The goodness of data: The Optum approach to cultivating high value data for oncology research

Elenee argentinis
ADVANCED DATA AND ANALYTICS, LIFE SCIENCES
OPTUM
Agenda

1. The needs of oncology researchers
2. Why Optum is positioned to drive transformation
3. Oncology enrichment at scale — going from breadth to depth
4. Questions
Oncoogy dominates pipeline of top 100 companies
The movement to specialty areas continues

Biomed Tracker 2018 – top 107 biopharmaceutical companies by revenue

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How many of you are engaged in the care of oncology patients or in oncology research? (select all that apply)

a) Patient care
b) Oncology research
c) Both
d) Neither
Optum is positioned to support life sciences oncology research needs…
We sit at the intersection of care and reimbursement

CARE

- Signs, symptoms
- Clinical assessments
- Vital signs, labs
- Care plans
- Radiology
- Pathology

REIMBURSEMENT

- Deterministically linked
- Filled Rx
- Reimbursed
- Submitted claims
- Care utilization

Optum clinical EHR and medical and pharmacy claims datasets

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How many of you are using real world oncology data? 
(select all that apply)

a) Using EHR data
b) Using claims data
c) Using genomics/molecular data
d) Using imaging data
e) Not using any
We have the building blocks for high quality research across cancers

- **Data breadth**: Population size
- **Data depth**: Completeness of cancer specific variables
- **Continuum of care**: Care outside the oncology clinic
- **Pre- and post-cancer encounters**: (signs, symptoms, assessments, tests, procedures, labs)
- **Data quality**: (provenance and traceability)

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How much oncology data does your organization license?

a) We license one file for a specific cancer at a time (i.e., PDL-1)
b) We license a few data sets at a time (two to four mutation files)
c) We license the entirety of one or many data vendors datasets
d) We don’t license any data
Breadth

These populations include data from the entire patient journey

<table>
<thead>
<tr>
<th>BREADTH OF SPECIALTIES (e.g., for breast or ovarian cancer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiology</td>
</tr>
<tr>
<td>Gynecology</td>
</tr>
<tr>
<td>Medical oncology</td>
</tr>
<tr>
<td>Osteopathic/orthopedic oncology</td>
</tr>
<tr>
<td>Primary care</td>
</tr>
<tr>
<td>Psychology</td>
</tr>
<tr>
<td>Radiology oncology</td>
</tr>
<tr>
<td>Surgical oncology</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>PRE- AND POST-CANCER CARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs, symptoms</td>
</tr>
<tr>
<td>Clinical assessments</td>
</tr>
<tr>
<td>Labs, procedures, biomarkers</td>
</tr>
<tr>
<td>Diagnosis/staging</td>
</tr>
<tr>
<td>Surgery</td>
</tr>
<tr>
<td>Radiation therapy</td>
</tr>
<tr>
<td>Chemo-therapy</td>
</tr>
<tr>
<td>Oral medication</td>
</tr>
<tr>
<td>Follow up care</td>
</tr>
</tbody>
</table>

A significant portion of cancer patients get their pre-diagnosis screening and intervention outside the oncology clinic

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3752900/
Example of the importance of continuum of care
Prostate cancer

Urology conducts more PSA tests and prescribes nearly as much as oncologists because they often treat early stages of prostate cancer.

<table>
<thead>
<tr>
<th>PROSTATE CANCER DIAGNOSIS</th>
<th>2016–2018</th>
<th>N=424493</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>PROVIDER SPECIALTY</th>
<th>Urology (N=26,814)</th>
<th>Oncology (N=7,106)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>TESTS</th>
<th>PSA, N=141,528</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PHARMACOTHERAPY</th>
<th>N=69,568</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distribution of tests</th>
<th>Urology (N=27,309)</th>
<th>Oncology (N=2,934)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Distribution of pharmacotherapy</th>
<th>Urology (N=6,589)</th>
<th>Oncology (N=8,475)</th>
</tr>
</thead>
</table>

Comparison of specialty in prostate cancer urology is highly engaged in both diagnosis and treatment.

Cancer patients care outside of oncology clinic
Patients with melanoma and bladder cancer get up to 50% of their care from other specialties

<table>
<thead>
<tr>
<th>Melanoma</th>
<th>Top five other specialties who deliver supportive care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other specialties</td>
<td>7%</td>
</tr>
<tr>
<td>Surgery (misc)</td>
<td>8%</td>
</tr>
<tr>
<td>General physician</td>
<td>13%</td>
</tr>
<tr>
<td>Dermatology</td>
<td>21%</td>
</tr>
<tr>
<td>Oncology and related</td>
<td>51%</td>
</tr>
</tbody>
</table>

Top five other specialties who deliver supportive are
- Plastic surgery
- Otolaryngologist
- Cardiology
- Hematology
- Ophthalmology

<table>
<thead>
<tr>
<th>Bladder cancer</th>
<th>Top five other specialties who deliver supportive care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other specialties</td>
<td>2%</td>
</tr>
<tr>
<td>Surgery (misc)</td>
<td>3%</td>
</tr>
<tr>
<td>General physician</td>
<td>17%</td>
</tr>
<tr>
<td>Dermatology</td>
<td>29%</td>
</tr>
<tr>
<td>Oncology and related</td>
<td>49%</td>
</tr>
</tbody>
</table>

Top five other specialties who deliver supportive care
- Cardiology
- Hematology
- Rehabilitation
- Psychiatry
- Gynecology

Oncology and related
- Oncology 11.57%
- Pathology 21.65%
- Radiology 12.01%
- Anesthesia 5%

Reference: Counts based on ICD 10 diagnostic codes for specific cancer and provider specialty, Optum EHR data 2018
Optum oncology data quality supports publications
Optum data has been used in many types publications

> 30 articles and abstracts
Over the past two years

Cancer types addressed *(most common)*
- Breast, lung, pancreatic, prostate, glioblastoma, ovarian, thyroid, renal, colon, multiple myeloma

Types of studies
- Comparative effectiveness research
- Outcomes research (i.e., overall survival studies have been done)
- Algorithms to identify cancer types (i.e., pancreatic cancer patients)
- Therapeutic choices in specific cancer types
- Surveillance of patients specific gene mutations to assess risk of developing prostate cancer
<table>
<thead>
<tr>
<th>No.</th>
<th>Study Title</th>
<th>Journal</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U.S. prevalence of endocrine therapy-naive locally advanced or metastatic breast cancer</td>
<td>Breast cancer</td>
<td>2019 Apr</td>
</tr>
<tr>
<td>2</td>
<td>Analysis of Real-World Data on Overall Survival in Multiple Myeloma Patients With ( \geq 3 ) Prior Lines of Therapy Including a Proteasome Inhibitor (PI) and an Immunomodulatory Drug (IMiD), or Double Refractory to a PI and an IMiD</td>
<td>Multiple myeloma</td>
<td>2016 Nov</td>
</tr>
<tr>
<td>3</td>
<td>U.S. prevalence of endocrine therapy–naïve locally advanced or metastatic breast cancer</td>
<td>Breast cancer</td>
<td>2019 Apr</td>
</tr>
<tr>
<td>5</td>
<td>Validation of algorithms to identify pancreatic cancer and thyroid neoplasms from health insurance claims data in a 10-year follow-up study</td>
<td>Thyroid neoplasm</td>
<td>2018 Aug</td>
</tr>
<tr>
<td>7</td>
<td>Incidence of pericardial and pleural effusions in patients with small cell lung cancer treated with third-line or later-line therapy: An analysis of electronic health records data</td>
<td>Small cell lung cancer</td>
<td>2018 Jul</td>
</tr>
<tr>
<td>9</td>
<td>A real-world evidence study to define the prevalence of endocrine therapy-naive hormone receptor-positive locally advanced or metastatic breast cancer in the US</td>
<td>Breast cancer</td>
<td>2017</td>
</tr>
<tr>
<td>10</td>
<td>Analysis of Real-World Data on Overall Survival in Multiple Myeloma Patients With ( \geq 3 ) Prior Lines of Therapy Including a Proteasome Inhibitor (PI) and an Immunomodulatory Drug (IMiD), or Double Refractory to a PI and an IMiD</td>
<td>Multiple myeloma</td>
<td>2016</td>
</tr>
<tr>
<td>12</td>
<td>Comparison of Overall Survival Associated with Lenalidomide+Dexamethasone and Bortezomib+Dexamethasone Among Relapsed/Refractory Multiple Myeloma Patients: A Matched Analysis of Real World and Clinical Trial Populations</td>
<td>Multiple myeloma</td>
<td>2017</td>
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</tbody>
</table>
What oncology enrichment at Scale look like
Optum oncology data — Going from breadth to depth

We can give life sciences the benefit of our breadth and tailor our data for depth

Marketing insights | Med affairs | Health economics | Post market safety | Clinical trial planning and execution | Regulatory grade evidence
Our approach
Enrichment starts with tuning the data to answer specific questions

What is the cost?
TCOC
Burden of illness
Cost effectiveness

What is the risk?
Risk estimation
Risk stratification

Which intervention is better?
Comparative Effectiveness & Quality

Who is the patient?
Study inclusion criteria: population health
The enrichment plan
Sequenced starting with solid tumors

Cancers with similar features allow us to scale so the staging construct and metastatic concepts shared by solid tumors will allow us to offer a suite of pan-oncology files using similar techniques adapted to each cancer.

Biomed Tracker 2018 – top 107 biopharmaceutical companies by revenue
We can use clinical notes to take our data from broad to deep.

- **4.5 billion free-text medical notes**
- **74 million patients**
  - More than 45% have activity spanning more than 3 years
  - More than 30% have activity spanning more than 5 years
- **140K providers**
  - More than 700 hospitals and 7,000 clinics
Do you have an internal natural language processing team?

a) No we outsource it
b) We have a few dedicated employees
c) We have a fully staffed department
Architectural flexibility

Flexibility lets us extract and build models on top of the extracted entities

Annotations
- Annotators are subject matter experts with clinical background
- Annotations followed by a curation (reconciliation) phase

Models
- Models are constantly evaluated during development process
- Standard metrics such as PPV (precision), Sensitivity (recall) and F-score are reported on a held-out test set

Output
- Output is normalized to reduce variability and as an additional step to prevent PHI leaks
- Quality check are performed (volumetrics, outliers, distributions, comparisons with available structured data, extrinsic evaluation, …)

Structured data
Deliver new standardized variables that researchers can use

Modeling data
Add analytics to create derived variables from combinations of extracted structured and unstructured fields

Extraction data
NLP pipeline extract the terms that define concepts and relationships between them: TNM, stage, grade, biomarkers, tumor characterization, metastatic references

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We’ve realized the power that linked data can bring to patient care

Jane Smith
Age 57, BMI 22
Stage III Breast Cancer | HER2 positive ER/PR neg

- EHR/EMR
- Medical claims
- Pharmacy claims
- Biomarkers
- Genomics
- Devices
- Devices
- Imaging
- Imaging
- Diagnostics
- Storefront pharmacy
- Groceries, CPG
- Media
- SDOH socio-econ

Patient reports a lump in her breast
Genetic panel reveals HER2 mutation
Radiology confirms tumor size, lymph nodes
Buying cigarettes (told doc she quit)
Using apps for depression management

Doesn’t own a car

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Now we can support our clients with enterprise linking

1. Protect
   De-identify datasets to protect patient privacy and reduce risk

2. Link
   Connect matching patient records across datasets to increase data completeness and dimensionality

3. Exchange
   Securely exchange data in our open ecosystem as either a data owner or data user

Assemble a more holistic view of the patient to expand the set of questions that can be answered in health care
What can we explore linking for our clients?

- Trial data
- Provider populations
- Digital apps

- Genomics and molecular data

- Imaging data

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Upcoming Presentations

July 31, Ironwood 3
2:15 pm

Leveraging EHR and Claims Data to Predict Changing Drug Utilization Trends
Conor Wyand, Director of Real World Evidence and Value, Optum Life Sciences