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Comorbidities, Gender, and Race in the Severity of COVID-19

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ABSTRACT

Objective: COVID-19 pandemic claimed a lot of lives. Comorbidities have been suggested to drive the number of patients who suffered from COVID-19. This study was conducted retrospectively to examine how comorbidities like diabetes, hypertension, and factors like vaccination, race and gender impacted COVID-19 in patients admitted to the hospital (in-patient services) with a COVID-19 diagnosis. Method: A retrospective cohort study of 17,624 adult patients diagnosed with COVID-19 and admitted to in-patient services at Ochsner Health, between March 1, 2020 and March 31, 2022 was conducted. All data, including demographics, comorbidities, laboratory results, COVID-19 vaccination status, and severity of disease were collected from the electronic health record and analyzed. Result: In the unadjusted analysis, diabetes and hypertension were statistically significant predictors of major/extreme SOI ($p < 0.0001$) and ROM ($p < 0.0001$). Age and vaccination status were significant ($p < 0.0001$), but the strength of association was weak: as age increases, severity of illness (SOI) increases (RR=1.00(1.00-1.00)). Length of hospital stay was significantly longer for patients with diabetes after controlling for age and prior vaccination status ($p < 0.0001$). This study also shows that patients with diabetes or hypertension comorbidities were more likely to be vaccinated prior to admission than those without the comorbidity. Conclusion: Our study showed that patients with diabetes or hypertension comorbidities were more likely to be vaccinated prior to admission than those without the comorbidity. However, having these diagnoses may worsen the outcome of COVID-19 infection. Diagnosis with prior diabetes or hypertension was marginally associated with major or extreme severity of illness [RR(95% CI)= 1.02(1.01-1.03) and RR(95% CI)= 1.01(1.01-1.02)] and risk of mortality [RR(95% CI)= 1.05(1.04-1.07) and RR(95% CI)= 1.03(1.02-1.04)] compared to minor or moderate risk.

INTRODUCTION

COVID-19 though, no longer a pandemic, continues to spread, the virus is evolving in its human host. This has led to the emergence of SARS-CoV-2 variants and lineages. The CDC defines a SARS-CoV-2 variant by the presence of one or more mutations, or single changes, in a virus' genome, or genetic code. It defines a SARS-CoV-2 lineage as a group of closely related viruses with a common ancestor. [1]. In the United States each year, COVID-19 can lead to illness, hospitalization, and death [2]. It is still important to monitor the burden from year to year on how the disease is affecting people across the nation. Currently, there is a big drop in hospitalization due to vaccination, medications like Paxlovid and remdesivir when given within few days of symptoms especially in people that have a higher risk of severe disease or death. The vaccines are effective and a surveillance system that provided data to inform what might be annual update moving forward. CDC recommendation includes getting at least a dose of the updated vaccine for ages six-months and above, people over age 65 to get a second dose of the updated vaccine [3][4][5]. CDC estimates that from October 1, 2024 through September 20, 2025, there have been 13.8 million – 20.3 million COVID-19 illnesses; 3.3 million – 4.8 million COVID-19 outpatient visits; 380,000 – 540,000 COVID-19 Hospitalizations; 44,000 -63,000 CO3VID-19 Deaths [6]

METHODS

A retrospective cohort study of 17,624 adult patients diagnosed with COVID-19 and admitted to in-patient services at Ochsner Health between March 1, 2020 and March 31, 2022 was conducted. All data, including demographics, comorbidities, laboratory results, COVID-19 vaccination status, and severity of disease were collected from the electronic health record. Patient characteristics were presented as mean ± SD, median and quartiles, or counts and proportions, where appropriate. Comparisons were performed using the chi-square test or Fisher exact test for categorical variables and the t-test or Wilcoxon rank sum test for continuous variables. Further analysis entailed fitting a linear regression for the length of stay(LOS) and log-Binomial regression models for each binary outcome: severity of illness (SOI) and risk of mortality(ROM). All statistical analysis was done using SAS version 9.4 and all tests performed at a 5% level of significance.

RESULTS AND DISCUSSIONS

The results of this study are shown on tables 1-3. Table 1 shows the Descriptive characteristics of adult patients admitted to an Ochsner hospital (in-patient) with a COVID-19 diagnosis between March 1, 2020 and March 31, 2022. Table 2 shows the unadjusted and adjusted association between prior comorbidities (diabetes mellitus and hypertension) and severity of COVID-19 infection among patients admitted to the hospital with COVID-19, and Table 3 the association between prior comorbidities (diabetes mellitus and hypertension) and severity of COVID-19 infection among the patients admitted to the hospital with COVID-19, stratified by vaccination status prior to admission. The primary outcome was severity of disease assessed by length of in-patient stay (in days), severity of illness (minor, moderate, major, extreme) and risk of mortality (minor, moderate, major, extreme). Our study showed that out of the 17,624 adult patients diagnosed with COVID-19 and admitted to in-patient services at Ochsner Health between March 1, 2020 and March 31, 2022, the number of patients with each comorbidity were as follows: Hypertension 10,141 (57.5), Diabetes 6,178 (35.), Hyperlipidemia 5,620 (31.9), Congestive heart failure 827 (4.7), Asthma 992 (5.6), COPD (1692 (9.6) upon admission. We also observed that patients with diabetes or hypertension who were admitted to the

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hospital with COVID-19 were more likely to have severe illness than not [RR(95%CI)= 1.52(1.30-1.77), RR(95%CI)= 1.28(1.12-1.47), respectively]. Patients with diabetes and hypertension were also more likely to have a longer length of stay in the hospital (p<0.0001).)). Length of hospital stay was significantly longer for patients with diabetes after controlling for age and prior vaccination status (p < 0.0001). There were no gender differences by prior diagnosis of diabetes or hypertension, but Black patients were more likely than White or Other race to have diabetes (40.4% vs 32.0% and 34.1%, respectively) and hypertension (63.7% vs 55.1% and 41.8%, respectively). Patients with hypertension or diabetes were more likely to have been vaccinated for COVID-19 prior to hospital admission (p<0.0001). Diagnosis with prior diabetes or hypertension was marginally associated with major or extreme severity of illness [RR(95% CI)= 1.02(1.01-1.03) and RR(95% CI)= 1.01(1.01-1.02)] and risk of mortality [RR(95% CI)= 1.05(1.04-1.07) and RR(95% CI)= 1.03(1.02-1.04)] compared to minor or moderate risk, with even less strength of association after adjusting for age and prior vaccination status. Highest risk of mortality was among men, white, and vaccinated patients (p<0.0001). Patients with diabetes and hypertension averaged less than one day longer length of stay in the hospital, but patients with public insurance and no vaccination prior to hospitalization had increased time spent in the hospital (p<0.0001). Vaccination prior to hospitalization was mildly protective of severity of illness.

A study conducted by some researchers reported that COVID-19 vaccine was associated with over 8 million fewer confirmed cases, over 120 thousand fewer deaths, and 700 thousand fewer hospitalizations during the first six months of the campaign [8]. In the United States, it was not until middle of December in 2020 that the first SARS-CoV-2 vaccine received emergency use authorization from Advisory Committee on Immunization Practice (ACIP) This organization advises CDC on population groups and circumstances for the use of vaccine. ACIP initial recommendation was for 1) healthcare workers and long-term care facility residents in phase 1a, on December 20, 2020 by ACIP recommended that in Phase 1b, vaccine should be offered to persons aged ≥75 years and frontline essential workers (non–health care workers), and that in Phase 1c, persons aged 65–74 years, persons aged 16–64 years with high-risk medical conditions, and essential workers not recommended for vaccination in Phase 1b should be offered vaccine [7]. The patients reported in our study might not have received vaccine by 2020. Our study shows that reduction in hospitalization might have been as a result of vaccines.

Diabetes and Hypertension

Diabetes seems to be one of the most significant comorbidities associated with a worst prognosis of COVID-19. COVID-19 patients with diabetes or hypertension had more ICU admissions compared with the non-diabetic and non-blood pressure patients [9]. Patients with diabetes are more susceptible to viral and bacterial infections, including those of the respiratory tract [9]. Our study observed that Patients with diabetes and hypertension were also more likely to have a longer length of stay in the hospital (p<0.0001).)). Length of hospital stay was significantly longer for patients with diabetes after controlling for age and prior vaccination status (p < 0.0001).

Other Factors (Race and Gender)

Highest risk of mortality was among men, white, and vaccinated patients (p<0.0001). Most vaccinated patients had comorbidity, that might be a reason for high risk of mortality.

Table 1: Descriptive characteristics of adult patients admitted to an Ochsner hospital (in-patient) with a COVID-19 diagnosis between March 1, 2020 and March 31, 2022, overall and by diabetes and hypertension status (N=17,624).

Characteristics	Overall	Diabetes n(%)	No Diabetes n(%)	P-Value	Hypertension n(%)	No Hypertension n(%)	P-Value
	Overall	**6,178(35.1)**	**11,446(65.0)**		**10,141(57.5)**	**7,483(42.5)**	
Demographics							
Age (years), mean±SD	60.4±16.9	63.9±14.1	58.5±17.9	<.0001	64.9±14.5	54.3±18.0	<.0001
Sex, n (%)				0.779			0.056
Female	8807(50.0)	3096(35.2)	5711(64.9)		5131(58.3)	3676(41.7)	
Male	8815(50.0)	3081(35.0)	5734(65.1)		5010(56.8)	3805(43.2)	
Race, n (%)				<.0001			<.0001
African American	6271(36.3)	2536(40.4)	3735(59.6)		3994(63.7)	2277(36.3)	
White	10,411(60.3)	3332(32.0)	7079(68.0)		5734(55.1)	4677(44.9)	
Other	596(3.5)	203(34.1)	393(65.9)		249(41.8)	347(58.2)	
Ethnicity, n (%)				0.284			<.0001
Non-Hispanic or Latino/a	16,357(94.7)	5761(35.2)	10596(64.8)		9610(58.8)	6747(41.3)	
Hispanic or Latino/a	911(5.3)	305(33.5)	606(66.5)		358(39.3)	553(60.7)	
Marital Status, n (%)				<.0001			<.0001
Married or Significant Other	8109(47.5)	2818(34.8)	5291(65.3)		4662(57.5)	3447(42.5)	
Divorced, Legally Separated, Widowed	3949(23.1)	1614(40.9)	2335(59.1)		2699(68.4)	1250(31.7)	
Single	5033(29.5)	1600(31.8)	3433(68.2)		2536(50.4)	2497(49.6)	
Insurance Type, n (%)				<.0001			<.0001
Commercial	6220(35.3)	2014(32.4)	4206(67.6)		3376(54.3)	2844(45.7)	
Medicaid	1486(8.4)	503(33.9)	983(66.2)		747(50.3)	739(49.7)	
Medicare	5095(28.9)	2147(42.1)	2948(57.9)		3550(69.7)	1545(30.3)	
Self-pay	4473(25.4)	1411(31.5)	3062(68.5)		2325(52.0)	2148(48.0)	
Other	350(2.0)	103(29.4)	247(70.6)		143(40.9)	207(59.1)	
Comorbidities							
Diabetes Mellitus, n(%)	6,178(35.1)	n/a	n/a	n/a	4385(71.0)	1793(29.0)	<.0001
Hypertension, n(%)	10,141(57.5)	4385(43.2)	5756(56.8)	<.0001	n/a	n/a	n/a
Hyperlipidemia, n (%)	5620(31.9)	2824(50.3)	2796(49.8)	<.0001	4281(76.2)	1339(23.8)	<.0001
Congestive Heart Failure, n (%)	827(4.7)	436(52.7)	391(47.3)	<.0001	610(73.8)	217(26.2)	<.0001
Asthma, n (%)	992(5.6)	316(31.9)	676(68.2)	0.030	574(57.9)	418(42.1)	0.833
COPD, n (%)	1692(9.6)	697(41.2)	995(58.8)	<.0001	1174(69.4)	518(30.6)	<.0001
COVID-19 Vaccination Status							
Vaccinated, n (%)	2239(12.7)	937(41.9)	1302(58.2)	<.0001	1501(67.0)	738(33.0)	<.0001
Unvaccinated, n (%)	15,385(87.3)	5241(34.1)	10,144(65.9)		8640(56.2)	6745(43.8)	

Note: Vaccinated defined as >= 1 COVID-19 vaccine;
Chi-square test or t-test used to compute p-values, as appropriate;
Row percentages are presented;
n/a = not applicable

Table 2: The unadjusted and adjusted association between prior comorbidities (diabetes mellitus and hypertension) and severity of COVID-19 infection among patients admitted to the hospital with COVID-19.

Characteristics	Severity of COVID-19 Infection							
	Severity of Illness			Risk of Mortality n(%)			Length of Stay	
	Major/ Extreme n(%)	Minor/ Moderate n(%)	RR(95%CI)	Major/ Extreme n(%)	Minor/ Moderate n(%)	RR(95%CI)	Median(Q1-Q3)	P-Value
Overall	**16,549(95.4)**	**803(4.6)**	-	**15,072(86.9)**	**2280(13.1)**	-	**5.1(3.1-9.1)**	-
Age, median (q1,q3)	62(50-73)	54(35-70)	1.001(1.001-1.001)	63(50-73)	57(41-70)	1.002(1.002-1.003)		
Gender								
Male	8377(50.63)	304(37.86)	1.02(1.02-1.03)	7742(51.37)	939(41.18)	1.43(1.32-1.55)	5.2(3.2,9.6)	<0.0001
Female	8170(49.4)	499(62.1)		7328(48.63)	1341(58.82)		5.1(3.1,8.9)	
Race								
White	9810(62.63)	439(57.31)	1.01(1.00-1.01)	9014(63.25)	1235(56.70)	1.27(1.17-1.37)	5.0(3.1,9.0)	0.0282
Black	5854(37.37)	327(42.69)		5238(36.75)	943(43.30)		5.2(3.1,9.3)	
Ethnicity								
Non Hispanic/Latino(a)	15360(94.69)	751(94.47)	1.00(0.99-1.02)	14003(94.80)	2108(93.86)	1.16(0.99-1.36)	5.1(3.1,9.1)	0.0703
Hispanic/Latino(a)	862(5.31)	44(5.53)		768(5.20)	138(6.14)		5.3(3.2,10.0)	
Insurance								
Commercial	6270(50.19)	271(49.45)	1.00(0.99-1.01)	5746(50.24)	795(49.53)	1.00(0.99-1.02)	4.8(3.0,8.0)	<0.0001
Public Insurance	6223(49.81)	277(50.55)		5690(49.76)	810(50.47)		5.5(3.2,10.3)	
Vaccinated before admission								
Yes	2065(12.48)	135(16.81)	0.98(0.97-0.99)	1999(13.26)	201(8.82)	1.50(1.31-1.72)	4.5(2.8,8.0)	<0.0001
No	14484(87.52)	668(83.19)		13073(86.74)	2079(91.18)		5.2(3.2,9.3)	
Diabetes Mellitus			1.02(1.01-1.03)			1.05(1.04-1.07)		<0.0001
Yes	5905(35.7)	212(26.4)		5496(36.5)	624(27.2)		5.6(3.7-10.2)	
No	10,644(64.3)	591(73.6)		9576(63.5)	1659(72.8)		4.9(3.0-8.7)	
Hypertension			1.01(1.01-1.02)			1.03(1.02-1.04)		<0.0001
Yes	9597(58.0)	414(51.6)		8807(58.4)	1204(52.8)		5.2(3.3-9.6)	
No	6952(42.0)	389(48.4)		6265(41.6)	1076(47.2)		4.9(3.0-8.7)	

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Note: Public Insurance includes Medicaid and Medicare;Chi-square test or Wilcoxon rank sum test used to compute p-values, as appropriate; SOI categories, n(%): minor, 159(0.9); moderate, 644(3.7); major, 7684(44.3); extreme, 8867(51.1);ROM categories, n(%): minor, 258(1.5); moderate, 2024(11.7); major, 6047(34.8); extreme, 9025(52.0).
Unadjusted and adjusted log-binomial regression models were fit for each binomial outcome (SOI and ROM).
A linear regression model was fit for length of stay (LOS).The adjusted model included the two predictors of interest (hypertension and diabetes) and two variables identified a priori to be associated with the predictor and the outcome: age and COVID-19 vaccination status prior to in-patient admission.The aRR(95%CI) for diabetes mellitus was 1.01(1.00-1.02) and 1.04(1.03-1.05) for severity of Illness and risk of mortality, respectively. The aRR(95%CI) for hypertension was 1.00(0.99-1.00) and 0.99(0.98-1.00) for severity of Illness and risk of mortality, respectively. The adjusted p-values for diabetes and length of stay was <0.0001 and hypertension and length of stay was 0.4463.

Table 3: The association between prior comorbidities (diabetes mellitus and hypertension) and severity of COVID-19 infection among patients admitted to the hospital with COVID-19, stratified by vaccination status prior to admission.

Vaccination Status	Severity of COVID-19 Infection			
	Severity of Illness	Risk of Mortality	Length of Stay	
	RR (95% CI)	RR (95% CI)	Z	P-Value
Vaccinated				
Diabetes Mellitus	1.03(1.01-1.06)	1.10(1.07-1.12)	2.3479	0.019
Hypertension	1.02(1.00-1.05)	1.03(1.00-1.06)	-1.056	0.2911
Not Vaccinated				
Diabetes Mellitus	1.02(1.01-1.02)	1.04(1.03-1.06)	11.7602	<0.0001
Hypertension	1.01(1.00-1.02)	1.03(1.01-1.04)	-8.6849	<0.0001

Chi-square test or Wilcoxon rank sum test used to compute p-values, as appropriate

There were no gender differences by prior diagnosis of diabetes or hypertension, but Black patients were more likely than White or Other race to have diabetes (40.4% vs 32.0% and 34.1%, respectively) and hypertension (63.7% vs 55.1% and 41.8%, respectively). However, a study reported that men made up a higher proportion of hospitalized patients, showing that men are more sensitive to COVID-19 infection, which has been associated with a higher prevalence of smoking in men in several studies [10]. A study was carried out by a group that performed a systematic review and meta-analysis in the United States of 4.3 million patients from 68 studies, African American, Hispanic, and Asian American individuals had a higher risk of COVID-19 positivity and ICU admission but lower mortality rates than White individuals [11][12].

CONCLUSION

In our study, Health disparity played a significant role in the United States concerning who got the COVID- 19. Hypertension and diabetes were not a clinically significant predictor of severity of COVID-19 infection among patients admitted to the hospital. But those who had comorbidity stayed longer in the hospital. Vaccination prior to hospitalization was mildly protective of severity of illness, yet was associated with increased risk of mortality, likely due to higher vaccination among patients with comorbidities.

Currently, COVID-19 is quieter but not eradicated. Most current inpatients are older adults, individuals with multiple comorbidities, or those who are immunocompromised. The classic hypoxic pneumonia presentation still occurs, though overall severity is lower with Omicron-era variants compared to 2020–2021. Treatment approaches have stabilized, centering on antivirals, corticosteroids, and targeted immunomodulators, with several newer immunomodulatory options introduced in 2024–2025. Hospitalizations are now predominantly concentrated among older adults; patients with cardiovascular disease, chronic kidney disease, COPD, diabetes, obesity, or immunosuppression; and individuals who are unvaccinated, under-vaccinated, or have a poor vaccine response due to underlying conditions or immunosuppressive therapy. Clinical Presentation on the Floor/ICU Primary hypoxemic

pneumonia: Bilateral infiltrates, increasing O_2 needs, and typical viral pneumonia/ARDS pattern. Decompensation of chronic disease with COVID as a trigger: HF exacerbation, COPD flare, arrhythmia, MI, stroke, and renal failure- often in the setting of a positive SARS-CoV-2 test. Thrombotic/inflammatory complications: PE, DVT, myocardial injury, encephalopathy, and sepsis-like picture.

Current Inpatient Treatment of COVID-19 Disease:

The backbone is still the 2024 National Institutes of Health {NIH} guidelines, World Health Organization {WHO} therapeutics guidance, and the October 2025 Infectious Diseases Society of America {IDSA} update [13][14][15]. All hospitalized patients with confirmed/suspected COVID-19 received:

1. Supportive care: Appropriate level of respiratory support (nasal cannula -- HFNC -- NIV - - MV/ECMO as needed). Careful fluid balance and management of comorbidities.
2. VTE prophylaxis: Prophylactic-dose heparin for essentially all unless contraindicated; full-dose anticoagulation only if there's another indication (e.g., confirmed VTE). 3. Antibiotics: Empiric antibiotics only if clear concern for bacterial pneumonia/sepsis; studies show low rates of true bacterial co-infection, so overuse is discouraged. Hospitalized, no supplemental oxygen. 1. No routine steroids – NIH recommends against dexamethasone or systemic steroids in patients who do not require oxygen; in this group steroids were associated with higher mortality.
3. Consider remdesivir in higher-risk inpatients early in disease: NIH: Remdesivir can shorten time to recovery and may reduce progression when given early, particularly within ~10 days of symptom onset.

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References

1. Corona Virus Disease, DiPiro's Pharmacotherapy: A Pathophysiologic Approach, 132e, 12th Edition
2. (Public Health December 6, 2024). CDC
3. Song F, Shi N, Shan F, et al. Emerging coronavirus 2019-nCoV pneumonia. Radiology. 2020:200274. https://doi.org/10.1148/radiol.2020200274.
4. Friedman J, Liu P, Troeger CE, et al. Predictive performance of international COVID-19 mortality forecasting models. Nat Commun. 2021;12 [PMC free article] [PubMed] [Google Scholar]
5. Del Rio C, Collins LF, Malani P. Long-term health consequences of COVID-19. JAMA. Published online October 5, 2020. doi:10.1001/jama.2020.19719. (Public Health December).
6. Morris SB, Schwartz NG, Patel P, et al. Case Series of Multisystem Inflammatory Syndrome in Adults Associated with SARS-CoV-2 Infection – United Kingdom and United States, March-August 2020. MMWR Morb Mortal Wkly Rep. 2020;69(40):1450-1456. Published 2020 Oct 9. doi:10.15585/mmwr.mm6940e1
7. The Advisory Committee on Immunization Practices' Updated Interim Recommendation for Allocation of COVID-19 Vaccine — United States, December 2020: Kathleen Dooling 1,✉, Mona Marin 1, Megan Wallace 1,2, Nancy McClung 1, Mary Chamberland 1,3, Grace M Lee 4, H Keipp Talbot 5, José R Romero 6, Beth P Bell 7, Sara E Oliver 1

8. The impact of COVID-19 vaccination in the US: Averted burden of SARS-COV-2-related cases, hospitalizations and deaths: Teresa K Yamana 1,* Marta Galanti 1, Sen Pei 1, Manuela Di Fusco 2, Frederick J Angulo 3, Mary M Moran 3, Farid Khan 3, David L Swerdlow 3, Jeffrey Shaman 1,4

9. Leung JM, Yang CX, Tam A et al. ACE-2 expression in the small airway epithelia of smokers and COPD patients: implications for COVID-19. Eur Respir J. 2020;55(5):2000688. doi: 10.1183/13993003.00688-2020. [DOI] [PMC free article] [PubMed] [Google Scholar]

10. Farsalinos K, Barbouni A, Poulas K et al. Current smoking, former smoking, and adverse outcome among hospitalized COVID-19 patients: a systematic review and meta-analysis. Ther Adv Chronic Dis. 2020;11:2040622320935765. doi: 10.1177/2040622320935765. [DOI] [PMC free

11. The impact of COVID-19 vaccination in the US: Averted burden of SARS-COV-2-related cases, hospitalizations and deaths: Teresa K Yamana 1,* Marta Galanti 1, Sen Pei 1, Manuela Di Fusco 2, Frederick J Angulo 3, Mary M Moran 3, Farid Khan 3, David L Swerdlow 3, Jeffrey Shaman Therapeutics and COVID-19: living guideline, August 20251,4,*

12. Leo Lopez III, MD, MHS1; Louis H. Hart III, MD1; Mitchell H. Katz, MD1. Racial and Ethnic Health Disparities Related to COVID-19. JAMA Vol. 325, No. 8.

13. NIH Releases Final Version of COVID-19 Treatment Guidelines, 2024 National Institutes of Health {NIH} guidelines.

14. World Health Organization: Therapeutics and COVID-19: living guideline, August 2025

15. October 2025 Infectious Diseases Society of America {IDSA} update. All hospitalized patients with confirmed/suspected COVID-19.