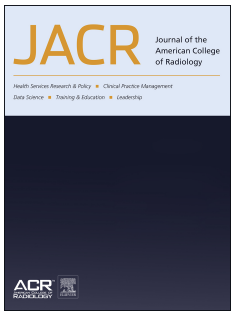

Imaging Utilization During the COVID-19 Pandemic Highlights Socioeconomic Health Disparities

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Imaging Utilization During the COVID-19 Pandemic Highlights Socioeconomic Health Disparities

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Introduction

The COVID-19 pandemic continues to take a significant toll on the health of the population with over 7 million people affected in the U.S. resulting in over 200,000 deaths, as of September 21, 2020[1]. The devastating impact from the pandemic highlights the long-standing socioeconomic health disparities and inequities in the U.S. healthcare system. Preventive measures intended to contain the spread of the SARS-CoV-2 virus, such as stay-at-home orders and social distancing efforts, have been challenging to effectively implement in low socioeconomic and underserved communities[2]. Crowded living conditions and employment in public-facing occupations, such as services and transportation, impair effective social distancing[3]. As a consequence, healthcare policy and the social determinants of health disproportionately affected the welfare of the minority, older, lower income and Medicaid/uninsured population. The most pervasive health disparities have been observed among African American and Latino individuals suffering both higher rates of COVID-19 infection and disease-related mortality[3]. The underlying socioeconomic factors that contribute to health disparities are complex and multifactorial, including age, sex, race, ethnicity, insurance status, education and income level.

In the U.S., racial and ethnic variation in the access and utilization of medical resources has been well established. There is a growing body of literature reporting socioeconomic health disparities in diagnostic imaging and interventional radiology[4,5]. There is a concern that these health disparities may be exacerbated when medical resources are limited, as seen during the COVID-19 pandemic. At the onset, healthcare institutions reallocated resources and limited some routine care, including imaging, in

preparation for the rapid influx of patients requiring medical attention. Radiology practices developed imaging recommendations for the judicious use of cross-sectional imaging, ultrasound and interventional radiology in order to prevent spread of COVID-19 disease to patients and healthcare providers[6,7].

Much has been written about the impact of COVID-19 on imaging volumes. Overall imaging volume declined, with the largest decline in the outpatient setting[6]. Inpatient imaging volume initially declined in preparation and subsequently rose with the influx of COVID-19 positive patients[7]. The rebound in inpatient imaging volume revealed a significant shift away from cross-sectional and advanced imaging modalities (CT, MRI, nuclear medicine, interventional procedures) toward radiography during the pandemic[7]. However, detailed analyses of the specific CPT-coded groups revealed that the individual imaging exams of CTA Chest, Radiography Chest and Ultrasound Venous Duplex had significantly increased imaging volumes in the late post-COVID-19 period, shedding light on the specific types of imaging exams needed to appropriately care for COVID-19 patients[7]. Although much is now known about imaging volumes during the pandemic, there is a relative paucity of data regarding the impact of COVID-19 on imaging utilization by different socioeconomic groups. Understanding the impact of social determinants on imaging utilization may assist healthcare leaders in allocating appropriate imaging resources during and after the COVID-19 pandemic.

The purpose of this study was to evaluate socioeconomic factors related to imaging utilization during the COVID-19 pandemic. We analyzed patient-level imaging data to assess socioeconomic factors stratified by the patient service location (inpatient,

emergency department, outpatient) during the COVID-19 pandemic in a large healthcare system.

Methods

We performed a retrospective review of the Radiology invoices in the charge master from January 1, 2019 – May 31, 2020 to evaluate socioeconomic factors related to imaging utilization during the COVID-19 pandemic in a large integrated healthcare system. All consecutive billing invoices were obtained according to the date of service across all patient locations (inpatient, emergency department, outpatient). Patient level data was obtained from the radiology professional billing system containing patients' contact information (residential address and zip code), payor billing information (insurance type), and demographic data (birthdate, sex, race). At the time of scheduling and registration, staff either obtain this data on new patients or reconfirm this data on existing patients in our healthcare system. Institutional Review Board (IRB) approval and waiver of informed consent was obtained for this retrospective analysis.

Our healthcare system is located in the New York metropolitan area serving a highly diverse population. In New York City, the first confirmed COVID-19 patient was on March 1, 2020 (week 10) with the number of daily new cases increasing to over 10,000 during the period of April 3 – April 25, 2020 (weeks 15-18)[1]. Since then, a steady decline occurred with only 1,282 new daily cases reported on May 31, 2020 (week 22). Given this timeline, the dataset was split to compare the pre-COVID-19 (January 1st – February 28th) and post-COVID-19 (March 1st – May 31st) periods. The February 2020 imaging data was adjusted to reflect the same 28 days of imaging data

acquired in February 2019 by removing one day (February 29, 2020) from the data analysis for similar comparisons. Our healthcare system had no significant decline in the number of imaging scanners in 2020 that could have potentially affected the access and availability of imaging during the COVID-19 pandemic.

The data variables were categorized as age (<18, 18-39, 40-59, 60-79, ≥80 years old), sex (male, female), race (white, black, Asian, other/multiracial, unknown), and insurance status (commercial, Medicare, Medicaid, uninsured). Self-pay status was included in the uninsured group. The residential zip code was linked to the median annual household income level (<$60,000, $60,000-79,999, $80,000-119,999, $120,000-149,999 and ≥$150,000) reported by the U.S. Census Bureau[8].

Statistical Analysis

The weekly total imaging volumes in 2020 and 2019 were analyzed from January 1st - May 31st (weeks 1-22) stratified by socioeconomic factors (age, sex, race, insurance status, income level) to demonstrate the trends during the pre-COVID-19 (Jan 1st – Feb 28th) and post-COVID-19 (Mar 1st – May 31st) periods. The calendar weeks were plotted on the X-axis and the weekly proportion of imaging exams in each socioeconomic group was plotted on the Y-axis for both 2020 and 2019 years.

The number of imaging services performed was aggregated to calculate the mean weekly volume and percentage of imaging volume for each group within the socioeconomic categories in the 2020 and 2019 post-COVID-19 periods. Additional sub-analyses were performed comparing the 2020 and 2019 socioeconomic factors during the post-COVID-19 period stratified by patient service location (inpatient,

emergency department, outpatient). In these analyses, the same weeks in the 2020 and 2019 calendar years were compared to account for monthly or seasonal variation. In addition, the 2020 post-COVID-19 mean weekly proportion of imaging exams for each socioeconomic category were also compared to the 2020 pre-COVID-19 period. Independent-samples t-tests were used to assess statistical significance amongst socioeconomic variables.

Multivariable logistic regression analyses were performed to assess the association of the socioeconomic factors with the imaging utilization performed during the 2020 post-COVID-19 period (dependent variable, Y=1), using the 2019 post-COVID-19 period as the dependent variable, Y=0. In the regression model, the independent variables and reference variables were selected based on the individual t-test analyses to evaluate the statistically significant socioeconomic groups in a multivariable regression model. Using individual patient level data, the multivariable logistic regression analyses were stratified by inpatient (n=196,351), emergency department (n=296,952), and outpatient (n=237,409) settings to assess if differences exist by patient service locations. P-values <0.05 determined statistical significance. SAS v9.4 (SAS, Cary, NC) was used for all statistical analyses.

Results

The total imaging case volume during the post-COVID-19 (Mar 1st – May 31st) period, was 348,539 exams in year 2020 and 526,128 exams in year 2019. In year 2020, the composition mix of the total imaging volume during the post-COVID-19 period was comprised of 42% (147,385/348,539) emergency department exams, followed by

33% (114,933/348,539) inpatient and 25% (86,221/348,539) outpatient exams. In year 2019, the total imaging volume during the post-COVID-19 period was comprised of 39% (205,774/526,128) emergency department exams, followed by 37% (196,619/526,128) outpatient and 24% (123,735/526,128) inpatient exams. A statistically significant difference ($p<0.0001$) was observed in the composition mix of the patient service locations for the total imaging case volume during the 2020 post-COVID-19 (Mar 1st - May 31st) period compared to 2019 (**Figure 1**).

The 2020 and 2019 trend data for the total imaging case volume from Jan 1st - May 31st stratified by the socioeconomic factors revealed the pattern of changes in the imaging utilization according to age, sex, race, insurance status, and income level. **Figures 2 and 3** show the trend data for the statistically significant groups in each socioeconomic category. A transition point is observed at week 10 with imaging utilization changing (increasing or decreasing) during the first week in the post-COVID-19 period, corresponding to the first confirmed COVID-19 positive patient in New York city on March 1, 2020 (week 10). The highest peak and lowest trough are observed at weeks 15-16 which also correspond to the peak in the incidence of COVID-19 cases in this geographic region. A gradual return to baseline is observed with the trend data approaching near baseline by week 22 compared to the pre-COVID-19 (Jan 1st – Feb 28th) period.

During the post-COVID-19 period, statistically significant differences were observed in the composition mix of the socioeconomic factors (age, sex, race, insurance status, income level). **Figure 4** reveals the individual comparisons of the 2020 and 2019 composition change in each variable group within the socioeconomic

category during the post-COVID-19 period. Overall, there was statistically significant increased imaging utilization in the mean weekly proportion of patients aged 60-79 years (p=0.0025), males (p<0.0001), non-white patients (black (p=0.0077), Asian (p=0.0002), other (p=0.0001), unknown (p=0.02)), Medicaid (p<0.0001) and uninsured patients (p=0.0013), and lower income brackets of <$60,000 (p=0.0043) and $60,000-$79,999 (p=0.0012) during the COVID-19 pandemic. In contrast, statistically significant decreased imaging utilization was seen in younger patients (<18 years old) (p<0.0001), females (p<0.0001), white patients (p=0.0003), commercially insured patients (p<0.0001), and higher income brackets $80,000-$119,999 (p=0.0092), $120,000-$149,999 (p=0.0015), ≥$150,000 (p<0.0001). **Table 1** confirms similar findings when comparing these socioeconomic factors in the 2020 post-COVID-19 (Mar 1st – May 31st) and 2020 pre-COVID-19 (Jan 1st – Feb 28th) periods.

The sub-analyses stratifying the comparisons of the socioeconomic factors by patient service location (inpatient, emergency department, outpatient) revealed similar observations (**Tables 2-4**). Overall, the socioeconomic findings were concordant amongst the inpatient and emergency department settings for age, sex, race and income level. The only exception was in the insurance status category for the commercially insured group which showed statistically increased imaging utilization in the inpatient setting (p<0.0001). In contrast to the other patient service locations, in the outpatient setting, there was statistically significant increased imaging utilization in patients aged 18-39 years (p=0.0011) and decreased imaging utilization in 40-59 year-old patients (p=0.0164). Additional discordant findings are seen in the income level for the outpatient location with statistically decreased imaging in patients <$60,000

(p=0.0155) and increased imaging utilization in patients $80,000-$119,999 level (p<0.0001).

Furthermore, the multivariable logistic regression analyses reveal the strength of the association of the socioeconomic factors with the imaging utilization during the post-COVID-19 period (**Table 5**). The following socioeconomic groups were selected as the independent variables (and corresponding reference variables) in the regression model based on the statistical significance observed in the t-test comparisons: age_60-79 (all other age groups: <18, 18-39, 40-59, ≥80), sex_male (female), race_white (non-white: black, Asian, other, unknown), insurance_commercial (non-commercial insurance groups: Medicaid, Medicare, uninsured), income_≥$80,000 (income <$80,000). Across all patient service locations, patients aged 60-79 years and males had statistically significant positive associations with imaging utilization during the 2020 post-COVID-19 period, while white race had significant negative associations. Some further insights are revealed by evaluating the Odds Ratio (OR) to assess the strength of associations particularly in the different patient service locations. The male sex variable had the strongest positive association with imaging utilization during the pandemic, which remained consistent across all patient service locations. The greatest effect was observed for the inpatient location with males having 33% higher odds compared to females. In contrast, the white race variable had the strongest negative association with imaging utilization during the pandemic across all patient service locations. The greatest effect was also seen for the inpatient location with 29% lower odds of whites compared to non-whites (blacks, Asian, other, unknown). Insurance status and income level was variable depending on the patient service location. In the emergency department

location, commercial insurance and higher income level (≥$80,000) had significant negative associations with imaging utilization. In contrast, the outpatient location showed that higher income level (≥$80,000) had significant positive association with imaging utilization while commercial insurance was not statistically associated.

Discussion

The COVID-19 pandemic has highlighted long-standing health disparities in the U.S. and has had a disproportionate impact on the health and well-being of individuals of lower socioeconomic status, thus compounding the pre-existing inequities in the U.S. healthcare system. The findings from this study revealed statistically significant changes in the composition mix of the socioeconomic factors of patients undergoing imaging during the COVID-19 pandemic. Overall, older patients (aged 60-79 years), males, and non-white (black, Asian, other, unknown) racial groups received significantly more medical imaging during the COVID-19 pandemic compared to the same weeks in the prior year. In addition, this study revealed that patients with lower income levels (<$80,000) had significantly increased imaging utilization while patients with higher income levels ≥$80,000 had significantly decreased imaging utilization during the post-COVID-19 period. With regard to insurance status, Medicaid recipients and uninsured patients had significantly increased imaging utilization while patients with commercial (private) insurance had significantly decreased imaging utilization during the post-COVID-19 period. These findings are consistent with the health disparities reported in the literature related to the increased prevalence of COVID-19 amongst these groups.

Furthermore, some differences were observed when the socioeconomic factors were stratified by patient service location (inpatient, emergency department, outpatient). In the emergency department and inpatient locations, the socioeconomic factors that were related to statistically increased imaging utilization followed the same pattern of patient demographics that were most impacted by the pandemic (older, males, non-white and lower income) because these patients experienced a higher prevalence of COVID and were likely seeking care in the emergency department and subsequently admitted to the hospital. Additionally, the multivariable regression model revealed that the male sex variable had the strongest positive association and the white race variable had the strongest negative association with imaging utilization during the COVID-19 pandemic across all patient service locations, with the greatest effect observed in the inpatient setting.

In contrast, the patients that had significantly decreased proportions of imaging utilization in the outpatient location during the 2020 post-COVID-19 period were females, younger patients (<18 and 40-59 years old), white, lower income (<$60,000) and higher income (≥$120,000) levels. One possible explanation for this decline in the use of outpatient imaging services is that these patient groups were delaying their care during the COVID-19 pandemic as a consequence of the Centers for Medicare & Medicaid Services recommendation to limit nonessential and nonurgent medical care(9). This mandate particularly affected the performance of routine outpatient imaging, such as breast cancer screening, which would disproportionately affect the younger, female population. Additionally, the economic downturn caused by the pandemic resulted in high rates of unemployment and loss of medical insurance(10),

which may have disproportionately impacted those patients with prior commercial insurance and lower income households. However, we also consider the possibility that these findings can be explained by the pre-existing disparities related to imaging services reported in the literature(11), in particular to cancer screening and follow-up imaging(12,13). If this is indeed the case, this delayed care may lead to potential adverse health consequences for these populations. Understanding the impact of the decline in the utilization of imaging services for specific patient groups is important to better guide health policy during and after the pandemic to ensure imaging needs are met. If this issue is not addressed proactively, it may potentially result in widening of existing disparities in radiology in the post pandemic era that includes access to outpatient imaging services, especially cancer screening programs.

The main limitation of this study is the retrospective design using aggregated volume data, thus limiting our ability to perform more detailed regression analyses evaluating the key socioeconomic factors driving specific types of imaging utilization by CPT-coded groups during the COVID-19 pandemic. Another limitation is that our healthcare institution experienced an extremely high volume of COVID-19 patients during the pandemic potentially limiting the generalizability of these results to less affected institutions. Given the rapid spread of COVID-19 across the country with several states now surpassing the total number of cases in New York, other institutions are likely experiencing a high volume of COVID-19 patients and these results may serve as a reference. However, further studies in other regions in the U.S. would be helpful to analyze the geographic variability.

Understanding socioeconomic health disparities is a critical step in assessing the short- and long-term effects from the COVID-19 pandemic. It is important for healthcare leaders to be aware of these health disparities in directing utilization of resources during the pandemic and subsequent recovery. Imaging utilization stratified according to socioeconomic factors may help predict the demand for imaging services during a potential resurgence of the COVID-19 pandemic.

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Figure Legends

Figure 1. Composition mix of the total imaging case volume stratified by patient service location (inpatient, emergency department, outpatient) in the 2020 and 2019 post-COVID-19 period (Mar 1st – May 31st). In the 2020 post-COVID-19 period (**A**), there was a statistically significant change ($p<0.0001$) in the composition mix for the total imaging volume with increased proportions of emergency department and inpatient exams, compared to 2019 (**B**).

Figure 2. 2020 and 2019 imaging utilization trend data from January 1st - May 31st stratified by age (**A**), sex (**B**) and race (**C**) for the statistically significant groups within each socioeconomic category. A transition point is observed at week 10 (red vertical line) indicating the shift in the imaging utilization in the first week of the post-COVID-19 period. Calendar weeks are presented on the X-axis and the weekly proportion of imaging exams on the Y-axis.

Figure 3. 2020 and 2019 imaging utilization trend data from January 1st - May 31st stratified by insurance status (**A**) and income level (**B**) for the statistically significant groups within each socioeconomic category. A transition point is observed at week 10 (red vertical line) indicating the shift in the imaging utilization in the first week of the post-COVID-19 period. Calendar weeks are presented on the X-axis and the weekly proportion of imaging exams on the Y-axis.

Figure 4. Comparison of the 2020 and 2019 mean weekly composition mix of the socioeconomic factors for total imaging volume in the post-COVID-19 period is displayed in stacked bar graphs for age (**A**), sex (**B**), race (**C**), insurance status (**D**), and income level (**E**). The percentage composition for each socioeconomic group is indicated in the column with the total summed to 100% on the Y-axis. P-values <0.05 are denoted with the "*" symbol.

Table 1: Comparison of the 2020 Mean Weekly Composition Mix of the Socioeconomic Factors for Total Imaging Volume in the Post-COVID-19 and Pre-COVID-19 Periods

Socioeconomic Factors	2020 Post-COVID-19		2020 Pre-COVID-19		p-value (*<0.05)
	Mean %	SD	Mean %	SD	
Age					
<18	4.90	0.64	5.91	0.26	<.0001*
18-39	14.18	1.29	15.36	0.65	0.0108*
40-59	27.93	1.24	27.57	1.02	0.4825
60-79	37.02	2.08	35.21	0.38	0.0090*
≥80	15.98	1.09	15.95	0.67	0.9449
	100%		100%		
Sex					
Male	48.48	5.43	38.35	0.62	<.0001*
Female	51.52	5.43	61.65	0.62	<.0001*
	100%		100%		
Race					
Asian	7.17	0.51	6.87	0.29	0.1346
Black	17.08	1.31	15.73	0.42	0.0033*
Other	20.85	2.50	17.71	0.37	0.0007*
Unknown	5.36	0.56	5.05	0.26	0.1283
White	49.54	4.36	54.64	0.60	0.0012*
	100%		100%		
Insurance					
Commercial	34.60	2.42	37.35	0.83	0.0017*
Medicaid	19.20	1.01	16.80	0.42	<.0001*
Medicare	40.50	1.41	40.65	0.40	0.7519
Uninsured	5.69	0.81	5.20	0.46	0.1162
	100%		100%		
Income					
<$60,000	13.32	2.09	11.25	0.37	0.0039*
$60,000-$79,999	27.65	1.39	26.14	0.48	0.0024*
$80,000-$119,999	39.63	1.39	40.98	0.53	0.0055*
$120,000-$149,999	15.57	1.51	17.15	0.40	0.0028*
≥$150,000	3.84	0.42	4.48	0.21	0.0001*
	100%		100%		

Table 2: Comparison of the 2020 and 2019 Mean Weekly Composition Mix of the Socioeconomic Factors for the Inpatient Service in the Post-COVID-19 Period

INPATIENT Socioeconomic Factors	2020		2019		p-value (*<0.05)
	Mean %	SD	Mean %	SD	
Age					
<18	6.33	0.85	6.52	0.60	0.5302
18-39	7.34	0.66	7.08	0.61	0.3081
40-59	23.18	1.65	19.79	1.24	<.0001*
60-79	44.10	2.65	42.22	0.99	0.0298*
≥80	19.05	2.85	24.39	0.88	<.0001*
	100%		100%		
Sex					
Male	58.87	3.87	51.68	0.78	<.0001*
Female	41.13	3.87	48.32	0.78	<.0001*
	100%		100%		
Race					
Asian	8.77	0.57	7.60	0.49	<.0001*
Black	18.31	0.88	18.46	0.67	0.6401
Other	21.60	3.71	15.32	0.62	<.0001*
Unknown	4.88	1.26	3.11	0.38	0.0002*
White	46.44	4.60	55.51	1.00	<.0001*
	100%		100%		
Insurance					
Commercial	27.58	1.39	25.22	0.86	<.0001*
Medicaid	21.76	1.34	17.98	0.95	<.0001*
Medicare	48.36	3.14	55.48	1.11	<.0001*
Uninsured	2.30	0.98	1.31	0.29	0.0037*
	100%		100%		
Income					
<$60,000	15.83	2.37	13.69	0.82	0.0077*
$60,000-$79,999	28.70	1.32	26.73	0.93	0.0002*
$80,000-$119,999	38.00	1.85	40.06	1.02	0.0024*
$120,000-$149,999	14.15	1.10	15.44	0.75	0.0022*
≥$150,000	3.32	0.45	4.09	0.33	<.0001*
	100%		100%		

Table 3: Comparison of the 2020 and 2019 Mean Weekly Composition Mix of the Socioeconomic Factors for the Emergency Department Service in the Post-COVID-19 Period

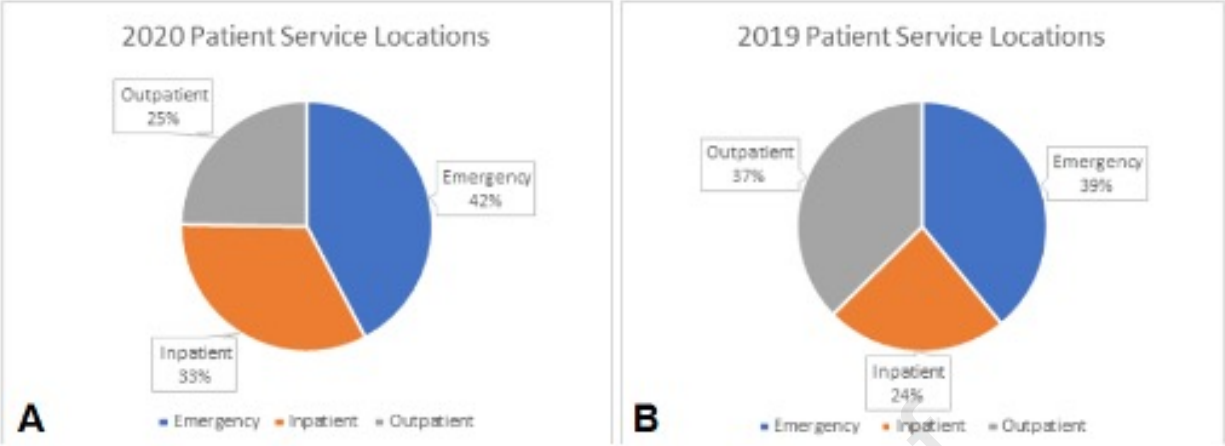
EMERGENCY Socioeconomic Factors	2020		2019		p-value (*<0.05)
	Mean %	SD	Mean %	SD	
Age					
<18	4.62	1.47	7.72	0.52	<.0001*
18-39	19.75	2.61	21.66	0.58	0.0230*
40-59	26.91	2.10	24.41	0.82	0.0011*
60-79	30.29	2.73	27.47	0.77	0.0031*
≥80	18.44	1.86	18.75	0.74	0.5843
	100%		100%		
Sex					
Male	48.36	2.74	43.30	0.57	<.0001*
Female	51.64	2.73	56.69	0.57	<.0001*
	100%		100%		
Race					
Asian	6.84	0.70	6.60	0.26	0.2557
Black	18.73	1.10	18.93	0.56	0.5731
Other	21.92	2.36	19.28	0.51	0.0017*
Unknown	4.03	0.79	3.70	0.24	0.1568
White	48.48	3.98	51.49	0.87	0.0192*
	100%		100%		
Insurance					
Commercial	30.69	1.61	32.10	0.57	0.0094*
Medicaid	20.30	1.20	20.69	0.69	0.3308
Medicare	38.91	2.25	37.58	0.77	0.0542
Uninsured	10.09	0.85	9.63	0.79	0.1678
	100%		100%		
Income					
<$60,000	13.40	1.70	11.95	0.41	0.0099*
$60,000-$79,999	28.62	1.32	27.96	0.81	0.1358
$80,000-$119,999	39.36	1.28	41.02	0.79	0.0007*
$120,000-$149,999	14.94	1.06	15.41	0.52	0.1656
≥$150,000	3.67	0.34	3.66	0.27	0.9073
	100%		100%		

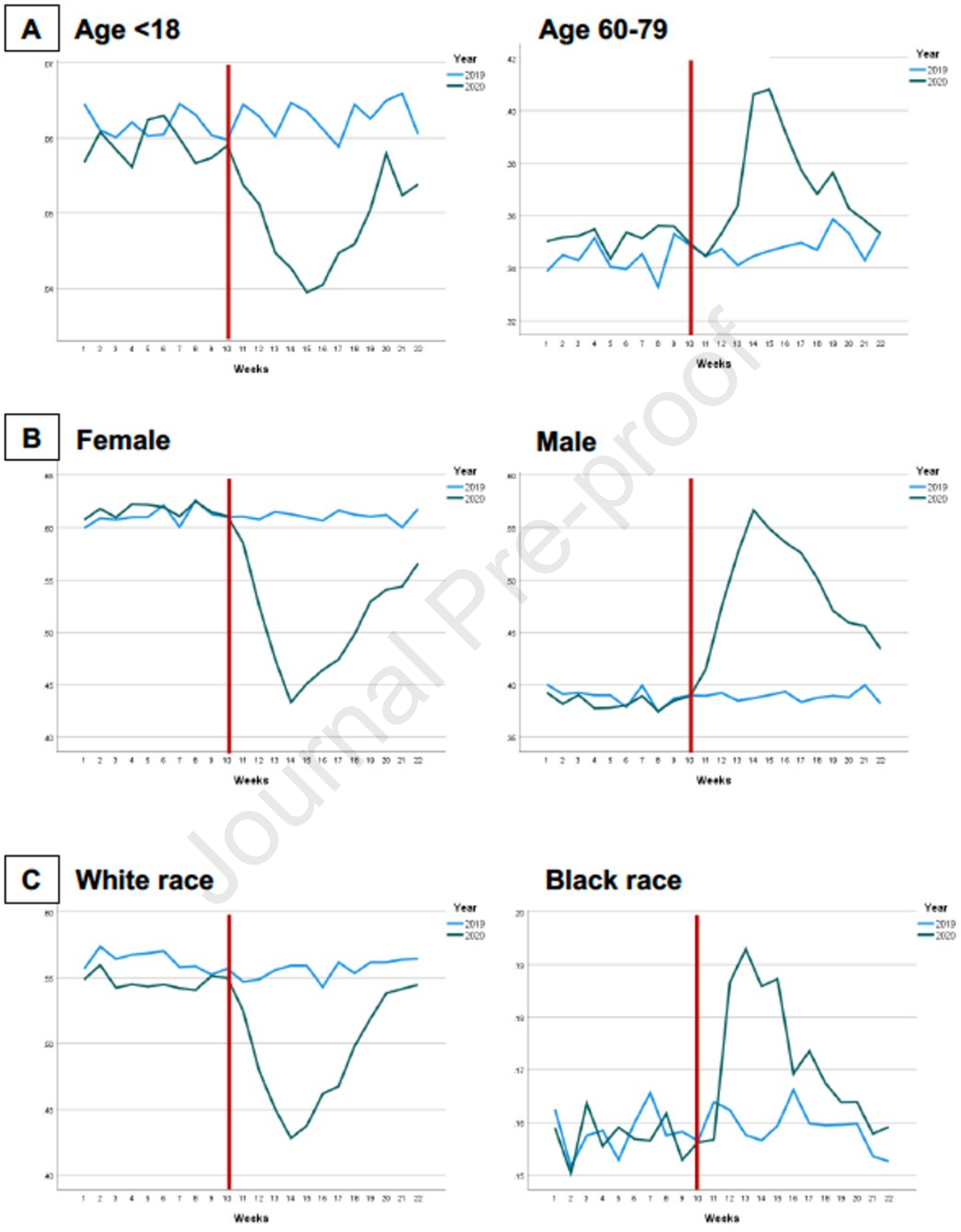
Table 4: Comparison of the 2020 and 2019 Mean Weekly Composition Mix of the Socioeconomic Factors for the Outpatient Service in the Post-COVID-19 Period

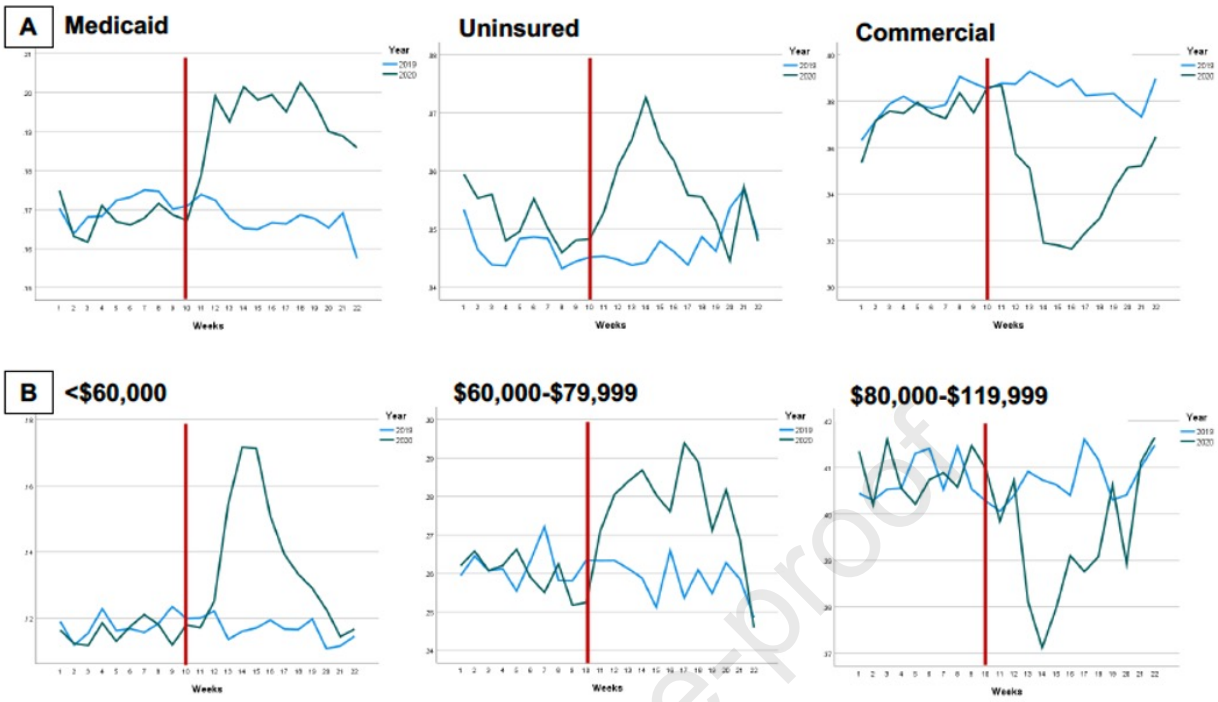
OUTPATIENT Socioeconomic Factors	2020		2019		p-value (*<0.05)
	Mean %	SD	Mean %	SD	
Age					
<18	3.60	0.53	4.61	0.16	<.0001*
18-39	14.58	1.89	12.36	0.34	0.0011*
40-59	35.87	1.95	37.55	1.24	0.0164*
60-79	38.36	1.71	37.75	1.12	0.299
≥80	7.59	1.19	7.73	0.38	0.6815
	100%		100%		
Sex					
Male	33.07	4.33	26.52	0.50	0.0001*
Female	66.93	4.33	73.48	0.50	0.0001*
	100%		100%		
Race					
Asian	5.37	0.62	5.51	0.34	0.4605
Black	12.36	1.57	11.23	0.31	0.0250*
Other	16.09	1.21	15.88	0.60	0.5811
Unknown	8.48	0.35	7.35	0.38	<.0001*
White	57.71	2.05	60.02	0.73	0.0017*
	100%		100%		
Insurance					
Commercial	52.51	1.64	53.38	1.01	0.1177
Medicaid	13.25	1.22	11.94	0.56	0.0027*
Medicare	32.56	1.35	32.86	1.29	0.5679
Uninsured	1.69	0.30	1.83	0.15	0.1475
	100%		100%		
Income					
<$60,000	8.44	0.81	9.11	0.42	0.0155*
$60,000-$79,999	24.59	2.02	23.58	0.61	0.0972
$80,000-$119,999	43.24	1.17	41.20	0.52	<.0001*
$120,000-$149,999	18.94	1.47	20.32	0.54	0.0061*
≥$150,000	4.81	0.67	5.79	0.38	0.0002*
	100%		100%		

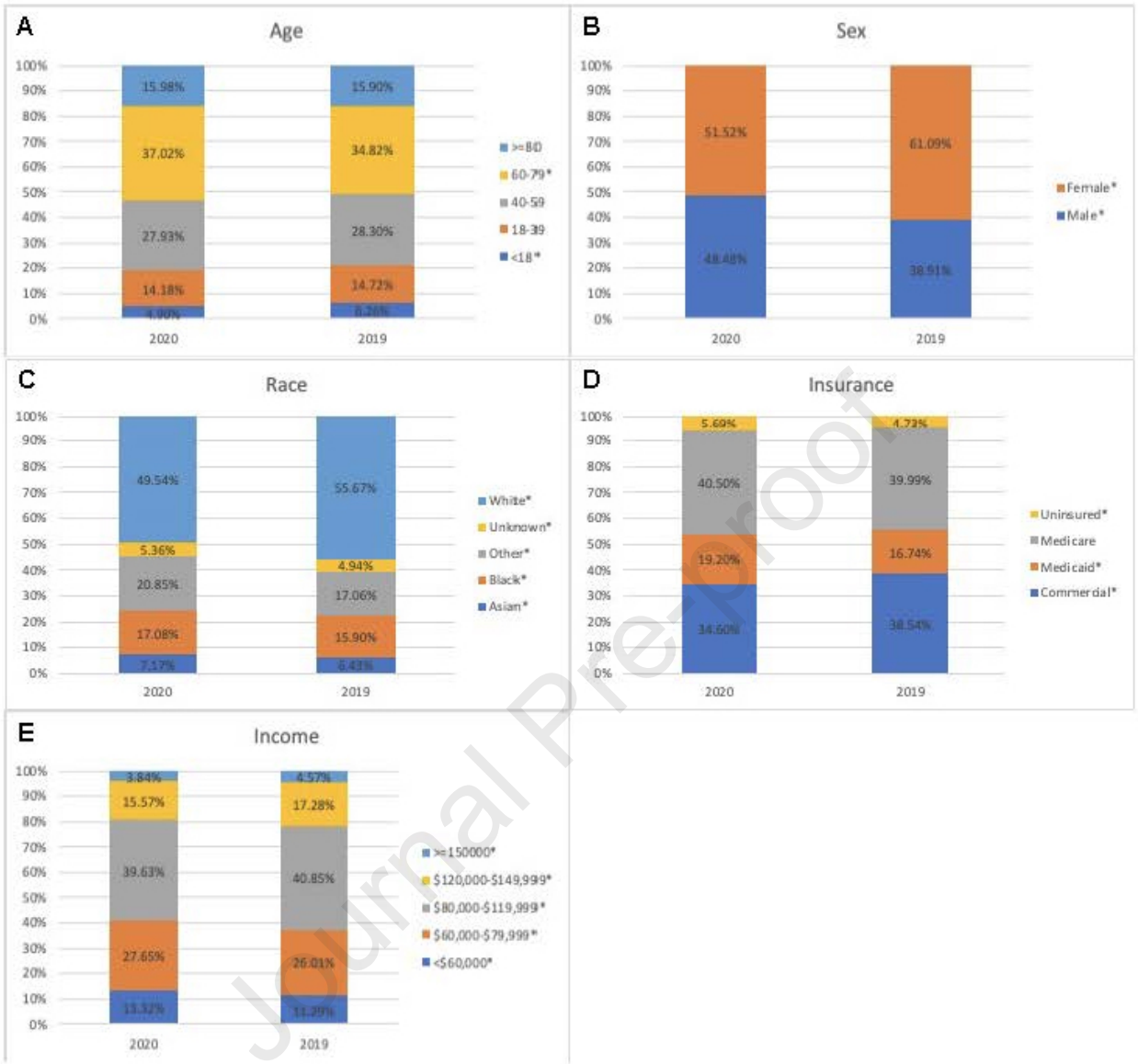
Table 5: Multivariable Logistic Regression Analyses of the Socioeconomic Factors with Imaging Utilization During the 2020 Post-COVID-19 Period Stratified by Patient Service Location

Socioeconomic Factors	INPATIENT (n=196,351)		EMERGENCY (n=296,952)		OUTPATIENT (n=237,409)	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Age_60-79	1.09 (1.07,1.11)	<.0001*	1.14 (1.12,1.16)	<.0001*	1.04 (1.02,1.06)	0.0002*
Sex_Male	1.33 (1.31,1.35)	<.0001*	1.22 (1.20,1.24)	<.0001*	1.23 (1.20,1.25)	<.0001*
Race_White	0.71 (0.70,0.72)	<.0001*	0.88 (0.87,0.90)	<.0001*	0.92 (0.90,0.93)	<.0001*
Insurance_Commercial	1.13 (1.11,1.15)	<.0001*	0.96 (0.95,0.98)	<.0001*	1.00 (0.98,1.02)	0.9695
Income_≥$80,000	0.93 (0.91,0.94)	<.0001*	0.95 (0.94,0.97)	<.0001*	1.05 (1.03,1.07)	<.0001*









Summary statement: The purpose of this study was to evaluate socioeconomic factors related to imaging utilization during the pandemic.

Take-Home points:

- During the COVID-19 pandemic, significant changes in the composition mix of socioeconomic factors were observed, with patients aged 60-79 years, male, non-white (black, Asian, other, unknown), Medicaid/uninsured status, and income levels <$80,000 having increased imaging utilization, consistent with the known health disparities in COVID-19 prevalence.
- Patients aged <18 years, female, white, commercially insured and those at income levels ≥$80,000 received significantly decreased imaging during the post-COVID-19 (Mar 1st – May 31st) period, with unknown potential health consequences of delayed care.
- Identifying socioeconomic health disparities related to imaging utilization is an initial step towards understanding the need for imaging resources in specific patient groups during the COVID-19 pandemic and subsequent recovery.
- In a time of a healthcare crisis, it is important to understand socioeconomic factors related to imaging utilization to direct imaging resources in order to ensure adequate access and availability.