Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____   _____
Robert P. Barclay   Date

Approval Sheet

Investigating the Association Between Race and Healthcare Seeking Behavior among Patients
Diagnosed with COVID-19

By

Robert P. Barclay
Master of Public Health

Epidemiology

_____
Jessica L. Harding, PhD
Committee Chair

Abstract Cover Page

Investigating the Association Between Race and Healthcare Seeking Behavior among Patients
Diagnosed with COVID-19

By

Robert P. Barclay

Bachelor of Arts
University of Minnesota
2020

Thesis Committee Chair: Jessica L. Harding, PhD

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology
2022

Abstract

Abstract

Investigating the Association Between Race and Healthcare Seeking Behavior among Patients
Diagnosed with COVID-19
By Robert P. Barclay

The COVID-19 pandemic has significantly disrupted global health systems, presenting new barriers in healthcare access, introducing new inequities in healthcare, and exacerbating existing disparities in health outcomes. One such consequence of the pandemic is delayed or forgone healthcare. Previous research demonstrates that delayed healthcare is associated with worse health, lower quality of life, and increased incidence of chronic illness, and various social determinants of health such as race, gender have been previously identified as factors associated with delayed or canceled healthcare appointments. There is scant research investigating such inappropriate healthcare seeking behavior during the pandemic and its resultant social disparities. We constructed a survey to collect data on health history, socioeconomic status, and pandemic-related impacts from members of a large, integrated healthcare system in the Southeastern United States (KPGA) who had been diagnosed with COVID-19. This survey data was then merged with the members' electronic medical records from KPGA. To measure the relationship between race (non-Hispanic Black versus non-Hispanic white) and healthcare seeking behavior, we conducted utilized multivariable regression modeling. In our analysis, we found that Black race was associated with inappropriate healthcare seeking behavior, in addition to higher educational attainment, exercising fewer than 150 minutes per week, obesity, diabetes, flu vaccine compliance, providing care for a loved one during the pandemic, and reporting at least one social impact because of the pandemic. Our findings indicate that race was associated with inappropriate healthcare seeking behaviors after controlling for various factors, and that further investigation of the social impacts of the COVID-19 pandemic is warranted.

Cover Page

Investigating the Association Between Race and Healthcare Seeking Behavior among Patients
Diagnosed with COVID-19

By

Robert P. Barclay

Bachelor of Arts
University of Minnesota
2020

Thesis Committee Chair: Jessica L. Harding, PhD

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology
2022

Table of Contents

Literature Review

<u>Epidemiology of COVID-19 in the United States</u>

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), "a highly transmissible and pathogenic coronavirus," was first observed in Wuhan, China, in December 2019. SARS-CoV-2 is the pathogen which causes the respiratory disease commonly known as "coronavirus disease 2019" (COVID-19).[1] As of April 9, 2022, the United States has documented more than 80.1 million cases of COVID-19 and 981,000 deaths due to COVID-19.[2] While everyone is susceptible to COVID-19 infection, risk of infection is not equally distributed across the general population. For example, Black adults are 51% more likely to be infected than their white counterparts, men are 32% more likely than women. When compared to 18-29 year-olds, 50-59 year-olds and 60-69 year-olds are 69% and 65% more likely to be infected.[3] Disparities have also been shown to exist across various social determinants of health. For example, Americans living in a neighborhood with financial insecurity are at 10% greater risk of COVID-19 infection than those who do not live in such a neighborhood, and those who speak English as a second language are more than two times more likely to become infected when compared to those who speak English as their primary language.[3] Many of these disparities—especially those experienced by populations of color—persist beyond initial SARS-CoV-2 infection and include broader adverse outcomes such as hospitalization, intensive care unit (ICU) admissions, and death.[4–7] This has led to overwhelmed health systems and a significant disruption to the delivery of healthcare.[8,9]

<u>Factors Associated with Delayed or Forgone Healthcare</u>

   Healthcare utilization and access are essential measures to determine the degree to which a healthcare system is serving its intended population. The National Academies of Sciences, Engineering, and Medicine have identified four components of healthcare utilization: whether a patient's need for care, whether a patient understands that they need care, whether a patient wishes to obtain care, and whether care can be accessed by the patient.[10] Healthcare access, on the other hand, specifically refers to how well a patient is able to utilize health services to reach "the best possible health outcome."[10] As such, the five elements in determining access are approachability, acceptability, availability and accommodation, affordability, and appropriateness. Timely access has been shown to be a key determinant of personal health because it provides patients with the resources they need at the most appropriate time for care.[11,12] According to Petrovic et al., there are a myriad of reasons why patients may decide to delay seeking healthcare: employment constraints, familial circumstances, cultural factors, and personal beliefs. The authors argue that economic factors are the most common determinants of a patient's decision to engage in inappropriate healthcare seeking behavior, postponing or delaying healthcare.[13]

   Previous studies have found that such inappropriate healthcare seeking behaviors are associated with an array of inferior health outcomes, such as heightened disease severity, lower self-reported levels of health and quality of life, greater risk of hospitalization, and longer inpatient stays in the hospital.[13–17] Utilizing administrative data from Veterans Affairs medical facilities, Prentice and Pizer investigated the relationship between delayed access to healthcare and mortality. After controlling for health status and facility-level factors, patients who waited at least 31 days for an outpatient visit were more likely to die within 6 months of follow-up compared to patients whose wait time was less than 31 days.[18] Studies have also found that forgone healthcare

is especially harmful to Black and African American patients, who disproportionately experience adverse outcomes in overall health and disease-specific benchmarks when their care is delayed.[19–21] Additionally, Petrovic et al. investigated the physiological effects of forgone healthcare on several biomarkers linked to severe chronic illnesses such as diabetes and cardiovascular disease. They report that forgoing medical care for economic reasons is associated with worsened levels of blood glucose and high-density lipoprotein cholesterol in addition to elevated blood pressure.[13]

Prior to the COVID-19 pandemic, a large body of literature has sought to identify the factors associated with healthcare seeking behaviors among selected populations. Here, we summarize some of those key factors. First, women have significantly higher rates of healthcare utilization and are more likely to have a healthcare encounter in a given year as compared with men, but they are also more likely than men to delay care and have unmet healthcare needs.[22] In their work seeking to understand gender differences in healthcare seeking behaviors, Thompson et al. stratified their analysis by type of healthcare sought (physical versus mental). They found that when seeking physical healthcare, age, individual motivation to prevent illness, trust in physicians, and presence of chronic conditions are significant predictors among both men and women. When seeking mental healthcare, all of the aforementioned factors are predictors for both men and women, but trust in physicians is an additional significant predictor for only women.[23] Like many others in the literature,[24–28] Thompson et al. report that men disproportionately underutilized primary care for concerns about both mental and physical health. Despite this confirmation, they provide no explanation for the gender differences observed in healthcare seeking behavior, but say that more research is needed.[23] Kielb et al. report that enrollment in a high-deductible health insurance plan (versus enrollment in a health insurance plan with a lower

deductible)[29], a diagnosis of clinical depression, poor self-rated health, and poverty are predictors of healthcare avoidance or deferral.[29]

Second, among disabled individuals[30] and Black individuals[31], perceived discrimination in healthcare influences healthcare seeking behavior and reduces healthcare utilization. In a cross-sectional study of a national survey of disabled Americans, Moscoso-Porras and Alvarado report that 78.8% of respondents who perceived discrimination based on their disability sought care, while 86.1% of those with no perceived discrimination sought care. After controlling for potential confounders, they found that those with perceived discrimination were 15% (1.04-1.28) more likely to exhibit inappropriate healthcare seeking behavior (not seek care for a concerning injury or symptom).[30] To investigate the relationship between perceived discrimination and healthcare seeking behavior in a racially integrated community, Casagrande et al. conducted a cross-sectional survey among Black and white respondents. These authors found that Black individuals reporting one or two experiences of discrimination in their lifetime were 1.8 times more likely (1.2, 2.6) to delay care or fail to adhere to provider recommendations than those who reported no experiences of discrimination. When compared to the same reference group, those who had two or more such experiences were 2.6 times as likely (1.7, 4.1) to delay care or fail to adhere to recommendations. Casagrande et al. did not find an association between seeking healthcare and inappropriate healthcare seeking behaviors.[31] In a more recent study, Alcalá and Cook found that those who perceived discrimination in healthcare were 1.97 times more likely (1.26, 3.09) to delay or postpone prescription adherence and 1.84 times more likely (1.31, 2.59) to delay or postpone medical care than those who had not perceived any discrimination.[32] Finally, perception of symptom severity, perceived control over symptoms, and encouragement to seek care from others are factors influencing healthcare seeking behaviors among all populations.[33]

Impact of COVID-19 on Healthcare

The COVID-19 pandemic has altered pathways to seeking healthcare and thus exerted unique pressure on healthcare seeking behaviors. During the initial emergence of the pandemic (March 1-May 31, 2020), 42 states and territories within the United States implemented mandatory stay-at-home orders, affecting 2,355 (73%) of 3,233 U.S. counties. Moreland et al. have observed decreased movement of residents in 97.6% of U.S. counties with mandatory stay-at-home orders.[34] When active, these measures greatly inhibited physical movement, and when mobility was restricted this way during COVID-19, it reduced healthcare utilization.[8] During the pandemic, healthcare access has also been severely limited on the supply side, thus making it more difficult to seek care. In a nationally representative web survey of American adults, 40.9% of respondents reported that COVID-19 has caused them to defer healthcare, 12% had delayed emergency care, and 31.5% delayed routine medical care.[35]

Orders and recommendations from government and public health officials early in the pandemic urged providers to cancel nonessential health services to limit transmission of SARS-CoV-2. While those initial recommendations have expired, many health systems have remained overburdened throughout the pandemic and have chosen to divert their resources away from normal operations and toward COVID-19. This has resulted in decreased opportunities for seeking non-COVID healthcare.[36] Finally, key factors that have reduced healthcare utilization and healthcare seeking behaviors in the United States have been patient fears of becoming exposed to SARS-CoV-2 and care rationing guidelines from the Centers for Disease Control and Prevention, other federal agencies, and state officials.[37]

In a systematic review on healthcare access during COVID-19, Núñez et al. identified four key themes relating to the effects the COVID-19 pandemic has had on access to healthcare and the

unique barriers it has created for patients: time-based obstacles in seeking treatment for chronic illness; availability of specialized providers to treat "episodic illness"; concerns about technological resources and the ability to access providers via telehealth or other electronic means; systemic factors such as spatial, financial, informational, and psychological barriers; and factors relating to social determinants of health such as educational attainment and income.[38] They note that the fifth and final theme (social determinants of health) is the most difficult to capture in research, because it includes both individual-level and macro-level factors.[38] While some of the individual-level social determinants of health are relatively well documented, structural and contextual determinants are less so. Similarly, national level datasets have lagged advancements related to social determinants of health, and many lack standardized definitions of certain social characteristics like gender identity, sexual orientation, and disability status, while many public health practitioners still lack the requisite skillsets for addressing issues of health equity.[39]

When defining access to care during COVID-19, Smolić et al. identify three potential outcomes: a patient forgoing care, a patient postponing care, and a provider denying care to a patient.[40] To assess the likelihood of these outcomes, they utilized data from Wave 7 of the Survey of Health, Ageing, and Retirement (SHARE) in Europe, which collected an array of socioeconomic data from a sample of individuals aged at least 50 years old and represents 25 European countries plus Israel. Among their respondents, the following were observed to be associated with postponed care: *fair* or *poor* self-rated health (compared to *excellent*), being a woman (versus man), regularly taking prescription drugs (versus not regularly taking prescription drug), *high* educational attainment (versus *medium*), diagnosis of a major health condition since their last interview, and reporting *great difficulty* in making ends meet since the beginning of the pandemic (versus *easily* making ends meet). This work is illuminating but has its limitations. The

authors note that they were unable to distinguish those who needed care from those who did not, which may have underestimated the true impact.[40]

Atherly et al. sought to identify which types of healthcare were being delayed during the COVID-19 pandemic and to better understand patients' motivations for doing so. Using a survey of 1,694 primary care patients from a mid-sized Vermont city, Atherly et al. found that 48% (n=812) of those surveyed reported delay in care related to the pandemic. Among those who delayed care, 78% reported care was delayed because the provider cancelled their appointment, while only 22% voluntarily cancelled their appointment. Finally, 26.1% were either *very concerned* or *concerned* about their deferral of care, 30% felt *neutral*, and 40% were either *unconcerned* or *very unconcerned* about deferring care. However, there are key weaknesses in how the investigators defined delayed care and their chosen survey responses.[41]

Czeisler et al. identify specific predictors of delaying or avoiding care during the COVID-19 pandemic. Specifically, younger adults (18-24 years versus 25-44 years) were 12% more likely to delay or avoid care, unpaid caregivers of adults were more likely to have delayed care than non-caregivers, people with two or more comorbidities were more likely to have delayed or avoided care than those with fewer than two comorbidities, and people with disabilities were more likely than people without a disability were more likely to have avoided care.[35] Several studies have observed increased disease severity[42,43] and worsened post-surgical outcomes as a result of delayed care during the COVID-19 pandemic.[42,44]

Using data from the Johns Hopkins COVID-19 Civic Life and Public Health Survey, Anderson et al. sought to investigate the frequency, determinants, and types of healthcare delays reported during the pandemic.[45] The authors found that Hispanic respondents (versus non-Hispanic white respondents), 18-34-year-olds and 35-49-year-olds (versus those 65 years or older),

respondents who rated their health as *fair* or *poor* (versus those who rated their health as *excellent*), those with a household income less than $35,000 per year (versus $35,000-$74,999), Medicaid recipients (versus those covered by Medicare or private health insurance), and those who reported a mental health comorbidity were more likely to delay filling a prescription during the pandemic. No such difference was observed when comparing non-Hispanic Black respondents to non-Hispanic white respondents. Compared to those who were employed, those who were *unemployed or not working owing to disability* were overall more likely to forgo any type of medical care in addition to being more likely to delay filling a prescription and to delay scheduled medical care. Finally, employed individuals and Medicaid recipients were more likely to exhibit inappropriate healthcare seeking behavior both due to fear of exposure to SARS-CoV-2 and pandemic-related financial concerns. Compared to respondents who were covered by Medicare or private health insurance, uninsured individuals were more likely to forego care due to financial concerns.[45] While this study proports to be the first of its kind, its authors note there are several key limitations. First, they cite their small sample size and resultant inability to generate enough power within subgroups of their study population. Second, they question whether their population is representative of the "differences in timing and extent of the pandemic and public health responses" in all regions of the United States. Third, they created novel survey questions to measure forgone medical specifically for their study, which makes it impossible to directly compare their findings with literature pre-dating the COVID-19 pandemic. Finally, the survey did not collect household-level data such as financial or insurance status of a spouse or family member, which may also have influenced healthcare seeking decisions.[45]

<u>Gaps in Knowledge</u>

Due to the novel and dynamic nature of COVID-19, there is still much to be learnt about how COVID-19 is impacting healthcare behavior, particularly during later phases of the pandemic when many restrictions have been lifted. In particular, it is unclear how race impacts healthcare seeking behaviors during COVID-19 as few studies have examined this. Given the known associations between race and healthcare seeking behaviors pre-pandemic[31,32] it is perhaps reasonable to anticipate that the COVID-19 pandemic may compound these associations. Furthermore, few studies have looked specifically among people infected with COVID-19, which may change healthcare seeking behaviors considerably, nor has anyone used a combined electronic medical record (EMR) and survey approach to capture social determinants of health, including race (often missing in EMR), unique experiences associated with COVID-19, demographics, and comorbidities.

<u>Study Aims</u>

In this thesis, our primary aim is to examine the association between race and healthcare seeking behaviors among a Southeastern US insured population diagnosed with COVID-19.

Methods

<u>Study Population</u>

This study is a cross-sectional analysis of members of Kaiser Permanente Georgia (KPGA), a large integrated healthcare system including over 260,000 current adult (≥18 years) members, across the Atlanta metropolitan area and North Georgia.

Between July 1 and August 15, 2021, all adult KPGA members with a confirmed COVID-19 diagnosis and valid email address (n~17,500, from January 1, 2020, through Jun 1, 2021) were invited via email to participate in a COVID-19 survey. COVID-19 status was defined by a positive

COVID-19 PCR test or an ICD-10 diagnosis (code U07.1, B97.29, B34.2, B97.21, or J12.81). Among the 17,500 eligible KPGA members, 533 accessed the survey (response rate: 3%). We excluded anyone who did not provide informed consent (n = 51), was missing a unique KPGA study ID (n=2), did not complete the survey (n = 110), did not identify as either non-Hispanic Black or non-Hispanic white (n=8), were missing gender (n=11), or were missing ethnicity (n=3). For this analysis we only included individuals self-reporting as non-Hispanic white or non-Hispanic Black, leaving us with a final sample size of 307 (response rate: 2%), **Figure 1**.
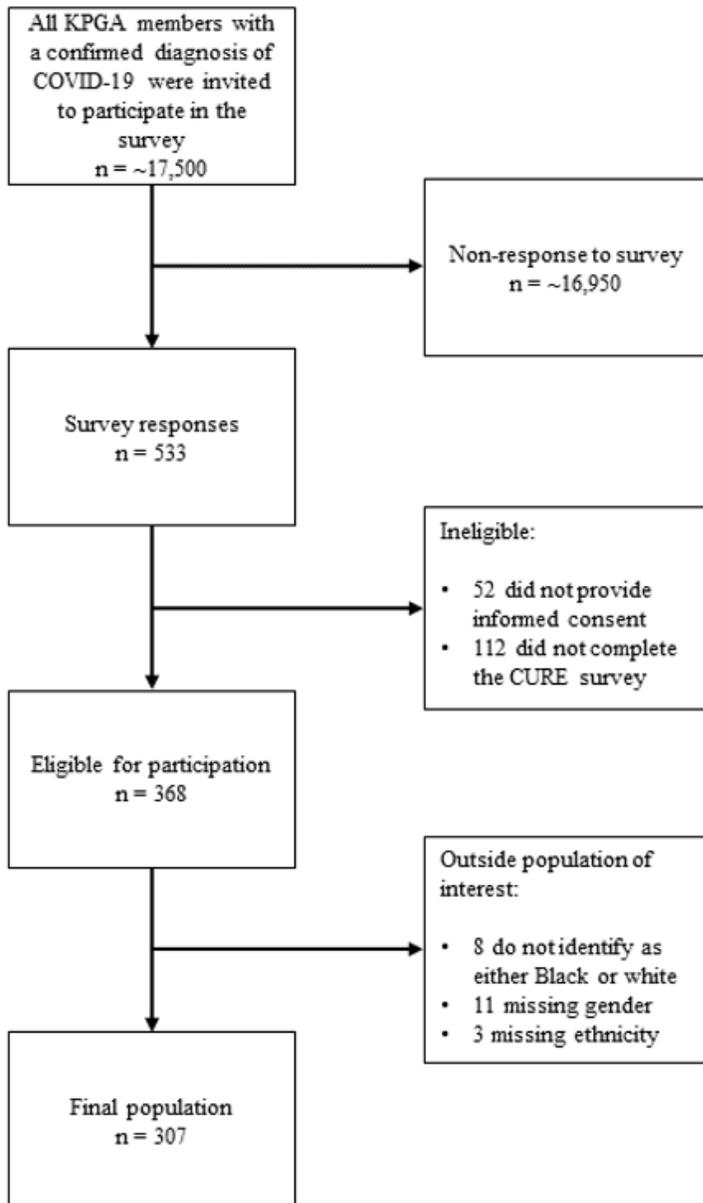
Figure 1. Selection of study population

COVID-19 Survey

We asked participants to answer several questions related to their unique experiences of the COVID-19 pandemic, health behaviors pre- and post-COVID-19 infection, social determinants of health, demographics, vaccine hesitancy, medical mistrust, and locus of control. Variables included in the survey were chosen based on *a priori* knowledge and adapted from a variety of sources including KPGA's Center for Research and Evaluation, the National Institute of Health's Office of Behavioral and Social Sciences Research,[46] and existing literature in the case of the indices for scoring locus of control and medical mistrust.[47,48] The complete survey, including survey response options, is included in **Appendix 1**.

Healthcare Seeking Behavior

The primary outcome for this study was *inappropriate* healthcare seeking behavior (healthcare seeking behavior),[49,50] assessed using two survey items as follows: a participant was considered to have *inappropriate* healthcare seeking behavior if they responded yes to the question "Since March 2020 have you 'cancelled an appointment' and/or 'postponed or delayed seeking care' (for any health concerns, including COVID-19)?" All others were considered to have appropriate healthcare seeking behavior.

Race

The primary exposure of interest was self-reported race (non-Hispanic Black versus non-Hispanic white). We recognize that our defined categories of race and ethnicity do not correspond to any individual physiological or behavioral differences.[51] In this study, we assume that both race and ethnicity are socially constructed categories that serve as proxies for social determinants of health, not as physiological or genetic indicators.[52] It is assumed that race and ethnicity are constructs that could intersect with healthcare seeking behavior, social determinants, and clinical

risk factors to produce discernable differences in healthcare seeking behavior and other health-related outcomes. As noted by Gadson et al.,[53] we recognize that any racial or ethnic disparities are actually "differences in treatment and access not explained by differences in health status or individual preference."[54] For this study, respondents were coded as non-Hispanic white if they reported *White* as their only race and did not report being Hispanic or Latino. Similarly, those whose who reported *Black or African American* as their only race and did not report being Hispanic or Latino were coded as non-Hispanic Black.

<u>Study Variables</u>

Key variables of interest captured in the survey included age (18-44, 45-64, 65+), gender (men, women), highest level of educational attainment (high school or less, some college, bachelor's degree, graduate degree), and household income (<$75,000, ≥$75,000+). Other variables considered to have biological or clinical significance to our research question were: average hours of sleep per night, self-rated health (*Good, fair, or poor*; *very good*; and *excellent)*, impact of specific major life disruptions due to the COVID-19 pandemic (job loss, transition to remote work, decrease in personal income, financial hardship, relationship breakdown, COVID-19 death in network, childcare responsibilities, virtual schooling, care for loved one), presence of *at least* one life disruption, healthcare barriers (e.g., ever been denied care, ever felt unfairly treated while seeking care, ever experienced a long wait time), and concerns about the length of protection provided by the COVID-19 vaccine.

Several other variables from the survey were considered in our analysis and were manipulated or transformed before use. First, minutes of physical activity per week was calculated by multiplying each respondent's number of exercise sessions per week by the time spent per exercise session. This was then dichotomized based on the CDC's recommendation of 150 minutes

of physical activity per week.[55] Second, to score locus of control[47] and medical mistrust,[48] each survey item within each measure (n=6 and n=17, respectively) was ranked on a 4-point Likert Scale from *Strongly Disagree* to *Strongly Agree*, and a simple mean for each measure was calculated for each subject. Then the population median for each measure was calculated. The population medians for locus of control and medical mistrust were 3.0 and 2.59, respectively. Finally, each subject was assigned a new dichotomized variable indicating whether they were above or below the median for the study population on each measure, similar to the technique used by Hamoda et al.[56]

To obtain information from KPGA's EMR, we linked survey individuals via unique KPGA medical record number, first name and last name. Of note, 53 individuals (17.3%) did not uniquely identify with a KPGA medical record number. For these individuals, only survey data is available. KPGA EMR data included 2019 flu vaccination status and comorbidities—diabetes, chronic pulmonary disease, and peripheral vascular disease—that are included in the Charlson comorbidity index[57] and defined using ICD-10 codes. A full list of variables pulled from the EMR is available in **Supplementary Table 2.**

To capture area-level data on socio-economic status, we also merged in, neighborhood deprivation index,[58] and social vulnerability[59] variables, geocoded by zip code, available from the American Community Survey and the Centers for Disease Control and Prevention. Neighborhood deprivation index was grouped into quartiles (within the study population). Social vulnerability index variables were broken into specified quartiles (0 to .2500, .2501 to .5000, .5001 to .7500, .7501 to 1.0) as recommended by CDC. [60]

Statistical Analysis

Characteristics of study participants were summarized using means, percentages, and frequencies as appropriate, and chi-square tests and *t* tests were used to test for differences in categorical and continuous characteristics, respectively, by race (non-Hispanic Black versus non-Hispanic white). Mann-Whitney U tests were used to test for differences in means among continuous variables which did not satisfy the normality assumptions. We conducted bivariate logistic regression analyses to assess the relationship between each potential covariate and inappropriate healthcare seeking behavior to inform selection of variables for the multivariable models. Additionally, we constructed a directed acyclic graph (DAG) to conceptualize the relationship between race and inappropriate healthcare seeking behavior, **Figure 2.**

To assess the relationship between race and inappropriate healthcare seeking behavior while accounting for potential confounders, we performed multivariable logistic regression analysis. When constructing the models, potential covariates identified in our DAG, and those with a p-value of 0.20 or less from the bivariate analyses were considered for inclusion. Additionally, covariates with known clinical relevance to our specific research question that did not meet the 0.20 threshold during bivariate analysis (e.g., age, gender) were considered for inclusion. Model selection was performed via backwards selection; in an iterative process, the covariate with the highest p-value was removed until all covariates in the model had p-values less than 0.20. In a second step, we also performed forward selection, adding in one variable at a time, to identify the variables that resulted in a 10% shift in ORs.
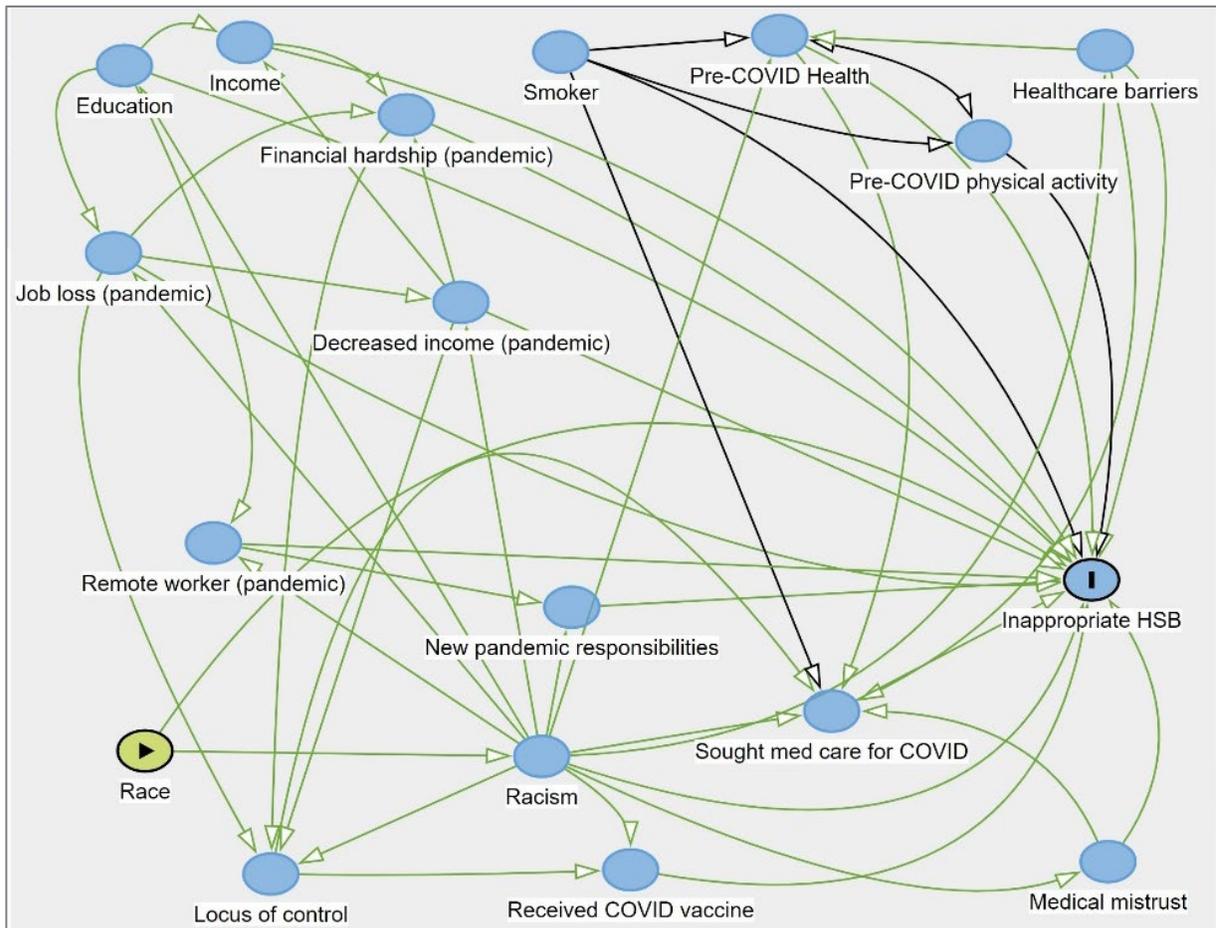
Figure 2. Directed acyclic graph conceptualizing the relationship between race and

healthcare seeking behavior

After variable specification, a collinearity assessment was conducted. Covariates were determined to be collinear if a condition index greater than 30 was observed concurrent to at least two variance decomposition proportions (VDPs) greater than 0.5. In any group of collinear variables, all were dropped from the models except for one. This decision was based on the need to retain primary exposure and outcome variables, ensure the models remained hierarchically well-formulated, and preserve biologically or clinically relevant variables. Successive assessments were run, and collinear variables dropped until the above conditions for collinearity were no longer satisfied among any set of variables in the model.

We report two final multivariable models. Model 1 includes race, age, income, pre-COVID health, pre-COVID sleep, reported at least one social impact during the COVID-19 pandemic, and providing care for a loved one. Model 2 includes the variables from model 1 and education, obesity, presence of diabetes, weekly physical activity, 2019 flu vaccination status, reported concerns about the duration of COVID-19's efficacy, and quartile rankings for the social vulnerability index and neighborhood deprivation index. Of note, model 2 includes 220 people as these additional variables were obtained from KPGAs EMR, which was not available for all individuals. To assess if this data was missing at random, we compiled a table of missing data by race, **Table 1.** We determined data was likely missing at random, and thus opted for a complete case analysis approach in both models.

All analyses were conducted using SAS 9.4 (Cary, North Carolina). The KPGA (IRB #00000406 and Emory Institutional Review Boards (IRB #MOD004-STUDY00001631) reviewed and approved this study.

Table 1, Missing data among Kaiser Permanente Georgia survey participants diagnosed with COVID-19, by race

Characteristic	Total (N=307)	Race	
		Non-Hispanic White (N=186)	Non-Hispanic Black (N=121)
Demographics[§]			
Marital status	1 (0.3%)	1 (0.3%)	--[†]
Education	1 (0.3%)	--	1 (0.3%)
Household income	5 (1.6%)	5 (2.7%)	--
Health behaviors prior to COVID-19			
Self-rated health	1 (0.3%)	--	1 (0.8%)
Average sleep per night	--	--	--
Weekly physical activity	28 (9.1%)	17 (9.1%)	11 (9.1%)
Comorbidities and 2019 healthcare utilization			
Body mass index (BMI), kg/m^2	55 (17.9%)	32 (17.2%)	23 (19.0%)
Charlson comorbidity score	53 (17.3%)	31 (16.7%)	22 (18.2%)
Chronic pulmonary disease	53 (17.3%)	31 (16.7%)	22 (18.2%)
Peripheral vascular disease	53 (17.3%)	31 (16.7%)	22 (18.2%)
Diabetes	53 (17.3%)	31 (16.7%)	22 (18.2%)
Received 2019 flu vaccine	53 (17.3%)	31 (16.7%)	22 (18.2%)
Social impacts during the COVID-19 pandemic			
Job loss	1 (0.3%)	1 (0.5%)	--
Shift to remote work	4 (1.3%)	3 (1.6%)	1 (0.8%)
Decrease in personal income	--	--	--
Financial hardship	1 (0.3%)	--	1 (0.8%)
Relationship breakdown	--	--	--
COVID-19 death in network	--	--	--
Childcare responsibilities	1 (0.3%)	--	1 (0.8%)
Virtual schooling	2 (0.7%)	1 (0.5%)	1 (0.8%)
Care for loved one	--	--	--
Reported at least one impact	2 (0.7%)	2 (1.1%)	--
Psychosocial factors			
Locus of control	7 (2.3%)	3 (1.6%)	4 (3.3%)
Medical mistrust	27 (8.8%)	13 (7.0%)	14 (11.6%)
Reported concern about length of protection from the COVID-19 vaccine	--	--	--

Table 1, Missing data among Kaiser Permanente Georgia survey participants diagnosed with COVID-19, by race

Characteristic	Total (N=307)	Race	
		Non-Hispanic White (N=186)	Non-Hispanic Black (N=121)
Area-level SDOH			
Social Vulnerability Index, overall theme	53 (17.3%)	31 (16.7%)	22 (18.2%)
Area Deprivation Index	53 (17.3%)	31 (16.7%)	22 (18.2%)

§ Non-missing values for ethnicity, gender, and age were required for exclusion in this study, so all participants necessarily have these values
† Denotes that the specified variable has 0 missing values

Results

Baseline Characteristics

Among our study population of 307 KPGA members, 39.4% non-Hispanic Black, mean age was 52.4 ± 13.3 years, 67.4% were women, 63.7% were married, 60.3% reported household incomes of at least $75,000 per year, **Table 2.**

Compared to white KPGA members, Black members were more likely to be women (76.9% versus 61.3%), to have diabetes (29.3% versus 17.4%) and to be obese (81.6% versus 53.2%). During the pandemic, Black members were more likely to have experience a shift to remote work (56.7% versus 40.4%), to become newly responsible for providing care to a loved one (20.7% versus 6.5%), and to experience financial hardship (29.2% versus 19.4%). Black participants were also less likely to be married (49.6% versus 73.0%), less likely to have a household income greater than or equal to $75,000 (52.9% versus 65.2%), and less likely to have received the 2019 flu vaccine (38.4% versus 56.1%). Black KPGA members were less likely than white members to live in area with a higher social vulnerability score but more likely to live in an area with a higher area deprivation score.

Baseline characteristics for the subset of our study population only containing those who have EMR data are detailed in **Supplementary Table 1**. Among this subpopulation of 254 KPGA members, 40.0% non-Hispanic Black, mean age was 52.5 ± 13.4 years, 70.9% were women, 43.7% were married, 57.5% reported household incomes of at least $75,000 per year.

Table 2, Baseline characteristics of Kaiser Permanente Georgia survey participants diagnosed with COVID-19, by race[§]

Characteristic	Total (N=307)	Race	
		Non-Hispanic White (N=186)	Non-Hispanic Black (N=121)
Demographics			
Gender			
Men	100 (32.6%)	72 (38.7%)	28 (23.1%)
Women	207 (67.4%)	114 (61.3%)	93 (76.9%)
Age, mean years (SD)	52 (± 13)	51 (± 13)	54 (± 13)
Age			
18-44 years	86 (28.0%)	44 (23.7%)	42 (24%)
45-64 years	157 (51.1%)	98 (52.7%)	59 (50%)
65+ years	64 (20.8%)	44 (23.7%)	20 (26%)
Marital status			
Married	195 (63.7%)	135 (73.0%)	60 (49.6%)
Not married	111 (36.3%)	50 (27.0%)	61 (50.4%)
Education			
High school, some college, associate's degree	123 (40.2%)	77 (41.4%)	46 (38.3%)
Bachelor's or graduate degree	183 (59.8%)	109 (58.6%)	74 (61.7%)
Household income			
≥$75,000	182 (60.3%)	118 (65.2%)	64 (52.9%)
<$75,000	120 (39.7%)	63 (34.8%)	57 (47.1%)
Health behaviors prior to COVID-19			
Self-rated health			
Good, fair, or poor	118 (38.6%)	70 (37.6%)	48 (40.0%)
Very good	144 (47.1%)	89 (47.8%)	55 (45.8%)
Excellent	44 (14.4%)	27 (14.5%)	17 (14.2%)
Average sleep per night			
≥6 hours	258 (84.0%)	162 (87.1%)	96 (79.3%)
<6 hours	49 (16.0%)	24 (12.9%)	25 (20.7%)
Weekly physical activity			
≥150 minutes	148 (53.0%)	84 (49.7%)	64 (58.2%)
<150 minutes	131 (47.0%)	85 (50.3%)	46 (41.8%)
Comorbidities and 2019 healthcare utilization			
Body mass index, mean kg/m^2 (SD)	34.0 (± 8.8)	32.1 (± 8.6)	37.0 (± 8.3)
Obesity			
Not obese (BMI<30kg/m2)	90 (35.7%)	72 (46.8%)	18 (18.4%)
Obese (BMI≥30kg/m2)	162 (64.3%)	82 (53.2%)	80 (81.6%)
Charlson comorbidity score			
0	113 (44.5%)	69 (44.5%)	44 (44.4%)
1	80 (31.5%)	50 (32.3%)	30 (30.3%)
2+	61 (24.0%)	36 (23.2%)	25 (25.3%)

Table 2, Baseline characteristics of Kaiser Permanente Georgia survey participants diagnosed with COVID-19, by race[§]

Characteristic	Total (N=307)	Race	
		Non-Hispanic White (N=186)	Non-Hispanic Black (N=121)
Chronic pulmonary disease	83 (27.0%)	55 (29.6%)	28 (23.1%)
Peripheral vascular disease	29 (9.4%)	20 (10.8%)	9 (7.4%)
Diabetes	56 (18.2%)	27 (14.5%)	29 (24.0%)
Received 2019 flu vaccine	125 (49.2%)	87 (56.1%)	38 (38.4%)
Social impacts during the COVID-19 pandemic			
Job loss	39 (12.8%)	29 (15.7%)	10 (8.3%)
Shift to remote work	142 (46.9%)	74 (40.4%)	68 (56.7%)
Decrease in personal income	89 (29.0%)	52 (28.0%)	37 (30.6%)
Financial hardship	71 (23.2%)	36 (19.4%)	35 (29.2%)
Relationship breakdown	57 (18.6%)	29 (15.6%)	28 (23.1%)
COVID-19 death in network	177 (57.7%)	99 (53.2%)	78 (64.5%)
Childcare responsibilities	44 (14.4%)	22 (11.8%)	22 (18.3%)
Virtual schooling	88 (28.9%)	46 (24.9%)	42 (35.0%)
Care for loved one	37 (12.1%)	12 (6.5%)	25 (20.7%)
Reported at least one impact	274 (89.3%)	161 (86.6%)	113 (93.4%)
Psychosocial factors			
Locus of control			
Above median	133 (43.3%)	74 (39.8%)	59 (48.8%)
Below or at median	167 (54.4%)	109 (58.6%)	58 (47.9%)
Medical mistrust			
Above median	111 (36.2%)	56 (30.1%)	55 (45.5%)
Below or at median	169 (55.1%)	117 (7.0%)	52 (43.0%)
Reported concern about length of protection from the COVID-19 vaccine	218 (71.0%)	133 (71.5%)	85 (70.3%)
Area-level SDOH			
Social Vulnerability Index, overall theme			
0 – 0.2500 (Least vulnerable)	76 (29.9%)	18 (11.6%)	23 (23.2%)
0.2501 – 0.5000	85 (33.5%)	23 (14.8%)	29 (29.3%)
0.5001 – 0.7500	52 (20.5%)	53 (34.2%)	32 (32.3%)
0.7501 – 1.000 (Most vulnerable)	41 (16.1%)	61 (39.4%)	15 (15.2%)
Area Deprivation Index			
First or second **quartiles** (Least deprived)	127 (50.0%)	100 (64.5%)	27 (27.3%)
Third	64 (25.2%)	32 (20.7%)	32 (32.3%)
Fourth (Most deprived)	63 (24.8%)	23 (14.8%)	40 (40.4%)

§ Data are N and % or mean and SD as reported

Bivariate Analysis of Race, Covariates, and Healthcare Seeking Behaviors

Overall, 37% of Black KPGA members and 63% of white KPGA members reported inappropriate healthcare seeking behaviors during the pandemic. Overall, 20% (n=30) canceled an appointment, 27% (n=84) postponed an appointment, and 11% (n=33) both canceled and postponed an appointment.

In bivariate analysis, race was not associated with inappropriate healthcare seeking behaviors (OR: 0.85, 95% CI: 0.54-1.35, p= 0.49), **Table 3.** Factors associated with inappropriate healthcare seeking behaviors were: being 65-years-old or older, compared to 18-44-years old (0.47, 0.24-0.90); *very good* self-rated health (0.54, 0.33-0.88) and *excellent* self-rated health (0.41, 0.20-0.83), both compared to *good, fair,* or *poor* health; body mass index (1.04, 1.01-1.07); obesity (0.58, 1.10-3.01); 2019 flu vaccine (0.57, 0.34-0.93); experiencing financial hardship during the COVID-19 pandemic (1.69, 0.99-2.89); experiencing *at least* one major life disruption during the COVID-19 pandemic (2.71, 1.21-6.03); reported concerns about how well the COVID-19 vaccine will work or about the length of its protection (0.54, 0.32-0.89); having an overall social vulnerability score between 0.75 and 1 (2.27, 1.04-4.93); and ranking in the third quartile of area deprivation index, compared to the first or second (0.90, 0.49-1.64). Factors not associated with inappropriate healthcare seeking behaviors were gender, marital status, education, household income, average sleep per night, weekly physical activity, Charlson comorbidity scores, chronic pulmonary disease, peripheral vascular disease, diabetes, locus of control, and medical mistrust.

Table 3, Bivariate logistic regression analysis of factors associated with inappropriate healthcare seeking behaviors among Kaiser Permanente Georgia survey participants diagnosed with COVID-19

Characteristic	N	Odds Ratio	95% CI[1]	p-value
Demographics				
Race				
Non-Hispanic White	186	ref	ref	ref
Non-Hispanic Black	121	0.85	0.54, 1.35	0.49
Gender				
Men	100	ref	ref	ref
Women	207	1.19	0.74, 1.92	0.50
Age				
18-44 years	86	1	--	--
45-64 years	157	0.80	0.47, 1.35	0.40
65+ years	64	0.47	0.24, 0.90	0.02
Marital status				
Married	195	ref	ref	ref
Not married	111	1.04	0.65, 1.66	0.87
Education				
High school, some college, associate's degree	123	ref	ref	ref
Bachelor's or graduate degree	183	1.40	0.88, 2.21	0.16
Household income				
≥$75,000	182	ref	ref	ref
<$75,000	120	1.43	0.90, 2.26	0.134
Health behaviors prior to COVID-19				
Self-rated health				
Good, fair, or poor	118	ref	ref	ref
Very good	144	0.54	0.33, 0.88	0.01
Excellent	44	0.41	0.20, 0.83	0.01
Average sleep per night				
≥6 hours	258	ref	ref	ref
<6 hours	49	0.64	0.35, 1.20	0.17
Weekly physical activity				
≥150 minutes	131	1.10	0.69, 1.76	0.70
<150 minutes	148	ref	ref	ref
Comorbidities and 2019 healthcare utilization				
Body mass index (BMI), kg/m^2	252	1.04	1.01, 1.07	0.01
Obesity				
Not obese	90	ref	ref	ref

Table 3, Bivariate logistic regression analysis of factors associated with inappropriate healthcare seeking behaviors among Kaiser Permanente Georgia survey participants diagnosed with COVID-19

Characteristic	N	Odds Ratio	95% CI[1]	p-value
Obese	162	0.58	1.10, 3.01	0.03
Charlson comorbidity	254	0.90	0.76, 1.07	0.22
0	113	ref	ref	ref
1	80	0.98	0.55, 1.73	0.93
2+	61	0.57	0.30, 1.08	0.08
Chronic pulmonary disease	83	0.86	0.51, 1.45	0.56
Peripheral vascular disease	29	0.69	0.31, 1.51	0.35
Diabetes	56	0.64	0.35, 1.17	0.15
Received 2019 flu vaccine	129	0.57	0.34, 0.93	0.03
Social impacts during the COVID-19 pandemic				
Job loss	39	1.03	0.53, 2.02	0.93
Shift to remote work	142	1.18	0.75, 1.86	0.50
Decrease in personal income	89	1.09	0.67, 1.79	0.70
Financial hardship	71	1.69	0.99, 2.89	0.05
Relationship breakdown	57	1.50	0.84, 2.68	0.17
COVID-19 death in network	177	1.01	0.64, 1.60	0.95
Childcare responsibilities	44	1.38	0.73, 2.61	0.33
Virtual schooling	88	1.46	0.89, 2.40	0.14
Care for loved one	37	1.50	0.75, 3.00	0.25
Reported at least one impact	274	2.71	1.21, 6.03	0.015
Psychosocial factors				
Locus of control				
Above median	133	ref	ref	ref
Below or at median	167	1.0	0.63, 1.57	0.99
Medical mistrust				
Above median	111	ref	ref	ref
Below or at median	169	0.77	0.48, 1.25	0.30
Reported concern about length of protection from the COVID-19 vaccine	218	0.54	0.32, 0.89	0.02
Area-level SDO				
Social Vulnerability Index, overall theme				
0 – 0.2500 (Least vulnerable)	76	ref	ref	ref
0.2501 – 0.5000	85	1.56	0.83, 2.91	0.16
0.5001 – 0.7500	52	1.45	0.71, 2.95	0.30
0.7501 – 1.000 (Most vulnerable)	41	2.27	1.04, 4.93	0.04

Table 3, Bivariate logistic regression analysis of factors associated with inappropriate healthcare seeking behaviors among Kaiser Permanente Georgia survey participants diagnosed with COVID-19

Characteristic	N	Odds Ratio	95% CI[1]	p-value
Area Deprivation Index				
First or second **quartiles** (Least deprived)	127	ref	ref	ref
Third	64	0.90	0.49, 1.64	0.05
Fourth (Most deprived)	63	1.87	1.01, 3.47	0.72

[1] CI = Confidence Interval

Multivariable Association Between Race and Inappropriate Healthcare Seeking Behaviors

In multivariable models not including KPGA EMR data, race was not associated with inappropriate healthcare seeking behavior (0.69, 0.41-1.14), **Table 4**. In model 1, factors associated with inappropriate healthcare seeking behaviors were: being 65 years old or older, compared to 18-44-years old (0.44, 0.22-0.88); *very good* self-rated health (0.46, 0.27-0.78) and *excellent* self-rated health (0.32, 0.15-0.69), both compared to *good, fair,* or *poor* health. Factors in model 1 not associated with inappropriate healthcare seeking behaviors were household income, average sleep per night, caring for a loved one, and reporting at least one social impact.

In model 2, including KPGA EMR, there was an association between race and healthcare seeking behavior (0.34, 0.15-0.75). Other factors associated with inappropriate healthcare seeking behaviors were: highest level of education completed, with those holding at least a bachelor's degree being approximately 2.5 times (2.49, 1.24-5.00) more likely to exhibit inappropriate healthcare seeking behavior compared to those with less education (high school, some college, or an associate's degree); exercising for fewer than 150 minutes per week (0.48, 0.24-0.96); diabetes (0.41, 0.16-1.01); 2019 flu vaccination (0.32, 0.16-0.65); caring for a loved one during the pandemic (6.59, 2.18-19.96); and experiencing at least one life disruption due to the COVID-19 pandemic (4.51, 1.23-16.55). Age, household income, self-rated health, average sleep per night, the Social Deprivation Index, and Area Deprivation Index were not associated with race.

Table 4, Multivariable association between race, covariates, and inappropriate healthcare seeking behaviors among Kaiser Permanente Georgia survey participants diagnosed with COVID-19[§]

	Inappropriate healthcare seeking behavior					
	Model 1			**Model 2**		
Variable	**OR[I]**	**95% CI[I]**	**p-value**	**OR[I]**	**95% CI[I]**	**p-value**
Race						
Non-Hispanic White	ref	ref	ref	ref	ref	ref
Non-Hispanic Black	0.69	0.41, 1.14	0.15	0.34	0.15, 0.75	<.01
Age						
18-44 years	ref	ref	ref	ref	ref	ref
45-64 years	0.91	0.51, 1.62	0.75	0.85	0.38, 1.89	0.68
65+ years	0.44	0.22, 0.88	0.02	0.44	0.16, 1.19	0.11
Education						
High school, some college, associate's degree	--	--	--	ref	ref	ref
Bachelor's or graduate degree	--	--	--	2.49	1.24, 5.00	0.01
Household income						
≥$75,000	ref	ref	ref	ref	ref	ref
<$75,000	1.55	0.93, 2.59	0.10	1.30	0.63, 2.70	0.49
Self-rated health						
Good, fair, or poor	ref	ref	ref	ref	ref	ref
Very good	0.46	0.27, 0.78	<.01	0.53	0.26, 1.10	0.09
Excellent	0.32	0.15, 0.69	<.01	0.69	0.21, 2.23	0.54
Average sleep per night						
≥6 hours	ref	ref	ref	ref	ref	ref
<6 hours	0.52	0.27, 1.03	0.07	0.69	0.27, 1.75	0.44
Weekly physical activity						
≥150 minutes	--	--	--	ref	ref	ref
<150 minutes	--	--	--	0.48	0.24, 0.96	0.04
Obesity	--	--	--	3.90	1.74, 8.74	<.001
Diabetes	--	--	--	0.41	0.16, 1.01	0.05
Received 2019 flu vaccine	--	--	--	0.32	0.16, 0.65	<.01
Care for loved one	1.77	0.83, 3.78	0.14	6.59	2.18, 19.96	<.001
Reported at least one social impact	2.32	0.97, 5.51	0.06	4.51	1.23, 16.55	0.02
Reported concern about length of protection from COVID-19 vaccine	--	--	--	0.66	0.31, 1.39	0.27

Table 4, Multivariable association between race, covariates, and inappropriate healthcare seeking behaviors among Kaiser Permanente Georgia survey participants diagnosed with COVID-19[§]

	Inappropriate healthcare seeking behavior					
	Model 1			**Model 2**		
Variable	**OR[I]**	**95% CI[I]**	**p-value**	**OR[I]**	**95% CI[I]**	**p-value**
Social Vulnerability Index, overall theme						
0 – 0.2500 (Least vulnerable)	--	--	--	ref	ref	ref
0.2501 – 0.5000	--	--	--	0.55	0.17, 1.76	0.31
0.5001 – 0.7500	--	--	--	1.08	0.26, 4.40	0.92
0.7501 – 1.000 (Most vulnerable)	--	--	--	0.53	0.11, 2.60	0.43
2019 Area Deprivation Index (quartiles)						
First or second (Lowest)	--	--	--	ref	ref	ref
Third	--	--	--	0.50	0.18, 1.40	0.19
Fourth (Highest)	--	--	--	2.72	0.62, 11.98	0.19

§ All variables reported in table 4 are included in models 1 and 2 as indicated.

Discussion

In this study, we evaluated the relationship between race and inappropriate healthcare seeking behavior among members of a large, integrated healthcare system that had previously been diagnosed with COVID-19. Overall, in multivariable models including EMR data, non-Hispanic Black members were 66% less likely to report inappropriate healthcare seeking behavior compared with non-Hispanic white KPGA members. Other factors that were associated with inappropriate healthcare seeking behavior in multivariable models were higher educational attainment, fewer than 150 minutes of weekly physical activity, obesity, diabetes, 2019 flu vaccine compliance, caring for a loved one during the COVID-19 pandemic, and reporting at least one life disruption due to the pandemic.

Our finding that non-Hispanic Black KPGA members were less likely to report inappropriate healthcare seeking behavior is inconsistent with the broader literature on race and healthcare seeking behavior in the general population,[15,17,19–21] whereby a large evidence base suggests Black adults are more likely to report inappropriate healthcare seeking behavior. However, studies examining healthcare seeking behaviors during the COVID-19 pandemic have produced markedly different results. For example, Ahmed et al. found that the association of racial identity and inappropriate healthcare seeking behavior was dependent upon the time-period throughout the pandemic. Out of the four time periods specified in their analysis, non-Hispanic Black patients were more likely to exhibit inappropriate healthcare seeking behavior in one period and less likely in another.[61] Several other studies have found no association between race and delayed healthcare,[62–64] while others have found that people of color are less likely to experience healthcare delays.[65,66] Papautsky et al. observed that during the first months of the pandemic, people of color were less likely to experience healthcare delays than non-Hispanic white patients.[67] Whaley et al.

found that patients living in neighborhoods with a greater share of residents with lower socioeconomic status and a greater share of minority residents were less likely to see a decrease healthcare utilization.[68] Huang et al.'s analysis of EMR data from Kaiser Permanente Southern California (KPSC) found that non-white races, including those who were Black, were more likely to have increased healthcare utilization following their COVID-19 diagnosis.[69] Roth et al. found that Black patients were more likely than their white counterparts to make use of primary care appointments both before *and* after being diagnosed with COVID-19.[70]

Our findings are thus broadly consistent with the current knowledge of race and healthcare seeking behavior during the pandemic. In Roth et al.'s analysis, Black patients were not significantly more likely to utilize primary care until they controlled for social vulnerability. This suggests that there are broader socioeconomic factors at play influencing healthcare seeking behavior.[70] Additionally, throughout the pandemic, there has been public discussion of racial disparities in healthcare and COVID-19 outcomes specifically, so it is possible that the issue was more front of mind for Black individuals, who were more proactive in seeking healthcare during the pandemic. Further, since a large share of the Black respondents in our study population are obese, it's possible that their increased likelihood of care seeking is due to increased interactions with the healthcare system in general.[65] Finally, it is possible that Black patients overall are less likely to access care, but that those with access to healthcare via private insurance such as those in the current study are more likely to keep their appointments.

In our analysis, race was not associated with inappropriate healthcare seeking behavior in our initial model, including all eligible survey participants, and not adjusting for comorbidities. However, in model 2, among those with EMR data available and adjusting for comorbidities, Black race was associated with a significant reduced likelihood of inappropriate healthcare seeking

behavior. We speculate that there may be several possible causes for this. First, the study populations may be different. However, in examining baseline characteristics of these two populations, the proportions of age, race, gender, and household income were similar. It is also possible that in adjusting for comorbidities in model 2, we were additionally accounting for residual differences in social determinants of health by accounting for diseases that are largely socially patterned. For example, diabetes and obesity are both disproportionally seen among the Black population[71–74] and those of low socioeconomic statuses[71,72,75]. This highlights the complexity in examining the association between race and health-related outcomes and the need for thoughtful consideration in developing multivariable models.

Other factors we identified as being significantly associated with inappropriate healthcare seeking behavior were higher education, exercising for fewer than 150 minutes per week, obesity, diabetes, 2019 flu vaccination, caring for a loved one during the COVID-19 pandemic, and reporting at least one social impact due to the pandemic. We found that education was a significant predictor of healthcare seeking behavior, which is consistent with prior work.[40] As such, it is likely that those with more formal education are more likely to be educated about COVID-19 and the risks associated. Additionally, they are more likely to be informed about their own health status and thus more confident in navigating their care, allowing them to decide which aspects of care they can cancel or postpone. We also found that new responsibilities caring for a loved one and having experienced any social impact were associated with delayed or postponed care. Leveraging this information, we may be able to identify those individuals with which targeted approaches, such as reminders via text message or postal mail may be most effective at reducing delayed or cancelled healthcare visits.[76] An important future direction will be to examine whether these same patterns are observed in a non-pandemic environment.

The key strength of the current study is the collection of data on patients' health behaviors that existed prior to COVID-19 infection, various measures of social determinants of health, and experiences during the pandemic, supplemented with EMR data, for which very few other studies have done. However, there are several limitations to consider. First, we are relying on self-reported data for our primary outcome, which is subject to misclassification. Further, our definition of healthcare seeking behavior does not include care types, and there may be important differences by telehealth, or inpatient visits, an important future direction. Second, use of KPGA as our source population, coupled with a low response rate (3%), limits generalizability of our findings. However, though KPGA is an insured population, important disparities exist within this setting. For example, previous investigations have identified racial disparities in KPGA member health outcomes despite all members having access to the KPGA network and its resources.[77] Nonetheless, it is likely that our study population is not representative of the general Atlanta population. Third, we did not ask respondents precisely when or how many times they may have canceled or delayed an appointment or what their motivated their healthcare seeking decisions, which did not allow us to report on the causation of inappropriate healthcare seeking behavior. Fifth, the high degree of missingness for EMR data eliminated 17.3% of cases (n=53), and this may have led to further selection bias in our model 2. Finally, there is the possibility for unmeasured confounding.

Conclusion

Among KPGA members diagnosed with COVID-19, Black members were less likely to delay or cancel care during the pandemic than white members after adjustment for several factors. Other factors associated with inappropriate healthcare seeking behavior included higher educational attainment, exercising fewer than 150 minutes per week, diabetes, flu vaccine compliance,

providing care for a loved one during the pandemic, and reporting at least one social impact because of the pandemic. More research is needed to understand the key drivers of healthcare seeking behavior among Black individuals and to investigate the ways in which social impacts on individuals have influenced their healthcare decisions.

References

1. Hu B, Guo H, Zhou P, Shi ZL. Characteristics of SARS-CoV-2 and COVID-19. *Nat Rev Microbiol*. 2021;19(3):141-154. doi:10.1038/s41579-020-00459-7

2. CDC. COVID Data Tracker. Centers for Disease Control and Prevention. Published March 28, 2020. Accessed April 9, 2022. https://covid.cdc.gov/covid-data-tracker

3. Rozenfeld Y, Beam J, Maier H, et al. A model of disparities: risk factors associated with COVID-19 infection. *Int J Equity Health*. 2020;19(1):126. doi:10.1186/s12939-020-01242-z

4. Azar KMJ, Shen Z, Romanelli RJ, et al. Disparities In Outcomes Among COVID-19 Patients In A Large Health Care System In California. *Health Aff (Millwood)*. 2020;39(7):1253-1262. doi:10.1377/hlthaff.2020.00598

5. Dalsania AK, Fastiggi MJ, Kahlam A, et al. The Relationship Between Social Determinants of Health and Racial Disparities in COVID-19 Mortality. *J Racial Ethn Health Disparities*. Published online January 5, 2021. doi:10.1007/s40615-020-00952-y

6. Romano SD, Blackstock AJ, Taylor EV, et al. Trends in Racial and Ethnic Disparities in COVID-19 Hospitalizations, by Region — United States, March–December 2020. *Morb Mortal Wkly Rep*. 2021;70(15):560-565. doi:10.15585/mmwr.mm7015e2

7. Lundon DJ, Mohamed N, Lantz A, Goltz HH, Kelly BD, Tewari AK. Social Determinants Predict Outcomes in Data From a Multi-Ethnic Cohort of 20,899 Patients Investigated for COVID-19. *Front Public Health*. 2020;8:571364. doi:10.3389/fpubh.2020.571364

8. Chu IYH, Alam P, Larson HJ, Lin L. Social consequences of mass quarantine during epidemics: a systematic review with implications for the COVID-19 response. *J Travel Med*. 2020;27(7):taaa192. doi:10.1093/jtm/taaa192

9. Abedi V, Olulana O, Avula V, et al. Racial, Economic, and Health Inequality and COVID-19 Infection in the United States. *J Racial Ethn Health Disparities*. 2021;8(3):732-742. doi:10.1007/s40615-020-00833-4

10. National Academies of Sciences E, Division H and M, Services B on HC, Disabilities C on HCU and A with. *Factors That Affect Health-Care Utilization*. National Academies Press (US); 2018. Accessed December 10, 2021. https://www.ncbi.nlm.nih.gov/books/NBK500097/

11. Levesque JF, Harris MF, Russell G. Patient-centred access to health care: conceptualising access at the interface of health systems and populations. *Int J Equity Health*. 2013;12:18. doi:10.1186/1475-9276-12-18

12. Institute of Medicine (US) Committee on Monitoring Access to Personal Health Care Services. *Access to Health Care in America*. (Millman M, ed.). National Academies Press (US); 1993. Accessed April 14, 2022. http://www.ncbi.nlm.nih.gov/books/NBK235882/

13. Petrovic D, Marcus K, Sandoval J, et al. Health-related biological and non-biological consequences of forgoing healthcare for economic reasons. *Prev Med Rep*. 2021;24:101602. doi:10.1016/j.pmedr.2021.101602

14. Guessous I, Luthi JC, Bowling CB, et al. Prevalence of Frailty Indicators and Association with Socioeconomic Status in Middle-Aged and Older Adults in a Swiss Region with

Universal Health Insurance Coverage: A Population-Based Cross-Sectional Study. *J Aging Res*. 2014;2014:e198603. doi:10.1155/2014/198603

15. Mielck A, Kiess R, Knesebeck O von dem, Stirbu I, Kunst AE. Association between forgone care and household income among the elderly in five Western European countries – analyses based on survey data from the SHARE-study. *BMC Health Serv Res*. 2009;9(1):52. doi:10.1186/1472-6963-9-52

16. S. Weissman J, Stern R, L. Fielding S, M. Epstein A. Delayed Access to Health Care: Risk Factors, Reasons, and Consequences. *Ann Intern Med*. Published online December 1, 2008. Accessed December 10, 2021. https://www.acpjournals.org/doi/abs/10.7326/0003-4819-114-4-325

17. Chen J, Rizzo JA, Rodriguez HP. The Health Effects of Cost-Related Treatment Delays. *Am J Med Qual*. 2011;26(4):261-271. doi:10.1177/1062860610390352

18. Prentice JC, Pizer SD. Delayed Access to Health Care and Mortality. *Health Serv Res*. 2007;42(2):644-662. doi:10.1111/j.1475-6773.2006.00626.x

19. Naghavi AO, Echevarria MI, Strom TJ, et al. Treatment delays, race, and outcomes in head and neck cancer. *Cancer Epidemiol*. 2016;45:18-25. doi:10.1016/j.canep.2016.09.005

20. Landry I. Racial disparities in hematopoietic stem cell transplant: a systematic review of the literature. *Stem Cell Investig*. 2021;8:24. doi:10.21037/sci-2021-058

21. Dalwadi SM, Lewis GD, Bernicker EH, Butler EB, Teh BS, Farach AM. Disparities in the Treatment and Outcome of Stage I Non-Small-Cell Lung Cancer in the 21st Century. *Clin Lung Cancer*. 2019;20(3):194-200. doi:10.1016/j.cllc.2018.11.004

22. Women and Health Care in the Early Years of the ACA: Key Findings from the 2013 Kaiser Women's Health Survey. KFF. Published May 15, 2014. Accessed April 14, 2022. https://www.kff.org/womens-health-policy/report/women-and-health-care-in-the-early-years-of-the-aca-key-findings-from-the-2013-kaiser-womens-health-survey/

23. Thompson AE, Anisimowicz Y, Miedema B, Hogg W, Wodchis WP, Aubrey-Bassler K. The influence of gender and other patient characteristics on health care-seeking behaviour: a QUALICOPC study. *BMC Fam Pract*. 2016;17(1):38. doi:10.1186/s12875-016-0440-0

24. Mackenzie CS, Gekoski WL, Knox VJ. Age, gender, and the underutilization of mental health services: the influence of help-seeking attitudes. *Aging Ment Health*. 2006;10(6):574-582. doi:10.1080/13607860600641200

25. Matheson FI, Smith KLW, Fazli GS, Moineddin R, Dunn JR, Glazier RH. Physical health and gender as risk factors for usage of services for mental illness. *J Epidemiol Community Health*. 2014;68(10):971-978. doi:10.1136/jech-2014-203844

26. Verhaak PFM, Heijmans MJWM, Peters L, Rijken M. Chronic disease and mental disorder. *Soc Sci Med 1982*. 2005;60(4):789-797. doi:10.1016/j.socscimed.2004.06.012

27. Carriere G. Consultations with doctors and nurses. *Health Rep*. 2005;16(4):45.

28. Nabalamba A, Millar WJ. Going to the doctor. *Health Rep*. 2007;18(1):23-35.

29. Kielb ES, Rhyan CN, Lee JA. Comparing Health Care Financial Burden With an Alternative Measure of Unaffordability. *Inq J Med Care Organ Provis Financ*. 2017;54:46958017732960. doi:10.1177/0046958017732960

30. Moscoso-Porras MG, Alvarado GF. Association between perceived discrimination and healthcare–seeking behavior in people with a disability. *Disabil Health J*. 2018;11(1):93-98. doi:10.1016/j.dhjo.2017.04.002

31. Casagrande SS, Gary TL, LaVeist TA, Gaskin DJ, Cooper LA. Perceived discrimination and adherence to medical care in a racially integrated community. *J Gen Intern Med*. 2007;22(3):389-395. doi:10.1007/s11606-006-0057-4

32. Alcalá HE, Cook DM. Racial Discrimination in Health Care and Utilization of Health Care: a Cross-sectional Study of California Adults. *J Gen Intern Med*. 2018;33(10):1760-1767. doi:10.1007/s11606-018-4614-4

33. Mandelzweig L, Goldbourt U, Boyko V, Tanne D. Perceptual, Social, and Behavioral Factors Associated With Delays in Seeking Medical Care in Patients With Symptoms of Acute Stroke. *Stroke*. 2006;37(5):1248-1253. doi:10.1161/01.STR.0000217200.61167.39

34. Moreland A, Herlihy C, Tynan MA, et al. Timing of State and Territorial COVID-19 Stay-at-Home Orders and Changes in Population Movement — United States, March 1–May 31, 2020. *Morb Mortal Wkly Rep*. 2020;69(35):1198-1203. doi:10.15585/mmwr.mm6935a2

35. Czeisler MÉ, Marynak K, Clarke KEN, et al. Delay or Avoidance of Medical Care Because of COVID-19–Related Concerns — United States, June 2020. *Morb Mortal Wkly Rep*. 2020;69(36):1250-1257. doi:10.15585/mmwr.mm6936a4

36. Hartnett KP, Kite-Powell A, DeVies J, et al. Impact of the COVID-19 Pandemic on Emergency Department Visits - United States, January 1, 2019-May 30, 2020. *MMWR Morb Mortal Wkly Rep*. 2020;69(23):699-704. doi:10.15585/mmwr.mm6923e1

37. Xu S, Glenn S, Sy L, et al. Impact of the COVID-19 Pandemic on Health Care Utilization in a Large Integrated Health Care System: Retrospective Cohort Study. *J Med Internet Res*. 2021;23(4):e26558. doi:10.2196/26558

38. Núñez A, Sreeganga SD, Ramaprasad A. Access to Healthcare during COVID-19. *Int J Environ Res Public Health*. 2021;18(6):2980. doi:10.3390/ijerph18062980

39. Penman-Aguilar A, Talih M, Huang D, Moonesinghe R, Bouye K, Beckles G. Measurement of Health Disparities, Health Inequities, and Social Determinants of Health to Support the Advancement of Health Equity. *J Public Health Manag Pract*. 2016;22:S33. doi:10.1097/PHH.0000000000000373

40. Smolić Š, Čipin I, Međimurec P. Access to healthcare for people aged 50+ in Europe during the COVID-19 outbreak. *Eur J Ageing*. Published online June 11, 2021. doi:10.1007/s10433-021-00631-9

41. Atherly A, Van Den Broek-Altenburg E, Hart V, Gleason K, Carney J. Consumer Reported Care Deferrals Due to the COVID-19 Pandemic, and the Role and Potential of Telemedicine: Cross-Sectional Analysis. *JMIR Public Health Surveill*. 2020;6(3):e21607. doi:10.2196/21607

42. Gerall CD, DeFazio JR, Kahan AM, et al. Delayed presentation and sub-optimal outcomes of pediatric patients with acute appendicitis during the COVID-19 pandemic. *J Pediatr Surg*. 2021;56(5):905-910. doi:10.1016/j.jpedsurg.2020.10.008

43. Seretis K, Boptsi E, Boptsi A, Lykoudis EG. The impact of treatment delay on skin cancer in COVID-19 era: a case-control study. *World J Surg Oncol*. 2021;19(1):350. doi:10.1186/s12957-021-02468-z

44. Bansal R, Aishwarya A, Rao R, et al. Impact of COVID-19 nationwide lockdown on retinoblastoma treatment and outcome: A study of 476 eyes of 326 children. *Indian J Ophthalmol*. 2021;69(10):2617-2624. doi:10.4103/ijo.IJO_2243_21

45. Anderson KE, McGinty EE, Presskreischer R, Barry CL. Reports of Forgone Medical Care Among US Adults During the Initial Phase of the COVID-19 Pandemic. *JAMA Netw Open*. 2021;4(1):e2034882. doi:10.1001/jamanetworkopen.2020.34882

46. National Institute of Health Office of Behavioral and Social Sciences Research. COVID-19 OBSSR Research Tools. Published online May 14, 2020. https://www.nlm.nih.gov/dr2/COVID-19_BSSR_Research_Tools.pdf

47. Rotter JB. Generalized expectancies for internal versus external control of reinforcement. *Psychol Monogr Gen Appl*. 1966;80(1):1-28. doi:10.1037/h0092976

48. LaVeist TA, Isaac LA, Williams KP. Mistrust of health care organizations is associated with underutilization of health services. *Health Serv Res*. 2009;44(6):2093-2105. doi:10.1111/j.1475-6773.2009.01017.x

49. Adinan J, Damian DJ, Mosha NR, Mboya IB, Mamseri R, Msuya SE. Individual and contextual factors associated with appropriate healthcare seeking behavior among febrile children in Tanzania. *PloS One*. 2017;12(4):e0175446. doi:10.1371/journal.pone.0175446

50. Abebe G, Deribew A, Apers L, et al. Knowledge, Health Seeking Behavior and Perceived Stigma towards Tuberculosis among Tuberculosis Suspects in a Rural Community in Southwest Ethiopia. *PLOS ONE*. 2010;5(10):e13339. doi:10.1371/journal.pone.0013339

51. Williams DR. Race and health: Basic questions, emerging directions. *Ann Epidemiol*. 1997;7(5):322-333. doi:10.1016/S1047-2797(97)00051-3

52. Williams DR, Collins C. US Socioeconomic and Racial Differences in Health: Patterns and Explanations. *Annu Rev Sociol*. 1995;21(1):349-386. doi:10.1146/annurev.so.21.080195.002025

53. Gadson A, Akpovi E, Mehta PK. Exploring the social determinants of racial/ethnic disparities in prenatal care utilization and maternal outcome. *Semin Perinatol*. 2017;41(5):308-317. doi:10.1053/j.semperi.2017.04.008

54. Institute of Medicine (US) Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. (Smedley BD, Stith AY, Nelson AR, eds.). National Academies Press (US); 2003. Accessed April 14, 2022. http://www.ncbi.nlm.nih.gov/books/NBK220358/

55. Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease Prevention and Health Promotion. Physical Activity. Centers for Disease Control and

Prevention. Published March 17, 2022. Accessed April 9, 2022.

https://www.cdc.gov/physicalactivity/basics/adults/index.htm

56. Hamoda RE, McPherson LJ, Lipford K, et al. Association of sociocultural factors with

initiation of the kidney transplant evaluation process. *Am J Transplant*. 2020;20(1):190-

203. doi:10.1111/ajt.15526

57. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic

comorbidity in longitudinal studies: development and validation. *J Chronic Dis*.

1987;40(5):373-383. doi:10.1016/0021-9681(87)90171-8

58. U.S. Census Bureau. *2019 American Community Survey Data*.

https://data.census.gov/mdat/#/search?ds=

59. Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease

Registry/ Geospatial Research, Analysis, and Services Program. *CDC/ATSDR Social

Vulnerability Index 2018 Database*.; 2021.

https://www.atsdr.cdc.gov/placeandhealth/svi/data_documentation_download.html

60. CDC/ATSDR SVI Frequently Asked Questions (FAQ) | Place and Health | ATSDR.

Published March 15, 2022. Accessed March 28, 2022.

https://www.atsdr.cdc.gov/placeandhealth/svi/faq_svi.html

61. Ahmed A, Song Y, Wadhera RK. Racial/Ethnic Disparities in Delaying or Not Receiving

Medical Care During the COVID-19 Pandemic. *J Gen Intern Med*. 2022;37(5):1341-1343.

doi:10.1007/s11606-022-07406-7

62. Lei L, Maust DT. Delayed Care Related to COVID-19 in a Nationally Representative Sample of Older Americans. *J Gen Intern Med*. 2022;37(5):1337-1340. doi:10.1007/s11606-022-07417-4

63. Hurst JH, Zhao C, Fitzpatrick NS, Goldstein BA, Lang JE. Reduced pediatric urgent asthma utilization and exacerbations during the COVID-19 pandemic. *Pediatr Pulmonol*. 2021;56(10):3166-3173.

64. Wenger NS, Stanton AL, Baxter-King R, Sepucha K, Vavreck L, Naeim A. The Impact of COVID-19 on Routine Medical Care and Cancer Screening. *J Gen Intern Med*. Published online January 10, 2022. doi:10.1007/s11606-021-07254-x

65. Robertson M, Wei SC, Beer L, et al. Delayed entry into HIV medical care in a nationally representative sample of HIV-infected adults receiving medical care in the USA. *AIDS Care*. 2016;28(3):325-333. doi:10.1080/09540121.2015.1096891

66. Johnston SS, Juday T, Seekins D, et al. Patterns and correlates of linkage to appropriate HIV care after HIV diagnosis in the US Medicaid population. *Sex Transm Dis*. 2013;40(1):18-25. doi:10.1097/OLQ.0b013e3182782014

67. Papautsky EL, Rice DR, Ghoneima H, et al. Characterizing Health Care Delays and Interruptions in the United States During the COVID-19 Pandemic: Internet-Based, Cross-sectional Survey Study. *J Med Internet Res*. 2021;23(5):e25446. doi:10.2196/25446

68. Whaley CM, Pera MF, Cantor J, et al. Changes in Health Services Use Among Commercially Insured US Populations During the COVID-19 Pandemic. *JAMA Netw Open*. 2020;3(11):e2024984. doi:10.1001/jamanetworkopen.2020.24984

69. Huang BZ, Creekmur B, Yoo MS, Broder B, Sharp AL. Healthcare Utilization Among Patients Diagnosed with COVID-19 in a Large Integrated Health System. *J Gen Intern Med*. Published online 2022:1-8.

70. Roth SE, Govier DJ, Marsi K, Cohen-Cline H. Differences in Outpatient Health Care Utilization 12 Months after COVID-19 Infection by Race/Ethnicity and Community Social Vulnerability. *Int J Environ Res Public Health*. 2022;19(6):3481.

71. Bleich SN, Thorpe RJ, Sharif-Harris H, Fesahazion R, LaVeist TA. Social context explains race disparities in obesity among women. *J Epidemiol Community Health*. 2010;64(5):465-469. doi:10.1136/jech.2009.096297

72. Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CJ, Flegal KM. Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA*. 2006;295(13):1549-1555. doi:10.1001/jama.295.13.1549

73. Bruce MA, Sims M, Miller S, Elliott V, Ladipo M. One size fits all? Race, gender and body mass index among U.S. adults. *J Natl Med Assoc*. 2007;99(10):1152-1158.

74. Seo DC, Torabi MR. Racial/ethnic differences in body mass index, morbidity and attitudes toward obesity among U.S. adults. *J Natl Med Assoc*. 2006;98(8):1300-1308.

75. Wang Y, Beydoun MA. The obesity epidemic in the United States--gender, age, socioeconomic, racial/ethnic, and geographic characteristics: a systematic review and meta-regression analysis. *Epidemiol Rev*. 2007;29:6-28. doi:10.1093/epirev/mxm007

76. Henderson R. Encouraging Attendance at Outpatient Appointments: Can We Do More? *Scott Med J*. 2008;53(1):9-12. doi:10.1258/RSMSMJ.53.1.9

77. Stiefel MC, Gordon NP, Wilson-Anumudu FJ, Arsen EL. Sociodemographic Determinants of Health and Well-Being Among Adults Residing in the Combined Kaiser Permanente Regions. *Perm J*. 2019;23:18-091. doi:10.7812/TPP/18-091

Appendix 1 – Survey

First, we would like to ask you some basic questions*. Choose the option that is most appropriate for you.

1. First Name
2. Last Name
3. What year were you born?
   - Option Year 1920-2003
4. What is your sex?
   - Male
   - Female
5. What is your Kaiser Permanente Georgia Medical Record Number (MRN)?
6. What race or races do you consider yourself to be? Select all that apply.
   - White
   - Black or African American
   - Asian
   - American Indian or Alaska Native
   - Native Hawaiian or Other Pacific Islander
   - Prefer not to answer
   - Do not know
7. Do you consider yourself to be Hispanic or Latino?
   - Yes
   - No
   - Prefer not to answer
   - Do not know
8. What is the highest degree or level of school you have completed?
   - Some high school
   - High school graduate or equivalent
   - Some college
   - Associate degree (for example AA, AS)
   - Bachelor's degree (for example, BA, BS, AB)
   - Graduate degree (for example, master's, doctorate, PhD)
9. What is your marital status?
   - Married
   - Divorced
   - Widowed
   - Separated
   - Never married

10. In 2019, what was your total household income before taxes?
- Less than $25,000
- $25,000-$34,999
- $35,000-$49,999
- $50,000-$74,999
- $75,000-$99,999
- $100,000-$149,999
- $150,000-$199,999
- $200,000 and above

these variables are used for linkage purposes only.

11. Since March 2020, have any of the following impacted your ability to receive healthcare (for any health concerns, including COVID-19)? Select all that apply.
- You canceled an appointment
- You postponed or delayed seeking care
- You tried to get care but were turned away
- Your provider canceled an appointment
- Your provider postponed or delayed an appointment

12. Did you experience any symptoms of COVID-19?
- Yes
- No

[if answered yes to Q12]

12a. What symptoms did you experience? Select all that apply
- Fever or chills
- Cough
- Shortness of breath
- Chest pain
- Sore throat
- Headache
- Muscle or body aches
- Runny nose
- Fatigue or excessive sleepiness
- Confusion
- Diarrhea
- Nausea
- Vomiting
- Loss of sense of smell or taste

13. When you first thought you might have COVID-19, how long did it take you to get a COVID-19 test?
- Less than 1 day (i.e., you took a test on the same day you thought you might have COVID-19)
- 1-2 days
- 3-4 days
- 5-6 days
- 7 or more days

14. Where did you go to get a COVID-19 test? (*KPGA = Kaiser Permanente Georgia)
    - KPGA clinic or testing site
    - Non-KPGA pharmacy (e.g. CVS or Wallgreens
    - Georgia Department of Health test site
    - Non-KPGA (privately own testing site (e.g. testing lab or non-KPGA clinic)
    - Hospital
    - Other

15. Where did you first go to seek medical care when you started experiencing symptoms of COVID-19 or thought that you might have COVID-19?
    - Registered medical practitioner in the community
    - Nearby public health facility or hospital
    - Nearby private clinic
    - Nearby private hospital
    - Traditional healer
    - Community health worker
    - Other
    - Did not seek medical care

Now, we are going to ask you some questions about your health BEFORE you were diagnosed with COVID-19.

16. Before you were diagnosed with COVID-19, how would you have rated your overall physical health?
    - Excellent
    - Very good
    - Good
    - Fair
    - Poor

17. Before you were diagnosed with COVID-19, how much sleep would you say you were getting, on average, every night?
    - Less than 6 hours
    - 6-8 hours
    - 8-10 hours
    - More than 10 hours

18. Before you were diagnosed with COVID-19, on average, how many days per week did you engage in moderate to strenuous exercise (e.g. a brisk walk)?
    - 1
    - 2
    - 3
    - 4
    - 5
    - 6
    - 7

19. Before you were diagnosed with COVID-19, on average, how many minutes per exercise session did you engage in moderate to strenuous exercise (e.g., a brisk walk)?
   - Option 1-150 minutes
20. Before you were diagnosed with COVID-19, did you smoke tobacco?
   - Yes - Frequently
   - Yes – Infrequently
   - No - But I have smoked in the past
   - No – Never
   - No – But I am exposed to tobacco via secondhand/passive/environmental smoke

[if answered yes to Q20]

20a. How many cigarettes a day do you smoke?
   - 10 cigarettes or less
   - 11-20
   - 21-30
   - 31 or more

21. Before you were diagnosed with COVID-19, how often, on average, did you drink alcohol?
   - Never
   - Monthly or less
   - 2-4 times per month
   - 2-3 times per week
   - 4 or more times per week

[if answered yes to Q21]

21a. Before you were diagnosed with COVID-19, on average, how many alcoholic drinks did you have on a typical day when you were drinking?
   - 1-2 drinks
   - 3-4 drinks
   - 5-6 drinks
   - 7-9 drinks
   - 10 or more drinks

21b. Before you were diagnosed with COVID-19, on average, how often did you have six or more alcoholic drinks on one occasion?
   - Never
   - Less than monthly
   - Monthly
   - Weekly
   - Daily or almost daily

Now, we are going to ask you some questions about your health since being diagnosed with COVID-19. These questions relate to your health at the PRESENT TIME.

22. After you were diagnosed with COVID-19, how would you have rated your overall physical health?
- Excellent
- Very good
- Good
- Fair
- Poor

23. After you were diagnosed with COVID-19, how much sleep would you say you were getting, on average, every night?
- Less than 6 hours
- 6-8 hours
- 8-10 hours
- More than 10 hours

24. After you were diagnosed with COVID-19, on average, how many days per week did you engaged in moderate to strenuous exercise (e.g., a brisk walk)?
- 1
- 2
- 3
- 4
- 5
- 6
- 7

25. After you were diagnosed with COVID-19, on average, how many minutes per exercise session did you engage in moderate to strenuous exercise (e.g., a brisk walk)?
- Option 1-150 minutes

26. After you were diagnosed with COVID-19, did you smoke tobacco?
- Yes - Frequently
- Yes - Infrequently
- No - But I have smoked in the past
- No – Never
- No – But I am exposed to tobacco via secondhand/passive/environmental smoke

[if answered yes to Q26]

26a. How many packs, on average, do you smoke per day?
- 10 cigarettes or less
- 11-20
- 21-30
- 31 or more

27. After you were diagnosed with COVID-19, how often, on average, did you have a drink containing alcohol?
- Never
- Monthly or less
- 2-4 times per month
- 2-3 times per week
- 4 or more times per week

[if answered yes to Q27]

27a. On average, how many drinks containing alcohol did you have on a typical day when you were drinking?
- 1-2 drinks
- 3-4 drinks
- 5-6 drinks
- 7-9 drinks
- 10 or more drinks

27b. After you were diagnosed with COVID-19, on average, how often did you have six or more alcoholic drinks on one occasion?
- Never
- Less than monthly
- Monthly
- Weekly
- Daily or almost daily

Now, we are going to ask you some questions about how the COVID-19 pandemic has affected your personal life more generally.

28. Since March 2020, have you experienced a shift to remote working?
- Yes
- No

[if answered yes to Q28]

28a. On a scale of 1-5, where 1="not impacted at all" and 5="majorly impacted", how much has a shift to remote working impacted your personal daily life?
- 1 (not impacted at all)
- 2
- 3
- 4
- 5 (majorly impacted)

29. Since March 2020, have you experienced a relationship breakdown?
- Yes
- No

[if answered yes to Q29]

29a. On a scale of 1-5, where 1="not impacted at all" and 5="majorly impacted", how much has this relationship breakdown impacted your personal daily life?

- 1 (not impacted at all)
- 2
- 3
- 4
- 5 (majorly impacted)

30. Since March 2020, have you experienced job loss?

- Yes
- No

[if answered yes to Q30]

30a. On a scale of 1-5, where 1="not impacted at all" and 5="majorly impacted", how much has this job loss impacted your personal daily life?

- 1 (not impacted at all)
- 2
- 3
- 4
- 5 (majorly impacted)

31. Since March 2020, have you experienced a decrease in personal income?

- Yes
- No

[if answered yes to Q31]

31a. On a scale of 1-5, where 1="not impacted at all" and 5="majorly impacted", how much has this decrease in personal income impacted your personal daily life?

- 1 (not impacted at all)
- 2
- 3
- 4
- 5 (majorly impacted)

32. Since March 2020, have you experienced financial hardship?

- Yes
- No

[if answered yes to Q32]

32a. On a scale of 1-5, where 1="not impacted at all" and 5="majorly impacted", how much has this financial hardship impacted your personal daily life?

- 1 (not impacted at all)
- 2
- 3
- 4
- 5 (majorly impacted)

33. Since March 2020, has someone you know died from COVID-19?

- Yes
- No

33a. On a scale of 1-5, where 1="not impacted at all" and 5="majorly impacted", how much has this death impacted your personal daily life?
- 1 (not impacted at all)
- 2
- 3
- 4
- 5 (majorly impacted)

34. Since March 2020, have you become newly responsible for providing care to a loved one?
- Yes
- No

34a. On a scale of 1-5, where 1="not impacted at all" and 5="majorly impacted", how much has becoming newly responsible for providing care to a loved one impacted your personal daily life?
- 1 (not impacted at all)
- 2
- 3
- 4
- 5 (majorly impacted)

35. Since March 2020, have you become newly responsible for overseeing school or education for school-age children (e.g. homeschooling or facilitating virtual school)?
- Yes
- No

35a. On a scale of 1-5, where 1="not impacted at all" and 5="majorly impacted", how much has becoming newly responsible for overseeing school or education for school-age children impacted your personal daily life?
- 1 (not impacted at all)
- 2
- 3
- 4
- 5 (majorly impacted)

36. Since March 2020, have you become newly responsible for childcare/daycare for children?
- Yes
- No

[if answered yes to Q36]
36a. On a scale of 1-5, where 1="not impacted at all" and 5="majorly impacted", how much has becoming newly responsible for childcare/daycare for children impacted your personal daily life?
- 1 (not impacted at all)
- 2
- 3
- 4
- 5 (majorly impacted)

Now we are going to ask you some questions about the COVID-19 vaccine.

37. Have you received the COVID-19 vaccine or do you plan on getting the COVID-19 vaccine when it becomes available to you?
- Yes – I already have received the vaccine
- Yes – I plan on getting the vaccine when it is available to me
- No – I have not received the vaccine and do not plan on getting the vaccine
- Unsure
38. Are you concerned about the safety of the COVID-19 vaccine?
- Yes
- No
- Unsure
39. Are you concerned about how well the COVID-19 vaccine will work?
- Yes
- No
- Unsure
40. What concerns do you have about the COVID-19 vaccine? Select all that apply.
- Immediate side effects from receiving the vaccine
- Long-term side effects
- How well the vaccine will protect me from COVID-19
- How long the vaccine will protect me from COVID-19
41.   Would you encourage your friends or family to get the vaccine?
- Yes
- No
- Unsure

Now, we are going to ask you some questions about your experiences with the health care system more generally. This includes your experiences before, during and after your diagnosis of COVID-19.

42. Have you ever felt unfairly treated in getting medical care?
- Yes
- No

43. Have you ever felt that you were denied medical care or provided inferior or poor medical care?
    - Yes
    - No
44. Have you ever had to wait a long period of time before getting medical care?
    - Yes
    - No
45. Have you ever had trouble getting medical care from a specialist such as a heart doctor?
    - Yes
    - No

46. For the next set of statements, please indicate if you strongly disagree, disagree, agree, or strongly agree with each statement (select only one option for each item):

	Strongly disagree	Disagree	Agree	Strongly agree
When I make plans, I am almost certain that I can make them work				
Getting people to do the right thing depends upon ability; luck has nothing to do with it				
What happens to me is my own doing				
Many of the unhappy things in people's lives are partly due to bad luck				
Getting a good job depends mainly on being in the right place at the right time				
Many times I feel that I have little influence over the things that happen to me				

47. For the next set of statements, please indicate if you strongly disagree, disagree, agree or strongly agree with each statement

	Strongly disagree	Disagree	Agre
You had better be cautious when dealing with healthcare organizations			
Patients have sometimes been deceived or misled by healthcare organizations			
When healthcare organizations make mistakes, they usually cover it up			
Healthcare organizations have sometimes done harmful experiments on patients without their knowledge			
Healthcare organizations don't always keep your information totally private			
Sometimes, I wonder if healthcare organizations really know what they are doing			
Mistakes are common in healthcare organizations			
I trust that health care organizations will tell me if a mistake is made about my treatment			
Health care organizations often want to know more about your business than they need to know			
The patient's medical needs come before other considerations at health care organizations			
Health care organizations are more concerned about making money than taking care of people			
Health care organizations put the patient's health first			
Patients should always follow the advice given to them at health care organizations			
I typically get a second opinion when I am told something about my health			
I trust that health care organizations check their staff's credentials to make sure they are hiring the best people			
They know what they are doing at health care organizations			
I trust that health care organizations keep up with the latest medical information			

Appendix 1 – Supplementary Tables

Supplementary table 1 Baseline characteristics of Kaiser Permanente Georgia survey participants diagnosed with COVID-19 and missing EMR data, by race[§]

		Race	
Characteristic	Total (N=254)	Non-Hispanic White (N=155)	Non-Hispanic Black (N=99)
Demographics			
Gender			
Men	74 (29.1%)	53 (34.2%)	21 (21.2%)
Women	180 (70.9%)	102 (65.8%)	78 (78.8%)
Age, mean years (SD)	52.5 (± 13.4)	53.0 (± 13.9)	51.9 (± 12.6)
Age			
18-44 years	69 (27.2%)	38 (24.5%)	31 (31.3%)
45-64 years	129 (50.8%)	81 (52.3%)	48 (48.5%)
65+ years	56 (22.0%)	36 (23.2%)	20 (20.2%)
Marital status			
Married	111 (43.7%)	111 (72.1%)	51 (51.5%)
Not married	43 (16.9%)	43 (27.9%)	48 (48.5%)
Education			
High school, some college, associate's degree	105 (41.3%)	66 (42.6%)	39 (39.8%)
Bachelor's or graduate degree	148 (58.3%)	89 (57.4%)	59 (60.2%)
Household income			
≥$75,000	146 (57.5%)	96 (63.6%)	50 (50.5%)
<$75,000	104 (40.9%)	55 (36.4%)	49 (49.5%)
Health behaviors prior to COVID-19			
Self-rated health			
Good, fair, or poor	105 (41.3%)	64 (41.3%)	41 (41.8%)
Very good	117 (46.1%)	72 (46.5%)	45 (45.9%)
Excellent	31 (12.2%)	19 (12.3%)	12 (12.2%)
Average sleep per night			
≥6 hours	212 (83.5%)	134 (86.5%)	78 (78.8%)
<6 hours	42 (16.5%)	21 (13.6%)	21 (21.2%)
Weekly physical activity			
≥150 minutes	113 (44.5%)	64 (46.0%)	49 (55.1%)
<150 minutes	115 (45.3%)	75 (54.0%)	40 (44.9%)
Comorbidities and 2019 healthcare utilization			
Body mass index, mean kg/m^2 (SD)	34.0 (± 8.8)	32.1 (± 8.6)	37.0 (± 8.3)
Obesity			
Not obese (BMI<30kg/m2)	90 (35.4%)	72 (46.8%)	18 (18.4%)
Obese (BMI≥30kg/m2)	162 (63.8%)	82 (53.3%)	80 (81.6%)
Charlson comorbidity score			

Supplementary table 1 Baseline characteristics of Kaiser Permanente Georgia survey participants diagnosed with COVID-19 and missing EMR data, by race[§]

Characteristic	Total (N=254)	Race Non-Hispanic White (N=155)	Non-Hispanic Black (N=99)
0	113 (44.5%)	69 (44.5%)	44 (44.4%)
1	80 (31.5%)	50 (32.3%)	30 (30.3%)
2+	61 (24.0%)	36 (23.2%)	25 (25.3%)
Chronic pulmonary disease	83 (32.7%)	55 (35.5%)	28 (28.3%)
Peripheral vascular disease	29 (11.4%)	20 (12.9%)	9 (9.1%)
Diabetes	56 (22.0%)	27 (17.4%)	29 (29.3%)
Received 2019 flu vaccine	125 (49.2%)	87 (56.1%)	38 (38.4%)
Social impacts during the COVID-19 pandemic			
Job loss	34 (13.4%)	26 (16.8%)	8 (8.1%)
Shift to remote work	118 (46.5%)	61 (39.9%)	57 (58.2%)
Decrease in personal income	79 (31.1%)	46 (29.7%)	33 (33.3%)
Financial hardship	66 (26.0%)	34 (21.9%)	32 (32.7%)
Relationship breakdown	51 (20.1%)	27 (17.4%)	24 (24.2%)
COVID-19 death in network	154 (60.6%)	88 (56.8%)	66 (66.7%)
Childcare responsibilities	36 (14.2%)	20 (12.9%)	16 (16.3%)
Virtual schooling	76 (30.0%)	41 (26.6%)	35 (35.7%)
Care for loved one	30 (11.8%)	9 (5.8%)	21 (21.2%)
Reported at least one impact	230 (90.6%)	136 (88.3%)	94 (95.0%)
Psychosocial factors			
Locus of control			
Above median	109 (42.9%)	61 (39.9%)	48 (49.5%)
Below or at median	141 (55.5%)	92 (60.1%)	49 (50.5%)
Medical mistrust			
Above median	85 (33.5%)	43 (29.9%)	42 (48.3%)
Below or at median	146 (57.5%)	101 (70.1%)	45 (51.7%)
Reported concern about length of protection from the COVID-19 vaccine	185 (72.8%)	115 (74.2%)	70 (70.7%)
Area-level SDO			
Social Vulnerability Index overall theme			
0 – 0.2500 (Least vulnerable)	41 (16.1%)	18 (11.6%)	23 (23.2%)
0.2501 – 0.5000	52 (20.5%)	23 (14.8%)	29 (29.3%)
0.5001 – 0.7500	85 (33.5%)	53 (34.2%)	32 (32.3%)
0.7501 – 1.000 (Most vulnerable)	76 (29.9%)	61 (39.4%)	15 (15.2%)
Area Deprivation Index			
First or second **quartiles** (Least deprived)	127 (50.0%)	100 (27.3%)	27 (27.3%)
Third	64 (25.2%)	32 (20.7%)	32 (32.3%)
Fourth (Most deprived)	63 (24.8%)	23 (14.8%)	40 (40.4%)

§ Data are N and % or mean and SD as reported

Supplementary table 2 Variables obtained from KPGA EMR data

Variable

Date of COVID-19 diagnosis
COVID-19 ICD-10 code
Neighborhood deprivation index
Social vulnerability index
Body mass index
Charlson comorbidity score

- Chronic pulmonary disease
- Peripheral vascular disease
- Diabetes without chronic complication
- Diabetes with chronic complication

2019 flu vaccine

Supplementary table 3 Sensitivity analysis of stepwise forward selection in a multivariate logistic regression analysis of factors associated with inappropriate healthcare seeking behaviors among Kaiser Permanente Georgia survey participants diagnosed with COVID-19

	Variables Included	Inappropriate healthcare seeking behavior		
		Odds Ratio	95% CI	p-value
Model 1A	Race			
Non-Hispanic White	Obesity	ref	ref	ref
Non-Hispanic Black		0.56	0.31, 1.03	0.06
Model 1B	Race			
Non-Hispanic White	Obesity	ref	ref	ref
Non-Hispanic Black	Social Vulnerability Index, overall theme	0.49	0.26, 0.93	0.03
Model 1C	Race			
Non-Hispanic White	Obesity	ref	ref	ref
Non-Hispanic Black	Social Vulnerability Index, overall theme Education	0.46	0.24, 0.87	0.02
Model 1D	Race			
Non-Hispanic White	Obesity	ref	ref	ref
Non-Hispanic Black	Social Vulnerability Index, overall theme Education Weekly physical activity	0.38	0.19, 0.79	0.01
Model 1E	Race			
Non-Hispanic White	Obesity	ref	ref	ref
Non-Hispanic Black	Social Vulnerability Index, overall theme Education Weekly physical activity 2019 Area Deprivation Index	0.36	0.17, 0.77	0.008
Model 1F	Race			
Non-Hispanic White	Obesity	ref	ref	ref
Non-Hispanic Black	Social Vulnerability Index, overall theme Education Weekly physical activity 2019 Area Deprivation Index Received 2019 flu Vaccine	0.34	0.15, 0.74	0.007
Model 1G	Race			
Non-Hispanic White	Obesity	ref	ref	ref
Non-Hispanic Black	Social Vulnerability Index, overall theme	0.33	0.15, 0.74	0.006

Supplementary table 3 Sensitivity analysis of stepwise forward selection in a multivariate logistic regression analysis of factors associated with inappropriate healthcare seeking behaviors among Kaiser Permanente Georgia survey participants diagnosed with COVID-19

	Variables Included	Inappropriate healthcare seeking behavior		
		Odds Ratio	**95% CI**	**p-value**
	Education			
	Weekly physical activity			
	2019 Area Deprivation Index			
	Received 2019 flu vaccine			
	Reported concern about length of protection from COVID-19 vaccine			
Model 1H	Race			
Non-Hispanic White	Obesity	ref	ref	ref
Non-Hispanic Black	Social Vulnerability Index, overall theme	0.34	0.15, 0.75	0.008
	Education			
	Weekly physical activity			
	2019 Area Deprivation Index			
	Received 2019 flu vaccine			
	Reported concern about length of protection from COVID-19 vaccine			
	Diabetes			