Memorial Sloan Kettering Cancer Center

OMOP CDM Oncology Module at Work

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OHDSI Oncology WG

Memorial Sloan Kettering Cancer Center

Northwestern University

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Tufts CTSI
Tufts Clinical and Translational Science Institute

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COLUMBIA UNIVERSITY DEPARTMENT OF BIOMEDICAL INFORMATICS

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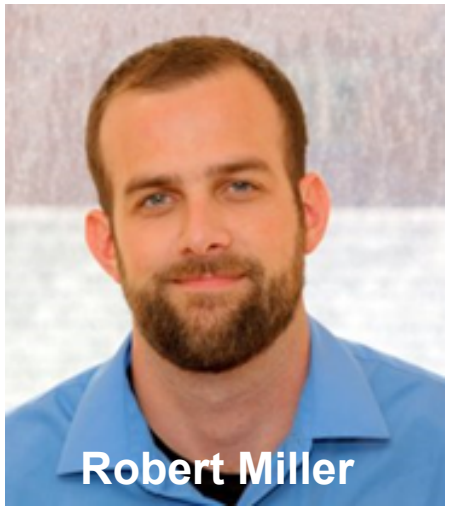
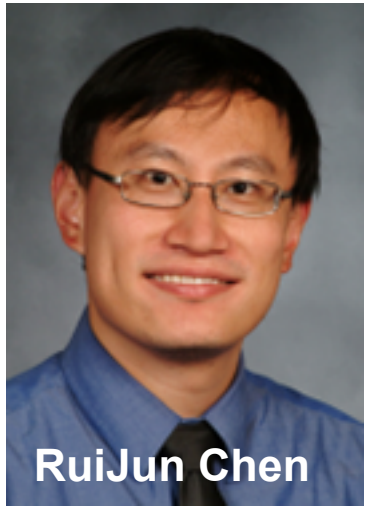

Robert Miller

Jeremy Warner

Andrew Williams

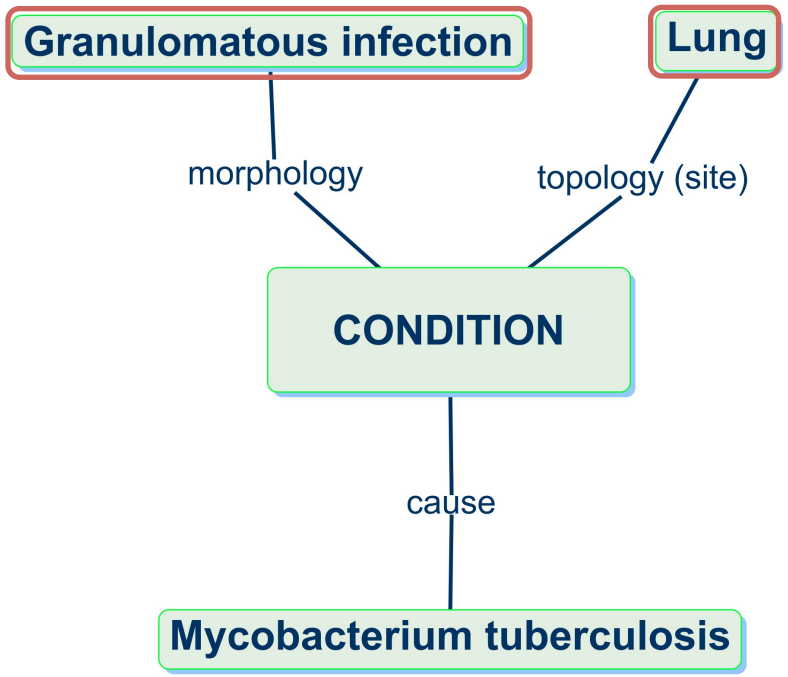

RuiJun Chen

Rimma Belenkaya

Challenges: Granularity

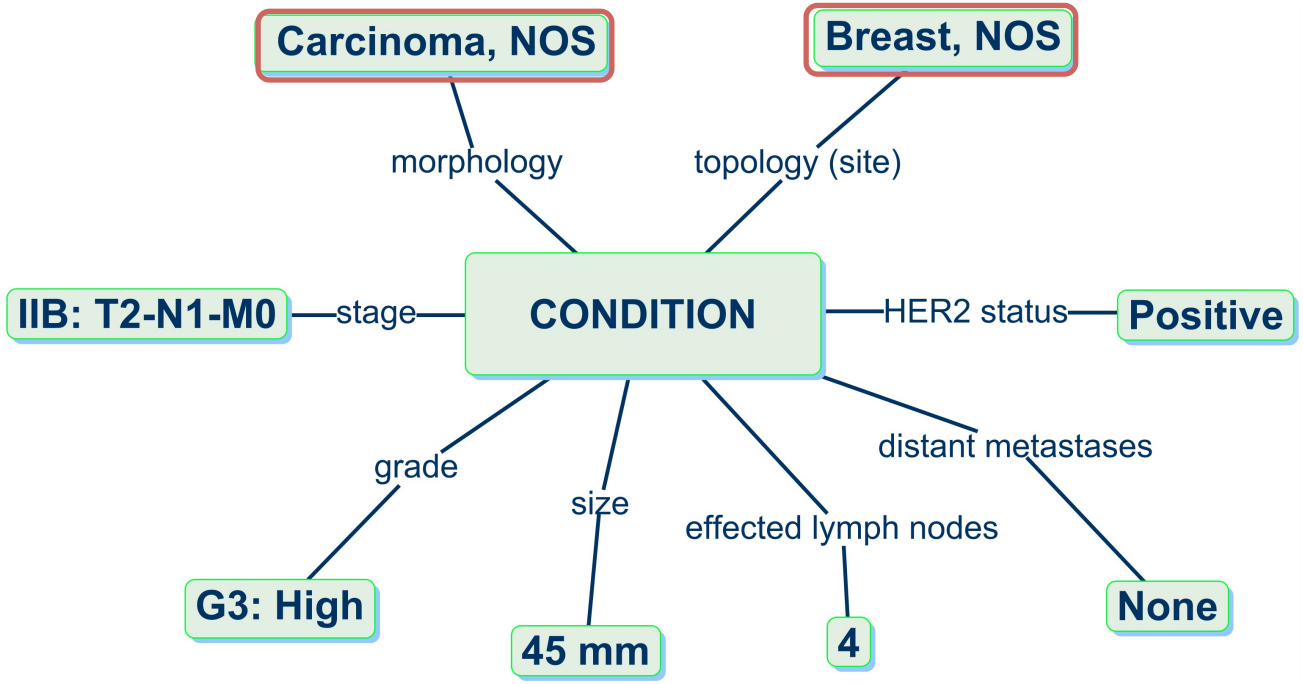
Normal Condition

Most normal conditions are defined by three main dimensions implicitly, plus some extra attributes



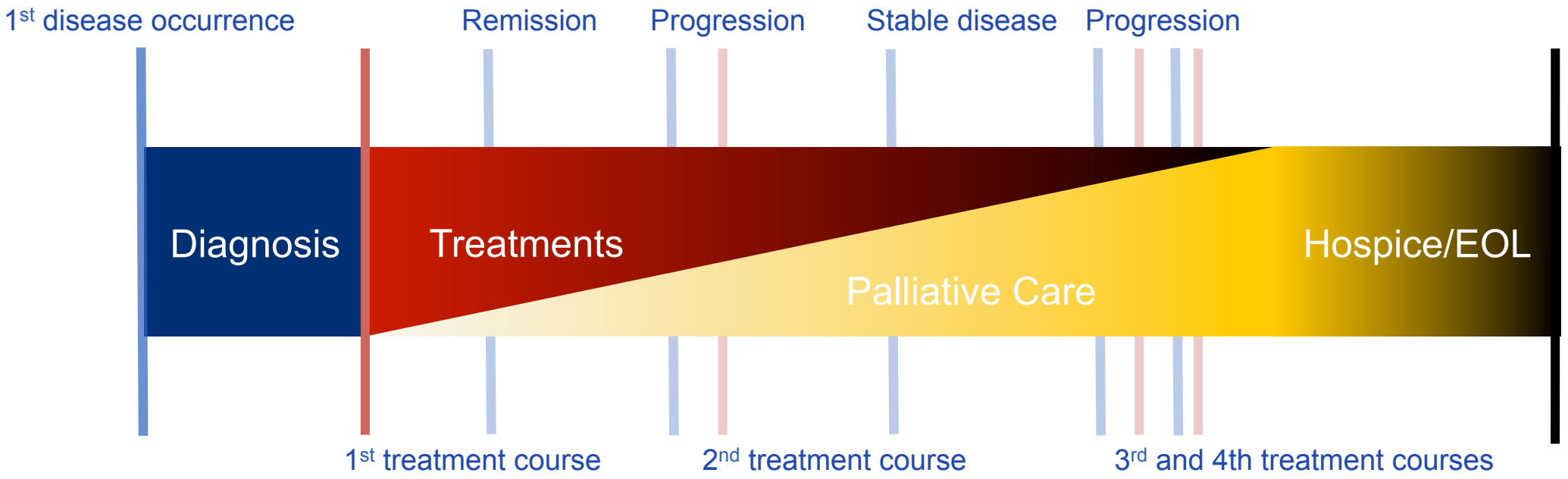
Cancer

- Cause is not known, but morphology and topology are detailed and explicit
- The many tumor attributes (modifiers) are also explicit and well defined



Challenges: Abstraction

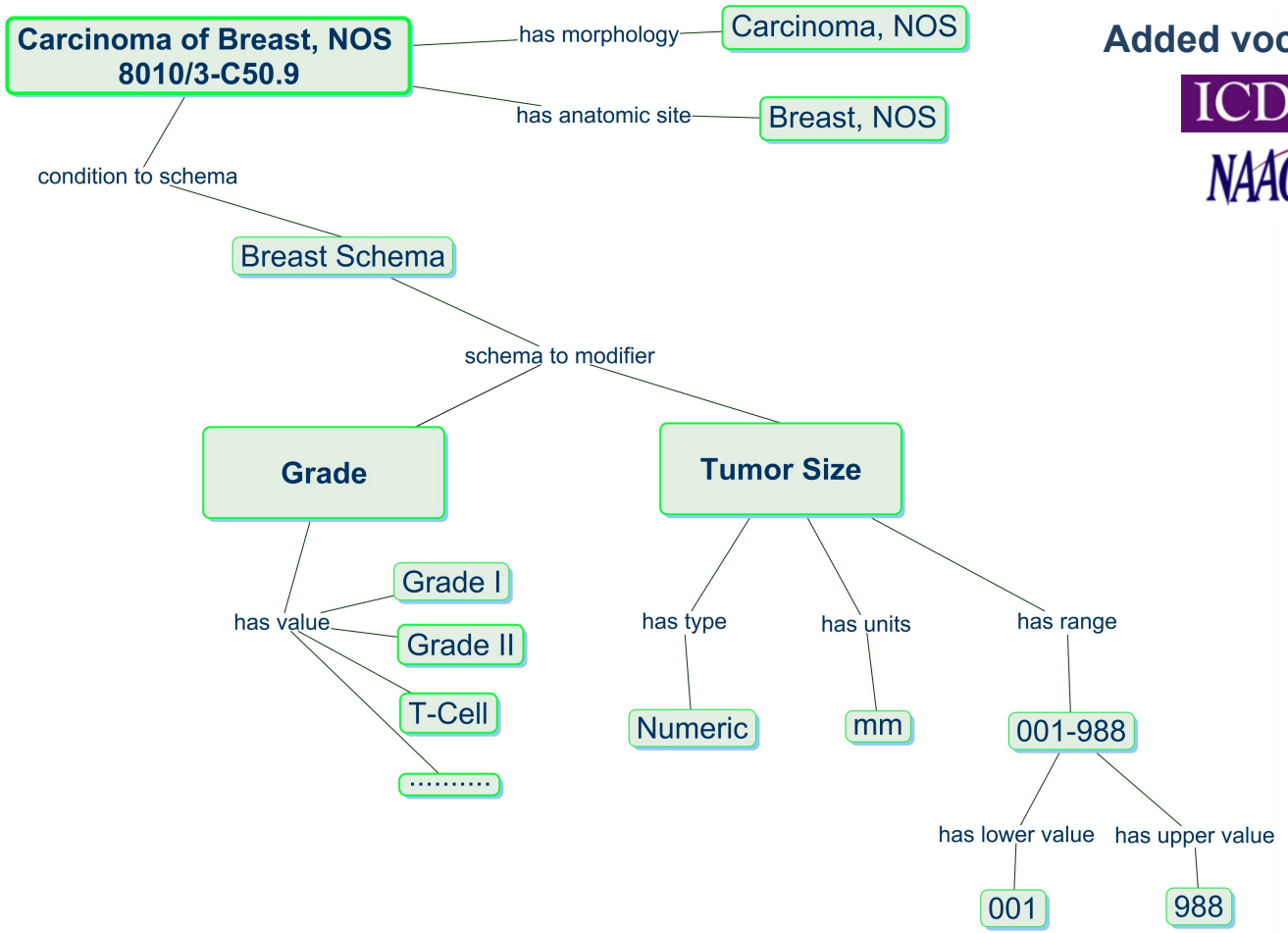
- Clinically and analytically relevant representation of cancer diagnoses, treatments, and outcomes requires data abstraction



  - Not readily available in the source data
  - Traditionally not supported in OMOP CDM

Solving Granularity Challenge

Cancer Diagnosis Model in the OMOP Vocabulary



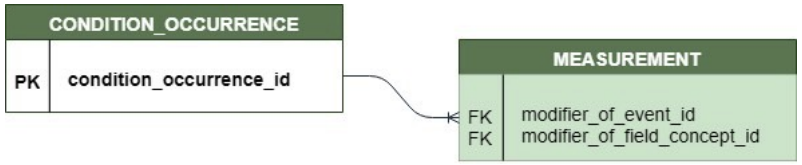
Added vocabularies:

ICD - O

NAACCR

Solving Granularity Challenge

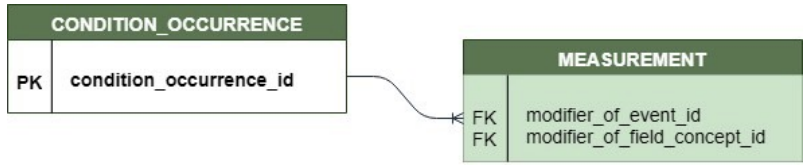
Cancer diagnosis representation in the OMOP CDM



- **Precoordinated concept** of cancer **Morphology + Site** is stored in **Condition_Occurrence**
- **Diagnostic modifiers** are stored in **Measurement** and **linked to** the **Condition_Occurrence** record

Solving Granularity Challenge

Cancer diagnosis representation in the OMOP CDM



- **Precoordinated concept** of cancer **Morphology + Site** is stored in **Condition_Occurrence**
- **Diagnostic modifiers** are stored in **Measurement** and **linked to** the **Condition_Occurrence** record

Example of cancer diagnosis in the OMOP CDM

Histology+Site diagnosis in **Condition_Occurrence**

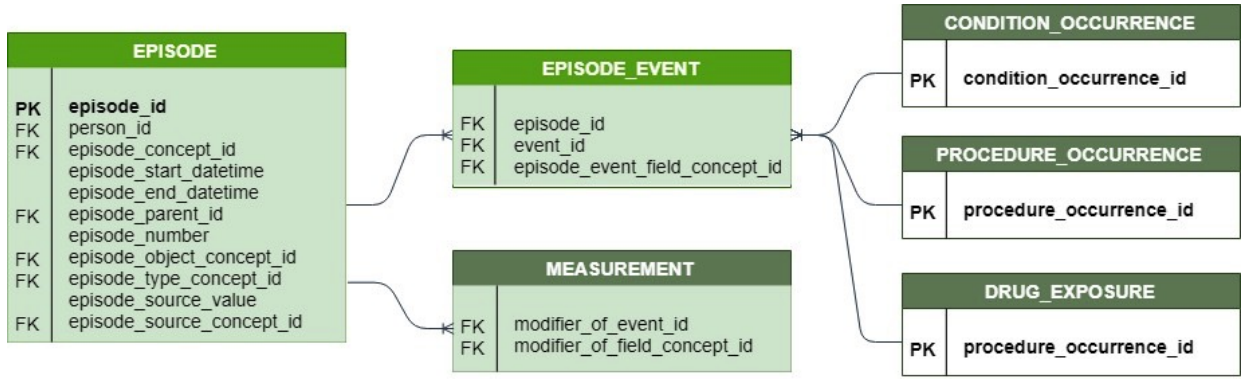
condition_occurrence_id	123456789	
person_id	1	
condition_concept_id	**4116071**	← **SNOMED concept 'Carcinoma of breast'**
condition_start_datetime	June 9, 2019	
condition_type_concept_id	32535	
condition_source_value	**8010/3-C50.9**	← **Precoordinated concept of ICD-O Histology & Site**
condition_source_concept_id	44505310	

Grade modifier in **Measurement**

measurement_id	567890	
person_id	1	
measurement_datetime	June 9, 2019	
measurement_concept_id	**35918640**	← **NAACCR concept 'Grade Pathological'**
measurement_date	June 9, 2019	
value_as_concept_id	**35922509**	← **NAACCR concept 'G3: High combined histologic grade (unfavorable); SBR score of 8-9 points'**
measurement_type_concept_id	32534	← **OMOP concept 'Tumor registry'**
measurement_source_value	3844	← **NAACCR code for 'Grade Pathological'**
measurement_source_concept_id	35918640	← **NAACCR concept 'Grade Pathological'**
value_source_value	breast@3844@3	← **NAACCR code for 'G3: High combined histologic grade (unfavorable); SBR score of 8-9 points'**
modifier_of_event_id	**123456789**	← **Value of the respective condition record condition_occurrence_id**
modifier_field_concept_id	**1147127**	← **Concept for 'condition_occurrence.condition_occurrence_id'**

Solving Abstraction Challenge

Disease and treatment episodes in the OMOP CDM

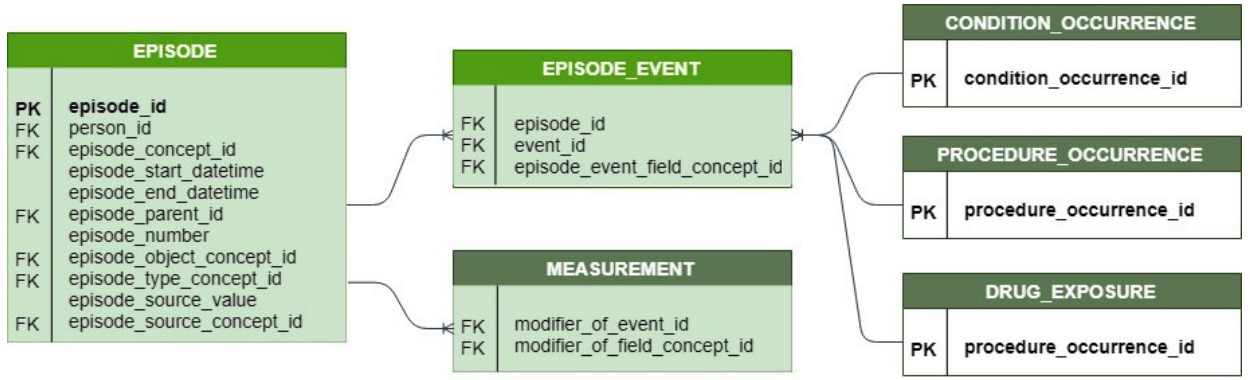


Added vocabularies:

HemOnc.org

Solving Abstraction Challenge

Disease and treatment episodes in the OMOP CDM



Added vocabularies:

HemOnc.org

Example of disease and treatment episodes in the Episode table

'First occurrence'-of-*'Carcinoma of breast'*

episode_id	12345
person_id	1
episode_concept_id	**32528**
episode_start_datetime	June 9, 2019
episode_object_concept_id	**4116071**
episode_type_concept_id	32535

- episode_concept_id: **OMOP concept 'First disease occurrence'**
- episode_object_concept_id: **SNOMED concept 'Carcinoma of breast'**
- episode_type_concept_id: **OMOP concept 'Tumor registry'**

'Treatment regimen'-of-*' Carboplatin and Paclitaxel'*

episode_id	12346
person_id	1
episode_concept_id	**32531**
episode_start_datetime	July 9, 2019
episode_parent_id	12345
episode_object_concept_id	35804255
episode_type_concept_id	32545

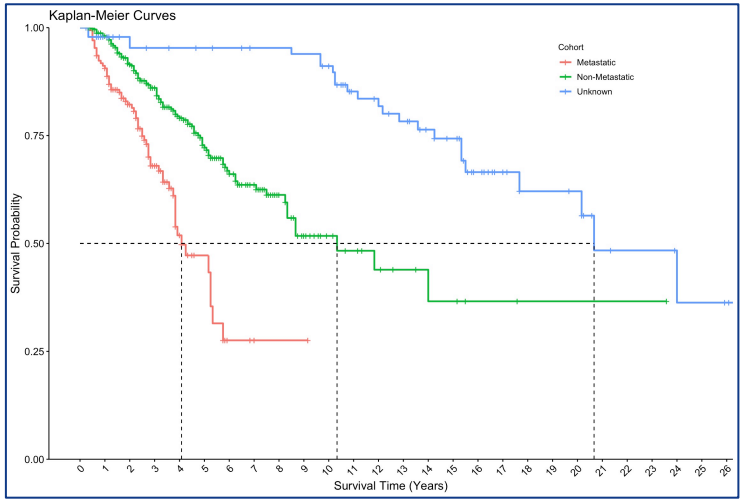
- episode_concept_id: **OMOP concept 'Treatment Regimen'**
- episode_start_datetime: **Foreign key to the disease Episode record**
- episode_parent_id: **HemOnc concept 'Carboplatin and Paclitaxel'**
- episode_object_concept_id: **OMOP concept 'Episode algorithmically derived from EHR'**

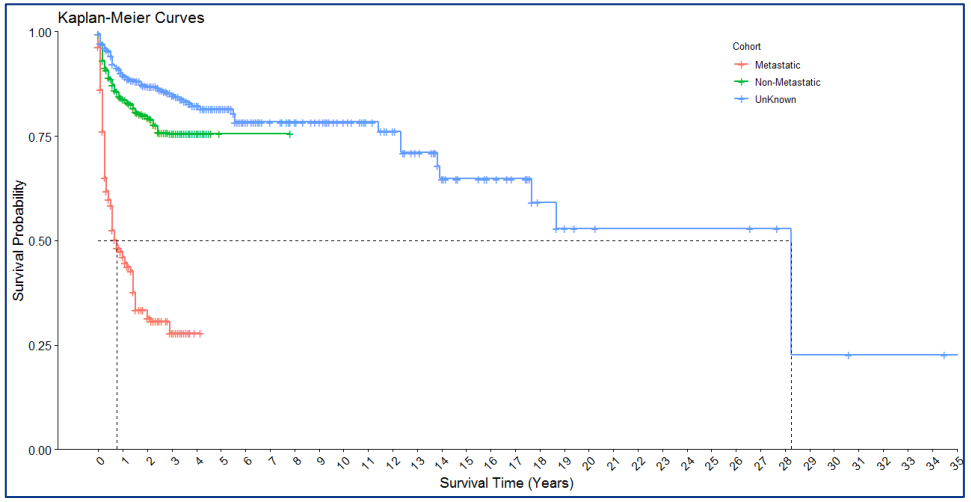
Testing

- Developed **vocabulary-driven ETL** for data conversion from Tumor Registry
- **Converted EHR** and **Tumor Registry data** from four participating institutions
- Tested **clinical characterization use cases**
  - Survival from initial diagnosis
  - Time from diagnosis to treatment
  - High-level treatment course for 1st cancer occurrence
  - Derivation of chemotherapy regimens from atomic drugs

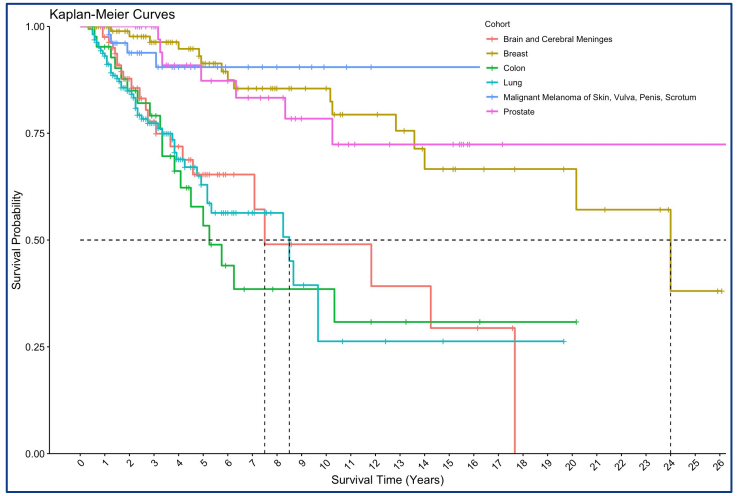
Survival from diagnosis

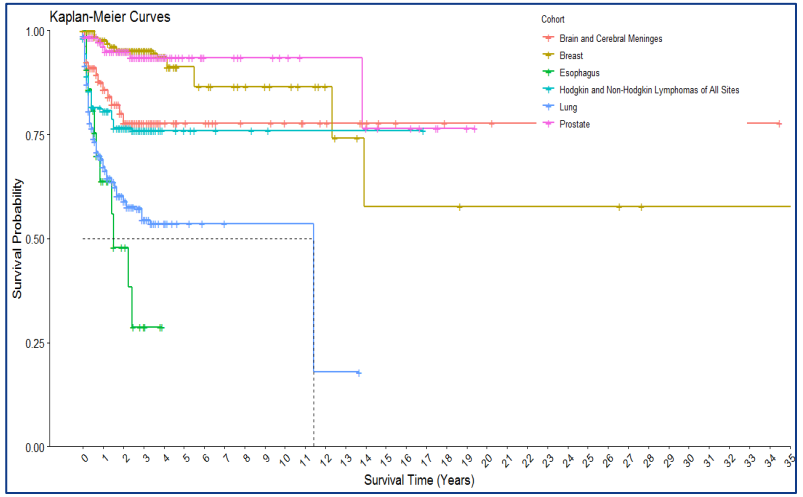
Metastatic vs. Non-metastatic cancers





Six most prevalent cancers





Join the Effort!

- **CDM and Vocabulary Work**
  - Adding domains for genomics, imaging and outcomes
  - Improving ICD-O-3 to SNOMED mapping precision
  - Mapping of NAACCR data dictionary to SNOMED
- **Oncology-specific THEMIS conventions**
- **ETL**
  - Validation
  - Conventions and algorithms for fusing tumor registry and EHR data on the same patient
- **Use-case-driven algorithms for**
  - identifying & characterizing cancer populations
  - identifying treatment pathways and disease progression
  - predicting disease progression

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Thank you!

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OBSERVATIONAL HEALTH DATA SCIENCES AND INFORMATICS

Thank you!