Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Assessing the impact of insurance type on COVID-19 mortality in black and white patients in the largest healthcare system in the state of georgia

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Abstract:Importance: The increased COVID-19 mortality for Black individuals over White individuals may be explained by the known racial disparities in access to insurance.

Objective: To determine whether racial disparities in COVID-19 mortality still exist when Blacks and Whites are equally insured.

Design: Routinely collected data on race, mortality, type of insurance, known risk factors, and lab results from the EPIC Patient Management System were analyzed using a multivariable logistic regression model.

Setting: Piedmont Healthcare is the largest hospital system in Georgia. Due to its multiple locations across the state of Georgia, it receives a relatively equitably insured population.

Participants: All patients hospitalized with a positive COVID-19 status between March 1 and November 30, 2020.

Main Outcomes: We hypothesized that Black patients would not have higher odds of mortality than White patients, and that type of insurance would predict COVID-19 mortality.

Results: 6,881 (3,674 Black, 3,207 White; 48% male, mean age = 60) patients were included. Race was not a significant predictor of COVID-19 mortality ($p>0.05$). When controlling for age and insurance, the mortality rate for Black patients was not statistically significant from that for White patients ($p>0.05$). Compared to those relying on Medicare, patients with commercial (OR=0.68, 95% CI: 0.48-0.96) or out-of-pocket (self-pay) insurance (OR=0.22, 95% CI: 0.03-0.88) had lower odds of mortality.

Conclusions: National trends of racial disparities in COVID-19 mortality may be partially explained by disparities in insurance.

Keywords: COVID-19 ■ Race ■ Insurance ■ Mortality ■ Social Determinants of Health

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INTRODUCTION

Research into racial differences in COVID-19 mortality has been recognized by clinicians as a top priority.[1, 2] As of June 30, 2021, the COVID-19 pandemic has led to 595,171 deaths in the United States, about 39% of which were individuals with racial and ethnic minority backgrounds.[3] Research suggests Black individuals are more likely than other groups to contract COVID-19 due to socioeconomic factors (e.g., they are less likely to work from home and are more likely to live in intergenerational households or with family members who are healthcare workers),[4] and are more likely to test positive for COVID-19 than White individuals.[5, 6] In particular, the increased mortality for Black individuals over White individuals from COVID-19 is well documented.[7,8] In the United States, Black Americans die from COVID-19 2.8 times more than White Americans.[9] While a physiologic predisposition is possible,[10, 11] it is likely given the economically disadvantaged position of Black citizens in the United States that other factors are involved.

Social determinants of health (SDOH), such as Black individuals being more underinsured and lacking access to information about COVID-19,[2,4] are likely contributors as reasons for increased mortality. Despite overall improvements in US population health over time, many disparities in healthcare between Black and White individuals have persisted and, in some cases, widened.[12] People of color and low-income individuals historically have had greater barriers to accessing care, including a higher uninsured rate, compared to Whites and those with higher incomes.[13] The Black American population is 43.9% insured by Medicare or Medicaid compared to 33.7% White Americans, while 9.9% are uninsured compared to 5.9% White Americans.[14] According to the Institute of Medicine,[15] Medicare or Medicaid, as well as other "lower-end" health plans, are subject to "higher per capita resource constraints and stricter limits on covered services," as they have developed different clinical cultures with different practice norms than higher-end plans. As a result, Black patients report worse health status overall than White individuals. Data show that disparities in some health outcomes, such as heart disease, have actually widened over time.[12]

Having inadequate insurance coverage can lead to increased COVID-19 mortality, similar to what was seen in the H1N1 pandemic in which minorities were

disproportionately affected due to lack of adequate healthcare and resources.[16] Additionally, the greater use of "lower-end"[15] health plans is a further source of health inequity. It is already known that because of factors such as polluted neighborhoods,[17] poverty, and stress, Black individuals are statistically more likely to have many of the known risk factors for COVID-19 mortality,[18] including obesity, diabetes, chronic coronary, liver, or kidney disease, or asthma.[10, 19] However, increased COVID-19 mortality has been seen for Black patients even when controlling for these conditions,[6, 20] suggesting they may be less likely to have these comorbid conditions under control, with inadequate insurance as a probable contributing factor, barring them from preventative care.[21] Uncontrolled comorbid conditions such as metabolic syndrome may lead to increased inflammation in minorities,[22] and may directly lead to increased mortality in COVID-19 patients.[23] Further compounding the issue, Black citizens are more likely to face financial struggles that require them to prioritize work and income over caring for their personal health. Those with poor health coverage may delay seeking care or getting tested until symptoms have progressed to a worse stage, placing them at higher risk of complications and death.[24, 25] In summary, having less insurance coverage can lead to increased COVID-19 mortality in three ways: 1. Higher load of health conditions associated with mortality; 2. Poorly controlled health conditions; and 3. Delay of care due to financial concerns.

In the state of Georgia, an individual must have a low income (i.e., a certain percent of the Federal Poverty Line that varies with situation) and be either disabled, pregnant, a child, over the age of 65, or in need of nursing home care to be eligible for Medicaid.[26] An individual simply must be over 65 or have certain disabilities or diseases to qualify for Medicare.[27] 83% of Medicare recipients meet the age requirement rather than the disability requirement.[28] Thus, receiving Medicaid can be used as a proxy for low income, while receiving Medicare can be used roughly as a proxy for age. These studies lend further support that disparities in health care coverage are responsible for the increased odds of death seen in Black patients.

In this paper, we sought to further understand the increased COVID-19 mortality for Black individuals over White individuals. One plausible cause prior to admission appears to be the effects of low socioeconomic status, particularly less insurance coverage,[25] and its corresponding impact on SDOH. We examined the role of insurance in mortality among Black and White hospitalized patients in the Piedmont Hospital System using a multivariable logistic regression analysis of routinely collected data. Mortality rate, pre-existing conditions, laboratory tests, race, and type of insurance were collected for patients hospitalized with COVID-19 in the Piedmont Healthcare System.

Given the literature, in the current analysis we expected to find that a) hospitalized Black patients would not be more likely to die than hospitalized White patients when controlling for age, pre-existing illness, and insurance status; b) using insurance status as a proxy for low income, insurance status would significantly predict COVID-19 mortality among both Black and White patients, with Medicare recipients (due to age) having the worst outcomes followed by Medicaid (due to socioeconomic status); and c) increased markers of illness and inflammation (measured in our study as pre-existing cardiovascular disease and acute kidney injury as shown through creatinine values upon admission) would predict COVID-19 mortality among both Black and White patients, consistent with past studies.[24]

METHODS

Study Participants

This was a retrospective analysis of COVID-19 patients, inclusive of Black and White patients of all ages and demographics. We collected data on all patients hospitalized in the Piedmont Healthcare System who were COVID-19 positive for a 9-month period from March 1, 2020 – November 30, 2020 (n=6,902). We considered a patient to be positive if they had COVID-19 positive lab work, infection type, or paperwork from the Department of Public Health entered in Piedmont's Epic system. We excluded patients with missing data for age (n=21). The final analysis consisted of 6,881 patients, of which 3,674 were Black and 3,207 were White.

Study Design

Data was gathered using patient lab values and CPT codes entered into the Epic system during the course of hospitalization. In order to control for known related variables, we collected a wide range of data points including previous health diagnoses known to be risk factors for COVID-19, treatment variables, and laboratory results. These variables, their definitions, and the search criteria used to find them are listed in Table 1 . All data was collected via a search starting five days before the earliest COVID-related entry, and 30 days after the latest COVID-related entry. We defined mortality as whether the patient died any time within the search period. We also reviewed all insurance payor data within our facility during that time frame and specifically for those patients with a COVID-19 positive status. In order to better reflect differences in socioeconomic status, insurance categories were aggregated as fol-

Table 1. Definitions and Search Criteria for Study Variables

Variables	Definitions
COVID-19 Positive	Patient was listed as COVID-19 positive if one of the following is true: 1) Positive Labs 2) Infections Types 3) Paperwork from Georgia Department of Public Health
Hospitalization	Patient admitted to the hospital with inpatient status
Mortality	Patient died at any time within the general search period
Race	Patient's recorded race at time of hospital visit
Age	Patient's current age or age at date of death
BMI Over 30	Patient had at least one recorded BMI value of greater than or equal to 30
Gender	Patient's recorded gender at time of hospital visit
Insurance	Patient's payor group
ICU Admission	Patient spent any time bedded in the ICU (hospital account in search range has an ICU bed charge)
Direct Admission to ICU	Patient admitted to ICU upon admission to hospital
Intubated	Patient utilized a ventilator device at any point during the hospital stay
Pre-existing Anemia	Patient had diagnosis of anemia (any type) prior to arrival (identifying history from Healthy Planet Registry)
Pre-existing Diabetes	Patient had diagnosis of diabetes prior to arrival (identifying history from Healthy Planet Registry)
Pre-existing Cardiovascular Disease or Hypertension	Patient had diagnosis of cardiovascular disease or hypertension prior to arrival (identifying history from Healthy Planet Registry)
Chronic Kidney Disease	Patient had diagnosis of chronic kidney disease prior to arrival (identifying history from Healthy Planet Registry
Chronic Liver Disease	Patient had diagnosis of chronic liver disease prior to arrival (identifying history from Healthy Planet Registry
Chronic Respiratory Disease	Patient had diagnosis of chronic respiratory disease prior to arrival (identifying history from Healthy Planet Registry
Rheumatologic Disease	Patient had diagnosis of rheumatologic disease prior to arrival
Cough Symptoms	Patient complained of or exhibited cough
Fever Symptoms	Patient complained of or experienced fever
Pneumonia	Patient have evidence of pneumonia (check CXR / CT results bilateral infiltrates or pneumonia or opacities)
Advanced Heart Failure	ICD 10 Code: I11.0, I13.0, I13.2, I50.1, I50.9, I50.20, I50.21, I50.22, I50.23, I50.31, I50.32, I50.33, I50.41, I50.42, I50.43
Acute Respiratory Distress Syndrome	ICD 10 Code: J80
Sepsis Alert	Patient met criteria for Sepsis Alert (best practice advisory documentation)
Home Med Anticoagulant	Patient had a current prescription for an anticoagulant
Home Med Antiplatelet	Patient had a current prescription for an anti-platelet drug
Home Med ARBs	Patient had a current prescription for an angiotensin II receptor blocker (ARB)
Home Med Aspirin	Patient had aspirin listed as current medication
Hospital Med Anticoagulant	Anticoagulant administered to patient during hospital visit
Hospital Med Heparin	Heparin administered to patient during hospital visit

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Table 1 (*continued*)

Variables	Definitions
Hospital Med Hydroxychloroquine	Hydroxychloroquine administered to patient during hospital visit
Hospital Med Remdesivir	Remdesivir administered to patient during hospital visit
Abnormal BMP Panel	Patient had any abnormal values for any test within the BMP panel
Abnormal BNP	Patient had any abnormal BNP values
Abnormal Creatinine	Patient had any abnormally high creatinine values
Abnormal Lymphocytes	Patient had any abnormally low lymphocyte values
CRP >= 5.0	Patient had a CRP value greater than or equal to 5.0
D-dimer >= 3.0	Patient had a D-dimer value greater than or equal to 3.0
GFR <= 30	Patient had a GFR value less than or equal to 30
Lactate >= 4.0	Patient had a lactate value greater than or equal to 4.0
Platelet <= 100	Patient had a platelet count less than or equal to 100
Troponin >= 0.1	Patient had a troponin level greater than or equal to 0.1
White Blood Cell >= 10.5	Patient had a White blood cell count greater than or equal to 10.5

lows: the "Medicaid with Commercial" and "Medicare and Medicaid" categories were aggregated with "Medicaid;" "Medicare with Commercial" was combined with "Medicare;" and "Medicare and Medicaid" was combined with "Medicaid" as the qualification for Medicaid implies a lower socioeconomic status on part of the patient. The only patient identifier used to link insurance payor data to medical records was the patient's Medical Record Number, which was removed after linking data. All subsequent analysis was a review of aggregated data without patient identifiers. Other than the variables in Table 1, we did not account for co-morbidities nor duration of symptoms at the time of diagnosis or admission.

Outcomes and Measures

The variables of interest were 1. Mortality differences between Black and White patients over a 9-month period from March 1, 2020 – November 30, 2020. 2. Type of insurance, as collected through payor information at Piedmont, 3. Pre-existing Cardiovascular disease (CVD) or hypertension as documented in admission medical history and acute kidney injury co-morbidities measured as creatinine values. The prespecified primary end point was overall mortality.

The study was approved by the Internal Review Board of Piedmont Healthcare, Inc. and conducted in accordance with the ethical standards of the Declaration of Helsinki. No funding was provided for the study and all researchers were salaried employees of Piedmont Healthcare.

Statistical Analysis

The data collected conformed to the existing data quality standards of Piedmont Healthcare. For an initial comparison of factors between Black and White patients, demographic variables such as gender, BMI, pre-existing conditions, treatment variables, laboratory results were reported as counts with percentages. Age was the only continuous variable reported as mean with standard deviation. We compared patient characteristics between our Black and White patient populations using Chi-square and Fisher's Exact test for categorical variables and Student t-test for age (α=0.05; see Table 2).

To identify risk factors contributing to COVID-19 mortality, we then developed a multivariable logistic regression model. Age remained as a continuous variable, while Gender and Race were coded into a binary (1: Male, 0: Female; 1: Black, 0: White). The remaining variables were converted into binary format prior to analysis, meaning that all variables were converted to a True or False Boolean, with true indicating the presence of the risk factor or diagnosis (i.e., values for Abnormal Creatinine were either False: not abnormal creatinine or True: abnormal creatinine). Data was split into 80% training and 20% testing using a stratified sampling technique, thus both data sets had the same class proportion. The training set was used to fit the model while the testing set was used to estimate model performance. We initially included 40 variables in the model then used stepwise regression for variable selection. In each step, we removed factors that ap-

Table 2. Characteristics of Hospitalized COVID-19 Patients from March 1 to November 30, 2020 in the Piedmont Healthcare System (N=6881)

Variables n (%)	Total (N=6881)	Black (n=3674)	White (n=3207)	p-value
Mortality	841 (12)	404 (11)	437 (14)	0.001
Age (mean ± sd)	60 ± 18	57 ± 17	64 ± 18	< 0.001
BMI Over 30	3900 (57)	2290 (62)	1610 (50)	< 0.001
Gender: Male	3290 (48)	1627 (44)	1663 (52)	< 0.001
Insurance				
Medicare	3810(55)	1852(50)	1958(61)	< 0.001
Medicaid	547(8)	397(11)	150(5)	
Self-pay	200(3)	102(3)	98(3)	
Commercial	2324 (34)	1323(36)	1001 (31)	
ICU Admission	1547 (22)	828 (23)	719 (22)	0.931
Direct Admission to ICU	547 (8)	290 (8)	257 (8)	0.889
Intubated	1127 (16)	597 (16)	530 (17)	0.782
Pre-existing Anemia	1911 (28)	1104 (30)	807 (25)	< 0.001
Pre-existing Diabetes	2683 (39)	1534 (42)	1149 (36)	< 0.001
Pre-existing Cardiovascular Disease or Hypertension	5119 (74)	2741 (75)	2378 (74)	0.686
Chronic Kidney Disease	3444 (50)	2030 (55)	1414 (44)	< 0.001
Chronic Liver Disease	359 (5)	144 (4)	215 (7)	< 0.001
Chronic Respiratory Disease	1818 (26)	912 (25)	906 (28)	0.001
Rheumatologic Disease	1336 (19)	666 (18)	670 (21)	0.004
Cough Symptoms	3025 (44)	1613 (44)	1412 (44)	0.936
Fever Symptoms	3803 (55)	2153 (59)	1650 (51)	< 0.001
Pneumonia	217 (3)	146 (4)	71 (2)	< 0.001
Advanced Heart Failure	1446 (21)	746 (20)	700 (22)	0.129
Acute Respiratory Distress Syndrome	512 (7)	280 (8)	232 (7)	0.573
Sepsis Alert	1244 (18)	677 (18)	567 (18)	0.440
Home Med Anticoagulant	1276 (19)	632 (17)	644 (20)	0.002
Home Med Antiplatelet	2142 (31)	983 (27)	1159 (36)	< 0.001
Home Med ARBs	1627 (24)	971 (26)	656 (20)	< 0.001
Home Med Aspirin	2128 (31)	974 (27)	1154 (36)	< 0.001
Hospital Med Anticoagulant	6386 (93)	3431 (93)	2955 (92)	0.052
Hospital Med Heparin	2645 (38)	1556 (42)	1089 (34)	< 0.001
Hospital Med Hydroxychloroquine	594 (9)	428 (12)	166 (5)	< 0.001
Hospital Med Remdesivir	1876 (27)	808 (22)	1068 (33)	< 0.001
Abnormal BMP Panel	5308 (77)	2872 (78)	2436 (76)	0.031
Abnormal BNP	2245 (33)	1084 (30)	1161 (36)	< 0.001
Abnormal Creatinine	3551 (52)	2166 (59)	1385 (43)	< 0.001
Abnormal Lymphocytes	4844 (70)	2461 (67)	2383 (74)	< 0.001
CRP >= 5.0	4354 (63)	2329 (63)	2025 (63)	0.851
D-dimer >= 3.0	2416 (35)	1242 (34)	1174 (37)	0.016

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Table 2 (*continued*)

Variables n (%)	Total (N=6881)	Black (n=3674)	White (n=3207)	p-value
GFR <= 30	1699 (25)	1087 (30)	612 (19)	< 0.001
Lactate >= 4.0	406 (6)	215 (6)	191 (6)	0.896
Platelet <= 100	662 (10)	316 (9)	346 (11)	0.002
Troponin >= 0.1	972 (14)	535 (15)	437 (14)	0.282
White Blood Cell >= 10.5	3170 (46)	1622 (44)	1548 (48)	< 0.001
Variables n (%)	Total (N=6881)	Black (n=3674)	White (n=3207)	p-value

peared to be non-significant ($p>0.05$) and added additional factors when they showed significant improvement to the model. In the final model, only significant variables ($p<0.05$) were retained (see Table 3). Odds ratios and 95% confidence intervals were generated (Table 3). A confusion matrix was created to show the predicted probabilities of COVID-19 mortality for the testing set, including model metrics such as accuracy, sensitivity and specificity. We also performed multicollinearity test to assess whether any of the predictor variables were highly correlated. Lastly, we evaluated the potential interaction between age and insurance by performing a stratified analysis. We compared the mortality rate between Black and White patients within each insurance subtype by two age groups: more than 65 years old and less than or equal to 65 years old. We also developed an interaction term of age and insurance and included it in the original model, but it did not show significant effect and was later dropped. All statistical analyses were performed using the R software version 4.0.5.

RESULTS

In our initial comparison of Black and White patients, White patients were significantly more likely to be male (52%) and older (mean age: 64 compared to 57 years old; see Table 2). While Black patients in our sample had significantly higher levels of several known risk factors for COVID-19 death (i.e., BMI over 30, diabetes, and chronic kidney disease, see Table 2), the White patients in our sample did show significantly higher levels of chronic respiratory disease, chronic liver disease, and rheumatologic disease (see Table 2). A slightly larger proportion of Black patients (36%) had commercial insurance than White patients (31%). Black patients were more likely than White patients to have Medicaid insurance, while White patients were more likely to have Medicare. Finally, White patients showed a slightly higher mortality rate (14%) than Black patients (11%). One potential explanation for this result is that the White patients in our sample were significantly older by 7 years (see Table 2), and age appears to be one of the strongest predictors of COVID-19 death.[29] When compared to similarly aged patients with the same insurance (See Table 4), there was no significant difference in mortality rate, suggesting that the higher likelihood of mortality seen in our initial comparison for Whites was driven primarily by age and Medicare status.

The final regression model was a significant fit to the testing data, accuracy=81.9%, sensitivity=84.5%, specificity=81.5% for the variables retained (see Table 3). Multicollinearity was not detected. Consistent with our first hypothesis, race was not retained as a significant predictor of mortality, although age was a significant predictor with older patients showing a slightly higher odds of mortality.

Consistent with our second hypothesis, type of insurance was retained as a significant predictor of mortality for all patients. Compared to those relying on Medicare, patients with commercial (OR=0.68, 95% CI: 0.48-0.96) or out-of-pocket (self-pay) insurance (OR=0.22, 95% CI: 0.03-0.88) had lower odds of mortality (see Table 3). Patients with Medicaid insurance had similar odds of mortality than patients with Medicare (OR=1.08, 95% CI: 0.56-1.98), inconsistent with our predictions.

In order to investigate the potential confound of age found in our initial comparison, an interaction effect between age and insurance status was also added to the model. This effect was not significant and thus was not retained, suggesting that the effects of insurance type and age do not interact in predicting mortality. Finally, consistent with our third hypothesis, patients with markers of cardiovascular disease and inflammation such as abnormal troponin (OR=1.33, 95% CI: 1.02-1.72), BNP (OR=.63, 95% CI: .45-.89), and creatinine (OR=1.64, 95% CI: 1.19-2.28) had a higher risk of mortality when controlling for other factors (see Table 3).

Table 3. Odds Ratios and 95% Confidence Intervals of Significant Variables from the Multivariable Logistic Regression Model *

Significant Variables for COVID-19 Mortality	Odds Ratio	95% CI
Intubated	5.66	4.06-7.92
Lactate >= 4.0	2.66	1.91-3.72
ICU Admission	2.39	1.69-3.36
Sepsis Alert	1.96	1.52-2.51
CRP >= 5.0	1.77	1.33-2.36
GFR <= 30	1.76	1.35-2.32
Abnormal Creatinine	1.64	1.19-2.28
Acute Respiratory Distress Syndrome	1.61	1.17-2.22
Abnormal BNP	1.47	1.14-1.88
Platelet <= 100	1.39	1.05-1.84
Home Med Aspirin	1.37	1.09-1.73
Advanced Heart Failure	1.35	1.05-1.74
Troponin >= 0.1	1.33	1.02-1.72
White Blood Cells >= 10.5	1.31	1.01-1.71
Insurance: Medicaid vs Medicare	1.08	0.56-1.98
Age	1.06	1.05-1.07
Direct Admission to ICU	0.76	0.55-1.04
BMI Over 30	0.76	0.59-0.97
Home Med Anticoagulant	0.73	0.55-0.96
Insurance: Commercial vs Medicare	0.68	0.48-0.96
Pre-existing Diabetes	0.68	0.53-0.85
Pre-existing Anemia	0.67	0.52-0.85
Pre-existing Cardiovascular Disease or Hypertension	0.66	0.47-0.93
Abnormal BMP Panel	0.63	0.45-0.89
Cough Symptoms	0.58	0.46-0.73
Hospital Med Anticoagulant	0.45	0.26-0.80
Insurance: Self-pay vs Medicare	0.22	0.03-0.88

Model accuracy=81.9%, sensitivity=84.5%, specificity=81.5%

DISCUSSION

In our population, Black patients were not significantly more likely to die compared to White patients when controlling for age and insurance type. This is inconsistent with past research showing that Black patients are more likely to die than White patients when controlling for pre-existing conditions and illness severity.[6,8] However, this is consistent with the studies that examined insurance. For example, lack of insurance[25] and Medicare or Medicaid insurance[24] have been found to be associated with likelihood of hospitalization. In our study, patients insured with Medicare had worse outcomes than those with Medicaid. Price-Haywood et al.[24] did find slightly worse risk of death for Medicare than Medicaid, and Yehia et al.[30] found significantly worse risk for Medicare recipients only. In addition, the Black patients seen in the Price-Haywood et al. study had lab results indicating more advanced illness, including elevated levels of creatinine, aminotransferases, and increased markers of inflammation, suggesting they may have delayed treatment or have poorly controlled pre-existing health conditions. In our study, increased creatinine, troponin, and/or a history of heart disease were associated with higher mortality rates, further supporting the hypothesis that poorly controlled chronic conditions (presumably because of inadequate insurance coverage) lead to greater COVID-19 mortality.

Piedmont is unique in that it receives a disproportionately well-insured population of Black patients, due in part to the local presence of a publicly funded hospital (Grady Hospital) that tends to draw away publicly insured patients. This phenomenon is known in Atlanta healthcare as the "Grady Effect." One potential explanation for the findings above is that, due to the Grady Effect, Black patients and White patients were relatively equitably insured in our sample. Although Black patients were more likely to have Medicaid, this was a relatively small part of the sample, and Black patients were also more likely to have commercial insurance and less likely to have Medicare. Therefore, these data enable us to examine the relationship between insured status, race, and mortality rate in a relatively equitably insured population. When contrasted with other past research that did not control for insurance coverage, this provides support for the hypothesis that differences in insurance coverage—including differences in management of pre-existing conditions—may play a role in COVID-19 mortality. This would suggest that SDOH, rather than physiologic differences or other factors, are the driver of the higher mortality rate for Black patients in the United States. This could have strong ramifications for future research and policy decisions with respect to socioeconomic inequality and healthcare. Although Black patients were also younger in our sample, mortality rate did not differ between Black and White patients within each age group, and an interaction effect of age and insurance type was not

Table 4. Mortality Rate per 1,000 Patients stratified by Age and Insurance Type

Age < 65	Black (n=2376)	White (n=1494)	Rate Ratio	p-value
Medicare	61(25.7)	38(25.4)	1.01	0.970
Medicaid	16(6.7)	6(4.0)	1.68	0.285
Self-pay	2(0.8)	2(1.3)	0.63	0.664
Commercial	49(20.6)	37(24.8)	0.83	0.402
Age >= 65	Black (n=1298)	White (n=1713)	Rate Ratio	p-value
Medicare	262(201.8)	338(197.3)	1.02	0.781
Medicaid	1(0.80)	3(1.8)	0.44	0.527
Self-pay	0(0)	1(0.6)	0	0.569
Commercial	13(10.0)	12(7.0)	1.43	0.378

significant in the analysis. Thus, insurance appears to be the most likely explanation.

There are several limitations to this study. This is a retrospective analysis, and thus we were limited to the data routinely collected by the Piedmont Healthcare System, which included only patients that were hospitalized with a positive COVID-19 status. Thus, we could not account for cases that were not hospitalized or not given a COVID-19 test. Because we included all deaths with a COVID-19 positive status in our search criteria, we assume the mortalities were related to COVID-19. To determine the primary cause of death would require careful clinical chart review. We did not account for treatments used during the course of hospitalization or for all possible comorbidities, which may have provided a more complete picture. Our data was specific to the Piedmont Healthcare System in Georgia, so some aspects may not generalize to other hospital systems in other regions of the world. Future researchers should examine whether patients who died from COVID-19 delayed care because of insurance concerns, or if certain chronic conditions may have been poorly controlled due to poor insurance coverage prior to contracting COVID-19. Finally, due to low numbers we did not examine mortality rates in other racial or ethnic groups. Although more work needs to be done to fully explain this relationship, the current data provides some direction for future study.

CONCLUSION

The Piedmont population of over 6,900 COVID-19 patients were relatively equitably insured, allowing us to compare outcomes for Black and White patients while controlling for insurance type. These results emphasize the impact of healthcare access on COVID-19 outcomes. Moreover, this also demonstrates that systemic inequalities in SDOH contribute to excess mortality and the unequal burden on minorities in this pandemic. More research is needed to fully understand the relationship between access to healthcare and pandemic deaths.

KEYPOINTS

Question: Does the relationship between race and COVID-19 mortality still exist when Black and White patients are equally insured?

Findings: In a retrospective analysis of hospital data for an equitably insured population, White and Black patients did not differ in odds of mortality from COVID-19. White patients were more likely to be older and on Medicare. Insurance type was a significant predictor in a logistic regression analysis, even when controlling for risk factors and laboratory results.

Meaning: Racial disparities in COVID-19 mortality in the US population may be partially explained by disparities in insurance.

DECLARATION OF COMPETING INTEREST

To: The Journal of the National Medical Association

Date: August 27, 2021

Dear Whomever It May Concern:

I have no conflicts of interest in the following paper submitted for publication:

Assessing the Impact of Insurance Type on COVID-19 Mortality in Black and White Patients in the Largest Healthcare System in the State of Georgia

My research team and all authors also have no conflict of interest.

Thank you.

Best Regards,
Jayne Morgan, M.D.
Corresponding Author

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