UNIVERSITY OF CALIFORNIA, MERCED

Suicidal behavior, health and mortality among African Americans

A dissertation submitted in partial satisfaction of the requirements for the degree of Doctor of Philosophy

In

Public Health

by

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2024

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2024

DEDICATION

This dissertation is dedicated to the younger generations of my family; with courage, love, and faith, you can achieve anything. To all the wonderful people who have supported me on my journey, thank you. To my therapist, the UC Merced health center, and my academic advisor, completing my PhD would not have been possible without your support, thank you. And lastly, to this unknown power that continues to guide and support me, thank you, thank you, thank you.

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List of Abbreviations

Acronyms

NSUDH – National Survey on Drug Use and Health

WHO – World Health Organization

U.S. – United States

CDC – Centers for Disease Control and Prevention

SAMHSA – Substance Abuse and Mental Health Services Administration

ED –Emergency Department

COPD – Chronic obstructive pulmonary disorder

HCAI – California Department of Health Care Access and Information

CCS – Clinical Classification Software

ICD-9-CM – International Classification of Diseases, Clinical Modification 9th Revision, Clinical Modification Codes

ICD-10-CM – International Classification of Diseases, Clinical Modification 10th Revision, Clinical Modification Codes

E-code – Injury diagnostic Code

CI – Confidence Intervals

SMR – Standardized Mortality Ratios

NH – non-Hispanic

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Acknowledgements

I would like to acknowledge my committee members Dr. Goldman-Mellor, Dr. Ha, and Dr. Chan-Golston for their support and guidance throughout my dissertation journey. Thank you all so much.

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Education

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Williams O, Tabor R, Kuehne K, Olden J, and **Hall C**. Seasonal Catch Rates of the Endemic Olympic Mudminnow in Wetland Habitat. *Northwest Science*. 2021;95(2):201-209.

Hall C, Ha S, Yen IH, Goldman-Mellor S. Risk factors for hyperthermia mortality among emergency department patients. *Annals of Epidemiology*. 2021; 64:90-95.

Bailey AM, **Hall C.A**, Legan S.J, Demas G.E. Food restriction during development delays puberty but does not affect adult seasonal reproductive responses to food availability in Siberian hamsters (*Phodopus sungorus*). *Journal of Experimental Zoology Part A: Ecological and Integrative Physiology*. 2021;335(8):691-702.

Goldman-Mellor S, **Hall C**, Cerdá M, and Bhat H. Firearm suicide mortality after emergency department presentations. *Annals of Epidemiology.* 2021; 54:38-44.

Sharp W, Mangalmurti A, **Hall C**, Choudhury S, and Shaw P. Associations between neighborhood, family factors and symptom change in childhood attention deficit hyperactivity disorder. *Social Science & Medicine*. 2021; 271:1-8.

Roe J.H, Wild K.H, and **Hall C.A**. (2017). Thermal biology of eastern box turtles in a longleaf pine system managed with prescribed fire. *Journal of Thermal Biology*. 2017; 69:325-333.

Research Presentations

Oral Presentations

Hall C.A. Ha S, Chan-Golston A, Goldman-Mellor S. Socioeconomic risk factors for suicidal behavior among African Americans. 3rd Annual Suicide Research Symposium; Virtual, April 2024.

Hall C. A. and Williams O. How to catch Olympic Mudminnows? US Fish and Wildlife Service; Lacey, WA, August 2018.

Hall C. A., Kasperek S, Sharp W, Sudre G, and Shaw P. Using social environment to predict outcomes of Attention-Deficit Hyperactivity Disorder. National Institutes of Health. Bethesda; MD, February 2017.

Hall C.A. and Roe J.H. Overwintering Behavior of Eastern Box Turtles *(Terrapene carolina carolina)* in a Fire Managed Ecosystem. North Carolina Academy of Science Conference; Winston-Salem, NC, March 2015

Hall, C.A., Bailey A.M., and Demas G.E. The effects of food restriction on development in seasonally reproducing mammals. Center for the Integrative Study of Animal Behavior; Bloomington, IN, July 2014.

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Hall C. and Goldman-Mellor S. Risk factors for hyperthermia mortality among emergency department patients: A matched case-control study. Society for Epidemiologic Research; May 2021.

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Hall C. A. and Roe J.H. Could winter burns minimize burn injuries and mortality of Eastern Box turtles *(Terrapene carolina carolina)* in a fire-managed system? Pembroke Undergraduate Research and Creativity Center Symposium; Pembroke, NC, April 2016.

Hall C. A. and Kelly L.A. Invasive Fire Ants *(Solenopsis invicta)* in wetlands of Southern-eastern North Carolina. North Carolina Louis Stokes Alliance for Minority Participation Conference; Pembroke, NC, October 2015 ***(awarded 1st place)***.

Hall C.A. and Roe J.H. Overwintering Behavior of Eastern Box Turtles *(Terrapene carolina carolina)* in a Fire Managed Ecosystem. 2nd NC Congress of Herpetology Meeting; Asheboro, NC, May 2015.

Hall C.A., Bailey A.M., and Demas G.E. Food availability as a cue for seasonal reproduction: Delayed reproductive development in juvenile Siberian hamsters *(Phodopus sungorus)*. Presented at the Society for Integrative and Comparative Biology; West Palm Beach, FL, January 2015 and at the Annual Biomedical Research Conference for Minority Students; San Antonio, TX, November 2014.

Hall C. A., Bailey A.M., and Demas G.E. The impacts of food restriction on reproductive development in a seasonally reproducing mammal, the Siberian hamster *(Phodopus sungorus)*. ***Nominated by NSF-REU program*** to present at the Council on Undergraduate Research meeting; Arlington, VA, October 2014.

Hall C.A., Wilson W and Roe J.H. How Deep Are Eastern Box Turtles (Terrapene carolina carolina) Burying to Escape Severe Winter Conditions? Presented at the Pembroke Undergraduate Research and Creativity Symposium, Pembroke, NC, April

2014 ***(awarded 3rd place)*** and at the 37th annual Herpetology Conference, Gainesville, FL, April 2014 ***(awarded 1st place)***.

Invited Talks and Lectures

"Oh, the Places You'll!" RISE Symposium Keynote Speaker, University of North Carolina at Pembroke; Pembroke, NC, August 2023.

Structural inequality in the education system due to district rezoning, University of California at Merced; Merced, CA, November 2022.

Structural inequality and segregation in the education system, University of California at Merced; Merced, CA, October 2019.

Interdisciplinary Science in Public Health: Bridging the gaps between environmental science and mental health studies, University of California at Merced; Merced, CA, April 2019.

My journey towards success. Lunch & Learn program: Wheaton High School; Bethesda, MD, December 2016.

How can Atkins prepare you for the next chapter of your life? After School Seminar Series: Atkins High School; Winston-Salem, NC, June 2016.

Research Experience

Firearm suicide mortality among emergency department patients (2018-2019)
University of California Merced. Merced CA
Graduate Student Researcher
Supervisor: Dr. Sidra Goldman-Mellor

- Developed study measures using the *International Classification of Diseases, Ninth Revision, Clinical Modification* codes
- Prepared and organized California hospitalization/emergency department data for analysis
- Assisted in writing the manuscript for publication

Population research and management of sensitive species (Salmon, Olympic mudminnow, Oregon spotted frog, Western Pond turtle, and Lamprey) (2017-2018)
US Fish and Wildlife Service. Lacey WA
Conservation Scientist and Educator-AmeriCorps

- Conducted field surveys and managed population data collected at field sites
- Assisted biotechnicians with seasonal spawning of Salmonids at national fish hatcheries
- Developed and sponsored habitat restoration projects in the Lacy, WA and Olympia, WA communities
- Conducted classroom visits to educate students on conservation and environmental stewardship

- Developed and implemented lesson plans on environmental topics
- Developed pre and post learning worksheets for lesson plan evaluation

The effect of social-environmental factors on the clinical course of Attention-Deficit Hyperactivity Disorder (ADHD) (2016-2017)
National Institutes of Health; National Human Genome Research Institute. Bethesda MD
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Supervisor: Dr. Phillip Shaw

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- Assisted in the evaluation and quality control of neuroimages (e.g., MRIs and FMRIs)

Eastern box turtle ecology, overwintering behaviors and thermoregulation (2013-2016)
University of North Carolina at Pembroke. Pembroke NC
RISE-fellow researcher
Supervisor: Dr. John Roe

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- Collected and managed data on weather conditions, macro habitat evaluation, GPS location, and box turtle behavior

Trophic ecology and the effect of genotype on invasive fire ant colonies in North Carolina wetlands (2015)
University of North Carolina at Pembroke. Pembroke NC
Research Assistant
Supervisor: Dr. Lisa Kelly

- Conducted field surveys and collected fire ant colony samples in NC wetlands
- Collected and managed data on micro habitat evaluation and GPS location of fire ant colonies
- Collected samples of other plant and insect species for isotope analysis
- Genotyped fire ant samples using multiplex polymerase chain reaction

Effects of food restriction on reproductive development in Siberian hamsters (2014)
University of Indiana; Center for the Integrative Study of Animal Behavior. Bloomington IN.
Research Assistant Intern
Supervisor: Dr. Allison Bailey

- Conducted research on food availability as a cue for seasonal reproduction in Siberian hamsters
- Managed caloric intake of Siberian hamsters, including data collection

- Performed animal dissections for evaluating adipose tissue and structure of Siberian hamster reproductive organs
- Assisted in quantitative polymerase chain reaction to measure gene expression of kisspeptin

Other experience and activities

Merced Applegate Park Zoo recreational leader (2022-present)
- Maintain a safe clean-living environment for animals
- Provide animals with medications and recommended diets
- Assist in outreach programs for the Merced community

Fresno Public Health Department (2022)
- Developed health education materials for the Fresno community
- Assisted with LGBTQ health, community outreach

Teaching Assistant (2018-2023)
- Assisted in teaching Global Health, Environmental Health, U.S. Health Care, Research in Public Health, Mental Illness, and Introduction to Public Health, Introduction to Epidemiology
- Work with lead instructor to support student learning and engagement
- Provides tutoring and supplemental instruction for students
- Hosted discussion sections for Global Health and Introduction to Epidemiology to deepen student learning of the course material

Evidence-Based Teaching CETL workshop (2021)
- Completed workshop series to support undergraduate teaching and learning-based methods

Women in STEM Graduate Mentor Program (2019-2020)
- Mentored an undergraduate student in professional growth and development
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University of North Carolina at Pembroke, Residential Advisor (2013-2017)
- Maintained a positive, clean, and safe living environment for on-campus residents
- Facilitated and enforced campus housing policies
- Developed education, diversity, and recreational programs for the on-campus housing community

University of North Carolina at Pembroke, Federal TRIO Program Tutor (2013-2014)

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- Helped students with developing SMART goals and a plan of action to improve their grades and academic performance

Fellowships and Awards

2017-2018	Segal AmeriCorps Education Award ($5,815)
2016-2017	National Institutes of Health Post-Baccalaureate Fellowship
2015	University of North Carolina at Pembroke Emerging leader of the year award
2015	NC GlaxoSmithKline Women in Science Scholarship ($795)
2015	Hawk Research Assistantship ($1200)
2015	Research Initiative for Scientific Enhancement Summer Fellow
2014-2015	Pembroke Undergraduate Research and Creativity travel awards ($1000)
2014	National Science Foundation-REU nomination to the Council on Undergraduate Research conference
2014	National Science Foundation Research Experience for Undergraduates (REU) internship
2012-2015	Crosby scholar scholarship ($4800)

Services and Affiliations

Institutional Services

2020-2021	UC Merced Graduate Student Government Public Relations Officer
2019-2020	UC Merced W-STEM Graduate Mentor

Peer Reviewing

2019	Peer Reviewer for *The Journal of Rural Health*

Organizations/Memberships

2021	Society for Epidemiologic Research
2018	AmeriCorps Alumni
2015	NC Herpetological Society
2014	Tri Beta National Honors Society
2014	Society for Integrative and Comparative Biology
2013-2016	The Research Initiative for Scientific Enhancement Alumni

Service/Community Outreach

2019	UC Merced graduate group co-web designer
2016	Bethesda Cares Ending Homelessness Program
2016	Elderly Appreciation Project
2015	Carolina Tiger Rescue Center
2015	North Carolina Natural Science Museum; Astronomy Day

2015	North Carolina Natural Science Museum; Reptile & Amphibians Day
2015	Coal Ash Community Project
2013	Mountain Justice Spring Break
2013	The Herpetology Education in Rural Place Project

Dissertation Abstract

Historically, suicide rates among African Americans were comparatively low to other racial/ethnic groups despite the significant generational trauma, racial discrimination, inequity, and poverty experienced by African Americans. However, African Americans have experienced the greatest recent increases in suicide rates compared with all other racial/ethnic groups, giving renewed urgency to understanding risk factors for suicidal behavior in this population. This dissertation makes a contribution to the literature on suicidal behavior among African Americans by investigating socioeconomic risk factors for suicidal behavior and clinical risk factors for suicide mortality among African Americans. The first study examines the association between educational attainment, annual family income, and suicidal behavior among a representative sample of African American adults. The second study investigates the association between clinical factors (e.g., chronic illness, injuries, mental/substance use disorders) and suicide morality among African American emergency department patients. This dissertation also examines the risk of cause-specific mortality (e.g., heart disease, cerebrovascular disease, suicide) in the context of mental illness among African Americans. The results indicate that socioeconomic risk factors may not be strong predictors of suicidal behavior among African Americans. Lower income African American males in particular, may be a high-risk population for suicidal behavior. Mental disorders are strongly associated with suicidal behavior among African Americans. African Americans with mental disorders may also have an elevated risk of cause-specific mortality. Reducing the burden of suicidal behavior among African Americans may require community-based suicide prevention programing and reducing stigma associated with mental health. Improving chronic disease management and health behaviors among African Americans with mental disorder may help reduce mortality associated with mental illness in this population. Future studies should further investigate the causal mechanisms underlying the relationship between mental illness, suicidal behavior, and cause-specific mortality among African Americans.

Suicidal behavior, health and mortality among African Americans

Introduction

Suicide is a pressing public health problem worldwide. The latest report on global suicide estimates by the World Health Organization (WHO) showed that in 2019, over 700,000 people died by suicide.[1] From 2000 to 2019, WHO reported a 36% global decrease in suicide rates, but a 17% increase in the Americas.[1] Within this same time-period, estimates from the Centers for Disease Control and Prevention (CDC) showed that the age-adjusted suicide rate in the United States (U.S.) increased by approximately 33.7% (10.4 per 100,000 in 2000 to 13.9 per 100,000 in 2019).[2] As national suicide rates continue to increase, suicide mortality remains a significant problem in the U.S. According to the latest available estimates from the CDC, the age-adjusted suicide rate increased from 13.9 per 100,000 in 2019 to 14.2 per 100,000 in 2022.[3] Reducing suicide mortality is a public health priority, and with timely evidence-based interventions suicides can be prevented.[1] By 2030, the WHO aims to reduce global suicide rates by one third.[1] However, if suicide rates continue to increase in the U.S., this goal may not be met.

The scope of the problem of suicide also includes non-fatal suicidal behaviors, which occur more frequently than suicide. For example, in 2022, 49,476 Americans died by suicide, but an estimated 23 million Americans experienced some form of non-fatal suicidal behavior (e.g., thought about suicide, developed plans for suicide, or attempted suicide).[3,4] Collectively, suicides and non-fatal suicidal behaviors have an immense toll on the U.S. economy. The economic burden of suicide and suicidal self-harm exceeds $500 billion per year.[5] However, the annual economic cost of suicide alone contributes to an economic loss of more than $400 billion, in work loss productivity, medical expenses, injury morbidity, and potential years of life lost due to premature mortality.[5] The burden of suicide is also imposed upon the families of suicide victims as untimely deaths can be financially burdensome, and suicide bereavement may warrant psychological interventions.[6,7] To address the problem of suicide in the U.S., the federal government has issued a 2024 national strategy plan for suicide prevention, which to be successful highlights the need for suicide-related research in at-risk populations.[8]

Historically, suicide rates among African Americans were comparatively low to other racial/ethnic groups despite the significant generational trauma, racial discrimination, inequity, and poverty experienced by African Americans.[9] More recently, however, there has been an unprecedented increase in suicides among African Americans. The age-adjusted suicide rate among Blacks/African Americans increased by 43%, from 5.4 per 100,000 in 2010 to 7.7 per 100,000 in 2020, which was the largest percentage increase in suicides of any racial/ethnic group in the U.S.[3,10] The latest suicide estimates from the CDC, indicate that suicide rates among African Americans are continuing to increase. Between 2021 and 2022, the age-adjusted suicide rate among African Americans increased from 8.7 per 100,000 to 8.9 per 100,000.[3] Furthermore, in 2022, it was documented for the first time that the suicide rate among African Americans aged 10-

19 surpassed that of non-Hispanic Whites (8.1 per 100,000 and 7.9 per 100,000, respectively).[11] African American males have a higher suicide mortality rate than females.[12] In 2022, the suicide mortality rate among African American males (14.9 per 100,000) was more than four times the rate of African American females (3.5 per 100,000).[13] Although African American males die by suicide more than African American females, a recent study revealed that suicide rates among Black females are on the rise. Among Black females (aged 15-84), the suicide rates increased from 2.1 per 100,000 in 1999 to 3.4 per 100,000 in 2020.[14] There is limited literature on African American elderly suicides, but one study has reported that between 2010 and 2018, the suicide rate among African Americans aged 65 and older increased by 64%.[15]

In view of the rising suicides among African Americans, it is important that researchers investigate suicide risk and protective factors among African Americans to inform suicide prevention and policy efforts. Compared to other racial/ethnic groups, it is possible that risk and protective factors for suicide differ among African Americans.[9] For instance, shared cultural values, beliefs, behaviors, and experiences specific to African Americans may play a vital role in the development and prevention of suicidal behavior among African Americans.[9] The existing literature on suicidal behavior among African Americans is limited but growing in part due to the rise in African American suicides.[9,16]

Given the growing public concerns related to suicide rates in African American, this dissertation makes a contribution to the literature on suicidal behavior among African Americans, consisting of two studies that investigate socioeconomic and clinical risk factors for suicidal behavior among African Americans.

The third study of this dissertation examines the risk of cause-specific mortality in the context of mental illness among African Americans. Although African Americans have similar rates of mental illness compared with the general population, they are more likely to be undertreated for mental disorders.[17,18] Barriers such as stigma around mental health, medical mistrust, and lack of insurance are known to prevent African Americans from receiving mental health treatment.[18] This is a pressing issue that may contribute to excess mortality among African Americans given the association between mental disorders and risk of premature or excess mortality.[19,20] This study contributes to the literature on understanding the relationship between mental disorders and cause-specific mortality, specifically among African Americans compared to other racial/ethnic groups.

Chapter 1: Socioeconomic risk factors for suicidal behavior among a representative sample of African Americans

Socioeconomic disadvantage (e.g., lower education, unemployment, and low levels of income) is a strong predictor of suicidal behavior, [21–24] and a major problem in the African American population. Compared to other racial/ethnic groups, African Americans experience a greater burden of poverty and lower socioeconomic advancement.[25–27] Consequently, socioeconomic disadvantage may lead to untreated mental illness and psychological distress,[28,29] which can increase the risk of suicidal behavior. Despite socioeconomic position being an important correlate of suicidal behavior, there are limited studies on the association between socioeconomic position and suicidal behavior specifically among African Americans.

Prior studies on this topic have largely focused on African Americans living in high-poverty areas. In a population of young low-income African American adults, Ialongo and colleagues found that those with incomes at or below the poverty level were more likely to report a suicide attempt rather than suicidal ideation only, indicating there is a high severity of suicidal behavior among African Americans with severe socioeconomic diadvantage.[30] Kaslow et al. has also reported in multiple studies that homelessness among lower income African Americans is a strong predictor of attempted suicide.[31,32] The results of these studies offer important insight into the effects of extreme poverty on severe suicidal behavior; however, these studies were restricted to highly selective populations of economically disadvantaged African Americans. The study conducted by Ialongo and colleagues, for example, assessed suicidal behavior in 1,150 young adults aged 19 to 22 who were enrolled in a program evaluating interventions on early learning and aggression. Kaslow et al. used a study population that included 200 African Americans seeking medical attention at an urban public hospital. Thus, the results of these studies have limited generalizability to the broader African American population.

While socioeconomic position is generally associated with better health, it is possible that among African Americans socioeconomic advantage *increases,* rather than decreases, the risk of suicidal behavior. In the 1990s, several studies reported that higher educational attainment was a risk factor for suicidal behavior in African Americans.[9,33,34] Contradicting previous studies, in 2001-2003, Joe et al. reported that Black Americans with lower levels of educational attainment were 3.64 times more likely to attempt suicide than those with higher levels of educational attainment.[35] When examining ethnicity and sex, Assari et al. found that higher educational attainment increased odds of lifetime suicidal ideation among Caribbean Blacks, but reduced odds of lifetime suicidal ideation among African American women.[36] In this study, educational attainment was not associated with suicidal behavior among African American men.[36] These findings make an important contribution to understanding the association between socioeconomic position and suicidal behavior among African Americans, including through showing the importance of sex as a potentially modifying factor in the relationship between educational attainment and suicidal behavior. However, these studies are relatively outdated and their generalizability to current social conditions is uncertain. Furthermore, they did not examine income as an indicator of socioeconomic position.

Racial inequality in the U.S. may have implications for the relationship between socioeconomic position and suicidal behavior among African Americans. African Americans receive lower health gains from higher education and income compared to Whites, [37–40] in part due to the psychological impacts of systemic racism in the education system and workforce, as well as racial pay gaps and the daily life stressors they disproportionately experience.[40,41] In a recent study of emergency department patients, educational attainment was found to be less protective against future suicide attempts and mortality in Blacks compared to non-Hispanic Whites.[42]

To our knowledge, no study has examined associations between both educational attainment and income and suicidal behavior in a representative sample of U.S. African Americans. Given the recent increases in African American suicides, and the ongoing issue of disparities in the economic and educational advancement of African Americans, [10,43] this is an important gap to address.

The current study examines whether educational attainment and annual family income are predictors of suicidal behavior among African American adults. Given the wide range of societal challenges endured by African Americans, we hypothesized that lower educational attainment and income levels would be associated with increased odds of suicidal behavior in the context of current socioeconomic conditions.

Methods

Data source

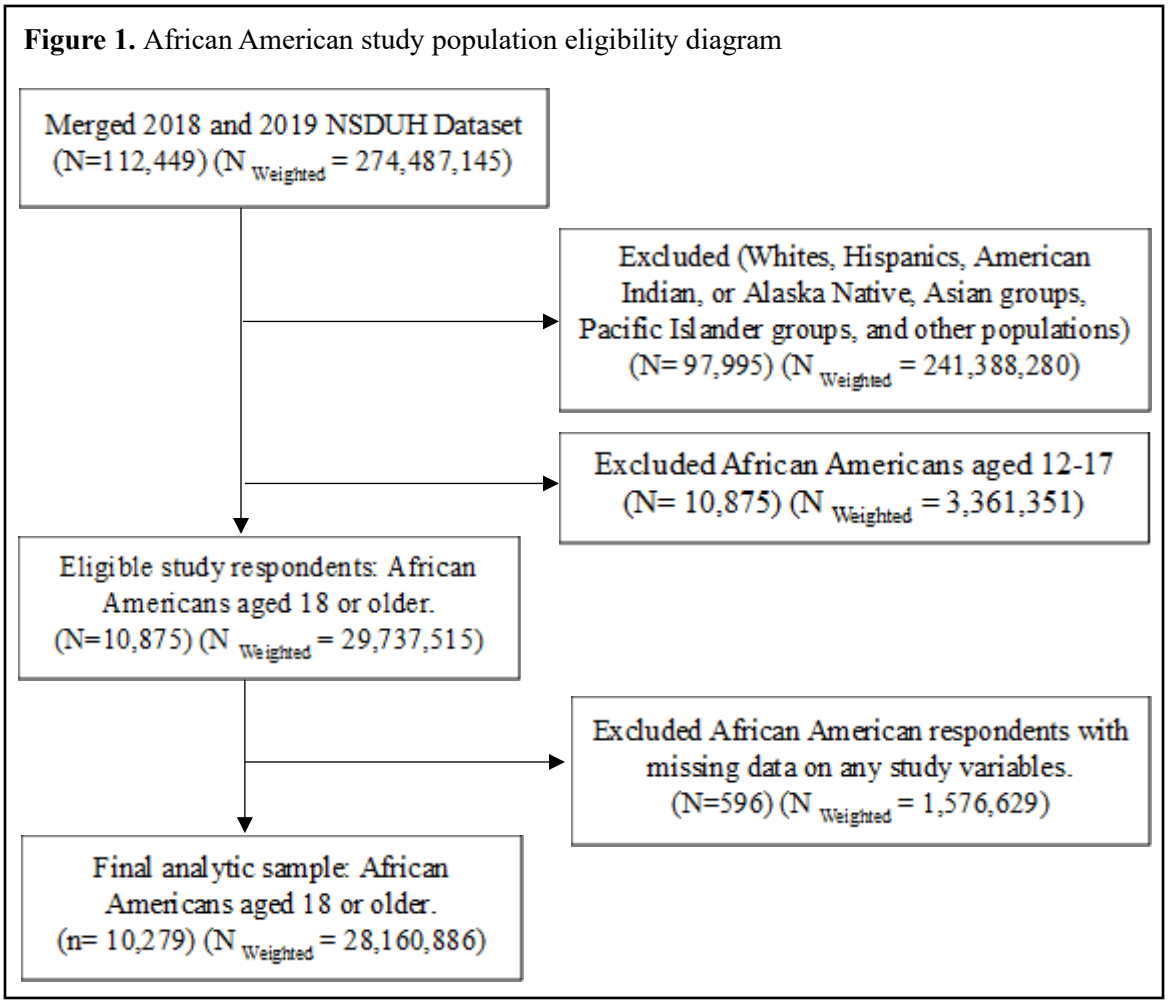
This study used publicly available secondary data from the 2018 and 2019 National Survey on Drug Use and Health (NSDUH).[44] NSDUH is a nationwide cross-sectional survey first established in 1971 and conducted yearly by the U.S. Substance Abuse and Mental Health Services Administration (SAMHSA). Since 1999, NSDUH has been administered using computer-assisted personal interviews and audio computer-assisted self-interviews.[44] NSDUH uses a stratified multistage area probability design within each state, including the District of Columbia.[45] The stratification starts at the state level, and states are stratified into populated state sampling regions (SSR).[45] Census tracts are then selected within each SSR, and census block groups are selected within each census tract, followed by area segments (a collection of census blocks) that are selected within each census block group.[45] Within each area segment, households are randomly selected, and at least two residents (aged 12 or older) are selected for the NSUDH interview.[45] The population data collected in the NSDUH excludes institutionalized individuals (e.g., individuals in treatment facilities, prisons, and nursing homes), unsheltered people (e.g., homeless and/or transient people living in cars, streets, or places not meant for habitation),[46] and active military personnel, which together comprise less than two percent of the population.[44] NSUDH is primarily designed to provide information on drug and substance use (including tobacco and alcohol use), treatment of psychological distress, depression, and mental health care of youths (age 12 -17) and adults (age 18 and older) in the U.S.[44] Demographic data obtained from the NSDUH include sex, race/ethnicity, educational attainment, employment status, military status, marital status, and household size. Survey respondents are also asked questions about their income, health care access, medical insurance, and illegal activities related to drug

use. Participation in the NSDUH is voluntary, and those who complete the NSDUH interview receive $30.00 for their participation.[47] NSDUH applies statistical imputation procedures to reduce any inconsistencies in the survey data, including the occurrence of missing or ambiguous data.[48] Detailed information on NSDUH's sampling and survey techniques can be found in SAMHSA's 2019 methodological resource manual.[45,48] This study was defined exempt by the institutional review board as NSDUH data are publicly available.

Study Sample

The original NSDUH 2018 and 2019 datasets contained 112,449 individuals aged 12 years and older. The dataset was then further restricted to African American adults aged 18 or older. The age restriction for this study was necessary as participants younger than 18 years old are not asked questions about suicidal behavior and are unlikely to have obtained their highest level of education. The final analytic sample included 10,279 African American adults, representing approximately 28,160,886 individuals across the US. A diagram of the study population eligibility criteria is shown in **Figure 1**.

Figure 1. African American study population eligibility diagram



Exposure measures

Our exposure measures of interest included educational attainment and annual family income, and were ascertained using variables defined by NSDUH. Educational attainment was measured according to the highest level of education completed, and self-reported by each survey participant into four categories: less than high school, high school diploma/GED, some college/associate's degree, or college graduate or higher. The reference category for educational attainment is college graduate or higher and was chosen due to the large number of observations in that category.

Annual family income was self-reported and coded as a four-category variable: annual income of $0-$19,999, $20,000-$49,999, $50,000-$74,999, or ≥$75,000. The reference category for annual family income was those making ≥$75,000.

Outcome measure

The outcome measure of interest was past-year suicidal behavior, which was coded as a binary variable (0 = no, 1 = yes). Participants coded as reporting suicidal behavior responded "yes" to at least one of the following questions: "At any time in the past 12 months, did you seriously think about trying to kill yourself?", "During the past 12 months, did you make any plans to kill yourself?", or "During the past 12 months, did you try to kill yourself?" Survey participants who responded "no" to all suicide-related questions were defined as not having past-year suicidal behavior.

Covariates

Various characteristics associated with educational attainment, family income, and suicidal behavior were considered *a priori* confounders and treated as covariates in this study.[49–51] These covariates included sex (male, female), age (18–25, 26–34, 35–49, 50-64, and 65 years or older), marital status (not married, married), sexual identity (heterosexual, non-heterosexual/unsure), religiosity (religious values important or not important), past-year substance or alcohol use disorder (yes, no), past-year major depression (yes, no), past-year delinquent behavior (yes, no), overall health (excellent/very good/good or fair/poor), and the presence of chronic health conditions (0, 1, or 2+) reported by the survey respondent as a condition they were diagnosed with by a doctor or another health care professional.

Statistical Analyses

To analyze population data in NSDUH, SAMHSA provides sampling weights to adequately represent the entire U.S. noninstitutionalized population aged 12 or older. The sampling weights are used to account for disproportionate sampling by age groups.[45] The NSDUH datasets for 2018 and 2019 were combined and reweighted based on the recommendations found in SAMHSA's 2019 methodological resource manual.[52] We first examined the sociodemographic characteristics of the study population using descriptive statistics. We then calculated the prevalence of suicidal behavior for each level of

educational attainment and annual family income. To account for the high correlation between educational attainment and annual family income, we first examined the relationship between each exposure variable and suicidal behavior separately using three logistic regression models: (1) an unadjusted bivariate analysis (model 1), (2) a partially adjusted model that controlled for sex, age, marital status, sexual identity, religiosity, overall health, and chronic conditions (model 2), and (3) a fully adjusted model that controlled for all model 2 characteristics as well as past-year substance use disorder, past-year major depression, and past-year delinquency (model 3). Then we conducted a logistic regression model that included both exposures along with all other covariates. Lastly, we performed sex-stratified analyses that included both exposure variables of interest and all sociodemographic characteristics to examine whether the associations between educational attainment, annual family income, and suicidal behavior varied between male and female participants. All analyses were conducted using STATA/SE 18.0 (College Station, TX) and weighted to account for NSDUH's complex survey design.

Results

In the sample of 10,279 African American adults aged 18 or older, approximately 4.0% of the sample reported a past-year history of suicidal behavior. The largest proportion of survey respondents were between the ages of 35-49 (25.2%) and more than half of the survey respondents were female (54.9%). Unweighted and weighted sample characteristics are presented in **Table 1**.

Table 1. Unweighted and weighted characteristics of African American adult respondents in NSDUH 2018 and 2019.

Sociodemographic Characteristics	Past year suicidal behavior $N_{weighted}$ = 1,125,433		No past-year suicidal behavior $N_{weighted}$ = 27,035,453		x^2 test
	Unweighted n	Weighted %	Unweighted n	Weighted %	
Educational attainment					15.921*
≤ High school	84	12.9	1,416	15.0	
High school diploma/GED	203	34.9	3,214	30.6	
Some college /associate degree	233	38.0	3,360	33.0	
College graduate or higher	70	14.2	1,699	21.3	
Annual family income					26.616*
$0 - $19,999	235	37.4	2,985	26.8	
$20,000 - $49,999	189	33.1	3,503	34.8	
$50,000 - $74,999	68	12.7	1,246	14.2	
≥ $75,000	98	16.8	1,955	24.3	
Sex					6.186*
Male	234	39.1	4,294	45.4	
Female	356	61.0	5,395	54.6	
Age (years)					209.903*
18-25	343	38.1	3,304	14.5	
26-34	104	20.2	2,007	18.0	
35-49	106	23.6	2,559	25.3	
50-64	32	16.0	1,118	25.3	
65+	5	2.1	701	16.9	
Married	65	15.0	2,306	33.2	58.715*
Non-heterosexual/unsure	136	19.8	779	5.9	125.866*
Religiosity	375	66.6	7,512	79.2	36.645*
Overall health: fair/poor	127	24.4	1,343	17.8	11.442*
Chronic health conditions					0.302*
No chronic conditions	374	55.4	6,515	56.7	
One chronic condition	166	30.7	2,338	29.6	
Two or more chronic conditions	50	13.9	836	13.7	
Past-year substance use disorder	156	30.4	743	6.6	321.365*
Past-year major depression	247	44.3	522	4.5	1097.104*
Past-year delinquent behavior	191	40.1	2,146	22.2	71.104*

*Indicates statistical significance ($P < 0.05$) based on $\chi 2$ test

Prevalence estimates of past-year suicidal behavior across levels of educational attainment are shown in **Figure 2**. The prevalence of past-year suicidal behavior was approximately equal among African American adults with some college or an associate's degree and those with a high school diploma/GED (4.6%). The prevalence of suicidal behavior was slightly lower among those with less than a high school education (3.5%), and those with a college degree (2.7%).

Figure 2. Weighted prevalence estimates of past-year suicidal behvaior by levels of educational attainment

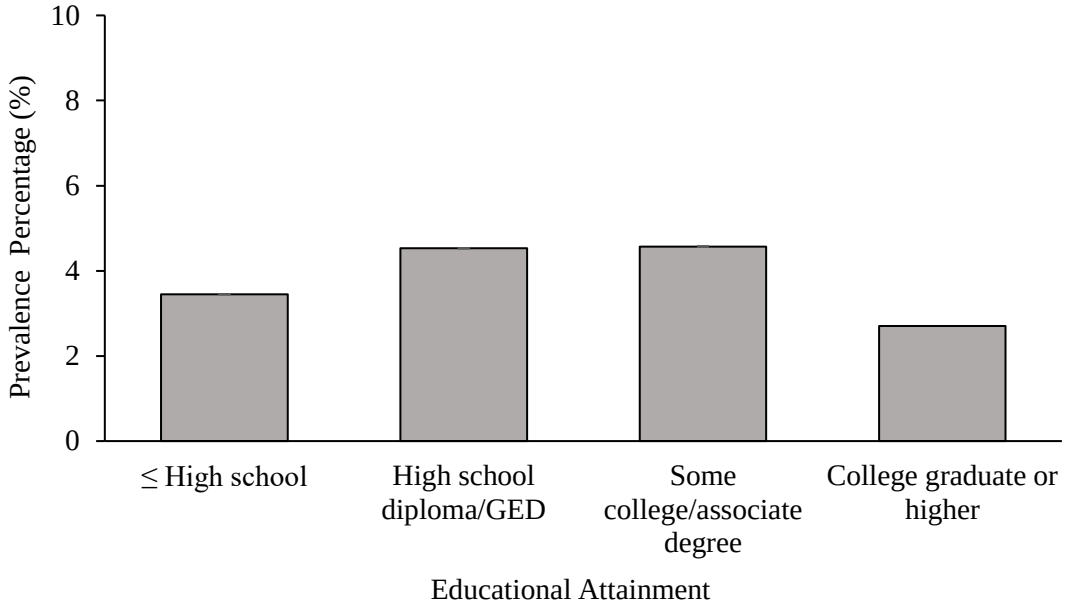


Figure 3 shows the prevalence estimates of past-year suicidal behavior across levels of annual family income. Overall, the proportion of African Americans reporting suicidal behavior decreased with rising income. More specifically, the prevalence estimates were 5.5% among those earning $0-$19,999, 3.8% among those earning $20,000-$39,999, 3.6% among those earning $40,000-$74,999, and 2.9% among those earning ≥$75,000.

Figure 3. Weighted prevalence estimates of past-year suicidal behavior by levels of annual family income

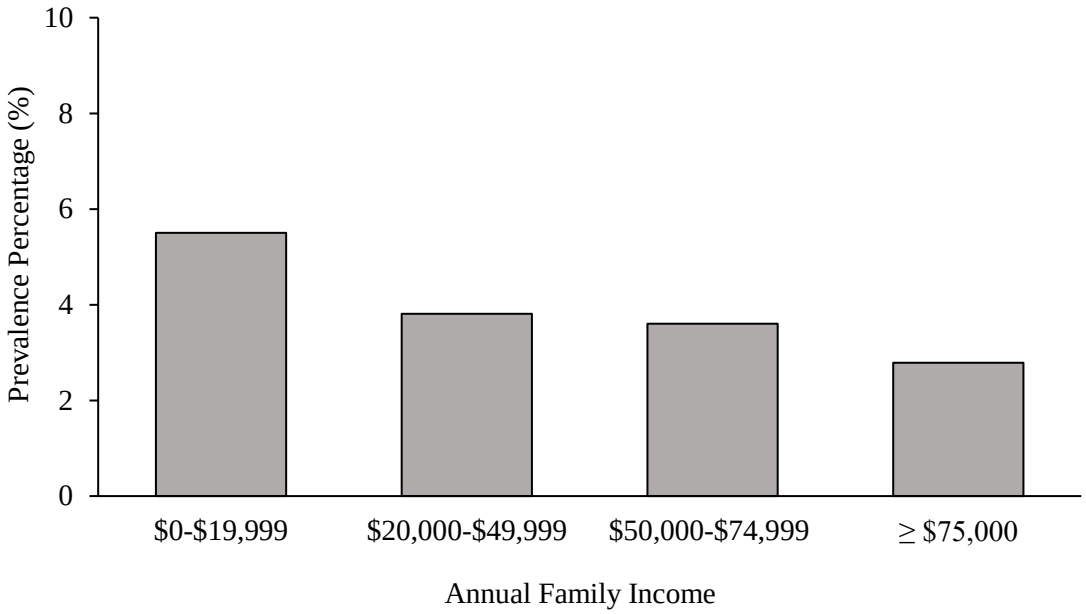


Table 2 shows the associations between educational attainment and sociodemographic characteristics with past-year suicidal behavior. In the unadjusted bivariate analysis, African Americans with a high school diploma/GED, as well as those with some college credit or an associate's degree, were both 1.7 times more likely to engage in suicidal behavior during the past year than those with a college degree or higher (Table 2, model 1). After accounting for sociodemographic characteristics in the partially (Table 2 model 2) and fully adjusted (Table 2 model 3) models, there were no significant associations between educational attainment and suicidal behavior.

Table 2. Weighted bivariate and multiple logistic regression models examining the association between educational attainment and past-year suicidal behavior.

	Model 1 (unadjusted) [a] (95% CI)	Model 2 (partially adjusted) [b] (95% CI)	Model 3 (fully adjusted) [c] (95% CI)
Education levels			
≤ High school	1.29 (0.86, 1.93)	0.99 (0.64, 1.52)	0.92 (0.60, 1.42)
High school diploma/GED	**1.71 (1.21, 2.42)**	1.33 (0.92, 1.93)	1.50 (0.98, 2.29)
Some college/associate degree	**1.72 (1.14, 2.60)**	1.32 (0.87, 2.00)	1.33 (0.87, 2.02)
College graduate or higher	1.00	1.00	1.00
Males		0.83 (0.67, 1.03)	**0.77 (0.59, 0.99)**
Age (years)			
18-25		1.00	1.00
26-34		**0.45 (0.34, 0.60)**	**0.41 (0.29, 0.58)**
35-49		**0.37 (0.27, 0.51)**	**0.41 (0.30, 0.58)**
50-64		**0.22 (0.12, 0.39)**	**0.26 (0.15, 0.47)**
65+		**0.04 (0.01, 0.10)**	**0.07 (0.03, 0.20)**
Married		**0.61 (0.40, 0.94)**	0.71 (0.47, 1.08)
Non-heterosexual/unsure		**2.47 (1.86, 3.29)**	**1.90 (1.36, 2.66)**
Religiosity		**0.61 (0.48, 0.77)**	**0.58 (0.45, 0.76)**
Overall health: fair/poor		**1.82 (1.31, 2.52)**	1.35 (0.94, 1.94)
Chronic health conditions			
No chronic conditions		1.00	1.00
One chronic condition		**1.63 (1.16, 2.29)**	1.40 (0.99, 1.96)
Two or more chronic conditions		**2.22 (1.37, 3.58)**	1.54 (0.93, 2.57)
Past-year substance use disorder		…	**2.83 (1.98, 4.03)**
Past-year major depression		…	**10.68 (7.79, 14.64)**
Past-year delinquent behavior		…	**1.79 (1.26, 2.52)**

[a] Weighted unadjusted bivariate analysis, [b] Partially adjusted multivariate analysis, [c] Fully adjusted multivariate analysis.
Results in **bold** indicate statistical significance ($P < 0.05$).
Reference groups for adjusted regression models are college graduate or higher, ≥$75,000, age 18-25, not married, no government assistance, heterosexual/straight sexual identity, religious values not important, unemployment, shared household, non-metro, no past-year substance use disorder, no past-year major depression, no past-year delinquent behavior, overall health: good/ very good/excellent and no chronic health conditions.

Table 3 shows the results of the association between annual family income and past-year suicidal behavior. In the unadjusted bivariate analysis, adults with family income levels of $0-$19,999 were twice as likely to report suicidal behavior compared to those with incomes of ≥$75,000 (Table 3, model 1). Adults reporting incomes of $20,000-$49,999 also had higher odds (OR=1.38, 95% CI=1.00, 1.89) of reporting suicidal behavior compared to those with incomes ≥$75,000 (Table 3, model 1). However, after controlling for sociodemographic characteristics in the partially and fully

adjusted models, family income was no longer significantly associated with suicidal behavior (Table 3, models 2 and 3).

Table 3. Weighted bivariate and multiple logistic regression models examining the association between annual family income and past-year suicidal behavior.

	Model 1 (unadjusted) [a] (95% CI)	Model 2 (partially adjusted) [b] (95% CI)	Model 3 (fully adjusted) [c] (95% CI)
Annual family income			
$0 - $19,999	**2.02 (1.42, 2.88)**	1.42 (0.97, 2.10)	1.27 (0.83, 1.94)
$20,000 - $49,999	**1.38 (1.00, 1.89)**	1.09 (0.77, 1.54)	1.09 (0.77, 1.54)
$50,000 - $74,999	1.30 (0.82, 2.04)	1.23 (0.78, 1.93)	1.27 (0.79, 2.06)
≥ $75,000	1.00	1.00	1.00
Males		0.84 (0.67, 1.06)	0.77 (0.58, 1.01)
Age (years)			
18-25		1.00	1.00
26-34		**0.45 (0.34, 0.60)**	**0.40 (0.29, 0.57)**
35-49		**0.37 (0.27, 0.50)**	**0.40 (0.29, 0.55)**
50-64		**0.21 (0.12, 0.38)**	**0.25 (0.14, 0.45)**
65+		**0.04 (0.01, 0.10)**	**0.07 (0.02, 0.18)**
Married		0.65 (0.42, 1.01)	0.74 (0.48, 1.13)
Non-heterosexual/unsure		**2.44 (1.84, 3.23)**	**1.88 (1.35, 2.61)**
Religiosity		**0.61 (0.48, 0.77)**	**0.59 (0.45, 0.77)**
Overall health: fair/poor		**1.74 (1.23, 2.45)**	
Chronic health conditions			
No chronic conditions		1.00	1.00
One chronic condition		**1.64 (1.17, 2.29)**	1.39 (0.99, 1.96)
Two or more chronic conditions		**2.22 (1.36, 3.63)**	1.53 (0.91, 2.55)
Past-year substance use disorder		…	**2.80 (1.96, 4.00)**
Past-year major depression		…	**10.36 (7.59, 14.15)**
Past-year delinquent behavior		…	**1.78 (1.25, 2.54)**

[a] Weighted unadjusted bivariate analysis, [b] Partially adjusted multivariate analysis, [c] Fully adjusted multivariate analysis.
Results in **bold** indicate statistical significance ($P < 0.05$).
Reference groups for adjusted regression models are college graduate or higher, ≥$75,000, age 18-25, not married, no government assistance, heterosexual/straight sexual identity, religious values not important, unemployment, shared household, non-metro, no past-year substance use disorder, no past-year major depression, no past-year delinquent behavior, overall health: good/ very good/excellent and no chronic health conditions.

With regard to sociodemographic characteristics, there were significant associations between adults reporting a non-heterosexual identity, poor/fair overall health, or at least one chronic condition and suicidal behavior in all of the partially adjusted models. In the fully adjusted models, adults who identified as non-heterosexual were still more likely to engage in suicidal behavior compared to heterosexual adults. In addition, adults reporting past-year substance/alcohol use disorder, major depression, and delinquent behavior were also more likely to report suicidal behavior. Results from the

regression models also showed that adults over 25 had a lower likelihood of reporting suicidal behavior; respondents who reported that religious values were important to them also had reduced odds of past-year suicidal behavior.

In the sex-stratified analyses (**Table 4**), educational attainment was not associated with suicidal behavior in African American males. However, male respondents with a family income of $0-$19,999 were nearly 3 times more likely to engage in suicidal behavior than males with family incomes ≥$75,000. Males aged 26-34, 50-64, and ≥65 were significantly less likely to report suicidal behavior compared to males aged 18-25. Males with religious values were also significantly less likely to report suicidal behavior. However, males reporting past-year history of major depression or substance/alcohol use disorder had higher odds of reporting suicidal behavior than those without such disorder.

Among African American females, there were no significant associations between educational attainment or family income and suicidal behavior. Females above the age of 25 years were significantly less likely to report suicidal behavior. Marriage and religiosity in females also lowered the odds of suicidal behavior. However, non-heterosexual females had a nearly 1.8-fold increase in the likelihood of suicidal behavior compared to heterosexual females. Females with a past-year history of major depression, substance/alcohol use disorder, and delinquent behavior also had higher odds of reporting suicidal behavior.

Table 4. Weighted multiple logistic regression models examining the association between educational attainment and annual family income levels with past-year suicidal behavior among African American males and females.

	African American Males	African American Females
	Adjusted odds ratios (95% CI)	Adjusted odds ratios (95% CI)
Education levels		
≤ High school	0.89 (0.44, 1.82)	0.99 (0.55, 1.78)
High school diploma/GED	1.66 (0.89, 3.10)	1.45 (0.83, 2.54)
Some college/associate degree	1.34 (0.71, 2.52)	1.35 (0.82, 2.22)
College graduate or higher	1.00	1.00
Annual family income		
$0 - $19,999	**2.79 (1.63, 4.76)**	0.74 (0.42, 1.30)
$20,000 - $49,999	1.37 (0.72, 2.60)	0.87 (0.51, 1.49)
$50,000 - $74,999	1.28 (0.67, 2.45)	1.26 (0.72, 2.21)
≥ $75,000	1.00	1.00
Age (years)		
18-25	1.00	1.00
26-34	**0.31 (0.18, 0.53)**	**0.48 (0.31, 0.47)**
35-49	**0.49 (0.26, 0.94)**	**0.36 (0.26, 0.50)**
50-64	**0.20 (0.07, 0.57)**	**0.27 (0.14, 0.53)**
65+	**0.01 (0.00, 0.08)**	**0.12 (0.04, 0.37)**
Married	1.16 (0.59, 2.28)	**0.54 (0.36, 0.82)**
Non-heterosexual/unsure	2.09 (0.91, 4.78)	**1.80 (1.19, 2.76)**
Religious values important	**0.58 (0.36, 0.93)**	**0.57 (0.41, 0.79)**
Overall health: fair/poor	1.48 (0.73, 2.99)	1.33 (0.80, 2.22)
Chronic health conditions		
No chronic conditions	1.00	1.00
One chronic condition	1.35 (0.77, 2.37)	1.53 (1.00, 2.34)
Two or more chronic conditions	1.56 (0.79, 3.10)	1.64 (0.84, 3.20)
Past-year substance use disorder	**2.23 (1.39, 3.55)**	**3.58 (2.29, 5.61)**
Past-year major depression	**19.97 (12.39, 32.19)**	**7.92 (5.42, 11.57)**
Past-year delinquent behavior	1.37 (0.87, 2.15)	**2.19 (1.46, 3.29)**

Results in **bold** indicate statistical significance ($P < 0.05$).

Reference groups for adjusted regression models are college graduate or higher, ≥$75,000, age 18-25, not married, no government assistance, heterosexual/straight sexual identity, religious values not important, unemployment, shared household, non-metro, no past-year substance use disorder, no past-year major depression, no past-year delinquent behavior, overall health: good/ very good/excellent and no chronic health conditions.

Discussion

Using a study sample of 10,279 NSDUH respondents representing roughly 28 million African American adults in the U.S., we provide one of the first nationally representative studies to investigate the roles of educational attainment and annual family income on self-reported past-year suicidal behavior among African Americans. Our main study findings did not support our hypothesis that lower socioeconomic position is associated with suicidal behavior among African Americans. While crude prevalence estimates for past-year suicidal behavior were highest among adults who reported that they had some college or a high school degree, we did not find any significant covariate-adjusted associations between educational attainment and suicidal behavior. Similarly, past-year suicidal behavior prevalence was highest for those who reported that they had a family income of $0-$19,000, but after accounting for covariates we did not find any significant associations between annual family income and suicidal behavior.

In the general population, previous studies have reported that individuals with a high school diploma have a greater risk of suicidal behavior compared to those with higher levels of education.[53–55] Studies have also shown that lower levels of educational attainment may predispose individuals to economic hardship, family and intimate partner discord, problem-solving difficulty in challenging circumstances, and poor physical and psychological health,[55] factors that can lead to the development of suicidal behavior. However, research on the relationship between educational attainment and suicidal behavior among African Americans has been inconsistent. Joe et al. reported a significant association between lower levels of educational attainment and suicidal behavior among Black Americans in the early 2000s.[35] However, several other studies have reported *higher* educational attainment as a risk factor for suicidal behavior among African Americans.[9,33,34,36,56] These inconsistencies could be due to study design differences, but it is also possible that educational attainment is no longer strongly associated with suicidal behavior among African Americans.

While socioeconomic position is important to overall quality of life, it does not protect African Americans against the experiences of racism or discrimination that can lead to suicidal behavior. There is a growing body of research showing that suicidal behavior among African Americans is highly correlated with racial injustice in the U.S. Several studies show that African Americans who are directly or indirectly exposed to negative interactions with police officers have an elevated risk of mental health problems, including suicidal behavior.[57–61] Hans Oh et al., also reported that various discriminatory events experienced by Black Americans were associated with suicidal behavior, even after adjusting for sociodemographic characteristics and psychiatric disorders.[60] The contextual experiences of racism and discrimination among African Americans are complex, but research suggests that racialized experiences of various kinds, including online encounters with racism and intergenerational trauma, may affect risk for suicidal behavior through various pathways among African Americans.[60,62,63] Across all stages of life, African Americans have a high likelihood of encountering some form of racism or

discrimination regardless of their socioeconomic position.[64] Thus, the racialized experiences faced by many African Americans may provide a better explanation than socioeconomic position for the increase in suicidal behavior among African Americans.

Financial hardship is a well-documented risk factor for suicidal behavior,[21–24] and among low-income African Americans extreme destitution may lead to outcomes of severe suicidal behavior.[30–32] In this study, we did not find that an association between low annual family income and suicidal behavior in a representative sample of African Americans. One possible explanation for our null findings between income and suicidal behavior among African Americans could be due to low statistical power, as there were few individuals in the $0-$19,999 income group. Another explanation could be related to the positive effects of social support and religiosity [65–67] that may build resiliency against financial difficulties, thus lower the likelihood of suicidal behavior. In the present study, we did find that religiosity lowered odds of suicidal behavior, but examining religiosity as a mediator or moderator in the association between income and suicidal behavior was out of scope for this paper.

When examining sex differences, we did find a significant association between lower income and suicidal behavior among males: those with annual incomes of $0-$19,999 were 2.5 times more likely than high-income males to report suicidal behavior. Annual income was not associated with suicidal behavior among females. From this study, it is unclear why lower income is associated with a higher risk of suicidal behavior in African American males, but not females. However, there are several poverty-related issues (e.g., greater risk of incarceration or police engagement, limited social support and resources, engagement in risk-taking behaviors) that are more specifically linked to the experiences of African American males, and may convey risk for suicidal behavior.[68] To our knowledge, no prior literature has examined risk factors for suicidal behavior among African American males and females by different income levels. Thus, the findings of this study make an important contribution to the literature and indicate a need for further investigation of factors associated with suicidal behavior among African American males and females separately.

While our main findings did not suggest that educational attainment and annual family income were strong predictors of suicidal behavior in the broader African American population, we did find that sexual identity was associated with greater odds of suicidal behavior. In our fully adjusted models, African Americans reporting a non-heterosexual identity were more likely to engage in suicidal behavior than those who reported they were heterosexual. In sex-stratified analyses, non-heterosexual African American females – but not African American males – had higher odds of reporting suicidal behavior. A wide range of studies have shown that sexual minorities are more likely than non-sexual minorities to engage in suicidal behavior, due to increased exposures to negative experiences such as community and family rejection, discrimination, stigmatization, and victimization.[69–75] While few studies have focused on suicidal behavior among sexual minority African Americans/Blacks, reports do indicate that non-heterosexual African Americans experience a unique set of challenges that put them at greater risk of suicidal behavior, including higher rates of unemployment, worse

mental and physical health, poor family cohesion, and lower levels of community support.[70]

With regards to physical health, previous studies have examined physical health disparities and suicidal behavior among African Americans and non-Hispanic Whites,[76,77] and other studies have focused on the association between physical illness and mental health problems among African Americans.[78–80] There is limited literature on the relationship between physical illness and suicidal behavior specifically among African Americans, despite the significant burden of chronic illnesses and health inequities in the African American population.[81] In our partially adjusted regression models, we found significant associations between fair/poor overall health and chronic illness and suicidal behavior. In our fully adjusted models, reporting poor/fair health or a chronic illness was no longer associated with suicidal behavior, which may be explained by the effect of pre-existing mental health or substance use problems.

Mental and behavioral health problems are the strongest predictors of suicidal behavior across all populations.[82–89] In our study, depression and substance use disorder were strongly associated with suicidal behavior overall (as well as in males and females separately), while delinquent behavior was associated with suicidal behavior only among females. These findings are consistent with other studies showing that depression, substance use, alcohol use, and aggressive behaviors are important risk factors for suicidal behavior among African Americans.[30,32,35,90] We did not find a significant association between delinquent behavior and suicidal behavior among males.

Evidence from this study provides important implications for suicide prevention strategies among African American populations. First, it is important to recognize that risk and protective factors for suicidal behavior in the general population may differ from those among African Americans due to cultural characteristics (e.g., religiosity, mental health stigmatization), healthcare barriers (access to healthcare, medical mistrust, lack of culturally competent practitioners, clinician bias), and systemic barriers (e.g., racism, discrimination, poverty). Thus, African Americans should be treated as a distinct subpopulation for suicide prevention strategies and research. One possible suicide prevention strategy may include screening African American sexual minority individuals, as well as African Americans with mental and behavioral disorders, for suicidality. Evidence from the current study shows that religiosity protects against suicidal behavior among African Americans. However, this may not be true for African American sexual minorities due to negative attitudes around homosexuality.[91,92] This study also shows that lower income males may be a high-risk population for suicidal behavior. Therefore, future studies should also address risk and protective factors for suicidal behavior in subpopulation of African Americans. Aside from religiosity, prior literature shows that supportive networks and connectedness among African Americans may reduce burdens associated with health and other adversities.[56]

Limitations

This study is subject to several limitations. First, the NSUDH is a cross-sectional survey, which makes it impossible to determine any causal relationship between

socioeconomic position or other factors and suicidal behavior among our study sample. This study also relied on self-reported information, which is subject to recall and other forms of biases. Another limitation of our study is that the study results may be limited to low statistical power despite aggregating two years of NSUDH survey data. While we were able to control for many sociodemographic characteristics in the current study, the NSDUH does not include information on potentially important social determinants of suicidal behavior among African Americans, such as exposure to discrimination, racism, racial profiling, domestic violence, and inadequate social support. Lastly, we were unable to examine the relationship between educational attainment, family income, and suicide mortality.

Conclusion

Despite limitations, this study is the first nationally representative study to investigate the associations between educational attainment, annual family income, and suicidal behavior among African Americans. This study contributes to the literature on suicidal behavior among African Americans by demonstrating that educational attainment and annual family income are not strong predictors of suicidal behavior among African Americans. However, lower-income African American males in particular may be a high-risk population for suicidal behavior. In addition, African American sexual minority individuals, and those with mental and substance use problems, are likely to be high-risk populations in need of targeted prevention strategies.

Chapter 2: Clinical risk factors associated with suicide among African American emergency department patients

Although not without challenges, there is a growing consensus that healthcare settings may provide a critical window of opportunity for suicide prevention (e.g., suicide risk screening, brief interventions), and emergency departments (EDs) may be particularly useful in such efforts.[93–97] Compared with the general population, studies show that ED patients have a greater risk of suicide.[98–100] The ED is often the first place of contact among individuals in a suicidal crisis, and it has been reported that over 30% of suicide decedents seek ED care within a year before their death.[24,101] African Americans frequently utilize EDs as a primary source of care compared to other racial/ethnic groups.[102–104] In this context, EDs may be an important place to monitor, identify, and target African Americans at risk for suicide.

Previous studies have sought to identify clinical factors associated with suicide mortality among ED patients, which is important for targeting high-risk patients for suicide-related interventions. Multiple studies show that the risk of suicide is highest among ED patients diagnosed with self-harm or mental disorders compared to ED patients without such conditions.[24,88,98,99,105,106] Studies also show that ED patients diagnosed with psychotic disorders (e.g., bipolar disorder and schizophrenia) have a greater risk of suicide compared with ED patients diagnosed with other mental disorders.[99,107] However, it is also estimated that approximately 36% of ED patients who die by suicide within a year are not diagnosed with any mental or behavioral disorder.[96] Physical illness diagnoses such as back pain, traumatic brain injury, cancer, congestive heart failure, chronic obstructive pulmonary disorder (COPD), epilepsy, HIV/AIDS, and sleep disorders are other conditions associated with a higher risk of suicide among ED patients.[105]

These associations may have important implications for the risk of suicide among African American ED patients, in part because African Americans experience worse health outcomes and higher rates of chronic illness compared with other racial/ethnic groups.[108,109] African Americans also face several structural barriers (e.g., lack of health insurance, low health literacy, bias and discrimination from health care providers) to receiving quality health care,[109] which may lead to difficulties in managing illnesses, increasing their vulnerability to suicidal behavior. Although African Americans have higher utilization rates of psychiatric services in EDs compared with other groups, the undertreatment of mental disorders among African Americans is another issue that may contribute to the burden of suicidal behavior in this population.[18,110,111] Despite the large burden of illness among African Americans, existing research has not investigated clinical factors for suicide among African American ED patients. To avoid missed opportunities for suicide prevention among African Americans, this is an important gap in the literature to address.

The present study aims to examine physical, mental, and behavioral conditions associated with the risk of suicide among African American ED patients. This study includes an investigation of clinical diagnoses previously shown to increase risk of

suicide among ED patients, such as cancer, cerebrovascular disease, COPD, heart disease, neurological conditions, mental disorders, and substance use disorders.[98,100,105,112,113] This study also investigates medical conditions shown to be associated with suicidal behavior, such as asthma, diabetes, pain-related conditions, and injuries.[114–123]

Methods

Data Source

This study used emergency department (ED) data from the California Department of Health Care Access and Information (HCAI) for the period January 1, 2010, through December 31, 2016 (the most recent data available to us). HCAI provided nonpublic, deidentified patient-level data on all individuals who presented to a California-licensed ED during the study period, excluding those in federal (e.g., Veterans Administration) hospitals. Visits resulting in patient hospitalization or discharge home were included. The dataset was then restricted to visits made by African American ED patients aged ≥10 years. A unique patient identifier (encrypted SSN) was used to identify all visits made by an individual patient. Patients could make multiple ED visits during the study period, but only their first-occurring visit or "index visit" was retained for follow-up analysis. For patients who had an ED visit and were then admitted to the same hospital, the date of their index visit was the date of their discharge from the hospital. For patients who had an ED visit and were transferred to another facility or had an ED visit that resulted in a discharge home, the date of their index visit was the date of their ED encounter. Patients who died on their index visit were excluded from analysis.

HCAI also provided linked death records from the California Department of Public Health - Vital Records office, which includes information on the date, cause, and manner of death for all patients who made an ED or hospital visit in California and died during the same calendar year (in California or another state). Death records were linked to patient hospital records by the patient's social security number, sex, date of birth, race/ethnicity, and zip code of residence. As HCAI only provides linked death records that occur within the calendar year, this study was limited to index ED visits that occurred January 1st-June 30th in each year of 2010-2016, to ensure all patients could be followed for six months of mortality observation. This study was approved by the Institutional Review Boards of the California Health and Human Services Agency and the University of California, Merced.

Measures

First, index visits were grouped into 13 "diagnostic groups" based on the patient's primary Clinical Classification Software (CCS), International Classification of Diseases, Clinical Modification (ICD-9/10-CM) diagnosis or injury code (E-code), as shown in **Table 5.**

Table 5: Clinical classifications software (CCS), diagnostic (ICD-9/ICD-10 CM), and injury codes (E-codes) used to define patient diagnostic groups.

Morbidity categories and diagnostic groups	CCS codes	ICD-9-CM/E-codes	ICD-10-CM/E-codes
Chronic illness			
Asthma	128		
Cancer	11-43		
Cerebrovascular disease	109-113		
Chronic obstructive pulmonary disease	127		
Diabetes	49-50		
Heart disease	96-97, 100-101, 103-105, 107-108	402, 404, 425(5)	I11, I13, I42(6)
Kidney disease	156-158, 161	403	I12
Non-cancerous pain, and neurological conditions (e.g., sickle cell anemia, degenerative disorders, musculoskeletal diseases, joint disorders, intracranial injury)*	61, 79-81, 83-85, 95, 202-207, 210-212, 653	800-801, 307(8), 357(5)	S02(0,1), S07(1), F45(4), G62(1)
Mental and substance use disorder			
Currently active mental health conditions and self-harm*	650-652, 654-659, 662, 670	V62(85) E950-E958(9)	R45(850), X71-X83
Currently active alcohol and substance use*	241, 242, 660, 661	709(3), 908, E860, E850-E858	R78(0), T51, Y905-Y909
Injury			
Assault injuries*		995(50,51,52,53,54) 995(59) 995(80,81,82,83,84) 995(85) E960-E968(9)	T39-T65, T74, T76, X92-X99, Y00-Y09
Unintentional injuries (accidents and other undetermined injuries)*		E800-E807, E810-E849, E861-E869, E880-E928, E980-E989	V00- V99, W00-W99, X00-X58, Y21-Y33
Other conditions	All other CCS codes		

*Subsequent or sequela encounters were excluded for all ICD-10/E-codes.

To maximize statistical power, we grouped specific diagnostic groups into four categories of morbidity: chronic illness, mental disorder and substance use, injury, and other conditions. The chronic illness category comprised diagnosis codes from the following diagnostic groups: asthma, cancer, cerebrovascular disease, chronic obstructive pulmonary disease (COPD), diabetes, heart disease, kidney disease, and non-cancerous pain/neurological conditions. The mental disorder and substance use morbidity category included diagnosis codes from the mental disorder and substance use diagnostic groups. The mental and substance use diagnostic groups comprised diagnosis codes that indicated

a currently active mental health condition, self-harm with suicidal intent, or substance (drug/alcohol) use disorder; diagnoses indicating a personal history of mental disorder or substance use disorder, long-term alcohol use (e.g., alcoholic liver disease), or in-remission status for substance use disorder were not included. The injury morbidity category included diagnosis codes from the assault and unintentional injury diagnostic groups. The 'other conditions' morbidity category included visits for any other condition. In the event that a patient had a primary diagnosis and an E-code that would have led to categorization in different groups, we prioritized the patient's primary E-code over their primary diagnosis code because E-codes reflect the cause and intent of the patient's ED visit.

The primary outcome of interest was suicide mortality within six months of the patient's index visit. Suicide deaths were defined as those with an ICD-10 code of X60-X84, Y87.0, or U03.

Patient sociodemographic characteristics assessed at index visit included sex (male, female), age (10-25, 26-45, 46-65, and ≥66 years), and insurance status (private, Medicaid, Medicare, self-pay, and other).

Statistical Analysis

First, we examined the demographic characteristics of the study sample using descriptive statistics. We then calculated six-month crude suicide mortality rates per 100,000 person-years of follow-up in each morbidity category. Person-years accrued within each morbidity category began on each patient's index date and ended on the patient's date of death or 180 days after their index visit, whichever was earlier. Patients without a matched death record within 180 days after their index date were presumed alive during the follow-up period.

Next, we calculated age- and sex-specific six-month standardized mortality ratios (SMRs) as the ratio of the observed numbers of deaths in each morbidity category to the expected numbers of deaths given the 2010-2016 California underlying suicide rates among African Americans. Suicide deaths in California for 2010-2016, stratified by age and sex, were extracted from the CDC's Web-based injury statistics query and reporting system database.[3] First we calculated the annual age-and sex-specific suicide rates. Then we divided the annual suicide rates by half to account for the study's six-month mortality rate. Expected deaths for each morbidity category were calculated by multiplying the six-month suicide rate estimates among the race-, age-, and sex-matched population of California by the total number of patients in each morbidity category. Confidence intervals (95% CIs) around SMRs were calculated using the Mid-P exact test with Miettinen's (1974d) modification. All analyses were conducted using STATA/SE 18.0 (College Station, TX).

Results

The final analytic sample included 1,227,282 African American ED patients aged 10 years and older. Patient characteristics at index visit are shown in **Table 6**.

Table 6. Characteristics of 1,227,282 African Americans receiving emergency department care in California during 2010-2016.

Patient characteristics at index visit	N	(%)
Sex		
Male	556,669	45.4
Female	670,613	54.6
Age (years)		
10-25	328,853	26.8
26-45	390,829	31.9
46-65	352,241	28.7
≥ 66	155,359	12.7
Insurance Type		
Private	368,226	30.0
Medicaid	341,015	27.8
Medicare	200,128	16.3
Self-pay	235,150	19.2
Other insurance	82,465	6.7
Morbidity categories and diagnostic groups		
Chronic illness	288,441	23.5
Cancer	4,332	0.4
Kidney disease	6,563	0.5
Cerebrovascular disease	10,537	0.9
Diabetes	14,813	1.2
Chronic obstructive pulmonary disease	15,722	1.3
Heart disease	21,932	1.8
Asthma	23,516	1.9
Non-cancerous pain and neurological conditions	191,056	15.6
Injury group	264,135	21.5
Unintentional injuries	236,551	19.3
Assault injuries	27,584	2.3
Mental and substance use disorder	46,569	3.8
Substance (drug/alcohol) use disorder	12,710	1.0
Mental disorders and self-harm	33,859	2.8
Other conditions	628,137	51.2

The majority of index ED visits were made by female patients (n=670,613, 54.6%), and the mean age of the patient population was 41.5 years (SD: 19.5). A larger proportions of ED patients were insured through private health insurance (n=368,226, 30.0%) and Medicaid (n=341,015, 27.8%) at their index visit. The remaining patients in the analytic sample were uninsured (n=235,150, 19.2%) or had Medicare (n=200,128,

16.3%) or other types of health insurance (n=82,465, 6.7%). The largest morbidity category was the "other visits" category (n=628,137, 51.2%), within which several non-specific conditions predominated: abdominal conditions (n=94,158, 15.0%), acute respiratory illnesses (n=91,288, 14.5%), and skin-related conditions (n=42,993, 6.8%). Among the three morbidity categories of primary interest, the largest morbidity category comprised patients receiving ED care for chronic illnesses (n=288,441, 23.5%). The next largest morbidity category included patients receiving ED care for assault and unintentional injuries (n=264,135, 21.5%).

During the six-month follow-up period, 100 patients died by suicide, resulting in an overall incidence rate of 8.2 per 100,000 person-years. Consistent with suicide trends in the U.S.,[124,125] males had a higher suicide rate (12.9 per 100,000 person-years) compared with females (4.4 per 100,000 person-years). Suicide rates were highest and approximately equal among young and middle-aged patients, compared to older patients. Patients aged 10-24 years had a suicide rate of 8.8 per 100,000 person-years. Patients aged 26-45 years and 46-65 years had a suicide rate of 8.5 per 100,000 person-years and 8.6 per 100,000 person-years, respectively. Patients 66 years and older had a suicide rate of 5.4 per 100,000 person-years.

The six-month incidence rates of suicide mortality within each morbidity category are shown in **Table 7**, and the corresponding SMRs are presented in **Table 8**.

Table 7. Six-month rates of suicide mortality among African American emergency department patients in California, 2010-2016, by morbidity category and diagnostic group.

Morbidity categories and diagnostic groups	Patients in each group (n)	Suicide Deaths (n)	Six-month incidence rate per 100,000 person-years	
			Rate	95% CI
Chronic illness	228,441	11	3.9	(2.1, 7.0)
Cancer	4,332	***	32.9	(4.6, 233.7)
Kidney disease	6,563	0	–	–
Cerebrovascular disease	10,537	***	20.0	(5.0, 79.7)
Diabetes	14,813	***	6.8	(1.0, 48.5)
Chronic obstructive pulmonary disease	15,722	0	–	–
Heart disease	21,932	0	–	–
Asthma	23,516	0	–	–
Non-cancerous pain and neurological conditions	191,056	***	3.7	(1.8, 7.7)
Injury	264,135	18	6.8	(4.3, 10.9)
Unintentional injuries	236,551	16	6.8	(4.2, 11.1)
Assault injuries	27,584	***	7.3	(1.8, 29.0)
Mental and substance use disorder	46,569	31	66.8	(47.0, 95.0)
Substance (drug/alcohol) use disorder	33,859	***	39.6	(16.5, 95.2)
Mental disorders and self-harm	12,710	26	77.0	(52.4, 113.1)
Other conditions	628,137	40	6.4	(4.7, 8.8)

*** Indicates suppressed value (deaths <10).

Table 8. Six-month standardized mortality ratios comparing African American emergency department patients and matched underlying population from California, according to patient morbidity category, 2015-2016.

Morbidity categories	Observed deaths	Expected deaths	SMR (95% CI)
Chronic illness	11	10.6	1.0 (0.5, 1.8)
Injury	18	10.8	1.7 (1.0 2.6)
Mental and substance use disorder	31	2.0	15.9 (11.0, 22.2)
Other conditions	40	22.2	1.8 (1.3, 2.4)

Expected deaths for each morbidity category were calculated by multiplying the six-month suicide rate estimates among the race-, age-, and sex-matched population of California by the total number of patients in each morbidity category.

Among African American patients presenting to the ED with chronic illness, the six-month suicide rate was 3.9 per 100,000 person-years. The corresponding SMR for chronic illness indicated that patients with a chronic illness were no more likely to die by suicide than the demographically (age, sex, race/ethnicity) matched California population (SMR: 1.0, 95% CI: 0.5, 1.8). Within the chronic illness group, most suicide deaths occurred among patients presenting with non-cancerous pain and neurological conditions (n<10 deaths), with an incidence rate of 3.7 per 100,000 person-years. Cancer patients had the highest suicide mortality rate (32.9 per 100,000 person-years) compared to all other chronic conditions in the chronic illness diagnostic group; however, there were few cancer patients in the study sample and the confidence interval around that group's suicide rate was very imprecise (95% CI: 4.6, 233.7).

Among patients presenting to the ED with assault or unintentional injuries, the six-month suicide rates were 6.8 per 100,000 person-years and 7.3 per 100,000 person-years, respectively. Compared to the demographically matched California population, there was slightly greater suicide mortality among patients presenting to the ED with unintentional or assault injuries (SMR: 1.7, 95% CI: 1.0, 2.6).

ED patients with a currently active mental or substance use disorder had a six-month suicide mortality rate of 66.8 per 100,000 person-years, higher than any other patient morbidity category. This rate was nearly 16 times higher than that of the demographically matched California population (SMR: 15.9, 95% CI: 11.0, 22.2). The highest rate of suicide was observed among patients presenting to the ED with a mental disorder (77.0 per 100,000 person-years). Patients with a substance use disorder had a suicide rate of 39.6 per 100,000 person-years.

Patients presenting to the ED for any other condition also had a suicide rate of 7.3 per 100,000 person-years. The corresponding SMR indicated that the patients in this group were 1.8 times as likely to die by suicide than the demographically matched California population (SMR: 1.8, 95% CI: 1.3, 2.4).

Discussion

To our knowledge, this is the first study to examine clinical diagnoses associated with suicide among African American ED patients. An interesting finding from this study was that African American ED patients presenting with chronic illnesses were no more likely to die by suicide than African Americans in the general population of California. This finding is inconsistent with previous studies in the U.S. that have reported strong associations between several physical illnesses and suicide among ED patients.[100,105,106] A possible explanation for our null findings might be due to low statistical power, since we only observed 11 suicides in the chronic illness group. Alternatively, physical illness may not be a leading predictor of suicide among African Americans due to other competing risk factors that are more strongly associated with the risk of suicide. For example, a case-control study reported that African Americans with severe Type 1 diabetes had a higher likelihood of suicide attempts compared with controls.[123] However, those who attempted suicide were also more likely to report a history of childhood abuse, substance abuse, and depression, which independently increased their odds of suicidal behavior.[123] It is also possible that African Americans with chronic illnesses may be more likely to engage in a range of self-care practices for chronic disease management, which may have implications for reducing suicidal behavior. For example, a large qualitative study reported that spirituality, social support, and traditional medicines (e.g. herbal remedies, homeopathy) played a critical role in the management of chronic illness among African Americans regardless of age, socioeconomic status or health insurance.[126] More research is needed to determine whether physical illness is a strong predictor of suicide among African Americans.

African Americans presenting to the ED with injuries had a greater risk of suicide compared to the demographically matched California population. This is consistent with previous research in other patient populations.[100,106,122,127,128] Possible mechanisms mediating the association between injuries and elevated risk of suicide may include psychological distress, physical disability, and pain, as well as costly medical treatments.[122,129–132] Violence victimization, however, is a known risk factor for non-fatal suicidal behavior among African American adolescents and women,[132–136] but less is known about the extent to which violence victimization leads to suicide mortality among African Americans. Future research may want to consider psychopathology as an important mediating factor in the relationship between violent injuries and suicide among African Americans.[122] At present, no previous studies have not investigated the association between unintentional injuries and the risk of suicide among African Americans. Thus, our findings contribute to the current literature, however, future studies are necessary to better understand the association between unintentional injuries and the risk of suicide among African Americans.

Patients diagnosed with mental, or substance use disorders had the highest six-month incidence rate of suicide – nearly 16 times higher than that of the demographically matched California population. These findings are consistent with previous studies showing that patients with mental or substance use disorders have a greater risk of suicide mortality compared with the general population.[88,98,99,106,107] While mental and substance

use disorders are treatable, African Americans may be undertreated for mental and substance use disorders.[18,110,137] Undertreated mental and substance use disorders may lead to severe functional impairment and morbidity, which can increase the risk of suicide. As African Americans frequently utilize EDs for primary and mental health services,[102] the results of this study provide support for suicide prevention among African American patients presenting to EDs with mental and substance use disorders.

Limitations

The results of this study should be considered in the context of several limitations. The main limitation of this study is that we had to restrict the analysis to patients with ED visits that occurred between January 1st-June 30th of each calendar year to ensure all patients could be followed for six months of suicide mortality. Due to this limitation, our estimates of suicide mortality rates lacked statistical power and are imprecise. Patient suicides that occurred outside of the six-month period of observation could not be observed, and patients with ED visits occurring in July-December of each year were excluded from the study, potentially giving rise to bias due to the seasonality of suicidal behavior.[138] Another limitation of the study includes the potential misclassification of diagnoses due to coding errors in the ED, and the assignment of patient diagnostic groups. Suicide mortality classifications are also subject to misclassification and may result in undercounting suicide cases. Our findings may also not be generalizable to the entire U.S., given that the African American population in California is comparatively lower than other racial/ethnic groups, and the overall suicide rate of California is comparatively lower than that of other states.[139,140] Due to limitations of the administrative dataset, we were unable to assess additional measures related to suicidal behavior among African Americans, such as exposures to poverty, structural racism, homelessness, and community-level violence.

Conclusion

This study provides the first available estimates of suicide mortality among African American ED patients with a broad range of medical conditions. Because suicide rates among African Americans are increasing, future studies should aim to reproduce and extend the time period of observation utilizing ED data to understand suicide mortality among African American ED patients. Given the study limitations, it is unclear whether African American ED patients with chronic illnesses are a high-risk population for suicide. African American patients clinically diagnosed with mental or substance use disorders had the greatest risk of suicide and may be important targets for suicide prevention in ED settings. Additional research is needed to understand the elevated risk of suicide among patients presenting with injuries and other conditions to effectively target these patients for suicide-related interventions.

Chapter 3: Racial and ethnic disparities in all-cause and cause-specific mortality among the emergency department patients with mental disorders

Mental disorders are a leading cause of illness in the U.S. impacting more than 57 million Americans.[141] Although mental disorders are treatable, barriers such as limited health care access, lack of mental health awareness, and stigma around mental health prevent many individuals from receiving mental health treatment.[19] This is a significant public health problem because untreated mental disorders can impair daily functioning, reduce quality of life, and give rise to physical health problems.[20,142,143] It is also well documented that mental disorders reduce life expectancy and contribute to both premature and excess mortality.[19,20,144–147]

Suicide is perhaps the most widely recognized cause of mortality linked to mental illness. The proportion of suicide decedents with a history of mental disorders is estimated to be between 60-98%.[148,149] However, mental disorders are also associated with an elevated risk of death from non-communicable diseases (e.g., cardiovascular disease, cancer, respiratory disease).[144,145] For example, studies from multiple countries show that patients with severe mental illnesses (e.g., schizophrenia, bipolar disorder, depressive disorders) are more likely to die of suicide, injuries, infections, and chronic diseases compared with the general population.[144,145,150,151] It has also been demonstrated that regardless of severity, any mental disorder may increase the risk of mortality due to suicide and other non-communicable diseases.[152,153]

More recent attention has been focused on understanding racial/ethnic disparities in mental illness and cause-specific mortality. However, the literature on this topic has largely derived from European countries.[154–156] This is a major limitation of the literature because the results of these studies may not be generalizable to the U.S. given that European countries differ from the U.S. in terms of social services, healthcare systems, and health outcomes.[157,158] Only a few U.S.-based studies have investigated racial/ethnic disparities in cause-specific mortality among individuals with mental disorders.[157] Most studies in the U.S. have focused on the association between mental illness and excess or all-cause mortality with or without assessing any variation by race/ethnicity.[147,159–161] In the U.S., understanding racial/ethnic disparities in mental illness and cause-specific mortality is important because racial identity has a significant impact on determinants of health. To inform public health prevention strategies in the U.S. population, this is an important literature to build upon.

In modern research, race/ethnicity categories are widely recognized as social constructs (i.e. created by historical, political, and cultural factors) without any biological significance.[162–164] Within the framework of using race/ethnicity as a social construct, race and ethnicity categories are used to help understand health disparities across different groups of people.[162–164] In the U.S., race/ethnicity as a determinant of health occurs in the context of systemic racism, which is a pervasive problem in the U.S. that arose from historical racism and inequalities.[162,165–167] Systemic racism systematically places racial minorities (i.e., non-Hispanic Whites) at a socioeconomic disadvantage in society, which has implications for poor health outcomes (e.g., lack of health insurance,

lower health literacy, poor nutrition).[167] Systemic racism also contributes to the differential treatment of minority groups in healthcare systems, which has led to minority populations receiving lower-quality health care and underutilizing healthcare services.[167]

Due to the impacts of systemic racism, African Americans have higher rates of mortality compared with other racial/ethnic groups.[168] Studies also show that the average life expectancy for African Americans is comparatively low compared with other racial/ethnic groups.[169–171] Due to the limited number of U.S.-based studies on racial/ethnic disparities in mental illness and cause-specific mortality, less is known about the risk of cause-specific mortality among African Americans compared with other racial/ethnic groups. Some studies suggest the clinical course of mental illness may be more debilitating among African Americans compared with other groups,[172,173] which may contribute to racial/ethnic disparities in cause-specific mortality.

The present study adds to the literature by being the first study to investigate racial/ethnic disparities in cause-specific mortality among ED patients with mental disorders. ED data was used for this study because EDs serve a diverse patient population and patients with mental disorders are frequently treated in the ED.[174,175] This study had two main objectives: (1) to quantifying rates of cause-specific mortality among African Americans and other patients presenting with mental disorders and (2) investigate disparities in the risk of cause-specific mortality between African Americans and other patient groups with mental disorders.

Methods

Data Source

This study used ED data from HCAI for the period January 1, 2010, through December 31, 2016 (the most recent data available to us). HCAI provided nonpublic, deidentified patient-level data on all individuals who presented to a California-licensed ED during the study period, excluding those in federal (e.g., Veterans Administration) hospitals. The dataset was restricted to ED patients aged 18 and older with a diagnosis of a mental disorder (e.g., anxiety disorders, mood disorders, attention-deficit, conduct, and disruptive behavior disorders) or suicidal behavior in the primary or secondary diagnostic position. Patients were excluded if their diagnosis indicated "personal history" of a mental disorder. The CCS and ICD-9/10-CM diagnosis and E-code used to define mental disorders and suicidal behavior in the patient population are shown in **Table 9.**

Table 9: Clinical classifications software (CCS), diagnostic (ICD-9/ICD-10 CM), and injury codes (E-codes) used to define mental disorders in the patient population.

Mental disorders	CCS codes	ICD-9-CM/E-codes	ICD-10-CM/E-codes
Mental disorders and suicidal behavior*	650-652, 654-659, 662, 670	V62(85) E950-E958(9)	R45(850), X71-X83

*Subsequent or sequela encounters were excluded for all ICD-10/E-codes.

A unique patient identifier (encrypted SSN) was used to identify all visits made by an individual patient. Patients could make multiple ED visits during the study period, but only the first-occurring visit (i.e., the index visit) was retained for follow-up analysis. For patients who had an ED visit and were then admitted to the same hospital, the date of their index visit was the date of their discharge from the hospital. For patients who had an ED visit and were transferred to another facility or had an ED visit that resulted in a discharge home, the date of their index visit was the date of their ED encounter. Patients who died on their index visit were excluded from analysis.

HCAI also provided linked death records from the California Department of Public Health - Vital Records office, which includes information on the date, cause, and manner of death for all patients who made an ED or hospital visit in California and died during the same calendar year (in California or another state). Death records were linked to patient hospital records by the patient's social security number, sex, date of birth, race/ethnicity, and zip code of residence. As HCAI only provides linked death records that occur within the calendar year, this study was limited to index ED visits that occurred January 1st-June 30th in each year of 2010-2016, to ensure all patients could be followed for at least 6 months of mortality observation. This study was approved by the Institutional Review Boards of the California Health and Human Services Agency and the University of California, Merced.

Measures

Race and Ethnicity

Race/ethnicity was reported by HCAI as non-Hispanic (NH) White, NH Black, Hispanic Asian/Pacific Islander, American Indian, unknown and multiracial. We categorized race/ethnicity into four categories: NH White, NH Black, Hispanic and other (Asian/Pacific Islander, American Indian, unknown or multiracial). Asian/Pacific Islander, American Indian, unknown and multiracial groups were combined into in a single "other" race/ethnicity category due to sample size limitations.

Cause-specific mortality

The primary outcome of interest in this study was cause-specific mortality. Mortality data on the leading causes of death in the U.S. were ascertained from the CDC's Web-based injury statistics query and reporting system,[176] and used to inform the categories of cause-specific mortality. To maximize statistical power, we only examined the five leading causes of death in the U.S. from 2010 through 2016, as well as suicide (due to its strong association with mental disorder) and all-cause mortality. Mortality was measured using the International Classification of Diseases, Tenth Revision (ICD-10), codes for underlying cause of death. The categories of mortality included: heart disease (ICD-10 codes: I00-I09, I20-I51), cancer (C00-C97), cerebrovascular disease (I60-I69), chronic lower respiratory disease (CLRD) (J40-J47), unintentional injuries (V01-X59, Y85-Y86), suicide (X60-X84, Y87, U03), and all-cause mortality (A01-Z99).

Patient sociodemographic characteristics of interest included sex (male, female), age (18-33, 34-49, 50-65, and ≥ 66 years), and insurance type at index visit (private insurance, Medicaid, Medicare, self-pay, or other).

Statistical Analysis

First, we examined the sociodemographic characteristics of the patient population using descriptive statistics. We then calculated six-month crude mortality rates per 100,000 person-years of follow-up for all-cause mortality and cause-specific mortality. Person-time accrued began on each patient's index date and ended on the patient's date of death or 180 days after their index visit, whichever came first. Patients without a matched death record within 180 days after their index date were presumed alive during the follow-up period. Cox proportional hazard models were used to estimate hazard ratios (HRs) and their 95 CIs for all-cause mortality and cause-specific mortality by race/ethnicity. The models included race/ethnicity as the main predictor of interest, as well as sex, age, and health insurance status. Because African Americans have higher rates of mortality compared with NH Whites in the general population, NH White patients were used as the reference group in this study. The proportional hazard assumption was assessed graphically and using the Schoenfeld residual test for each covariate. Because age failed to meet proportional hazards assumptions, we used stratified Cox models by age to allow baseline hazards to vary across age strata.[177,178] After using the stratified Cox models for all mortality outcomes, we note that the stratified Cox models for suicide and all-cause mortality were shown to be non-proportional. Given non-proportionality in Cox regression models can lead to inaccurate hazard estimates,[179] hazard ratios for suicide and all-cause mortality should be interpreted with caution.

To further investigate risk of mortality associated with NH Black patients, we conducted post hoc analyses (i.e. stratified Cox models by age with NH Black patients as the reference group) to determine whether NH Black patients had a greater risk of all-cause and cause-specific mortality compared to Hispanic patients and patients of other racial/ethnic groups. All analyses were conducted using STATA/SE 18.0 (College Station, TX).

Results

Descriptive Characteristics

A total of 1,014,593 ED patients aged 18 years and older were included in the analytic sample. Patient characteristics assessed at index visit are shown in **Table 10**. NH White patients accounted for more than half of the patient population (n=527,623; 52.0%). Among the minority patients, 105,614 identified as NH Black (10.4%), 227,145 identified as Hispanic (n=27.3%), and 104,211 identified with other racial and ethnic groups (n=10.3%). The NH White patients were older (mean age=45.7, SD=18.5) compared to the NH Black (mean age=40.6, SD=16.0), Hispanic (mean age=39.7, SD=16.6), and other (mean age=42.8, SD 17.6) patient groups. The majority of index ED

visits were made by female patients across all racial/ethnic groups (n=592,947, 58.4%). With regard to insurance status, higher proportions of NH White patients (n=189,003, 35.8%), Hispanic patients (n=88,238, 31.9%) and patients of other racial/ethnic groups (n=43,464, 41.7%) were insured through private health insurance. For NH Black patients, a higher proportion of patients were insured through Medicaid (n=38,964, 36.9%). Across all racial/ethnic groups, smaller proportions of patients were uninsured at their index visit (range: 5.0% to 6.5%).

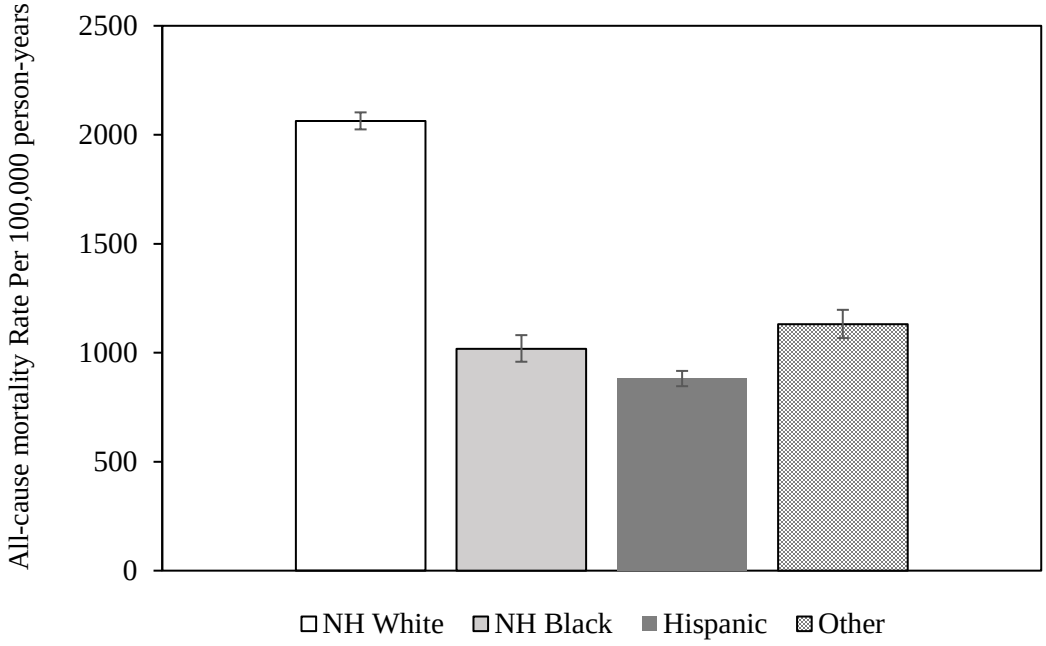
Table 10. Characteristics of 1,014,593 emergency department patients receiving care for a currently active mental health disorder in California, 2010-2016.

Patient characteristics at index visit	NH White		NH Black		Hispanic		Other	
	N	(%)	N	(%)	N	(%)	N	(%)
Total N	527,623	52.0	105,614	10.4	277,145	27.3	104,211	10.3
Sex								
Male	220,752	41.8	44,720	42.3	113,517	41.0	42,657	40.9
Female	306,871	58.2	60,894	57.7	163,628	59.0	61,554	59.1
Age (years)								
18-33	166,142	31.5	42,063	39.8	119,821	43.2	38,266	36.7
34-49	147,855	28.0	32,056	30.4	84,374	30.4	31,287	30.0
50-65	133,638	25.3	24,129	22.9	50,112	18.1	22,228	21.3
≥ 66	79,988	15.2	7,366	7.0	22,838	8.2	12,430	11.9
Insurance Type								
Private	189,003	35.8	23,453	22.2	88,238	31.9	43,464	41.7
Medicaid	112,222	21.3	38,964	36.9	87,953	31.7	22,940	22.0
Medicare	131,727	25.0	18,500	17.5	39,455	14.2	18,322	17.6
Self-pay	68,440	13.0	17,813	16.9	47,290	17.1	13,247	12.7
Other	26,089	5.0	6,852	6.5	14,148	5.1	6,206	6.0

All-cause mortality

During the follow-up period, there were a total of 15,427 deaths due to all-cause mortality among patients presenting to the ED with mental disorders. **Figure 4** shows the six-month incidence rates of all-cause mortality among the patient population by race/ethnicity. All-cause mortality rates were highest for NH Whites (2063.4 per 100,000 person-years), followed by other racial/ethnic groups (1130.2 per 100,000 person-years), and NH Black patients (1017.8 per 100,000 person-years). Hispanic patients had the lowest six-month incidence rate of all-cause mortality (880.7 per 100,000 person-years).

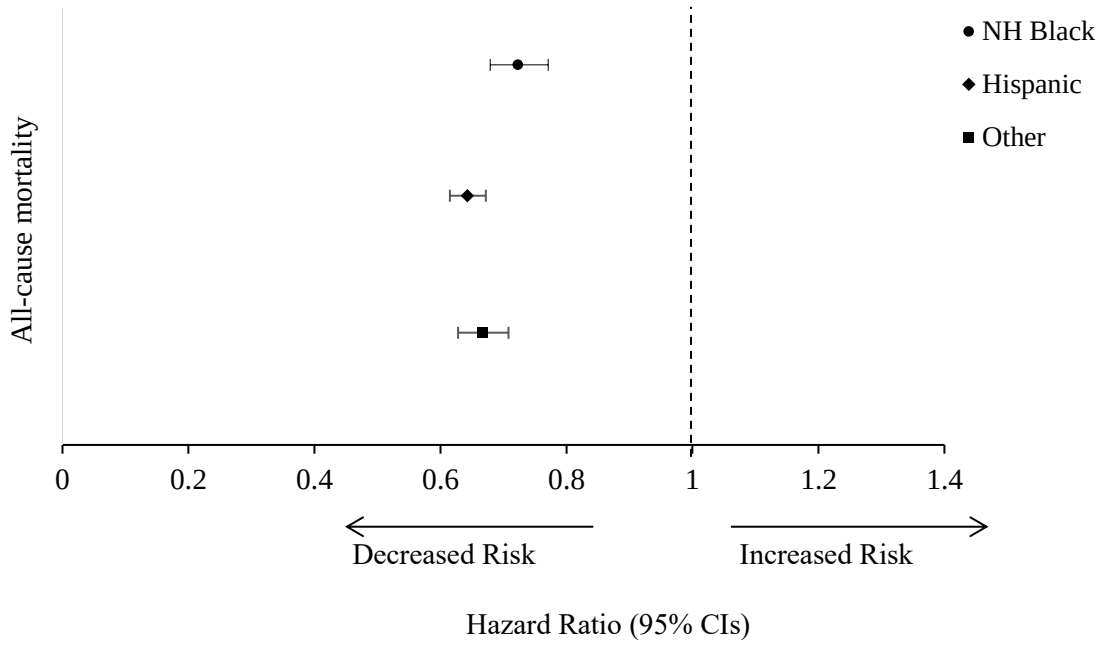
Figure 4. Six-month incidence rates of all-cause mortality, per 100,000 person years, among ED patients receiving care for a currently active mental disorder in California (2010-2016), by patient race/ethnicity



Abbreviations: ED, emergency department; NH, non-Hispanic

Results from the stratified Cox model indicated that the risk of all-cause mortality was significantly lower for NH Black (HR=0.72, 95% CI: 0.68-0.77), Hispanic (HR=0.64, 95% CI: 0.62-0.67), and other racial/ethnic groups patients (HR=0.67, 95% CI: 0.63-0.71) compared to NH White patients (**Figure 5**). In the post hoc analysis NH Black patients were treated as the reference group, NH Black patients had a significantly higher risk of all-cause mortality compared with Hispanic patients (HR=1.12; $p<0.001$). There was no statistically significant difference in all-cause mortality between NH Black patients and patients of other racial/ethnic groups (HR=1.08; $p=0.057$).

Figure 5. Forest plot comparing the risk of all-cause mortality among ED patients receiving care for a currently active mental disorder in California (2010-2016), by patient race/ethnicity



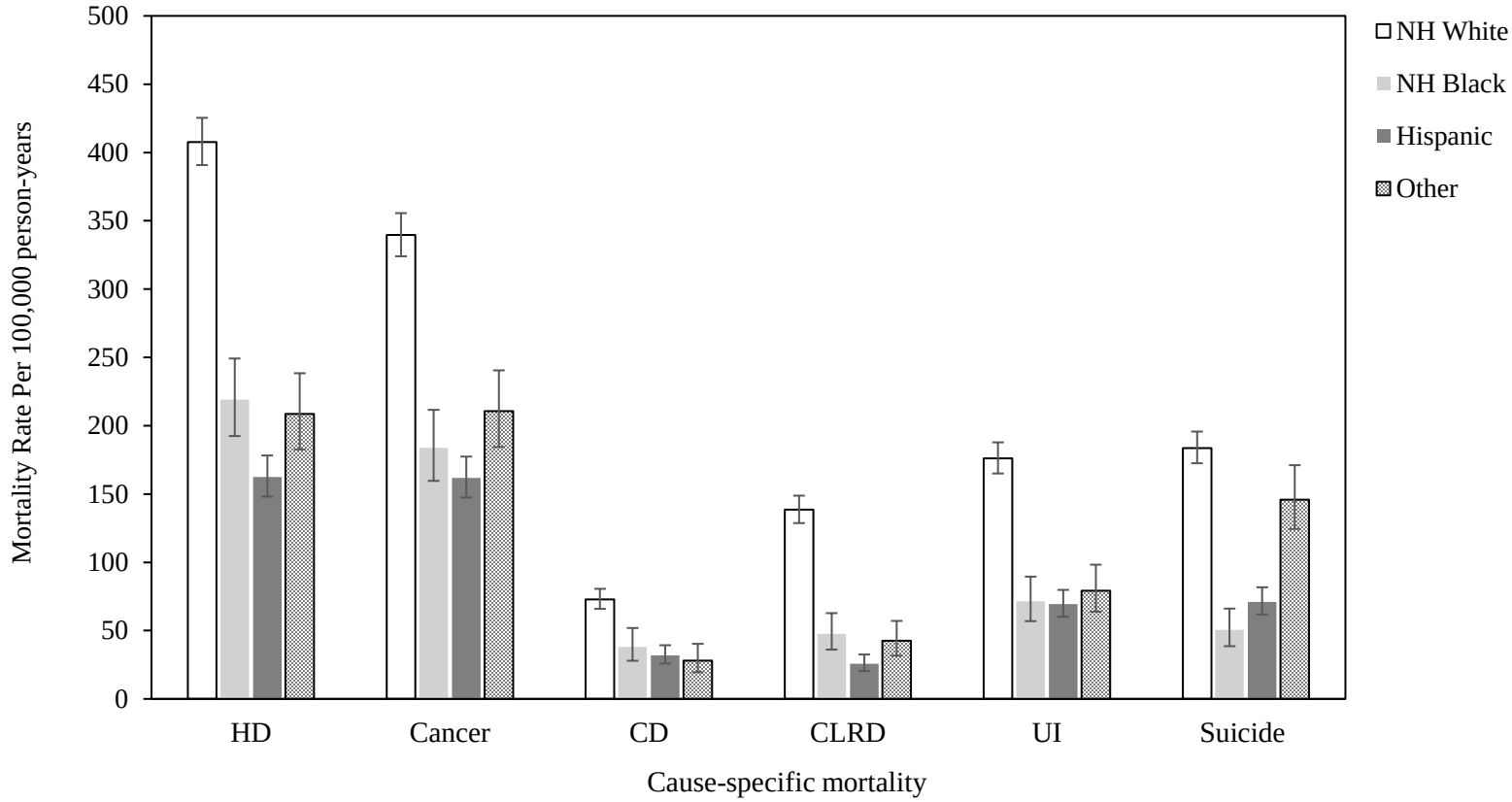
Estimates are hazard ratios from the age-stratified Cox proportional hazard model, adjusted for sex and health insurance status, with NH White patients as the reference group. The vertical dotted line represents a hazard ratio of one, and all hazard ratio estimates were rounded to two decimal places.

Abbreviations: ED, emergency department; CI, confidence interval; NH, non-Hispanic

Heart disease mortality

A total of 3,020 deaths occurred due to heart disease during the six-month follow-up period. Heart disease mortality rates were highest for NH White patients (407.7 per 100,000 person-years), followed by NH Black patients (219.0 per 100,000 person-years), and patients of other racial/ethnic groups (208.6 per 100,000 person-years) (**Figure 6**). Hispanic patients had the lowest six-month incidence rate of heart disease mortality (162.4 per 100,000 person-years). (**Figure 6**).

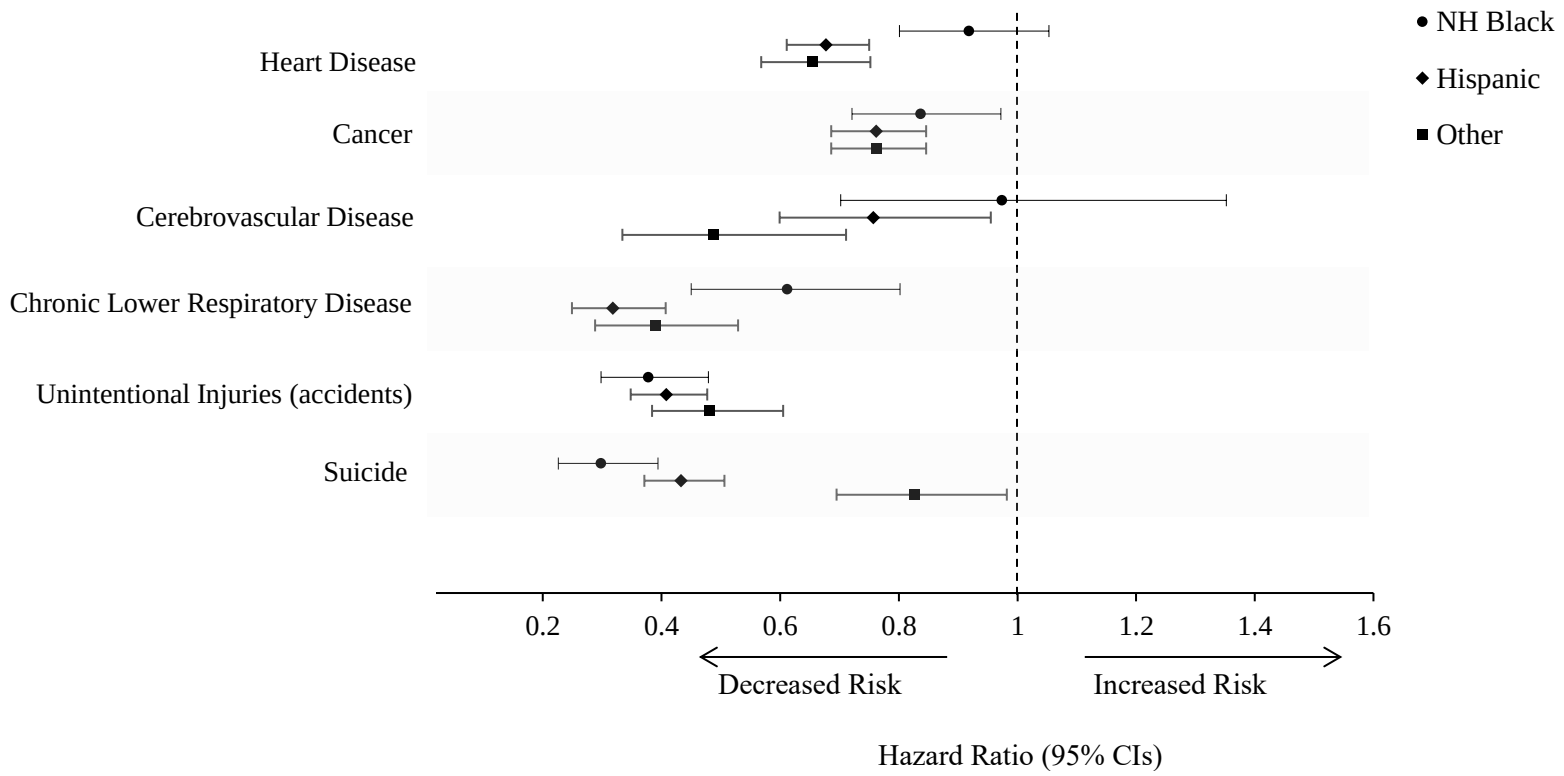
Figure 6. Six-month incidence rates of cause-specific mortality, per 100,000 person-years, among ED patients receiving care for a currently active mental disorder in California (2010-2016), by patient race/ethnicity



Abbreviations: ED, emergency department patients; NH, non-Hispanic; HD, heart disease; CD, cerebrovascular disease; CLRD, chronic lower respiratory disease; UI, unintentional injury

Results from the stratified Cox model (**Figure 7**) showed that there was no statistically significant difference in the risk of heart disease mortality between NH Black and NH White patients (HR=0.92, 95% CI: 0.80, 1.1). The risk of heart disease mortality was significantly lower for Hispanic patients (HR=0.68, 95% CI: 0.61, 0.75) and patients of other racial/ethnic groups (HR= 0.65, 95% CI: 0.57, 0.75) compared to NH White Patients. In the post hoc analysis, NH Black patients were approximately 1.4 times more likely to die by heart disease than Hispanic patients (HR=1.36; $p<0.001$) and patients of other racial/ethnic groups (HR=1.40; $p<0.001$).

Figure 7. Forest plot comparing the risk of cause-specific mortality among ED patients receiving care for a currently active mental disorder in California (2010-2016), by patient race/ethnicity



Estimates are hazard ratios from the age-stratified Cox proportional hazard model, adjusted for sex and health insurance status, with NH White patients as the reference group. The vertical dotted line represents a hazard ratio of one, and all hazard ratio estimates were rounded two decimal places.

Abbreviations: ED, emergency department patients; NH, non-Hispanic

Cancer mortality

There was a total of 2,627 cancer-related deaths during the six-month follow-up period among patients presenting to the ED with mental disorders. NH White patients had the highest rate of cancer mortality (339.6 per 100,000 person-years), followed by patients of other racial/ethnic groups (210.6 per 100,000 people-years) (**Figure 6**). Among the NH Black patients, the six-month incidence rate of cancer was 183.8 per 100,000 person-years. Hispanic patients had the lowest rate of cancer mortality compared to all other patient groups (161.7 per 100,000 people-years).

When compared to NH White patients, the NH Black patients, Hispanic patients, and patients of other racial/ethnic groups had a lower risk of dying of cancer (**Figure 7**). Results from the post hoc analysis showed that there was no difference in the risk of cancer mortality for NH Black patients compared to Hispanic patients (HR=1.10; p=0.268) or patients of other racial/ethnic groups (HR=1.10; p=0.356).

Cerebrovascular disease mortality

A total of 537 ED patients with mental disorders died of cerebrovascular disease during the six-month follow-up period. NH White patients had the highest rate of cancer mortality (72.9 per 100,000 person-years), followed by NH Black patients (38.1 per 100,000 people-years) and Hispanic patients (31.9 per 100,000 person-years) (**Figure 6**). Patients of other racial/ethnic groups had the lowest six-month incidence rate of cerebrovascular disease (28.0 per 100,000 person-years).

For risk of death due to cerebrovascular disease, there were no significant difference in risk of mortality among the NH Black compared to NH White patients (**Figure 7**). Among the Hispanic patients and patients of other racial/ethnic groups, the risk of cerebrovascular disease mortality was significantly lower compared to NH White patients (Hispanic: HR=0.76, 95% CI: 0.69, 0.85) (Other: HR, 95% CI: 0.76, 0.69, 0.85) (**Figure 7**). The post hoc analysis indicated that the NH Black patients had a higher risk of cerebrovascular disease mortality compared with patients of other racial/ethnic groups (HR=2.00; p<0.005). There was no significant difference in risk of cerebrovascular disease mortality between the NH Black patients and Hispanic patients (HR=1.29; p=0.187).

Chronic lower respiratory disease mortality

During the six-month follow-up period, 887 ED patients with mental disorders died of chronic lower respiratory disease (CLRD). NH White patients had the highest rate of chronic lower respiratory disease mortality (138.5 per 100,000 person-years) (**Figure 6**). The six-month incidence rate of mortality for CLRD was slightly higher among NH Black patients (47.6 per 100,000 person-years) compared with patients of other racial/ethnic groups (42.5 per 100,000 person-years) (**Figure 6**). Hispanic patients had the lowest rate of mortality due to CLRD (25.7 per 100,000 person-years) (**Figure 6**).

The risk of CLRD mortality was significantly lower for NH Black patients (HR=0.61, 95% CI: 0.45, 0.80), Hispanic patients (HR=0.32, 95% CI: 0.25, 0.41), and patients of other racial/ethnic groups (HR=0.39, 95% CI: 0.29, 0.53) compared to NH

White patients (**Figure 7**). When comparing the risk of CLRD mortality between the NH Black and Hispanic patients, the post hoc analysis indicated that NH Black patients were nearly twice as likely to die of CLRD compared with the Hispanic patients (HR=1.89; $p< 0.001$). Compared with patients of other racial/ethnic groups, the NH Black patients also a had higher risk of CLRD mortality (HR=1.54; $p<0.05$).

Unintentional injury mortality

During the six-month follow-up period, 1,266 deaths occurred due to unintentional injuries among patients presenting to the ED with mental disorders. The NH White patients had the highest rate of unintentional injury mortality (176.1 per 100,000 person-years) (**Figure 6**). The rate of unintentional injury mortality was slightly higher among patients of other racial/ethnic groups (79.2 per 100,000 person-years) compared with NH Black patients (71.4 per 100,000 person-years) (**Figure 6**). Hispanic patients had the lowest rate of mortality due to unintentional injuries (69.3 per 100,000 person-years) (**Figure 6**).

The risk of mortality due to unintentional injuries was significantly lower for the NH Black patients, Hispanic patients, and patients of other racial/ethnic groups, compared with the NH White patients (**Figure 7**). In the post hoc analysis, there were no significant difference in mortality due to unintentional injuries between the NH Black patients and Hispanic patients (HR=0.93; p=0.581). When comparing risk of mortality due to unintentional injuries between the NH Black patients and patients of other racial/ethnic groups, there was no significant difference in mortality between the two patient groups (HR=0.78; P=0.127).

Suicide mortality

A total of 1,358 ED patients with mental disorders died of suicide during the six-month follow-up period. While the NH White patients had the highest six-month incidence rate of suicide compared to all other patient groups (183.7 per 100,000 person-years), suicide rates were also relatively high among patients of other racial/ethnic groups (145.9 per 100,000 person-years). Hispanic patients had a suicide rate of 71.1 per 100,000 person-years, and the NH Black patients had the lowest rate of suicide (50.5 per 100,000 person-years) in the patient population (**Figure 6**).

Results from the stratified Cox model showed that NH Black patients, Hispanic patients, and patients of other racial/ethnic groups were all significantly less likely to by suicide than NH White patients (**Figure 7**). When comparing NH Black patients to Hispanic patients and patients of other racial/ethnic groups, the NH Black patients were significantly less likely to die by suicide (Hispanic: HR=0.69; $p<0.05$) (Other: HR=0.36; $p<0.001$).

Discussion

Main Findings

To our knowledge, this is the first study in the U.S. to investigate racial/ethnic disparities in cause-specific mortality among ED patients diagnosed with mental disorders. Overall, we found that the NH Black patients had lower rates of all-cause and cause-specific mortality compared with the NH White patients. In cause-specific mortality, the NH Black patients had a lower risk of mortality due to cancer, CLRD, unintentional injuries and suicide compared with NH White patients. There was no statistical difference in the risk of mortality due to heart disease and cerebrovascular disease between the NH Black patients and the NH White patients with mental illnesses.

Mental disorders increase the risk of physical illness, in part, because mental disorders can increase the risk of health behaviors (e.g., substance use, smoking, alcohol consumption, poor nutrition, physical inactivity).[142] In general, African Americans have higher rates of chronic disease morbidity and mortality compared with NH White Americans.[168] A possible explanation for our findings could be related to the overrepresentation of older NH White patients in the study sample given that the co-occurrence of mental and physical illnesses, and the risk of mortality increases with age.[180] However, after controlling for age in the stratified Cox models, the NH Black patients had a lower risk of mortality for multiple conditions. NH White patients with mental disorders in general may have higher rates of mortality from a wide range of chronic conditions compared with other racial/ethnic groups. Among a population of adults with schizophrenia, one study reported higher rates of all-cause premature mortality and premature mortality due to heart disease, cancer, influenza, and pneumonia, sepsis, chronic obstructive pulmonary disease, liver disease, other natural deaths, suicide, accidents, and undetermined causes among NH White Americans compared with other racial/ethnic groups.[157] This study reported NH Black Americans had higher rates of premature mortality for renal disease and diabetes compared with White Americans groups.[157]

The co-occurrence of mental disorders and substance use may explain the elevated rates of mortality among NH White Americans with mental disorders. African Americans with mental disorders are less likely to engage in substance use compared with their NH White counterparts.[181,182] Substance use can lead to the development of chronic disease (e.g., lung disease, heart disease, stroke, cancer) and infections, impair organ function, increase the risk of accidents and suicidal behavior, and interfere with self-care management and adherence to medical treatment.[183–186] Addressing substance use among patients with mental disorder may be an important step towards reducing mortality associated with mental disorders. This may include screening or monitoring patients with mental disorders for substance use in clinic settings for substance use interventions.

In this study, the risk of heart disease mortality and cerebrovascular disease mortality did not differ between the NH White and NH Black patients with mental

disorders. To our knowledge, has not been reported in previous studies. This finding may indicate there are shared similarities in the underlying mechanisms or etiologic factors that give rise to heart disease and cerebrovascular disease mortality among NH Black and NH White Americans with mental disorders. Tobacco use, for example, may be an important risk factor for cardiac and cerebrovascular mortality among NH Black and NH White Americans with mental disorders. Smoking rates in general are higher among those with mental disorders compared to those without such disorders.[187,188] However, there is some evidence to indicate smoking patterns among those with mental disorders may vary across racial/ethnic groups. For example, one study reported positive associations between smoking and depressive symptoms among NH Black and NH White Americans, while smoking was not associated with depressive symptoms among Hispanic and Asian groups.[189] Additional research on the causal mechanisms between mental disorders and mortality across racial/ethnic groups could be important for informing universal public health prevention strategies to reduce mortality associated with mental disorders.

When comparing the risk of mortality among the NH Black patients with all other minority patients, we found that the NH Black patients had a higher risk of all-cause mortality compared with Hispanic patients only. The NH Black patients also had a greater risk of heart disease mortality and CLRD mortality compared with the Hispanic patients and patients of other racial/ethnic groups. The risk of cerebrovascular disease mortality was also higher among NH Black patients compared with patients of other racial/ethnic groups. For deaths due to suicide, the NH Black patients had a lower mortality risk relative to all other minority patient groups. This finding was not surprising given that African American suicide rates in general are relatively low compared with other racial/ethnic groups.[190] Our analyses also indicated that there was no significant difference in the risk of cancer or unintentional injury mortality between the NH Black patients and other minority patients. These findings offer new insight into cause-specific mortality among racialized minorities with mental health disorders.

Racial minorities face similar challenges within the context of systemic racism; however, cultural differences may contribute to different outcomes of mortality among racial minority groups. For example, studies show that foreign-born minorities have better health compared with U.S.-born minorities.[191,192] African Americans are disproportionately burdened by chronic illness and poor overall health compared with most racial/ethnic groups,[108,109,193] which could explain why the NH Black patients had a greater risk of mortality for several chronic conditions compared with other minority patients. Studies have also reported that African Americans with mental disorders have an elevated risk of obesity, diabetes, and smoking compared with other groups.[189,194] Mental health management strategies that target unhealthy behaviors may help reduce racial/ethnic disparities associated with mortality and mental illness.

Limitations

The results of this study should be considered in the context of several limitations. The main limitation of this study is that we had to restrict the analysis to patients with psychiatric visits that occurred between January 1st-June 30th of each calendar year to

ensure all patients could be followed for six months of mortality. Due to this limitation, our estimates of mortality rates are imprecise. Patient deaths that occurred outside of the six-month period of observation could not be observed, and patients with ED visits occurring in July-December of each year were excluded from the study. There is also the potential for the misclassification of race/ethnicity, cause of death, and the medical diagnoses use to identify racially diverse patients with mental health problems. Our findings may also not be generalizable to the entire U.S., given that in California the African American population is comparatively small compared to other racial/ethnic minoritized groups.[139] We were also unable to examine generational or immigrant status, or ethnic subgroups (e.g., Caribbean Blacks, Mexican Americans) in the study population, which limits the ability for understanding more nuanced associations in racial/ethnic disparities of cause-specific mortality among patients with mental health problems.

Conclusions

This is the first study in the U.S. to address differences in cause-specific mortality in a racially diverse group of ED patients with mental disorders. Health prevention efforts aimed at targeting and managing physical illness as well as health behaviors among patients with mental disorders may help reduce racial/ethnic disparities in the risk of mortality associated with mental illness. The findings of the study showed that NH White patients in particular, had an elevated risk of mortality relative to all other patient groups. Additional research is needed to understand the causal mechanisms contributing to mortality among NH White patients with mental disorders to strategically reduced mortality in this population.

Conclusions, research recommendations, and solutions

This dissertation adds valuable research to the growing literature on suicidal behavior and mental health among African Americans. The first study examined educational attainment and annual family income as predictors of suicidal behavior among a representative sample of African American adults in the U.S. Key findings from this study indicated that educational attainment and annual family income may not be strongly associated with suicidal behavior. This was surprising given that socioeconomic factors are recognized to be strong predictors of suicidal behavior in the general population and contribute to health disparities among African Americans. However, there was evidence from this study to indicate that lower-income African American males may be a high-risk population for suicidal behavior. This is an important finding because suicides occur more frequently among African American males compared with females. Future research should be aimed at understanding risk factors (e.g., lower levels of support, criminality, psychopathology) for suicidal behavior among lower-income African American males and determine whether lower income is a leading predictor of suicide mortality among African American males. This study also identified potential subpopulations of African Americans that may be vulnerable to suicidal behavior, such as African Americans with mental disorders and non-heterosexual African Americans.

The second study of this dissertation examined clinical risk factors associated with suicide mortality among African American ED patients in California. An important finding from this study was that compared with the general population, African American ED patients presenting with mental or substance use disorders had a substantially high risk of suicide mortality. In light of these findings, African Americans presenting to EDs with mental or substance use disorders may be an important population to screen for suicidal behavior in EDs. It is important to note that this study was limited to the California population, and the findings of this study may vary across the U.S. Future research may want to examine whether certain disorders are more strongly associated with suicide mortality among African American ED patients to effectively target those at the greatest risk of suicide for suicide-related interventions. It may also be valuable to understand the relationship between the onset of mental illness and the risk of suicide mortality among African Americans to help inform suicide prevention strategies. Other findings from this study indicated that African American patients presenting with injuries and other conditions may have a higher risk of suicide compared with the general population. Future studies may want to investigate this further by addressing whether certain injuries are more predictive of suicide mortality among African Americans. It was unclear from this study whether chronic illnesses are important predictors of suicide among African Americans. Replicating this study using an ED dataset with an extended follow-up period for the observation of mortality may provide better suicide estimates for understanding the relationship between suicide mortality and chronic disease among African American ED patients.

The final study investigated racial/ethnic disparities in mental illness and cause-specific mortality among California ED patients. The findings of this study showed that NH White ED patients with mental disorders had a higher risk of cause-specific mortality

compared with other racial/ethnic groups. The NH Black patients with mental disorders had an elevated risk of death from heart disease, cerebrovascular disease, and CLRD compared with other minority patient groups. There were no differences in the risk of death for heart disease and cerebrovascular disease among the NH Black patients and NH White patients. Reducing the burden of disease associated with mental illness will require the early detection of physical illness among people with mental disorders. Health providers should consider educating their patients on the relationship between mental illness and chronic disease. Smoking, poor nutrition, physical inactivity, alcohol consumption and drug use are modifiable risk factors associated with the risk of developing chronic diseases.[195] Studies also show that people with mental disorder are more likely than the general population to engage in poor health behaviors.[181,187,188,194] Therefore, public health initiatives that involve promoting healthy behaviors among people with mental disorders may also be important in reducing cause-specific mortality related to mental illness. It is unclear why NH White people have an elevated risk of mortality compared with other groups. Future studies should aim to investigate the causal mechanisms underlying the relationship between mental illness and cause-specific mortality among different racial/ethnic groups.

Potential solutions and policy initiatives

Protective factors for suicidal behavior in the general population may differ from those among African Americans due to cultural characteristics (e.g., religiosity, mental health stigmatization), healthcare barriers (access to healthcare, medical mistrust, lack of culturally competent practitioners, clinician bias), and systemic barriers (e.g., racism, discrimination, poverty). In the first study of the dissertation, we found that religiosity was a protective factors against suicidal behavior among African Americans. Aspects of religion that may reduce suicidal behavior include social support from church membership, increased optimism from spiritual beliefs, and the belief that suicide is a sin.[9] Community and family support protect against suicidal behavior among African Americans.[9] The National Council for Mental Wellbeing has proposed establishing community-based mental health awareness and wellness programs involving African American church members, families, and community members to help alleviate suicidal behavior among African Americans.[10] African American sexual minorities in particular may benefit from community-based programs supporting mental health due to limited social support arising from negative attitudes around homosexuality.[91,92]

The implementation of the Affordable Care Act has had a positive impact on reducing income and insurance barriers to mental health care among African Americans.[196] However, stigma and structural racism may prevent African Americans from seeking mental health care. Potential strategies for improving mental health care utilization among Americans may include increasing the recruitment and retention of African American mental health professionals as well as ensuring cultural competence among mental health professionals.[10] Studies have reported success reducing stigma through psychoeducational materials specifically tailored towards African Americans.[197] Psychoeducation is also shown to improve knowledge on mental disorders and increase the willingness for African Americans to recommend mental health treatment to others.[198]

Therefore, educational outreach programs and informational social marketing related to mental health may be important for reducing the social stigma associated with mental health among African Americans. Reducing social stigma associated with mental illness may have positive impacts on treatment-seeking behaviors among those experiencing suicidal behavior or mental health challenges.

Health policies and federal regulations play a critical role in reducing heath disparities, promoting and improving treatment for mental disorders, and regulating exposure to legal substances (e.g., tobacco, alcohol, marijuana, prescription medications). For suicide prevention, the federal government has issued a comprehensive national strategy plan in collaboration with federal agencies and national organizations to address the problem of suicidal behavior in the U.S.[8] The national strategy plan contains 15 goals, 87 objectives, and 200 actions organized under four strategic directions:

- Community-based suicide prevention
- Implementing effective, accessible, and quality suicide prevention and treatment services
- Improving suicide research and surveillance
- Embedding health equity into suicide prevention

The actions and goals of this plan strategically benefit all racial/ethnic groups, which is promising for reducing suicides among African Americans.

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