Racial and ethnic disparities for risk of COVID-19 from billing codes at UCHealth

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Background

- As of February 19, 2021, the Colorado Center for Personalized Medicine COVID-19 Data Mart (CCDM) consists of 1,225,362 UCHealth patients.
- Using ICD-10 billing code, U07.1,. 47,916 patients have tested positive for COVID-19,
- We wanted to determine what billing codes may be associated with racial and ethnic disparities in contracting COVID-19.

Methods

- Only patients with >=2 visits in the last 5 years were considered.
- COVID- patients were selected matching to cases based on age (>18), sex, race, and ethnicity at 4:1 ratio where possible.
- Billing codes for COVID+ patients were restricted to only those prior to COVID diagnosis.
- Phecodes were then constructed from ICD-9 and ICD-10 billing codes using the PheWAS R package.
- We then stratified data into 3 groups (European American non-Hispanic (EA), African American non-Hispanic (AA), and all Hispanic (LA).
- We then ran Firth logistic regressions within each group with ~1800 phecodes as explanatory variables adjusting for age and sex (where appropriate), excluding results with <20 cases, and COVID status as the outcome variable.
- We also ran similar analyses with hospitalizations and ICU visits due to COVID as outcome variables.
- Differences in association between racial/ethnic groups were then assessed using Cochran's Q test using the Metasoft package.

Results

Table 1: Demographics of COVID cases and matched controls

Variable	Total	COVID.Cases	COVID.Controls
N	237,030	47,422	189,608
Males (N; %)	110,836; 47%	22,177; 47%	88,659; 47%
Age 18-35	85,017; 36%	17,030; 36%	67,987; 36%
Age 36-50	62,162; 26%	12,446; 26%	49,716; 26%
Age 51-65	53,988; 23%	10,956; 23%	43,032; 23%
Age >65	35,863; 15%	6,990; 15%	28,873; 15%
European American (N; %)	144,388; 61%	28,878; 61%	115,510; 61%
Hispanic American (N; %)	48,581; 21%	9,720; 21%	38,861; 21%
African American (N; %)	9.555; 4%	1,911; 4%	7,644; 4%

Figure 1: Forest plots of COVID cases and matched controls for phecodes related to (a) Type 2 Diabetes and (b) Pain.

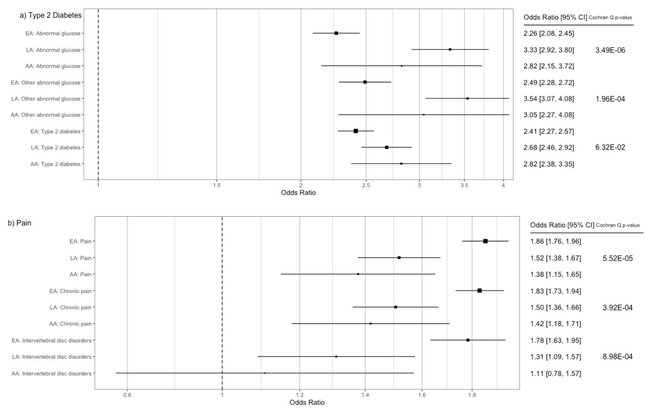


Table 2: Patients with Abnormal Glucose phecode without Type 2 Diabetes and patients with Type 2 Diabetes and Abnormal Glucose phecodes by race/ethnicity

Variable	Abnormal.Glucose.Only	T2D.And.Abnormal.Glucose
EA	3,342; 74.3%	1,159; 25.7%
LA	859; 62.8%	508; 37.2%
AA	175; 54.3%	147; 45.7%

Table 5: Demographics of ICU visits among COVID cases

Variable	Total	COVID.ICU	COVID.No.ICU
N	47,416	2,535	44,881
Males (N; %)	22,179; 47%	1,277; 50%	20,902; 47%
Age 18-35	17,027; 36%	535; 21%	16,492; 37%
Age 36-50	12,443; 26%	558; 22%	11,885; 26%
Age 51-65	10,954; 23%	744; 29%	10,210; 23%
Age >65	6,992; 15%	698; 28%	6,294; 14%
European American (N; %)	28,879; 61%	962; 38%	27,917; 62%
Hispanic American (N; %)	9,728; 21%	1,061; 42%	8,667; 19%
African American (N; %)	1,912; 4%	248; 10%	1,664; 4%

Table 3: Demographics of hospitalizations among COVID cases

Variable	Total	COVID.Hospitalizations	COVID.No.Hospitalizations
N	47,416	4,317	43,099
Males (N; %)	22,179; 47%	2,449; 57%	19,730; 46%
Age 18-35	17,027; 36%	352; 8%	16,675; 39%
Age 36-50	12,443; 26%	768; 18%	11,675; 27%
Age 51-65	10,954; 23%	1,415; 33%	9,539; 22%
Age >65	6,992; 15%	1,782; 41%	5,210; 12%
European American (N; %)	28,879; 61%	2,030; 47%	26,849; 62%
Hispanic American (N; %)	9,728; 21%	1,527; 35%	8,201; 19%
African American (N; %)	1,912; 4%	352; 8%	1,560; 4%

Figure 2: Forest plots of hospitalizations among COVID cases for phecodes related to (a) Respiratory ailments and (b) Pain.

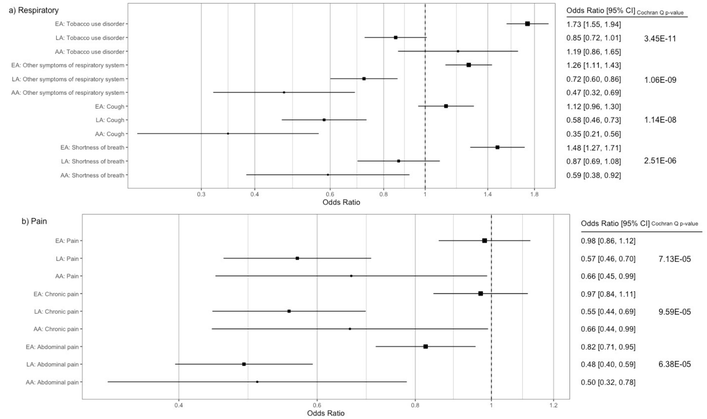
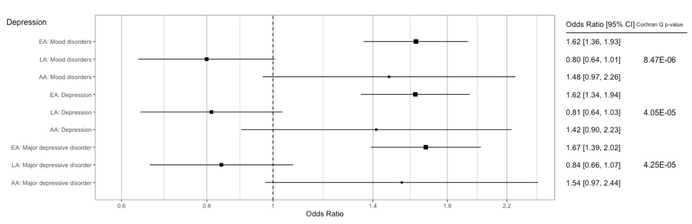


Table 4: Concordance of Tobacco Use Disorder Phecode vs Tobacco Smoking History from Social History Questionnaire by race/ethnicity

Variable	EA.Tobacco.Use.Disorder	EA.No.Tobacco.Use.Disorder	LA.Tobacco.Use.Disorder	LA.No.Tobacco.Use.Disorder	AA.Tobacco.Use.Disorder	AA.No.Tobacco.Use.Disorder
Smoker	641; 85.2%	111; 14.8%	253; 89.4%	30; 10.6%	125; 97.7%	3; 2.3%
Quitter	1832; 81.7%	411; 18.3%	539; 87.9%	74; 12.1%	124; 93.2%	9; 6.8%
Never Smoker	346; 5.4%	6,121; 94.6%	146; 5.0%	2,785; 95.0%	32; 5.5%	554; 94.5%

Figure 3: Forest plots of hospitalizations among COVID cases for phecodes related to Depression



Conclusions

- Within UCHealth, racial and ethnic disparities exist for risk and severity of COVID-19.
- Fewer AA and LA patients have abnormal glucose billing codes not associated with Type 2 Diabetes than EA patients, likely affecting risk associated with COVID-19 diagnosis.
- Pain phecodes are more strongly associated with risk of COVID-19 and hospitalization in EA patients compared to LA and AA patients.
- Tobacco use disorder and related respiratory phecodes are more strongly associated with risk of hospitalization in EA patients.
- There is a greater discordance between tobacco use disorder phecode and tobacco smoking history from the social history questionnaire in EA patients compared to LA and AA patients.
- Phecodes related to depression are positively associated with risk of ICU admittance due to COVID in EA and AA patients but are negatively associated in LA patients.

Implications

- Pre-diabetes may be underdiagnosed in LA and AA patients, though pre-diabetes seems to be weakly associated with risk of COVID-19.
- LA and AA patients may be less likely to be given a pain related phecode, contributing to hidden risk of COVID-19 and severity.
- LA and AA patients may be receiving a more liberal definition of tobacco use disorder, masking risk of COVID-19 severity.
- Language barriers or cultural factors may play a role in increased non-diagnosis of depression related phecodes in LA patients, masking risk of COVID-19 severity.