


Covid-19 and Pre-Morbid Lifestyle-Related Risk Factors—A Review

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Ifeoma N Monye¹, Moyosore Taiwo Makinde²,
Tijani Idris Ahmad Oseni^{3,4} , Abiodun Bamidele Adelowo⁵
and Samba Nyirenda⁶; On behalf of the Society of Lifestyle Medicine
of Nigeria (SOLONg)

¹Brookfield Clinics Centre for Lifestyle Medicine/Department of Family Medicine, National Hospital, Abuja, Nigeria. ²Department of Family Medicine, Lagos State University Teaching Hospital, Ikeja, Lagos, Nigeria. ³Department of Family Medicine, Ambrose Alli university, Ekpoma, Nigeria. ⁴Lifestyle and Behavioural Medicine Unit, Department of Family Medicine, Irrua Specialist Teaching Hospital, Irrua, Nigeria. ⁵Niger Delta Power Holding Company, Abuja, Nigeria. ⁶Sarai Holistic Care, Francistown, Botswana.

ABSTRACT: Since its outbreak in December 2019 in China, COVID-19 has spread like wild fire to affect many communities of the world. The high infectivity and case fatality rates of the disease among the general population and the severely ill patients respectively drew the attention of the global community. Our review showed that socio-demographic and lifestyle-related risk factors and underlying comorbid diseases were directly and indirectly associated with increased susceptibility and severity of COVID-19. These factors included older age (≥ 60 years), male gender, and ethnic minority groups (especially blacks), smoking, low serum level of vitamin D, unhealthy diet, physical inactivity (with poor exposure to sunlight), overweight/obesity, high blood pressure/hypertension, high blood cholesterol, cardiovascular diseases (like stroke and coronary heart disease), diabetes mellitus, chronic obstructive pulmonary disease, chronic kidney disease, chronic liver disease, and some cancers (like leukemia, lymphoma, or myeloma). The literature further revealed that the clinical progression of the majority of these associated risk factors can be modified through effective and comprehensive risk reduction through healthy living and lifestyle modification. COVID-19 preventive and treatment guidelines that give adequate attention to risk reduction and healthy lifestyle among people—either in the pre-, peri-, or post-COVID-19 stage, should be developed by public health policymakers and clinicians. This will play a significant role in the global effort to combat the pandemic, and reduce its negative impact on the life expectancy and socio-economic development of the world particularly in low- and middle-income countries (LMICs).

KEYWORDS: Covid-19, lifestyle, risk factors, pre-morbid, Healthcare Quality Improvement

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CORRESPONDING AUTHOR: Tijani Oseni, Department of Family Medicine, Ambrose Alli University, KM 13, Benin/Auchi Road, Ekpoma, Edo 320001, Nigeria. Email: tijanioseni@aauekpoma.edu.ng

Introduction

Coronavirus Disease 2019 (COVID-19) was first reported in Wuhan City, Hubei Province, China in December 2019, and within a few months, it had spread rapidly to most countries of the world. It was therefore not unexpected when the World Health Organization (WHO) announced COVID-19 as a Public Health Emergency of International Concern (PHEIC), after which it was declared a global pandemic on the 12th of March 2020.^{1–4} COVID-19 thus became one of the rare diseases to achieve a worldwide pandemic status in recent human history. Available data indicates that the global case-fatality rate (CFR) for COVID-19 has displayed notable variations worldwide.⁵ On a global scale, it has been observed that CFR escalates notably as age advances. Specifically, CFR remains below 1% for patients under 50 years of age, but surges to 1.3% for those aged 50, further increasing to 3.6% for individuals in their 60s, 8% for septuagenarians, and 14.8% for octogenarians.⁵ Unfortunately, an interim report from the WHO Solidarity trial consortium indicates that commonly utilized COVID-19 treatment regimens, including Remdesivir,

Hydroxychloroquine, Lopinavir, and Interferon, have shown limited to no significant impact on hospitalization and case fatality rates for the disease.⁶ This calls for the researchers and clinicians to expand their scope as they look for more effective preventive and treatment options for COVID-19. This will involve further research into all the common factors that may be associated with the disease.

Methods

We conducted a review of the existing evidence concerning the association between specific lifestyle-related risk factors and the onset and progression of COVID-19. This was done in Google search engine, Academia, ResearchGate, and MEDLINE database. The websites of reputable public health organizations, such as the WHO, United Nations, United Nations Children's Fund (UNICEF), Public Health Ontario, Centre for Disease Control (CDC), Nigeria Centre for Disease Control (NCDC), and the National Association of Chronic Disease Directors were also visited for relevant and current information. Some of the keywords that were searched include COVID-19,



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COVID-19 risk factors, clinical outcome in COVID-19, underlying comorbid diseases in COVID-19, and so on. The inclusion criteria were—topics relating to COVID-19 and its risk factors; articles from review studies, case reports, and original studies; articles published from 2019 till date; and articles written in English language only. Editorials, letters to the editor, and commentary articles were excluded from the review. A total number of 2750 articles were retrieved. They were visualized, profiled, cleansed, prepared, analyzed, and summarized, out of which 36 most relevant articles were selected.

Association Between Socio-Demographic Factors and COVID-19

It seems that the disease displays a predilection for specific socio-demographic groups within society. Multiple systematic reviews of COVID-19 cases in China and various countries globally indicate that infection rates, hospital admissions, severity of illness, and mortality are notably higher among individuals aged 65 and older, males, and ethnic minority populations.⁷ Notably, some reports suggest that individuals of Black ethnicity exhibit an infection rate 3 times higher and a mortality rate almost 6 times higher when compared to Caucasians.⁷

A retrospective observational study involving 1591 COVID-19 patients in Italy corroborated these findings. Among all confirmed COVID-19 cases in the study, males accounted for 82% of infections, while females comprised 18%, with a median age of 63 years.⁸

Similarly, a study examining 5700 COVID-19 patients admitted to 12 hospitals in the New York City area observed a median patient age of 63 years, with 39.7% being female and 60.3% male. Regarding racial distribution, 39.8% were of Caucasian ethnicity, 8.7% were of Asian descent, and 51.5% were identified as African American or belonging to other ethnic groups.⁹

The observed uneven distribution of COVID-19 incidence and severity within black and other ethnic minority communities could be attributed to several factors.⁷ These include socio-economic disparities, cultural practices, lifestyle choices, genetic predisposition, or potential variations in susceptibility or response to the infection and its treatment.

Additionally, researchers are investigating other potential factors contributing to the increased burden of COVID-19 among individuals of black ethnicity. These factors encompass a higher prevalence of abnormal expression of angiotensin-converting enzyme 2 (ACE 2), which serves as the host receptor for SARS-CoV-2, within black ethnic groups. Furthermore, there is an elevated risk of acute renal and cardiac complications within the black ethnic population, often associated with a heightened prevalence of cardiovascular risk factors among ethnic minority communities.⁷

Association Between Pre-Morbid Lifestyle-Related Risk Factors and COVID-19

Presently, available evidence suggests that COVID-19 can affect individuals across the health spectrum, irrespective of

their well-being.^{10,11} However, there is a growing body of evidence indicating that certain lifestyle-related factors or behaviors may predispose specific groups to a higher risk of contracting COVID-19 compared to others. Among the recognized predisposing factors are smoking, overweight or obesity, and hypovitaminosis D. The latter may stem from inadequate dietary intake or limited exposure to sunlight due to a sedentary lifestyle.^{12,13}

Early on, 1 study even posited that smoking might confer protective effects against SARS-CoV-2.¹⁴ Nevertheless, multiple subsequent studies conducted by various researchers and the World Health Organization's official positions have unequivocally linked smoking to an increased likelihood of both contracting SARS-CoV-2 and experiencing severe forms of COVID-19.^{15,16}

Hypovitaminosis D represents another risk factor associated with an augmented susceptibility to and severity of COVID-19.^{8,17} A study conducted in Spain, involving 216 confirmed COVID-19 patients upon hospital admission, revealed that 82.2% of these patients exhibited vitamin D deficiency, in contrast to 47.2% of healthy individuals of similar age and gender.¹⁸ It is noteworthy that research has demonstrated a positive correlation between advancing age and decreasing serum vitamin D levels,¹⁹ potentially explaining the heightened fatality rate of COVID-19 within older age groups. Furthermore, serum vitamin D levels are generally lower in males compared to females and in individuals with obesity, regardless of gender.⁸ Low serum vitamin D levels may also be associated with the habitual consumption of certain unhealthy diets.^{12,13} Additionally, a sedentary lifestyle can lead to diminished serum vitamin D levels, as individuals engaged in such lifestyles often lack adequate sunlight exposure due to limited outdoor physical activity.²⁰

As a result, the implementation of lifestyle intervention measures, such as vitamin D-rich diets and supplements coupled with sufficient exposure to sunlight, may hold promise in the prevention of COVID-19 among at-risk populations, particularly older men.^{8,21} Furthermore, these interventions could be beneficial in the supportive care of confirmed COVID-19 patients, regardless of the stage of the disease.¹⁸ Encouraging at-risk individuals and confirmed COVID-19 patients to engage in regular outdoor physical activity to ensure adequate sunlight exposure may also emerge as a crucial strategy for disease prevention and management. This is especially significant in Africa, where research has indicated that up to two-thirds of the population suffers from some degree of vitamin D insufficiency.²²

Association Between Lifestyle-Related Co-Morbid Conditions and COVID-19

Several studies have consistently indicated that individuals with specific lifestyle-related underlying health conditions face a heightened susceptibility to contracting SARS-CoV-2 in comparison to those without these conditions. In addition to

factors such as age, gender, ethnicity, and lifestyle-related risk elements, there are other determinants that can amplify an individual's vulnerability to both SARS-CoV-2 infection and the development of severe COVID-19. These determinants include the presence of lifestyle-related chronic medical conditions, such as chronic obstructive pulmonary diseases (COPD), heart disease, high blood pressure, diabetes mellitus, kidney disease, liver disease, cerebrovascular disease (such as a previous stroke), certain types of cancers, and immunocompromised states resulting from either diseases like HIV/AIDS or the use of immunosuppressive drugs like chemotherapy.^{10,11}

This perspective is reinforced by clinical observations that reveal a substantial prevalence of underlying lifestyle-related diseases, such as cardiovascular disease, liver disease, kidney disease, and malignant tumors, among many older COVID-19 patients, often contributing to the severity of clinical manifestations.²³

Of particular note, COVID-19 patients with comorbid diabetes mellitus tend to exhibit a significantly elevated risk of hospitalization and mortality when compared to individuals with other underlying medical conditions.^{24,25} The precise reasons for this heightened susceptibility and severity in individuals with diabetes mellitus are not yet fully understood. However, it is well-established that individuals with diabetes mellitus frequently experience dysregulation of their immune systems, rendering them generally more susceptible to infections.^{8,24} Additionally, infections in diabetic patients, especially those with poorly controlled blood glucose levels, typically exhibit a more rapid progression and greater severity in comparison to individuals without diabetes mellitus.²⁶

Existing research further supports the previously mentioned connection between COVID-19 and certain comorbidities. A meta-analysis, which encompassed 7 studies and 1576 COVID-19 patients, substantiated that a noteworthy portion of these patients presented with underlying chronic health conditions. The most prevalent comorbidities were hypertension (21.1%, 95% CI: 13.0-27.2%) and diabetes mellitus (9.7%, 95% CI: 7.2-12.2%), followed by cardiovascular disease (8.4%, 95% CI: 3.8-13.8%) and respiratory system disease (1.5%, 95% CI: 0.9-2.1%).²⁷

Factors Influencing Clinical Outcomes and Prognosis in COVID-19 Management

The available evidence indicates that a majority of COVID-19 cases will either be asymptomatic or present with mild to moderate symptoms that do not necessarily necessitate close monitoring or hospitalization. However, a minority of cases will progress to a severe clinical stage, requiring specialized care in a healthcare facility. Among these severe cases, some may unfortunately result in fatalities, often involving multiple organ injuries that demand intensive care unit (ICU) management.

Several factors have been identified as contributing to the severity of COVID-19 cases. These factors encompass socio-demographic elements such as older age and male gender, as well

Table 1. Premorbid risk factors for Covid-19.

VARIABLE	RISK FACTOR
Sociodemographic characteristics	Older age (≥ 60 years)
	Male gender
	Ethnic minority groups (especially blacks)
Lifestyle-related	Smoking
	Unhealthy diet
	Physical inactivity (with poor exposure to sunlight)
Pre-existing conditions	Overweight/obesity
	Low serum level of vitamin D
	High blood cholesterol
Pre-existing comorbidities	High blood pressure/hypertension
	Cardiovascular diseases (like stroke and coronary heart disease)
	Diabetes mellitus
	Chronic obstructive pulmonary disease
	Chronic kidney disease
	Chronic liver disease
Some cancers (like leukemia, lymphoma, or myeloma)	

as lifestyle-related risk factors like a history of smoking, severe obesity, inadequate nutrition leading to hypovitaminosis D, physical inactivity, high blood pressure, and elevated blood cholesterol levels. Additionally, underlying lifestyle-related chronic conditions like hypertension, cardiovascular diseases (especially stroke and coronary heart disease), certain types of cancer, diabetes mellitus, chronic kidney disease, chronic liver disease, and chronic obstructive pulmonary disease (COPD) play a role in disease severity. The premorbid risk factors are shown in Table 1.

Enhancing COVID Management Through Lifestyle Intervention to Optimize Prevention and Treatment Efforts

The review strongly indicates that while COVID-19 primarily affects the respiratory system, it is linked to certain risk factors that can either predispose individuals to the disease or exacerbate its clinical course. The 3 primary socio-demographic risk factors implicated in COVID-19—advanced age, male gender, and Black ethnicity—are well-documented non-modifiable risk factors for chronic non-communicable diseases such as hypertension, cardiovascular disease, type 2 diabetes mellitus, and specific cancers.^{28,29}

Additionally, certain pre-existing lifestyle-related risk factors have been associated with an increased susceptibility to

SARS-CoV-2 infection and poorer clinical outcomes in COVID-19 cases. These directly implicated lifestyle-related risk factors encompass a history of tobacco smoking or current smoking, overweight or obesity, high blood pressure, high cholesterol levels, and insufficient vitamin D levels. Indirectly, risk factors like poor dietary habits and limited outdoor physical activity, which results in inadequate sunlight exposure and subsequent vitamin D deficiency, are also linked to COVID-19 susceptibility. Notably, smoking, overweight or obesity, high cholesterol levels, unhealthy diets, and physical inactivity are well-established modifiable risk factors for chronic non-communicable diseases such as hypertension, cardiovascular disease, type 2 diabetes mellitus, chronic obstructive pulmonary disease (COPD), and certain cancers.³⁰

The literature further identifies chronic non-communicable diseases, including chronic obstructive pulmonary diseases (COPD), hypertension, cardiovascular diseases (such as heart disease and stroke), diabetes mellitus, chronic kidney disease, chronic liver disease, and specific cancers like leukemia, lymphoma, or myeloma, as underlying comorbid conditions that either influence or are associated with COVID-19 clinical outcomes. Substantial evidence indicates that the presence of these underlying chronic diseases often increases susceptibility to COVID-19, its progression, and the severity of clinical outcomes. According to the United Nations, approximately 66% of individuals aged 70 and over in most developed countries have at least 1 underlying chronic disease, which places them at heightened risk of contracting SARS-CoV-2 and experiencing severe COVID-19 consequences.³¹ Additionally, a wealth of evidence strongly links these chronic comorbid diseases to unhealthy lifestyle choices, such as poor dietary patterns, tobacco usage, and physical inactivity.³⁰ Moreover, overweight or obesity and high cholesterol levels are intermediate lifestyle-related risk factors for these chronic comorbidities.²⁸

According to the World Health Organization (WHO) and numerous scientists, certain prudent lifestyle choices, when consistently and correctly practiced, have undergone clinical validation for their effectiveness in managing modifiable risk factors associated with COVID-19.^{32,33} The health promoting or protective factors/choices have the potential to prevent, control, or even reverse some of the underlying chronic diseases linked to the virus. Among the well-established health promoting or protective healthy lifestyle choices capable of achieving these objectives are; adopting a plant-based whole food diet, engaging in sufficient physical activity, with an emphasis on outdoor exercise; ensuring restorative sleep, implementing effective stress management techniques, abstaining from excessive alcohol consumption, fostering good mental health, and cultivating social connectivity.³²⁻³⁴

The risk factors and comorbid conditions that contribute to susceptibility to COVID-19 and its unfavorable clinical outcomes are predominantly associated with lifestyle choices. Consequently, it is plausible to theorize that COVID-19 is, in

essence, a lifestyle-related disease. Thus, optimizing the lifestyle of both the general population and those at risk through healthy choices, coupled with other preventive measures such as diligent hand washing, mask-wearing, physical distancing, and self-isolation, is likely to expedite the flattening of the COVID-19 pandemic curve.²¹ This, in turn, would yield significant socioeconomic benefits.

In the case of confirmed positive COVID-19 individuals, lifestyle modifications may slow disease progression, stabilize underlying chronic conditions, and substantially improve clinical outcomes, thereby reducing the fatality rate.³⁵ This approach assumes particular importance, particularly for COVID-19 cases that do not respond favorably to pharmacotherapy. Notably, a WHO interim study report indicated that commonly used COVID-19 treatment regimens, including Remdesivir, Hydroxychloroquine, Lopinavir, and Interferon, appeared to have limited or no significant impact on hospitalization duration, initiation of ventilation, or overall mortality among COVID-19 patients.⁶

In the post-COVID-19 phase, adopting a healthy lifestyle is expected to facilitate swift recovery of affected organs, hasten rehabilitation, stabilize underlying conditions, and expedite the return of patients to their pre-morbid functionality, facilitating their reintegration into society.

Comprehensive preventive measures encompassing proper hand hygiene, mask usage, physical distancing, self-isolation, and healthy lifestyles are pivotal in the global endeavor to swiftly curb the COVID-19 pandemic. Policymakers should carefully consider the association between COVID-19, socio-demographic risk factors, lifestyle-related risk elements, and underlying chronic diseases. The development of a comprehensive COVID-19 prevention guideline should prioritize the general population, with particular emphasis on at-risk groups who face a higher susceptibility to SARS-CoV-2. Furthermore, clinical management guidelines for confirmed COVID-19 cases should include comprehensive lifestyle modification as an integral aspect of care, regardless of the disease stage. Finally, healthy lifestyles should be incorporated into the rehabilitation phase for individuals who have tested negative for COVID-19 to ensure their holistic recovery and reintegration into society.

Conclusion

In conclusion, the high infectivity and case fatality rates of Covid-19 disease among the general population and the severely ill patients respectively have drawn the attention of the global community. To halt the progression and improve outcomes, policymakers and clinicians need to start paying more details to the associated socio-demographic and lifestyle-related risk factors, and underlying comorbid diseases that may increase susceptibility and worsen the clinical outcome of COVID-19 such as older age (≥ 60 years), male gender, and ethnic minority groups (especially blacks), smoking, low serum level of vitamin D, unhealthy diet, physical inactivity (with

poor exposure to sunlight), overweight/obesity, high blood pressure/hypertension, high blood cholesterol, cardiovascular diseases (like stroke and coronary heart disease), diabetes mellitus, chronic obstructive pulmonary disease, chronic kidney disease, chronic liver disease, and some cancers (like leukemia, lymphoma or myeloma). This will likely improve preventive efforts and clinical management of COVID-19, thereby playing a significant role in the global effort to combat the pandemic and reduce its negative impact on the life expectancy and socio-economic development of the world particularly, LMICs, like Nigeria, where there is the potential of an explosion of COVID-19, due to her large population and extremely limited resources to effectively manage the multi-dimensional-ity of the disease.

Author Contributions

All the authors contributed equally in the conception design and writing of this review.

ORCID iD

Tijani Idris Ahmad Oseni  <https://orcid.org/0000-0001-5301-1983>

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