OHDSI community efforts on COVID-19 disease natural history

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Ross Williams
Erasmus MC

on behalf of OHDSI community
Agenda

• Welcome - FDA/RUF team - 5 min
• OHDSI community overview - Patrick
• Characterization of patients hospitalized with COVID-19 - Dani
• Prediction of COVID outcomes in symptomatic patients - Ross
• Project CHARYBDIS: Large-scale disease natural history of COVID progression - Talita
• Q&A - All - 15 min
OHDSI: a global open science community

OHDSI Collaborators:
➢ 2,770 users
➢ 25 workgroups
➢ 18,700 posts on 3,250 topics

OHDSI Network:
➢ 152 databases
➢ 18 countries
➢ approx. 600M patient records

OHDSI's Mission: To improve health by empowering a community to collaboratively generate the evidence that promotes better health decisions and better care
Open community data standard: OMOP CDM

Standardized clinical data
- Person
  - Observation_period
  - Visit_occurrence
  - Visit_detail
  - Condition_occurrence
  - Drug_exposure
  - Procedure_occurrence
  - Device_exposure
  - Measurement
  - Note
  - Note_NLP
  - Survey_conduct
  - Observation
  - Specimen
  - Fact_relationship

Standardized health system data
- Location
- Location_history
- Care_site
- Provider

Standardized derived elements
- Condition_era
- Drug_era
- Dose_era

Standardized health economics
- Cost
- Payer_plan_period

Standardized metadata
- CDM_source
- Metadata

Standardized vocabularies
- Concept
- Vocabulary
- Domain
- Concept_class
- Concept_relationship
- Relationship
- Concept_synonym
- Concept_ancestor
- Source_to_concept_map
- Drug_strength
Complementary evidence to inform the patient journey

Clinical characterization: What happened to them?

Observation

Patient-level prediction: What will happen to me?

Inference

Population-level effect estimation: What are the causal effects?

Causal inference
What have we done?

In only **88** hours, we have:

- Convened **351** participants brought together from **30** countries
- Held **12** Global Huddles, **>100** collaborator calls, **>13,000** chat messages
- Engaged **15** concurrent channels
- Reviewed **>10,000** publications
- Drafted **9** protocols
- Released **13** study packages
- Designed **355** cohort definitions
- Assembled a distributed data network with **37** partners signed on to execute studies
3 things that we did in 4 days together that nobody has ever done before

- First large-scale characterization of COVID patients in US and Asia
- First prediction model externally validated on COVID patients to support triage to ‘flatten the curve’
- Largest study ever conducted on the safety of hydroxychloroquine
Open collaboration requires FULL transparency in every step of the research process


- Phenotype definitions and analysis specifications are both human-readable and computer-executable using ATLAS against any OMOP CDM: [https://atlas.ohdsi.org/#/estimation/cca/6](https://atlas.ohdsi.org/#/estimation/cca/6)

- Analysis source code freely available and directly downloadable: [https://github.com/ohdsi-studies/Covid19EstimationHydroxychloroquine](https://github.com/ohdsi-studies/Covid19EstimationHydroxychloroquine)

- Manuscript posted on Medrxiv while awaiting peer-review: [https://www.medrxiv.org/content/10.1101/2020.04.08.20054551v1](https://www.medrxiv.org/content/10.1101/2020.04.08.20054551v1)

An international characterisation of patients hospitalised with COVID-19 and a comparison with those previously hospitalised with influenza

Prof Dani Prieto-Alhambra
University of Oxford
Open collaboration requires FULL transparency in every step of the research process

- Protocol and analysis source code freely available and directly downloadable: https://github.com/ohdsi-studies/Covid19HospitalizationCharacterization

- Phenotype definitions are both human-readable and computer-executable using ATLAS against any OMOP CDM: https://atlas.ohdsi.org/

- Manuscript posted on Medrxiv while awaiting peer-review: https://www.medrxiv.org/content/10.1101/2020.04.22.20074336v1

- All analysis results available for public exploration through interactive R shiny application: http://evidence.ohdsi.org/Covid19CharacterizationHospitalization/

- The study is a living evidence repository: any data partners can execute analysis and share aggregate results at any point, including updates as data accumulate
KEY FINDINGS

• 26,074 (US: 2,477, South Korea: 5,172, Spain: 18,425) included

• 49,331 summary characteristics extracted, summarised in an interactive web app (next slides)

https://www.medrxiv.org/content/10.1101/2020.04.22.20074336v1

*under peer review
KEY FINDINGS (2)

• 26,074 COVID19 admitted patients from 3 continents
  – US: 2,477
  – South Korea: 5,172
  – Spain: 18,425

• 49,331 summary characteristics extracted, summarised in an interactive web app (next slides)
KEY FINDINGS (3)

• Patients were majority male in the US (VA OMOP: 94%, STARR-OMOP: 57%, CUIMC: 52%) and Spain (SIDIAP: 54%, HM: 60%)
• ... but majority female in South Korea (HIRA: 56%).
• Age profiles varied across data sources.
• COVID is no flu
• Healthier
• Less drug usage
• Exceptions
  obesity, diabetes, OA
<table>
<thead>
<tr>
<th>Covariate Name</th>
<th>CUHMC Mean</th>
<th>CUHMC SD</th>
<th>DCMC Mean</th>
<th>DCMC SD</th>
<th>HIRA Mean</th>
<th>HIRA SD</th>
<th>STARR-OHMP Mean</th>
<th>STARR-OHMP SD</th>
<th>VA ODHMP Mean</th>
<th>VA ODHMP SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>age group: 00-04</td>
<td>&lt;1.0%</td>
<td></td>
<td>2.1%</td>
<td>0.15</td>
<td>&lt;1.7%</td>
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<td></td>
<td></td>
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<td>1.2%</td>
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<td>11.5%</td>
<td>0.54</td>
<td>&lt;1.7%</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>age group: 15-19</td>
<td>3.3%</td>
<td>0.19</td>
<td>12.1%</td>
<td>0.39</td>
<td>&lt;1.7%</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>age group: 20-24</td>
<td>5.4%</td>
<td>0.23</td>
<td>9.1%</td>
<td>0.20</td>
<td>7.4%</td>
<td>0.28</td>
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<td>age group: 25-29</td>
<td>5.5%</td>
<td>0.23</td>
<td>9.7%</td>
<td>0.31</td>
<td>&lt;1.7%</td>
<td></td>
<td></td>
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<td></td>
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<td>age group: 30-34</td>
<td>5.0%</td>
<td>0.22</td>
<td>8.4%</td>
<td>0.20</td>
<td>13.5%</td>
<td>0.37</td>
<td></td>
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</tr>
<tr>
<td>age group: 35-39</td>
<td>5.0%</td>
<td>0.20</td>
<td>9.2%</td>
<td>0.30</td>
<td>7.1%</td>
<td>0.27</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>age group: 40-44</td>
<td>4.0%</td>
<td>0.29</td>
<td>6.2%</td>
<td>0.29</td>
<td>&lt;1.7%</td>
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<tr>
<td>age group: 45-49</td>
<td>8.4%</td>
<td>0.31</td>
<td>15.9%</td>
<td>0.27</td>
<td>&lt;1.7%</td>
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</tr>
<tr>
<td>age group: 50-54</td>
<td>1.2%</td>
<td>0.11</td>
<td>11.5%</td>
<td>0.54</td>
<td>&lt;1.7%</td>
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<td>0.8%</td>
<td>0.10</td>
<td>7.2%</td>
<td>0.27</td>
<td>&lt;1.7%</td>
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<tr>
<td>age group: 60-64</td>
<td>0.8%</td>
<td>0.10</td>
<td>7.2%</td>
<td>0.27</td>
<td>&lt;1.7%</td>
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<td>age group: 70-74</td>
<td>0.1%</td>
<td>0.32</td>
<td>3.3%</td>
<td>0.19</td>
<td>&lt;1.7%</td>
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</tr>
<tr>
<td>age group: 75-79</td>
<td>0.1%</td>
<td>0.32</td>
<td>3.3%</td>
<td>0.19</td>
<td>&lt;1.7%</td>
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</tr>
<tr>
<td>age group: 80-84</td>
<td>0.8%</td>
<td>0.26</td>
<td>13.3%</td>
<td>0.37</td>
<td>&lt;1.7%</td>
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<td></td>
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<td>age group: 85-89</td>
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<td>0.23</td>
<td>3.3%</td>
<td>0.19</td>
<td>1.9%</td>
<td>0.11</td>
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<td>age group: 90-94</td>
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<td>0.07</td>
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</tr>
<tr>
<td>age group: 95-99</td>
<td>&lt;1.0%</td>
<td></td>
<td>&lt;1.0%</td>
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<td>&lt;1.0%</td>
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<tr>
<td>condition_era_group during day -30 through 0 days relative to index: Abdominal abscess</td>
<td>&lt;1.0%</td>
<td></td>
<td>&lt;1.0%</td>
<td></td>
<td>&lt;1.0%</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>condition_era_group during day -30 through 0 days relative to index: Abdominal aortic aneurysm</td>
<td>&lt;1.0%</td>
<td></td>
<td>&lt;1.0%</td>
<td></td>
<td>&lt;1.0%</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>condition_era_group during day -30 through 0 days relative to index: Abdominal aortic aneurysm without rupture</td>
<td>&lt;1.0%</td>
<td></td>
<td>&lt;1.0%</td>
<td></td>
<td>&lt;1.0%</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>condition_era_group during day -30 through 0 days relative to index: Abdominal aortic ectasia</td>
<td>&lt;1.0%</td>
<td></td>
<td>&lt;1.0%</td>
<td></td>
<td>&lt;1.0%</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>condition_era_group during day -30 through 0 days relative to index: Abdominal distension, gaseous</td>
<td>&lt;1.0%</td>
<td></td>
<td>&lt;1.0%</td>
<td></td>
<td>&lt;1.0%</td>
<td></td>
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</tr>
</tbody>
</table>

http://evidence.ohdsi.org/Covid19CharacterizationHospitalization/
Seek COVER: Development and validation of a personalized risk calculator for COVID-19 outcomes in an international network

Ross D. Williams
Department of Medical Informatics, Erasmus University Medical Center, Rotterdam, The Netherlands
Open collaboration requires FULL transparency in every step of the research process

- Protocol and analysis source code freely available and directly downloadable: https://github.com/ohdsi-studies/Covid19PredictionStudies

- Phenotype definitions are both human-readable and computer-executable using ATLAS against any OMOP CDM: https://atlas.ohdsi.org/

- Manuscript posted on Medrxiv while awaiting peer-review: https://www.medrxiv.org/content/10.1101/2020.05.26.20112649v1

- All analysis results available for public exploration through interactive R shiny application: http://evidence.ohdsi.org/Covid19CoverPrediction

- The study is a living evidence repository: any data partners can execute analysis and share aggregate results at any point, including updates as data accumulate
Design and implementation of a standardized framework to generate and evaluate patient-level prediction models using observational healthcare data

Jenna M Reps, 1 Martijn J Schuemie, 1 Marc A Suchard, 2 Patrick B Ryan, 3 and Peter R Rijnbeek 2

1Janssen Research and Development, Raritan, NJ, USA; 2Department of Biomathematics, UCLA School of Medicine, CA, USA; and 3Department of Medical Informatics, Erasmus University Medical Center, Rotterdam, The Netherlands

Corresponding Author: Dr Jenna M Reps, Janssen Research and Development, Raritan, New Jersey, USA; jreps@its.jnj.com

Received 30 May 2017; Revised 8 December 2017; Editorial Decision 23 February 2018; Accepted 15 March 2018

Feasibility and evaluation of a large-scale external validation approach for patient-level prediction in an international data network: validation of models predicting stroke in female patients newly diagnosed with atrial fibrillation

Jenna M. Reps, 1 Ross D. Williams, 2 Seng Chan You, 3 Thomas Falconer, 4 Evan Minty, 5 Alison Callahan, 6 Patrick B. Ryan, 1 Rae Woong Park, 1 Hong-Seok Lim, 1 and Peter Rijnbeek 2
COVER design for predicting COVID-19 outcomes in symptomatic patients presenting in outpatient setting

Pre-index characteristics used as predictors:
- Age = year(cohort start date) – year of birth: 5-year strata
- Sex
- Condition groups (SNOMED + descendants), >=1 occurrence
- Drug era groups (ATC/RxNorm + descendants), >=1 day during the interval which overlaps with at least 1 drug era

Cohort-based:
- cancer, chronic obstructive pulmonary disease, diabetes, heart disease, hypertension, hyperlipidemia, kidney disease

Outcomes:
- Hospitalization with pneumonia
- Hospitalization requiring intensive services (mechanical ventilation, tracheostomy, or ECMO)
- Death

Development:
Influenza OR (Fever AND (Cough OR Dyspnea OR myalgia OR malaise/fatigue))

External Validation:
COVID-19 diagnosis or positive test

Cohort start date = GP/ER/OP visit

>=365d of prior continuous observation
>=1 COVID-19 OR Influenza OR (Fever AND (Cough OR Dyspnea OR myalgia OR malaise/fatigue))
=0 flu-like symptoms
-60d to -1d
-30d to -1d
-365d to -1d
1d to 30d
Personalizing risk is only useful if the prediction model is reliable

**Internal validation in Influenza**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Predictors</th>
<th>No. Variables</th>
<th>AUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitalization with pneumonia</td>
<td>Conditions/drugs + age/sex</td>
<td>521</td>
<td>0.852</td>
</tr>
<tr>
<td></td>
<td>Age/sex</td>
<td>2</td>
<td>0.818</td>
</tr>
<tr>
<td></td>
<td>COVER-H</td>
<td>9</td>
<td>0.840</td>
</tr>
<tr>
<td>Hospitalization with pneumonia requiring intensive services or death</td>
<td>Conditions/drugs + age/sex</td>
<td>349</td>
<td>0.860</td>
</tr>
<tr>
<td></td>
<td>Age/sex</td>
<td>2</td>
<td>0.821</td>
</tr>
<tr>
<td></td>
<td>COVER-I</td>
<td>9</td>
<td>0.839</td>
</tr>
<tr>
<td>Death</td>
<td>Conditions/drugs + age/sex</td>
<td>205</td>
<td>0.926</td>
</tr>
<tr>
<td></td>
<td>Age/sex</td>
<td>2</td>
<td>0.909</td>
</tr>
<tr>
<td></td>
<td>COVER-F</td>
<td>9</td>
<td>0.896</td>
</tr>
</tbody>
</table>

**External validation in COVID**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Database</th>
<th>AUC (95% ci)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitalization with pneumonia</td>
<td>HIRA</td>
<td>0.806 (0.762-0.851)</td>
</tr>
<tr>
<td></td>
<td>SIDIAP</td>
<td>0.748* (0.699-0.769)</td>
</tr>
<tr>
<td>Hospitalization with pneumonia requiring intensive services or death</td>
<td>CUIMC</td>
<td>0.731 (0.611-0.851)</td>
</tr>
<tr>
<td>Death</td>
<td>HIRA</td>
<td>0.910 (0.889-0.931)</td>
</tr>
<tr>
<td></td>
<td>CUIMC</td>
<td>0.820 (0.796-0.840)</td>
</tr>
<tr>
<td></td>
<td>SIDIAP</td>
<td>0.895 (0.881-0.910)</td>
</tr>
</tbody>
</table>
Demo: COVER risk calculator

Use this tool to calculate the risk of COVID outcomes:

**Age:**
- 18
- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100

**Sex:**
- Male

- History of Cancer
- History of COPD
- History of Diabetes
- History of Heart disease
- History of Hyperlipidemia
- History of Hypertension
- History of Kidney Disease

**Predicted Risk (%):**
- COVER-H: 3.9%
- COVER-F: 1.5%
- COVER-I: 1.3%
### Model Table

**Download Model**

<table>
<thead>
<tr>
<th>Covariate Name</th>
<th>Value</th>
<th>Count</th>
<th>Outcome Mean</th>
<th>Non-outcome Mean</th>
<th>Std Mean Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 History of kidney disease</td>
<td>2</td>
<td>6578</td>
<td>0.172</td>
<td>0.0894</td>
<td>0.1744</td>
</tr>
<tr>
<td>4 History of hypertension</td>
<td>3</td>
<td>8722</td>
<td>0.2917</td>
<td>0.1174</td>
<td>0.3128</td>
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<tr>
<td>12 History of hyperlipidemia</td>
<td>-3</td>
<td>7172</td>
<td>0.2121</td>
<td>0.097</td>
<td>0.2279</td>
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<tr>
<td>6 History of heart disease</td>
<td>4</td>
<td>6400</td>
<td>0.2038</td>
<td>0.0863</td>
<td>0.2391</td>
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<td>10 History of diabetes</td>
<td>3</td>
<td>4676</td>
<td>0.1576</td>
<td>0.0629</td>
<td>0.2161</td>
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<tr>
<td>14 History of COPD</td>
<td>6</td>
<td>1364</td>
<td>0.0523</td>
<td>0.0182</td>
<td>0.131</td>
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<td>16 History of cancer</td>
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<td>3608</td>
<td>0.1273</td>
<td>0.0484</td>
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<td>24 gender = MALE</td>
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<td>0.1975</td>
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<td>23 age group: 90-94</td>
<td>25</td>
<td>558</td>
<td>0.022</td>
<td>0.0074</td>
<td>0.0854</td>
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<tr>
<td>22 age group: 85-89</td>
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<td>1029</td>
<td>0.0318</td>
<td>0.0139</td>
<td>0.0849</td>
</tr>
</tbody>
</table>

Showing 1 to 10 of 24 entries
Characterizing Health Associated Risks, and Your Baseline Disease In SARS-COV-2 (CHARYBDIS)

Talita Duarte-Salles

#OHDSICOV19 Characterization Study Group
1) Describe the baseline demographic, clinical characteristics, treatments and outcomes of interest among individuals with COVID-19 overall and stratified by sex, age and specific comorbidities

2) Describe characteristics and outcomes of influenza patients between September 2017 and April 2018 compared to the COVID-19 population
Present with symptoms
Tested for COVID-19*
Result obtained for COVID-19 test
Hospitalization
Hospitalization with intensive services
Death

**Medical history:**
- Demographics
- Conditions
- Drugs
- Health service utilization

**Plus...**
- ‘recent’ health behavior measurement

**Characterization:**
- Historical summary of presenting flu-like symptoms
- History utilization and outcomes of respiratory intensive services (ventilation, ECMO)

**Population-level Estimation:**
- Comparative safety of medicines considered for potential COVID-19 prophylaxis or treatment (HCl, bDMARDs, protease inhibitors, antifungals, antiparasitics)
- Effectiveness of medicines on viral incidence and outcomes, using other historical models (influenza)

**Patient-level Prediction:**
- Amongst patients with flu symptoms, who requires hospitalization?
- Amongst patients hospitalized with viral pneumonia, who requires intensive services or die?

---

**Medical history:**
- Demographics
- Conditions
- Drugs
- Health service utilization

**Plus...**
- ‘recent’ health behavior measurement
- measurement value

**Characterization:**
- Medical history and presenting symptoms amongst patients tested for COVID-19

**Population-level Estimation:**
- Does exposure increase the risk of incidence of COVID-related symptoms?

**Patient-level Prediction:**
- Amongst all patients, who received COVID-19 test?
- Amongst patients with flu-like symptoms, who received COVID-19 test?

---

**Medical history:**
- Demographics
- Conditions
- Drugs
- Health service utilization

**Plus...**
- ‘recent’ health behavior measurement
- measurement value
- inpatient services

**Characterization:**
- Medical history amongst patients hospitalized for COVID-19
- Treatment utilization among patients with COVID-19

**Population-level Estimation:**
- Does prior drug exposure increase risk of COVID-19 hospitalization? (ACE)

**Patient-level Prediction:**
- Amongst patients with COVID-19, who requires hospitalization?
- Amongst patients hospitalized with COVID-19, who requires intensive services?

---

**Medical history:**
- Demographics
- Conditions
- Drugs
- Health service utilization

**Plus...**
- ‘recent’ health behavior measurement
- measurement value
- inpatient services
- mortality
- Follow-up observation period

**Characterization:**
- Outcomes for patients with COVID-19
- Outcomes for patients hospitalized for COVID-19

**Population-level Estimation:**
- Comparative effects of interventions on COVID-19
- Does prior drug exposure increase risk of COVID-19 severity?

**Patient-level Prediction:**
- Amongst patients with COVID-19, who dies?

---

*Note: testing may take place anytime before symptoms through after hospitalization, or may not occur at all in COVID patients
### CHARYBDIS – Target cohorts

<table>
<thead>
<tr>
<th>COVID-19:</th>
<th>Influenza:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons <strong>tested</strong> for SARS-CoV-2</td>
<td>Persons with <strong>Influenza</strong> diagnosis or positive test 2017-2018</td>
</tr>
<tr>
<td>Persons <strong>tested positive</strong> for SARS-CoV-2</td>
<td></td>
</tr>
<tr>
<td>Persons <strong>tested</strong> with a <strong>COVID-19 diagnosis</strong> record or a SARS-CoV-2 <strong>positive test</strong></td>
<td>Persons <strong>hospitalized with influenza</strong> diagnosis or positive test 2017-2018</td>
</tr>
<tr>
<td>Persons with a <strong>COVID-19 diagnosis</strong> or a SARS-CoV-2 <strong>positive test</strong></td>
<td>Persons hospitalized with influenza diagnosis or positive test and <strong>requiring intensive services</strong> 2017-2018</td>
</tr>
<tr>
<td>Persons <strong>hospitalized</strong> with a COVID-19 diagnosis record or a SARS-CoV-2 positive test</td>
<td></td>
</tr>
<tr>
<td>Persons hospitalized and requiring <strong>intensive services</strong> with a COVID-19 diagnosis record or a SARS-CoV-2 positive test</td>
<td></td>
</tr>
</tbody>
</table>
CHARYBDIS – Stratification factors

COVID-19 and...

- Asthma
- Cancer
- Cardiac Outcomes
- Chronic Kidney Disease
- COPD
- Elderly
- End-Stage Renal Disease

- Gender Differences
- Heart Disease
- Hepatitis C
- HIV infection
- Hypertension
- Immune Disorders
- Obesity

- Pediatrics
- Pregnant Women
- Tuberculosis
- Type 2 Diabetes
- Dementia

... And more!
Pre-index characteristics (the last 30 days and the year prior to index):
- Demographics: Age, Sex
- Conditions groups (SNOMED + descendants)
- Drug groups (ATC/RxNorm + descendants)

Post-index characteristics (at index date and in the 30 days from index date):
- Conditions groups (SNOMED + descendants)
- Symptoms
- Outcomes
- Procedural treatments
- Pharmacological treatments
- Death
### CHARYBDIS – Features

<table>
<thead>
<tr>
<th>Prevalent Asthma or Chronic obstructive pulmonary disease (COPD)</th>
<th>Sepsis during hospitalization</th>
<th>Hospitalization for Asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma/COPD Step 1</td>
<td>Venous thromboembolic (pulmonary embolism and deep vein thrombosis) events</td>
<td>Hospitalization for COPD</td>
</tr>
<tr>
<td>Asthma/COPD Step 2</td>
<td>Pulmonary Embolism events</td>
<td>Pneumonia episodes</td>
</tr>
<tr>
<td>Asthma/COPD Step 3</td>
<td>Deep vein thrombosis events</td>
<td>intensive services during hospitalization</td>
</tr>
<tr>
<td>Gestational diabetes</td>
<td>Heart failure during hospitalization</td>
<td>mechanical ventilation during hospitalization</td>
</tr>
<tr>
<td>Eclampsia and pre-eclampsia</td>
<td>Cardiac arrhythmia during hospitalization</td>
<td>tracheostomy during hospitalization</td>
</tr>
<tr>
<td>Fever</td>
<td>Bradycardia or heart block during hospitalization</td>
<td>ECMO during hospitalization</td>
</tr>
<tr>
<td>Cough</td>
<td>Supraventricular arrhythmia during hospitalization</td>
<td>dialysis during hospitalization</td>
</tr>
<tr>
<td>Myalgia</td>
<td>Ventricular arrhythmia or cardiac arrest during hospitalization</td>
<td>Discharge from hospitalization</td>
</tr>
<tr>
<td>Malaise or fatigue</td>
<td>Death</td>
<td>Persons with chest pain or angina</td>
</tr>
<tr>
<td>Dyspnea</td>
<td></td>
<td>Angina during hospitalization</td>
</tr>
<tr>
<td>Anosmia OR Hyposmia OR Dysgeusia</td>
<td></td>
<td>Persons with hepatic failure</td>
</tr>
<tr>
<td>Persons with additional testing for SARS-Cov-2 (prior test &gt;=1d before test)</td>
<td></td>
<td>Acute pancreatitis events</td>
</tr>
<tr>
<td>Persons with additional testing for SARS-Cov-2 (prior test &gt;=5d before test)</td>
<td></td>
<td>Total cardiovascular disease events</td>
</tr>
<tr>
<td>Hospitalization episodes</td>
<td></td>
<td>Gastrointestinal bleeding events</td>
</tr>
<tr>
<td>Pneumonia during hospitalization</td>
<td></td>
<td>Cardiovascular-related mortality</td>
</tr>
<tr>
<td>Acute Respiratory Distress syndrome (ARDS) during hospitalization</td>
<td></td>
<td>Transient ischemic attack events</td>
</tr>
<tr>
<td>Acute kidney injury (AKI) diagnosis during hospitalization</td>
<td></td>
<td>Stroke (ischemic or hemorrhagic) events</td>
</tr>
<tr>
<td>Acute kidney injury (AKI) using diagnosis codes and change in measurements during hospitalization</td>
<td></td>
<td>Ischemic stroke events</td>
</tr>
<tr>
<td>Abortion</td>
<td></td>
<td>Hemorrhagic stroke (intracerebral bleeding) events</td>
</tr>
<tr>
<td>Premature Rupture of Membranes</td>
<td></td>
<td>Acute myocardial infarction events</td>
</tr>
<tr>
<td>Fetal growth restriction</td>
<td></td>
<td>Bleeding during hospitalization</td>
</tr>
<tr>
<td>Cesarean section</td>
<td></td>
<td>Incident depression with no prior treatment and no mania/psychoses</td>
</tr>
<tr>
<td>Incident depression with no prior treatment and no mania/psychoses</td>
<td>Safety and medical errors</td>
<td>Hospitalization for psychosis</td>
</tr>
<tr>
<td>Suicide and suicidal ideation</td>
<td>Multi-system inflammatory syndrome (Kawasaki disease or toxic shock syndrome)</td>
<td>Multi-system inflammatory syndrome (Kawasaki disease or toxic shock syndrome)</td>
</tr>
</tbody>
</table>
Open collaboration requires FULL transparency in every step of the research process

- Protocol and analysis source code freely available and directly downloadable: https://github.com/ohdsi-studies/Covid19CharacterizationCharybdis

- Phenotype definitions are both human-readable and computer-executable using ATLAS against any OMOP CDM: https://atlas.ohdsi.org/

- All analysis results will be available for public exploration through interactive R shiny application: http://data.ohdsi.org/Covid19CharacterizationCHARYBDIS/

- The study is a living evidence repository: any data partners can execute analysis and share aggregate results at any point, including updates as data accumulate

Join the Journey!
Demo: ATLAS phenotypes

Cohort #202

Persons tested with a COVID-19 diagnosis record or a SARS-CoV-2 positive test with at least 365d prior observation

Enter a cohort definition description here

Cohort Entry Events

Events having any of the following criteria:

- a procedure occurrence of SARS-CoV-2 testing
  - occurrence start is: After 2019-12-01

- a measurement of SARS-CoV-2 testing
  - occurrence start is: After 2019-12-01

- an observation of SARS-CoV-2 testing
  - occurrence start is: After 2019-12-01

With continuous observation of at least 0 days before and 0 days after event index date

Limit initial events to: all events per person.
Demo: CHARIBDYS Git repository

Characterizing Health Associated Risks, and Your Baseline Disease In SARS-COV-2 (CHARYBDIS)

- Analytics use case(s): Characterization
- Study type: Clinical Application
- Tags: OHDSI, Study-a-thon, COVID-19
- Study lead: Talita Duarte-Salles, Kristin Kostka, Albert Prats-Uribe
- Study lead forums tag: tduarte, kfreaney, Albert_Prats
- Study start date: April 21, 2020
- Study end date: Mid-June 2020
- Protocol: Word Doc
- Publications: -
- Results explorer: -

Objectives: 1) Describe the baseline demographic, clinical characteristics, treatments and outcomes of interest among individuals tested for SARS-CoV-2 and/or diagnosed with COVID-19 overall and stratified by sex, age and specific comorbidities; 2) Describe characteristics and outcomes of hospitalized influenza patients between September 2017 and April 2018 compared to the COVID-19 population.

Installation