Computable Phenotype and Severity Outcomes Validation of Adult Patients Admitted to the Hospital with Confirmed Coronavirus Disease 2019 (COVID-19)

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Background

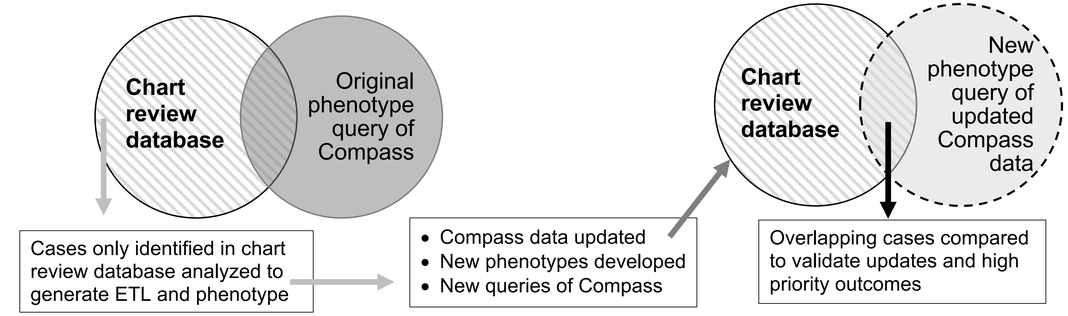
- Observational electronic health record (EHR)-derived data has been increasingly used to characterize patient-level aspects of the COVID-19 pandemic including disease natural history, the impact of therapies, and population-level outcomes (1).
- Computable phenotypes have emerged as an important informatics method (2) to solve such research questions.
- Despite the widespread use of these methods, it is unknown the extent to which this data is valid and high quality (3).

Rationale: This study aims to validate an EHR-computed phenotype of patients hospitalized for COVID-19 with a database of manually abstracted patient charts.
Hypothesis: We hypothesize that the cohort definition phenotype will accurately identify patients hospitalized for COVID-19.

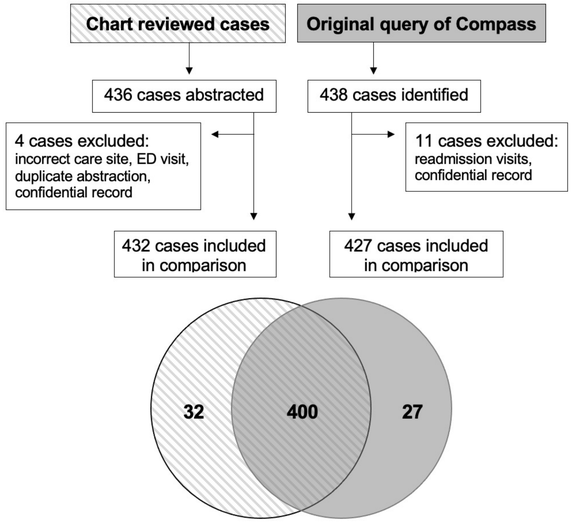
Methods

- **REDCap chart review database** of patients hospitalized for COVID-19 March 18-April 26, 2020 at UCHealth University of Colorado Hospital; inclusion based on COVID-19 infection flag in Epic, first admission
- The **EHR-computed phenotype** was developed through the Rapid Response Data for Discoveries (R2D2) collaboration and based on the Common Data Model (4)
- A query was designed to match the REDCap database cohort and search data in Health Data Compass (HDC) (5)
- Clinical and demographic variables were abstracted and extracted from flowsheets and notes in Epic charts
- Patients in the HDC dataset were linked by an arbitrary identifier with the patients in the REDCap database
- Patient records were manually compared to determine validity of the phenotype and outcomes of interest

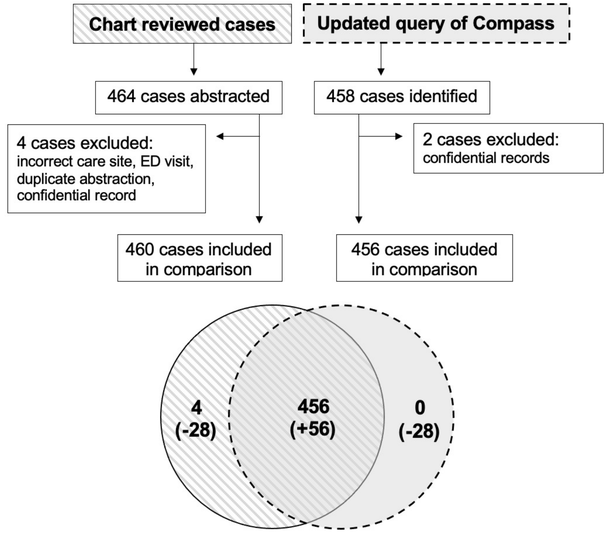
Methods : Validation Process Overview



Results : Initial comparison between chart reviewed cases and Compass data query



Results : Repeat comparison between chart review cases and updated Compass data query



Conclusions

- An EHR-computed phenotype had a 92.2% sensitivity compared with chart review in identifying cases of patients hospitalized for COVID-19.
- Analysis of patients missed by the EHR phenotype identified errors in data extraction, transformation and loading (ETL), particularly with regard to visit type in patients' encounters.
- This work highlighted limitations of applying date-restricted logic in the phenotype definition to ICD-10 diagnosis codes.
- Analysis of outcomes of interest (invasive mechanical ventilation, extracorporeal membrane oxygenation, and in-hospital mortality) showed high quality concordance.
- Demographic information reliably underwent ETL from the EHR into HDC.

Implications and Future Work

- This work has led to improvements in the phenotype definition's inclusion criteria and Compass's process.
- Data quality validation is critical as EHR-derived data and phenotypes are increasingly used in observational research.
- These findings ensure integrity of this EHR-data and strengthens the reliability of the Common Data Model.

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