Clinical Outcomes and Socio-demographic Disparities among COVID-19 Patients with Autoimmune Diseases

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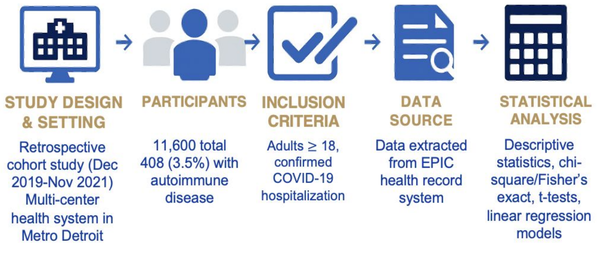
Introduction

- COVID-19 disproportionately affected racial and ethnic minority groups and particularly immunocompromised populations.
- 23.5 million Americans (~7% of the population) live with autoimmune diseases.[1]
- COVID-19 shares many similarities with autoimmune diseases with respect to autoimmune response and pathogenicity. Studies have shown that mechanisms underlying autoimmune and autoinflammatory conditions play a role in host defense mechanisms against SARS-COV-2, such as causing cytokine storm syndrome, ARDS, microvascular thrombosis, multiorgan failure, and death.[2-5]
- The impact of COVID-19 on patients with autoimmune diseases is not fully understood, representing a critical knowledge gap in patient care and disease management.
- This study investigated differences in hospitalization outcomes between COVID-19 patients with autoimmune diseases and those without, to clarify risks and inform future clinical care strategies.

Aims and Objectives

1. Compare demographic and clinical characteristics of hospitalized COVID-19 patients with and without autoimmune diseases.
2. Assess differences in-hospital outcomes, including length of stay (LOS), ICU admission, and mortality.
3. Identify potential disparities in outcomes across sex and racial/ethnic groups.

Methods



- Demographics (age, sex, race/ethnicity)
- Autoimmune diagnosis (ICD-10 codes)
- Hospitalization outcomes (LOS, ICU admission, mortality)

Results

Table 1. Patient demographics.

	Non-Autoimmune (n = 11,192)	Autoimmune (n = 408)	P-value
Age, mean (SD)	61.4 (18.2)	61.2 (16.5)	0.8209[1]
Female, n (%)	5626 (50.3)	276 (67.6)	0.0001[2]
Race, n (%)			0.0030[2]
American Indian or Alaska Native	35 (0.3)	3 (0.7)	
Asian	320 (2.9)	3 (0.7)	
Black or African American	2700 (24.1)	108 (26.5)	
Native Hawaiian/Pacific Islander	7 (0.1)	1 (0.2)	
White or Caucasian	7279 (65)	276 (67.6)	
Other	851 (7.6)	17 (4.2)	
Ethnicity, n (%)			0.0343[3]
Arab or Middle Eastern Descent	1131 (10.1)	22 (5.4)	
Hispanic/Latinx	166 (1.5)	7 (1.7)	
Non-Hispanic/Latinx	9291 (83)	370 (90.7)	
Other	603 (5.4)	9 (2.2)	

[1]Equal variance two sample T-test [2]Chi-square p-vale [3]Monte Carlo simulation

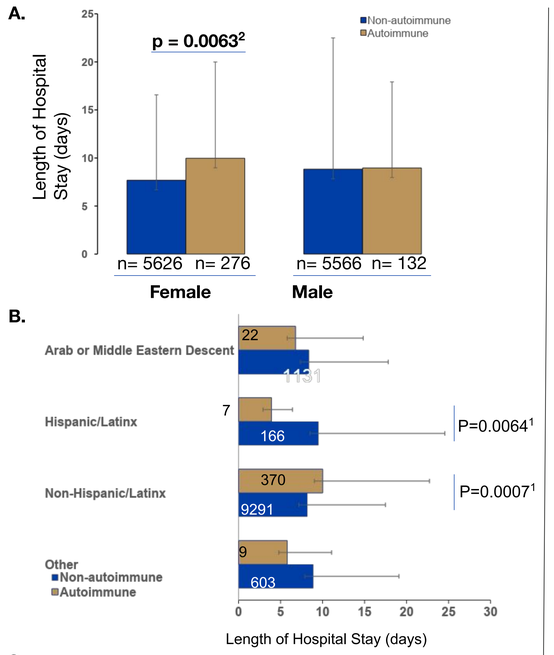
- The autoimmune cohort was predominantly female (67.7% vs. 50.3%, p<0.001)
- Significant demographic differences included greater proportion of Black patients (26.5% vs. 24.1%), lower proportions of Asians (0.7% vs. 2.9%), and lower proportions of Arab/Middle Eastern descent (5.4% vs. 10.1%) in the autoimmune group (all p<0.01)

Table 2. Comparison of outcomes severity among COVID-19 patients with and without autoimmune disease.

Mean Days (SD)	Non-autoimmune (n=11,192)	Autoimmune (n=408)	P-value
LOS	8.3 (9.5)	9.7 (12.3)	0.0253[1]
Number of ICU admissions	0.1 (0.4)	0.2 (0.4)	0.3323[2]
LOS ICU	9.2 (11.2)	9.7 (11)	0.7766[2]
Longest ICU stay	9.7 (11.7)	10.2 (12.4)	0.7175[2]
Shortest ICU stay	8.9 (11.1)	9.3 (10.9)	0.7695[2]
Total LOS ICU	10 (12)	10.6 (13.5)	0.7284[2]
Death during admission, n(%)	995 (8.9)	37 (9.1)	0.9011[3]

[1]Unequal variance two sample T-test, [2]Equal variance two sample T-test, [3]Chi-square p-value

- **LOS was significantly longer in patient with autoimmune disease compared to controls (p=0.0253)**



[1]Equal variance two sample T-test [2]Unequal variance two sample T-test

Figure 1. Severity of COVID-19 for Patients by (A) Sex, (B) Ethnicity, (C) Race. Mean LOS in days. Numbers in bars are (n).

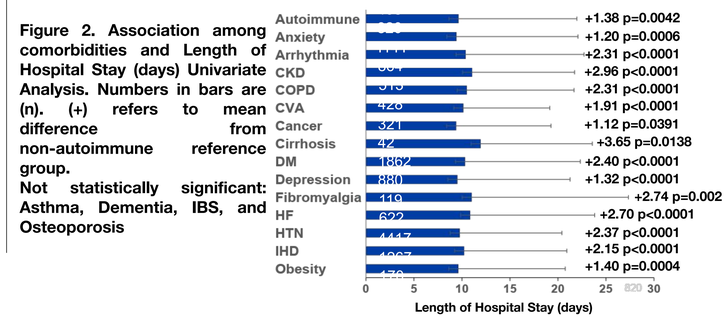


Figure 2. Association among comorbidities and Length of Hospital Stay (days) Univariate Analysis. Numbers in bars are (n). (+) refers to mean difference from non-autoimmune reference group.
Not statistically significant: Asthma, Dementia, IBS, and Osteoporosis

Table 3. Association among comorbidities and Length of Hospital Stay (days) Multivariate Linear Regression

	PE[1]	P-Value
Intercept	7.25 (7.03, 7.48)	<.0001
Autoimmune	0.60 (-0.35, 1.55)	0.2171
Arrhythmia	0.98 (0.36, 1.60)	0.0020
CKD	1.43 (0.73, 2.13)	<.0001
COPD	0.97 (0.11, 1.83)	0.0277
Cirrhosis	2.68 (-0.20, 5.56)	0.0682
DM	1.31 (0.80, 1.82)	<.0001
Fibromyalgia	1.89 (0.16, 3.62)	0.0320
HTN	1.46 (1.04, 1.87)	<.0001

[1]The point estimate (PE) is the change in the LOS with the change in that predictor variable.

- **In Univariate analysis,**
  - Patients with an autoimmune condition, on average, had lengths of stay that were 1.38 days longer than those without an autoimmune condition (Diff: 1.38; p=0.0042).
  - Patients with anxiety, arrhythmia, and chronic kidney disease (CKD) had significantly longer hospital stays compared to those without these conditions, with mean differences of +1.2 days (p = 0.0006), +2.31 days (p < 0.0001), and +2.96 days (p < 0.0001), respectively.
- **In Multivariate linear regression models,**
  - After adjusting for comorbidities, the association with autoimmune is no longer significant (P=0.2452).
  - Patients with conditions such as arrhythmias and chronic kidney disease (CKD) had significantly longer hospital stays compared to those without these conditions (arrhythmias: mean difference = 0.98 days, P = 0.0020; CKD: mean difference = 1.43 days, P < 0.0001)

Conclusions

- Sex and ethnic disparities were observed, with higher prevalence of autoimmune diseases among women and a modestly higher proportion of Black patients, highlighting potential healthcare inequities.
- Our findings align with existing literature, supporting known associations between chronic conditions and increased hospital length of stay (LOS).
- The relationship between multimorbidity burden and LOS represents a novel focus, as most prior studies have emphasized mortality outcomes, particularly in the early COVID-19 period.
- Limitations include the retrospective design, focus on hospitalized patients only, and lack of vaccination data, which may limit generalizability across different COVID-19 variants and time periods.
- Future studies that consider outpatient cases, vaccination status, and treatment regimens would help clarify the impact of autoimmune diseases on COVID-19 outcomes.

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