



Penn Medicine



dGEM-COVID project: Applying the Decentralized Generalized Linear Mixed Effects Model (dGEM) for Hospital Profiling of COVID-19 Mortality Data across OHDSI Network

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May 24, 2022



Introduction: dGEM-COVID

▶ Aim:

- A distributed network analysis of hospital profiling on the COVID-19 mortality rate

Hospital profiling

► Goal:

- compare the quality of care between hospitals via structural measures
 - E.g., nursing ratios, presence of residency programs, availability of advanced technology, volume



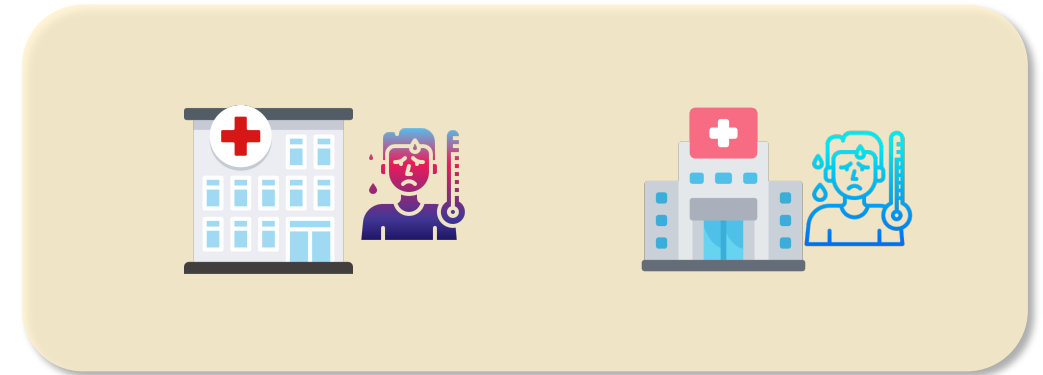
Hospital profiling

▶ Goal:

- compare the quality of care between hospitals via structural measures
 - E.g., nursing ratios, presence of residency programs, availability of advanced technology, volume

▶ Challenge:

- “case-mix” situation



Hospital profiling

▶ Goal:

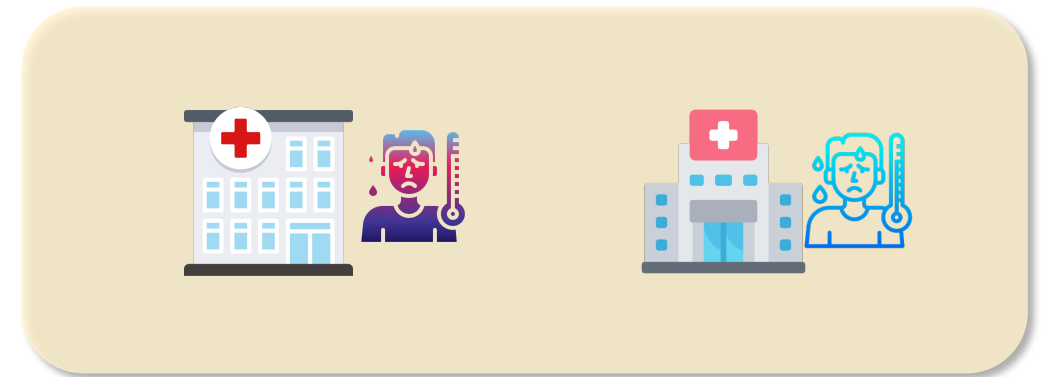
- compare the quality of care between hospitals via structural measures
 - E.g., nursing ratios, presence of residency programs, availability of advanced technology, volume

▶ Challenge:

- “case-mix” situation

▶ Question:

- How can we make fair comparison across hospitals?

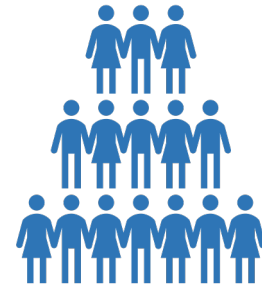




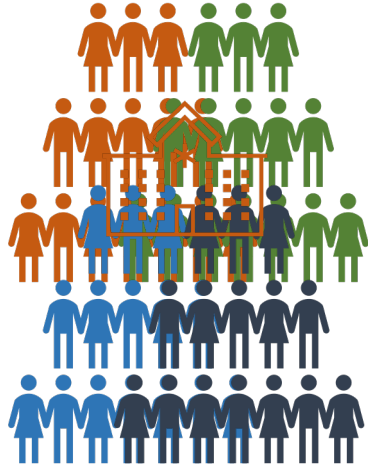
A Solution

(taking mortality as an example)

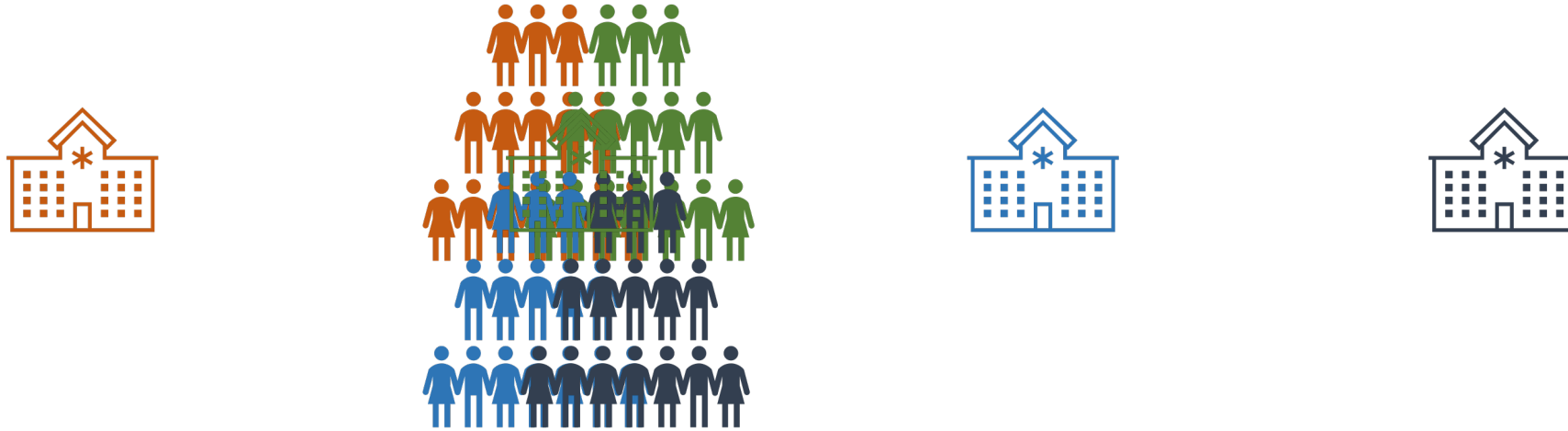
evaluate the “risk-standardized” mortality rate by
counterfactually treating all patients at a given hospital



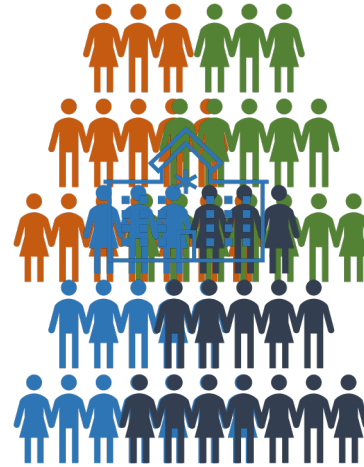
Counterfactual



Counterfactual



Counterfactual



Challenges

If a hospital want to participant the ranking, but cannot share their patient-level data

A Solution

dGEM: Decentralized algorithm for Generalized mixed Effect Model

- Federated learning
 - No need to transfer patient-level data
 - Only transfer the hospital-specific effects

Conventional

dGEM

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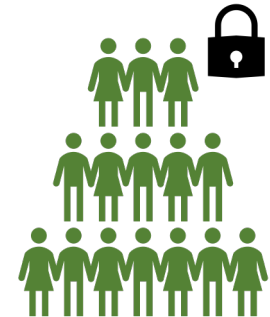
\hat{Y}_1



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Introduction: dGEM-COVID

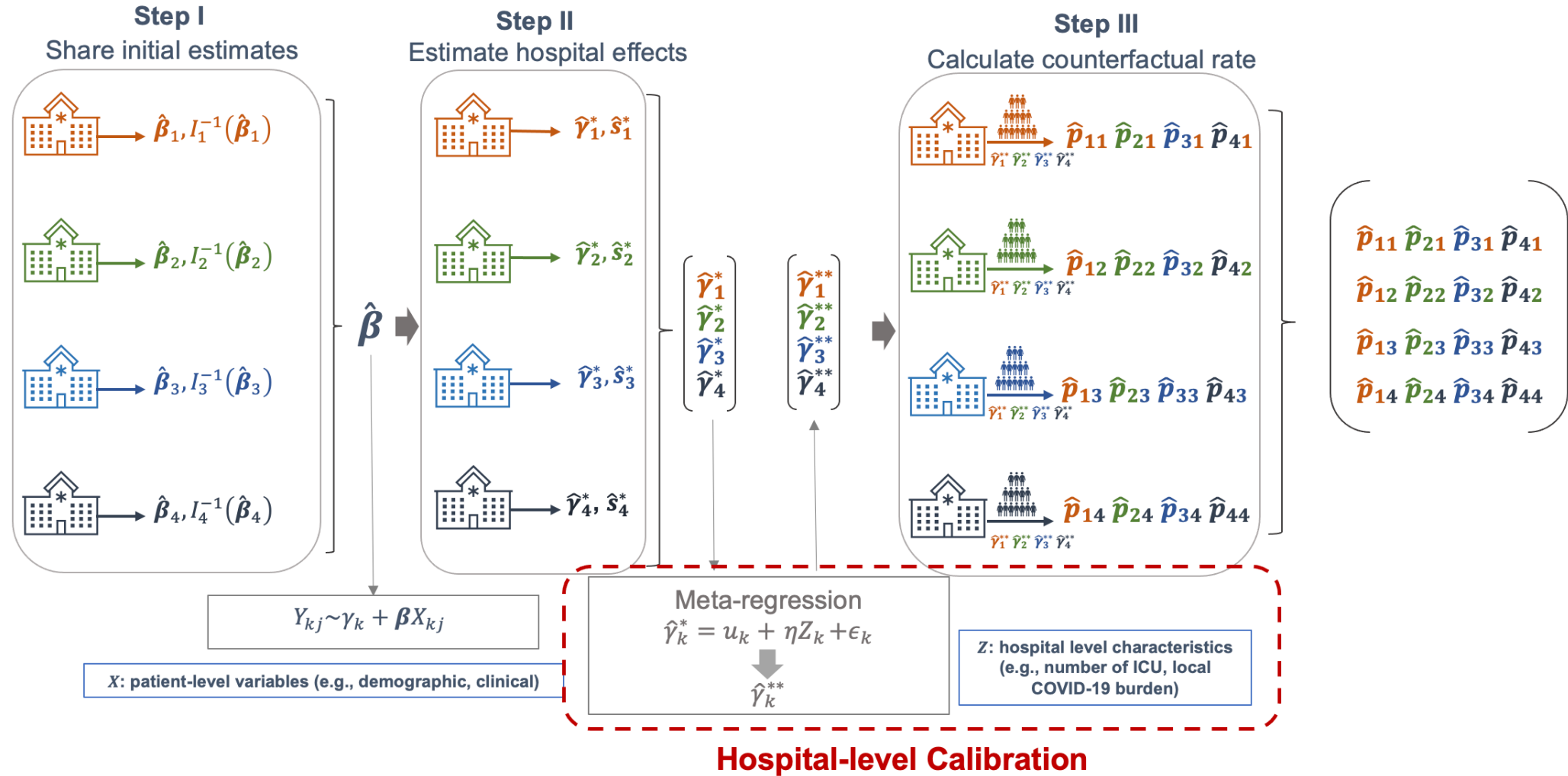
▶ Aim:

- A distributed network analysis of hospital profiling on the COVID-19 mortality rate

▶ Method:

- Decentralized Generalized Linear Mixed Effects Model (dGEM)
 - Privacy-preserving (patient-level and hospital-level), communication-efficient, heterogeneity-aware, hospital-level calibration

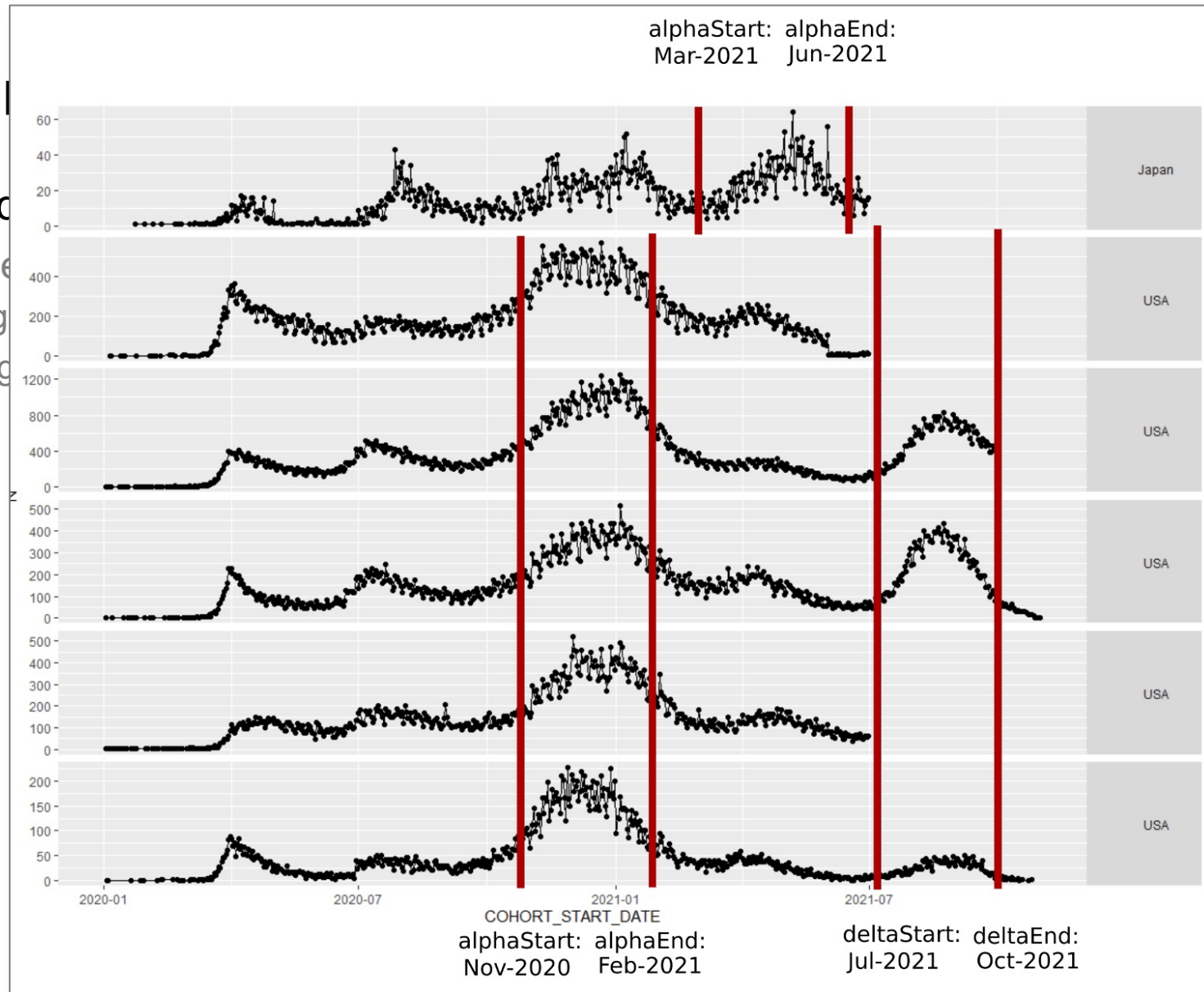
dGEM Workflow



Introduction

▶ Study cohort of

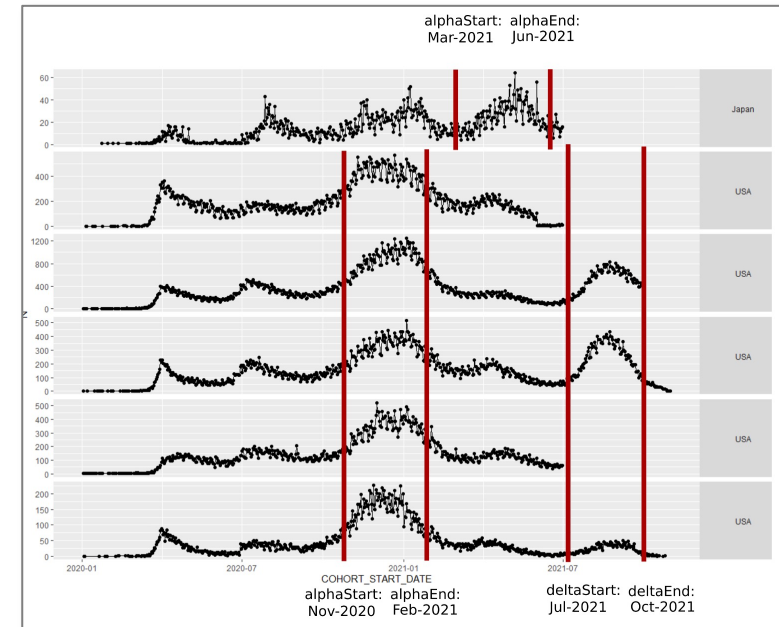
- Two time periods
 - i) during
 - ii) during



Introduction: dGEM-COVID

▶ Study cohort details:

- Two time periods for the hospital profiling:
 - i) during the Alpha wave (in the USA approximately Nov 2020-Feb 2021)
 - ii) during the Delta wave (in the USA approximately Jul 2021-Oct 2021)
 - Outcome of interest:
 - COVID-19 Mortality
 - Measure for hospital profiling:
 - Standardized COVID-19 Mortality Rate
 - Variables:
 - Age, Charlson comorbidity, gender, history of cancer/chronic obstructive pulmonary disease/heart disease/hypertension/hyperlipidemia/kidney disease/obesity/diabetes, number of visits recorded in visit table in 2019
- ▶ Target journal and submission timeline:
- Nature Methods, July 2022



PDA-OTA: Privacy-preserving Distributed Algorithms Over the Air

PDA
Privacy-preserving Distributed Algorithms

Welcome back
Jessie Tong!

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User Profile

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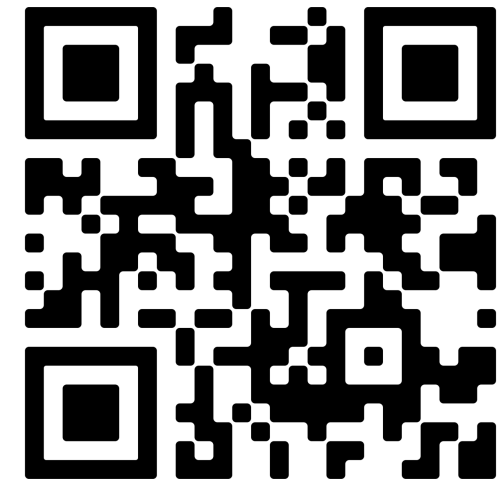
Home Page for PDA-OTA

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Introduction Video of PDA-OTA

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Privacy-preserving Distributed Algorithms Over-The-Air



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Project Name	Creation Date	Sites uploaded (*)	Rounds completed (**)	Lead Site	Invitation Code	
Lead Projects						
+ New Project						
dGEM_Covid_Alpha	2022-05-23 11:37:22	0/8	0/3	UPenn	98930	Delete Project
dGEM_Covid_Delta	2022-05-23 11:38:11	0/9	0/3	UPenn	73776	Delete Project




Participating Projects

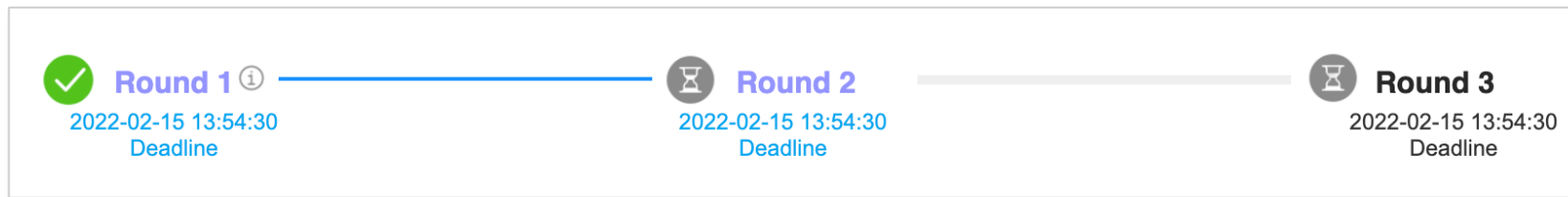
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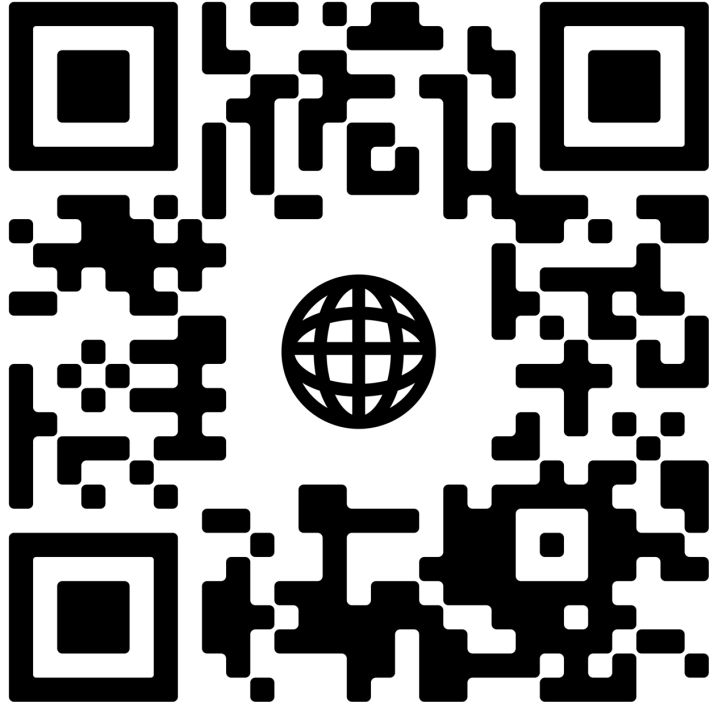
(*) Sites uploaded - how many sites have finished uploading (for the current round) / total number of participating sites

(**) Rounds completed - how many rounds have been completed / total number of rounds

File	Round	Date Uploaded
 optum_ehr_initialize.json	1	2022-05-02 17:11:27 (EST)
 optum_ehr_derive.json	2	2022-05-02 17:16:14 (EST)
 optum_ehr_estimate.json	3	2022-05-02 17:19:32 (EST)

File	Round	Date Uploaded
 ccae_initialize.json	1	2022-05-02 17:05:23 (EST)
 ccae_derive.json	2	2022-05-02 17:16:23 (EST)
 ccae_estimate.json	3	2022-05-02 17:19:41 (EST)





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<https://github.com/ohdsi-studies/dGEMcovid>