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Research Article

Health Promotion and Racial Disparity in COVID-19 Mortality Among African American Populations

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Abstract

COVID-19, known as Coronavirus Disease 2019, is a major health issue resulting from novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. Its emergence has posed a significant menace to the global medical community and healthcare system across the world. Notably, on December 12, 2020, the Food and Drug Administration (FDA) approved the utilization of the Pfizer and Moderna COVID-19 vaccines. As of July 31, 2022, the United Stated has witnessed over 91.3 million cases of COVID-19 and nearly 1.03 million fatalities. An intriguing observation is the recent reduction in the mortality rate of COVID-19, attributed to an augmented focus on early detection, comprehensive screening, and widespread vaccination. Despite this positive trend in some demographics, it is noteworthy that the overall incidence rates of COVID-19 among African American and Hispanic populations have continued to escalate, even as mortality rates have decreased. Therefore, the objective of this research study is to present an overview of COVID-19, spotlighting the disparities among different racial and ethnic groups. It also delves into the management of COVID-19 within the minority populations. To reach our research objective, we used a publicly available COVID-19 dataset from kaggle: https://www.kaggle.com/datasets/paultimothymooney/covid19-cases-and-deaths-by-race. In addition, we obtained COVID-19 datasets from 10 different states with the highest proportion of African American populations. Many considerable strikes have been made in COVID-19. However, success rate of treatment in the African American population remains relatively limited when compared to other ethnic groups. Hence, there arises a pressing need for novel strategies and innovative approaches to not only encourage prevention measures against COVID-19, but also to increase survival rates, diminish mortality rates, and ultimately improve the health outcomes of ethnic and racial minorities.

Keywords: COVID-19; African Americans; incidence rate; death rate; racial; health disparity; and health promotion

Introduction

The COVID-19 virus has infected hundreds of millions of world populations and caused millions of deaths. The COVID-19 disease disproportionately affects the African American community, resulting in higher morbidity and mortality rates compared to other racial and ethnic groups [1-3].

Several studies have reported that COVID-19 racial and ethnic disparities are associated with lower socioeconomic status in the United States [4]. According to the National Urban League, African Americans are infected with COVID-19 at three times the rate of White Americans.

According to the New York Times 'analysis based on the federal government data, COVID -19 infection rate is 62 per 10,000 for African Americans, 73 per 10,000 for Latinos, and 23 per 10,000 for White Americans [5]. A similarly disproportionate pattern for deaths has been reported for different ethnic groups. The scientific report based on Johns Hopkins Hospital University shows that African Americans are twice more likely to die from COVID-19. The lack of primary care physician, comorbidity, poor lifestyle, lack of access to healthcare, limited health insurance, geographical location, lack of information, lower education, and other life challenges contribute significantly to COVID-19 disparity [6,7].

COVID-19 vaccines have proven to be effective in preventing severe illness, hospitalization, and even fatalities among individuals. The management of COVID-19 involves a multifaceted approach that includes health promotion, infection prevention, supportive care, provision of oxygen and mechanical ventilatory support when necessary, preventive measures such as social distancing, shelter-in-place, utilization of face masks, hand hygiene, and maintaining environmental cleanliness [8,9]. Many scientific investigations have highlighted the potential benefits of health promotion by encouraging regular physical exercise and maintaining a well-balanced diet rich in nutrient-packed vegetables, fruits, and essential vitamins. These preventive measures aim to improve the overall well-being of individuals who may have been impacted by COVID-19. Recently, we demonstrated that edible medicinal plants (black seed, curcumin, garlic, and ginger) and vitamins (vitamin C and D) possess antiviral activities, and their individual intake shows promise for the prevention and/or control of COVID-19 [10]. Our findings shed light on a promising avenue for augmenting preventive measures against the virus. As individuals continue to seek effective ways to fortify their defences, the documented efficacy of edible medicinal plants and vitamins offers a compelling option that merits consideration. However, further clinical trials are needed to fully validate the benefits of edible medicinal plants and vitamins. Empirical trials have substantiated the antioxidative, antifungal, antimicrobial, anticancer, and anti-inflammatory properties of medicinal plants and vitamins in relation to COVID-19. This research study aims to provide an overview of COVID-19 with a special emphasis on the racial/ethnic disparities - based on the differences in both incidence and mortality rates, and on the management of COVID-19 among minority populations based on health promotion.

Approaches

Data Source and Acquisition: Our study drew upon a readily accessible COVID-19 dataset sourced from Kaggle.com at https://www.kaggle.com/datasets/paultimothymooney/covid19-cases-and-deaths-by-race. Furthermore, Table 1 provides a comprehensive enumeration of supplemental data origins, each gathered from selected 10 states with the highest proportion of African American inhabitants.

State	Data Source
Delaware	https://coronavirus.delaware.gov/latest-data/
Louisiana	http://ldh.la.gov/Coronavirus/
Maryland	https://coronavirus.maryland.gov/
North Carolina	https://www.ncdhhs.gov/divisions/public-health/covid19/covid-19-nc-case-count#by-race-ethnicity
South Carolina	https://www.scdhec.gov/infectious-diseases/viruses/coronavirus-disease-2019-covid-19/testing-sc-data-covid-19
Tennessee	https://www.tn.gov/health/cedep/ncov.html
Virginia	http://www.vdh.virginia.gov/coronavirus/
Alabama	https://alpublichealth.maps.arcgis.com/apps/opsdashboard/index.html#/6d2771faa9da4a2786a509d82c8cf0f7
Georgia	https://dph.georgia.gov/covid-19-daily-status-report
Louisiana	http://ldh.la.gov/Coronavirus/
Mississippi	https://msdh.ms.gov/msdhsite/_static/14,0,420.html
North Carolina	https://www.ncdhhs.gov/covid-19-case-count-nc
South Carolina	https://scdhec.gov/health/infectious-diseases/viruses/coronavirus-disease-2019-covid-19/monitoring-testing-covid-19
Tennessee	https://www.tn.gov/health/cedep/ncov.html
Virginia	https://public.tableau.com/views/VirginiaCOVID-19Dashboard/VirginiaCOVID-19Dashboard?:embed=yes&:display_count=yes&:showVizHome=no&:toolbar=no

Table 1: Data source for COVID-19 mortality for each State with a high proportion of African Americans.

Machine Learning Techniques in Medical Research

Machine Learning (ML) is becoming an important approach across clinical research, biomedical research, medical diagnostics, and precision medicine. In the context of the current study, ML

algorithms were employed to analyze a dataset consisting of COVID-19 patients from African American populations across all 50 states of the United States. ML is a branch of artificial intelligence (AI) that is used to classify data based on models which have been developed and for predictive analytics, in particular breast cancer [11,12] and COVID-19 [13-16]. It provides tools by which large quantities of data can be automatically analyzed. In the present study, ML algorithms were harnessed to process and examine a curated dataset of COVID-19 patients, which was sourced from Kaggle.com: https://www.kaggle.com/datasets/paultimothymooney/covid19-cases-and-deaths-by-race. We interpreted these data focusing on COVID-19 positive cases and mortality rates among African Americans, and compared the results to other ethnic groups.

Data Selection and Collection

We collected dataset focused on COVID-19 within African American community across all 50 states in the United States. From comprehensive pool of states, we strategically identified and concentrated our investigation on 10 specific states with the highest proportion of African American residents. Our main goal here was to closely examine the existing racial disparities in health outcomes (Table 2). Table 2 presents a ranked list of 10 states showcasing the highest proportion of African American populations in the United States, listed in descending order.

RANK	**STATE**	**PERCENT**
1	Mississippi	38.79%
2	Louisiana	33.23%
3	Georgia	32.40%
4	Maryland	30.63%
5	South Carolina	27.03%
6	Alabama	26.43%
7	Delaware	22.78%
8	North Carolina	22.22%
9	Virginia	20.36%
10	Tennessee	17.09%

Table 2: States with the Highest Proportions of African Americans Residents in the United States

RESULTS

Among the 50 states in the United States, we chose to focus on a subset of 10 states with the highest proportion of African American residents in order to investigate the racial health disparities associated with COVID-19. Among the ten selected states for this study, six states (Alabama, Delaware, Georgia, Maryland, Mississippi, and Virginia) underwent one cohort of data collection, while four states (Louisiana, North Carolina, South Carolina, and Tennessee) were subject to two cohorts of data collection.

Analyzing our dataset, we found a compelling evidence that African American communities face a greater susceptibility to COVID-19 infection and mortality compared to other racial and ethnic groups (Table 3). Table 3 underscores this pattern, illustrating that the African American population in the United States exhibits the highest incidence rates of COVID-19 infection as well as the highest mortality rates resulting from the disease. The data provided in Table 3 specifically highlight the mortality rates for COVID-19 within the African American population across the selected states. It is noteworthy that the impact of COVID-19 demonstrates regional variability. For example, within the selected states, Louisiana stands out with the highest COVID-19 mortality rates in the general population (70.48% out of 18,283 positive cases in one reported dataset and 48.92% out of 78,122 positive cases in another reported dataset), while Virginia displays the lowest COVID-19 mortality rate (23.14%out of 70,670 positive cases) within its African American population. However, the percentage of African Americans represented in the total positive cases in the State of Louisiana is unknown or was not reported. The state of Delaware reported 1,209 positive cases with no death among African American residents.

Consistent with our finding, a report indicated the death rate for African Americans age 45-54 (59.5 per 100,000) is nearly 13 times higher than the mortality rate for White Americans (4.3) in the state of Louisiana [17]. We also observed that the percentage of African Americans represented in COVID-19 deaths is often higher than their representation in the total population in each state, as indicated by the census data. This suggests a disproportionate impact of the disease on African Americans in these states.

Nonetheless, it is important to note that certain states, the racial discrepancy in COVID-19 mortality is less pronounced.

State	Total positive cases in state	Total deaths in state	Percentage of African Americans represented in total cases	Percentage of African Americans represented in total deaths	Percentage of total population that identify as African Americans (census)
Delaware	1209	23	0.00%	0%	23.00%
Louisiana	18283	702	unknown	70.48%	32.70%
Maryland	6,185	138	33.40%	39.86%	30.90%
North Carolina	3651	65	27.38%	35.38%	22.20%
South Carolina	2792	67	38.00%	46.00%	27.10%
Tennessee	4634	94	14.00%	0.00%	17.10%
Virginia	4042	109	15.20%	0.00%	19.90%
Alabama	53587	1121	31.04%	42.73%	26.80%
Georgia	116926	3001	26.20%	46.35%	32.40%
Louisiana	78122	3416	unknown	48.92%	32.70%
Mississippi	35419	1230	46.51%	50.00%	37.80%
North Carolina	85701	1503	16.20%	31.47%	22.20%
South Carolina	56648	961	24.08%	40.16%	27.10%
Tennessee	61960	741	20.49%	35.49%	17.10%
Virginia	70670	1966	15.52%	23.14%	19.90%

Table 3: COVID-19 positive cases and deaths in selected ten (10) states representing the highest percentage of African American residents in the United States

Discussion

Racial and Ethnic Disparities in COVID-19

Historically, racial and ethnic minority groups in the United Sates, constituting over one third of the population have faced economic and social marginalization [18]. This has resulted in reduced opportunities for education, healthcare, financial resources, consequently placing African American populations at a heightened vulnerability to adverse health outcomes [19].

The onset of the COVID-19 pandemic has exacerbated health disparities in the United States, leading to disproportionately adverse clinical outcomes for African American patients in comparison to other ethnic groups [20,21]. In a recent study, we showcased the practical applications of machine learning in the realm of breast cancer diagnosis and classification. Our findings strongly indicate that machine learning holds considerable promise in accurately diagnosing and predicting various types of breast cancer [22].

In the case of the present study, we utilized a large dataset through a machine learning approach and conducted an evaluation of the extent of racial and ethnic disparities related to COVID-19 within the United States. The resulting data strongly indicate that the impact of COVID-19 varies significantly across different racial and ethnic groups in the United Sates, with African Americans experiencing the most adverse clinical outcomes (Table 3). The data presented in Table 3 underscore the clear emergence of COVID-19 cases, hospitalizations, fatalities, and vaccination rates within the African American community, demonstrating the highest incidence and mortality rates when compared to all ethnic groups. Our findings are consistent with existing ecological studies that have unveiled elevated COVID-19 mortality among African Americans in the United States. Furthermore, other

studies have provided evidence showcasing that African American communities face a 3.2-fold the higher risk of COVID-19 mortality when compared with White Americans [23,24].

Addressing COVID-19 Disparities through Health Promotion Strategies

Maintaining overall health via regular exercise and balanced dietary intake can play pivotal role in alleviating the existing disparities associated with COVID-19. By embracing these practices, individuals can empower themselves and their communities, ensuring that everyone is equipped to safeguard their health and contribute to collective protection. We believe that actions such as behavioural modification, engaging in physical activity, and adopting a nutritious diet hold the potential to diminish virus transmission, curtail its propagation, and enhance outcomes for both individuals and communities.

The World Health Organization (WHO) has identified the lack of physical activity as a prominent risk factor contributing to global mortality. Their recommendations highlight that even modest level of physical activity offers advantages over complete inactivity, and engaging in higher levels of physical activity yields even more favorable health outcomes [25-27]. While nutritional and physical activity benefits are frequently examined in isolation, recent insights emphasize the synergistic potential of combining both elements to achieve more profound positive health effects and to bolster the immune system, surpassing the impacts of single-focused approaches. Scientific research underscores that regular, moderate exercise can significantly diminish the risk of infection when compared to a sedentary lifestyle [28]. Physical activity, when combined with other preventive measures, can potentially contribute to better outcomes in managing the effects of COVID-19. The provided Figure 1 below illustrates an example of health promotion practices that people are encouraged to incorporate into their daily routines.

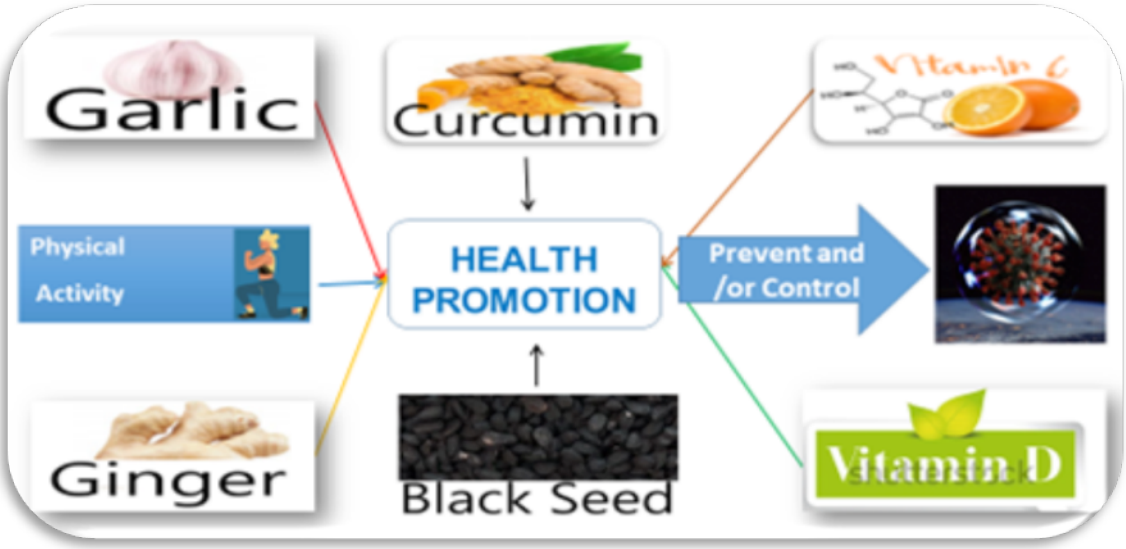

Figure 1: Achieve optimal health through consistent engagement in physical exercise and a well-balanced dietary regimen rich in nutrient-packed vegetables, fruits, and essential vitamins.

Addressing COVID-19 Disparities through Healthy Diet Strategies

Maintaining a well-balanced diet is pivotal in fostering a robust immune system, bolstering its ability to effectively counteract viral challenges. Edible medicinal plants, known for their extensive historical use in traditional medicine to address infectious diseases, have emerged as a promising reservoir of antimicrobial and antiviral agents. The consumption of these edible medicinal plants, in combination with essential vitamins, holds potential in managing SARS-CoV-2. Recently, we demonstrated in our laboratory that edible medicinal plants (black seed, curcumin, garlic, and ginger) and vitamins (vitamin C and D) possess antiviral activities, and their individual intake shows promise for the prevention and/or control of COVID-19 [10]. In addition to antiviral activity, these edible medicinal plants and vitamins have in common eight (8) pharmacological effects including anti-bacterial, anti-cancer, anti-fungal, anti-inflammatory, anti-mutagenic, antioxidant, anti-viral, and immunomodulatory properties [10]. We conclude that, the selected edible medicinal plants and vitamins possess anti-viral properties that are more likely to prevent and/or disrupt

the SARS-CoV-2 replication cycle, enhance the human immune system and promote good health [10]. Using machine learning approach to address COVID-19 pandemic, we demonstrated in our laboratory that countries where people consume the most fruits and vegetables have less COVID-19 incidence and mortality rates compared to countries where people consume the least fruits and vegetables [29]. A study from the PURE global research indicates that optimal benefits of eating fruits, legumes, and vegetables are observed when individuals have three to four servings per day, with is the equivalent to a daily intake of 375-500 grams. This level of consumption is associated with a reduce risk of all-cause mortality [30].

Addressing COVID-19 Disparities through Physical Activity Strategies

Physical activity plays a crucial role in maintaining a healthy lifestyle and overall well-being. It offers numerous benefits, including improved cardiovascular health, weight management, enhanced physical fitness, and stronger muscles and bones. Several investigations have shown that regular physical activity can contribute to the prevention and control of various diseases, such as diabetes, cardiovascular diseases, hypertension, cancer, depression, and osteoporosis [31-34]. A recent study indicates that physical activity may have a positive impact on vaccination programs by potentially enhancing T-cell production and the development of neutralizing antibodies [35,36]. However, additional investigation is needed, particularly concerning the potential benefits of incorporating acute exercise to enhance vaccine responses.

Engaging in physical exercise triggers the release of hormones including endorphins, dopamine, and serotonin, counteracting the impacts of excessive calorie intake and inadequate nutrition [37]. This process contributes to improved immune function [35]. Furthermore, emerging evidence suggests that physical activity may also have a positive impact on the management of COVID-19. While it's essential to follow public health guidelines and medical advice to prevent the spread of the virus, maintaining an active lifestyle can help support a person overall health. Consistently, observational studies indicated that physical activities may reduce significantly the risk of all cause and disease-specific mortality [38-40]. The 2018 guidelines for physical activity advice adults to participate in a minimum of 150 to 300 minutes per week of moderate physical activity (MPA), 75 to 150 minutes per week of vigorous physical activity (VPA), or a balanced combination of both intensities [41]. Within the physically active demographic, an increasing proportion of people are embracing more elevated levels of leisure-time physical activity as a means to uphold health and enhance fitness [42,43].

Conclusion

The African American community continues to grapple with the most elevated rates of COVID-19 infections and fatalities in comparison to other ethnic groups within the United states [44,45]. This alarming trend is evident in Table 3, which showcases COVID-19 positive cases and fatalities on a state-by-state basis, further emphasizing the profound impact of COVID-19 on African Americans across the general population in the United States.

Reflecting on the words of Dr. Martin Luther King Jr. from 1966, "Of all forms of inequality, injustice in health is the most shocking and inhuman," it is disheartening to acknowledge that despite the passage of more than half a century, African Americans and other minority communities continue to endure the repercussions of inequalities that underlie income and health disparities.

The highest incidence, mortality rates, and reduced survival rates attributed to COVID-19 among African Americans can be attributed to a range of interconnected factors. These include the cumulative impact of socioeconomic disparities, restricted access to healthcare services, an elevated burden of comorbidities, challenges related to food security, heightened unemployment rates, unstable housing conditions, and unequal availability of advancements in COVID-19 treatment [46-48].

In light of these persistent disparities, it is evident that novel strategies and innovative approaches are imperative to both prevent COVID-19 transmission and improve survival rates. Such strategies must be tailored to address the unique challenges faced by racial and ethnic minorities, particularly African Americans, in order to ameliorate COVID-19 mortality rates and enhance overall health outcomes.

Author Contributions

Conceptualization, C.G.Y.; Methodology, C.G.Y., S.W., and P.B.T; formal analysis, C.O., S.W., D.O, P.N., Y.G., C.G.Y and P.B.T.; investigation, C.G.Y, C.O., S.W, D.O, P.N., Y.G., R.A.A, and P.B.T.; supervision, C.G.Y., L.L., and R.A.A.; funding, C.G.Y., and P.B.T.; writing-original draft preparation, all authors; writing-reviewing and editing, all authors; All authors have read and agreed to the published version of the manuscript.

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Kaggle.com. The "Data for Black Lives" is a movement of activists, organizers, and scientists committed to the mission of using data to create concrete and measurable change in the lives of Black people.

Data Availability Statement: The COVID-19 dataset that support the findings in this paper were made available in Kaggle.com (https://www.kaggle.com/datasets/paultimothymooney/covid19-cases-and-deaths-by-race.

Conflicts of Interest: The authors declare no conflict of interest.

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