidence



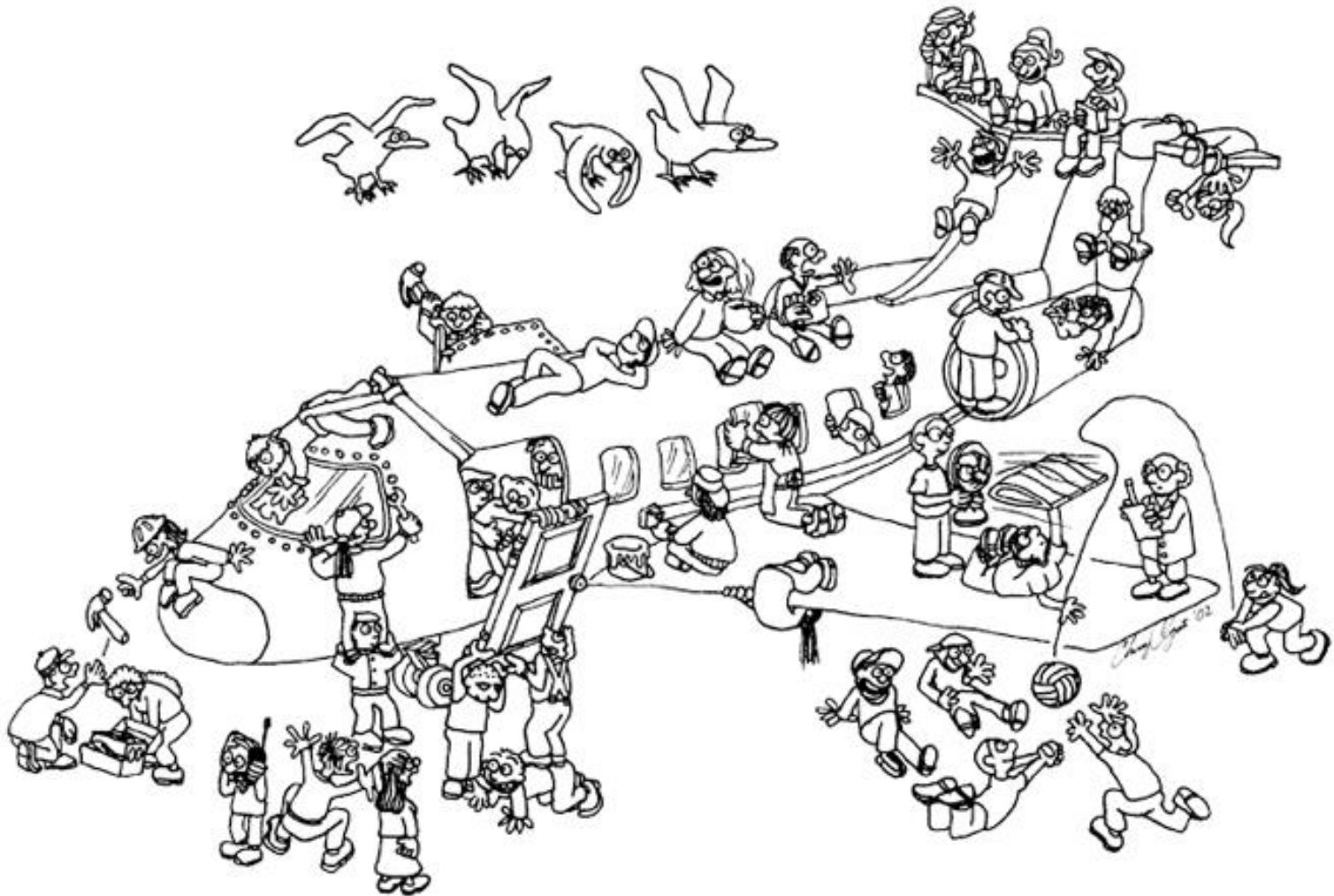
Outcomes:

- Patterns of care
- Clinical outcomes
- Costs of care

Building the plane while flying it!



Let's go together!
Safer, farther, faster



Thank you!



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