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

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#OHDSICOVID19
Characterization Study Group

AGENDA

- Why CHARYBDIS?
- Aims & Methods
- Data sources
- Findings to date

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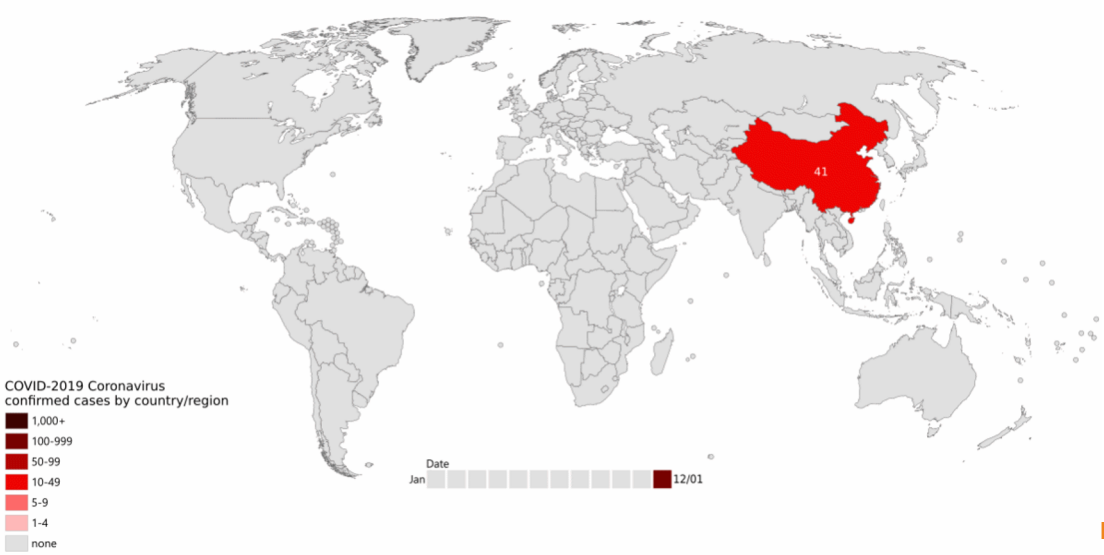
Why CHARYBDIS?

COVID-19 -> new disease -> need to understand its natural history

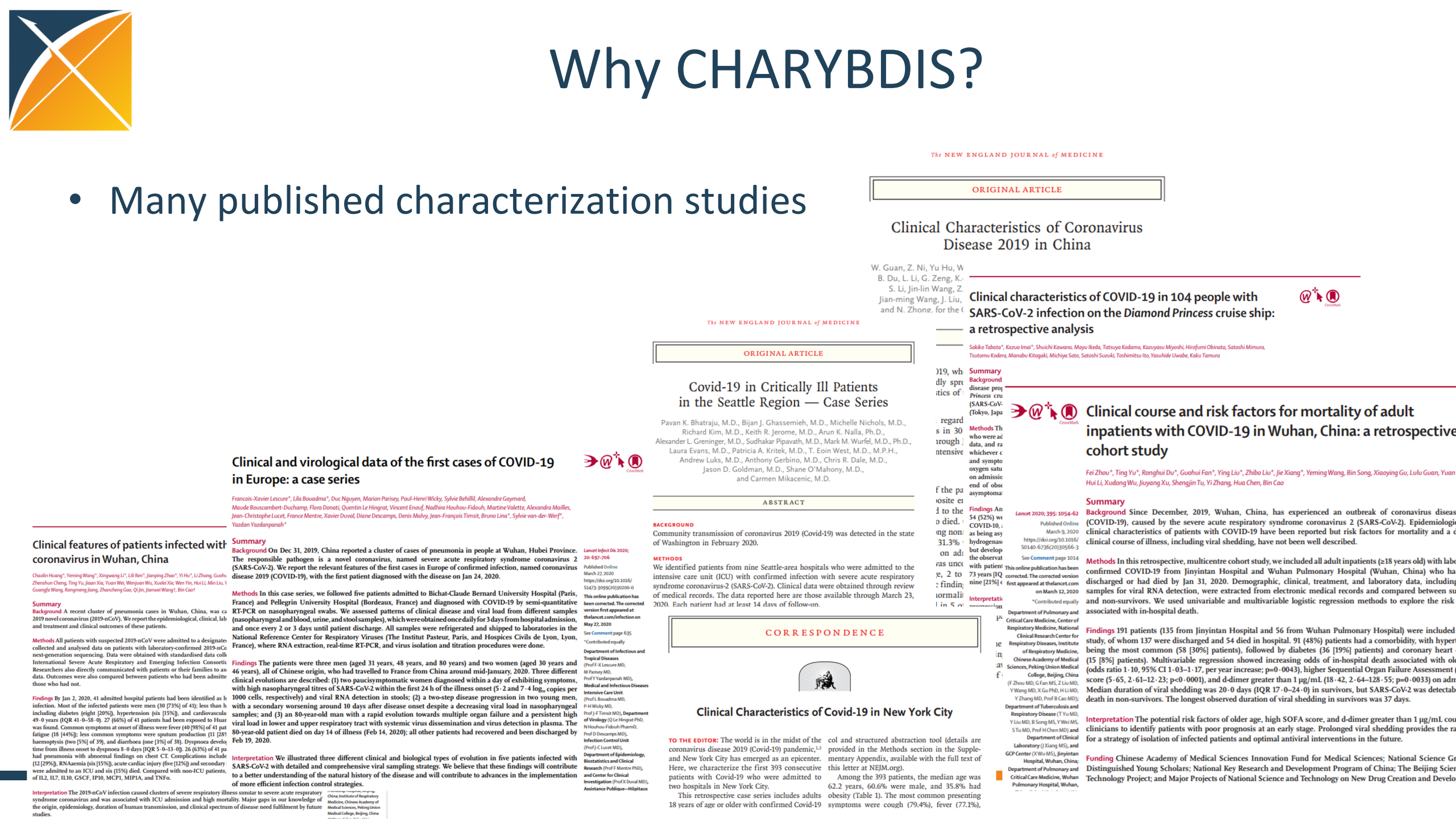
COVID-19 Patient trajectory

Presentation of symptoms	Tested for COVID-19	Tested positive or diagnosed with COVID-19	Hospitalization	Hospitalization requiring intensive services	Death



Why CHARYBDIS?

- Many published characterization studies



Clinical features of patients infected with coronavirus in Wuhan, China

Clinical and virological data of the first cases of COVID-19 in Europe: a case series

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Clinical Characteristics of Coronavirus Disease 2019 in China

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Covid-19 in Critically Ill Patients in the Seattle Region — Case Series

Clinical characteristics of COVID-19 in 104 people with SARS-CoV-2 infection on the *Diamond Princess* cruise ship: a retrospective analysis

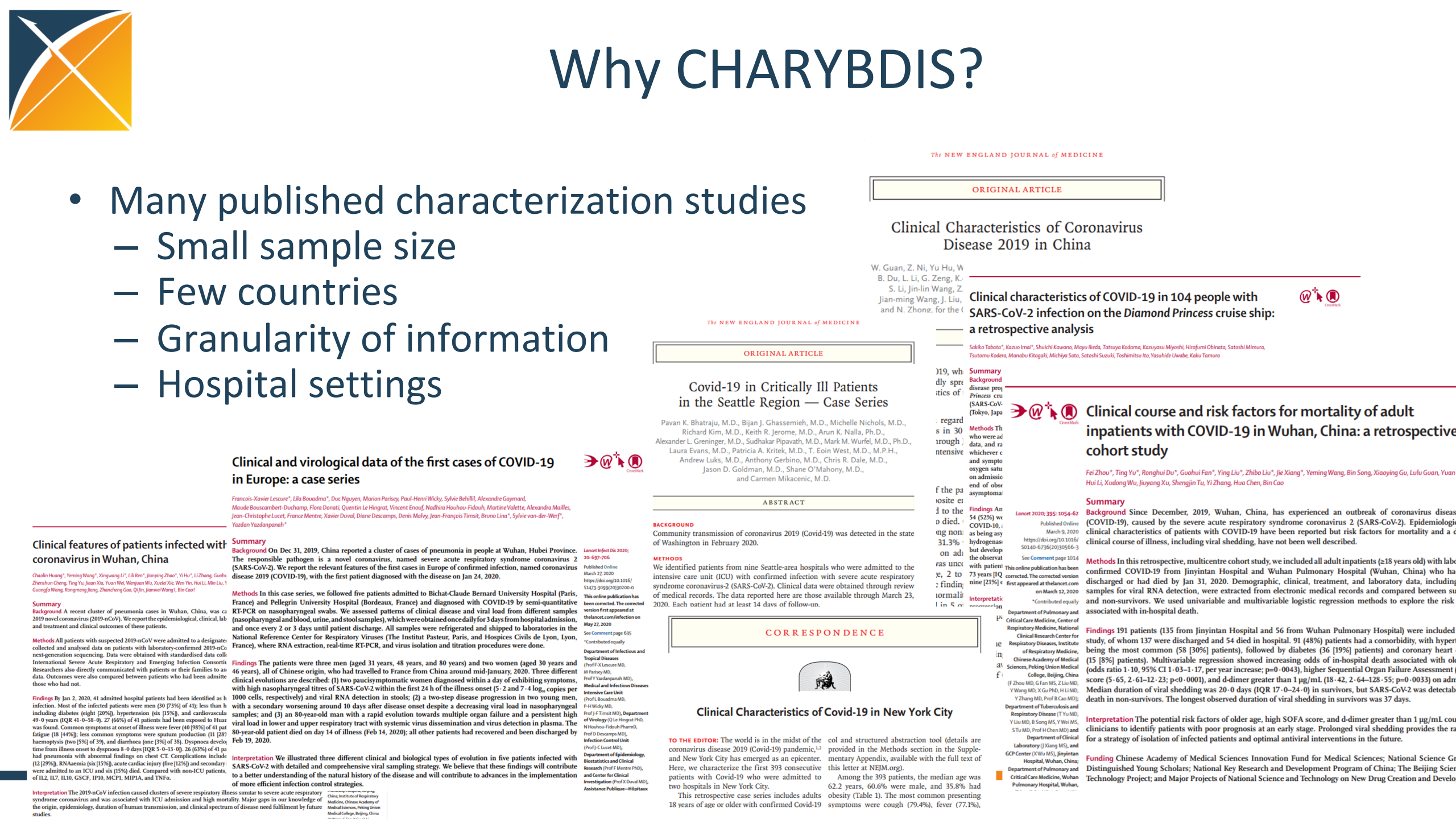
Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study

CORRESPONDENCE

Clinical Characteristics of Covid-19 in New York City

Why CHARYBDIS?

- Many published characterization studies
  - Small sample size
  - Few countries
  - Granularity of information
  - Hospital settings



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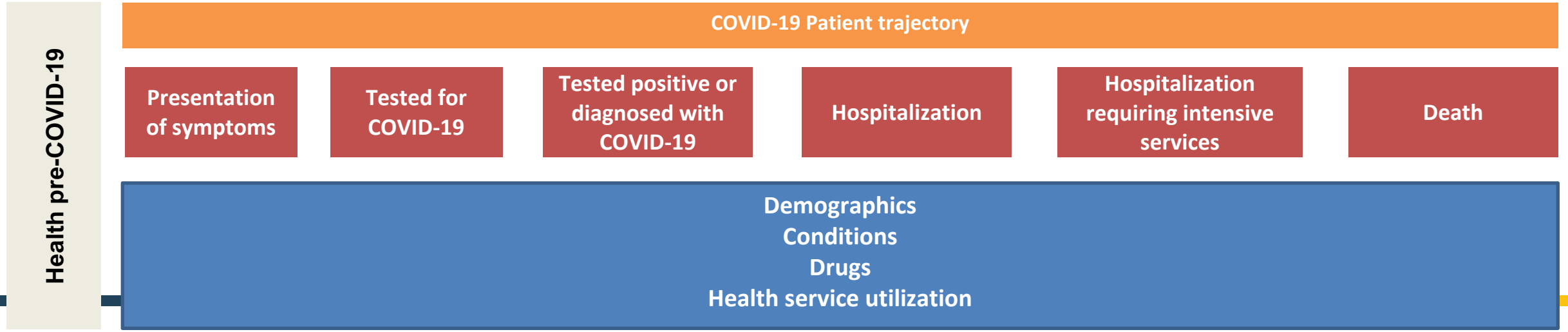
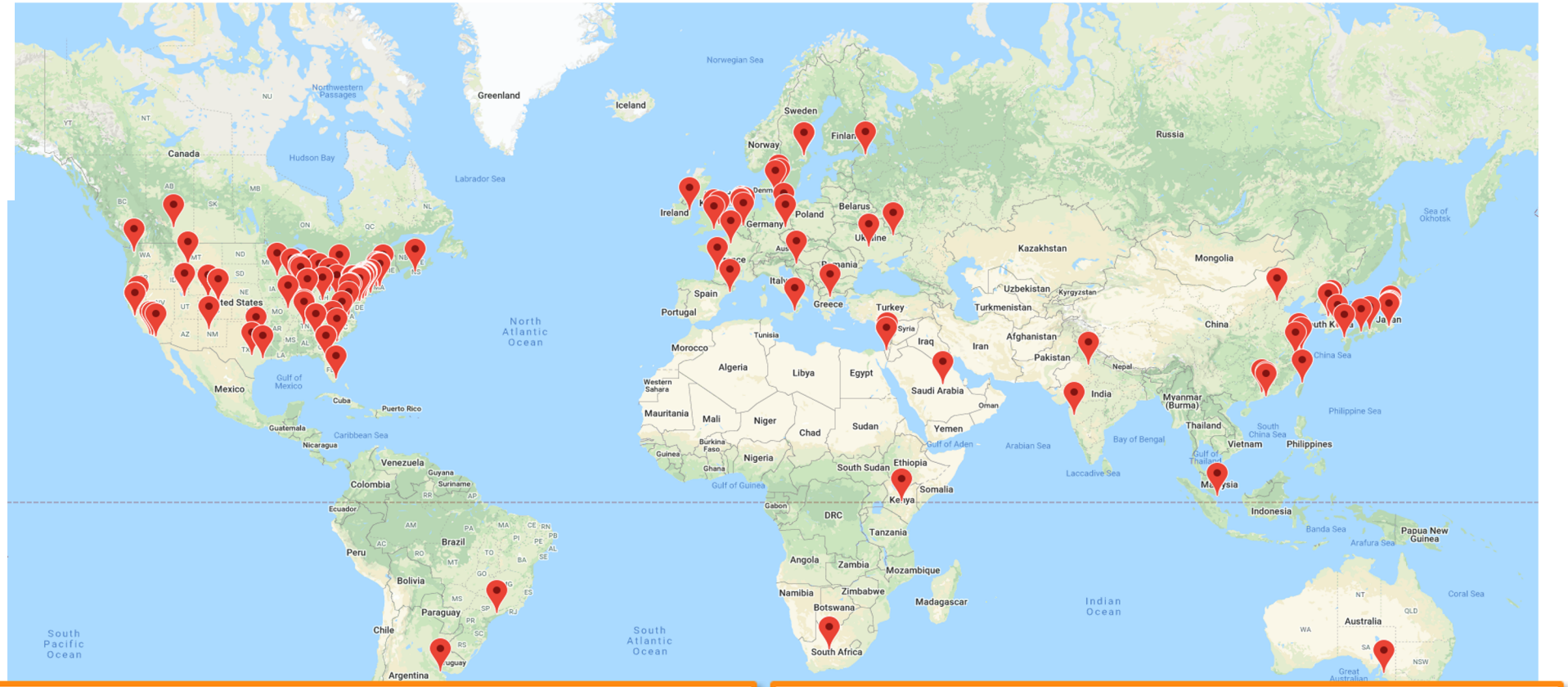
Why CHARYBDIS?

- 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?



Why CHARYBDIS?

A global pandemic requires a global response



OHDSI Collaborators:

- 2,770 users
- 25 workgroups
- 18,700 posts on 3,250 topics

OHDSI Network:

- 152 databases
- 18 countries
- approx. 600M patient records

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CHARYBDIS – Aims

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

FULL STUDY PROTOCOL AVAILABLE AT https://github.com/ohdsi-studies/Covid19CharacterizationCharybdis

CHARYBDIS – Target cohorts

COVID-19

- Persons **tested for SARS-CoV-2**
- Persons **tested positive** for SARS-CoV-2
- Persons with a **COVID-19 diagnosis** or a SARS-CoV-2 positive test
- Persons **hospitalized with a COVID-19** diagnosis record or a SARS-CoV-2 positive test
- Persons hospitalized and **requiring intensive services** with a COVID-19 diagnosis record or a SARS-CoV-2 positive test

Influenza

- Persons with **influenza** diagnosis or positive test 2017-2018
- Persons **hospitalized with influenza** diagnosis or positive test 2017-2018
- Persons hospitalized with influenza diagnosis or positive test and **requiring intensive services** 2017-2018

COHORT DEFINITIONS AVAILABLE AT:
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!

OHDSI
Observational Health Data Sciences and Informatics

PHENOTYPE DEFINITIONS AVAILABLE AT:
https://atlas.ohdsi.org/

CHARYBDIS – Features

Pre-index characteristics (the last 30 days and the year prior to index):

- **Conditions** groups (SNOMED + descendants)
- **Drug** groups (ATC/RxNorm + descendants)

Post-index characteristics (at index date and in the 30 days from index date):

- **Demographics**: Age, Sex, Race
- **Conditions** groups (SNOMED + descendants)
- **Symptoms**
- **Outcomes**
- **Procedural treatments**
- **Drug** groups (ATC/RxNorm + descendants)

R PACKAGE TO RUN AVAILABLE AT https://github.com/ohdsi-studies/Covid19CharacterizationCharybdis

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CHARYBDIS - OHDSI COVID-19 Data Network

USA (11)	EUROPE (8)	ASIA-PACIFIC (3)
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

EHR = Electronic Health Records, EMR = Electronic Medical Records

As of 12Oct2020

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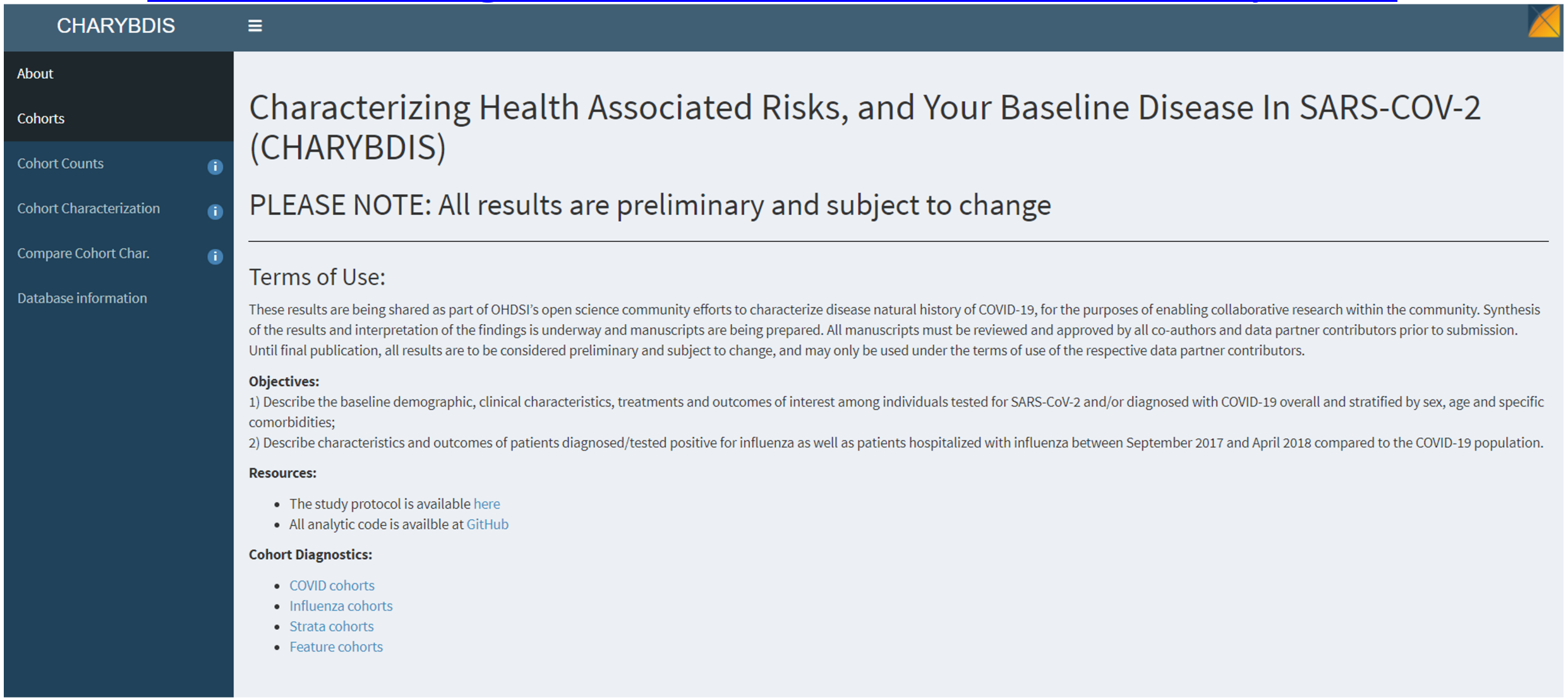
CHARYBDIS – web app

data.ohdsi.org/Covid19CharacterizationCharybdis/

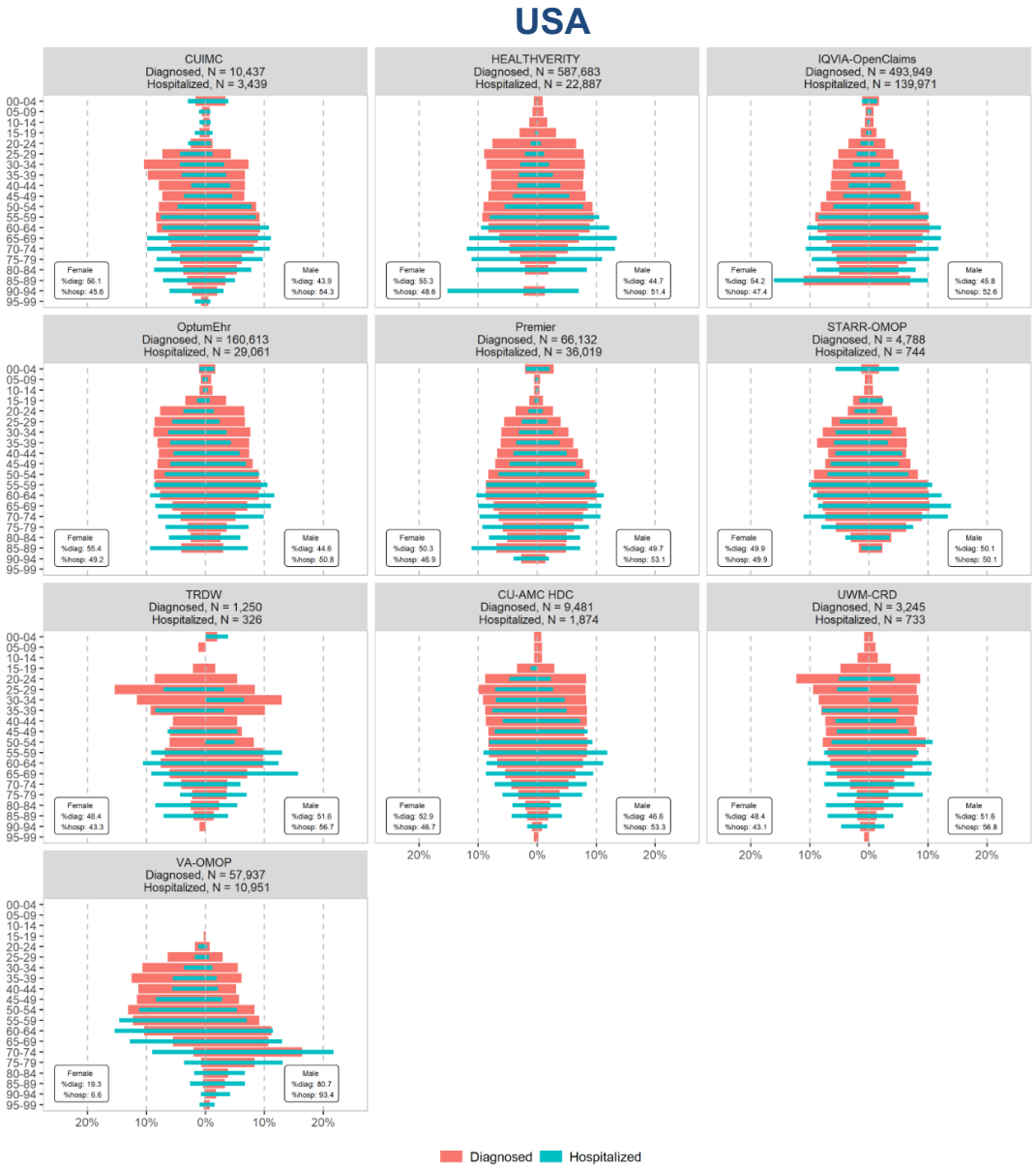


Findings to date – COVID-19

- Diagnosed -> more frequently females
- Hospitalized -> more frequently male

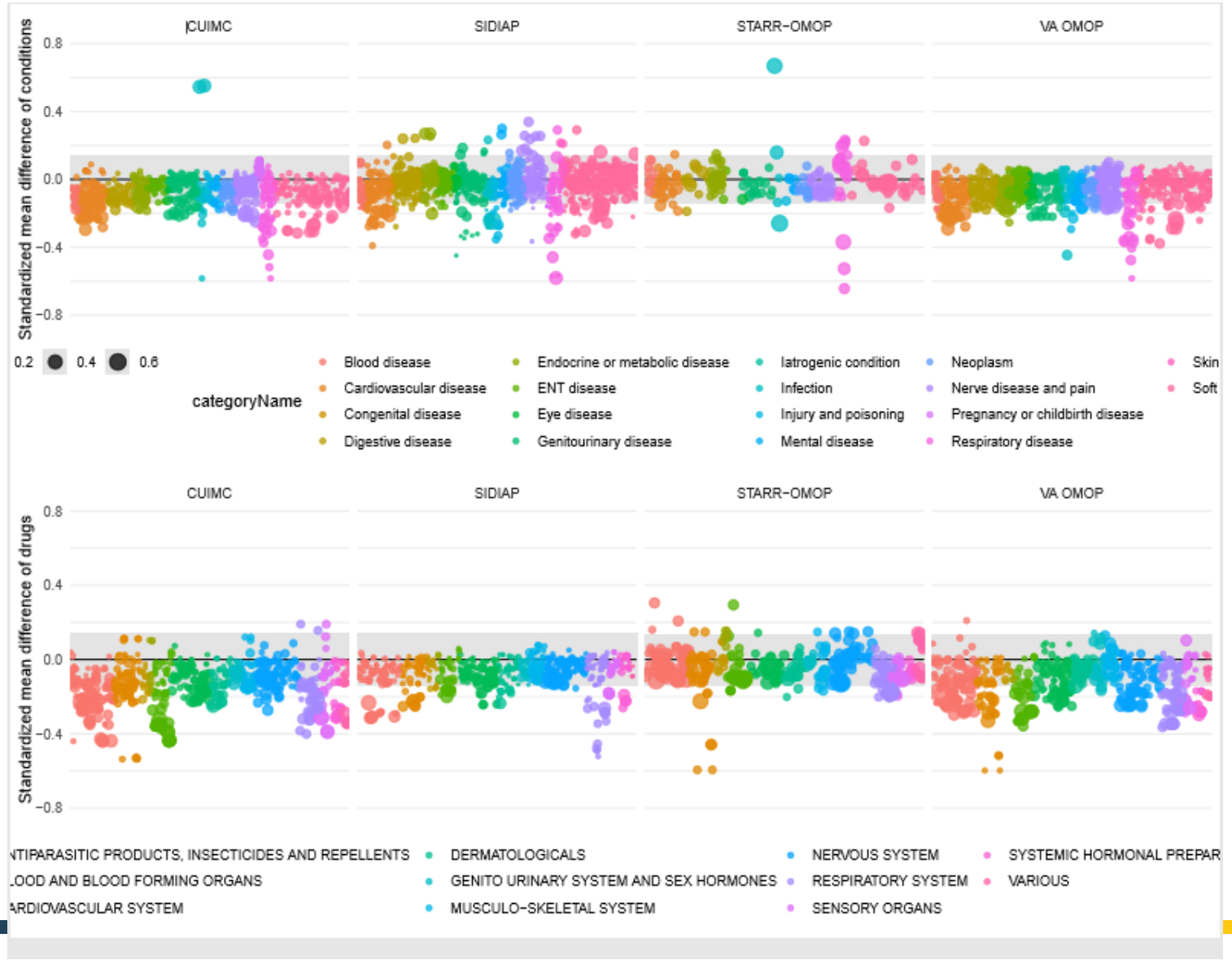
Findings to date – COVID-19

- Diagnosed -> more frequently females
- Hospitalized -> more frequently male
- Age differences -> hospitalized older than diagnosed



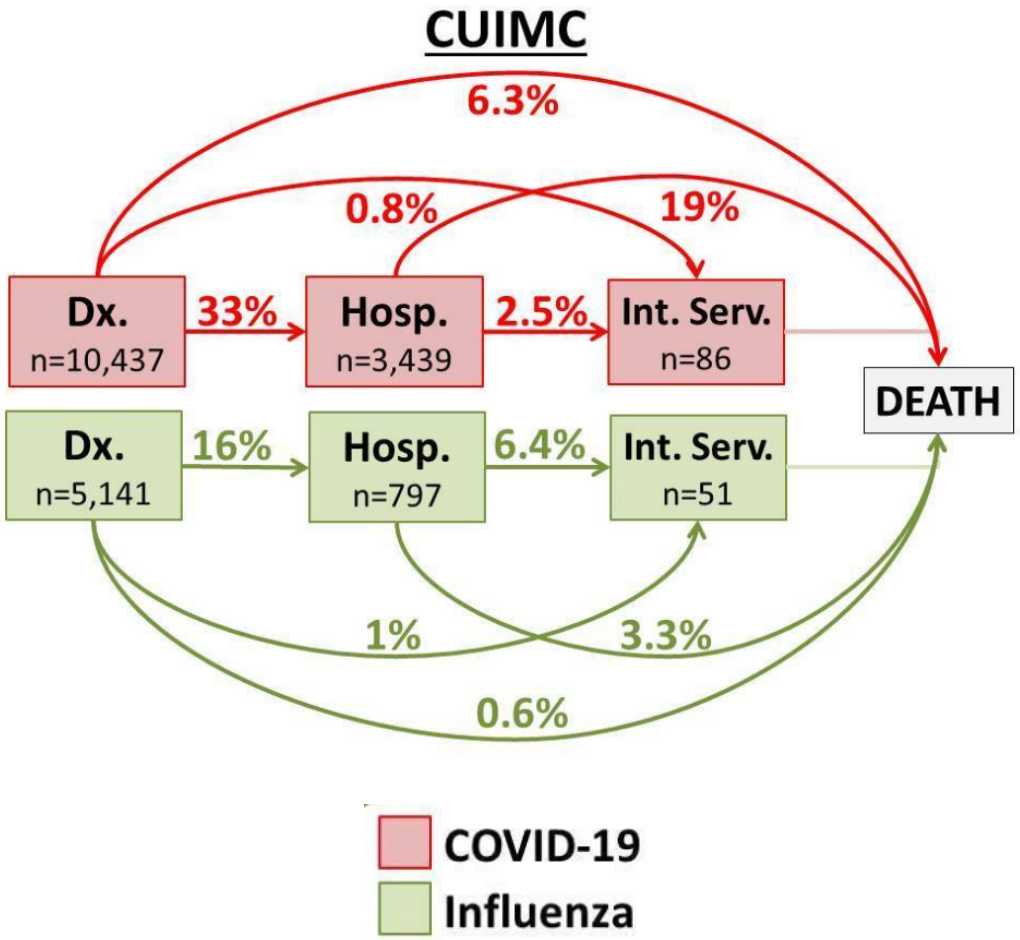
Findings to date – COVID vs Flu

- COVID is no flu
- Healthier
- Less history of drug use



Findings to date – COVID vs Flu

- COVID is no flu
- Healthier
- Less history of drug use
- Worse outcomes



Publications to date

nature COMMUNICATIONS

ARTICLE

https://doi.org/10.1038/s41467-020-18849-z OPEN

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: 8362, South Korea: 7341, Spain: 18,425) COVID-19 patients, summarising between 4811 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 84,585 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 protecting groups vulnerable to influenza is likely a useful 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.

Comment on this paper

Heterogeneity and temporal variation in the management of COVID-19: a multinational drug utilization study including 71,921 hospitalized patients from China, South Korea, Spain, and the United States of America

Albert Prats-Uribe, Anthony G. Sena, Lana Yin Hui Lai, Waheed-Ul-Rahman Ahmed, Heba Alghoul, Osaid Alser, Thamir M Alshammari, Carlos Areia, William Carter, Paula Casajust, Dalia Dawoud, Asieh Golozar, Jitendra Jonnagaddala, Paras Mehta, Gong Menchung, Daniel R Morales, Fredrik Nyberg, Jose D Posada, Martina Recalde, Elena Roel, Karishma Shah, Nigam Shah, Lisa M Schilling, Vignesh Subbian, David Vizcaya, Andrew Williams, Lin Zhang, Ying Zhang, Hong Zhu, Li Liu, Peter Rijnbeek, George Hripcsak, Jennifer C.E Lane, Edward Burn, Christian Reich, Marc A Suchard, Talita Duarte-Salles, Kristin Kostka, Patrick B Ryan, DANIEL PRIETO-ALHAMBRA

doi: https://doi.org/10.1101/2020.09.15.20195545

Comment on this paper

Characteristics and outcomes of 627 044 COVID-19 patients with and without obesity in the United States, Spain, and the United Kingdom

Martina Recalde, Elena Roel, Andrea Pistillo, Anthony G Sena, Albert Prats-Uribe, Waheed Ul-Rahman Ahmed, Heba Alghoul, Thamir M Alshammari, Osaid Alser, Carlos Areia, Edward Burn, Paula Casajust, Dalia Dawoud, Scott L DuVall, Thomas Falconer, Sergio Fernandez-Bertolin, Asieh Golozar, Mengchun Gong, Lana Yin Hui Lai, Jennifer C.E Lane, Kristine E Lynch, Michael E Matheny, Paras P Mehta, Daniel R Morales, Karthik Natarjan, Fredrik Nyberg, Jose D Posada, Christian G Reich, Lisa M Schilling, Karishma Shah, Nigham H Shah, Vignesh Subbian, Lin Zhang, Hong Zhu, Patrick Ryan, Daniel Prieto-Alhambra, Kristin Kostka, Talita Duarte-Salles

doi: https://doi.org/10.1101/2020.09.02.20185173

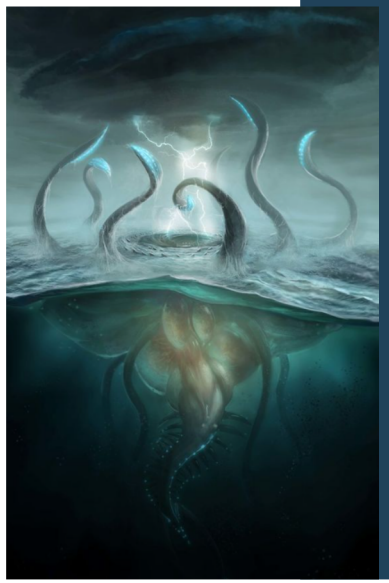
CHARYBDIS - Papers in preparation

Paper Topic	Title	Study Lead(s)
Autoimmune	Characteristics, outcomes and mortality amongst 45,576 patients with prevalent autoimmune disease hospitalized with COVID-19: a multinational distributed network cohort analysis	Eng Hooi Tan (Cheryl), Daniel Prieto-Alhambra
Pregnancy	Clinical characteristics, symptoms, management and health outcomes in 8,598 pregnant women diagnosed with COVID-19 compared to 27,510 with seasonal influenza in 2017-2018 in France, Spain and the US: a distributed cohort analysis	Lana Lai, Asieh Golozar, Talita Duarte-Salles and Daniel Prieto-Alhambra
Pediatrics	Baseline characteristics, hospital treatments, and outcomes of 55,270 children and adolescents diagnosed (3,693 hospitalized) with COVID-19 in France, Germany, Spain, South Korea and the United States: an international network cohort study	Talita Duarte-Salles, Daniel Prieto-Alhambra
HIV	Using Real World Data to Understand HIV and COVID-19 Co-Infection in Two Countries: Characterizing HIV-COVID-19 Co-Infected Patients Across the Care Cascade	Julianna Kohler, Kristin Kostka, Rupa Makadia, Daniel Prieto-Alhambra
Asthma	Characteristics and outcomes of 674,532 COVID-19 patients with and without asthma in the United States, Spain, and the United Kingdom	Daniel Morales
Testing	Baseline characteristics, symptoms and outcomes among people tested for COVID-19: an international network cohort analysis including >1.9 million people tested and >111,000 tested positive for SARS-CoV-2 in South Korea, Spain and the USA	Lana Lai, Asieh Golozar and Daniel Prieto-Alhambra
Racial disparities	Characterizing COVID-19 disease natural history differences between Blacks and Whites	Patrick Ryan, Shawn Baldry
Interventions	Use of dialysis, tracheostomy, and extracorporeal membrane oxygenation among 240,151 patients hospitalised with COVID-19 in the United States	Edward Burn, Kristin Kostka, Talita Duarte-Salles
General - Clinical Paper	Characterizing Health Associated Risks, and Your Baseline Disease In SARS-COV-2 (CHARYBDIS): an international network cohort including 1.2 Million COVID-19 cases from 8 countries	Talita Duarte-Salles, Albert Prats-Uribe, Kristin Kostka
General - Informatics Paper	TBD	Talita Duarte-Salles, Albert Prats-Uribe, Kristin Kostka, Patrick Ryan
Gender differences	TBD	Kristin Kostka, Maura Beaton, Noemie Elhdad, Ru-fong Cheng
VTE	TBD	Kristin Kostka, Daniel Prieto-Alhambra, Evan Minty
Cancer	Characteristics and outcomes of 118,155 COVID-19 individuals with cancer in the United States and Spain: a network cohort study	Elena Roel, Talita Duarte-Salles
Follow-Up Time / Repeated Testing	TBD	Vojtech Huser

CHARYBDIS

Only a monster can beat another monster

CHARYBDIS



CHARYBDIS

About
Cohorts
Cohort Counts
Cohort Characterization
Compare Cohort Char.
Database information
Database
HealthVerity, CDM_Premier,
Cohort
Persons with a COVID-19 dia
Strata
All, with Full 30-day follow u

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Search:

Cohort	Strata	HealthVerity	CDM_Premier_COVID_v1240	CPRD_COVID	DCMC	HIRA	HM Hospitals	NFHCRD	optum_ehr_covid_v1239	SIDIAP_H	SIDIAP	STARR-OMOP	TRDW	VA-OMOP	IPCI	IQVIA_OpenClaims
		Subjects	Subjects	Subjects	Subjects	Subjects	Subjects	Subjects	Subjects	Subjects	Subjects	Subjects	Subjects	Subjects	Subjects	Subjects
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	All	371,153	66,132	2,679	559	7,603	2,089	403	45,508	43,411	124,221	4,788	1,250	25,538	1,417	493,949
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Full 30-day follow up	22,440	3,902	894	162	7,348	17	276	13,690	28,570	81,896	2,703	641	19,196	1,009	243,316
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with < 30-day follow up	348,713	62,230	1,785	397	255	2,072	127	31,818	14,841	42,325	2,085	605	6,340	408	250,633
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Sex = Female	203,731	33,271	1,527	314	4,502	843	197	24,717	24,891	71,680	2,388	1,199	4,374	859	267,537
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Sex = Male	167,422	32,861	1,152	245	3,101	1,246	206	20,791	18,520	52,541	2,398	234	21,163	558	226,333
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Age >= 18	356,610	63,572	2,647	552	7,351	2,078	396	44,480	41,474	119,188	4,603		25,535	1,394	476,351
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Age < 18	14,543	2,560	32	7	251	11	7	1,028	1,937	5,033	185		<5	23	17,618
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Age >= 65	72,735	22,579	1,315	98	1,373	1,257	81	13,332	11,966	31,473	1,380		10,999	483	174,479
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Age < 65	298,418	43,553	1,364	461	6,229	832	322	32,176	31,445	92,748	3,408		14,538	934	319,470
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Black or African American		14,306						10,701			120		8,012		
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with White		28,556						22,674			2,026		13,246		
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Index date: Jan 2020	23	2,380	8		12	<5	<5	6	34	80	51		110	<5	4,063
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Index date: Feb 2020	37	2,560	6	277	1,899	5	261	12	82	241	223		87	<5	3,246
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Index date: Mar 2020	48,024	21,729	404	282	5,263	1,446	139	10,735	23,791	67,452	852		2,124	561	69,665
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Index date: Apr 2020	132,103	32,530	1,884		425	636	<5	20,045	18,294	52,958	1,582		9,881	591	314,366
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Index date: May 2020	190,943	6,081	377		<5			13,746	1,187	3,452	1,434		6,265	170	100,026
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Index date: Jun 2020								960			570		7,024	89	
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent Type 2 Diabetes Mellitus	10,115	10,783	392	108	1,765	271	9	1,091	4,999	9,840	555	179	9,325	248	171,626
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent Type 2 Diabetes Mellitus	361,038	55,349	2,287	451	5,838	1,818	394	44,417	38,412	114,381	4,233	1,071	16,213	1,169	322,323
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent hypertension	16,294	19,008	544	154	1,950	712	19	2,068	11,175	20,995	1,319	307	16,474	379	281,426
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent hypertension	354,859	47,124	2,135	405	5,653	1,377	384	43,440	32,236	103,226	3,469	943	9,064	1,038	212,523
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent chronic kidney disease	2,511	1,180	122	155	243			319	1,498	505	289	107	4,104	102	64,604
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent chronic kidney disease	368,642	64,952	2,557	404	7,360			45,189	41,913	123,716	4,499	1,143	21,434	1,315	429,345
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent end stage renal disease	865	955	7	155	26			409	134		73	70	1,032		18,232
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent end stage renal disease	370,288	65,177	2,672	404	7,577			45,099	43,277		4,715	1,180	24,506		475,717
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent heart disease	9,516	11,533	504	106	1,319	331	7	1,217	8,142	17,718	977	245	12,310	268	220,786
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent heart disease	361,637	54,599	2,175	453	6,284	1,758	396	44,291	35,269	106,503	3,811	1,005	13,228	1,149	273,163
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent malignant neoplasm excluding non-melanoma skin cancer	2,970	3,157	220	32	412	174		460	4,307	8,805	887	106	5,551	152	73,444
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent malignant neoplasm excluding non-melanoma skin cancer	368,183	62,975	2,459	527	7,191	1,915		45,048	39,104	115,416	3,901	1,144	19,987	1,265	420,505
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent Human immunodeficiency virus infection	266	128							82	56	19	14	408		4,653
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent Human immunodeficiency virus infection	370,887	66,004							43,329	124,165	4,769	1,236	25,130		489,296
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent Hepatitis C	374	410			61	8		38	407	647	61	35	1,680		9,905
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent Hepatitis C	370,779	65,722			7,542	2,081		45,470	43,004	123,574	4,727	1,215	23,858		484,044
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent obesity	6,658	7,298	1,011	29	16	92		22,350	14,136	36,527	1,246	325	11,586	283	155,436
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent obesity	364,495	58,834	1,668	530	7,587	1,997		23,158	29,275	87,694	3,542	925	13,952	1,134	338,513
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent Dementia	2,587	3,697	198	6	438	47		225	2,421	6,007	38	29	2,314	48	57,998
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent Dementia	368,566	62,435	2,481	553	7,165	2,042		45,283	40,990	118,214	4,750	1,221	23,224	1,369	435,951
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent tuberculosis				8	24				40	85			27		89
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent tuberculosis				551	7,579				43,371	124,136			25,511		493,860
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent Autoimmune condition	3,478	1,678	285	49	815	81		381	3,556	8,255	418	133	5,142	244	105,239
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent Autoimmune condition	367,675	64,454	2,394	510	6,788	2,008		45,127	39,855	115,966	4,370	1,117	20,396	1,173	388,710
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent chronic obstructive pulmonary disease (COPD) without asthma	3,949	3,335	212		149	113		5,800	6,764	15,811	231	89	6,667	121	68,854
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent chronic obstructive pulmonary disease (COPD) without asthma	367,204	62,797	2,467		7,454	1,976		39,708	36,647	108,410	4,557	1,161	18,871	1,296	425,095
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent Asthma without COPD	4,646	3,972	349	17	1,566	82		2,934	3,134	7,561	521	112	2,970	165	87,164
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	without Prevalent Asthma without COPD	366,507	62,160	2,330	542	6,037	2,007		42,574	40,277	116,660	4,267	1,138	22,568	1,252	406,785
Persons with a COVID-19 diagnosis or a SARS-CoV-2 positive test with no required prior observation	with Prevalent pre-existing condition of COVID risk factor	17,304	18,402	985	197	2,694	609	18	2,052	14,044	32,850	1,762	353	16,578	471	296,641

https://data.ohdsi.org/Covid19CharacterizationCharybdis/

JOIN the CHARYBDIS team

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Thank you!

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