

# COVID-19 prevention and health promotion for the whole community

Mohammed, M.<sup>1\*</sup> and Umar, A. Y.<sup>2</sup>

<sup>1</sup>Department of Biological Sciences, Federal University Gusau Zamfara, Nigeria.

<sup>2</sup>Department of Biological Sciences, Nigerian Defence Academy, Kaduna State, Nigeria.

\*Corresponding author. Email: mmohammed@fugusau.edu.ng; Tel: +2348069737482.

Copyright © 2023 Mohammed and Umar. This article remains permanently open access under the terms of the [Creative Commons Attribution License 4.0](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received 16th September 2023; Accepted 12th December, 2023

**ABSTRACT:** As our understanding of Covid-19 has grown, numerous techniques for preventing its spread have emerged. Scholars and practitioners in public health have focused on four important Covid-19 prevention strategies: behavioural, technical, biomedical, and structural/community-level interventions. Recent material in these areas provides an overview of current Covid-19 preventive breakthroughs. Current COVID-19 prevention models, which build on traditional techniques, use intimate partners, families, social media, emerging technology, prescription therapy, immunization, and regulatory changes to influence change. Despite significant success, more action is required to meet the national goal of stopping the COVID-19 epidemic. Government and non-governmental organizations are uniquely positioned to promote prevention science in collaboration with cross-disciplinary professionals from other domains.

**Keywords:** Community, COVID-19 prevention, epidemic, health promotion.

## INTRODUCTION

Although global commitment to control covid-19 has increased significantly in recent years, most people continue to recover without hospital treatment (WHO, 2023). More than 760 million cases of covid-19 have been reported in more than 214 countries and territories, resulting in 6.9 million deaths have been documented from December 2019 (WHO, 2023). United States of America remains the country most affected by COVID-19, however, the virus continues to spread rapidly all over the world (JHU, 2020).

Despite the rapid spread of COVID-19, several countries have achieved important success in curbing its transmission through various infection prevention and control (IPC) guidelines, which include immunization, frequent hand washing, maintenance of physical distance from others, quarantine, covering coughs, and keeping unwashed hands away from face (He *et al.*, 2023; Nussbaumer *et al.*, 2020; WHO, 2020a).

Successes include developing a highly sensitive and standard COVID-19 diagnostic test such as real-time reverse transcription polymerase chain reaction (rRT-

PCR) and CT scans in individuals with high clinical suspicion (Alafeef and Pan, 2022; Pradana *et al.*, 2022; Vogel, 2020; Salehi *et al.*, 2020). Although, as of June 2023, more than 13 billion COVID-19 vaccines have been administered while most people recover without drug treatment (WHO, 2023). Management involves treating the symptoms and seven trials were evaluated and approved for treatment including chloroquine, vasodilators, corticosteroids, immune therapies, lipoic acid, bevacizumab, and recombinant angiotensin-converting enzyme (Barletta *et al.*, 2023; Olukosi *et al.*, 2023; Hawks *et al.*, 2020).

## OBSTACLES TO COVID-19 PREVENTION AND CONTROL

Obstacles to effective COVID-19 prevention and control include misinformation about the disease on social media, difficulties in implementing lockdown, stigmatization, social hostility, lack of testing and other medical facilities, myths, perceptions and beliefs, and social and religious factors

which are discussed below (Klabbers *et al.*, 2023; Khan *et al.*, 2022).

### **Misinformation about the disease in the social media**

Social media also known as social network help people spread misleading information that poses a serious problem for public health information as fast as possible to a wide range of viewers all over the globe (Sule *et al.*, 2023; Kim *et al.*, 2019), but this effort is being defeated by many of those who abuse this medium. Myriads of information and incident that surge from rumours, hoaxes, and misinformation regarding COVID-19 aetiology, prevention, symptoms, and management were circulated all over the globe. During the pandemic, Twitter, Facebook, and other platforms have engaged in efforts to combat misinformation still appearing in prominent pages and groups (Broniatowski *et al.*, 2023; Kousy *et al.*, 2020). This misinformation masked healthy behaviours in preventing the disease and promoting erroneous behaviours which have been generally accepted by the population (Tasnim *et al.*, 2020).

### **Lockdown challenges**

COVID-19 lockdown was first implemented in Wuhan helping to bring the epidemic in China under control rapidly (WHO, 2020a). The lockdown is necessary to prevent the health system from being overwhelmed and to bring the disease under control requires the population to remain indoors except for the sectors carrying out essential activities such as health and security (Mockshell and Ritter, 2023; Mboera *et al.*, 2020). This approach has not seemed to be successful due to setbacks in its effective implementation (Altman, 2020). This lockdown faces serious setbacks in low-income countries due to low livelihood, lack of shelter, and other basic needs (O'Connor *et al.*, 2023; Torales *et al.*, 2020).

### **Stigmatization**

No person or group of people is more likely than others to spread COVID-19 (WHO, 2020b), therefore, maintaining the privacy and confidentiality of those seeking healthcare and those who may be part of any contact investigation is necessary (Gill *et al.*, 2023; CDC, 2020). Due to fear of stigma, potential contact has refused to report themselves for testing which leads to isolation by the patient to avoid discrimination which reduces the patient's possibility of seeking medical care (Spruijt *et al.*, 2023; Torales *et al.*, 2020). This reduces the possibility of diagnosing, treating, and controlling the disease which leads to widespread infection among those that harbour the virus unknowingly (Malas and Malas, 2023).

### **Lack of diagnostics, testing kits, and trained manpower**

The most effective disease control is early diagnosis. Early detection of infectious disease outbreaks can lead to a decreased impact on the population (Lindsay and Petra, 2016). The infrastructure, equipment, and manpower needed to detect COVID-19 that complies with WHO guidelines is lacking in many low-income and developing countries thereby narrowing the number of individuals to be tested (Chong *et al.*, 2023; Giri and Rana, 2020). With the global shortage of medical masks, ventilators, intensive care unit beds, and adequate quarantine facilities, most developing countries rely on locally made masks which may not be effective in preventing transmission and insufficient ventilators result in a high mortality rate (WHO, 2020a). In addition, lack of trained manpower capable of performing molecular diagnosis such as PCR required to test for COVID-19, and doctors on the frontline come down with the disease due to a lack of protective equipment to protect themselves (Gonete *et al.*, 2023; Giri and Rana, 2020).

### **Social and religious factors**

The WHO outline practical consideration and recommendations for religious leaders and faith-based communities in the context of COVID-19. Religious leaders play an important role in passing the information to their members which may not be more likely accepted from other sources (Nche *et al.*, 2023; WHO, 2020c). Gatherings have proven to be effective in the transmission of COVID-19. Religious gathering that does not comply with national and local should be cancelled (Khalek and Dollah, 2023; WHO, 2020c). This is because some communities especially in developing countries believe religion is the cure for the coronavirus. In some localities, lockdown and social distancing rules have been ignored by religious groups who perform activities regardless of the COVID-19 threat (Dauda, 2023; Kolifarhood *et al.*, 2020).

### **Burden of COVID-19**

As a result of the implementation of large-scale data collection methods for examination worldwide and enhanced methods of validating data, COVID-19 is the most documented pandemic in history (JHU, 2020). Improvement in several data sources can contribute to reasonably accurate estimates and understanding of the pandemic trends (Wolkewitz and Schumacher, 2017). This results in an accurate picture of where the pandemic and the factors that explain its spread. About 214 countries have reported 19.1 million COVID-19 cases and 715,000 deaths since China reported its first case to the World

Health Organization. The United States leads the world in confirmed coronavirus cases. Among the 45 countries with more than 50,000 COVID-19 cases, it has the eighth highest number of deaths per 100,000 people: 47.93 deaths from the coronavirus 100,000 are Americans. But in the case of fertility ratio, the United States is significantly better than many countries. The country's case fatality ratio is 3.3%, meaning that for every 100 people with COVID-19, only about three die (JHU, 2020).

## RISK FACTORS FOR COVID-19

These risk factors include age, diabetes, heart disease and hypertension, smoking, blood type and obesity.

### Age

COVID-19 can affect any age group, and the risk of dying from the disease is more common among older people with associated medical conditions requiring hospitalization which increases significantly with age (Zsichla and Müller, 2023; Amitava *et al.*, 2020). The tendency is because many elderly people have chronic medical conditions, such as heart disease and diabetes, that can exacerbate the symptoms of COVID-19 (Haybar *et al.*, 2020). The ability of the immune system to fight off pathogens also declines with age, leaving elderly people vulnerable to severe viral infections (Zhang *et al.*, 2023a; Subramaniam and Usha., 2011).

### Diabetes

Diabetes mellitus is a disease that results in high blood sugar levels linked to the risk of more severe COVID-19 infections (Khunti *et al.*, 2023; Matteo *et al.*, 2020). People with type-2 diabetes were more likely to have a critical case of COVID-19 or to die from the disease compared with those patients without any underlying health conditions such as hypertension, heart disease, or respiratory disease (Shi *et al.*, 2020). This link could also play a role in poorer outcomes in a person with diabetes exposed to COVID-19 (Fukushima *et al.*, 2023; Kumar *et al.*, 2020).

### Heart disease and hypertension

Conditions that affect the cardiovascular system, such as heart disease and hypertension, generally worsen the complications of COVID-19 (Dele *et al.*, 2023; Huang *et al.*, 2020). Attacking the lungs directly by the virus might deplete the body's supply of oxygen to the point that the heart must work harder to pump oxygenated blood through

the body. The virus might also attack the heart directly, as cardiac tissue contains angiotensin-converting enzyme 2 (ACE2) — a molecule that the virus plugs into to infect cells (Xiong *et al.*, 2020). COVID-19 can also initiate an overblown immune response known as a cytokine storm, wherein the body becomes severely inflamed and the heart could suffer damage as a result (Adair *et al.*, 2023; Zhang *et al.*, 2023b; Susanna *et al.*, 2020).

### Smoking

Smoking cigarettes is associated with heightened adverse disease prognosis (Tonnesen *et al.*, 2019). Suffering organ damage and requiring breathing support are prone to severe COVID-19 infections (Park *et al.*, 2018). Smokers may be vulnerable to catching viral infections because smoke exposure dampens the immune system over time, damages tissues of the respiratory tract, and triggers chronic inflammation (Patanavanich *et al.*, 2023; Constantine and Katerina., 2020). Smoking is also associated with a multitude of medical conditions, such as emphysema and atherosclerosis, which could exacerbate the symptoms of COVID-19 (Klein *et al.*, 2023; CDC, 2020).

### Obesity

Obesity is generally a risk factor for increased risk of mortality among COVID-19 patients. Obesity increased food intake, and nutrient/energy imbalance affect immune deficiency, especially in vulnerable populations (Adair *et al.*, 2023; Bornstein *et al.*, 2020). Lung and chest capacity are altered significantly due to fat deposits in the mediastinum and abdominal cavities. These alterations reduce lung compliance, chest wall, and the entire respiratory system, and likely contribute to the respiratory symptoms of obesity such as wheezing, dyspnea, and orthopnea (Schachter *et al.*, 2001; Sin *et al.*, 2002). Obese patients might also have reduced lung capacity or increased inflammation in the body (Tong *et al.*, 2023, Adair *et al.*, 2023; Pelosi *et al.*, 1998).

### Blood type

Blood type is associated with susceptibility to contracting COVID-19 (Lu *et al.*, 2020). Individuals with blood types in the A group (A-positive, A-negative, AB-positive, AB-negative) were at a higher risk of contracting the disease compared with non-A-group types. People with an O blood type had a lower risk of getting the infection compared with non-O blood types (Moslemi *et al.*, 2023; Cheng *et al.*, 2005). A person's blood type indicates what kind of certain antigens cover the surfaces of their blood cells. These

antigens produce certain antibodies to help fight off a pathogen (Svensson *et al.*, 2013). COVID-19 SARS coronavirus (SARS-CoV), anti-A antibodies helped to inhibit the virus; that could be the same mechanism with SARS-CoV-2, helping blood group O individuals to keep out the virus (Ergoren *et al.*, 2023; Guillon *et al.*, 2008; Cheng *et al.*, 2005).

## MODE OF TRANSMISSION

The possible mode of transmission for COVID-19 includes respiratory, contact, droplet, and fomites.

### Respiratory transmission

Coronavirus is a respiratory virus, and as such, the infectious agent is mainly transmitted through respiratory droplets of different sizes (aerosols) through coughing and sneezing that remain suspended in the air when symptomatic people sneeze or cough. Large droplets (which are bigger than about 0.0002 inches, or 5 microns, in size) of virus-laden mucus are the primary mode of transmission, fine particles that can stay suspended in the air for hours and can travel with air currents (WHO, 2020d). It can also occur during medical procedures that generate aerosols (El-Kassas *et al.*, 2023; Han *et al.*, 2023).

### Contact and droplet transmission

COVID-19 can be transmitted directly through infected secretions such as saliva when an infected person coughs, sneezes, talks, or sings. In that situation, viral particles emitted from the respiratory tract of an infected individual land on a surface. Respiratory droplet transmission can also occur when a person is in close contact with an infected person who has respiratory symptoms (e.g. coughing or sneezing) or who is talking or singing; in these circumstances, respiratory droplets that include the virus can reach the mouth, nose or eyes of a susceptible person and can result in infection (Ali *et al.*, 2023; Ong *et al.*, 2020). The virus then sneaks into the body via the mucous membranes, infecting the susceptible person. Indirect contact transmission involving contact of a susceptible host with a contaminated object or surface (fomite transmission) may also be possible (Bahramian *et al.*, 2023; Zhang *et al.*, 2020).

### Fomites transmission

Respiratory secretions or droplets expelled by infected individuals can contaminate surfaces and objects, creating fomites (Gharehchahi *et al.*, 2023). Therefore, transmission may also occur indirectly through touching surfaces in the

immediate environment or objects contaminated with the virus from an infected person, followed by touching the mouth, nose, or eyes (Short *et al.*, 2023; Ong *et al.*, 2020).

## GENERAL PREVENTION OF COVID-19

The following are general methods of prevention and control of COVID-19 infection (BMJ, 2020). People should be recommended to wash their hands often with soap and water for at least 20 seconds or an alcohol-based hand sanitizer (containing at least 60% alcohol), especially after being in public, blowing their nose, or coughing/sneezing (Begum, 2020; Rundle *et al.*, 2020). Unwashed hands should not be used to touch the eyes, nose, or mouth (Jones *et al.*, 2020; Dewangan *et al.*, 2020). Avoid close contact with others (at least 1 meter, including shaking hands, especially those who are sick, have a fever, or are coughing or sneezing (Jamali *et al.*, 2023; Taufik *et al.*, 2022). Avoid travelling to congested areas (Vichiensan *et al.*, 2023; Hara and Yamaguchi, 2021). Use respiratory hygiene such as covering your mouth and nose while coughing or sneezing, disposing of tissues in a closed bin quickly, and washing your hands (Adegbite and Ijah, 2023; Majjama'a *et al.*, 2020). Seek medical attention as soon as possible if they have a fever, cough, or difficulty breathing. In some countries or situations, wearing a mask in public is required (Bogale *et al.*, 2023; Sehatpour *et al.*, 2023; BMJ, 2020).

People going from high-risk areas may be checked using questions regarding their journey, interaction with ill people, signs of infection, and/or temperature testing (Taggart *et al.*, 2022. Zafri *et al.*, 2022) Shielding is a protective method used to safeguard vulnerable persons (including children) who are at extremely high risk of severe sickness from COVID-19 due to an underlying health condition (Cowley *et al.*, 2023; Ward *et al.*, 2022). Shielding entails reducing all encounters between particularly vulnerable persons and other people to protect them from virus contact (Sujarwoto and Maharani, 2022).

## CONCLUSION/ RECOMMENDATION

The synergy of immunization, face mask-wearing, hand washing, social distancing, health promotion and community engagement form a strong framework for preventing COVID-19. The commitment of public health and the adoption of evidence-based preventive measures are fundamental to overcoming the challenges posted by the disease. Government and non governmental organization should incorporate the use of intimate partners, families, social media, emerging technology, prescription therapy, and regulatory changes to stop COVID-19. More action are required to meet the national goal of stopping the COVID-19 epidemic.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

## REFERENCES

- Adair, T. (2023). Premature cardiovascular disease mortality with overweight and obesity as a risk factor: Estimating excess mortality in the United States during the COVID-19 pandemic. *International Journal of Obesity*, 47(4), 273-279.
- Adegbite, S. N., & Ijah, C. N. (2023). Effects of socio-cultural behaviour on COVID-19 protocol among rural dwellers in Rivers State, Nigeria. *KIU Journal of Humanities*, 8(1), 131-139.
- Alafeef, M., & Pan, D. (2022). Diagnostic approaches for COVID-19: lessons learned and the path forward. *ACS nano*, 16(18), 11545-11576.
- Ali, S. A., Pathak, D., & Mandal, S. (2023). A review of current knowledge on airborne transmission of covid-19 and their relationship with environment. *International Journal of Pharma Professional's Research*, 14(1), 1-5.
- Altman, M. (2020). Smart thinking, lockdown and Covid-19: Implications for public policy. *Journal of Behavioral Economics for Policy*, 4(COVID-19 Special Issue), 23-33.
- Bahramian, A. (2023). Influence of indoor environmental conditions on airborne transmission and lifetime of sneeze droplets in a confined space: a way to reduce COVID-19 spread. *Environmental Science and Pollution Research*, 30(15), 44067-44085.
- Barletta, A. M., Marino, G., Spagnolo, B., Bianchi, F. P., Falappone, P. C. F., Sagnolo, L., Gatti P. (2023). Conenzyme Q10+ alpha lipoic acid for chronic COVID-19 syndrome. *Clinical and Experimental Medicine*, 23(3), 667-678.
- Begum, F. (2020). Knowledge, attitudes, and practices towards COVID-19 among B. Sc. Nursing students in selected nursing institutions in Saudi Arabia during COVID-19 outbreak: an online survey. *Saudi Journal of Nursing and Health Care*, 3(7), 194-198.
- BMJ (2020). Corona virus disease 2019 (COVID-19); BMJ best practice. *BMJ Publishing Group Limited* 2020.
- Bogale, K. A., Zeru, T., Tarkegn, M., Balew, M., Worku, M., Asrat, A., Adamu, A., Mulu, Y., Getachew, A., & Ambaw, F. (2023). Awareness and care seeking for long COVID symptoms among Coronavirus disease survivors in Bahir Dar City, Northwest Ethiopia: Phenomenological study. *BMC Public Health*, 23(1), 1-9.
- Bornstein, S. R., Dalan, R., Hopkins, D., Mingrone, G., & Boehm, B. O. (2020). Endocrine and metabolic link to coronavirus infection. *Nature Reviews Endocrinology*, 16(6), 297-298.
- Broniatowski, D. A., Kerchner, D., Farooq, F., Huang, X., Jamison, A. M., Dredze, M., Quinn, S.C., & Ayers, J. W. (2022). Twitter and Facebook posts about COVID-19 are less likely to spread misinformation compared to other health topics. *PLoS One*, 17(1), e0261768.
- Cheng, Y., Cheng, G., Chui, C. H., Lau, F. Y., Chan, P. K., Ng, M. H., Sung, J. J., & Wong, R. S. (2005). ABO blood group and susceptibility to severe acute respiratory syndrome. *JAMA*, 293(12), 1447-1451.
- Chong, Y. P., Choy, K. W., Doerig, C., & Lim, C. X. (2023). SARS-CoV-2 Testing Strategies in the Diagnosis and Management of COVID-19 Patients in Low-Income Countries: A scoping Review. *Molecular Diagnosis & Therapy*, 1-18.
- Cowley, L. E., Hodgson, K., Song, J., Whiffen, T., Tan, J., John, A., Bandyopadhyay, A., & Davies, A. R. (2023). Effects of the COVID-19 pandemic on the mental health of clinically extremely vulnerable children and children living with clinically extremely vulnerable people in Wales: a data linkage study. *BMJ Open*, 13(6), e067882.
- Dauda, K. O. (2023). Religious leaders and COVID-19 guidelines enforcement in rural communities of Nigeria. *Islamic Review: Jurnal Riset dan Kajian Keislaman*, 12(2), 37-60.
- Dewangan, V., Sahu, R., Satapathy, T., & Roy, A. (2020). The Exploring of Current Development status and the unusual Symptoms of coronavirus Pandemic (Covid-19). *Research Journal of Pharmacology and Pharmacodynamics*, 12(4), 172-176.
- El-Kassas, M., Alborai, M., Elbadry, M., El Sheemy, R., Abdellah, M., Afify, S., Madkour, A., Zaghloul, M., Awad, A., Wifi, M. N., & Eltabbakh, M. (2023). Non-pulmonary involvement in COVID-19: A systemic disease rather than a pure respiratory infection. *World Journal of Clinical Cases*, 11(3), 493- 505.
- Ergoren, M. C., Akan, G., Guler, E., Tuncel, G., Akovali, D., Evren, E. U., Suer, H. K., & Sanlidag, T. (2023). Sex and ABO blood differences in SARS-CoV-2 infection susceptibility. *Global Medical Genetics*, 10(01), 22-26.
- European Center for Disease Control (CDC) (2020). COVID-19. European Center for Disease Control.
- Fukushima, T., Chubachi, S., Namkoong, H., Asakura, T., Tanaka, H., Lee, H., Azekawa, S., Okada, Y., Koike, R., Kimura, A., & Japan COVID-19 Task Force. (2023). Clinical significance of prediabetes, undiagnosed diabetes and diagnosed diabetes on critical outcomes in COVID-19: Integrative analysis from the Japan COVID-19 task force. *Diabetes, Obesity and Metabolism*, 25(1), 144-155.
- Gharehchahi, E., Dehghani, F., Rafiee, A., Jamalidoust, M., & Hoseini, M. (2023). Investigating the Presence of SARS-CoV-2 on the Surfaces, Fomites, and in Indoor Air of a Referral COVID-19 Hospital, Shiraz, Iran. *Journal of Health Sciences & Surveillance System*, 11(1 (Supplement)), 241-251.
- Gill, N., Garg, J., & Garg, R. (2023). An exploratory cross-sectional study on public stigma against coronavirus disease 2019 from Punjab. *Indian Journal of Social Psychiatry*, 10, 4103.
- Giri, A. K., & Rana, D. R. (2020). Charting the challenges behind the testing of COVID-19 in developing countries: Nepal as a case study. *Biosafety and Health*, 2(02), 53-56.
- Gonete, T. Z., Asseffa, N. A., Gashu, K. D., Tilahun, B., Angaw, D. A., Jisso, M., amiso, A., Alemayehu, A., Fikre, R., Abdisa, B., & Endehabtu, B. F. (2023). Communicable and non-communicable diseases diagnosis and treatment service availability at primary health care Units during COVID-19 outbreak in Ethiopia. *Ethiopian Journal of Health Sciences*, 33(2), 95-104.
- Guillon, P., Clément, M., Sébille, V., Rivain, J. G., Chou, C. F., Ruvoën-Clouet, N., & Le Pendu, J. (2008). Inhibition of the interaction between the SARS-CoV spike protein and its cellular receptor by anti-histo-blood group antibodies. *Glycobiology*, 18(12), 1085-1093.
- Han, J., He, S., Shao, W., Wang, C., Qiao, L., Zhang, J., & Yang, L. (2023). Municipal solid waste, an overlooked route of transmission for the severe acute respiratory syndrome coronavirus 2: A review. *Environmental Chemistry Letters*,

- 21(1), 81-95.
- Hara, Y., & Yamaguchi, H. (2021). Japanese travel behaviour trends and change under COVID-19 state-of-emergency declaration: Nationwide observation by mobile phone location data. *Transportation Research Interdisciplinary Perspectives*, 9, 100288.
- Hawks, L., Woolhandler, S., & McCormick, D. (2020). COVID-19 in prisons and jails in the United States. *JAMA Internal Medicine*, 180(8), 1041-1042.
- Haybar, H., Kazemnia, K., & Rahim, F. (2020). Underlying chronic disease and COVID-19 infection: a state-of-the-art review. *Jundishapur Journal of Chronic Disease Care*, 9(2), e103452.
- He, X., Chen, X., Wang, H., Du, G., & Sun, X. (2023). Recent advances in respiratory immunization: A focus on COVID-19 vaccines. *Journal of Controlled Release*, 355, 655-674.
- Huang C., Wang Y., Li X., Ren L., Zhao J., HuY., Zhang L., Fan G., Xu J., Gu X., Cheng Z., Yu T., Xia J., Wei Y., Wu W., Xie X., Yin W., Li H., Liu M., Xiao Y., Gao L., Xie J., Wang G., Jiang R., Gao Z., Jiang R., Gao Z., Jin Q., Wang J., & Cao, B. (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The Lancet*, 395(10223), 497-506.
- Jamali, Y. A., Soomro, S., Kumar, A., Soomro, P., Shah, H., Ahmed, S., & Khuhro, A. B. (2023). Knowledge, risk perceptions and preventive behaviors regarding to COVID-19 pandemic in general population of Sindh, Pakistan. *Pakistan Journal of Medical & Health Sciences*, 17(01), 554-554.
- Johns Hopkins University (JHU) (2020). COVID-19 Dashboard by the centre for system science and engineering (CSSE) at Johns Hopkins University (JHU). Retrieved 05 August 2020 from <https://coronavirus.jhu.edu/map.html>.
- Jones, L., Walsh, K., Willcox, M., Morgan, P., & Nichols, J. (2020). The COVID-19 pandemic: Important considerations for contact lens practitioners. *Contact Lens and Anterior Eye*, 43(3), 196-203.
- Khalek, A. A., & Dollah, S. R. (2023). Mosques as Islamic religious spaces during the COVID-19 Pandemic: A discourse on the Malaysian and Bruneian experiences. *International Journal of Islam and Contemporary Affairs*, 3(2), 57-71.
- Khan, M. L., Malik, A., Ruhi, U., & Al-Busaidi, A. (2022). Conflicting attitudes: Analyzing social media data to understand the early discourse on COVID-19 passports. *Technology in Society*, 68, 101830.
- Khunti, K., Feldman, E. L., Laiteerapong, N., Parker, W., Routen, A., & Peek, M. (2023). The impact of the COVID-19 pandemic on ethnic minority groups with diabetes. *Diabetes Care*, 46(2), 228-236.
- Kim, L., Fast, S. M., & Markuzon, N. (2019). Incorporating media data into model of infectious disease transmission. *Plos One*, 14(2), eo197646.
- Klabbers, R. E., Muwonge, T. R., Ajidru, S., Borthakur, S., Mujugira, A., Sharma, M., & O'laughlin, K. N. (2023). Understanding the barriers and facilitators of COVID-19 riskmitigation strategy adoption and COVID-19 vaccination in refugee settlements in Uganda: a qualitative study. *BMC Public Health*, 23, Article number 1401.
- Klein, J. D., Resnick, E. A., Chamberlin, M. E., & Kress, E. A. (2023). Second-hand smoke surveillance and COVID-19: a missed opportunity. *Tobacco Control*, 32(2), 265-266.
- Kolifarhood, G., Aghaali, M., Saadati, H. M., Taherpour, N., Rahimi, S., Izadi, N., & Nazari, S. S. H. (2020). Epidemiological and clinical aspects of COVID-19; a narrative review. *Archives of Academic Emergency Medicine*, 8(1), e41.
- Kousy, R., Joude, J. A., Kraitem, A., Elanam, M. B., Karam, B., Adib, E., Zarka, J., Traboulsi, C., Akl, E. W., & Baddour, K. (2020). Corona virus goes viral: quantifying the covid-19 misinformation Epidemic on Twitter. *Cureus*, 12(3), e7255.
- Lindsay, S., & Petra, D. (2016). Drivers of earlier infectious disease outbreak detection: a systematic literature review, 53, 15-20.
- Maijama'a, R., Musa, K. S., Isah, A. A., & Adamu, S. (2020). Analysis of the impact of coronavirus outbreak on the Nigerian economy. *American Journal of Environmental and Resource Economics*, 5(2), 39-43.
- Malas, E. M., & Malas, H. S. (2023). Evaluation of stigmatization and perception of stigmatization regarding COVID-19 in society. *International Journal of Social Humanities Sciences Research*, 10(94), 831-842.
- Matteo A., Maria C. C., Michele M., Laura M., Alberto C., Stefano D (2020). Covid-19 in people with diabetes: understanding the reason for the worse outcomes. *The Lancet Diabetes and Endocrinology*, 8, 782-792.
- Mboera, L. E., Akipede, G. O., Banerjee, A., Cuevas, L. E., Czypionka, T., Khan, M., Kock, R., McCoy, D., Mmbaga, B.T., Misinz, G., & Urassa, M. (2020). Mitigating lockdown challenges in response to COVID-19 in Sub-Saharan Africa. *International Journal of Infectious Diseases*, 96, 308-310.
- Mockshell, J., & Ritter, T. N. (2023). Applying the six-dimensional food security framework to examine a fresh fruit and vegetable program implemented by self-help groups during the COVID-19 lockdown in India. *World Development*, 175, 106486.
- Moslemi, C., Sækmose, S., Larsen, R., Brodersen, T., Didriksen, M., Hjalgrim, H., Banasik, K., Nielsen, K.R., Bruun, M.T., Dowsett, J., & Pedersen, O. B. (2023). A large cohort study of the effects of Lewis, ABO, 13 other blood groups, and secretor status on COVID-19 susceptibility, severity, and long COVID-19. *Transfusion*, 63(1), 47-58.
- Nche, G. C., Agbo, U. M., & Okwueze, M. I. (2023). Church leader's Interpretation of COVID-19 in Nigeria: Science, Conspiracies, and Spiritualization. *Journal of Religion and Health*, 1-24.
- Nussbaumer-Streit, B., Mayr, V., Dobrescu, A. I., Chapman, A., Persad, E., Klerings, I., Wagner, G., Siebert, U., Ledingger, D., Zachariah, C., & Gartlehner, G. (2020). Quarantine alone or in combination with other public health measures to control COVID-19: a rapid review. *Cochrane Database of Systematic Reviews*, 4, CD13574.
- O'Connor, J., Ludgate, S., Le, Q. V., Le, H. T., & Huynh, P. D. P. (2023). Lessons from the pandemic: Teacher educators' use of digital technologies and pedagogies in Vietnam before, during and after the Covid-19 lockdown. *International Journal of Educational Development*, 103, 102942.
- Olukosi, A. Y., Fowora, M., Adeneye, A. K., Chukwu, E., Aina, O., Ajibaye, O., Salako, B. L. (2023). A Survey of chloroquine use for COVID-19 in Nigeria. *African Health Sciences*, 23(1), 83-92
- Ong, S. W., Tan, Y. K., Chia, P. Y., Lee, T. H., Ng, O. T., & Wong M. S (2020). Surface environmental and personal equipment contamination by severe acute respiratory syndrome corona virus 2 (SARS-Cov-2) from a symptomatic patient. *JAMA*, 323(16), 1610-1612.
- Park, J. E., Jung, S., Kim, A., & Park, J. E. (2018). MERS transmission and risk factors: A systematic review. *BMC Public*

- Health*, 18, Article number 574.
- Patanavanich, R., Siripoon, T., Amponnavarat, S., & Glantz, S. A. (2023). Active smokers are at higher risk of COVID-19 death: a systematic review and meta-analysis. *Nicotine and Tobacco Research*, 25(2), 177-184.
- Pelosi, P., Croci, M., Ravagnan, I., Tredici, S., Pedoto, A., Lissoni, A., & Gattinoni, L. (1998). The effects of body mass on lung volumes, respiratory mechanics, and gas exchange during general anesthesia. *Anesthesia & Analgesia*, 87(3), 654-660.
- Pradana, F. K., Sriatmi, A., & Kartini, A. (2022). The CIPP Model of stunting management program during Covid-19 pandemic in Semarang City, Jurnal Gizi Indonesia. *The Indonesian Journal of Nutrition*, 10(2), 150-160.
- Rundle, C. W., Presley, C. L., Militello, M., Barber, C., Powell, D. L., Jacob, S. E., Atwater, A.R., Watsky, K. L., Yu, J., & Dunnick, C. A. (2020). Hand hygiene during COVID-19: recommendations from the American Contact Dermatitis Society. *Journal of the American Academy of Dermatology*, 83(6), 1730-1737.
- Salehi, S., Abedi, A., Balakrishnan, S., Gholamrezanezhad, A. (2020). Corona virus disease (COVID-19): A systematic review of imaging findings in 919 covid-19 patients. *American Journal of Roentgenology*, 215(1), 87-93.
- Schachter, L. M., Salome, C. M., & Peat, J. K. (2001). Obesity risk of asthma and wheeze but not airways hyper-responsiveness. *Thorax*, 56(1), 4-8.
- Sehatpour, A., Jahanbin, M., Fatemi, A., Parviz, N., & Sajedi, S. M. (2023). systematic investigation of dental, heart and lung diseases in patients with covid-19 and hospitalized in ICU based on radiology stereotypes. *Journal of Pharmaceutical Negative Results*, 4(2), 2717-2733.
- Shi, Q., Zhang, X., & Jiang, F. (2020). Clinical characteristics and risk factors for mortality of covid-19 patients with diabetes in Wuhan, China: a two centre, retrospective study. *Diabetes Care*, 43, 1382-1391.
- Short, K. R., & Cowling, B. J. (2023). Assessing the potential for fomite transmission of SARS-CoV-2. *The Lancet Microbe*, 4(6), e380-e381.
- Sin, D. D., Jones, R. L., & Man, S. P. (2002). Obesity is a risk factor for dyspnea but not for airflow obstruction. *Archives of Internal Medicine*, 162(13), 1477-1481.
- Spruijt, I., Cronin, A., Udeorji, F., Nazir, M., Shehu, S., Poix, S., Villanueva, A., Jansen, N., Huitema, I., Suurmond, J., & Fiekert, K. (2023). Respected but stigmatized: Healthcare workers caring for COVID-19 patients. *Plos One*, 18(7), e0288609.
- Subramaniam, P., & Usha, P. (2011). Aging and immune function: molecular mechanism to intervention. *Antioxidant and Redox Signalling*, 14(8), 1551-1585.
- Sujarwoto, S., & Maharani, A. (2022). Sociodemographic characteristics and health access associated with COVID-19 infection and death: a cross-sectional study in Malang District, Indonesia. *BMJ Open*, 12(5), e052042.
- Sule, S., DaCosta, M. C., DeCou, E., Gilson, C., Wallace, K., & Goff, S. L. (2023). Communication of COVID-19 misinformation on social media by physicians in the US. *JAMA Network Open*, 6(8), e2328928-e2328928.
- Susanna, F., Jenny, A. H., Paul, S. M., & Christian, M. (2020). Covid-19: Immunology and treatment options. *Clinical Immunology*, 215, 108448.
- Svensson, L., Hult, A. K., Stamps, R., Angstrom, J., Teneberg, S., Storry, J. R., Jorgensen, R., Rydberg, L., Henry, S. M., Olsson, M. L. (2013). Forssman expression on human erythrocytes: biochemical and genetic evidence of a new histo-blood group system. *Blood*, 121, 1459-1468.
- Taggart, L., Mulhall, P., Kelly, R., Trip, H., Sullivan, B., & Wallén, E. F. (2022). Preventing, mitigating, and managing future pandemics for people with an intellectual and developmental disability-Learnings from COVID-19: A scoping review. *Journal of Policy and Practice in Intellectual Disabilities*, 19(1), 4-34.
- Tasnim, S., Hossain, M. M., & Mazumder, H. (2020). Impact of rumors and misinformation on COVID-19 in social media. *Journal of Preventive Medicine and Public Health*, 53(3), 171-174.
- Taufik, A., Harahap, S., Siregar, K. W., Hasibuan, Y. A., Hasibuan, N. F., & Siregar, Y. H. (2022). Prevention behavior of COVID-19 transmission in productive age. *Contagion: Scientific Periodical Journal of Public Health and Coastal Health*, 4(2), 87-99.
- Tong, L., Khani, M., Lu, Q., Taylor, B., Osinski, K., & Luo, J. (2023). Association between body-mass index, patient characteristics, and obesity-related comorbidities among COVID-19 patients: A prospective cohort study. *Obesity Research & Clinical Practice*, 17(1), 47-57.
- Tonnesen, P., Marott, J. L., Nordestgaard, B., Bojesen, S. E., & Lange, P. (2019). Secular trends in smoking in relation to prevalent and incident smoking-related disease: A prospective population-based study. *Tobacco Induced Diseases*, 1-8.
- Torales, J., O'Higgins, M., Castaldelli-Maia, J. M., & Ventriglio, A. (2020). The outbreak of COVID-19 coronavirus and its impact on global mental health. *International Journal of Social Psychiatry*, 66(4), 317-320.
- Vichiensan, V., Hayashi, Y., & Kamnerdsap, S. (2023). Passengers' perception of COVID-19 countermeasures on urban railway in Bangkok. In: *Transportation amid pandemics* (pp. 293-307). Elsevier.
- Vogel, G. (2020). New blood tests for antibodies could show true scale of coronavirus pandemic. World Health Organisation. Retrieved from <https://pesquisa.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/resource/pt/covidwho-9938>.
- Ward, J. L., Harwood, R., Smith, C., Kenny, S., Clark, M., Davis, P. J., Draper, E.S., Hargreaves, D., Ladhani, S., Linney, M., & Viner, R. M. (2022). Risk factors for PICU admission and death among children and young people hospitalized with COVID-19 and PIMS-TS in England during the first pandemic year. *Nature Medicine*, 28(1), 193-200.
- WHO (2020a). Best practices for infection prevention and control, with a spotlight on covid-19: countries share experiences. World Health Organization, Europe. Retrieved 16 June, 2020 from [https://www.who.int/publications/i/item/WHO-2019-nCoV-policy\\_brief-IPC-2020](https://www.who.int/publications/i/item/WHO-2019-nCoV-policy_brief-IPC-2020).
- WHO (2020b). Global atlas of medical devices technical series. 2017. Retrieved 5th August, 2020 from <http://apps.who.int/bookorders>.
- WHO (2020c). Practical considerations and recommendations for religious leaders and faith based communities in the context of covid-19.
- WHO (2020d). World Health Organization report of the WHO-China Joint Mission on Coronavirus Disease 2019 (covid-19).
- WHO (2023). World Health Organization fact sheet on covid 19. Retrieved December, 2023. [who.int/news-room/fact-sheet/detail/coronavirus-diseases-\(covid-19\)](http://who.int/news-room/fact-sheet/detail/coronavirus-diseases-(covid-19)).
- Wolkewitz, M., & Schumacher, M. (2017). Survival biases lead to flawed conclusions in observational treatment studies of

- influenza patients. *Journal of clinical Epidemiology*, 84,121-129.
- Xiong, T. Y., Redwood, S., Prendergast, B., & Chen, M. (2020). Corona virus and the cardiovascular system: acute and long term implication. *European Heart Journal*, 14(19), 1798-1800.
- Zafri, N. M., Khan, A., Jamal, S., & Alam, B. M. (2022). Risk perceptions of COVID-19 transmission in different travel modes. *Transportation Research Interdisciplinary Perspectives*, 13, 100548.
- Zhang, J. J., Dong, X., Liu, G. H., & Gao, Y. D. (2023). Risk and protective factors for COVID-19 morbidity, severity, and mortality. *Clinical Reviews in Allergy & Immunology*, 64(1), 90-107.
- Zhang, V., Fisher, M., Hou, W., Zhang, L., & Duong, T. Q. (2023a). Incidence of new-onset hypertension post-COVID-19: comparison with influenza. *Hypertension*, 80(10), 2135-2148.
- Zhang, Z., Zhang, L., & Wang, Y. (2020b). COVID-19 indirect contact transmission through the oral mucosa must not be ignored. *Journal of Oral Pathology & Medicine*, 49(5), 450-451.
- Zsichla, L., & Müller, V. (2023). Risk factors of severe COVID-19: A review of host, viral and environmental factors. *Viruses*, 15, 175.