MILLIMAN REPORT

Racial disparities in cardiovascular conditions

An analysis of prevalence and provider care patterns

March 2021

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Executive summary

The recent acceleration of lifesaving and life-prolonging medicine in the United States is quite remarkable. Almost equally remarkable, however, is that although the overall rate is declining heart disease remains the leading cause of death in the United States and disproportionately affects Black people.[1] Milliman is committed to shining a light on racial disparities in healthcare through objective analysis and research. We set out to study the disparity in cardiovascular conditions experienced by Black people. We conducted our own study, reviewed other relevant research and literature, considered contributing factors, and considered approaches that healthcare organizations and providers can take toward promoting health equity and eliminating the disparity gap.

Our claims-based study across all insurance coverage segments—commercial, Medicaid managed care, Medicare fee-for-service (MFFS) and Medicare Advantage plans—focused on two aspects of cardiovascular conditions: prevalence rates and provider patterns of care. Our analysis of prevalence rates found that, compared to their non-Hispanic white counterparts, Black people experience higher prevalence rates of cardiovascular conditions such as hypertension, congestive heart failure, cerebrovascular disease, and pulmonary heart disease. Studying provider patterns of care, our analysis of angiography and percutaneous coronary intervention (PCI) utilization rates among patients with nonspecific chest pain or atherosclerosis and other heart disease, we found a statistical bias toward performing the procedures for white patients compared to Black patients.

While some of the disparity in prevalence rates is explained by clinical risk factors such as diabetes, obesity, high cholesterol, and congenital heart defects, these conditions do not fully explain the differences.[2] Given the disproportionate rate of cardiovascular conditions and associated deaths among Black people, many of which are preventable, we also consider factors within the healthcare system that may contribute to the disparity. Some factors we identified include racism, implicit bias, and limited availability of race and ethnicity data. Healthcare organizations can play a significant role in closing the racial disparity gap.

Racial disparities and cardiovascular disease

Despite the significant decrease in the rate of avoidable deaths from heart disease, the death rate remains highest for Black people.[3] The U.S. Office of Minority Health reported in 2020 that the rate of diagnosed cases of coronary heart disease was higher among white people (5.8%) than Black people (5.4%); however, the death rate for Black people was 30% higher.[4]

A review of the literature indicated higher prevalence of certain cardiovascular conditions and modifiable risk factors among Black adults. The prevalence of heart failure is highest for Black adults compared to other races, with a rate of 3.9% for women and 3.5% for men, and with earlier onset.[5,6] Furthermore, heart failure mortality in Black women is almost three times higher than for white women.[7] Strokes are 50% more likely among Black adults than their white counterparts; the likelihood of a Black woman having a stroke is double that of a white woman, and mortality is 70% higher for Black men as compared to white men.[8] It is important to note that, due to selection and sample of each study's target populations, prevalence estimates may differ between studies. The incidence of myocardial infarction

[1] Centers for Disease Control and Prevention (April 2019). Health, United States Spotlight: Racial and Ethnic Disparities in Heart Disease. Retrieved March 2, 2021 from https://www.cdc.gov/nchs/hus/spotlight/HeartDiseaseSpotlight_2019_0404.pdf.

[2] Centers for Disease Control and Prevention. Know Your Risk for Heart Disease. Retrieved March 2, 2021 from https://www.cdc.gov/heartdisease/risk_factors.htm.

[3] Centers for Disease Control and Prevention (April 2019), Health, United States Spotlight, Ibid.

[4] U.S. Department of Health and Human Services (February 14, 2020). Heart Disease and African Americans. Minority Population Profiles, Office of Minority Health. Retrieved March 2, 2021 from https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlid=19.

[5] Bibbins-Doming, Kirsten, et al. (March 19, 2009). Racial differences in incident heart failure among young adults. *New England Journal of Medicine*, vol. 360, pp. 1179-1190. Retrieved March 2, 2021 from https://www.nejm.org/doi/full/10.1056/NEJMoa0807265.

[6] Virani S., Alonso A., Benjamin E., et al. Heart Disease and Stroke Statistics—2020 Update: A Report From the American Heart Association. Circulation. Volume 141, Issue 9, March 3, 2020. Chapter 20. Table 20-2. Retrieved March 18, 2021 from https://doi.org/10.1161/CIR.0000000000000757.

[7] Balla, Sujana et al. (November 17, 2020). Disparities in Cardiovascular Care and Outcomes for Women from Racial/Ethnic Minority Backgrounds. Curr Treat Options Cardio Med (2020) 22:75. Retrieved March 21, 2021 from https://link.springer.com/content/pdf/10.1007/s11936-020-00869-z.pdf.

[8] Stroke and African Americans - The Office of Minority Health (hhs.gov).

or fatal coronary heart disease is highest among Black men, followed by Black women in comparison to white men and women.[9]

Black people have a higher prevalence of modifiable risk factors, including hypertension and obesity, and earlier age of onset for cardiovascular disease. The National Health and Nutrition Examination Survey (NHANES) estimated 42.1% of Black adults aged 20 and over were most likely to have hypertension in 2015 and 2016, compared with rates of 29.4% for Latinx, 28.7% for white, and 27.2% for Asian populations.[10] Black people in the United States have the highest prevalence of hypertension in the world.[11] Updated statistics from the American Heart Association in 2020 indicated that more than 50% of Black people in the United States have hypertension, and for nearly 80% their hypertension is not controlled to goal.[12] Black adults aged 35 to 64 are 50% more likely to have hypertension than whites, and Black adults aged 18 to 49 are two times more likely to die from heart disease than white adults.[13] Specific to gender, cardiovascular conditions accounted for the top three leading causes of pregnancy-related deaths for Black women,[14] and in the U.S., Black women are at least 2.5 times more likely to die of pregnancy-related complications than white women.[15]

Our literature review also included provider patterns of care of patients with cardiovascular conditions, beginning with a notable study by Schulman et al. in 1999. The study found that a patient's race and sex independently influenced how physicians managed chest pain, including recommendations for cardiac catheterization.[16] Several studies over the past 20 years indicate distinct disparities in cardiovascular clinical care.

- Compared to white patients, Black patients presenting to an emergency department (ED) with potential acute coronary syndrome are less likely to receive cardiac or PCI to receive thrombolytic therapy within the recommended time or PCI within 90 minutes of hospital arrival, to undergo initial diagnostic testing or noninvasive and invasive diagnostic evaluations. Differences may, in part, be due to presenting symptoms and the quality of care among hospitals.[17]
- Compared to white patients, Black patients presenting to the ED with heart failure (HF) symptoms were less likely to be hospitalized. If admitted, Black patients were less likely to be admitted to a cardiology service, or to be managed by a cardiologist while in the intensive care unit (ICU).[18]
- Black patients undergoing coronary artery bypass grafting (CABG) surgery experienced higher morbidity and mortality rates, even after adjusting for comorbidity burden, socioeconomic status, and facility and surgeon characteristics.[19]

[9] Virani S., Alonso A., Benjamin E., et al. Ibid. Chapter 19. Chart 19-6.

[10] Centers for Disease Control and Prevention (April 2019), Health, United States Spotlight, Ibid

[11] Yancy, Clyde, et. al. (May 2014). Heart failure in African Americans: Disparities can be overcome. *Cleveland Clinic Journal of Medicine*, vol. 81, no. 5, pp. 301-311. Retrieved March 2, 2021 from http://www.abcardio.org/wp-content/uploads/2016/11/Yancy_Colvin.pdf.

[12] American Heart Association (August 6, 2020). Race and Ethnicity Data Collection Essentials. Target: BP. Retrieved March 2, 2021 from https://targetbp.org/tools_downloads/race-ethnicity-data-collection-essentials/.

[13] Centers for Disease Control and Prevention (May 2017).CDC Vitalsigns "African American Health: Creating Equal Opportunities for Health. Retrieved March 2, 2021 from https://www.cdc.gov/vitalsigns/pdf/2017-05-vitalsigns.pdf.

[14] Building U.S. Capacity to Review and Prevent Maternal Deaths (2018). Report From Nine Maternal Mortality Review Committees. Retrieved March 2, 2021 from http://reviewtoaction.org/Report_from_Nine_MMRCs.

[15] National Center for Health Statistics. 2018 Maternal Mortality Statistics Highlight Wide Racial and Ethnic Gaps. Centers for Disease Control and Prevention. Retrieved March 2, 2021, from https://www.cdc.gov/nchs/maternal-mortality/images/19-313784-MMR-Visual-abstract-2.png.

[16] Schulman, Kevin, et al. (February 25, 1999). The effect of race and sex on physicians' recommendations for cardiac catheterization. *New England Journal of Medicine*, vol. 340, no. 8, pp. 618-626. Retrieved March 2, 2021 from https://www.nejm.org/doi/pdf/10.1056/NEJM199902253400806?articleTools=true.

[17] DeVon, Hollie, et al. (2014). Disparities in patients presenting to the emergency department with potential acute coronary syndrome: It matters if you are Black or white. *Heart Lung*, National Institute of Health vol. 43, no. 4, pp. 270-277. Retrieved March 2, 2021 from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4082800/pdf/nihms-592841.pdf.

[18] Nayak, Aditi, et al. (August 2020). Advances in heart failure: Understanding the complexity of heart failure risk and treatment in Black patients. *Circulation: Heart Failure*, American Heart Association, vol. 13, no. 8. Retrieved March 2, 2021 from https://www.ahajournals.org/doi/10.1161/CIRCHEARTFAILURE.120.007264.

[19] Mehta, Rajendra, et al. (January 12, 2016). Association of hospital and physician characteristics and care processed with racial disparities in procedural outcomes among contemporary patients undergoing coronary artery bypass grafting surgery. *Circulation*, American Heart Association, vol. 133, no. 2, pp. 124-130. Retrieved March 2, 2021 from https://www.ahajournals.org/doi/epub/10.1161/CIRCULATIONAHA.115.015957.

- A study of acute myocardial infarct (AMI) admissions found that Black patients lived substantially closer to hospitals with revascularization programs but the proportion of admissions was only slightly higher than for white patients, and a higher proportion of Black patients were admitted to lower-quality hospitals.[20]
- Studies of disparities in cardiovascular care and outcomes highlight differences in cardiovascular treatment management, and mortality rates for women of color, compared with men and with white women.[21]

While these studies show differences in provider patterns of care, some improvements in care equity and provider patterns have also been noted. For example, the NHANES 2003-2012 found that Black patients, compared with white and Latinx people, were the most likely to receive combination antihypertensive medications; although only 31% had adequate blood pressure control, this outcome was not due to inferior treatment.[22] A 2020 study by Breathett et al. suggested allocation of advanced heart failure therapies was not associated with race and gender, but evidence of bias might contribute to delay and lower allocation for women.[23]

Our study focused on differences between Black and white populations. Study of other races and ethnicities is a topic for future research. We also explore some contributing factors from a systems perspective and discuss approaches that healthcare organizations and providers can take to mitigate the racial differences.

Consistent with the AP style guide, throughout this paper, we capitalize Black when used in a racial, ethnic, or cultural context while leaving white in lowercase.[24] Below are some key definitions we use in this paper.

- **Health disparities** are differences in the quality of healthcare that are not due to access-related factors, clinical needs, preferences, or appropriateness of interventions.[25]
- **Race** is a social interpretation of how someone looks.[26] In classifying race and ethnicity, the U.S. Office of Management and Budget (OMB) categorizes race as Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, and White.
- **Ethnicity** refers to a social group that has a common national or cultural tradition. The two minimum OMB categories for ethnicity are either Hispanic or Latino, or not Hispanic or Latino.[27]

Studying disparities in cardiovascular disease

Our study is based on the Milliman MedInsight Emerging Experience research data set of encrypted de-identified healthcare claims data for individuals nationwide, enrolled in commercial insurance plans, Medicaid managed care, Medicare fee-for-service (MFFS), and Medicare Advantage plans, including dual eligible members. The 2017-2021 data set, which is updated monthly and more current than many other claims-based data sources, contains medical and pharmacy claims data that can be analyzed to understand utilization, cost, and quality trends. Given the COVID-19 pandemic of 2020, we chose to focus our study on 2017 to 2019.

Claims data has the advantage of reflecting all the healthcare services incurred by individuals at any provider entity; however, it only reveals claims when healthcare services are sought and insurance is billed. Occurrence of conditions among persons who do not engage medical professionals may not be detected by healthcare claims analysis.

[20] Popescu, Ioana, et al. (June 14, 2011). Differences in admitting hospital characteristics for Black and white Medicare beneficiaries with acute myocardial infarction." *Circulation*, National Institute of Health, vol. 123, no. 23, pp. 2710-2716. Retrieved March 2, 2021 from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3142883/pdf/nihms298856.pdf.

[21] Balla, Sujana et al. (November 17, 2020). Disparities in Cardiovascular Care and Outcomes for Women from Racial/Ethnic Minority Backgrounds. Curr Treat Options Cardio Med (2020) 22:75. Retrieved March 21, 2021 from https://link.springer.com/content/pdf/10.1007/s11936-020-00869-z.pdf.

[22] Nayak, Aditi, et al., Ibid.

[23] Breathett Khadijah, et al. (July 21, 2020). Association of gender and race with allocation of advanced heart failure therapies. *JAMA Network Open*. vol. 3, no. 7, Retrieved March 2, 2021 from https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2768394.

[24] Daniszewski, J. Announcements: Why we will lowercase white. *The Associated Press*. [Online] 2020. [Cited: 01 15, 2021.] https://blog.ap.org/announcements/why-we-will-lowercase-white.

[25] Institute of Medicine (2003). Unequal Treatment: Confronting Racial and Ethinic Disparities in Health Care. National Academies of Science, Engineering, and Medicine. Retrieved March 2, 2021 from https://doi.org/10.17226/12875.

[26] Unequal Treatment, Ibid.

[27] OMB (October 30, 1997). Revisions to the Standards for the Classification of Federal Dara on Race and Ethnicity. Retrieved March 2, 2021 from https://obamawhitehouse.archives.gov/omb/fedreg_1997standards.

Patients with cardiovascular disease were identified based on the Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications Software (CCS) for ICD-10-PCS implemented in MedInsight claims processing software.

The table in Figure 1 provides rounded counts of total insured individuals within the database, and those within the data subset used for our study of Black and non-Hispanic white patients age 20 years and older.

FIGURE 1: INDIVIDUALS IN THE RESEARCH DATABASE FOR YEARS 2017 TO 2019

RESEARCH DATABASE (INCLUDES COMMERCIAL, MEDICAID MANAGED CARE, MEDICARE ADVANTAGE AND MEDICARE FEE-FOR-SERVICE INSURED INDIVIDUALS; NATIONWIDE)	TOTAL INSURED INDIVIDUALS (ROUNDED COUNT)	INDIVIDUALS WITH "DISEASES OF THE CIRCULATORY SYSTEM"	% WITH DISEASES OF CIRCULATORY SYSTEM
Total count of all individuals in the database	19.0 million	6.1 million	32%
Total count with race/ethnicity data	4.1 million	2.1 million	51%
Total count identified as Black or non-Hispanic white	3.0 million	1.8 million	60%
Total count persons age 20+ in our study subset of Black and non-Hispanic white	2.3 million	1.6 million	70%

One challenge faced in this data set, and many healthcare research data sets, is the incomplete availability of race and ethnicity information. Despite this limitation, race and ethnicity fields were populated for approximately 61% of those enrolled in Medicaid and 56% of those enrolled in Medicare, but only 6% of those enrolled in commercial health insurance plans. The lack of race and ethnicity information may be due to a number of reasons including: health plans not requiring the information (i.e., "optional" fields, particularly for commercial populations), sensitivities around requesting the information or reluctance to provide the data, and other institutional barriers.

Analysis of cardiovascular disease prevalence

We studied cardiovascular disease prevalence comparing prevalence risk ratios in the Black population compared to the white population, by gender, age bands, and insurance type. As noted previously, study of other races and persons of Latinx ethnicity are topics for further research.

Our study identified higher prevalence rates of cardiovascular disease for Black women and men overall. For three conditions—late effects of cerebrovascular disease, congestive heart failure (non-hypertensive), and hypertension with complications and secondary hypertension—higher prevalence rates were noted for Black men and women in comparison to their white counterparts across all age bands and insurance types.

Comparisons of prevalence rates between Black and white persons in each clinical group generated risk ratios for each CCS cardiovascular category, summarized in the tables in Figure 2 and 3.

A risk ratio of 1.0 means no difference between Black and white patients. A ratio greater than 1.0 means a greater prevalence in Black patients than whites. A ratio of 2.5, for example, would indicate a rate 2.5 times higher for a Black person compared with a white person.

For each risk ratio, we calculated the 95% confidence interval (CI) to illustrate the statistical strength of the findings, shown in the table in parentheses beside each risk ratio. The 95% CI uses statistical methods to estimate the range of values that contain the true population parameter 95% of the time. A larger sample size and lesser dispersion of data points results in a tighter 95% CI. Conversely, smaller sample sizes or greater dispersion of data points result in a wider 95% CI. If the 95% CI of a risk ratio crosses 1.0, it implies no difference between Black and white patients in our study data set.

Figures 2 and 3 show the risk ratios for CCS clinical conditions in women and men of different age groups, the 95% CI for each risk ratio, the total numbers of patients in our data set, and the overall prevalence rates for the population age 20 and older. We did not report risk ratios where small sample size for a particular condition and gender-age group caused a very wide confidence interval greater than 0.6; however, we included the absolute numbers of patients in every grouping for transparency.

FIGURE 2: CARDIOVASCULAR DISEASE RISK RATIOS COMPARING 3-YEAR PREVALENCE (2017-2019) FOR BLACK AND WHITE WOMEN IN DIFFERENT AGE BANDS

Prevalence risk ratio for Black women compared to white women								
Total Black unique female members in database	31,998	7,345	17,251	12,524	56,335	75,807	201,260	
Total white unique female members in database	96,734	56,864	70,351	86,035	301,265	536,809	1,148,058	
Average Member Years per Black female member	1.43	1.42	1.51	1.57	2.13	2.08	1.88	
Average Member Years per white female member	1.64	1.62	1.69	1.85	2.38	2.46	2.22	
Healthcare insurance coverage	**Medicaid**	**Commercial**	**Medicaid**	**Commercial**	**Medicare**	**Medicare**	**Total**	**2017-2019**
Age group	**20-39**	**20-39**	**40-64**	**40-64**	**65-69**	**70+**	**20+**	**prevalence**
CCS clinical category								
Acute cerebrovascular disease								
Risk Ratio	**1.06**	-	**1.56**	**1.74**	**1.54**	**1.11**		
95 CI	**(0.85, 1.33)**	-	**(1.39, 1.75)**	**(1.45, 2.08)**	**(1.48, 1.60)**	**(1.09, 1.14)**		
Black Patient Count in this clinical group	**101**	10	**395**	**142**	**2,938**	**6,154**	**9,740**	**4.8%**
White Patient Count in this clinical group	**288**	78	**1,035**	**562**	**10,216**	**39,111**	**51,290**	**4.5%**
Late effects of cerebrovascular disease								
Risk Ratio	-	-	**2.14**	**2.58**	**2.31**	**1.41**		
95 CI	-	-	**(1.78, 2.57)**	**(1.87, 3.57)**	**(2.17, 2.45)**	**(1.35, 1.46)**		
Black Patient Count in this clinical group	30	3	**170**	**50**	**1,437**	**3,262**	**4,952**	**2.5%**
White Patient Count in this clinical group	70	15	**324**	**133**	**3,333**	**16,436**	**20,311**	**1.8%**
Aortic and peripheral arterial embolism or thrombosis								
Risk Ratio	-	-	-	-	**1.31**	**1.16**		
95 CI	-	-	-	-	**(1.15, 1.49)**	**(1.05, 1.27)**		
Black Patient Count in this clinical group	6	2	40	15	**287**	**500**	**850**	**0.4%**
White Patient Count in this clinical group	25	4	156	66	**1,172**	**3,064**	**4,487**	**0.4%**
Acute myocardial infarction								
Risk Ratio	-	-	**1.33**	-	**1.21**	**0.97**		
95 CI	-	-	**(1.12, 1.59)**	-	**(1.13, 1.30)**	**(0.93, 1.02)**		
Black Patient Count in this clinical group	30	6	**161**	53	**1,023**	**2,055**	**3,328**	**1.7%**
White Patient Count in this clinical group	66	18	**492**	297	**4,515**	**14,957**	**20,345**	**1.8%**
Cardiac arrest and ventricular fibrillation								
Risk Ratio	-	-	**1.30**	-	**1.92**	**1.80**		
95 CI	-	-	**(1.00, 1.71)**	-	**(1.72, 2.15)**	**(1.68, 1.92)**		
Black Patient Count in this clinical group	33	2	**70**	15	**421**	**1,069**	**1,610**	**0.8%**
White Patient Count in this clinical group	85	16	**219**	81	**1,172**	**4,207**	**5,780**	**0.5%**
Congestive heart failure, nonhypertensive								
Risk Ratio	**2.16**	**2.75**	**1.89**	**2.25**	**1.75**	**1.07**		
95 CI	**(1.69, 2.75)**	**(1.38, 5.46)**	**(1.71, 2.09)**	**(1.89, 2.69)**	**(1.69, 1.81)**	**(1.05, 1.09)**		
Black Patient Count in this clinical group	**112**	**11**	**545**	**163**	**4,313**	**10,477**	**15,621**	**7.8%**
White Patient Count in this clinical group	**157**	**31**	**1,174**	**497**	**13,170**	**69,134**	**84,163**	**7.3%**
Pulmonary heart disease								
Risk Ratio	**1.10**	-	**1.49**	**1.71**	**1.49**	**1.26**		
95 CI	**(0.87, 1.39)**	-	**(1.26, 1.75)**	**(1.36, 2.16)**	**(1.41, 1.57)**	**(1.21, 1.31)**		
Black Patient Count in this clinical group	**97**	16	**194**	**87**	**1,531**	**2,890**	**4,815**	**2.4%**
White Patient Count in this clinical group	**266**	103	**532**	**349**	**5,505**	**16,255**	**23,010**	**2.0%**
*Hypertension with complications and secondary hypertension								
Risk Ratio	**2.56**	**3.81**	**2.68**	**3.14**	**2.27**	**1.51**		
95 CI	**(2.15, 3.05)**	**(2.52, 5.78)**	**(2.48, 2.91)**	**(2.79, 3.52)**	**(2.21, 2.33)**	**(1.49, 1.54)**		
Black Patient Count in this clinical group	**231**	**33**	**946**	**398**	**7,891**	**16,492**	**25,991**	**12.9%**
White Patient Count in this clinical group	**273**	**67**	**1,437**	**872**	**18,604**	**77,203**	**98,456**	**8.6%**

*This is one of 4 hypertension categories in the CCS clinical classification system, and is separate from Essential Hypertension.

FIGURE 3: CARDIOVASCULAR DISEASE RISK RATIOS COMPARING 3-YEAR PREVALENCE (2017-2019) FOR BLACK AND WHITE MEN IN DIFFERENT AGE BANDS

Prevalence risk ratio for Black men compared to white men								
Total Black unique male members in database	19,351	5,215	13,909	7,802	34,317	39,991	120,585	
Total white unique male members in database	66,894	45,275	58,622	72,452	230,946	392,588	866,777	
Average Member Years per Black male member	1.41	1.46	1.51	1.56	2.10	2.06	1.85	
Average Member Years per white male member	1.57	1.61	1.65	1.83	2.35	2.43	2.17	
Healthcare insurance coverage	**Medicaid**	**Commercial**	**Medicaid**	**Commercial**	**Medicare**	**Medicare**	**Total**	**2017-2019**
Age group	**20-39**	**20-39**	**40-64**	**40-64**	**65-69**	**70+**	**20+**	**prevalence**
CCS clinical category								
Acute cerebrovascular disease								
Risk Ratio	-	-	**1.36**	**1.34**	**1.51**	**1.08**		
95 CI	-	-	**(1.21, 1.53)**	**(1.08, 1.67)**	**(1.44, 1.58)**	**(1.05, 1.12)**		
Black Patient Count in this clinical group	55	10	**351**	**90**	**2,262**	**3,475**	**6,243**	**5.2%**
White Patient Count in this clinical group	190	50	**1,089**	**624**	**10,082**	**31,477**	**43,512**	**5.0%**
Late effects of cerebrovascular disease								
Risk Ratio	-	-	**1.74**	**1.60**	**2.22**	**1.48**		
95 CI	-	-	**(1.44, 2.09)**	**(1.06, 2.40)**	**(2.07, 2.37)**	**(1.41, 1.56)**		
Black Patient Count in this clinical group	18	3	**156**	**27**	**1,154**	**1,814**	**3,172**	**2.6%**
White Patient Count in this clinical group	42	6	**378**	**157**	**3,506**	**12,009**	**16,098**	**1.9%**
Aortic and peripheral arterial embolism or thrombosis								
Risk Ratio	-	-	0.69	**1.74**	**1.20**	**1.18**		
95 CI	-	-	(0.47, 1.00)	**(1.00, 3.02)**	**(1.06, 1.36)**	**(1.06, 1.32)**		
Black Patient Count in this clinical group	3	2	31	**15**	**276**	**378**	**705**	**0.6%**
White Patient Count in this clinical group	20	5	190	**80**	**1,546**	**3,134**	**4,975**	**0.6%**
Acute myocardial infarction								
Risk Ratio	**1.77**	-	**1.04**	**0.95**	**1.02**	**0.88**		
95 CI	**(1.22, 2.58)**	-	**(0.90, 1.22)**	**(0.74, 1.22)**	**(0.95, 1.08)**	**(0.84, 0.93)**		
Black Patient Count in this clinical group	**41**	8	**203**	**65**	**1,051**	**1,491**	**2,859**	**2.4%**
White Patient Count in this clinical group	**80**	32	**820**	**636**	**6,962**	**16,541**	**25,071**	**2.9%**
Cardiac arrest and ventricular fibrillation								
Risk Ratio	-	-	**1.44**	-	**1.70**	**1.41**		
95 CI	-	-	**(1.16, 1.78)**	-	**(1.54, 1.87)**	**(1.31, 1.52)**		
Black Patient Count in this clinical group	36	1	**112**	18	**487**	**806**	**1,460**	**1.2%**
White Patient Count in this clinical group	123	26	**328**	158	**1,933**	**5,593**	**8,161**	**0.9%**
Congestive heart failure, nonhypertensive								
Risk Ratio	**1.72**	**3.39**	**1.46**	**2.23**	**1.56**	**0.99**		
95 CI	**(1.32, 2.23)**	**(1.90, 6.03)**	**(1.33, 1.61)**	**(1.89, 2.62)**	**(1.51, 1.62)**	**(0.97, 1.01)**		
Black Patient Count in this clinical group	**83**	**16**	**550**	**176**	**3,631**	**6,116**	**10,572**	**8.8%**
White Patient Count in this clinical group	**167**	**41**	**1,585**	**734**	**15,654**	**60,701**	**78,882**	**9.1%**
Pulmonary heart disease								
Risk Ratio	-	-	**1.24**	-	**1.23**	**1.18**		
95 CI	-	-	**(1.02, 1.51)**	-	**(1.15, 1.33)**	**(1.12, 1.25)**		
Black Patient Count in this clinical group	33	8	**131**	47	**823**	**1,313**	**2,355**	**2.0%**
White Patient Count in this clinical group	137	40	**445**	355	**4,485**	**10,885**	**16,347**	**1.9%**
*Hypertension with complications and secondary hypertension								
Risk Ratio	**2.12**	**3.38**	**2.32**	**3.07**	**2.00**	**1.42**		
95 CI	**(1.74, 2.58)**	**(2.29, 4.98)**	**(2.14, 2.51)**	**(2.73, 3.45)**	**(1.94, 2.05)**	**(1.39, 1.45)**		
Black Patient Count in this clinical group	**155**	**35**	**876**	**356**	**5,628**	**8,959**	**16,009**	**13.3%**
White Patient Count in this clinical group	**253**	**90**	**1,592**	**1,077**	**18,946**	**61,885**	**83,843**	**9.7%**

*This is one of 4 hypertension categories in the CCS clinical classification system, and is separate from Essential Hypertension.

We determined the average Member Years per insured member, defined as the average number of years of healthcare claims data for an individual, to confirm that none of the study groups exhibited an atypically high degree of churn in health insurance enrollment. Patterns appear to be consistent across this data set and within reasonable expectations.

A feature of our data set is the larger volume of Medicare beneficiaries, partly due to the larger proportion of Medicare beneficiaries with race and ethnicity information, and partly due to the natural history and typical onset of the cardiovascular conditions studied.

This means that our estimates of the condition prevalence rates for the total population age 20+ are influenced by the greater volume of older patients, and by the disproportionately higher volume of older white patients than black.

In Figure 3, we noticed that the total number of Black male unique patients in the 70+ age band was only 17% higher than the 65-69 age group, while the total number of white male unique patients was 70% higher in the 70+ age band than ages 65-69. Similar trends occurred for women in Figure 2, with the total number of Black female unique patients being 35% higher in the 70+ age group than the 65-69 age band, while the total number of white females aging into the 70+ age group grew by 78% compared to the 65-69 age band.

This is consistent with statistics from the U.S. Census Bureau,[28] which reported that the median age for Black Americans was 32.3 years in 2019 (up from 30.6 in 2010) while the median age for white Americans was 39.5 years (up from 38.4 in 2010). Other publications have studied racial differences in mortality. [29,30]

Specific highlights from our prevalence analyses, by age group, include:

- For ages 20 to 39 years:
  - For the population enrolled in Medicaid, hypertension with complications and secondary hypertension and congestive heart failure occurred approximately twice as often among Black women and men, compared to white women and men. This CCS category does not include essential hypertension.
  - For commercially insured populations, hypertension with complications and secondary hypertension occurred approximately three times more often in Black women and men than in white women and men. Most other cardiovascular conditions occurred at such low volumes in the subset of commercially insured patients with race and ethnicity information that confidence intervals were too wide and risk ratios could not be determined.
  - Acute myocardial infarction was expectedly low in the 20-39 age group enrolled in Medicaid, yet measurably higher in Black compared to white males.
- For ages 40 to 64 years:
  - Acute cerebrovascular disease (stroke) was estimated to be 1.6 to 1.7 times more likely in Black women compared to white for both Medicaid and commercially insured populations.
  - For commercially insured populations, hypertension with complications and secondary hypertension was approximately three times more likely in Black women and men, compared to white. For Medicaid-enrolled populations, prevalence was approximately 2.3 to 2.7 times higher in Black compared to white men and women in our data set.
  - Congestive heart failure (non-hypertensive) was approximately 2.3 times more likely in Black women and 2.2 times more likely in Black men compared to white women and men for the commercially insured population, and 1.9 and 1.5 times more prevalent in Black women and men compared to white for Medicaid enrollees in our study data set.
- For ages 65 to 69 years, covered by Medicare (includes Medicare Advantage and Medicare fee-for-service):
  - Late effects of cerebrovascular disease occurred at 2.3 and 2.2 times higher rates in Black women and men, than in white women and men.
  - Hypertension with complications and secondary hypertension continue to exhibit higher prevalence among Black women, at 2.3 times the rates in white women, and 2.0 times higher in Black men compared to white men. This CCS category does not include essential hypertension.
- For ages 70 years and older, covered by Medicare, differences in condition prevalence between Black and white patients are narrower.

We reviewed other published reports of prevalence rates for similar three- to four-year time spans, to check the validity of our findings. We noted that prevalence estimates may vary between studies due to use of different data sources and different population samples in each study. Some studies have relied on self-reported survey information from National Health and Nutrition Examination Survey (NHANES).

[28] U.S. Census Bureau. 65 and Older Population Grows Rapidly as Baby Boomers Age. June 2020. Release Number CB20-99. Retrieved March 25, 2021 from https://www.census.gov/newsroom/press-releases/2020/65-older-population-grows.html.

[29] Bond, Jermane, Herman, Allen. Lagging Life Expectancy for Black Men: A Public Health Imperative. American Journal of Public Health 2016 July:106(7): 1167-1169. Retrieved March 25, 2021 from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4984780.

[30] Centers for Disease Control and Prevention (2017) Table 15. Life expectancy at birth, at age 65, and at age 75, by sex, race, and Hispanic origin: United States, selected years 1900–2016. Retrieved March 25, 2021 from https://www.cdc.gov/nchs/data/hus/2017/015.pdf.

For example, we compared our data set estimates of stroke (acute cerebrovascular disease) prevalence rates for populations age 20+ to those reported in the American Heart Association (AHA) Heart Disease and Stroke Statistics,[31] which had used NHANES 2013-2016 data. We found that our prevalence estimates were about 1.25 times higher for Black females and about 1.6 times higher for Black males, compared to that report. Similarly, our estimates of stroke prevalence rates in white women and men were about 1.8 and 2.0 times higher than the AHA report.

These differences may be related to the age characteristics of our data subset with race and ethnicity information. In our study data set, 73% of white females, 72% of white males, 66% of Black females, and 62% of Black males were age 65+, which is approximately three to four times the proportion of individuals age 65+ in the NHANES 2013-2016 data for a population age 20+ years.

Analysis of provider patterns of care

Prior studies have suggested that Black patients were less likely to receive angiography and percutaneous coronary intervention (PCI) procedures than white patients of the same age and gender.[32] Using the Milliman MedInsight Emerging Experience research data set, previously described, we conducted statistical analyses to assess coronary angiography and PCI rates in white patients compared to Black patients, males and females, at provider facilities defined by the National Provider Identifier (NPI).

Claims data do not include any information on whether the patient was symptomatic or asymptomatic at the time of the procedure.[33] However, our analysis focused only on patients with nonspecific chest pain or atherosclerosis and other heart disease, as defined by CCS clinical categories. Under coronary angiographies, we included left heart and right heart cardiac catheterizations, coronary angiographies and ventriculography, captured by the Healthcare Common Procedure Coding System (HCPCS). We cannot comment on appropriate use.[34]

- For each AHRQ CCS cardiovascular category, our analysis focused on provider facilities that saw at least 20 Black and 20 white patients during the 2017-2019 period and that conducted at least 20 angiography procedures or 20 PCI procedures per year. The two CCS categories that met this analytic cutoff were Nonspecific Chest Pain and Coronary Atherosclerosis. A total of 82 provider entities met the above inclusion criteria. We used the billing provider NPI code to define providers. Prevalence rates of nonspecific chest pain in our study data set are similar between Black and white patients in all age, gender, and insurance coverage groups.
- Coronary atherosclerosis occurred more frequently in white men aged 40 and above compared to Black men for all insurance coverage groups. Prevalence of coronary atherosclerosis was similar between Black and white women in all age bands and insurance coverage groups in our data set.

The null hypothesis is that there is no difference between procedure rates in the Black and white patients seen by a specific provider entity. We used chi-squared tests to evaluate the research hypothesis that there is a difference in the distribution between Black and white patients seen by that provider.

Each provider was independently assessed, and the chi-squared analysis only included the patients that provider saw. Providers are not compared to each other. The rates of angiographies in the entire data set do not affect the chi-squared test of an individual provider entity.

[31] Virani S., Alonso A., Benjamin E., et al. Ibid. Chapter 14.

[32] Bonow, Robert, et al. (March 15, 2005). The cardiovascular state of the union: Confronting healthcare disparities. Circulation, American Heart Association, vol 111, no. 10, pp. 1205-7. Retrieved March 2, 2021 from https://doi.org/10.1161/01.CIR.0000160705.97642.92.

[33] Bradley SM, Spertus JA, Kennedy KF, et al. Patient Selection for Diagnostic Coronary Angiography and Hospital-Level Percutaneous Coronary Intervention Appropriateness: Insights From the National Cardiovascular Data Registry. JAMA Intern Med. 2014;174(10):1630–1639. Retrieved November 30, 2020 from doi:10.1001/jamainternmed.2014.3904.

[34] Patel, M.R., Bailey, S.R., Bonow, R.O., et al. ACCF/SCAI/AATS/AHA/ASE/ASNC/HFSA/HRS/SCCM/SCCT/SCMR/STS 2012 Appropriate Use Criteria for Diagnostic Catheterization: A Report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, Society for Cardiovascular Angiography and Interventions, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Failure Society of America, Heart Rhythm Society, Society of Critical Care Medicine, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and Society of Thoracic Surgeons. J Am Coll Cardiol. 2012 May, 59 (22) 1995–2027. Retrieved November 30, 2020 from https://www.jacc.org/doi/full/10.1016/j.jacc.2012.03.003.

The grid chart in Figure 4 visualizes the chi-squared results. Columns indicate the ranges of chi-squared standard residuals for male patients, while rows indicate ranges of standard residuals for female patients.

- A chi-squared standard residual >=|2.0| can be thought of as being at least two standard deviations from "no difference", and is described as "very likely higher". The corner squares indicate "very likely higher" for both male and female patients.
- "Likely higher" represents a chi-squared standard residual between |2.0| and |1.0|, similar to one standard deviation from "no difference", and the number of providers in this range is shown in the neighboring squares.
- The null hypothesis, chi-squared standard residual = 0 up to <|1.0|, represents providers whose distribution of procedures exhibited "no difference" among the male or female Black and white patients seen by that provider, shown in the central square.

Grid squares in yellow contain providers whose distribution of procedures tended toward a higher likelihood of the procedure in white patients compared to Black patients in the same CCS diagnostic category. The top left corner square indicates similar patterns for male and female patients. Grid squares in green contain providers whose distribution of procedures tended toward a higher likelihood of the procedure in Black patients compared to white patients in the same CCS diagnostic category. The bottom right corner square indicates similar patterns for male and female patients.

Some providers did not meet inclusion criteria for one gender, and were shown on the grid in the gray penultimate column and row. Total providers are shown in the outermost column and row of the grid.

Results for the Medicaid patient population in the nonspecific chest pain diagnostic category are described fully in the next few figures. For ease of reading, we have placed similar subsequent analyses of Medicaid patients with coronary atherosclerosis, and Medicare patients with either nonspecific chest pain or coronary atherosclerosis, in Appendix B in the Supplemental Information.

FIGURE 4A: PRACTICE DISTRIBUTION OF DIFFERENCES BETWEEN ANGIOGRAPHY RATES FOR BLACK AND WHITE, MALE AND FEMALE MEDICAID PATIENTS DIAGNOSED WITH NONSPECIFIC CHEST PAIN (2017-2019)

Difference in Practice Angiography Rates for Female Patients	≥20 Female Angiography Procedures	Difference in Practice Angiography Rates for Male Patients: ≥20 Male Angiography Procedures: Very likely higher in white	Likely higher in white	Unlikely any difference	Likely higher in black	Very likely higher in black	<20 Male Angiography Procedures	Total
	Very likely higher in white	**5**	**2**				1	8
	Likely higher in white	**3**	**4**	**11**	**1**		4	23
	Unlikely any difference	**2**	**6**	**19**	**1**		4	32
	Likely higher in black				**3**		2	5
	Very likely higher in black			**2**	**1**			3
	<20 Female Angiography Procedures	1	1	4	1			
	Total	11	13	36	7	0		

FIGURE 4B: PRACTICE DISTRIBUTION OF DIFFERENCES BETWEEN PCI RATES FOR BLACK AND WHITE, MALE AND FEMALE MEDICAID PATIENTS DIAGNOSED WITH NONSPECIFIC CHEST PAIN (2017-2019)

Difference in Practice PCI Rates for Female Patients	Difference in Practice PCI Rates for Male Patients						
	≥20 Male PCI Procedures					<20 Male PCI Procedures	Total
	Very likely higher in white	Likely higher in white	Unlikely any difference	Likely higher in black	Very likely higher in black		
≥20 Female PCI Procedures: Very likely higher in white	2	2				1	5
≥20 Female PCI Procedures: Likely higher in white	3	4	3	1		4	15
≥20 Female PCI Procedures: Unlikely any difference	4	3	10			4	21
≥20 Female PCI Procedures: Likely higher in black						1	1
≥20 Female PCI Procedures: Very likely higher in black							0
<20 Female PCI Procedures	3	4	7				
Total	12	13	20	1	0		

A greater number of providers in the yellow compared to green grid squares suggests that some practices exhibit a greater likelihood of conducting procedures in white patients compared to Black. We wanted to study this further and determine statistical significance.

Figure 5 provides additional detail on the volume of Medicaid patients seen and procedures conducted by the providers shown in the Figure 4 grid charts and tests of statistical significance defined as a probability p <= 0.05 that observed differences are due to chance. Providers that met inclusion criteria saw an average of 650 white and 421 Black Medicaid enrollees with nonspecific chest pain.

FIGURE 5: MEMBER DISTRIBUTION FOR ANGIOGRAPHIES AND PCI PROCEDURES IN BLACK AND WHITE MEDICAID PATIENTS DIAGNOSED WITH NONSPECIFIC CHEST PAIN (2017-2019)

	TOTAL WHITE PATIENTS	TOTAL ANGIOGRAPHIES IN WHITE PATIENTS	TOTAL BLACK PATIENTS	TOTAL ANGIOGRAPHIES IN BLACK PATIENTS	ANGIOGRAPHY RATE IN WHITE PATIENTS	ANGIOGRAPHY RATE IN BLACK PATIENTS	CHIX P-VALUE
F	30,636	1,884	22,344	1,256	6.1%	5.6%	0.012
M	21,870	2,043	13,295	1,030	9.3%	7.7%	<0.001

	TOTAL WHITE PATIENTS	TOTAL PCIs IN WHITE PATIENTS	TOTAL BLACK PATIENTS	TOTAL PCIs IN BLACK PATIENTS	PCI RATE IN WHITE PATIENTS	PCI RATE IN BLACK PATIENTS	CHIX P-VALUE
F	21,625	1,223	14,292	710	5.7%	5.0%	<0.001
M	18,371	1,322	10,206	535	7.2%	5.2%	<0.001

Our provider analysis results suggest differences in provider practice patterns by patient race for Black and white patients seen at those practices. ChiX p-values indicate that differences are statistically significant. In Medicaid patients with nonspecific chest pain, 78 provider practices met the inclusion criteria for angiographies, and 56 practices met inclusion criteria for PCI procedures. As we described earlier, the prevalence of nonspecific chest pain was similar between Black and white populations.

Similar analyses for Medicaid patients with coronary atherosclerosis are shown in Appendix B in the Supplemental Information. In Medicaid patients with coronary atherosclerosis, 42 provider practices met the inclusion criteria for angiographies and 28 practices for PCI procedures. ChiX p-values indicate that differences were statistically significant for male patients. Providers that met inclusion criteria saw an average of 203 white and 135 Black Medicaid enrollees with coronary atherosclerosis.

Differences in practice patterns for Black and white patients were also statistically significant for Medicare patients with nonspecific chest pain for both angiography and PCI rates. In our analysis, 69 practices meet inclusion criteria for angiographies and 57 practices for PCI procedures in Medicare patients with nonspecific chest pain. These providers saw an average of 1,298 white and 182 Black Medicare beneficiaries with nonspecific chest pain.

Similarly, in Medicare patients with coronary atherosclerosis, 62 practices met inclusion criteria for angiographies and 51 practices for PCI procedures, and showed statistically significant differences between these procedure rates in Black and white patients, except for angiographies in male Medicare patients with coronary atherosclerosis. These analyses are shown in Appendix B. These providers saw an average of 1,505 white and 152 Black Medicare beneficiaries with coronary atherosclerosis.

Without clinical information, we cannot speculate on whether these high-level differences between Black and white patients in our study are related to differences in clinical severity, signs and symptoms, comorbidities, risk factors, patient clinical history, or other clinical considerations. Facilities could assess whether such differences occur in their populations and investigate possible patient, provider, and policy-influenced root causes.

Looking to the future

Our research identified disparities, comparing cardiovascular disease prevalence rates and differences in provider practice patterns as they relate to treatment of Black people and white people. Through a focused literature search and review of other related studies, we identified a number of factors that can contribute to racial disparities in cardiovascular disease and health overall. Here we discuss three of those factors—racism, implicit bias, and data insufficiency—and approaches that healthcare organizations can take to addressing racial disparities in cardiovascular disease and more broadly to achieve equity in healthcare.

> "The sources of these disparities are complex, are rooted in historic and contemporary inequities, and involve many participants at several levels, including health systems, their administrative and bureaucratic processes, utilization managers, healthcare professionals, and patients."
>
> – IOM 2002, Unequal Treatment

RACISM

In the United States, while racism is recognized as a long-standing contributing factor to health disparities, there has been limited progress toward resolving the issue.[35] Just 20 years ago, the Institute of Medicine (IOM) issued a landmark report "Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care." Even after accounting for differences such as access to care and socioeconomic conditions, race and ethnicity remain significant predictors of the quality of healthcare received; "bias, prejudice, and stereotyping on the part of health care providers may contribute to differences in care," the report says.[36] Racial differences result in the experience of a lower quality of care and outcomes. More recently,

[35] Williams, David R. & Sternthal, Michelle (October 8, 2010). Understanding racial/ethnic disparities in health: Sociological contributions. *J Health Soc Behav*. 51(Suppl): S15–S27. Retrieved March 2, 2021 from https://journals.sagepub.com/doi/10.1177/0022146510383838?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&rfr_dat=cr_pub%3Dpubmed&.

[36] Unequal Treatment, Ibid.

in a 2020 survey on race and health, more than 65% of Black respondents reported that structural or systemic racism, unconscious bias, racism, and discrimination have been personal obstacles in their lives, and major obstacles to achieving equal outcomes. [37]

The sources of racial disparities can be deep-rooted, and healthcare organizations can play a significant role in eliminating them. "Leading from the inside-out"[38] is one approach that healthcare organizations might take to actively identify and address racism from within. A growing number of resources, tool kits, and training are available for healthcare organizations to use in their approaches. A few examples include Racial Equity Tools,[39] Race Forward,[40] and the Institute for Healthcare Improvement (IHI).[41]

> "As leaders for equity, we have to examine, unpack and mitigate our own biases *and* dismantle the policies and structures that hold inequity in place. We call this leading from the inside-out."
>
> – National Equity Project

IMPLICIT BIAS

Implicit bias is another factor that can contribute to differences in provider practice patterns and care received. Most, if not all, healthcare professionals would clearly deny racial bias and denounce racism, but studies continue to demonstrate implicit bias at play in treatment, care, and outcomes.[42] Implicit bias is "the process of associating stereotypes or attitudes towards categories of people without conscious awareness." [43] Where bias is a negative attitude held about a group of people relative to another group, implicit bias—these negative associations—operate unintentionally or unconsciously. Studies show that our implicit bias influences our behavior more directly than our explicit or expressly held viewpoints.[44] These built-in blind spots can affect both the delivery of care and health outcomes.

Raising awareness and recognition of implicit bias is an approach that healthcare organizations and individual providers can take to reduce racial disparities. The Implicit Association Test (IAT) is a useful tool that is free and publicly available. The IAT was developed in the 1990s, has been used by millions, and is available online through Harvard's Project Implicit.[45,46] Revealing blind spots can be an eye-opener for individuals and organizations alike, and can be a key step to achieving equity in provider patterns of care. The IAT tool is available online at Project Implicit (harvard.edu).

RACE AND ETHNICITY DATA

Another contributing factor, highlighted by our own research and literature review, is the lack of consistent and accurate race and ethnicity data. As we found with our study, race and ethnicity data are often incomplete, unknown, purposefully omitted, or not collected by healthcare organizations. This is a significant institutional barrier to measuring and addressing racial health disparities. Even since the introduction of Patient Protection and Affordable Care Act (ACA) requirements to collect race, ethnicity, and language (REaL) data, the data is lacking. For example, one study showed 2015 completion rates for race below 50% for Medicare plans, below 20% for commercial plans, and below 10% for Medicaid plans. Completion rates for ethnicity fared even worse.[47] The relevance of consistent race and ethnicity data collection cannot be understated.

[37] Hamel, Liz, et al. (October 2020). Race, Health, and COVID-19: The Views and Experiences of Black Americans. Kaiser Family Foundation. Retrieved March 2, 2021, from http://files.kff.org/attachment/Report-Race-Health-and-COVID-19-The-Views-and-Experiences-of-Black-Americans.pdf.

[38] See the National Equity Project website at https://www.nationalequityproject.org/.

[39] See the Racial Equity Tools website at https://www.racialequitytools.org/.

[40] See the Race Forward website at https://www.raceforward.org/.

[41] See the Institute for Healthcare Improvement website at http://www.ihi.org/Pages/default.aspx.

[42] Bowen Matthew, Dayna. *Just Medicine. A Cure for Racial Inequality in American Health Care.* New York University Press, 2015, pp. 34, 37.

[43] Osta, Kathleen & Vasquez, Hugh. (June 13, 2019). Don't talk about implicit bias without talking about structural racism. National Equity Project. Retrieved March 2, 2021, from https://medium.com/national-equity-project/implicit-bias-structural-racism-6c52cf0f4a92.

[44] Bowen Matthew, Dayna, Ibid., P. 39.

[45] Sleek, Scott (January 31, 2018). The Bias Beneath: Two Decades of Measuring Implicit Associations. Association for Psychological Science. Retrieved March 2, 2021, from https://www.psychologicalscience.org/observer/the-bias-beneath-two-decades-of-measuring-implicit-associations.

[46] The IAT is available at https://implicit.harvard.edu/implicit/takeatest.html.

[47] Ng, Judy, et al. (March 2017). Data on Race, Ethnicity, and Language Largely Incomplete For Management Care Plan Members. Health Affairs, vol. 36, No. 3. Retrieved March 2, 2021 from https://www.healthaffairs.org/doi/full/10.1377/hlthaff.2016.1044.

Identifying and addressing racial disparities in cardiovascular conditions as well as health disparities overall require race and ethnicity data. Accurate and consistent data collection is essential to taking appropriate, data-driven action.[48] Using a standardized tool and collecting race and ethnicity data consistently is one approach that healthcare organizations can use to evaluate and address disparities in care. Using the expanded Office of Management and Budget (OMB) categories, for example, can provide healthcare organizations with a common yardstick for collecting data, setting goals, comparing results, and measuring progress toward eliminating disparities. Several REaL data collection and utilization best practice guides and tool kits are available to healthcare organizations. The "We Ask Because We Care" campaign resources, for example, provides an approach and tools that may alleviate patient concerns about privacy, discrimination, and potential misuse of the data.[49] With consistent collection and appropriate use of self-reported REaL data, healthcare organizations will have greater insight into disparity gaps and the ability to address root causes within their own systems.

> "The first step in achieving healthcare equity is to capture accurate and complete race and ethnicity demographic data. With better information, healthcare organizations can begin identifying and addressing drivers of inequity."
>
> – American Heart Association, Target:BP

Conclusion

Healthcare organizations can play a significant role in closing the racial disparity gap. "Leading from the inside-out" to address structural racism, raising awareness of implicit bias to resolve "blind spots," and consistently collecting and using data to quantify and reduce gaps are just three approaches that healthcare organizations can consider taking to reduce racial disparities in cardiovascular conditions. Using a combination of these three approaches and leveraging the readily available resources may serve healthcare organizations well with the necessary work to reduce racial disparities in cardiovascular conditions and in the overall health of our communities. Undoubtedly, readers of this paper will think of additional approaches and work to be done.

Milliman is committed to shining a light on racial disparities through objective analysis and research. Through our study of racial disparities in cardiovascular disease we have contributed new research findings and offered approaches that healthcare professionals, providers, and organizations might consider in their work toward achieving health equity.

The authors of this paper are four colleagues with strikingly different backgrounds united around a single cause, with sometimes contradicting perspectives and experiences. As we have traveled the journey developing this paper, it is remarkable how much we have learned individually and collectively from our research, data analysis, and from each other. We encourage you on your own journeys. When healthcare professionals, providers, and organizations work to bring equity across the healthcare delivery system, disparities in healthcare can be eliminated.

[48] American Heart Association, Race & Ethnicity Data Collection Essentials, Ibid.

[49] American Hospital Association (Dec 2020). Health Equity Snapshot: A Toolkit for Action. Retrieved March 13, 2021 from https://www.aha.org/system/files/media/file/2020/12/ifdhe_snapshot_survey_FINAL.pdf.

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ACKNOWLEDGMENTS

The authors would like to thank the following individuals for their contributions to the production of this research paper.

Andrew Naugle, MBA Principal and Healthcare Management Consultant, Rich Moyer, Principal and Chief Product Officer MedInsight, Marlene Howard, FSAA, MAAA, Milliman Principal and Consulting Actuary for peer review.

Thomas Pu, MHI; Dale Skinner, MS; and Leena Laloo, MBBS, CPC for data analysis; and Dominic Patacsil, Analyst for research and editorial support.

CAVEATS

The observations described in this paper are not necessarily applicable to any specific organization. Users of the information provided in this paper should be advised by professionals with experience in relevant domains. The information presented here is subject to change based on new research findings, changes in regulations or legislation, and the emergence of actual experience.

In performing our study, we relied on the emerging experience research data set of Milliman MedInsight® in accordance with permissible use, and on external, publicly available data. We have not audited or verified this data and other information. If the underlying data or information is inaccurate or incomplete, the results of our analysis may likewise be inaccurate or incomplete.

The opinions provided in this presentation are those of the authors and should not be attributed to Milliman, Inc.

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Appendix A

DATA SOURCES AND METHODOLOGY

Our study is based on the Milliman MedInsight Emerging Experience 2017-2021 research data set of encrypted de-identified healthcare claims data for individuals nationwide enrolled in commercial insurance plans, Medicaid managed care, Medicare fee-for-service (MFFS), and Medicare Advantage plans, including dual eligible members. This study focuses on the period from January 2017 to December 2019.

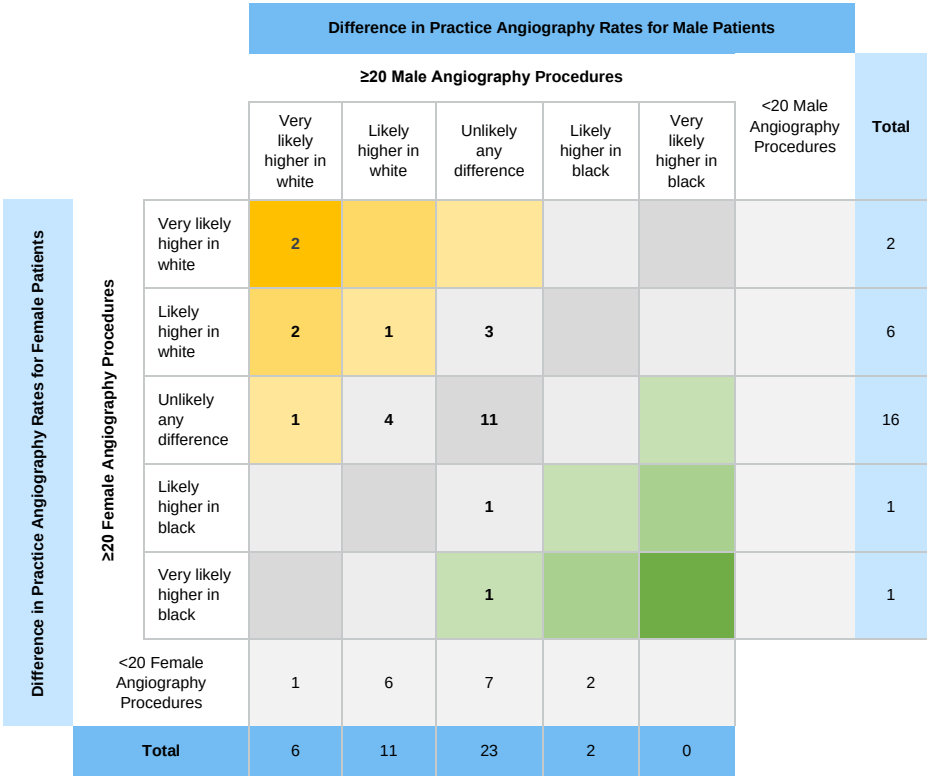
- The de-identified research dataset used for this study includes multiple data contributors in every category of health insurance. None of the individual contributors can be recognized in the aggregate results.
- All data are de-identified and reported in aggregate.
- The data set uses medical and pharmacy claims data to obtain utilization, cost, and quality trends.
- The data set includes membership and demographic information using enrollment data to summarize medical-eligible member months and pharmacy-eligible member months.
- Claims-based measures have the advantage of providing a more comprehensive look at all the healthcare utilization incurred across different provider entities and care settings, including inpatient, outpatient, professional, ancillary, and pharmacy care, and can identify diagnostic and procedural codes.
- AHRQ Clinical Classification Software (CCS) is an industry standard that was used to organize the healthcare claims data for individuals diagnosed with CCS-defined categories of clinical conditions.

DATA ANALYSIS CAVEATS AND LIMITATIONS

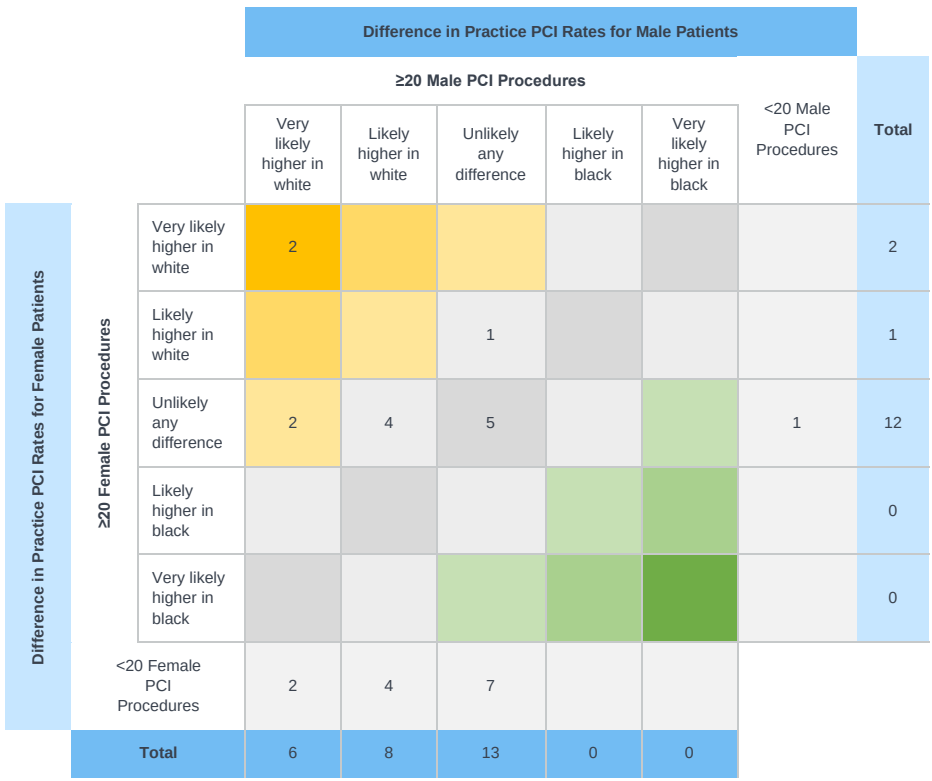
- Measures reflect only the measures amenable to claims-based measurement.
- Administrative data lack clinical details, such as lab values, clinical notes, and plans of care.
- The utilization and cost data used here do not represent the full national results or any specific area. It is a sample of near-real-time emerging data, useful for comparisons or observations on emerging experience.
- The study sample does not include information about uninsured individuals.

Appendix B: Provider practice distribution analyses

Practice distribution of differences between angiography rates for Black and white, male and female Medicaid patients diagnosed with coronary atherosclerosis (2017-2019)



Difference in Practice Angiography Rates for Female Patients	Difference in Practice Angiography Rates for Male Patients: ≥20 Male Angiography Procedures — Very likely higher in white	Likely higher in white	Unlikely any difference	Likely higher in black	Very likely higher in black	<20 Male Angiography Procedures	Total
≥20 Female Angiography Procedures: Very likely higher in white	2						2
Likely higher in white	2	1	3				6
Unlikely any difference	1	4	11				16
Likely higher in black			1				1
Very likely higher in black			1				1
<20 Female Angiography Procedures	1	6	7	2			
Total	6	11	23	2	0		



Difference in Practice PCI Rates for Female Patients	Difference in Practice PCI Rates for Male Patients: ≥20 Male PCI Procedures — Very likely higher in white	Likely higher in white	Unlikely any difference	Likely higher in black	Very likely higher in black	<20 Male PCI Procedures	Total
≥20 Female PCI Procedures: Very likely higher in white	2						2
Likely higher in white			1				1
Unlikely any difference	2	4	5			1	12
Likely higher in black							0
Very likely higher in black							0
<20 Female PCI Procedures	2	4	7				
Total	6	8	13	0	0		

Member distribution for angiographies and PCI procedures in Black and white Medicaid patients diagnosed with coronary atherosclerosis (2017-2019)

	TOTAL WHITE PATIENTS	TOTAL ANGIOGRAPHIES IN WHITE PATIENTS	TOTAL BLACK PATIENTS	TOTAL ANGIOGRAPHIES IN BLACK PATIENTS	ANGIOGRAPHY RATE IN WHITE PATIENTS	ANGIOGRAPHY RATE IN BLACK PATIENTS	CHIX P-VALUE
F	3,062	799	2,538	623	26.1%	24.5%	0.196
M	5,424	1,396	3,031	639	25.7%	21.1%	<0.001

	TOTAL WHITE PATIENTS	TOTAL PCIs IN WHITE PATIENTS	TOTAL BLACK PATIENTS	TOTAL PCIs IN BLACK PATIENTS	PCI RATE IN WHITE PATIENTS	PCI RATE IN BLACK PATIENTS	CHIX P-VALUE
F*	2,110	382	1,727	353	18.1%	20.4%	0.074
M	3,823	765	2,260	347	20.0%	15.4%	<0.001

* This phenomenon is observed because there is one practice that performed 130 angiographies among Black females. Although this practice performed angiographies among white females at a higher rate than Black females, the population served was smaller.

Practice distribution of differences between angiography rates and PCI rates for Black and white, male and female Medicare patients diagnosed with nonspecific chest pain (2017-2019)

Difference in Practice Angiography Rates for Female Patients	Difference in Practice Angiography Rates for Male Patients: ≥20 Male Angiography Procedures: Very likely higher in white	Likely higher in white	Unlikely any difference	Likely higher in black	Very likely higher in black	<20 Male Angiography Procedures	Total
≥20 Female Angiography Procedures: Very likely higher in white	1	2	2			1	6
Likely higher in white		5	4	1		7	17
Unlikely any difference	1	4	9	1		18	33
Likely higher in black	1	1	6	1		1	10
Very likely higher in black				1		1	2
<20 Female Angiography Procedures			1				
Total	3	12	22	4	0		

Difference in Practice PCI Rates for Female Patients	Difference in Practice PCI Rates for Male Patients: ≥20 Male PCI Procedures: Very likely higher in white	Likely higher in white	Unlikely any difference	Likely higher in black	Very likely higher in black	<20 Male PCI Procedures	Total
≥20 Female PCI Procedures: Very likely higher in white	1	3	1			1	6
Likely higher in white		2	2		1	5	10
Unlikely any difference		7	9	1		11	28
Likely higher in black		3	1			1	5
Very likely higher in black				1	1	1	3
<20 Female PCI Procedures		1	3		1		
Total	1	16	16	2	3		

Member distribution for angiographies and PCI procedures in Black and white Medicare patients diagnosed with nonspecific chest pain (2017-2019)

	TOTAL WHITE PATIENTS	TOTAL ANGIOGRAPHIES IN WHITE PATIENTS	TOTAL BLACK PATIENTS	TOTAL ANGIOGRAPHIES IN BLACK PATIENTS	ANGIOGRAPHY RATE IN WHITE PATIENTS	ANGIOGRAPHY RATE IN BLACK PATIENTS	CHIX P-VALUE
F	53,323	4,838	8,399	599	9.1%	7.1%	<0.001
M	33,712	4,010	3,687	342	11.9%	9.3%	<0.001

	TOTAL WHITE PATIENTS	TOTAL PCIs IN WHITE PATIENTS	TOTAL BLACK PATIENTS	TOTAL PCIs IN BLACK PATIENTS	PCI RATE IN WHITE PATIENTS	PCI RATE IN BLACK PATIENTS	CHIX P-VALUE
F	48,264	4,435	7,326	522	9.2%	7.1%	<0.001
M	32,685	4,297	3,456	336	13.1%	9.7%	<0.001

Practice distribution of differences between angiography rates and PCI rates for Black and white, male and female Medicare patients diagnosed with coronary atherosclerosis (2017-2019)

Difference in Practice Angiography Rates for Female Patients	Difference in Practice Angiography Rates for Male Patients: ≥20 Male Angiography Procedures — Very likely higher in white	Likely higher in white	Unlikely any difference	Likely higher in black	Very likely higher in black	<20 Male Angiography Procedures	Total
≥20 Female Angiography Procedures: Very likely higher in white	1	1	3	1		1	7
Likely higher in white	1	4	3		1	2	11
Unlikely any difference	1	2	11	4		7	25
Likely higher in black		1	4	1	2	1	9
Very likely higher in black			1	1			2
<20 Female Angiography Procedures		2	6				
Total	3	10	28	7	3		

Difference in Practice PCI Rates for Female Patients	Difference in Practice PCI Rates for Male Patients: ≥20 Male PCI Procedures — Very likely higher in white	Likely higher in white	Unlikely any difference	Likely higher in black	Very likely higher in black	<20 Male PCI Procedures	Total
≥20 Female PCI Procedures: Very likely higher in white	1		1			1	3
Likely higher in white	1	2	4			5	12
Unlikely any difference		4	10	3	1	4	22
Likely higher in black			2		2	1	5
Very likely higher in black					1		1
<20 Female PCI Procedures		2	4	1	1		
Total	2	8	21	4	5		

Member distribution for angiographies and PCI procedures in Black and white Medicare patients diagnosed with coronary atherosclerosis (2017-2019)

	TOTAL WHITE PATIENTS	TOTAL ANGIOGRAPHIES IN WHITE PATIENTS	TOTAL BLACK PATIENTS	TOTAL ANGIOGRAPHIES IN BLACK PATIENTS	ANGIOGRAPHY RATE IN WHITE PATIENTS	ANGIOGRAPHY RATE IN BLACK PATIENTS	CHIX P-VALUE
F	38,175	5,858	5,094	657	15.3%	12.9%	<0.001
M	52,150	7,506	4,092	550	14.4%	13.4%	0.099

	TOTAL WHITE PATIENTS	TOTAL PCIs IN WHITE PATIENTS	TOTAL BLACK PATIENTS	TOTAL PCIs IN BLACK PATIENTS	PCI RATE IN WHITE PATIENTS	PCI RATE IN BLACK PATIENTS	CHIX P-VALUE
F	35,430	5,248	4,442	533	14.8%	12.0%	<0.001
M	47,252	7,580	3,506	499	16.0%	14.2%	0.005