



Relationship between COVID-19 Outbreak with Non-Communicable Disease and Multisystem Inflammatory Syndrome in Children: A Narrative Review

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Abstract

The coronavirus disease 2019 (COVID-19) outbreak forced us to fight against the unprecedented times in the world. A big devastating impression on the world due to the COVID-19 outbreak causes the brink of no return. The COVID-19 pandemic has significantly influenced various facets of society, including its profound effects on children and the prevalence of non-communicable diseases (NCDs). Quarantine regulations have altered children's and teenagers' typical lifestyle routines. In this study, we address the possible short- and long-term impacts of high-risk NCD behaviors on health outcomes and how the COVID-19 pandemic affected childhood lifestyle. [*Bangladesh Journal of Infectious Diseases, December 2024;11(2):166-171*]

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Introduction

The coronavirus disease 2019 (COVID-19), affected by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has brushed the world as a pandemic¹. The COVID-19 pandemic has significantly influenced various facets of society, including its profound effects on children

and the prevalence of non-communicable diseases (NCDs). The pandemic has introduced unique challenges for children's physical, mental, and social well-being while also influencing the management and Prevention of NCDs due to disruptions in healthcare services and lifestyle changes. Understanding these impacts is crucial for implementing targeted strategies to mitigate the

repercussions on children's health and the management of non-communicable diseases during these unprecedented times².

The advent of Multisystem Inflammatory Syndrome in Children (MIS-C) as an association with COVID-19 has generated notable concern within the medical community. MIS-C represents an infrequent but grave condition characterized by systemic inflammation affecting several organs, often occurring in children and adolescent's weeks after acquaintance with the SARS-CoV-2 virus. Understanding the correlation between MIS-C and COVID-19 is paramount in comprehending the complexities of this novel inflammatory response and devising effective measures for identification, dealing, and inhibition in pediatric populations³.

There exists a strong interconnection between COVID-19 and non-communicable diseases (NCDs). Chronic conditions like cardiovascular disease (CVD) and diabetes are predictive factors for severe illness and fatalities resulting from COVID-19¹. Additionally, emerging evidence suggests that specific forms of acute organ damage in COVID-19 patients might persist even after they have been discharged from the hospital¹.

Potential interactions between COVID-19 and NCDs

Researchers are gaining deeper insights into how COVID-19 intersects with non-communicable diseases (NCDs). While anyone can be affected by SARS-CoV-2, those with conditions like cancer, cardiovascular disease, diabetes, and COPD face a higher risk of severe symptoms and fatal outcomes.

Various studies emphasize this heightened vulnerability among people with existing health issues, highlighting the amplified risk associated with these conditions in the context of COVID-19¹. Prior conditions might worsen COVID-19 outcomes through mechanisms like chronic inflammation and increased expression of the SARS-CoV-2 receptor in certain vital organs¹.

The virus can directly attack vital organs, leading to issues such as cardiac injury, arrhythmia, septic shock, acute kidney injury, and multi-organ failure¹. Regardless of age, the person who is suffering from conditions like high blood pressure, diabetes, and obesity faces a raised risk of severe illness from COVID-19, stated the Centers for Disease Prevention and Control (CDC)⁴.

Link between Covid-19 and Child Health

The opposing effects of COVID-19 are not restricted to the only infectious disease due to quarantine boundaries and the impaired lifestyle of children and adolescents. Lack of a healthy diet, lack of physical activity, extended screen time and sedentary behavior, interrupted sleep schedules, poor quality of sleep, and mental sicknesses during COVID-19 in childhood may increase the risk factor and tendency to NCDs in child².

Improper lifestyle forces weight gain and boosts the incidence of NCDs and associated mortality⁵. A deficiency in a healthy diet is accompanied by additional energy intake and weight gain and increases the tendency to develop obesity. Obesity is correlated with non-communicable diseases (NCDs). It is revealed that obesity enriches the risk of complications from COVID-19⁶. Food unavailability leads to the consumption of long-life foods, ultra-processed and calorie-dense comfort foods, as a substitute for fresh foods. This type of food has a high amount of salt, sugar, or trans-fat content. Finally, obesity is correlated with cardiometabolic risk factors⁶.

A study in the United States reported that signs of distress in their children were observed by 40.1% of parents⁷. Also, various mental health problems from a recent review have been identified among those exposed to the COVID-19 pandemic, including anxiety-related issues, stress, depressive mind, panic, irritation, impulsivity, somatization, sleep problems, emotional lability, post-traumatic stress disorder (PTSD), and suicidal tendency behavior⁸.

Severe but Rare Impact, Multisystem Inflammatory Syndrome in Children (MIS-C)

The pediatric COVID-19 cases associated with hyperinflammation were described, the World Health Organization (WHO), the US Centers for Disease Control and Prevention (CDC), and the Royal College of Pediatrics and Child Health (RCPCH) developed overlapping definitions of the syndrome and named it multisystem inflammatory syndrome in children (MIS-C) temporally associated with SARS-CoV-2⁹. Common elements associated with these definitions include prolonged fever, multi-organ dysfunction, elevated inflammatory markers, features close to Kawasaki disease and toxic shock syndrome, and recent or current SARS-CoV-2 infection or exposure; however, they slightly differ in many other criteria⁹.

MIS-C, a condition primarily affecting young, school-aged children, is characterized by persistent fever, heightened systemic inflammation, and dysfunction in multiple organ systems. The associated serious outcomes underscore the importance of increased awareness among parents, teachers, and school administrators. Predicting which children are at higher risk for MIS-C or likely to experience poor outcomes remains challenging due to existing knowledge gaps³. Current research suggests that SARS-CoV-2 may play a role in triggering or influencing MIS-C development. While further studies are needed to establish risk factors and prognosis, specific trends in the literature indicate that MIS-C can manifest in previously healthy children without known health issues, typically emerging within four weeks after SARS-CoV-2 infection. However, symptoms may appear before the resolution of COVID-19 symptoms in some cases³.

Discussion

The alterations in lifestyle due to the COVID-19 pandemic, involving measures like physical distancing, social isolation, and quarantine, may heighten the risk factors for non-communicable diseases (NCDs). These factors encompass reduced physical activity, unhealthy dietary habits, and mental health challenges like anxiety, depression, and chronic stress. Adopting an unhealthy lifestyle can lead to weight gain and exacerbate the occurrence of NCDs, consequently increasing mortality rates linked with these conditions⁵.

Control and modification actions for COVID-19, including home control, social distancing, and travel limitations, can contribute to unhealthy lifestyles and risky behaviors such as a low-quality diet, smoking, increased alcohol drinking, and lack of physical activity⁶. In addition, conventional risk factors for NCDs carry out barricades against proper measures to prevent COVID-19, such as the lack of personal protective equipment usage, social distancing, and improper personal hygiene¹⁰. A rapid assessment survey from the World Health Organization (WHO) stated that 75.0% of countries had disruptions to NCD service facilities, and the extent of the disruptions corresponded to the transmission phases of the pandemic in different countries¹¹.

COVID-19 Severity in Sedentary People

COVID-19 and insufficient physical activity increase vulnerability to infections and worsen the

progression of several prevalent conditions among older adults, including heart disease, cancer, compromised immunity, and inflammatory disorders⁴.

COVID-19 Severity in Obese People

Regarding COVID-19 and obesity, there is a significant association. Chronic inflammation associated with obesity results in heightened levels of interleukin (IL-6) and TNF- α in the bloodstream. This surge triggers macrophage infiltration into adipose tissue, leading to substantial oxidative stress and reduced immunity. These factors might function as indicators for escalated disease severity and elevated mortality rates following a COVID-19 infection⁴.

COVID-19 Severity in Diabetic People

The suggested link between COVID-19 severity and diabetes mellitus (DM) revolves around the idea that preexisting chronic inflammation, combined with an enhanced inflammatory response to the SARS-CoV-2 infection and a higher viral load, triggers a severe systemic immune reaction known as a "cytokine storm." This response is intricately linked to the heightened severity of COVID-19. Research findings indicate that the dysregulated immune system in individuals with DM significantly contributes to worsening the severity of illness⁴. Reviews in a retrospective case series, Yan et al. discovered a lower survival rate among diabetic patients compared to non-diabetic individuals¹². Similarly, a study in Mexico highlighted that diabetes correlates with increased hospitalization and poorer outcomes for COVID-19 patients. These observations align with findings echoed in various existing literature reviews¹³.

Additionally, adopting a broader perspective, Awortwe et al¹⁴ propose that cardio-metabolic syndrome, primarily characterized by insulin resistance, impaired glucose tolerance, dyslipidemia, hypertension, and central adiposity, correlates with adverse clinical outcomes in COVID-19 patients. These outcomes encompass mortality, ICU admissions, and severe infections. Another literature review by Ssentonoga et al¹⁵ reaffirmed that diabetes significantly elevates mortality risk due to COVID-19.

COVID-19 Severity in Hypertensive People

The advised link between COVID-19 severity and hypertension revolves around the connection that.

Elevated risk of high blood pressure and suffering a more severe course of infection with SARS-CoV-2 due to viral tropism of the heart and lungs, which may be enlightened by overexpression of ACE-2 receptors, angiotensin II receptor blockers (ARBs) in infected patients. In addition, it enhances inflammation response and cardiac aggression¹⁶.

In a literature review conducted by Wolff et al., it was established that diabetes, hypertension, and other cardiovascular diseases are the most prevalent chronic illnesses among COVID-19 patients¹⁷. The authors establish a more detailed connection between hypertension (as well as other cardiovascular diseases) and adverse clinical outcomes such as death or increased illness severity in individuals with COVID-19. Most literature reviews examining the relationship between hypertension and COVID-19 mortality conduct meta-analyses, consistently finding higher odds of COVID-19 mortality among hypertensive patients, often with odds ratios ranging between 2.5 to 3¹⁸. A comprehensive review by Ssentonoga et al¹⁵ discovered that cardiovascular diseases and congestive heart failure were significantly connected with an increased risk of mortality from COVID-19.

Covid-19 and COPD

COPD stands as the third most common chronic illness linked to adverse outcomes from COVID-19, alongside other underlying chronic conditions. A specific branch of research has emphasized the relationship between COVID-19 and COPD, identifying it as the most prevalent pulmonary chronic illness¹⁸. Graziani et al¹⁹ discovered that individuals with COPD and COVID-19 experienced notably worse prognoses, with increased rates of hospitalizations and mortality compared to those without COPD.

Covid-19 and chronic kidney disease

Chronic kidney disease ranks as the fourth most prevalent chronic condition linked to adverse COVID-19 outcomes. Bajgain et al²⁰ conducted a literature review indicating that approximately 2.6% of individuals with chronic kidney disease also contracted Covid-19. Additionally, Awowrtwe et al¹⁴ discovered a notably elevated risk of severe COVID-19 consequences among those with chronic kidney disease. Their findings highlighted that chronic kidney disease correlated with poorer clinical outcomes, such as increased mortality rates,

ICU admissions, and severe infections among COVID-19 patients.

COVID-19 and Liver Disease

The connection between COVID-19 and chronic liver disease appears concerning based on the available literature. Oyelade et al²¹ reported that among patients with both COVID-19 and underlying liver diseases, 57.3% (43 out of 75) experienced severe cases, with a mortality rate of 17.65% cases.

Experiences Learned from COVID-19 for NCD

First, governments everywhere need to acknowledge that NCDs impose severe and long-lasting negative consequences on health and non-health¹. Like COVID-19, NCDs hurt society and the economy. These consequences can extend outside the health system to include the job market, social fairness, and the stability of communities²². National policies and governance still need to be reinforced about NCD prevention and control during and after the COVID-19 epidemic. An exclusive concentration on infectious diseases will detract from the overall picture of the world's disease burden. In addition to NCD treatments, effective and affordable preventative strategies should remain a top priority. Like managing COVID-19, the Prevention and treatment of non-communicable diseases (NCDs) necessitate implementing multi-layered, multi-pronged solutions. Although preventive treatments are sometimes disregarded for their lengthy duration and less evident instant consequences, they merit special consideration¹. WHO's advice to address the most modifying lifestyle factors, including excessive alcohol consumption, tobacco use, poor food, and physical inactivity, for the Prevention and control of NCDs²³. The concept of CDC can be understood in the context of society, civilization, and ecosystems. The prevalence of NCDs alongside periodic infectious disease outbreaks necessitates a renewed focus on global health for sustainable human development²⁴.

Recent events highlight the importance of addressing upstream determinants that influence public health outcomes within our communities. We must apply lessons learned from current efforts to tackle COVID-19-related NCDs at both national and international levels to achieve SDG targets aimed at reducing premature deaths caused by non-communicable diseases by 2030 - this requires consistent action against these illnesses informed by

best practices developed through experience gained during recent global emergencies such as COVID-19¹.

Conclusion

Normal lifestyle behaviors and physical and psychological health in children and adolescents are drastically affected by the adverse effects of the COVID-19 pandemic. It is essential to reduce the adverse effects of this pandemic on individual and public health by preventing and controlling NCDs' risk factors. The latest analysis has clearly outlined and defined how lifestyle factors such as excess weight, obesity, type 2 diabetes, hypertension, and physical inactivity can exacerbate the severity of COVID-19. As a result, we advocate for proactive prevention and timely management of these aspects. It's essential to consider the lessons learned from the global fight against COVID-19 and apply them to national and international endeavors to control COVID-19 severity associated with non-communicable diseases (NCDs). So, it is very essential for satisfactory prevention and proper and prompt management of these lifestyle characteristics mentioned to decrease the impact of COVID-19 morbidity and mortality.

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Conflict of Interest

The authors have no relevant conflicts of interest to declare.

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