



Review Article

Right food, exercise, and yoga: Prophylactic therapy to fight against COVID-19

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ABSTRACT

The coronavirus pandemic crisis has affected millions of people and taken millions of lives. The current coronavirus strain is possibly originated in bats and pangolins. The first human transmission occurred in Wuhan, China. The virus has since spread mainly through person-to-person contact. It affects the person with old age or the person suffering from any other chronic diseases and had low immune power whereas the individual of young group age as well as with high immunity and had no participation in habits such as drinking alcohol and smoking reduces the risk of COVID-19 infection. The exact pathogenesis and targeted drug treatment of the disease are still unexplored. Through this review, we had attempted to put forward some of the protective measures to boost up immunity and to fight against the current COVID-19 pandemic crisis. A healthy lifestyle that includes a proper diet including foods containing antioxidants, foods having natural antiviral properties, zinc-containing foods, and probiotics help to boost immunity. Yoga and exercises including Surya Namaskar and other Pranayam make us healthy and improves immune power to fight with COVID-19 infection in the era of the corona crisis as well as various bacterial and viral infections.

Keywords: COVID-19, immunity, food, yoga, pranayam, healthy lifestyle

INTRODUCTION

Today millions of people were affected by the novel coronavirus disease (COVID-19) or Severe acute respiratory syndrome – corona virus (SARS-CoV), and maybe the number gets multiplies if not cured or prevented. In today date, it is a major public health issue.^[1] The disease is highly contagious and the eyes, nose, and mouth are the key entry portals of COVID-19 droplets. Before the eventual strike in the lungs, the virus gains entry to the area of the throat and stays on for a few hours. The virus' fatty acid coat clings to moisten mucous layers, which help the virus to enter the cells through binding to the specific cell receptors.^[2] The individuals with some pre-existing health issues such as diabetes, cardiovascular diseases, hypertension, and respiratory disorders as well the old age person as the immunity gets decline in the old age, are at the greater risk of developing COVID-19 complications.

COVID-19 can result in a minor infection in the younger age group with no underlying diseases and strong immunity.^[3-5]

The common symptoms produce at the onset of the disease are fever, cough, muscle pain, and fatigue. Other less common symptoms include sputum production, headache, hemoptysis, and diarrhea. Some patients also developed dyspnoea and lymphopenia. Patients had abnormal findings on chest CT scans that had pneumonia. The severe complications of the illness include RNAemia syndrome with acute respiratory failure, acute cardiac injury, and secondary infection. Around 36% of the patients had to be admitted to the intensive care unit (ICU) out of which approximately 15% of patients die.^[6-9]

The COVID-19 outbreaks are on such a critical peak but conventional medicine is not able to cope up with such a danger. There are currently too little prophylactic measures, and preferred choices to cure the disaster. No pharmaceutical drugs therapy yet had been proven to be safe and effective against the COVID-19 crisis. The option available now is only hydroxychloroquine (HCQ) which is yet under

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investigation process.^[10,11] During this crisis and a global search for successful prevention and treatment steps, the prophylactic and therapeutic potential of convention and complementary medicinal systems such as Ayurveda is not being considered.

Right food, exercise, and yoga may help to boost up the immunity and help to fight against the COVID-19 crisis and other several infections. A healthy lifestyle includes healthy food such as low-carb diet and dietary intake of essential foods with antioxidant properties such as turmeric and vitamins, natural antiviral herbs such as tulsi, neem, star anise, garlic and ginger, probiotics such as yogurt and zinc supplements.^[12] Yoga practices including Surya Namaskar, Bhastrika, Ujjayi, Anulom-Vilom, and Kapalbhata boost up the immune system as well as improve overall body functioning [Figure 1].^[13-15]

In this review, we have tried to emphasize the knowledge and practice of various foods and yoga which could be used efficiently for COVID-19 prophylaxis and adjuvant therapy.

Corona viruses

Coronaviruses belong to the genus of the *Coronaviridae* family and are viruses that are enveloped with a broad plus-strand RNA genome.^[16] The coronaviruses are widely distributed within humans and other mammals, and birds and can cause a diversity of serious health issues such as respiratory tract diseases, gastroenteritis, and neurological illness.^[17-19] Six species of coronavirus are identified to cause human diseases.^[20] Out of these six, four species of coronavirus that are- 229E, OC43, NL63, and HKU1 are widespread in immunocompetent individuals and usually produce common cold-like symptoms.^[20] The two other species of coronavirus- Severe acute respiratory syndrome – coronavirus (SARS- CoV) and the Middle East respiratory syndrome corona virus (MERS-CoV) are zoonotic in nature and have often been related to fatal disease.^[21] The SARS-CoV is recently identified to cause life-threatening pneumonia and is a major pathogenic human coronavirus known to date.^[22,23] SARS-CoV probably exists in an

animal reservoir and the human outbreak has recently been triggered by zoonotic transmission [Figure 2].^[24,25]

The effectual immune response of the host, including innate and adaptive immunity to SARS-CoV, seems critical for controlling and resolving viral infection.^[26] SARS-CoV was reported to occur more frequently in older men with comorbidities, who have weakened immune functions.^[4,5] The pathophysiology of COVID-19 exceptionally high pathogenicity is not yet completely understood, but the studies had been shown that the proinflammatory cytokines levels got elevated in serum and were associated with pulmonary inflammation and immeasurable damage to the lungs.^[27,28]

Till now the exact pathogenesis and the treatment therapy of SARS-CoV are uncertain, but the patient appears to have slighter lymphocyte levels, high leukocyte numbers, and the neutrophil-lymphocyte ratio (NLR), as well as lower monocyte, eosinophil, and basophil levels. Most severe patients showed high levels of biomarkers and inflammatory cytokines associated with the infection. The numbers of T-cells diminish dramatically, and in extreme cases became more affected. In patients with COVID-19, both helper T (Th) cells and suppressor T cells were below normal levels, with lower levels of Th cells in the extreme category. In extreme cases, the proportion of naïve Th cells increased, and memory Th cells decreased. COVID-19 patients also have lower levels of regulatory T-cells, which are more apparently reduced in severe cases.^[28]

Foods (ingredients) to increases immunity

Individuals with “below normal” immunity are more prone to COVID-19 infection and show evidence of higher morbidity and mortality. Individual diet or nutrient status plays a significant role in building immune response. Under-nutrition affects the immune system and suppresses the immune response that is necessary for host defense. Inadequate intake of energy and macronutrients and scarcity of micronutrients may cause under-nutrition that leads to mutilation of the immune function and can worst corona crisis.^[29] An optimal nutritious diet maintains the immune system of the body and helps the body to safeguard from COVID-19 infection. Some of the foods that are necessary to boost up immunity are listed below:

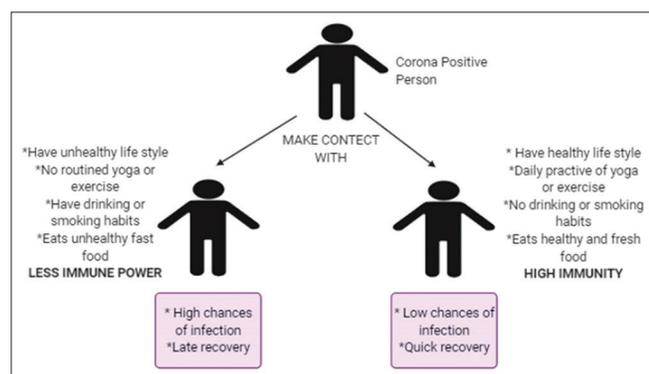


Figure 1: The figure represents the impact of immune power on the spread of COVID-19 infection. One COVID positive person contacts with the other persons, the one with an unhealthy lifestyle, no yoga or exercise routine, have drinking and smoking habit have low immune power hence more chances of acquiring infection and late recovery of infection, and there is another person with a healthy lifestyle, daily yoga and exercise routine, and no smoking and drinking habits have high immune power hence fewer chances of acquiring infection and faster recovery. (Figure is drawn with the help of biorender software)

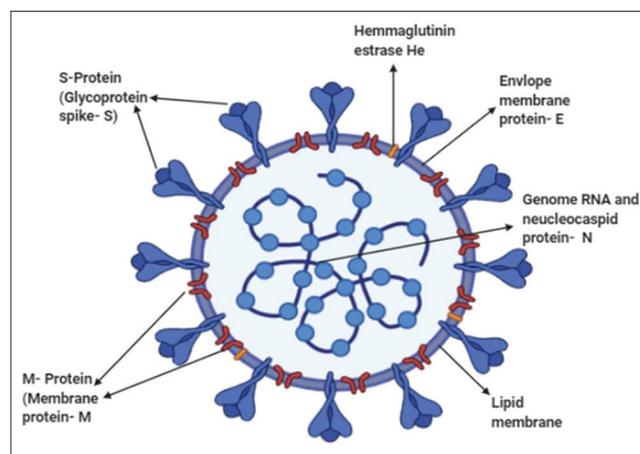


Figure 2: The figure represents the structure of corona virus (Figure is drawn with the help of biorender software)

1. *Curcuma longa* (Turmeric) - Turmeric is a species native to India and belongs to the Zingiberaceae family.^[30] It is used as a spice in India and has anti-inflammatory, anti-oxidant, anti-tumor, and antiviral properties,^[31-33] hence is a strong immunity booster. For centuries, the medicinal properties of turmeric have been known. Curcumin is the active compound of turmeric known for its medicinal properties but the mechanism of action of curcumin is still not entirely underestimated. Researchers found in a study that the mean serum IL-1 β and the vascular endothelial growth factor of the inflammatory cytokines were drastically reduced by using curcumin therapy. In the challenge of corona crisis, where the cytokine storm worsens patients rather than the replication of the virus, this curcumin therapy is assumed to be meaningful.^[30,31,34]
 2. *Allium sativum* (Garlic) and *Allium cepa* (Onion) – Garlic and onion are sulfur-containing compounds and has antioxidant, cardioprotective, anti-inflammatory, anti-microbial, and anti-tumor properties.^[35,36] The sulfur-containing compounds in them, scavenge oxidizing agents, hinder fatty acid oxidation, thus inhibiting the development of pro-inflammatory mediators, and prevent bacterial growth by association with enzyme-containing sulfur.^[35,37,38]
 3. *Zingiber officinale* (Ginger) - Ginger and its derivatives are utilized to improve immune system function. Ginger extract has anti-inflammatory, anti-tumor, and digestive properties.^[39] Ginger exhibits antioxidant properties, and there are around 50 antioxidant structures isolated from ginger rhizomes.^[40] In a test on the human respiratory tract cell line, fresh ginger (but not dried one), was shown to have anti-viral activity against the human respiratory syncytial virus,^[41] so because of all the above properties of ginger if we add ginger in our diet can improve the digestive system of the body.
 4. *Tinospora cordifolia* (Giloy or Guduchi) - Giloy is the herbaceous vine that belongs to the Menispermaceae family and is native to India. It is widely used in the Ayurvedic system of medicine for the treatment of diabetes, jaundice, fever, skin disease, etc.^[42] It is also used as an immunomodulatory agent.^[43] The study had shown that Giloy can boost-up immunity in children and has been taken as an adjuvant therapy to vaccination.^[44] The cordifolioside A and syringing are the active component of *Tinospora cordifolia* which are reported to hold immunomodulatory properties.^[45] Due to its anti-pyretic and immunomodulatory property, it can be used as a prophylactic to COVID-19 infection.
 5. Sunlight (Vitamin D) - Vitamin D is one of the fat-soluble vitamins. It is naturally found in very fewer foods. Its main source if intake is sunlight. Its synthesis is triggered in the body when ultraviolet rays of sunlight smack the human skin. The actual vitamin D obtained from any source like sun exposure, food, and other supplement is inert biologically and has to be activated by two hydroxylation processes in the body. The first hydroxylation process is performed in the liver where vitamin D is converted to 25-hydroxyvitamin D [25(OH)D], which has also called calcidiol and the second hydroxylation process occurs in the kidney and forms 1,25-dihydroxyvitamin D [1,25(OH)₂D], which is known as calcitriol, which is physiologically active.^[46]
- A recent study by Alipio (2020), suggested that a rise in serum level of 25(OH)D in the body, either improve clinical outcomes or lessen the worst outcomes, though, a decline in the serum level of 25(OH)D in the body, exacerbate the clinical outcomes of patients suffering from COVID-19 infection. Supplementation with Vitamin D may potentially enhance clinical results in patients with COVID-19 infections.^[47]
6. *Camellia sinensis* (Green tea) - From decade's green tea has been utilizing as a daily beverage. Its active component is catechins (polyphenol), which are of seven forms out of which epigallocatechingallate (EGCG) has several biological activities.^[48] Green tea has been reported to have anti-oxidant, anti-inflammatory,^[49,50] and immunomodulatory action.^[51] The constituents of green tea shown to inhibit viral infection by blocking the important enzymes in reproductive replication.^[52] All this above knowledge can suggest that green tea can be taken in the corona crisis as a health drink.
 7. Vegetables and fruits - Vegetables such as broccoli, spinach, and other cruciferous vegetables and fruits like strawberry, kiwi, papaya, and all citrus fruits are demonstrated to improve the immune system of the body.^[53-55] Fruits and vegetables are the most common and rich sources of ranges of nutrients which include vitamins, trace minerals, dietary fibers, and a lot of other types of biologically active compounds.^[53] Broccoli has antioxidant power and is a rich source of vitamins A, C, and E. The chemical sulforaphane present in broccoli has antioxidant and antiviral properties against the influenza virus so this can be used to combat the COVID-19 infection.^[34,56] Spinach is rich a source of vitamin A as it has beta-carotene; it increases the cells in the body that fight disease. It also has antioxidant power and is a rich source of vitamin C and other essential nutrients such as flavonoids and carotenoids which assist the body to the proper functioning of the immune system.^[57-59] Mushroom protects the body against respiratory disease and is a rich source of Vitamin D. Vitamin D supplement in diet can reduce the chances of infections of the respiratory tract by diminishing the manufacturing of inflammatory mediators in the body.^[60,61] Citrus fruits or foods containing vitamin C - Citrus fruits such as *Emblica officinalis* (Amla), *Citrus limon* (Lemon), *Citrus sinensis* (Orange), *Citrus maxima* (Pomelo), *Fragaria ananassa* (strawberry), and *Actinidia deliciosa* (kiwi) are the rich and one the best natural source of vitamin C.^[34] Vitamin C is a powerful antioxidant that safeguards the body against oxidative damage which can be caused by a serious infection, sepsis, and acute respiratory disease syndrome. Intravenous injection of a high dose of vitamin C therapy revealed to improve the symptoms of COVID-19 in patients.^[3,12] It is a vital factor in cell death, which helps to maintain the immune system by leaving cells out and replacing them with new cells. Vitamin C therapy lessens the interval of the severity of infection in the upper respiratory tract that includes common cold and damage caused by free radicals, hence reduces the symptoms of COVID-19 infection.^[62,63]
 8. Seeds and nuts - Most of the nuts and seeds like almond, peanuts, groundnuts, walnuts, and sunflower seeds have an enormous amount of vitamin E. Vitamin E is a lipid-soluble antioxidant widely exist in the cell membrane of cell cells including immune

cells.^[64] Almond is a rich source of magnesium, fiber, and protein which maintain the health of the body and magnesium helps to make our immune system stronger.^[65]

Sunflower seeds are an incredible source of phosphorus, magnesium, iron, calcium, copper, selenium, and Vitamin E capable of boosting the immune system of the body by combating the free radicals which can destruct the cells.^[66]

9. Yogurt - Probiotics are live microorganisms if taken in appropriate quantity awards health benefits to the host.^[67] Yogurt is a natural probiotic that assist the production of beneficial bacteria in the body. It also stimulates the immune system of the body hence can be included in the diet during the corona crisis.^[68]
10. Zinc-containing foods - Zinc is the organism's most significant trace element. Its major biological functions in the body are catalyst, regulatory, and structural ion. Zinc has a crucial role in the maintenance of the body's homeostasis, immune system, oxidative stress, aging, and apoptosis.^[69] Zinc is an important element to white blood cells, which are responsible to fight against infection. Its scarcity in the body can make the body more vulnerable to infections such as cold, flu, and other viral infections. Hence, the administration of zinc supplements is desirable to boost up immunity and fight against corona infection.^[3] Zinc-containing foods are cashews, pumpkin seeds, chickpeas, etc.^[12]

Many plants such as neem, tulsi, star anise, and other ayurvedic preparations are also used to boost up immunity and to fight against viral and other bacterial diseases.

Yoga to increase immunity and for a healthy body

Yoga asana and meditation practice grant natural care to the immune system of the body. Yoga practice liberates the immune system of the body from compromising by reducing the stress hormone in the body. Yoga asana also conditioned the lungs and respiratory tract and activates the lymphatic system that removes toxins from the body and makes sure that the organs of the body function optimally.^[15] The poor condition of mental health due to stress and depression is reported to raise the chances of acute respiratory infection.^[70]

This present scenario of the corona pandemic not only harms the physical health of the public but also affects mental health in many ways. Corona crisis produces socioeconomic and physiological insinuation. The rapid rise of the corona pandemic disturbs the life of the people due to lockdown and quarantine issues this increases the fear, anxiety, and depression in people. Factors that predispose including staying far away from family, solitude, fake rumors, misinformation on social media, monetary uncertainty, and stigmatization.^[71]

Research shows that regular yoga, pranayam, and meditation practice for around 20 min raises the level of "feel-good" chemical. i.e., endorphins in the body, and lowers the level of "stress hormone" i.e., cortisol. Stress is one of the chief killers of immunity.^[15] Stress dulls the mind and senses and deteriorates the condition of the person.^[72] Yoga practice pilot to the positive state of mind, encourage better health and develop immunity.^[73,74] The modern exercises

reinforce the muscles while the yoga-pranayam is the tool to strengthen the immune system. Practicing yoga-pranayam on a daily routine helps to fight with diseases, not only the diseases caused by a viral infection such as cold, cough, fever, and other diseases but also other bacterial diseases. To boost up the immunity and to cop-up with corona related one must have to perform the following yoga every day:

1. Surya Namaskar - Surya Namaskar is 'greeting to the god sun'. Surya Namaskar is a part of traditional Indian yogic practices. Twelve 'asanas' performed together with 'pranayam' completes one cycle of Surya Namaskar.^[13] The asanas series in Surya Namaskar is such that every asana is in complement with the asana after that. Throughout Surya Namaskar, the muscles of the entire body experience stretching and pressure in turn, thus giving more benefits with less time spent.^[75] This also helps in strengthening the immune system and lowers the level of stress and anxiety.^[76] The series of asanas included in Surya Namaskar are- pranamasan, hasta uttanasan, padahastasan, ashwasanchalansan, ashtanaga namaskar, bhujangasan, and parvatasan, shown in figure below.^[77] Each asana is performed along with breathing.^[78] The practice of Surya Namaskar on daily basis promotes healthy living and will also provide beneficial physical and mental wellbeing to struggle against the COVID-19 crisis [Figure 3].
2. Anulom Vilom - Anulom vilom (breathing exercise) pranayam is the practice of breathing from alternate nostril and that's why is also known as "Alternate Nostril Breathing." It is one of the most powerful pranayam for purifying the body and mind. This pranayam has advantages in healing most internal body environment and is very helpful in relieving stress and anxiety.^[79,80] It has been manifested to be successful in improving lung vital capacity, cardiopulmonary functioning as well as improve maximum oxygen uptake.^[80-82] Anulom vilom pranayam is performed in a relaxed sitting position (in padmasana), with straight back, closed eyes, and concentration on breathing. The pranayam is started with the inhalation from the left nostril (for four seconds) and closing the right nostril with the thumb, next step is to hold the breath (for six second) and then exhale from the right nostril by closing the left nostril with the ring and little

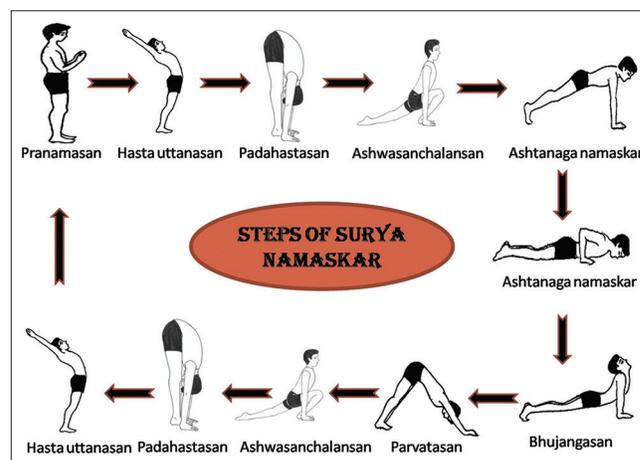


Figure 3: The diagram representing the various steps involved in Surya Namaskar and these involves pranamasan, hasta uttanasan, padahastasan, ashwasanchalansan, ashtanaga namaskar, bhujangasan and parvatasan

fingers (for eight seconds). The same has to be performed by inhaling through the right nostril and exhaling through the left nostril by closing the right nostril.^[83]

As mentioned above this pranayam makes the mind and body purify, reduces stress and anxiety, and strengthening immunity, hence can be practice during the COVID-19 crisis as prophylactic yoga to be healthy.

3. Bhastrika pranayam – Bhastrika pranayam (breathing exercise), also regarded as “bellow” reinforce the diaphragm and muscles of the abdomen, raise the exchange of oxygen and carbon -dioxide in the bloodstream, relieves inflammation of the throat, reduces phlegm accumulation, and stabilize and reinforce the nervous system.^[84] It has been shown that bhastrika pranayam induces central neuronal activation enhances reaction speed and regulates the sympathetic and parasympathetic phases of the autonomic nervous system.^[85] It has been performed by sitting straight in padmasana, with a closed mouth. Start the pranayam by quickly inhaling and exhaling ten times, start with a quick expulsion of the air follow each other in fast succession. While completing the ten expulsions take the deepest probable inhalation, hold the breath until comfortable, then take the slow but probably deepest exhalation. This ends up with the complete one round of the bhastrika pranayam, take some rest with normal breathing then start the next round up to three complete round.^[86]
4. Ujjayi pranayam - Ujjayi is a kind of pranayam, commonly known as “psychic breath” as it a loud breathing exercise. Ujjayi word denotes “victory”. The regular practice of Ujjayi pranayam calms the mind and helps in concentration or/and meditation. This is a breathing exercise in which we easily and efficiently inhale or exhale air from both the nostrils and a soft and warm sound is comes from the throat. The sound produces is suitable to the practitioner, and just audible. No pressure should be exerted on the chest while practicing the exercise.^[87,88] Ujjayi pranayam helps us to release stress and depression from our lives. This keeps the mind calm and smoothes the bodies’ nervous system, so can manage COVID-19 pressure.
5. Kapalbhathi - Kapalbhathi is consists of two Sanskrit words -Kapal means “skull” and Bhati means “shining,” meaning shining skull breath. The kapalbhathi is performed by sitting in a pose of padamasana and completely exhale. Inhale briefly from both nostrils, then exhale sharply (again out from nose) by drawing naval in toward the spine. The exhalation should be short and rapid, but extremely active, with short and slow inhalation. Once again draw the navel in while exhaling and relax it on inhalation. Complete one round of 30 (counting the exhalations) and rest with some deep breaths in between and repeat for a minute. Begin with 15 cycles, and gradually increase as tolerated.^[89]

Kapalbhathi pranayam helps to raise the level of oxygen in the body, therefore increases immunity from diseases. This pranayam also helps in clearing mucus from air passage, relieve congestion lowers bloating, increases lung capacity and it also cures health problems such as cold, cough, asthma, digestive problems, obesity, etc. It also controls glandular activities, thus helping the body to function properly.^[90]

CONCLUSION

Today the population of the whole world is suffering from the COVID-19 crisis. It not only deteriorates the physical health of the person but its consequences also affect the mental, social, and economical status of the person. Till now the treatment of the disease is not available but scientists are trying to very hard to discover the vaccine against COVID-19. Until the vaccine has to be discovered we have to take some safety measures to fight against the crisis and make the population healthier. Through this article we had tried to put forward some of the prophylactic routines to be followed to make the person physically and mentally fit and which helps to boost up the immunity. A proper diet which comprises the immunity-boosting ingredients and the daily practice of yoga and pranayam can help us to live a safe, protective, and a healthy life and can be used as a major weapon to fight against COVID-19.

Along with all the above-mentioned measures, one must also follow a healthy routine including, proper sleep of 7 h, drinking warm water, drinking plenty of water, eating fresh fruits and vegetables, avoid outside eating, avoid bad habits such as smoking and drinking and avoid unnecessary traveling.

Indeed future research is needed to confirm for the total treatment of the disease or to provide the proper guideline to live with the crisis efficiently until the vaccine not discovered.

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CONFLICT OF INTEREST

All authors declare conflict of interest as none.

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