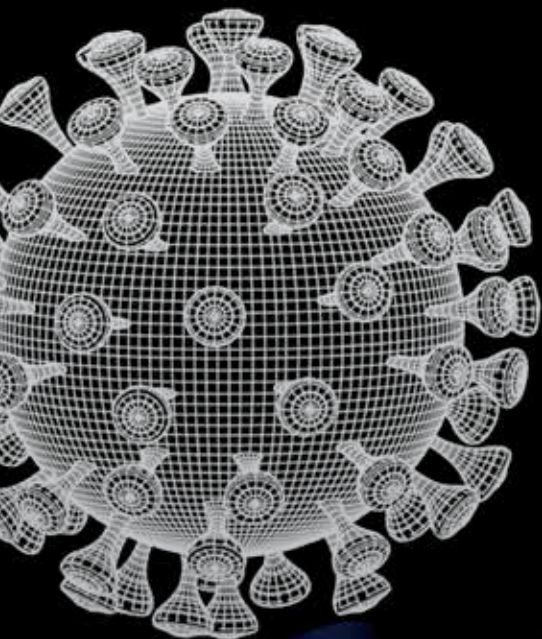


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Bangladeshi-American Pharmacists' Association



- **BOOSTING YOUR IMMUNE SYSTEM DURING A PANDEMIC**
- **LET US THINK POSITIVELY:
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- **COVID-19 AND HERD IMMUNITY: SHORT REVIEW**
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FOR 89 HIGH-RISK COVID-19 PATIENTS IN LONG-TERM CARE
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Departed Souls

*We deeply regret and mourn the departure of our fellow friends.
We miss them a lot and remember them in our prayers.
In this day of the Convention we will miss their presence.*

Nazir Ahmed
Mohammad Azim
Mohammed Hakim Bhuiyan
Manju Biswas
Utpal Kanti Biswas
Amanullah Chowdhury
Mohammad Jamshed Chowdhury
Dr. Faisal
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Shahidur Rahman (Khokon)
Dr. Rashid
Abdullah Al Sad
Mohammad Sikandar

Disclaimer: If we missed anybody's name it is an unintentional mistake.

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BANGLADESHI – AMERICAN PHARMACISTS' ASSOCIATION

29th Annual Convention Programs

SUNDAY, AUGUST 23RD

ONLINE

BAPA CONVENTION SCHEDULE AT-A-GLANCE

10:30 AM - 11:00 AM	Opening of Covention
11:00 AM - 1:00 PM	CONTINUING EDUCATION 1: Out-patient pharmacist role in monitoring and follow-up of COVID19 Nasheed Shams
1:00 PM - 1:15 PM	Sponsors Presentation Micromerchant
1:15 PM - 2:00 PM	Digital Break
2:00 PM - 5:00 PM	CONTINUING EDUCATION 2: COVID-19: Back to Future? A Challenge in the 21st Century Dr. Mohammad Naqibuddin, M.B.B.S, M.P.H. Mohammud M. Alam, M.D.
5:00 PM - 5:45 PM	Meet and Greet, adda
6:00PM - 9:00 PM	Cultural show with various performers
7:40PM - 8:00 PM	Maghrib Break (Performance Paused)

Message from the PRESIDENT



Parvin Rahman

Welcome to our 29th annual BAPA convention, which is virtual for the first time in our organization's history.

This year's convention, like all other aspects of our lives, has been affected by Covid-19. The current health crisis is unlike anything we have seen in our lifetimes. As we adjust to a "new normal" and mourn the loss of many as a collective community, we are also emerging with different perspectives and responsibilities in this new world.

As pharmacists, we are part of the healthcare communities who have had to act bravely and selflessly to serve customers at risk for or directly affected by the disease. I thank you all for your service as our community often goes unacknowledged. This spring, when we noticed pharmacists weren't being included in the healthcare providers category by the government, BAPA wrote letters to the Governor, our Senators, and congresspeople requesting access to the same resources provided to doctors and nurses that we deserved as well as recognition for our equal efforts in fighting the virus.

As Bangladeshis, we recognize our community has been one of the most gravely affected by the pandemic, especially in New York. We lost beloved people within and outside of the BAPA community, so as a leadership team we focused our efforts to set up a fundraising campaign that supported several organizations in NY, students in the DU pharmacy department, and impoverished people through Action Aid Bangladesh. Pharmacists from across the spectrum of pharmaceutical specialties collaborated to help raise money, from industry and retail professionals to hospital pharmacists and academics. I thank you all for coming together and hope to see the same kind of unity going forward in all aspects of our professional lives.

As the first female president of BAPA, I am honored to be of service to this organization and have great hopes for the year ahead. Although it hasn't gone exactly as planned, I want to acknowledge what a huge success the annual BAPA dinner was before we went into lockdown. Attendance was nearly double that of prior annual dinners and we were able to share our goals with you all in person.

We've been working hard to make progress on the goals and promises we made at our annual dinner, starting with our user-friendly website. Bapainfo.org is newly relaunched and better than ever. The site is updated daily with relevant healthcare news, helps us ensure we have a stronger digital presence moving forward and even launched online registration for the first time in BAPA history for this year's convention.

We've also been hard at work to register BAPA as a true nonprofit organization, which will provide savings to our organization through reduced taxes and fees. We submitted the application for the state tax waiver before the pandemic, and earlier this week, we submitted the application for BAPA to become a 501(c)(3) nonprofit organization as well.

Finally, we had the difficult task of organizing our virtual convention, something we never imagined would be on our to-do list! With our executive committee's combined efforts, we put together a very special program with important CE topics, which we hope will be enjoyable and educational. I'm sad we can't all be together for this year's convention, but we're excited to give you a brand new experience online.

Wishing you all a safe and healthy year ahead and hope to see you all at the other side of the pandemic.

Parvin Rahman

President

Message from the VICE PRESIDENT



Sabrina Rahman

Thank you for joining us for our 2020 Virtual Convention! I would like to extend a huge thanks to PSSNY for helping us to allow it to happen. I would also like to recognize Micro Merchant, Kinray, and Advance Pharmaceutical for their contributions and support.

During these unprecedented times we were still able to celebrate a great year for the Bangladeshi American Pharmacists Association. So many notable events have occurred since the beginning of this term and I am grateful for their successes. We took the time to hold a social meetup with the students from the BAPA chapter at LIU and St John's that was a huge networking accomplishment. I would like to also thank everyone who was able to attend this year's annual dinner which was a huge success involving so many new pharmacists. And with our latest project, The BAPA COVID relief fund we were able to raise around \$23,000 in just over 3 weeks due to the generous contributions from our members, families, and friends that went towards helping the neediest in our communities of USA & Bangladesh. These efforts and achievements just go to show how the collaboration within our Bangladeshi-American community continues to move forward in the profession of pharmacy and aiding others.

I would like to recognize the efforts made by the E-board to get the student members and newly graduated pharmacists involved in BAPA and hopefully paving their way towards our organization in permanency.

A huge thanks goes out to Dr. Parvin Rahman, our president, who has put in so much work, time, and dedication into rising BAPA up to another level. She has spent extended time reaching out to members personally and updating all relevant information needed for future boards.

I would lastly like to thank all the members of BAPA for the continued support and participation. I feel honored and humbled to have been chosen to serve this great organization and its members. I am forever grateful for the guidance from all those who have been an inspiration to me, especially my father Mohammed Rafiqur Rahman. I aspire to be like you all who have all been here from the start of my journey as a pharmacist and have cheered me on along the way.

Sabrina Rahman

Vice President

articles

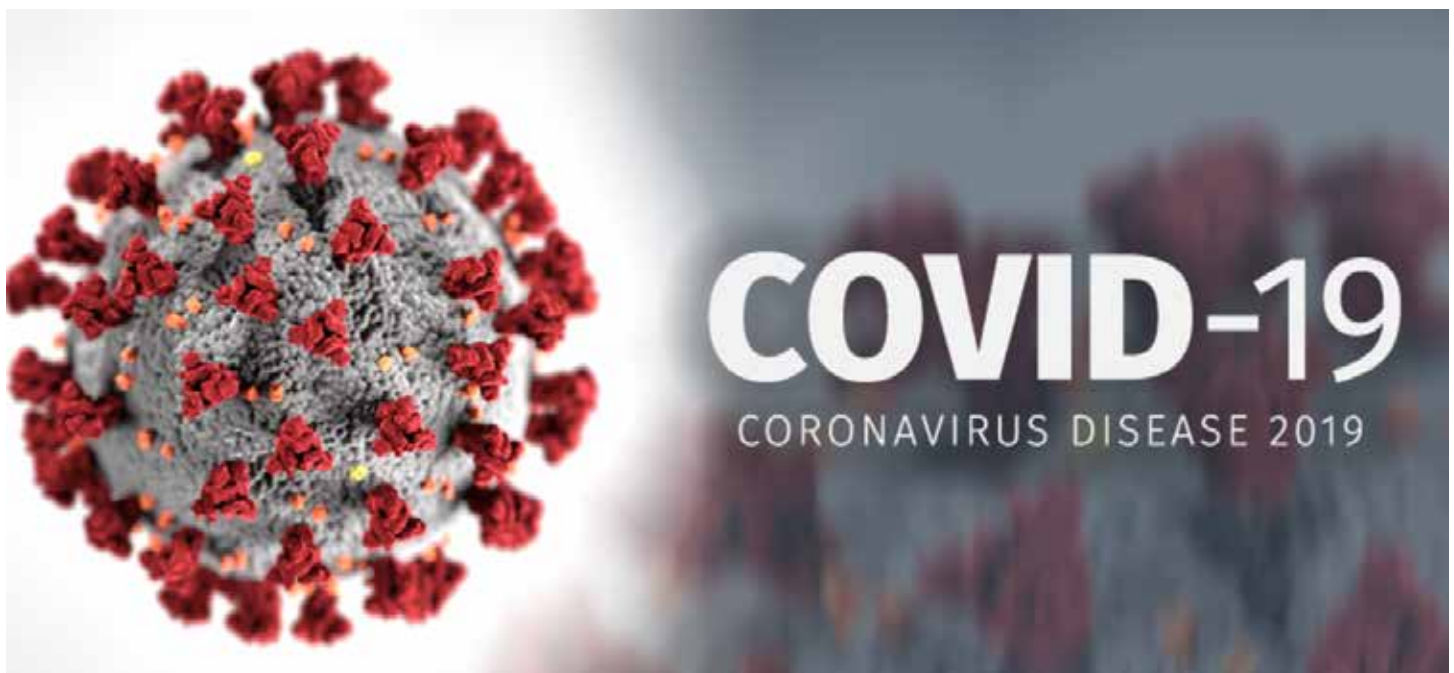


Boosting Your Immune System During A Pandemic

Kazi M. Anam M.S., RPh, ND

The immune system is our body's defense mechanism. As we age, our immune system becomes weaker. However, even for young individuals, there are many factors that can lower the capacity of the immune system. Lifestyle choices, stress management, mental health, eating patterns, sleep, exercise, and general mindset can all affect the body's defense system.

During a pandemic such as Covid-19, a robust immune system can help us survive.



Factors that affect our immune system:

1. Anxiety and Stress
2. Sleeping Pattern
3. Diet
4. Intermittent Fasting and Calorie Restriction
5. Exercise
6. Weight
7. Substance Use (Alcohol, Smoking, Drugs)
8. Supplement intake

1. Anxiety and Stress:

Anxiety and stress have significant effects on our immune system. We cannot avoid stress but how we manage stress will determine how much our immune system and other bodily functions are affected. Aside from interfering with our immune system, stress and anxiety is associated with many of the other diseases like high blood pressure, heart disease, cancer, diabetes, and autoimmune disease. So, everyone should have a stress management strategy. Common strategies could be: Exercise, Yoga, Meditation, Hypnosis, Walk, Laughter etc.

2. Sleep:

Sleep plays a huge role in our overall health, mental peace, happiness, functionality as well as our immune system. So, it is very important for most people to get 7-8 hours of sleep.

3. Diet:

The type of food and the quantity a person eats and the time when they consume those foods plays a big role in a person's immune system, overall health, weight and self-image. In general, consumption of plant-based whole foods, greens and vegetables, lean proteins, fruits, nuts etc. improves overall health, weight and the immune system. It is critical to devise a good meal plan that avoids an excess of white carbs (rice, potato, bread) or refined carbs like sugary foods.

4. Intermittent Fasting and calorie restriction:

Recent research shows that fasting and calorie restriction can improve the immune system by reducing the proinflammatory factors. Fasting has many benefits for body and mind. So, intermittent fasting is recommended by many experts for good health and longevity.

5. Exercise:

It is very important to exercise routinely. Both aerobic exercise and weight or resistance exercise are important. Exercise increases blood supply to all the cells with blood rich in oxygen and other nutrients. This, in turn, improves cellular nutrition and powers our immune cells to perform well when we are exposed to different microbial pathogens. Exercise also balances our immune system and improves our overall health.

6. Weight:

Weight plays a big role in overall health as well as the immune system. When someone is overweight, especially with excess fat around the stomach, it can trigger production of many pro-inflammatory immune cells which can promote inflammation in our body. Losing just 10 pounds can have a very good effect in balancing the immune system.

7. Substance Use:

Smoking, alcohol consumption, use of illicit drugs- all of these impact our immune system negatively. So, to stay healthy it is very important to stop or limit usage of these products.

8. Supplement Intake:

Supplements also play a big role in human health since most individuals do not eat balanced, nutritious meals with all types of whole foods, greens, fruits and nuts. These are some of the important supplements that can improve the immune system:

a) Vitamin D

It is actually considered a hormone and is produced by the kidneys. This controls our calcium concentration in blood and also has a positive impact on our immune system. Low Vitamin D can make a person become prone to infections, depression, cardiovascular disease as well as weight gain. There are several forms of vitamin D: Ergocalciferol, Cholecalciferol, Calcidiol and Calcitriol. When we measure our blood level for Vitamin D, the best indicator is 25-hydroxyvitamin D, also known as Calcidiol.

There is some controversy about the normal level of Vitamin D blood level. Some experts suggest a range of 20 - 40 ng/ml of Hydroxy Vitamin D and others suggest a range of 30 - 50 ng/ml. However, for normal healthy individuals, I recommend a level of 50 to 60 ng/ml. For anyone with autoimmune disease or cancer, my recommendation is 80-90 ng/ml of Hydroxyvitamin D. Just be aware that although vitamin D is safe, Hydroxyvitamin D level should not exceed 100ng/ml. Such high levels can lead to vitamin D toxicity. The bioactive form of Vitamin D is calcitriol, also known as 1,25 Dihydroxyvitamin D. For this reason supplementation with Vitamin D3 (Cholecalciferol) is preferred over Vitamin D2 (Ergocalciferol). Common dietary source of Vitamin D is fatty fish like Cod, Mackerel, Salmon, and Tuna. A small amount can be found in eggs, cheese, liver etc.



b) Vitamin C

Vitamin C was discovered in 1930 by Hungarian scientist Dr. Szent-Gyorgi, who received the Nobel prize for this very important discovery. Although many animals can make their own vitamin C in the body, humans cannot make any vitamin C on their own. Before the discovery of vitamin C, many sailors lost their lives to scurvy. Linus Pauling is a two-time Nobel prize winner who first theorized that large doses of vitamin C can be used in cancer and many other diseases. At the time, he was ridiculed for his theory. However, there is much evidence to support that large doses of IV vitamin C can be used for cancer and many other diseases. To treat Covid-19, some hospitals have used large doses of IV vitamin C as well. Vitamin C is very important for our immune system and also plays a vital role in keeping us healthy. The best way to take vitamin C is from a food source or powder supplement. I recommend a dose of 500mg to 1000mg daily from supplements and to also consume lots of fruits and vegetables that contain vitamin c. Common foods rich in vitamin C are: Green and red peppers, Broccoli, Grapefruit and Grapefruit juice, Orange and Orange juice, Lemon, Kiwifruit, Cantaloupe, and Strawberries.

c) Multivitamin and B-complex

It is very important that a good multivitamin and B-complex are consumed daily to keep the body functioning properly. Many health practitioners bear the notion that if we eat good food there is no need to supplement with multivitamins or B-complex. This could have been true in the 18th century or the early part of the 19th century when most people would eat whole foods along with lots of fruits and vegetables. However, today's processed foods, fast foods, and even whole foods cannot provide full nutrition. Part of the reason is because our soil is depleted of many minerals and nutrients and because fast food and processed food do not give us the nutrition needed. However, I would advise the readers to pay close attention to the type of vitamin they choose.

In general, I recommend food grade bioactive organic or chelated supplements. These types of supplements that are usually assimilated well in our body. Here are some of the leading manufacturers of Bioactive vitamin and supplements: Thorne research, Megafood, Pure encapsulation, New Chapter, Garden of life, Nordic Naturals, Standard process, Klaire labs, Barleans, Cardio-vascular Research etc.

d) Mushroom products:

Mushrooms have been in use for over 2000 years. In ancient times, some varieties of mushrooms were reserved for Chinese emperors for health, vigor and longevity. Fortunately, today, many reputable companies make mushroom blends to boost immune function, cognitive function as well as energy and longevity. One of the mushroom immune products that I find useful is Fungi perfecti made by Host defense.

There are many other wonderful mushroom products a person can select. Typically many of these mushrooms contain beta glucans that boost the immune system by activating B-cells, T-cells and Macrophages.

e) Selenium:

This is a crucial micronutrient that boosts our immune system as well as functions as a good antioxidant, helps to prevent certain types of cancers, thyroid health, prevention of heart disease etc. In nature, selenium is found as selenomethionine in Brazil nuts, soybeans, organ meats and dairy products. Typically a person should take about 50 mcg of selenium daily. One of the best forms of selenium is selenomethionine.

f) Zinc:

Zinc is an essential mineral and is necessary for us to stay healthy. It helps our body with many different functions, especially to fight off invading bacteria and viruses. Our daily intake of zinc should be about 15 mg. Common foods that have zinc are: Oysters, red meat, poultry, whole grains and nuts.

g) Turmeric:

The use of turmeric started about 4000 years before in Indian vedic culture. This was used as a spice in cooking. It had been also used medicinally for thousands of years. It gained a lot of popularity in recent times. Curcumin is the main ingredient in turmeric and its benefits are due to the presence of a variety of curcuminoids and are biologically active polyphenolic compounds. These curcuminoids are a powerful antioxidant and anti-inflammatory; these properties impact our immune system positively. This has a very wide range of benefits for our body as well as our brain and cognitive functions. This is widely used for joint inflammation and arthritis. This also improves longevity by reducing chronic inflammation in all parts of the body. It is recommended that for optimum anti-inflammatory benefits, one should consume between 500mg to 1000mg of turmeric extract.

h) Black seed oil:

Black seed had been in use in cooking as a spice or for medicinal purposes for thousands of years. It originated in southeast Asia, Egypt and many parts of Africa and the Middle East. It is interesting to note that this was one of the accompaniments in the tomb of Egyptian Pharaoh Tutankhamen. The main ingredient in black seed is Thymoquinone. This is also an outstanding antioxidant and anti-inflammatory which has positive effects on the immune system as well as in cancer prevention. Recommended use: one to two teaspoon daily after meals.

i) Probiotics:

Probiotics are live organisms that are essential for our immune system and digestive system. Humans are very complex organisms, composed of trillions of cells. It is estimated that there are about 30 trillions cells in our body. According to Ron Milo and his team of biologists, a man aged 20 to 30 with an average weight of 70kg most likely has about 30 trillion human cells. These 30 trillion human cells are host to 39 trillion organisms: bacteria, viruses etc. Our gut health and a robust immune system is dependent on healthy gut flora. This gut flora can be disturbed due to stress, unhealthy eating patterns, taking antibiotics and certain other medications.

Once gut ecology is disturbed, it opens us to many disease conditions: diarrhea, indigestion, flatulence, gas, frequent illness etc. Most fermented foods like yogurt, kefir, kombucha, sauerkraut, pickles etc have probiotics but that might not be enough to restore a good bacterial flora in the gut. In these circumstances, besides these foods, a supplement with probiotics is recommended. Some of the best brands of probiotics are: Dr. Ohhira's probiotics, Primal Defense by Garden of Life, and Renew Life. A broad spectrum probiotic with 15 to 30 billion flora is usually recommended for daily intake.

j) Omega-3 fish oils:

Although there were some controversies about omega-3 fish oils, it is now conclusive that this plays a big role in our cardiovascular health, mental health, for our skin and eyes, etc. Its anti-inflammatory properties are also helpful for joint health. The three main types of omega -3 fatty acids that are found in foods are: eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA) and alpha-linoleic acid (ALA). ALA is mainly found in flaxseed, soybean and canola oils. EPA and DHA are primarily found in Mackerel, Salmon, Cod liver oil, Herring and Oysters. Typically, 4 gms of fish oil supplement per day is recommended, if someone is not eating enough fish. It is not recommended to consume more than 3 servings of fish in a week due to mercury and other heavy metal toxicities. Even the wild-caught fish has mercury and other heavy metals in limited amounts. Anyone who consumes lots of large fish should have their blood routinely checked for mercury and heavy metal burden. These are the companies that I believe makes or distributes the purest form of omega-3 fish oil: Nordic Naturals, Barleans and Life Extension. When selecting a fish oil it is important to review the level of impurities like mercury, heavy metal, PVC, etc.

k) Green and red powder supplements:

It is well proven that phytonutrients in vegetables and fruits boosts our immune system. However, with a busy lifestyle, sometimes it is not practical to be able to eat a full spectrum of fruits and vegetables. That's when red and green powder can be helpful. Typically a green powder contains: Chlorella powder, Spirulina powder, Wheat grass powder, Oat grass powder, Cabbage, Kale, Broccoli, Green Bell pepper etc. A red

powder contains: Beet root powder, Apple, Pomegranate, Acai, Goji Berry, Raspberry, Blueberry powder etc. Some recommended brands are : KOS, Vega One, Primal Greens, Green Vibrant etc.

l) Grape seed extract:

Grapes and wine have been in use for centuries. Grape seed extract is made from crushed seeds of grape plants. It contains proanthocyanidin as well as resveratrol and tannins. Grape seed extract has antioxidant properties and resveratrol has anti-aging properties. This also helps our immune system to combat infection.

m) Green tea extract:

The main ingredient in green tea extract is catechins, namely epigallocatechin gallate (EGCG). Green tea has many benefits including prevention of certain cancers. One of the benefits of the polyphenols found in green tea is that it increases the number of “Regulatory T cells” that play a key role in immune function.

n) Epicor:

Epicor (Dried yeast fermentate) is a postbiotic ingredient made through the natural process of fermentation. This supports a healthy gut microbiome, which helps to support a healthy immune system. It is available as 500mg capsules. Recommended brands: Doctor’s Best, Healthy Origins.

Conclusion: Although all these supplements are beneficial for the immune system, mushroom products and probiotics are not necessary for everyone for year-round consumption. For customizing your personal needs, professional consultation is recommended.

Disclaimer: The author has no connection to the products recommended and author does not receive any type of financial incentives from any of the manufacturers mentioned in this article. It is recommended that before starting any new supplement, consult with your healthcare provider and do your own research.

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Let Us Think Positively: The Bright Side of COVID Lockdown

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Let us think positively! Let us find some hope out of all pessimistic happenings around us even out of this global pandemic! We all know the story of “Glass-Half-Full”. COVID 19 is undoubtedly one of the deadliest occurrences in recent human history that caused a death of more than 650 thousand people globally just in less than five months. While this lockdown has caused unlimited difficulties in businesses, social activities and wellbeing; it has also gifted us with some unique opportunities on the other side! Perhaps very few people will agree with me about those enlightening aspects of this pandemic, but surprisingly there are so many things which occurred around us during these quarantined months that we may consider as positive outcomes. In a few words, we can say COVID 19 offered us a fresher nature, less pollution, less crime, less traffic, less accidents, stronger family bondage, dedication to humanity, more relaxation, less work-stress, and more digital communication with friends and loved ones!

Cleaner Nature than Ever Before:

Perhaps everyone will agree about the much cleaner and quieter natural environment during this pandemic. As people around the globe stayed quarantined for either state-issued lockdowns or voluntary self-isolation, fewer and fewer people been utilizing highly polluting means of transportation. Environmentally, the pandemic has brought a reduction in greenhouse gases (GHG, mainly CO₂ and NO₂) and air pollution, mainly from a fall in fossil fuel consumption as airplanes are grounded, transportation reduced, trade hindered, and factories shut down. These bring important environmental gains as well as social benefits. The current drop in GHG emissions is larger than anything the world has seen since humans started to use fossil fuels.

Pollution and greenhouse gas emissions dropped dramatically around the world, with New York City recording a drastic 50% decrease since the city began taking measures to stop the spread of the virus. In China, GHG emissions dropped 25% since the beginning of the year and caused the world’s largest emitter to avoid some 250 million metric tons of carbon pollution—more than 50% annual carbon emissions of the UK. And not surprisingly, there is a similar story in almost every city around the world. Although it is unclear whether this “pause” in our environmental pollution will create a sustainable effect for climate change as a whole, but for sure, it is at least, a transition towards the right direction. Another beautiful example of cleaner nature is the Himalayas. For 30 years, its summit has been hidden from view by thick smog (smoke and fog). The lockdown has indeed cleared it.



Dedication and Compassion for the Society:

Indeed, crisis brings people together. Hundreds of front line professionals sacrificed their lives by unprecedented dedication and tireless service to the patients, elderly and the society as a whole. It gives a message to the entire humanity that human beings are by default created for serving each other regardless of their geographic location, skin color, or any other demographic or social identity. During this uncertain time, we found more people with helping hands in the neighborhood, showing kindness to each other offering various sorts of assistance for people in need. People posted inspiring messages on social media. Artists sang motivational songs to encourage everyone. Individuals and families supplied food for the frontline service providers. Donor organizations, Companies and private citizens distributed PPEs and other medical supplies. All these dedicated activities were full of hope that enlightened our heart during the entire pandemic uncertainties.

More Time for Loved Ones:

Because of hectic schedules, many of us could hardly give enough time for our loved ones during normal life schedule. During this quarantined pandemic we had a lot of time for our beloved family members that helped build stronger bonds among us. In fact, the lockdown and social distancing created a great opportunity for all of us to help each other out with in our families, that we very often may have missed in other times. The pandemic indeed was a great time for many of us to have more interaction with our children, having more fun, and engaging in more time taking care of them and vice versa.

Stress Less Daily Working Schedule:

During the lockdown we did not have to wake up early in the morning to catch the public transport or commute privately to avoid rush in the highways. There was plenty of time to rest 24/7 or watch movies with family members and have tea or coffee anytime you want. Many of us, including me could work remotely from home with a flexible schedule. Alternate side parking rule was also suspended in many cities including NYC, so there was no obligation to move the car. All these flexibilities created a sense of relaxation in our mind. And when you feel

relaxed, serotonin level rises in your blood. Serotonin is a neurotransmitter and mood stabilizer, colloquially known as the “happy chemical” that boosts your happiness and wellbeing.

Miscellaneous Benefits:

There was less crime and number of road accidents in most places in the world. Factories were closed or operated far below their capacity, road traffic reduced radically, and air traffic collapsed. Additionally, the lack of tourism had emptied the streets in overcrowded cities. While this may be bad news for the economy, it is good news for our planet. We communicated more than ever with our friends, families and neighbors during the lockdown at least by digital means. The pandemic brought us closer by heart although we maintained physical distancing.

In conclusion, I should say, there are a few lessons we may learn from this deadly pandemic. One tiny organism disrupted the entirety of human civilization. We are almost helpless against this invisible organism. Although we have plenty of knowledge and sophisticated technologies, we cannot control everything; COVID-19 and its aftermath has come with many inevitable eventualities. It also came as a great lesson to human society: clearly demonstrating the human ability to keep well with the bare minimum. It made us bond by means of DIY haircuts and It also has given us a great opportunity to devise the collaterals by utilizing the less utilized resources. Changes in nature at this time is truly remarkable at least when we see the decrease in emissions, reduced road noise and eco-friendlier life around us.

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COVID-19 and Herd Immunity: Short Review

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INTRODUCTION:

COVID-19 is the third coronavirus that cause severe respiratory illness in human. The previous two corona virus are SARS-COV and Middle East respiratory syndrome–coronavirus (MERS-COV). COVID-19 is recognized as a pandemic by the World Health Organization (WHO) in March 2020. Since the beginning it has had considerable global economic and health impacts. Although the situation is rapidly evolving, severe disease manifested by fever and pneumonia, leading to acute respiratory distress syndrome (ARDS), has been described in up to 20% of COVID-19 cases¹.

An ongoing outbreak of pneumonia associated with the severe acute respiratory coronavirus 2 (SARS-COV-2) started in December, 2019, in Wuhan, China. Information about critically ill patients with SARS-CoV-2 infection is scarce. Scientists described the clinical course and outcomes of critically ill patients with SARS-COV-2 pneumonia. The clinical spectrum of SARS-COV-2 pneumonia ranges from mild to critically ill cases, and a significant number of COVID-19 patients remain asymptomatic². Nine months after the first reported case, scientists around the globe are struggling to characterize this pathogen and the clinical manifestations. Currently there is no statistically proven treatment of COVID-19, only palliative care is provided whenever possible or advised to maintain isolation at home.

The objective of the reviewer is to check the probability of 'herd immunity' as much of the services and industry are opening up in USA.

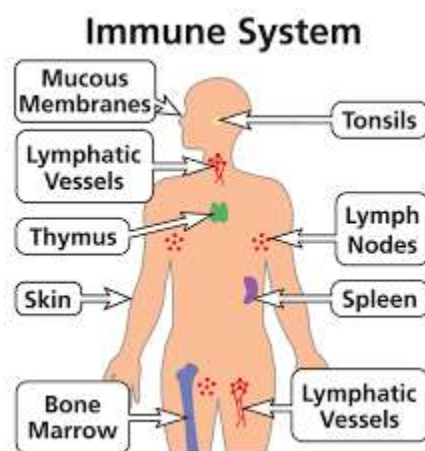
METHOD: The reviewer used 'google scholar' to search for COVID-19 related herd immunity. At least eight published articles were found, including comments to the editor. The key words used are: Immunity, herd immunity, R-naught (R_0), COVID-19, and genetic mutation of the virus. The author presents here the findings in non-scientific format.

OBSERVATIONS:

What is Immunity? Immunity is a condition of being able to resist a particular disease by preventing development of an infection by pathogenic microorganism. This disease prevention response of the body is called 'immune response'.

What organs/Parts of the body produces immune response?

A complex network of specialized cells, tissues, and organs that recognize and defend the body from foreign substances (antigens). Organs and tissues of the immune system include the bone marrow, spleen, thymus, tonsils, mucous membranes, and skin. Examples of specialized cells that provide defense are granulocytes, macrophages, neutrophil, and T lymphocytes. The lymphatic vessels of the immune system carries immune cells, which converge in lymph nodes found throughout the body. The following diagram is a brief sketch of our immune system³.



What are various types of Immunity? There are three types of immunity — Innate (natural), Adaptive (acquired), and passive.

Innate (Natural) immunity: Everyone is born with innate (natural) immunity, a type of general protection against antigens. Example, when the phagocytes detect any bacterial cells or any parts of bacterial cells, activation occurs and the pathogen is engulfed.

Adaptive (acquired) immunity: Adaptive immunity refers to antigen-specific immunity. This is a complex process compared to the innate immunity. The B-lymphocytes is like body's intelligence system. It identifies the antigen and then the T-lymphocytes start fighting the antigens. Adaptive immunity produces antigen specific antibody (a 'memory') that makes future responses against a specific antigen more efficient. Example, immunity against chickenpox., immunity stays forever.

Passive immunity: Passive immunity is a short-term immunity, it is 'borrowed' from another source and it lasts for a short time. For example, antibodies in a mother's breast milk give a baby temporary immunity to diseases the mother has been exposed to.

How Does the Immune System Work? When the body senses antigens, the immune system works to recognize the antigens and starts fighting with the foreign substances. The B-lymphocytes acts like body's intelligence and identifies the antigen and T-lymphocytes are like soldiers, they start fighting.

B lymphocytes are triggered to make antibodies (also called immunoglobulins). These proteins lock onto specific antigens. Antibodies usually stay in the body in case it has to fight the same antigen again. That is why someone who gets sick with a disease, like chickenpox, usually will not get sick from it again.

COVID-19, Its Virulent Nature: Recent COVID-19 updates shows that a single infected individual may trigger the outbreak. Currently there are no interventions to stop the spread. Moreover, the number of asymptomatic cases are significantly higher than expected.

What is Herd Immunity? Herd immunity refers to a reduction in the likelihood of someone catching a specific infectious disease because a significant proportion of the people in that community are immune to it. An individual is less likely to come in contact with an infectious person, the individual is less likely to get infected. The people in a community can be immune to a particular disease especially through previous exposure or vaccination.

Herd Immunity and COVID-19: The herd immunity of COVID-19 is assumed when enough people have developed immunity to COVID-19 and the risk of further community transmission is either eliminated or is significantly reduced.

What does it take to achieve herd immunity for COVID-19?

Earlier this year, scientists projected that herd immunity of COVID-19 may be achieved if 60% to 70% of the population have antibodies. either by vaccination or by active infection⁴. They have used a formula to calculate the percentage of people need to be immune to provide herd immunity to others. This formula is 'herd immunity threshold' = $(1 - 1/R_0) * 100$. This formula includes the basic reproduction number or 'R-naught' (R_0), which indicates the average number of new people that a single infected individual can infect. The R_0 for That figure for the flu is around 1.3, meaning that each infected person infects an average of 1.3 more people. Unfortunately, for COVID-19, the initial calculation of R-naught was between 2 and 3. This makes COVID-19 much more contagious⁴ compared to flu. A recent analysis with current COVID-19 virulence data shows that the R_0 value is 5.7. This means herd immunity threshold is 82.5%⁵⁻⁶. Nine months after first COVID-19 infection, statisticians estimated that only 3% of the population is immune, which is

way below the 82.5% threshold. Therefore, it is not likely to acquire herd immunity against COVID-19 from getting infected and recovered. The other possibility of herd immunity is through vaccination. Several initiatives of COVID-19 vaccine are simultaneously going on around the globe. But all are under R&D pipeline, only at Phase 1 level. There are indications that immunity may not last longer than four or five months. Immunity may wane over time, and people would need to be revaccinated. Therefore, repeated vaccination will be required like flu.

CONCLUSION:

In a few weeks, coronavirus changed its status from 'something we heard about on the news' to our new reality, causing the global shutdown of offices, schools, restaurants, theaters, and anything deemed 'non-essential'. COVID-19 is affecting people of all ages, though outcomes are worse for people over the age of 60. COVID-19 being new, there is no herd immunity and no vaccine is yet available. It is too deadly to get infected. Therefore, at this time it is wise to practice social distancing irrespective of vulnerability potential (children, young adult, adult, elderly, healthy), proper hand hygiene, and use face mask. It is also recommended to avoid large gathering, often sanitize high touch surfaces like door knob, faucet, etc. and isolate plates, mug, spoons, forks, etc. In essence, follow CDC guidelines to have a healthy life.

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Famotidine, PPIs and COVID-19

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The name Remdesivir or Favipiravir fits better with COVID-19 than Famotidine or Pepcid. The story began in Wuhan, China, in mid-January 2020 when Dr. Michael Callahan, an Infectious disease doctor from Massachusetts General Hospital was there and working on an avian flu project. As the COVID-19 was spreading in Wuhan, he joined his Chinese colleagues taking care of these patients. They have noticed many elderly patients with multiple comorbidities were improving, while others were not.

After reviewing over six thousand COVID-19 patient records, they noticed that many survivors had been suffering from chronic heartburn and were on Famotidine rather than more-expensive Omeprazole. To be exact, among the hospitalized COVID-19 patients taking Famotidine death rate was about 14% compared with 27% for those not on the drug.

After returning to the USA, Dr. Callahan contacted Florida-based Alchem Laboratories, which specializes in computer simulations to rapidly identify already available safe compounds that can be repurposed against microbial threats such as new viruses. Further work in this molecular modeling lead to the finding that Famotidine likely binds a viral enzyme called the “papain like protease”, which helps the virus to replicate.

In mid-April 2020, New York’s Northwell Hospitals initiated a study to test efficacy of intravenous famotidine in COVID-19 patients using high doses (about 9 times the typical oral dose). The study goal was to enroll about 1,200 people with moderate to severe COVID-19 and see if those who got famotidine were less likely to die or require a ventilator. After enrolling about 200 patients, cases of COVID-19 in NY started to decline and the study remains incomplete and unpublished.

Then in May 2020, Columbia University published a study that compared the outcomes of people with COVID-19 who were prescribed Famotidine within 24 hours of being admitted to the hospital to those who didn’t get it, looking at the records of more than 1,600 patients (1). About 5% (84) received Famotidine within 24 hours of hospitalization, including patients who had been taking the drug at the time of admission. The researchers found that 10% of patients who received Famotidine were placed on a ventilator or died, compared to 22% of patients who didn’t receive Famotidine.

Meanwhile, in early June 2020, the journal *Gut* published a small case series of 10 people who developed COVID-19 and reported taking Famotidine during their illness

(2). These people were not sick enough to go to the hospital, but their symptoms, such as cough and shortness of breath, improved within a day or two of taking Famotidine. It's a small study, and the researchers acknowledge that it's not enough to establish there's any real benefit from taking famotidine for people who have COVID-19.

Benefit of Famotidine is being evaluated in another small study of 110 patients in combination with H1 blocker (3). Dual therapy with cetirizine 10 mg and famotidine 20 mg b.i.d. showed symptoms improvement and reduction in intubation rate and death in this population.

Whether Famotidine has any direct antiviral activity is yet to be proven and most likely don't have (4). Boston-based Bisect Therapeutics, Inc. did two different biochemical analyses to test whether Famotidine can bind to viral proteases as the computer simulations had predicted, both tests showed no sign of binding. The Lab also tested whether Famotidine could stop the coronavirus from infecting monkey cells or human lung cells grown in lab dishes, again the researchers did not see any effect on viral infection.

The case for Famotidine became more interesting when another study on Proton Pump Inhibitors and COVID-19 is published recently (5). This study based on email survey of a total of 264,058 adults in the U.S. Of the 86,602 eligible respondents who completed the survey, 53,130 (61.3%) reported having acid reflux and similar symptoms and were queried about their use of anti-secretory medications. Among these, 3,386 (6.4%) reported having a positive COVID-19 test. Investigators noted a significantly increased odds for reporting a positive COVID-19 test in patients who used PPIs either once daily (OR = 2.15; 95% CI, 1.9-2.44) or twice daily (OR = 3.67; 95% CI, 2.93-4.6) compared with those who did not use PPIs. An elevated risk was not seen among patients who took histamine-2 receptor antagonists. Gastric acid suppression and increased risk of infections, such as C Difficile associated colitis and others, are well known. It is not a surprising to know that use of PPIs is associated with increased risk of COVID-19.

H2 receptors aren't just in the stomach—they're all over the body. Release of histamine in response to COVID-19 may be contributing to overactive immune response, so called cytokine storm, which damages to patients with severe cases of COVID-19. By blocking the histamine that mast cells release, Famotidine can dampen some of that response. The studies that showed Famotidine is associated with better outcomes may not be all wrong.

It was surprising to find that use of Famotidine reduced the risk of severe COVID-19. The protective role of the drug may not be mediated by a direct antiviral activity. But it is safe and commonly used medicine in both out-patient and in-patient setting, and any benefit is a plus. We recognize that observational findings do not prove effectiveness of a drug. Only a randomized, controlled clinical trials can determine whether Famotidine is truly effective, and is it the only H2 blocker which has this

protective role. While waiting for additional research, it is safer for patients with COVID-19 to take H2 blocker, especially Famotidine with or without H1 blocker, rather than a PPIs, whenever possible.

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Clinical Outcomes of Early Treatment With Doxycycline for 89 High-Risk COVID-19 Patients in Long-Term Care Facilities in New York

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Abstract

Rationale

Due to the cluster and associated comorbidities in residents of long-term care facilities (LTCFs), COVID-19-associated morbidity and mortality are significantly increased. Multiple therapeutic options, including hydroxychloroquine (HCQ) and azithromycin (AZI), were tried initially to treat moderate to severe COVID-19 and high-risk patients in LTCFs, but they were abandoned due to unfavorable reports. As a less toxic option, we initiated treatment with doxycycline (DOXY) very early in the course of illness. DOXY has antiviral, cardioprotective, immunomodulatory, and anti-inflammatory properties, but the efficacy of early intervention with DOXY in high-risk COVID-19 patients in LTCFs is unknown.

Objective

The goal of this retrospective study is to describe the clinical outcomes of high-risk COVID-19 patients with moderate to severe symptoms in LTCFs after early intervention with DOXY.

Design

Case-series analysis

Setting

LTCFs in New York

Participants

This observational study examines 89 patients who were diagnosed with COVID-19 from March 18 to May 13, 2020.

Exposure

All patients who were diagnosed with COVID-19 received DOXY and regular standard of care within 12 hours of the onset of symptoms. Additionally, four patients received meropenem, three patients received Zosyn, two patients received linezolid, and two patients received Bactrim DS. Four patients were on chronic ventilator support. No patients received any steroids or any other antiviral or immunomodulatory agents. The majority of the patients received zinc and calcium supplements as well.

Main outcomes and measures

Assessed measures were patients' characteristics, fever, shortness of breath (SOB), cough, oxygen saturation/pulse oximetry (POX), radiologic improvements, laboratory tests, DOXY side effects, hospital transfers, and death.

Results

Eighty-nine (89) high-risk patients, who developed a sudden onset of fever, cough, SOB, and hypoxia and were diagnosed with COVID-19, were treated with DOXY (100 mg PO or intravenous (IV) for seven days) and regular standard of care. Eighty-five percent (85%) of patients (n=76) demonstrated clinical recovery that is defined as resolution of fever (average 3.7 days, Coeff = -0.96, p = 0.0001), resolution of SOB (average 4.2 days), and improvement of POX: average 84% before treatment and average 95% after treatment (84.7 ± 7% vs. 95 ± 2.6%, p = 0.0001). Higher pre- and post-treatment POX is associated with lower mortality (oxygen saturation (Spo2) vs. Death, Coeff = -0.01, p = 0.023; post-Spo2 vs. Death, Coeff = -0.05, p = 0.0002). Within 10 days of symptom onset, 3% of patients (n=3) were transferred to hospital due to clinical deterioration and 11% of patients (n=10) died. The result was followed for 30 days from the onset of symptoms in each patient.

Conclusion

Early treatment with DOXY for high-risk patients with moderate to severe COVID-19 infections in non-hospital settings, such as LTCFs, is associated with early clinical recovery, decreased hospitalization, and decreased mortality.

Introduction

The COVID-19 pandemic placed an unprecedented and overwhelming burden on the U.S. healthcare system. Since the first case of COVID-19 in the U.S., there have been over two million COVID-19 cases and 122,000 deaths as of June 25, 2020 [1]. One-third of these deaths are nursing home residents or workers [2]. Data from small studies conducted in China [3] and France [4] present the clinical outcomes of COVID-19 patients who were treated with hydroxychloroquine (HCQ) and/or azithromycin (AZI). However, since HCQ and

AZI are both cardiotoxic, there are concerns about the development of arrhythmia in patients treated with these drugs [5]. With limited treatment options, our group first treated high-risk COVID-19 patients in long-term care facilities (LTCFs) with doxycycline (DOXY) and HCQ [6]. DOXY has anti-inflammatory [7], immunomodulating [8], cardioprotective [9-10], and antiviral [11] activities. Subsequently, other studies noted the harmful side effects and mortality associated with HCQ administration [12].

Based on current evidence and reference articles that detail COVID-19 pathophysiology and DOXY's mechanisms of action, DOXY may be an effective drug in the treatment of COVID-19. As a result, we began treating high-risk patients with only DOXY and supportive care. The efficacy of early DOXY intervention in high-risk COVID-19 patients in LTCFs is unknown. In this observational study, we collected data retrospectively, and we are presenting our clinical observations and outcomes of DOXY for high-risk patients with moderate to severe COVID-19 infections in LTCFs.

Materials & Methods

This case series assessed the clinical outcomes of eighty-nine (89) high-risk patients in LTCFs who developed a sudden onset of fever, cough, shortness of breath (SOB), and hypoxia between March 18 and May 13, 2020. High-risk patients were defined as patients who had at least one comorbidity such as hypertension (HTN), diabetes, coronary artery disease (CAD), congestive heart failure (CHF), chronic obstructive pulmonary disorder (COPD), obesity, or ventilator-dependency. These patients were diagnosed with COVID-19 and they were treated with an early course of DOXY (100 mg PO or IV for seven days) and regular standard of care. Since all patients were closely monitored by healthcare workers, COVID-19 symptoms were immediately noticed; DOXY was started within 12 hours and RT-PCR COVID-19 swab was collected. Assessed measures were patients' characteristics, fever, SOB, cough, oxygen saturation/pulse oximetry (POX), radiologic improvements, laboratory tests, DOXY side effects, hospital transfers, and death. Clinical recovery was defined as a resolution of fever, resolution of SOB, and improvement of POX ($\geq 93\%$). Follow-up chest X-rays (CXR) were ordered if clinically indicated.

The statistical analysis was done using Microsoft Excel 2016 (Microsoft Corporation, Redmond, Washington) with statistical application packages and IBM SPSS v23 (IBM Corp., Armonk, NY). The two-tailed T-test was used for between-group intervals in parametric data (e.g. POX). Binary logistic analysis and regression were used to assess the association of risk factors with the outcome. The patients' outcomes were recorded 30 days after symptoms onset.

All patients or patients' families gave informed consent before DOXY treatment was started, and oversight medical boards and corporate clinical services approved this observational study.

Results

Table 1 summarizes the characteristics, clinical features, lab and radiology results, outcomes, and side effects of DOXY of all 89 patients who were started with early DOXY treatment. The median age is 78 years, and the range is 43-101 years. One hundred percent (100%) of patients (n=89) tested positive for COVID-19 through reverse transcription-polymerase chain reaction (RT-PCR) and 85% of patients (n=76) showed clinical recovery. Eleven percent (11%) of patients died (n=10) and 3% of patients (n=3) were transferred to hospitals due to clinical deterioration.

Assessed Measures	LTCF Residents (n=89)	Percentage
Median Age, Years (Range)	78 (43-101)	
Male	50	56%
Female	39	44%
Clinically Recovered*	76	85%
Transferred to Hospital	3	3%
Death	10	11%
Hypertension (HTN)	62	70%
Diabetes	30	34%
Coronary Artery Disease (CAD)	41	46%
Congestive Heart Failure (CHF)	23	26%
Chronic Obstructive Pulmonary Disease (COPD)	31	35%
Obesity	37	42%
Ventilator Dependency**	4	4%
Fever	87	98%
Shortness of Breath (SOB)	85	96%
Cough	83	93%
Malaise/Weakness	71	80%
Altered Mental Status	56	63%
Diarrhea	31	35%
Chest Pain	27	30%
Tested COVID-19 Positive via RT-PCR	89	100%
High BUN	50	56%
High CR	46	52%
High LFT	33	37%

High Regular CRP	65	73%
High Ferritin	63	71%
High LDH	34	38%
High D-Dimer	57	64%
High Troponin	40	45%
High Procalcitonin	34	38%
Chest X-Ray (CXR) with Pneumonia	85	96%
Chest X-Ray (CXR) Improved	39	44%
Chest X-ray (CXR) Not Improved	41	46%
Chest X-Ray (CXR) Unavailable***	9	10%
Nausea, Vomiting, and Abdominal Discomfort	6	7%
No Side Effects	83	93%
Other Antibiotics	11	12%

Table 1: Characteristics, clinical outcomes, clinical features, lab and radiology results, side effects of doxycycline, and other antibiotics of all 89 high-risk COVID-19 patients who started seven-day doxycycline treatment in long-term care facilities

*Clinical recovery defined by resolution of fever (3.7 days), resolution of SOB (4.2 days), and average POX improvement 95%

**Four percent (n=4) of ventilator-dependent patients recovered and the ventilator setting returned to baseline.

***Chest X-ray not ordered, not required, or pending.

BUN: blood urea nitrogen; CRP: C-reactive protein; LFT: liver function test; LDH: lactate dehydrogenase; POX: pulse oximetry

Table 2 summarizes the characteristics, clinical features, lab and radiology results, outcomes, and side effects of DOXY of the remaining 76 patients who successfully completed the seven-day DOXY treatment. One hundred percent (100%) of patients demonstrated clinical improvement. After DOXY treatment started, resolution of fever and SOB occurred at an average of 3.7 days and 4.2 days, respectively. Average POX before and after treatment was 84% and 95%, respectively.

Assessed Measures	LTCF Residents (n=76)	Percentage
Median Age, Years (Range)	79 (43-101)	
Male	42	55%
Female	34	45%
Clinically Recovered*	76	100%
Hypertension (HTN)	52	68%
Diabetes	25	33%

Coronary Artery Disease (CAD)	35	46%
Congestive Heart Failure (CHF)	19	25%
Chronic Obstructive Pulmonary Disease (COPD)	26	34%
Obesity	33	43%
Ventilator Dependency**	4	4%
Fever	74	97%
Shortness of Breath (SOB)	72	95%
Cough	71	93%
Chest Pain	21	28%
Malaise/Weakness	62	82%
Altered Mental Status	45	59%
Diarrhea	25	33%
COVID-19 Positive	76	100%
High BUN	39	51%
High CR	39	51%
High LFT	26	34%
High Regular CRP	53	70%
High Ferritin	53	70%
High LDH	27	36%
High D-Dimer	48	63%
High Troponin	32	42%
High Procalcitonin	28	37%
Individuals with Pulse Oximetry (POX) Between 60% and 69% Before Treatment	4	5%
Individuals with Pulse Oximetry (POX) Between 70% and 80% Before Treatment	18	20%
Individuals with Pulse Oximetry (POX) Between 81% and 89% Before Treatment	42	47%
Individuals with Pulse Oximetry (POX) Between 90% and 92% Before Treatment	25	28%
Average Pulse Oximetry (POX) After Treatment	76	95%
Chest X-Ray (CXR) with Pneumonia	72	95%
Chest X-Ray (CXR) Improved	36	47%
Chest X-Ray (CXR) Not Improved	31	41%
Chest X-Ray (CXR) Unavailable***	9	12%
Nausea, Vomiting and Abdominal Discomfort	6	8%
No Side Effects	70	92%
Other Antibiotics	6	8%

Table 2: Characteristics, clinical outcomes, clinical features, lab and radiology results, side effects of doxycycline, and other antibiotics of 76 high-risk COVID-19 patients who completed seven-day doxycycline treatment in long-term care facilities

This table includes all patients who completed a full course (7 days) of DOXY therapy and excludes any patients who died and who were transferred to hospital and did not complete the seven-day course.

*Clinical recovery defined by resolution of fever (3.7 days), resolution of SOB (4.2 days), and average POX improvement 95% after treatment.

**Four percent (n=4) ventilator-dependent patients recovered and the ventilator setting returned to baseline.

***Chest X-ray either not ordered, or not required or pending.

BUN: blood urea nitrogen; CRP: C-reactive protein; LFT: liver function test; LDH: lactate dehydrogenase; POX: pulse oximetry

There was a statistically significant difference in POX before (pre-POX) and after (post-POX) treatment (n = 89, $84.7 \pm 7\%$ vs. $95 \pm 2.6\%$, p = 0.0001). In the multivariate analysis model, the resolution of fever was associated with a reduction in mortality (Coeff = -0.96, p = 0.0001). Higher pre-POX and post-POX were also associated with decreased mortality; lower pre- and post-treatment POX is associated with increased mortality (pre-oxygen saturation (Spo2) vs Death, Coeff = -0.01, p = 0.023; Post-spo2 vs Death, Coeff = -0.05, p = 0.0002). Other variables, such as initial CXR with pneumonia, BUN, creatinine, liver enzyme levels, CRP, ferritin, LDH, D-Dimer, troponin, and procalcitonin, were not associated with mortality. Overall mortality at 30 days in our cohort was 11% (n=10). Clinical improvement was noted in 76 patients. Additionally, 3% (n=3) required transfer to a hospital while the rest of the patients were treated in the nursing home facility.

Discussion

COVID-19 is a positive-sense, single-stranded ribonucleic acid (RNA) virus [13], with a lipophilic outer shell that allows the pathogen to easily infiltrate lung tissue [14]. The coronavirus is believed to recognize and bind to cluster of differentiation 26 (CD26)/dipeptidyl peptidase-4 (DPP4) markers expressed on the cell surface, serving as an entry point for viral invasion [15]. COVID-19 infects the upper and lower respiratory tract, causing the release of pro-inflammatory cytokines such as interleukin 1B (IL-1B), tumor necrosis factor (TNF), and IL-6 [16]. COVID-19 induces mast cell proliferation within the respiratory submucosa [17] and activates the NF-kB pathway [18], further increasing the inflammatory response. As a result, individuals with COVID-19 present with fever, cough, and SOB. Severe infection can progress to acute respiratory failure and vascular thrombosis.

COVID-19 is additionally correlated with acute cardiac injury and increased troponin I levels [19].

DOXY, an analog of tetracycline, is lipophilic and can also easily penetrate the lung epithelium [20]. Chemically modified tetracyclines (CMTs) can also induce apoptosis of mast cells [21]. The drug downregulates inflammatory markers demonstrated to have a role in COVID-19 pathophysiology. Evidence shows that DOXY downregulates the expression of DPP4 through the inhibition of the NF- κ B pathway [22], impeding the virus's ability to enter cells and consequently decreasing the viral load. Along with its anti-inflammatory and immunomodulatory properties, DOXY is considered to be cardioprotective. During reperfusion after myocardial injury, matrix metalloproteinases-2 (MMP-2) are released. DOXY's inhibition of the MMP-2 pathway rescues left ventricular function [23]. As a result, in patients with acute ST-segment elevation myocardial infarct (STEMI) and left ventricular dysfunction, DOXY reduces adverse left ventricular remodeling [24]. DOXY's cardioprotective characteristics may improve clinical recovery in COVID-19 patients with acute myocardial injury.

DOXY is also thought to have antiviral activity. In-vitro assays of cultured cells inoculated with the dengue virus suggest that DOXY inhibits the virus's serine protease, disrupting viral replication, and viral entry into cells [25]. Another study demonstrates that when cells infected with murine retrovirus were treated with DOXY, there was a 70% decrease in retroviral load [26]. Tetracyclines can potentially treat other viral infections as well, such as viral encephalitis, West Nile virus, and human immunodeficiency virus (HIV) [27]. Further research reveals that elevated levels of intracellular zinc inhibit viral replication of COVID-19 [28] and that DOXY facilitates this inhibition by acting as a zinc ionophore, transporting, and increasing intracellular concentrations of zinc. Recently, a study demonstrated that in-vitro, DOXY itself has antiviral activity against COVID-19 at a concentration of 5.6 μ M [29]. DOXY has anti-inflammatory, immunomodulatory, cardioprotective, and antiviral properties. No observational study has yet been done using an early regimen of DOXY to treat moderate to severe high-risk COVID-19 patients in an LTCF. This case series demonstrates that early DOXY treatment in a non-hospital environment has good clinical recovery (85%, n=76), minimized hospital transfers (3%, n=3), and reduced death (11%, n=10).

A limit to this study is that there was no control group. We thus compared the data from this population to that of a similar reference patient population in an LTCF in Washington. This study performed an epidemiological investigation regarding 129 confirmed cases of COVID-19. Of the 129 confirmed cases, 63% (n=81) were LTCF residents (median age = 81 years, range = 54-100 years), 26% (n=34) were healthcare workers (median age = 42.5 years,

range = 22-79 years, and 11% (n=14) were visitors (median age = 62.5 years, range = 52-88 years). Fifty-six point eight (56.8%) LTCF residents, 35.7% visitors, and 5.9% of healthcare personnel were hospitalized. Comorbidities among LTCF residents included HTN (69.1%), cardiac disease (56.8%), diabetes (37%), obesity (33%), and pulmonary disease (32.1%). Of the total population, 65.1% (n=84) were women. While no deaths occurred among staff members, 27.2% of LTCF residents and 7.1% of visitors died [30]. Comparing this study's data to our data using naive indirect comparison, early DOXY treatment may reduce hospital transfers and decrease mortality.

Conclusions

In this cohort of high-risk LTCF residents with moderate to severe COVID-19 infections who were treated with an early course of DOXY, improvement in oxygen saturation and resolution of fever were factors associated with lower mortality. The median time of all deaths in these high-risk patients was within the first 10 days in the course of illness. In the majority of our cohort, early initiation of DOXY treatment was associated with improved clinical outcomes, decreased hospitalizations, and decreased mortality. Larger randomized control trials are required to study the effect of DOXY treatment in moderate to severe COVID-19 infections.

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