

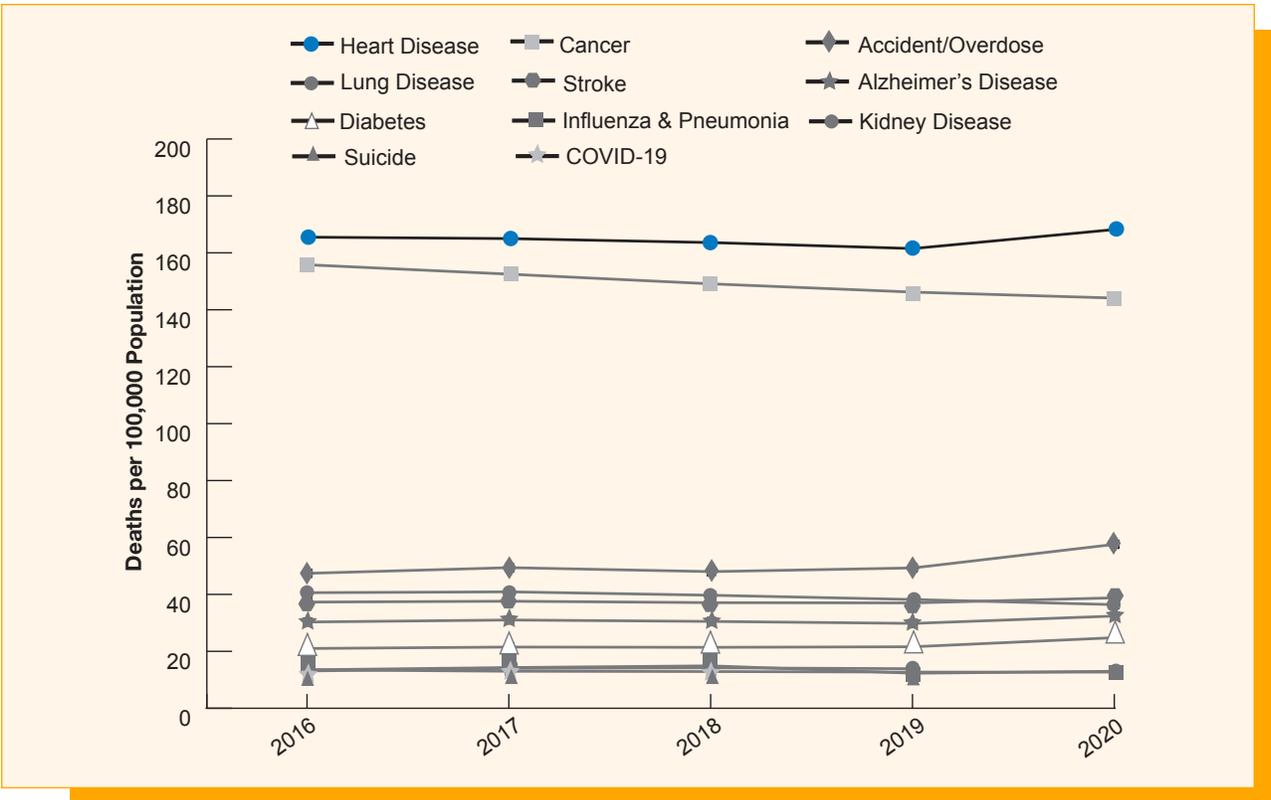
Hospital Deaths for Common Heart Conditions Increased While Hospitalizations Decreased During the First Year of COVID-19



Deaths From Heart Disease Increased in 2020

Heart disease is the most common underlying cause of death in the United States.ⁱ The 2022 *National Healthcare Quality and Disparities Report* (NHQDR) showed that the rate of deaths from heart disease increased in 2020 after decreasing for many years. This data spotlight examines the extent to which this health outcome is related to changes in the way people received heart disease care during the first year of the COVID-19 public health emergency (PHE).

Figure 1. Ten leading underlying causes of mortality in the United States, total population, 2016-2020



Source: CDC WONDER, Underlying Cause of Death by Bridged-Race Categories, 1999-2020. <https://wonder.cdc.gov/ucd-icd10.html>.

Note: Suicide was one of the 10 leading causes of death from 2016 to 2019 but was replaced by COVID-19 in 2020.

ⁱThe Department of Health and Human Services *Medical Examiners' and Coroners' Handbook on Death Registration and Fetal Death Reporting* defines an underlying cause of death as one that initiates the chain of pathological events leading to death.

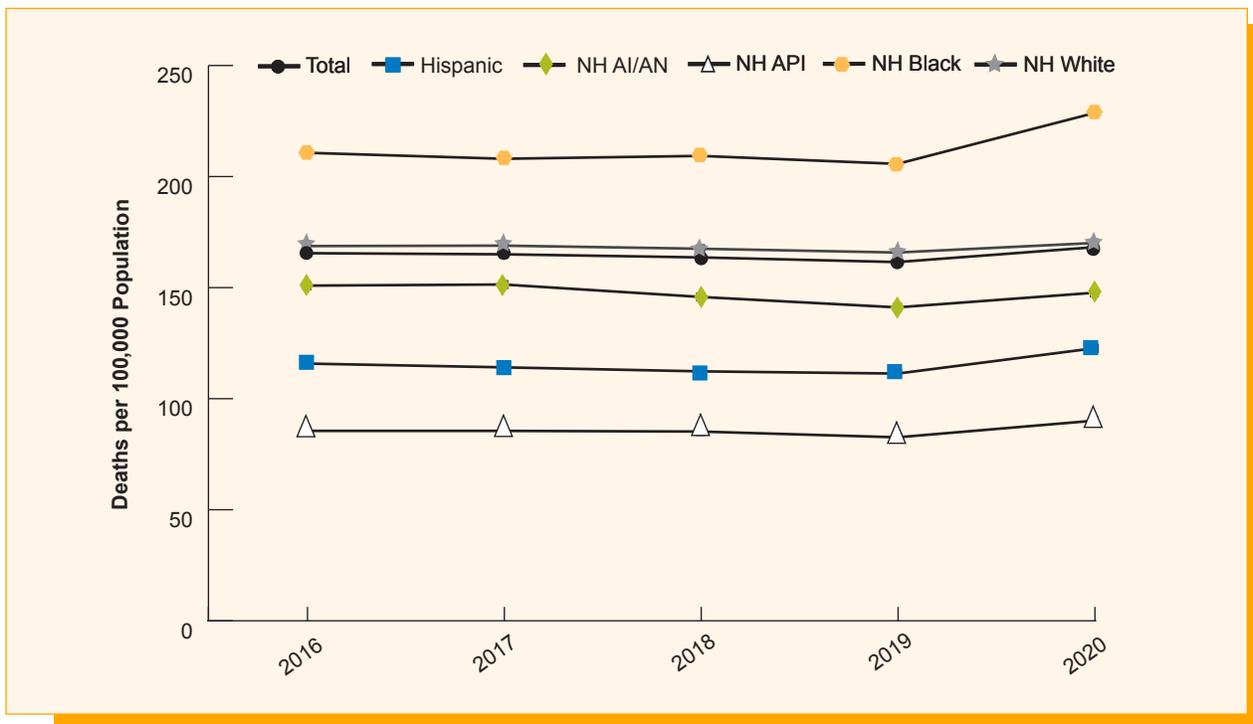
Figure 1 shows the 10 leading causes of death in the United States between 2016 and 2020. In 2020, the three leading causes were heart disease (168.2 deaths per 100,000 population), cancer (144.1 deaths per 100,000 population), and COVID-19 (85 deaths per 100,000 population). The remaining seven causes, in order, were accidents/overdose, stroke, lung disease, Alzheimer’s disease, diabetes, influenza and pneumonia, and kidney disease. After several years of decreasing, the heart disease death rate increased significantly in 2020, rising by 4.1%.

Racial and Ethnic Health Disparities for Heart Disease Persist

Widening racial and ethnic disparities during the COVID-19 PHE have been well documented.¹ Data from the National Vital Statistics System (NVSS) show that racial/ethnic disparities in age-adjusted mortality rates for heart disease had existed in the years leading up to 2020 but then widened for some groups (Figure 2).

Non-Hispanic (NH) Black people were consistently more likely to die from heart disease, followed by NH White, NH American Indian and Alaska Native (AI/AN), Hispanic, and NH Asian and Pacific Islander (API) people. The same health disparity patterns persisted in 2020, but while heart disease mortality rates increased in all racial and ethnic groups, a steeper rise in mortality rates for NH Black groups widened the disparity between NH Black and other groups.

Figure 2. Age-adjusted deaths from heart disease per 100,000 population, by race/ethnicity, 2016-2020



Key: AI/AN = American Indian or Alaska Native; API = Asian or Pacific Islander; NH = non-Hispanic.

Source: CDC WONDER, Underlying Cause of Death by Bridged-Race Categories, 1999-2020. <https://wonder.cdc.gov/ucd-icd10.html>.

Figure 2 shows age-adjusted rates of heart disease mortality by race/ethnicity. Significant disparities exist among racial/ethnic groups, with NH Black groups experiencing the highest rates of heart disease mortality and NH API groups experiencing the lowest rates. Notably, in 2020, heart disease mortality rates rose for many groups.

Between 2019 and 2020, heart disease mortality rates rose by:

- ◆ 11.1% in NH Black groups (going from 205.7 to 228.6 deaths per 100,000 population).
- ◆ 10.2% in Hispanic groups (going from 111.3 to 122.7 deaths per 100,000 population).
- ◆ 9.1% in NH API groups (going from 82.6 to 90.1 deaths per 100,000 population).
- ◆ 4.7% in NH AI/AN groups (going from 141.1 to 147.7 deaths per 100,000 population).
- ◆ 2.6% in NH White group (going from 165.8 to 170.1 deaths per 100,000 population).

Deaths From Ischemic Heart Disease and From Heart Failure Account for Most Heart Disease Deaths

As a cause of death, “heart disease” may be viewed as consisting of multiple subtypes of cardiovascular conditions,² including:

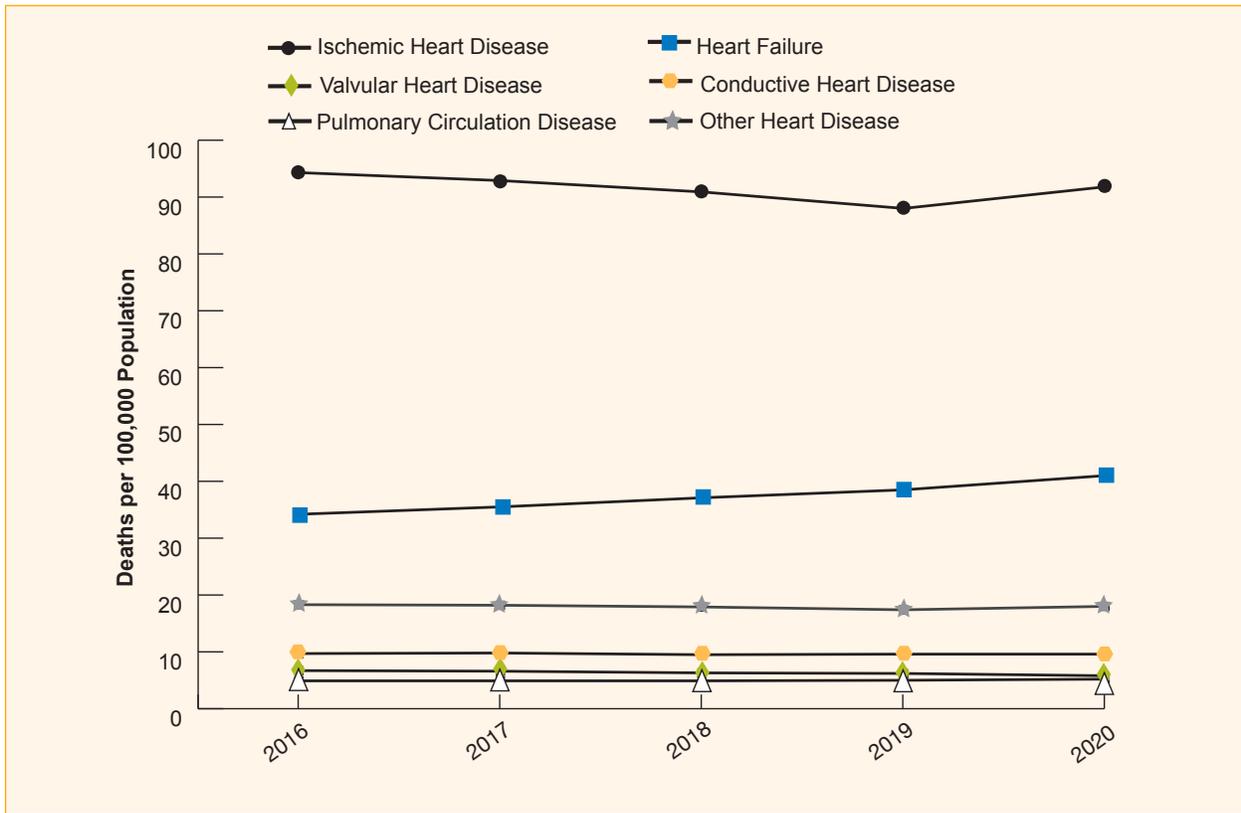
1. Ischemic heart disease, which includes acute myocardial infarction or “heart attack”;
2. Heart failure, including hypertensive heart disease with heart failureⁱⁱ;
3. Diseases affecting the heart valves;
4. Diseases affecting pulmonary circulation;
5. Diseases affecting the heart’s electrical conduction system, or “arrhythmias”; and
6. Other conditions affecting the heart.ⁱⁱⁱ

The Appendix provides more detail about each subtype. NVSS data indicate that deaths from ischemic heart disease and heart failure account for most deaths from heart disease (Figure 3).

ⁱⁱThis report groups together International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) codes for heart failure, cardiomyopathy, and hypertensive heart disease with heart failure. Unless otherwise specified, we will refer to this grouping as “heart failure.”

ⁱⁱⁱOther conditions affecting the heart include acute and chronic rheumatic disease, conditions affecting the pericardium (a membranous lining around the heart), and inflammatory and other conditions affecting myocardial tissues, such as myocarditis and cardiomyopathy. The Appendix has additional details.

Figure 3. Age-adjusted deaths per 100,000 population, by type of heart disease, 2016-2020



Source: CDC WONDER, Underlying Cause of Death by Bridged-Race Categories, 1999-2020. <https://wonder.cdc.gov/ucd-icd10.html>.

Note: The term "heart failure" includes ICD-10-CM codes for heart failure, cardiomyopathy, and hypertensive heart disease with heart failure.

Figure 3 shows that ischemic heart disease and heart failure are the most common causes of death from heart disease. Age-adjusted rates of death from ischemic heart disease increased sharply in 2020, after declining from 2016 through 2019. Age-adjusted rates of death from heart failure rose continuously between 2016 and 2020. In contrast, age-adjusted death rates for pulmonary circulation disease, conductive heart disease, and valvular heart disease remained relatively flat between 2016 and 2020, as did other heart disease.

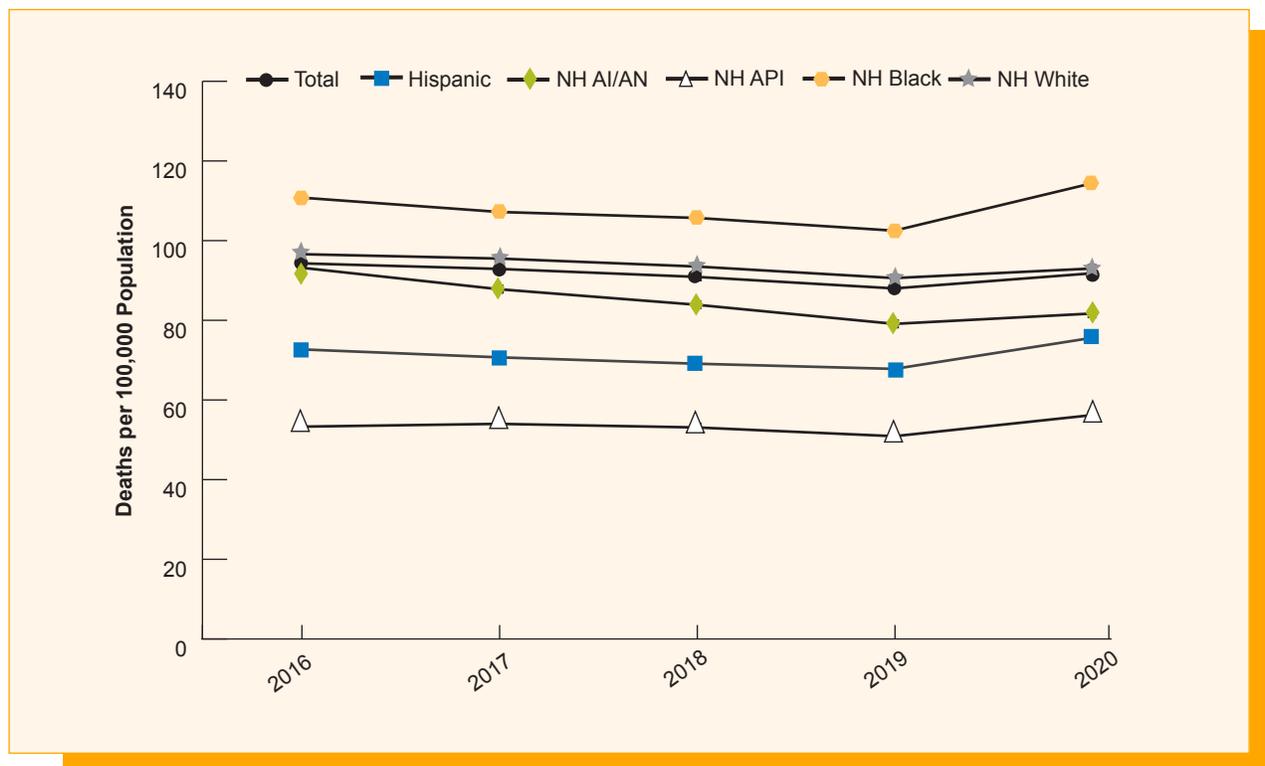
Specifically:

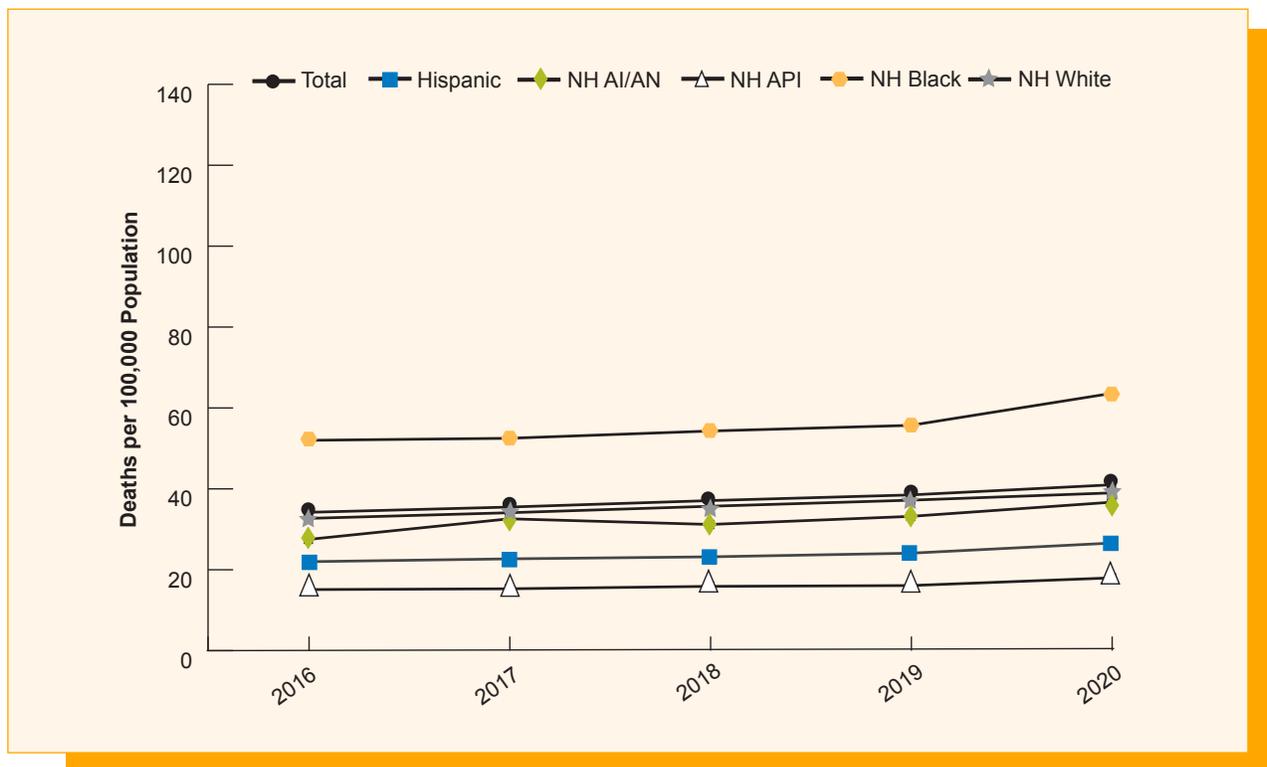
- ◆ The death rate from ischemic heart disease in the U.S. population declined by 6.7% from 2016 to 2019 (from 94.3 to 88.0 deaths per 100,000 population) but increased by 4.3% in 2020 (from 88.0 to 91.8 deaths per 100,000 population).
- ◆ From 2016 to 2020, the death rate from heart failure rose continuously by 19.9% (from 34.2 to 41.0 deaths per 100,000 population). The greatest increase was 6.5% from 2019 to 2020 (from 38.5 to 41.0 deaths per 100,000 population).
- ◆ Conductive heart disease ranged from 9.5 to 9.8 deaths per 100,000 population between 2016 and 2020.

- ◆ Valvular heart disease ranged from 5.8 to 6.7 deaths per 100,000 population between 2016 and 2020.
- ◆ Pulmonary circulation disease ranged from 4.9 to 5.2 deaths per 100,000 population between 2016 and 2020.
- ◆ Other heart disease ranged from 17.4 to 18.3 deaths per 100,000 population between 2016 and 2020.

NVSS data show that from 2016 to 2020, disparities for ischemic heart disease and for heart failure were consistent with the pattern of disparities for overall deaths due to underlying heart disease. NH Black groups had the highest death rates for these two subtypes, followed by NH White, NH AI/AN, Hispanic, and NH API groups (Figure 4). The data also show that deaths from ischemic heart disease and heart failure rose between 2019 and 2020, with the largest increases occurring in NH Black groups.

Figure 4. Age-adjusted deaths per 100,000 population due to underlying ischemic heart disease (upper panel) and to underlying heart failure (lower panel), by race/ethnicity, 2016-2020





Source: CDC WONDER, Underlying Cause of Death by Bridged-Race Categories, 1999-2020. <https://wonder.cdc.gov/ucd-icd10.html>.

Note: The term “heart failure” includes ICD-10-CM codes for heart failure, cardiomyopathy, and hypertensive heart disease with heart failure.

Disparities also exist in terms of relative change in death rate between 2019 and 2020, with deaths due to ischemic heart disease and heart failure increasing by:

- ◆ 11.6% and 14.2%, respectively, in NH Black groups (102.5 to 114.4 deaths per 100,000 population for ischemic heart disease and 55.7 to 63.6 deaths per 100,000 population for heart failure).
- ◆ 11.5% and 10.4%, respectively, in Hispanic groups (67.8 to 75.6 deaths per 100,000 population for ischemic heart disease and 24.1 to 26.6 deaths per 100,000 population for heart failure).
- ◆ 10.4% and 11.8%, respectively, in NH API groups (50.9 to 56.2 deaths per 100,000 population for ischemic heart disease and 16.1 to 18.0 deaths per 100,000 population for heart failure).
- ◆ 3.3% and 10.5%, respectively, in NH AI/AN groups (79.1 to 81.7 deaths per 100,000 population for ischemic heart disease and 33.2 to 36.7 deaths per 100,000 population for heart failure).
- ◆ 2.6% and 4.8%, respectively, in NH White groups (90.6 to 93.0 deaths per 100,000 population for ischemic heart disease and 37.2 to 39.0 deaths per 100,000 population for heart failure).

Hospitalizations Decreased but Hospital Deaths Increased in 2020

Many people who experience signs and symptoms of ischemic heart disease and heart failure will seek care from a hospital. Data characterizing hospital care for these conditions show different patterns of healthcare delivery and disparities than were seen in NVSS's mortality statistics.

Data from the Healthcare Cost and Utilization Project (HCUP) show that overall hospital admissions for acute myocardial infarction decreased 15.1% in 2020 (Figure 5). Similarly, hospital admissions for heart failure, which is considered an indicator of “potentially avoidable” hospitalizations, decreased 14.9% in 2020 (Figure 6).

The data suggest that fewer people in all racial and ethnic groups sought hospital care for heart failure during the COVID-19 PHE. The largest decreases occurred among NH API groups, followed by Hispanic, NH White, and NH Black groups (Figure 6). Data are not available for heart failure hospitalization rates among NH AI/AN groups.

Figure 5. Hospital admissions for acute myocardial infarction per 100,000 population, adults age 18 and over, 2016-2020

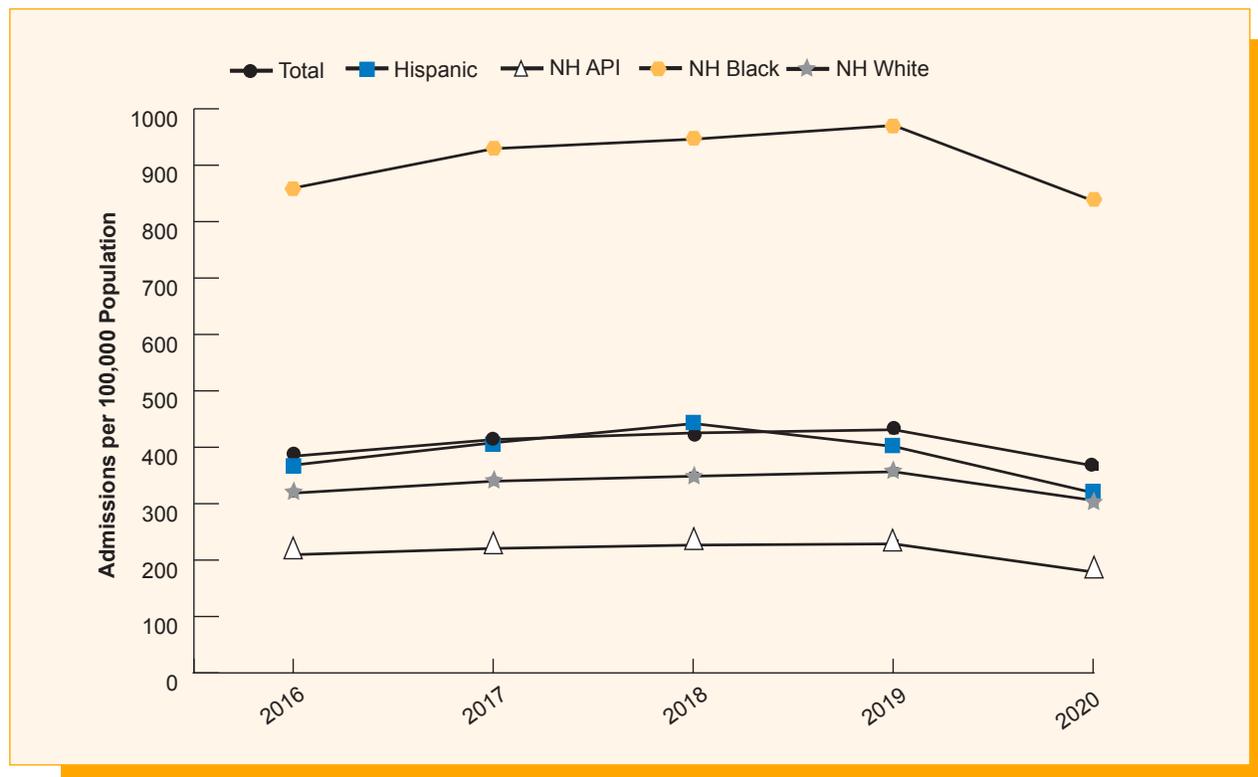


Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, National Inpatient Sample, 2016-2020. <https://datatools.ahrq.gov/hcupnet>.

Note: Acute myocardial infarction is defined by Clinical Classification Software Refined principal diagnosis code CIR009. Data stratified by race and ethnicity are not available for this measure because the NHQDR does not routinely report on this measure, so data were obtained from AHRQ's Data Tools website. Additional racial and ethnic data for this measure are available at <https://hcup-us.ahrq.gov/>.

From 2019 to 2020, hospital admission rates for acute myocardial infarction decreased from 202.6 to 172.1 admissions per 100,000 population (Figure 5). In 2016, 2017, and 2018, admission rates for acute myocardial infarction were 201.5, 203.3, and 201.3 admissions per 100,000 population, respectively.

Figure 6. Hospital admissions for heart failure per 100,000 population, by race/ethnicity, adults age 18 and over, 2016-2020



Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, State Inpatient Databases, 2016-2020, weighted to provider national estimates.

Note: Heart failure is defined by the value set MRTCHF^D* in the AHRQ Quality Indicators software. More information is available from the Inpatient Quality Indicators Technical Specifications web page at https://qualityindicators.ahrq.gov/measures/IQI_TechSpec.

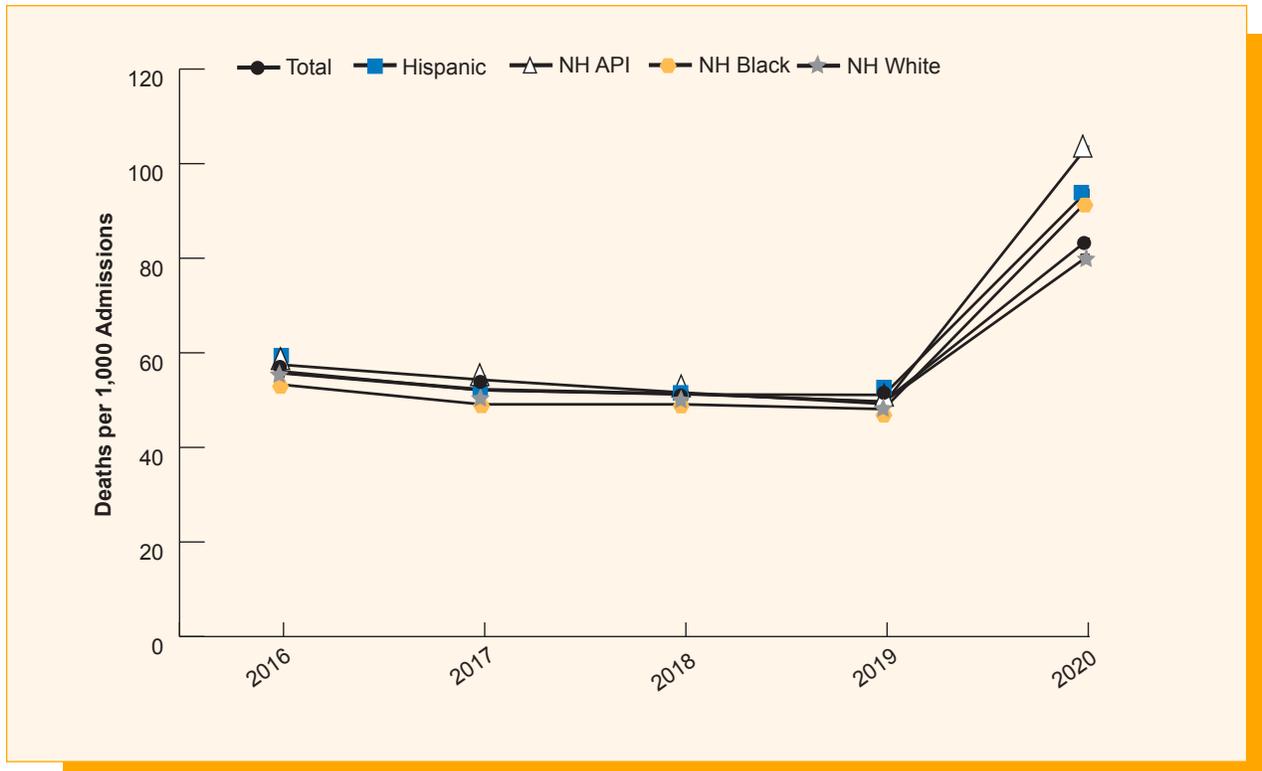
Hospital admission rates for heart failure decreased overall in 2020 from 431.1 to 367.0 admissions per 100,000 population, reversing a multiyear trend of rising admission rates for this condition (Figure 6). Decreased hospitalization rates for heart failure occurred in all racial and ethnic groups as well. Between 2019 and 2020, hospital admissions for heart failure decreased by:

- ◆ 21.9% for NH API groups (decreasing from 228.7 to 178.7 admissions per 100,000 population).
- ◆ 20.5% for Hispanic groups (decreasing from 401.4 to 319.1 admissions per 100,000 population).
- ◆ 14.3% for NH White groups (decreasing from 356.6 to 305.7 admissions per 100,000 population).
- ◆ 3.8% for NH Black groups (decreasing from 970.5 to 836.4 admissions per 100,000 population).

HCUP data also indicate that inpatient deaths increased sharply for people admitted with ischemic heart disease and with heart failure during the COVID-19 PHE. The overall rate of inpatient deaths per 1,000 hospital admissions with acute myocardial infarction increased 67.8% in 2020 (Figure 7), while the rate of inpatient deaths per 1,000 hospital admissions with heart failure increased 109.0% (Figure 8).

The rise in death rates varied among different racial and ethnic groups, resulting in widening disparities among groups, where relatively little disparity had existed previously. Rates of inpatient deaths due to acute myocardial infarction increased the most for NH API groups (more than doubling this group's 2019 mortality rate), followed by NH Black, Hispanic, and NH White groups (Figure 7). Rates of inpatient deaths due to heart failure increased the most for NH API and NH White groups, followed by Hispanic and NH Black groups (Figure 8).

Figure 7. Deaths per 1,000 hospital admissions with acute myocardial infarction, adults age 18 and over, 2016-2020

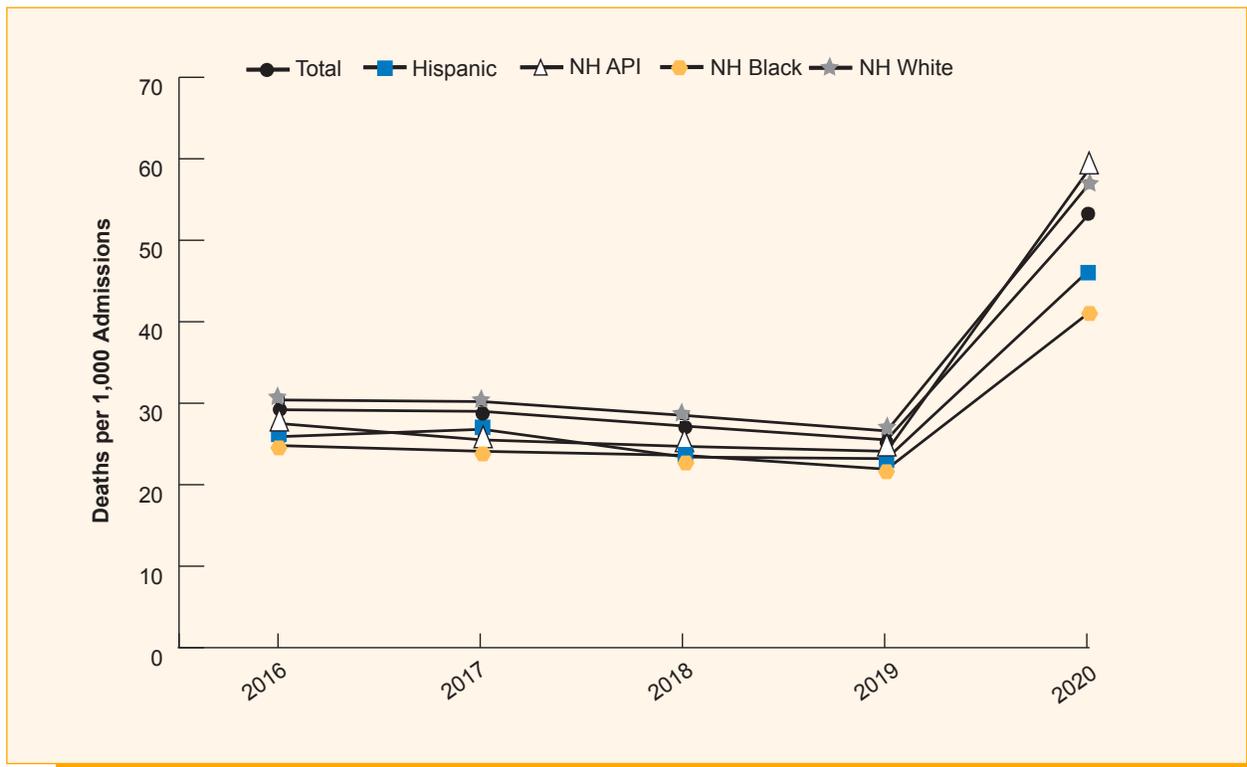


Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, State Inpatient Databases, 2016-2020, weighted to provide national estimates.

From 2019 to 2020, the overall rate of inpatient deaths with acute myocardial infarction rose from 49.7 to 83.4 deaths per 1,000 hospital admissions, after improving every year between 2016 and 2019. Between 2019 and 2020, in-hospital death rates for acute myocardial infarction increased:

- ◆ 109.3% in NH API groups (rising from 49.2 to 103.0 deaths per 1,000 hospital admissions).
- ◆ 90.4% in NH Black groups (rising from 48.1 to 91.6 deaths per 1,000 hospital admissions).
- ◆ 83.4% in Hispanic groups (rising from 51.1 to 93.7 deaths per 1,000 hospital admissions).
- ◆ 61.3% in NH White groups (rising from 49.6 to 80.0 deaths per 1,000 hospital admissions).

Figure 8. Deaths per 1,000 hospital admissions with heart failure, adults age 18 and over, 2016-2020



Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, State Inpatient Databases, 2016-2020, weighted to provide national estimates.

Hospital deaths from heart failure increased overall from 2019 to 2020 (rising from 25.5 to 53.2 deaths per 1,000 hospital admissions) and in all racial/ethnic groups, after improving every year between 2016 and 2019. The rise in hospital mortality rates varied among racial/ethnic groups, resulting in larger disparities. Between 2019 and 2020, in-hospital death rates for heart failure increased by:

- ◆ 143.6% in NH API groups (rising from 24.1 to 58.7 deaths per 1,000 hospital admissions).
- ◆ 113.9% in NH White groups (rising from 26.6 to 56.9 deaths per 1,000 hospital admissions).
- ◆ 99.6% in Hispanic groups (rising from 23.2 to 46.3 deaths per 1,000 hospital admissions).
- ◆ 87.7% in NH Black groups (rising from 21.9 to 41.1 deaths per 1,000 hospital admissions).

Discussion

Data compiled for the 2022 NHQDR indicate that heart disease remains the most common cause of death in the United States and that considerable disparities exist among racial and ethnic groups in terms of hospitalization and death due to underlying heart disease.

Between 2016 and 2019, wide, persistent racial and ethnic disparities were seen for deaths due to underlying heart disease in the United States, including deaths due to the most common types of

heart disease: ischemic heart disease and heart failure. While disparities existed when all heart disease deaths were counted, few or no disparities were observed when only in-hospital deaths were examined. The contrast suggests that, before the COVID-19 PHE, community-level factors (including public policy) were more important contributors to heart disease disparities than hospital quality of care.

In 2020, however, inpatient deaths increased sharply during admissions with acute myocardial infarction and admissions with heart failure, and racial and ethnic disparities in inpatient deaths for these conditions widened. It is important to note that in-hospital deaths contribute to only a small percentage of the overall rise in heart disease deaths. In addition, differences in rates of in-hospital death among racial and ethnic groups likely reflect differences in access to hospitals and differences in risk of dying while in the hospital. However, the rising inpatient death rates and growing disparities warrant closer monitoring.

The data do not identify specific causes for the rising hospital death rates due to heart disease or for the widening disparities, but three potential explanations have been suggested. First, hospitals may have been treating patients who were on average sicker and thus more likely to die in the hospital.^{3,4} For example, a 2020 survey showed that 41% of U.S. adults delayed or avoided care due to COVID-19-related concerns. In addition, an analysis of national emergency medical services data reported a significant increase in fatal out-of-hospital cardiovascular events in 2020.

These findings suggest that many people avoided care even when they had symptoms that warranted prompt evaluation and treatment.⁵ Thus, public health measures intended to limit the spread of SARS-CoV-2, the virus that causes COVID-19, as well as attempts by individuals to avoid exposure to healthcare settings, may have inadvertently decreased access to preventive care, medications, and other early treatment. This decreased access may have increased the acuity of those who sought hospital care.

Second, the quality of hospital care may have worsened in 2020 due to significant financial and operational disruptions experienced by many hospitals during the first year of the COVID-19 PHE. Multiple “surges” of people infected with the SARS-CoV-2 virus placed significant strain on hospitals’ capacity to care for patients, including those without COVID-19.⁶ Patients infected with SARS-CoV-2 required isolation from other patients, were more likely to require treatment in intensive care units, and had longer average lengths of stay. This situation strained hospital resources and led to hospital and emergency department crowding.

Supply chain disruptions⁷ further exacerbated hospitals’ challenges, while healthcare workforce participation declined through a combination of worker illness, reduced working hours, and attrition. Thus, hospitals may have lacked the capacity to care for patients safely and effectively, contributing to higher rates of inpatient heart disease deaths in 2020.

Third, undiagnosed or asymptomatic COVID-19 may have directly affected people’s hearts, contributing to some of the increased heart disease deaths observed in 2020, when vaccines were not yet available. For example, infection with the SARS-CoV-2 virus has been linked to blood clotting and inflammatory damage to the heart.⁸ Although this theory is worthy of consideration, a recent analysis of autopsy data from the United Kingdom identified relatively few cases of unidentified COVID-19. The study concludes that COVID-19’s societal effects on access and quality of healthcare delivery were more likely to explain an increase in heart disease deaths than the direct effects of SARS-CoV-2 on the heart.^{9,10}

In sum, the patterns highlighted in this data spotlight suggest that public policy and community-level factors were more important contributors to heart disease disparities than quality of hospital care in the years leading up to 2020. However, they also indicate that direct and indirect effects of COVID-19 may have negatively hindered the healthcare system's ability to care for people with heart disease, leading to increased rates of hospital death and widening health disparities for this outcome. As the nation's healthcare delivery system transitions into the post-acute phase of the COVID-19 pandemic, the NHQDR team will continue to monitor trends in heart disease deaths, as well as other outcomes that suggest worsening or improving care.

Appendix. Subtypes of Heart Disease

Subtypes are identified by their codes in the International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM).

- ◆ **Ischemic heart disease** (ICD-10-CM I20-I25) includes conditions that arise from blockages in the coronary arteries. They often present as a myocardial infarction or “heart attack.” Preventive care can reduce the risk of developing ischemic heart disease, but active heart attacks require treatment in acute care settings, such as hospitals.
- ◆ **Heart failure, including hypertensive heart disease with heart failure** (ICD-10-CM I11, I13, I50) includes conditions involving damaged or weakened heart muscles. A consequence of this condition is that fluid accumulates in the lungs or lower extremities because the heart cannot adequately pump blood. Uncomplicated heart failure can be managed with diuretics (“water pills”) and other medications in primary care settings, but heart failure exacerbations frequently lead to treatment in hospital settings.
- ◆ **Pulmonary circulation heart disease** (ICD-10-CM I26-I28) includes conditions that affect the arteries connecting the heart to the lung. They include pulmonary hypertension and pulmonary embolism (i.e., “blood clots”), which are treated with anticoagulants (blood thinners).
- ◆ **Conductive heart disease** (ICD-10-CM I47-I49) includes conditions arising from damage to the heart's natural pacemaker or its electrical conduction system. They may manifest as a variety of arrhythmias, including atrial fibrillation, or as sudden cardiac death. They are often treated by implanting a pacemaker or defibrillator in the chest wall.
- ◆ **Diseases of the heart valves** (ICD-10-CM I34-I38) include conditions that affect the membranous tissue valves that separate the four chambers of the heart or the membranous lining that covers the heart, respectively. Common forms of heart valve diseases, such as mitral valve regurgitation or aortic valve stenosis, often require surgical intervention to repair. Pericardial disease affecting the membrane that surrounds the heart is often infectious in nature. If management with medication fails, surgery may be required.
- ◆ **Other causes of heart disease** (ICD-10-CM I00-I09, I30-I33, I40-I46, I51) include miscellaneous conditions that can affect the heart, including acute and chronic rheumatic disease, conditions affecting the pericardium (a membranous lining around the heart), and inflammatory and other conditions affecting myocardial tissues, such as myocarditis and cardiomyopathy.

References

1. Hacker KA, Briss PA, Richardson L, Wright J, Petersen R. COVID-19 and chronic disease: the impact now and in the future. *Prev Chronic Dis*. 2021 Jun 17;18:E62. https://www.cdc.gov/pcd/issues/2021/21_0086.htm. Accessed June 12, 2023.
2. Shah NS, Molsberry R, Rana JS, Sidney S, Capewell S, O'Flaherty M, Carnethon M, Lloyd-Jones DM, Khan SS. Heterogeneous trends in burden of heart disease mortality by subtypes in the United States, 1999-2018: observational analysis of vital statistics. *BMJ*. 2020 Aug 13;370:m2688. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7424397/>. Accessed June 12, 2023.
3. Lyall MJ, Lone NI. Higher clinical acuity and 7-day hospital mortality in non-COVID-19 acute medical admissions: prospective observational study. *Emerg Med J*. 2021 May;38(5):366-370. <https://pubmed.ncbi.nlm.nih.gov/33658271/>. Accessed June 12, 2023.
4. American Hospital Association. Pandemic-Driven Deferred Care Has Led to Increased Patient Acuity in America's Hospitals. August 2022. <https://www.aha.org/guidesreports/2022-08-15-pandemic-driven-deferred-care-has-led-increased-patient-acuity-americas>. Accessed June 12, 2023.
5. Shekhar AC, Effiong A, Ruskin KJ, Blumen I, Mann NC, Narula J. COVID-19 and the prehospital incidence of acute cardiovascular events (from the Nationwide US EMS). *Am J Cardiol*. 2020 Nov 1;134:152-153. <https://pubmed.ncbi.nlm.nih.gov/32873370/>. Accessed June 12, 2023.
6. Myers LC, Liu VX. The COVID-19 pandemic strikes again and again and again. *JAMA Netw Open*. 2022;5(3):e221760. <https://pubmed.ncbi.nlm.nih.gov/35262720/>. Accessed June 12, 2023.
7. Grimm CA. Hospitals Reported That the COVID-19 Pandemic Has Significantly Strained Health Care Delivery. Office of Inspector General, U.S. Department of Health and Human Services; March 2021. Publication No. OEI-09-21-00140. <https://oig.hhs.gov/oei/reports/OEI-09-21-00140.asp>. Accessed June 12, 2023.
8. Xie Y, Xu E, Bowe B, Ziyad A. Long-term cardiovascular outcomes of COVID-19. *Nat Med*. 2022;28:583-590. <https://pubmed.ncbi.nlm.nih.gov/35132265/>. Accessed June 12, 2023.
9. Pell R, Fryer E, Manek S, Winter L, Roberts ISD. Coronial autopsies identify the indirect effects of COVID-19. *Lancet Public Health*. 2020 Sep;5(9):e474. <https://pubmed.ncbi.nlm.nih.gov/32791050/>. Accessed June 12, 2023.
10. Pell R, Suvarna SK, Cooper N, Ruttly G, Green A, Osborn M, Johnson P, Hayward A, Durno J, Estrin-Serlui T, Mafham M, Roberts ISD. Coronial postmortem reports and indirect COVID-19 pandemic-related mortality. *J Clin Pathol*. 2022 Jan 17;jclinpath-2021-208003. <https://pubmed.ncbi.nlm.nih.gov/35039447/>. Accessed June 12, 2023.

