

Efficacy of Primary Prevention in the COVID-19 Pandemic

ABSTRACT

Background: The COVID-19 treatment protocol has consistently been under modification since its inception, from the omission of drugs once considered lifesavers such as hydroxychloroquine to the addition of newer medications e.g.: remdesivir. In such situations, it is crucial that we reinforce the importance of primary prevention, especially in low-income countries, where issues exist of shortage of resources such as oxygen and ventilators. We demonstrate how primary prevention holds good against the emergence of new variants, and future pandemics.

Discussion: Articles predating and postdating the COVID-19 pandemic were analysed. The articles predating the pandemic included those relating to primary preventive methods used during the H1N1 pandemic of 2009, and articles postdating the pandemic included studies which demonstrate higher mortality of COVID-19 in smokers shed light on the importance of primary prevention, and demonstrate how primary prevention and good health education could have saved countless lives.

Conclusion: It is essential that Primary prevention be employed, not only in the case of chronic lifestyle conditions such as hypertension and diabetes mellitus but also in the cases of pandemics, where prevention before the chain of infection starts can prove to be lifesaving. As healthcare providers, the responsibility lies with us to emphasize on the importance of primary prevention and comprehensively propagate information.

and propagate information in a comprehensive manner.

Keywords : COVID-19, Primary prevention, Health education, pandemic, Mask usage, Ventilation

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Introduction

The COVID-19 pandemic, caused by SARS-CoV-2, the most recently identified strain of the coronavirus, had its index case reported in Wuhan, China, in December 2019.^[1] Symptoms of SARS-CoV-2 range from mild discomfort, to more grievous symptoms such as breathing difficulties, cough, fatigue, fever, loss of taste and smell.^[2] The pathophysiology behind breathing difficulties has been identified as being due to Acute Respiratory Distress Syndrome (ARDS), caused by a multitude of cascading factors such as cytokine storm and hypercoagulability leading to multiple organ failure and septic shock.^[3] The spread of the virus is mainly through airborne routes, aerosol spread, and less often due to fomites.

Primary prevention : A definition

Primary prevention refers to the act of intervening before health effects occur,^[4] through measures such as vaccinations, altering risky behaviours (poor eating habits, tobacco use), and banning substances known to be associated with a disease or health condition. Primary prevention has recently gained much traction in healthcare. In terms of chronic conditions such as Diabetes mellitus, and hypertension, primary and primordial prevention, not only help us identifying those at risk of these chronic conditions, and implement changes to one's lifestyle, such as increased physical exercise, and changes to a diet with lower glycaemic index, but such measures also help us to eliminate the occurrence of dire complications of such chronic lifestyle diseases, such as diabetic ulcers, strokes, nephropathies and retinopathies to name a few. The World Health Organisation, in January 2020, after confirming the spread of SARS-CoV-2 via human-to-human contact, released an advisory document relating to measures of primary prevention, to help curb the spread of the Coronavirus. These included measures such as wearing masks, hand hygiene, social distancing,

and etiquette regarding coughing and sneezing.^[6]

Methods of Primary Prevention

While the role of primary prevention in terms of chronic conditions has been well established, the emergence of the COVID-19 pandemic demonstrated that primary prevention in terms of an acute outbreak, such as a pandemic, is not as well implemented in many countries as we would expect. The following points based on published studies highlight the importance of primary prevention.^[7] Vaccination is an important pillar of primary prevention. In recent months we have seen the advent of several vaccines to protect against SARS-CoV-2. Vaccination protects populations by stopping the chain of infection, and preventing transmission and adverse health effects. The importance of vaccination can be seen on a global scale in the case of Israel, whose government started an aggressive national program in December 2020, to vaccinate patients above the age of 70, healthcare workers, and patients with chronic medical conditions. Prior to the start of the program, a daily average of 84 Covid-positive patients above the age of 70 were started on mechanical ventilation as compared to a daily average of 15 Covid-positive patients under the age of 50, which is a ratio of about 6:1. However, three months after the start of the program, this ratio dropped to 2:1.^[8] However, this model is an ideal one and is very difficult in countries where there are large populations and shortage of resources. The inequality in vaccine distribution also makes this a difficult model to execute. Hence it is necessary to look at other viable methods of primary prevention.

Hand hygiene in the form of washing hands and using sanitizers was one of the first line defences that announced to the general public to fight the Coronavirus infection. Even prior to the advent of the COVID-19 pandemic, studies confirmed the efficacy of washing hands with soap and

using ethanol-based sanitizers against enveloped viruses with a lipid bilayer. Diligent washing and hand sanitizing was proven to reduce infections by 20%-95%. In addition to this, a 95% ethanol-based rub was shown to reduce the influenza virus to undetectable levels after 30 seconds of use.^[9]^[10] To demonstrate the importance of hand hygiene, researchers from the University of Birmingham, used data regarding hand washing culture, obtained from surveys carried out by BVA France Sarl, Worldwide Independent Network of Market Research and GALLUP International from 63 countries. It was noted that at least 50% of the population did not practice hand hygiene in countries such as China, Japan, South Korea and the Netherlands.^[11] Researchers used this data and obtained a strong correlation between exposure to the SARS-CoV-2 and handwashing culture. This correlation can be clearly evidenced in the worst hit countries of the COVID-19 Pandemic. According to the survey, the percentage of people who do not practice regular handwashing is 23% in the USA, whereas 40% of the population did not practice adequate hand hygiene in India, followed by 27% of the population in Brazil. France, which is currently the 4th worst hit nation in terms of active cases^[12], showed a percentage of 38% of individuals who did not practice regular hand hygiene.

There is also emphasis placed upon the importance of good ventilation in hospitals and homes. Qian et al.^[13] in their study of 318 Coronavirus outbreaks with at least three or more transmissions, noticed that transmission of the virus occurred in indoor spaces, in all of the 318 cases except for one, demonstrating a strong relationship between COVID-19 spread and poor ventilation in indoor spaces. In addition to this, Park et al.^[14]—studied the spread of Coronavirus, in an eleventh-floor call centre, in South Korea. It was observed that 43.5% of the staff was found to be infected, however, the percentage of secondary infections of the household members of the infected staff members was only found to be 16.2%, implying an increase in spread of SARS-CoV-2, with decreased ventilation in crowded workspaces.

The concept of ventilation used in the battle against respiratory illnesses is not new. One of the very important risk factors for Tuberculosis, is living spaces with decreased amounts of ventilation. Cross ventilation has been an effective and inexpensive method in dealing with patients of respiratory illnesses such as Tuberculosis. Equipment such as High-efficiency particulate air (HEPA) filters, typically costing \$100, work in most homes, and can remove nearly 98% of particles $\geq 0.3 \mu\text{m}$.^[15] Such filters can help to eliminate biological aerosols ranging in size from 0.5 to 3 microns. A more affordable solution, such as facing a fan outside the window, in rooms with influenza patients, was also found to be effective, creating a negative pressure, and thereby transporting the air from the room towards the outside, a principle that is being increasingly used in infective disease wards, for respiratory conditions, in the UK.

There has been an influx of modern technological appliances that offer promise in dealing with SARS-CoV-2. An example of such devices used in the past is the usage of UV lights against the influenza virus. A hospital study on Influenza A (H5N1) found 2% and 19% rates of influenza in 2 similar buildings with and without UV lights. The effectiveness doubles when there is a continuous source of cold air at the ceiling, which sinks as warmer air rises and thus increases air circulation, and hence creates greater exposure to the UV light. A ceiling fan can help facilitate this.^[16] These previously used successful models have paved the way for more evidence based studies that may help to prove the success of UV lights irradiation to combat the COVID-19 pandemic.

An in vitro experiment conducted to study the effects of Deep UV irradiation on SARS-CoV-2 infected cells has yielded positive results.^[17] SARS-CoV-2 was isolated from a patient who contracted COVID-19 aboard the Diamond Princess cruise ship in Japan. The virus, was then propagated in vero cells, and stock cultures were obtained which were then subject to Deep UV irradiation for a short period of time. Marked cytopathic effects were observed in the irradiated cells, with infectious titre reduction rate of 84.7% in cells irradiated for 1s, and 99% in cells irradiated for 10 s.^[17] Such studies can help develop technologies that could be indispensable to hospital environments as well as for large scale disinfection and sterilisation.

A model to demonstrate the efficacy of mask-usage

In July 2020, the director of the CDC, Robert Redfield claimed that if everyone in the United States wore a mask, they could drastically reduce infection rates in 4-8 weeks^[18]. While some saw this claim as mainly conjecture, A computer scientist by the name of De Kai, from UC Berkeley decided to test the theory by developing a computer-based simulation that helps to compare infection rates between populations that largely wore masks, and populations that had reduced mask usage. The simulator by the name of Masksim™ takes sophisticated programming used by epidemiologists to track outbreaks and pathogens like COVID-19, Ebola, and SARS, and integrates this with other models that are used in artificial intelligence to take into account the role of chance and unpredictability.^[19] According to the simulator, If 80% of a closed population were to don a mask, COVID-19 infection rates would statistically drop to approximately one twelfth the number of infections, implying the strong relationship between adequate mask usage and a drop in COVID-19 infections.

Conclusion

The fact that such information is available to us, which could help curb the rise of coronavirus cases, not only amongst the general public but also among healthcare workers in hospitals, leads one to the conclusion that an important pillar of primary prevention is also health education and health promotion. The ongoing pandemic will always be known as one that was plagued by disinformation at all levels. Confusion regarding mask usage, and the types of masks to be used was rampant. In some cases, disinformation led to worse consequences. Some examples are that of self-medication with various unlicensed drugs, improper usage of masks, and misinformation regarding vaccines. Such examples lead us to believe that health information, and its responsible propagation to

the masses should be the cornerstone of primary prevention.

As healthcare providers the onus lies on us to propagate information in correct and comprehensible terms. Health education is of the utmost importance since simple measures at the most basic of levels may help to dictate the outcome of a COVID-19 infection. Advice given to the public regarding mask usage, hand sanitization, and social distancing may seem very elementary but are indeed the greatest of defences against SARS-CoV-2. Advice to stop smoking is also of paramount importance, since smoking affects ACE-2 expression and is considered a risk factor since ACE-2 receptors have been reported as being a route of entry for the virus. Further, Smoking is also an independent risk factor for the development of pneumonia that may affect the outcome of COVID-19 on the respiratory system.^[20] Advice regarding caloric intake and weight management is also of the utmost importance. Decreased immune responses against Influenza and decreased immunogenicity of the Influenza vaccine has been in obese patients.^[21] Obesity is also a risk factor for increased mortality in COVID-19 cases. In the present clinical scenario, where treatment protocol change rapidly, primary prevention is important to prevent transmission and resulting mortality and morbidity. The model of primary prevention must be employed when dealing with outbreaks with a timeline more rapid than those of chronic conditions. The implementation of such a model is of utmost importance, since it is imperative that we must be prepared to deal with such a situation in the future, with the age-old adage in mind - Prevention is always better than cure.

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