Using Healthcare Big Data in Pandemic Response by Characterizing Disease Natural History and Predicting Patient Outcomes (Project CHARYBDIS)

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IQVIA
Snapshot of the OHDSI COVID-19 Data Network

USA (11) | EUROPE (8) | ASIA-PACIFIC (3)
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Columbia University (NY – EHR) | CPRD (UK – EHR) | HIRA (South Korea – Administrative Claims)
Department of Veterans Affairs (National – EHR) | DA Germany (Germany – EHR) | DCMC (South Korea – EHR)
HealthVerity (Claims linked to diagnostic testing) | HM Hospitales (Spain – Hospital Billing) | Nanfang Hospital (China – EMR)
IQVIA Open Claims (National – Administrative Claims) | IPCI (Netherlands – EHR) |
Optum EHR (National – EHR) | LPD France (France – EHR) |
Optum SES (National – EHR linked to Socio-economic data) | LPD Italy (Italy – EHR) |
Premier (National – Hospital Billing) | SIDIAP (Spain – EHR) |
Stanford University (CA – EHR) | SIDIAP-H (Spain – EHR Hospital linkage) |
Tufts University (MA – EHR) |
University of Colorado Anschutz Medical Campus (CO – EHR) |
University of Washington Medicine COVID Research Dataset (WA – EHR) |

Together, OHDSI has studied:
- >7.4m patients tested for SAR-COV-2
- >1.6m patients diagnosed or tested positive for COVID-19
- >300k patients hospitalized with COVID-19
Characterizing Health Associated Risks, and Your Baseline Disease In SARS-COV-2 (CHARYBDIS)

1) Describe the baseline demographic, clinical characteristics, treatments, symptoms 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
Many published characterization studies
- Small sample size
- Few countries
- Granularity of information
- Hospital settings
Why CHARYBDIS?

- But many unanswered questions:
  - Who gets tested, infected and hospitalized?
    - Age and gender
    - Most frequent comorbidities
    - Treatment history
  - What are their symptoms and outcomes?
  - How different is COVID-19 from influenza?
# CHARYBDIS – Target cohorts

<table>
<thead>
<tr>
<th>COVID-19</th>
<th>Influenza</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons tested for SARS-CoV-2</td>
<td>Persons with influenza diagnosis or positive test 2017-2018</td>
</tr>
<tr>
<td>Persons tested positive for SARS-CoV-2</td>
<td>Persons hospitalized with influenza diagnosis or positive test 2017-2018</td>
</tr>
<tr>
<td>Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test</td>
<td>Persons hospitalized with influenza diagnosis or positive test 2017-2018 and requiring intensive services 2017-2018</td>
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<tr>
<td>Persons hospitalized with a COVID-19 diagnosis record or a SARS-CoV-2 positive test</td>
<td></td>
</tr>
<tr>
<td>Persons hospitalized and requiring intensive services with a COVID-19 diagnosis record or a SARS-CoV-2 positive test</td>
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</tbody>
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Cohort definitions available at: [https://atlas.ohdsi.org/](https://atlas.ohdsi.org/)
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
- Gender

... And more!

PHENOTYPE DEFINITIONS AVAILABLE AT:
https://atlas.ohdsi.org/
• COVID-19 diagnosis/tested positive more common in women

• Hospitalization with COVID-19 more common in men
• COVID-19 diagnosis/tested positive more common in women

• Hospitalization with COVID-19 more common in men

• Amongst age groups, hospitalized with COVID-19 are older than diagnosed/tested positive
CHARYBDIS – Findings to Date on COVID-19

- COVID is no flu
- COVID patients tend to be healthier
- Less history of drug use
- Worse outcomes
CHARYBDIS – Findings to Date on COVID-19

https://data.ohdsi.org/Covid19CharacterizationCharybdis/
CHARYBDIS – Findings to Date on COVID-19

HIGHLIGHT: Compared to individuals hospitalized with influenza, patients admitted with COVID-19 were more likely male, younger, and, in the US, had fewer comorbidities and lower medication use.

Deep phenotyping of 34,128 adult patients hospitalised with COVID-19 in an international network study

Edward Burn @et al.

Comorbid conditions appear to be common among individuals hospitalised with coronavirus disease 2019 (COVID-19) but estimates of prevalence vary and little is known about the prior medication use of patients. Here, we describe the characteristics of adults hospitalised with COVID-19 and compare them with influenza patients. We include 34,128 (US: 18,262, South Korea: 2,674, Spain: 13,492) COVID-19 patients, summarising between 481 and 11,643 unique aggregate characteristics. COVID-19 patients have been majority male in the US and Spain, but predominantly female in South Korea. Age profiles vary across data sources. Compared to 84,668 individuals hospitalised with influenza in 2014-19, COVID-19 patients have more typically been male, younger, and with fewer comorbidities and lower medication use. While protective groups vulnerable to influenza is likely a critical starting point in the response to COVID-19, strategies will likely need to be broadened to reflect the particular characteristics of individuals being hospitalised with COVID-19.

CHARYBDIS – Findings to Date on COVID-19

HIGHLIGHT: We show that obesity is more common amongst COVID-19 than influenza patients, and that obese patients present with more severe forms of COVID-19 with higher hospitalization, intensive services, and fatality than non-obese patients. These data are instrumental for guiding preventive strategies of COVID-19 infection and complications.

HIGHLIGHT: Comorbidities that were more prevalent with COVID-19 hospitalization (compared to COVID-19 diagnosed) in pregnancy included renal impairment and anemia. Multiple medications were used to treat pregnant women hospitalized with COVID-19, some with little evidence of benefit. Anosmia and dyspnea were indicative symptoms of COVID-19 in pregnancy compared to influenza, and may aid differential diagnosis. Despite low fatality, pregnancy and maternal outcomes were worse in COVID-19 than influenza.
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HIGHLIGHT: Observed disparity in testing practices led to variable baseline characteristics and outcomes, both nationally (US) and internationally. Our findings highlight the importance of large scale characterization of COVID-19 international cohorts to inform planning and resource allocation including testing as countries face a second wave.

HIGHLIGHT: We found that HIV and COVID-19 coinfected patients have higher prevalence of underlying comorbidities such as cardiovascular and respiratory disease as compared to HIV-negative COVID-19 infected patients. We also found that, across the care cascade, co-infected patients who received intensive services were more likely to have more serious underlying disease or a history of more serious events as compared to PLHIV who were diagnosed with COVID-19.

HIGHLIGHT: Despite negligible fatality, complications including pneumonia, ARDS and MIS-C were more frequent in children/adolescents with COVID-19 than with influenza. Dyspnea, anosmia and gastrointestinal symptoms could help differential diagnosis. A wide range of medications were used for the inpatient management of pediatric COVID-19.

Figure 3. Symptoms recorded at index date among children/adolescents (<18 years of age)

A. Diagnosed compared to hospitalized with COVID-19

Use of dialysis, tracheostomy, and extracorporeal membrane oxygenation among 240,392 patients hospitalized with COVID-19 in the United States


doi: https://doi.org/10.1101/2020.11.25.20229088

This article is a preprint and has not been peer-reviewed [what does this mean?]. It reports new medical research that has yet to be evaluated and so should not be used to guide clinical practice.

HIGHLIGHT: Use of dialysis among those hospitalized with COVID-19 is high at around 4%. Although less than one percent of patients undergo tracheostomy and ECMO, the absolute numbers of patients who have undergone these interventions is substantial and can be expected to continue grow given the continuing spread of the COVID-19.

HIGHLIGHT: Patients with autoimmune diseases had high rates of respiratory complications and 30-day mortality following a hospitalization with COVID-19. Compared to influenza, COVID-19 is a more severe disease, leading to more complications and higher mortality. Future studies should investigate predictors of poor outcomes in COVID-19 patients with autoimmune diseases.
JOIN the CHARYBDIS team

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Thank you!
Join the Journey

http://ohdsi.org