

“To advance the future of pandemic strategic planning in the face of present and future pathogens, may we be inspired to coordinate globally and cooperatively embrace innovative solutions.”

QUICK OVERVIEW:

The global community is at an incredibly unique moment in history; the challenge of COVID-19 is an opportunity to innovate 'leapfrog' solutions and advance our pandemic strategy. There are three windows in a pandemic; the post-FDA vaccine, the post-FDA treatment, and the long window of uncertainty immediately after a pandemic confirmation. It is during the 'window of uncertainty' when it is vital to explore advancing existing pandemic strategy to evolve and advance systematic methodologies designed to recalibrate and optimize the immune function in the human population. Minimizing the adverse health and economic impact of SARS-CoV-2 on the economy and society is critically important. Devising systematic methods to monitor and optimize population-wide immune modulation may help to reduce the adverse effect of COVID-19 on the global economy.¹ When addressing an immune centered pandemic strategy, it is essential to consider preventive measures to monitor and administer deficient micronutrients, such as vitamin D3 and magnesium. These micronutrients may potentially help to reduce susceptibility to respiratory infections and limit the severity of 'cytokine storms' in critical cases of COVID-19. Administering protective measures by focusing on balancing immune function may potentially lessen the severity of secondary respiratory infections and shorten the duration of hospitalizations. It is vital to consider that the future of pandemic preparedness may include optimizing and balancing the human immune system.

PREVENTIVE D3 & MAGNESIUM PROPHYLACTIC MEASURES POTENTIALLY:

1. Reduce susceptibility to secondary respiratory infections
 2. Enhance immune modulation to reduce inflammation
 3. Limit severity of 'cytokine storms' that lead to death in COVID-19
 4. Bronchodilation agent expanding airways
 5. Enhance effectiveness of treatment protocols
 6. May optimize vaccine effectiveness when available
 7. Limited to no regulatory issues to administer, ability to deploy immediately
- A. D3 and magnesium are more effective prophylactic before viral exposure.
- B. To effectively metabolize D3 must be combined with magnesium.

¹ "The coronavirus outbreak is first and foremost a human tragedy, affecting hundreds of thousands of people. It is also having a growing impact on the global economy. This article is intended to provide business leaders with a perspective on the evolving situation and implications for their companies." Source: **March 2020 | Executive Briefing | COVID-19 Implications for Business**
<https://www.mckinsey.com/business-functions/risk/our-insights/covid-19-implications-for-business>



PREVENT RESPIRATORY INFECTIONS

“Vitamin D appears capable of inhibiting pulmonary inflammatory responses while enhancing innate defense mechanisms against respiratory pathogens. Population-based studies reveal an association between circulating vitamin D levels, and lung function.” U.K. at the Institute of Food Research and School of Pharmacy²

H1N1 VITAMIN D HEALTHCARE RECOMMENDATIONS

After the outbreaks of H1N1 influenza in 2009, researchers recommended that “all health care workers and patients be tested and treated for vitamin D deficiency to prevent exacerbation of respiratory infections. Vitamin D reduces the production of proinflammatory cytokines, which may reduce the risk of cytokine storm in H1N1 infection”³

VITAMIN D IN SPANISH FLU

W. Grant and E. Giovannucci at the Sunlight Nutrition and Health Research Center in San Francisco who studied the Spanish Flu Pandemic influenza virus and secondary bacterial lung infections conclude “providing vitamin D supplements evaluated further as a possibly useful component of a comprehensive, vaccine-centered program to reduce influenza mortality rates, both in pandemics and seasonal influenza, especially in the elderly.”⁴ (Grant et al. 2009)

² Source: Vitamin D and respiratory health
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2759054/>

³ Source: Antimicrobial implications of vitamin D. Dermato Endocrinology
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3256336/>

⁴ Source: The possible roles of solar ultraviolet-B radiation and vitamin D in reducing case-fatality rates from the 1918–1919 influenza pandemic in the United States.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2835877/>



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EXECUTIVE SUMMARY

It is crucial to consider the expansion of existing quarantine and isolation procedures to include immune-boosting protocols such as loading dose vitamin D supplementation with magnesium to help slow the transmission of SARS-CoV-2 and reduce mortality rates by boosting population-wide immune function. Advancing existing pandemic protocols beyond isolation and quarantine to additionally include strategic measures designed to boost robust immune function in the population will be critically important to help slow the spread of infection. Enhancing immune function in high risk and vulnerable groups living in close corridor environments, such as prisons and nursing homes will also be strategically important.

Study of the variable mortality rates during the Spanish Flu of 1918–1920 has indicated that seasonal fluctuations in mortality may potentially reveal the effects of vitamin D synthesized in response to solar radiation on immune function. Vitamin D is an immune system modulator that prevents excessive inflammation and reduces susceptibility to infections. Worldwide, 1 billion people have a vitamin D deficiency and weakened immunity. Statistical projections estimate vitamin D deficiencies to be approximately 70% in China⁹, 74% in the U.K.¹⁰ and 42% in the United States.¹¹ Furthermore, weight, race and socio-economic profiles correlate with increased hypovitaminosis D, a deficiency in vitamin D.¹² Containment efforts in Wuhan, China, and on the Diamond Princess might have limited human exposure to ultraviolet B (UVB), thus decreasing vitamin D levels. The containment efforts may have significantly reduced the immune function in populations that previously exhibited high rates of hypovitaminosis D. Vitamin D deficiency may potentially contribute to enhanced vulnerability to viral diseases.¹³

Exploring expansion of the existing pandemic protocols currently centered on isolation and quarantine strategies might be valuable in preventing and reducing the transmission of pathogens. Evolving new pandemic strategies to include protocols designed to preemptively enhance robust immune system function in the global population, and addressing the adverse effects of isolation and quarantine on human immune function will be necessary in future pandemic strategies. A short-term method to optimize immune function is offsetting the prevalence of micronutrient deficiency in humans and mitigating the adverse effects of isolation and quarantine on human populations by administering loading dose vitamin D coupled with magnesium. This strategy would be a cost-effective solution to boost individual and community

9 Source: A comparison study of vitamin D deficiency among older adults in China and the United States. Scientific Reports <https://www.nature.com/articles/s41598-019-56297-y>

10 Source: Top tips: vitamin D deficiency. Guidelines in practice. <https://www.guidelinesinpractice.co.uk/nutrition/top-tips-vitamin-d-deficiency/454118.article>

11 Source: Prevalence of vitamin D deficiency and associated risk factors in the US population. CURES <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6075634>

12 Source: **Vitamin D fact sheet for consumers**. National Institutes of Health Office of Dietary Supplements, U.S. Department of Health and Human Services. <https://ods.od.nih.gov/factsheets/VitaminD-Consumer/>.

13 Source: The Interplay between vitamin D and viral infections. <https://www.ncbi.nlm.nih.gov/pubmed/30614127>



immunity, particularly among vulnerable populations in nursing homes, prisons and healthcare centers.

Crucially, the realistic timeframe for a publicly available COVID-19 vaccine may be 1–3 years away.¹⁴ ¹⁵ Owing to existing pressures and constraints restricting access to pharmaceutical supplies and protective equipment in the United States, innovative 'leapfrog' solutions must be considered for deployment in the current challenges facing our nation. As we prepare for a future of continued and potentially accelerated cross-species viral transmissions,¹⁶ the future of pandemic planning must evolve to integrate complementary strategies to boost community-wide immune modulation.

KEY COVID-19 CHALLENGES IN AMERICA AND FLORIDA

HEALTHCARE WORKERS

Presently there is a global shortage of protective equipment for healthcare workers, according to the World Health Organization.¹⁷ Even in the United States, we will be unable to supply healthcare workers with the necessary protective gear because of manufacturing and supply-chain constraints.¹⁸ Our 18 million healthcare workers in America will be on the frontline of COVID-19 treatment strategies. In Wuhan, 41% of cases were associated with hospital transmission, even with extensive protective equipment and quarantine procedures in place. In Wuhan alone, 1,102 medical workers have been infected, accounting for 73% of infections in the province and 64% nationwide.¹⁹ Due to protective equipment challenges facing our nation, healthcare worker infection and transmission rates in the United States may be significantly higher than those in China. Preemptive prophylactic and immune boosting measures may be instrumental in protecting our healthcare workers on the frontline of COVID-19.

14 Source: How long will it take to develop a coronavirus vaccine?

<https://www.newyorker.com/news/news-desk/how-long-will-it-take-to-develop-a-coronavirus-vaccine>

15 Source: A coronavirus vaccine will take at least 18 months—if it works at all

<https://www.technologyreview.com/s/615331/a-coronavirus-vaccine-will-take-at-least-18-months-if-it-works-at-all>

16 To address this, "continued collaborative efforts needed for research and training between physicians and veterinarians.: Source: **International project focuses on the cross-species transmission of infectious diseases**

<https://www.healio.com/infectious-disease/practice-management/news/print/infectious-disease-news/%7B8aae22bb-d71f-43d7-a323-7bd4d8451c49%7D/international-project-focuses-on-cross-species-transmission-of-infectious-diseases>

17 Source: **Shortage of personal protective equipment endangering health workers worldwide.** <https://www.who.int/news-room/detail/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide> <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3257661/>

18 Source: **Nurses battling coronavirus beg for protective gear and better planning.** The New York Times.

<https://www.nytimes.com/2020/03/05/us/coronavirus-nurses.html>

19 Source: **COVID-19 sickens over 1,700 health workers in China, killing 6.** Center for Infectious Disease Research and Policy.

<http://www.cidrap.umn.edu/news-perspective/2020/02/covid-19-sickens-over-1700-health-workers-china-killing-6>

ELDERLY PEOPLE AND PRE-EXISTING CONDITIONS

Florida is the ‘grayest’ state in the nation, with more than 3,000 assisted living facilities and 700 nursing homes.²⁰ The COVID-19 fatality rate for people 60–70 years old is 3.6%, and this proportion increases to 8% for those 70–80 years old and to 14–22% for those over 80 years old. The diverse residents in the state of Florida²¹ are critically vulnerable to COVID-19. The coronavirus outbreak in the Washington long-term care facility highlights the alarming risk to elderly people and others living in close quarters.²²

According to data as of March 9, 2020, the COVID-19 fatality rates in people with existing medical conditions are as follows: cardiovascular disease, 13.3%; diabetes, 9.2%; chronic respiratory disease, 8.0%; hypertension, 8.4%; and cancer, 7.6%.²³ The American Health Rankings at the United Health Foundation estimate that 121.5 million U.S. adults, or 48% of Americans, have at least one type of cardiovascular disease.²⁴ ²⁵ The CDC Diabetes Report indicates that 30.3 million Americans, or 9.4% of the nation, have diabetes.²⁶ In Florida, more than 2.3 million people, 13% of the population, are estimated to have diabetes.²⁷ The American Lung Association has estimated that 35 million Americans live with a chronic respiratory disease and reported that the respiratory disease rate is soaring.²⁸ ²⁹ The CDC has reported a 27% prevalence of hypertension in Florida.³⁰ The American Heart Association has highlighted that one in three Americans (77.9 million people) has high blood pressure.³¹ The American Cancer Society Journal has reported approximately 1.8 million cancer diagnoses annually, or 4,950 new cancer diagnosis per day.³² Florida Trend has estimated that, in 2015, there were 152.1 cases of cancer per

20 Source: Florida’s seniors most at risk if coronavirus spreads Tampa Bay Times <https://www.tampabay.com/news/health/2020/03/03/floridas-seniors-most-at-risk-if-coronavirus-spreads/>

21 Additional information on population in Florida: US Census Data: State of Florida Population Census Data State of Florida http://edr.state.fl.us/Content/population-demographics/data/Pop_Census_Day.pdf

22 Source: US nursing home COVID-19 outbreak highlights close quarter spread Al Jazeera <https://www.aljazeera.com/news/2020/03/nursing-home-covid-19-outbreak-highlights-close-quarter-spread-200303220606434.html>

23 Source: Age, sex, existing conditions of COVID-19 cases and deaths WorldOmeter. <https://www.worldometers.info/coronavirus/coronavirus-age-sex-demographics/>

24 Source: Public health impact: cardiovascular deaths <https://www.americashealthrankings.org/explore/annual/measure/CVDDeaths/state/FL>

25 Florida fact sheet leading causes of death http://www.heart.org/idc/groups/heart-public/@wcm/@adv/documents/downloadable/ucm_307161.pdf

26 Source: CDC diabetes report: diabetes growth rate steady, adding to health care burden <https://www.cdc.gov/media/releases/2017/p0718-diabetes-report.html>

27 Source: The burden of diabetes in Florida <http://main.diabetes.org/dorg/PDFs/Advocacy/burden-of-diabetes/florida.pdf>

28 Source: Respiratory disease rates have soared <https://www.webmd.com/lung/copd/news/20170929/respiratory-disease-death-rates-have-soared#1>

29 Source: Estimated prevalence and incidence of lung disease <https://www.lung.org/our-initiatives/research/monitoring-trends-in-lung-disease/estimated-prevalence-and-incidence-of-lung-disease/methodology.html>

30 Source: Hypertension in Florida: data from the One Florida Clinical Data Research Network https://www.cdc.gov/pcd/issues/2018/17_0332.htm

31 Source: 2013 statistical fact sheet high blood pressure: https://www.heart.org/idc/groups/heart-public/@wcm/@sop/@smd/documents/downloadable/ucm_319587.pdf

32 Cancer facts and figures 2020 <https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/annual-cancer-facts-and-figures/2020/cancer-facts-and-figures-2020.pdf>

100,000 residents.³³ Examination of the health status of our nation and the state of Florida suggests that we may be an immunocompromised³⁴ and immunosuppressed country because of the high prevalence of diagnosed disease and overlooked malnutrition exacerbated by the prevalent micronutrient deficiencies in our food supply.³⁵ A large proportion of the American population is incredibly vulnerable to mortality rates above 7% from SARS CoV-2 infection and the resulting disease COVID-19.

INCARCERATED AND CONFINED POPULATIONS

Our prison population nationwide comprises more than 2.3 million people housed in close living conditions in 1.3 million state prisons, 612,000 local jails and 221,000 federal prisons and jails. These individuals are extremely vulnerable to coronavirus. As the nation with the dubious distinction of having the highest incarceration rate in the world,³⁶ we must ensure that proactive measures are taken to protect an incredibly vulnerable population with no control over how they prepare for the pandemic. At this juncture, the “scope of preparedness in correctional settings is unclear”³⁷ according to National Association of Criminal Defense Lawyers President Nina J. Ginsberg.³⁸(Oladeu et al. 2020) Alarming, some state authorities plan to use the existing protocol for only the regular flu. This disregard for inmate health is highly concerning because a Chinese CDC study has found that COVID-19 virus is more contagious than either SARS or MERS.³⁹(Griffiths, Gan 2020) Furthermore, continuing waves of high-volume outbreaks have been observed in the country’s prison system. Despite questions of transparency regarding the infection rates in China in general and in the prison population, numerous prison officials have been fired or punished for failing to improve disease control practices in Chinese prisons.⁴⁰

Crucially, more than 540,000 people in confinement in America are in ‘pretrial detention’ and have not yet been convicted of a crime. According to the Prison Policy Initiative, “Many individuals are detained in local jails in ‘pretrial detention’ because they cannot afford to pay the bail amount set to secure their release. The median bail amount for felonies is \$10,000, which presents eight months of income for a typical person detained because they cannot pay

33 Source: Florida Trend cancer statistics

<https://www.floridatrend.com/article/26203/the-fight-against-cancer-in-florida-statistics>

34 Source: National Cancer Institute definition of immunocompromised

<https://www.cancer.gov/publications/dictionaries/cancer-terms/def/immunocompromised>

35 Source: Well fed but undernourished: an American epidemic

<https://kresserstitute.com/well-fed-but-undernourished-an-american-epidemic/>

36 Great visual data in world incarceration rates if every U.S. state were a country: states of incarceration: the global context 2018

<https://www.prisonpolicy.org/global/2018.html>

37 Source: What COVID-19 means for America’s incarcerated population – and how to ensure it’s not left behind.

<https://www.healthaffairs.org/doi/10.1377/hblog20200310.290180/full/>

38Source: Coronavirus plan for California prisons raises inmate and advocate concerns Los Angeles Times <https://www.latimes.com/california/story/2020-03-05/coronavirus-california-prison-plan>

39 Source: Chinese CDC study finds COVID-19 virus to be more contagious than SARS or MERS <https://www.cnn.com/2020/02/19/health/coronavirus-china-sars-mers-intl-hnk/index.html>

40 Source: Cracks in the system: COVID-19 in Chinese prisons

<https://thediplomat.com/2020/03/cracks-in-the-system-covid-19-in-chinese-prisons/>

bail.”⁴¹(Prison Policy 2020) Florida ranks 14th in the nation and has one of the highest incarceration rates (176,000 people in 2018).⁴² The people in this incredibly vulnerable population have no voice in how their safety is secured during this pandemic, and many have yet to be convicted of a crime.

LEARNING FROM HISTORY: VITAMIN D3 CONTAINMENT THEORY

THE SPANISH FLU: A THEORY

Study of the Spanish Flu seasonal mortality rates⁴⁸ has indicated that the variable fluctuations in seasonal death rates between the U.S. and U.K.⁴⁹ directly correlate. Additionally, differentiating citywide Spanish Flu death rates among those in Baltimore, Augusta and San Francisco appears to indicate an additional corollary potentially revealing the effects of solar available vitamin D levels on community-wide immunity. During the Spanish Flu, communities north of the 37th parallel with less sun exposure exhibited higher death rates. The seasonal variability in solar available vitamin D might have drastically affected the Spanish Flu 1918–1919 mortality rates.

THE DIAMOND PRINCESS: A THEORY

Solar UVB is the primary source of vitamin D for most people on Earth.⁵⁰ An unintended consequence of self-isolation, self-quarantine or mandated quarantine may be that populations are restricted from access to solar ultraviolet B (UVB) radiation. Drastically restricted UVB access may be an additional factor to consider when evaluating close corridor containment strategies, which may hinder the immune function of all isolated close living populations. Restricted UVB may provide a new perspective as to why containment strategies deployed in China⁵¹ and on the Diamond Princess⁵² fell short of immediate expected effectiveness.

41 Source: Mass incarceration: the whole pie 2019. Prison Policy Initiative
<https://www.prisonpolicy.org/reports/pie2019.html>

42 Source: Why the prison population is so high in Florida.
<https://www.sun-sentinel.com/news/sound-off-south-florida/fl-ne-hk-sosf-prison-population-florida-20190610-memsufs5onfqdofm7ac6mrx6fe-story.html>

48 Source: The possible roles of solar ultraviolet b radiation and vitamin D in reducing case fatality rates in 1918-1919 influenza pandemic in the United States. <https://europepmc.org/article/pmc/pmc2835877>

49 Source: The effects of the 1918-1919 influenza pandemic on infant and child health in Derbyshire. https://www.researchgate.net/figure/Weekly-death-rates-from-influenza-in-Derbyshire-and-other-areas-from-the-week-ending-29_fig1_8003758

50 Researchers at the Norwegian Institute for Air Research report that “the combined effects of UV radiation and diet on vitamin D status should be explored more rigorously, both in laboratory environments and at the population level. Source: **The relationship between ultraviolet radiation exposure and vitamin D**. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3257661/>

51 Vitamin D insufficiency is prevalent in China. 84% of Men and 89% of women below 30 ng/mL. Source: High Prevalence of Vitamin D Insufficiency in China: Relationship with the Levels of Parathyroid Hormone and Markers of Bone Turnover. PLOS. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3493569/>

52 Source: How the 'failed' quarantine of the Diamond Princess cruise ship started with ten coronavirus cases and ended with more than 700. <https://www.businessinsider.com/how-diamond-princess-cruise-ship-coronavirus-quarantine-went-wrong-2020-2#the-14-day-stipulation-was-meaningless-in-a-context-with-new-infections-and-new-transmission-episodes-adalja-said-23>

TIME TO UPDATE ISOLATION AND QUARANTINE STRATEGY?

In addition to existing strategies to limit infection risk that center on preventing the transmission of pathogens through physical quarantine, the effects of existing containment protocols on the immune function in quarantined and confined populations should be evaluated. Expanding strategies to limit infection transmission⁵³ so that they include auxiliary protocols designed to enhance robust immune function in contained and quarantined populations may help to mitigate the burden on human immune function. Exposure to light, access to clean air and an ability to move are three essential factors influencing immune function. Drastic changes in these three factors may reveal an overlooked aspect of existing isolation and quarantine on micronutrient deficient populations.

LIGHT

Our present quarantine and containment methods must be reevaluated to consider how rapidly restricted access to UV radiation may drastically reduce the vitamin D status and corresponding immune function in contained and quarantined populations. "Skin exposure to sunlight, specifically to UV radiation, triggers very well-known mechanisms that may ultimately promote a profound modulation of the immune system, including both innate and adaptive immunity. This modulation of the immunological response leads to defective control of tumor cells and pathogens."(Cela et al. 2018)⁵⁴ In addition to immunomodulation through the skin via UVB, recent research in neuroimmunology has indicated that light through an eye-brain hormonal modulation can strongly affect the immune response.⁵⁵

Research published in the European Respiratory Journal has examined the correlation of solar UVB exposure and global tuberculosis variability (which was also found to directly correlate with HIV infection in a given population). The study concluded that ultraviolet radiation and the resulting adequate vitamin D status has a more "direct effect on the immune response to bacterial infections by suppressing adaptive immunity and supporting innate immune responses."(Boer et al. 2017)⁵⁶ The unforeseen effects of contemporary quarantine methods may further decrease immune function in societies in which large percentages of the population are

53 Great Resource on US Pandemic Policy: CDC: national pandemic strategy documents.

<https://www.cdc.gov/flu/pandemic-resources/national-strategy/index.html>

54 Source: Immune system modulation produced by ultraviolet radiation

<https://www.intechopen.com/books/immunoregulatory-aspects-of-immunotherapy/immune-system-modulation-produced-by-ultraviolet-radiation>

55 Source: Visible light-induced changes in the immune response through an eye-brain mechanism (photoneuroimmunology)

<https://www.sciencedirect.com/science/article/abs/pii/S1011134495902414>

56 Source: Solar ultraviolet B exposure and global variation in tuberculosis incidence: an ecological analysis

<https://erj.ersjournals.com/content/49/6/1601979>



already deficient in vitamin D because of modern lifestyles, skin cancer prevention practices and micronutrient deficiencies in our food supply.

AIR

As populations self-isolate and quarantine, UVB access is restricted, and the access to clean air is also altered. According to the EPA, “A growing body of scientific evidence has indicated that the air within homes and other buildings can be more seriously polluted than the outdoor air in even the largest and most industrialized cities. Other research indicates that people spend approximately 90 per cent of their time indoors. Thus, for many people, the risks to health may be greater due to exposure to air pollution indoors than outdoors.”⁵⁷

Air pollution is an immediate source of inflammation with the potential to suppress the immune system’s regulatory T cells and decrease their function, thus further reducing lung capacity.⁵⁸ Researchers have stated that exposure to airborne respiratory pathogens and air pollutants modifies respiratory immune responses and is of significant public health importance.⁵⁹ In quarantine or containment situations, populations will be indoors 99–100% of the time and thus have prolonged exposure to toxic air pollutants found in homes.

MOVEMENT

Quarantine and containment drastically restrict the activity level and movement of populations, thereby potentially adversely affecting immune function.⁶⁰ According to the University of Florida Health, physical activity may potentially flush bacteria out of the lungs and airways, in turn reducing susceptibility to illness or even causing changes in antibodies in the immune cells that fight disease.⁶¹ Research published in *Frontiers of Immunology* has stated that “exercise can enhance *in vivo* immune responses to bacterial, viral and other antigens.” (Campbell, Turner 2018) Further evidence from epidemiological studies has revealed that physically active lifestyles help to reduce the incidence of bacterial and viral infections, thus indicating that ‘immune competency’ might potentially be optimized by regular exercise bouts.⁶²

57 Source: The inside story: a guide to indoor air quality. The United States Environmental Protection Agency. <https://www.epa.gov/indoor-air-quality-iaq/inside-story-guide-indoor-air-quality>

58 Source: **Air pollution alters immune function, worsens asthma symptoms.** UC Berkeley News <https://news.berkeley.edu/2010/10/05/asthma/>

59 Source: Effects of air pollutants on innate immunity: the role of Toll-like receptors and nucleotide-binding oligomerization domain-like receptors. *The Journal of Allergy and Clinical Immunology* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4341993/>

60 Source: **Exercise and immunity.** Medline Plus U.S. National Library of Medicine National Institute of Health. <https://medlineplus.gov/ency/article/007165.htm>

61). Source: **Exercise and immunity.** The University of Florida Health. <https://ufhealth.org/exercise-and-immunity>

62 Source: Debunking the myth of exercise-induced immune suppression: redefining the impact of exercise on immunological health across the lifespan. *Frontiers in Immunology* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5911985/>

A SOLUTION: MONITORING VITAMIN D3 AND MAGNESIUM

WHAT ARE THE BENEFITS OF VITAMIN D3?

According to researchers Susan Esposito and Mara Lelii “Vitamin D, or the ‘sunshine vitamin,’ is not just a vitamin; it is also a prohormone, a performance enhancer with numerous functions in the body.”⁶⁵(Esposito, Lelii 2015) Vitamin D is a potent immunomodulator that affects both the innate and adaptive immune response and plays a central role in maintaining immune homeostasis.⁶⁶

BOOSTING IMMUNE FUNCTION

Evidence suggests that vitamin D may have a therapeutic role in managing a variety of infections.⁶⁷ Vitamin D is a powerful immune system modulator that is necessary to activate the immune system’s T-cells, which identify and attack pathogens circulating throughout the body.⁶⁸ Vitamin D is increasingly being recognized for its positive effect on inflammation and enhancing the immune response to infection. Vitamin D has demonstrated to enhance immune response and reduce the implications of influenza in humans.⁶⁹ According to researchers at the Division of Endocrinology and Metabolism, Department of Internal Medicine, at the Medical University of Graz in Austria, “Vitamin D research has confirmed important interactions between vitamin D and cells from the innate as well as from the adaptive immune system. Data has shown that a broad spectrum of tissue cells, including immune cells, express vitamin D metabolizing enzymes, providing a biologically plausible mechanism for local, auto- and paracrine conversion of the native circulating forms, to the active form calcitriol. This process seems to be essential for normal immune function and therefore impaired, or insufficient vitamin D levels may lead to dysregulation of immune responses.”⁷⁰(Prietl et al. 2013). According to Dr. M. Hewison at the Department of Orthopedic Surgery and Molecular Biology Institute, David Geffen School of Medicine at UCLA, “In support of a broader role for vitamin D in human health, studies in vitro and using animal models have highlighted immunomodulatory and anticancer effects of vitamin D.” ⁷¹(Forrest, Stuhldeher 2011)

65 Source: Vitamin D and respiratory tract infections in childhood. BMC Infectious Diseases <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4628332/>

66 Source: Vitamin D and molecular actions on the immune system: modulation of innate and autoimmunity <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2861286/>

67 Source: Antimicrobial implications of vitamin D. Dermato Endocrinology <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3256336/>

68 Source: **An update on vitamin D and human immunity.** The Journal of Clinical Endocrinology and Metabolism. <https://www.ncbi.nlm.nih.gov/pubmed/21995874>

69 Source: **Vitamin D and influenza.** Advanced Nutrition <https://www.ncbi.nlm.nih.gov/pubmed/22797987>

70 Source: Vitamin D and immune function. Nutrients. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3738984/>

71 Source: **Prevalence and correlates of vitamin D deficiency** in US adults. Nutritional Research <https://www.ncbi.nlm.nih.gov/pubmed/21310306>

PREVENT RESPIRATORY INFECTIONS

According to researchers in the U.K. at the Institute of Food Research and School of Pharmacy, “Vitamin D appears capable of inhibiting pulmonary inflammatory responses while enhancing innate defense mechanisms against respiratory pathogens. Population-based studies reveal an association between circulating vitamin D levels, and lung function indicating strong justification for randomized controlled clinical trials of vitamin D supplementation in patients with respiratory diseases.”⁷²(Hughes, Norton 2009) Research in China, at the Department of Nutrition and Food Hygiene, Hubei Key Laboratory of Food Nutrition and Safety and the Ministry of Education Key Laboratory of Environment and Health, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China and the Department of Clinical Nutrition, People's Hospital of Sanya City, China, has confirmed an association between respiratory tract infections and vitamin D deficiency. The researchers observed inverse trends between vitamin D supplementation and the frequency and risk of respiratory tract infection, respiratory tract infection, and respiratory tract infection-related hospitalizations.”⁷³(Hong et al. 2020). Additionally, according to Margherita T. Cantorna at the Albert Einstein College of Medicine Center for Immunology and Infectious Disease at Pennsylvania State University, “There is strong evidence in humans and animal models that suggests that improving vitamin D status might be beneficial for improving outcomes of lung infection with a variety of microbes. It may be that vitamin D will have different effects depending on the nature of the host response and the relevant pathogen.”⁷⁴(Cantorna 2016)

H1N1 AND VITAMIN D—HEALTHCARE WORKER RECOMMENDATIONS

After the outbreaks of H1N1 influenza in 2009, researchers recommended that “all health care workers and patients be tested and treated for vitamin D deficiency to prevent exacerbation of respiratory infections. Vitamin D reduces the production of proinflammatory cytokines, which may reduce the risk of cytokine storm in H1N1 infection”⁷⁵(Youssef et al. 2011). In addition, W. Grant and E. Giovannucci at the Sunlight Nutrition and Health Research Center in San Francisco have studied the Spanish Flu Pandemic influenza virus, secondary bacterial lung infections and the subsequent role that solar UVB radiation and vitamin D might have had in reducing mortality rates. The researchers conclude that “providing vitamin D supplements or fortifying commonly consumed foods with higher amounts of vitamin D should be evaluated further as a possibly

72 Source: Vitamin D and respiratory health

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2759054/>

73 Source: Association of vitamin D supplementation with respiratory tract infections in infants. *Maternal Child and Nutrition*.

<https://onlinelibrary.wiley.com/doi/full/10.1111/mcn.12987?af=R>

74 Source: **Vitamin D and lung infection**. *Infection and immunology*

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5067742/>

75Source: Antimicrobial implications of vitamin D. *Dermato Endocrinology*

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3256336/>

useful component of a comprehensive, vaccine-centered program to reduce influenza mortality rates, both in pandemics and seasonal influenza, especially in the elderly."⁷⁶(Grant et al. 2009)

BOOST VACCINE RESPONSE:

According to researchers at the Mayo Clinic Vaccine Research Group Division of Infectious Diseases, there is a high potential for vitamin D to enhance the immune response to vaccines. Numerous studies are underway to investigate and theoretically confirm whether the prevalent hypothesis that vitamin D may be an effective adjuvant for vaccinations is correct⁷⁷ Further examination of the signaling pathways involved will be imperative. "Determining whether vitamin D will prove to be a promising adjuvant for vaccination will require further study. Vitamin D's role in innate, humoral and cellular immune responses to different classes of vaccines (bacterial, viral, polysaccharide, protein, etc.) remains unclear and yet is amenable to scientific inquiry."⁷⁸(Sadarangani et al. 2015)

MODERN POPULATIONS ARE CRITICALLY DEFICIENT IN VITAMIN D

Vitamin D deficiency is a widespread problem across all ages and socioeconomic strata.⁷⁹ Even in Florida, the 'sunshine state,' owing to modern lifestyles, skin cancer prevention practices, and micronutrient deficiencies in our food supply, a substantial number of Floridians are deficient in vitamin D. In America, "the overall prevalence rate of vitamin D deficiency is 41.6%, with the highest rate seen in African Americans (82.1%), followed by Hispanics (69.2%). Vitamin D deficiency was significantly more common among those who had no college education, were obese, with poor health status, hypertension, low high-density lipoprotein cholesterol level, or not consuming milk daily."⁸⁰(Forrest, Stuhldreher 2011) Even when supplementing, many people lack the proper magnesium levels to effectively metabolize vitamin D, because of mineral deficiencies.⁸¹ Vitamin D deficiency is an 'overlooked epidemic' and a serious global health problem; worldwide, more than 1 billion people are estimated to be deficient in vitamin D.⁸²

76 Source: The possible roles of solar ultraviolet-B radiation and vitamin D in reducing case-fatality rates from the 1918–1919 influenza pandemic in the United States.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2835877/>

77 Source: Numerous active studies are investigating the impact of vitamin D on vaccine immunogenicity presently registered on Clinicaltrials.gov.

78 Source: "Let there be light": the role of vitamin D in the immune response to vaccines. Expert Review of

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4913549/>

79 Source: Annual intramuscular injection of a megadose of cholecalciferol for treatment of vitamin D deficiency: efficacy and safety data. The Medical Journal of Australia

<https://www.mja.com.au/journal/2005/183/1/annual-intramuscular-injection-megadose-cholecalciferol-treatment-vitamin-d>

80 Source: Prevalence and correlates of vitamin D deficiency in US adults. Nutritional Research. <https://www.ncbi.nlm.nih.gov/pubmed/21310306>

81 Source: Low magnesium levels make vitamin D ineffective. Science Daily

<https://www.sciencedaily.com/releases/2018/02/180226122548.htm>

82 Source: Vitamin D deficiency an ignored epidemic

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3068797/>

INCLUDING MAGNESIUM IS A CRITICAL FACTOR

MAGNESIUM BENEFITS

Magnesium⁸³ a “unique bronchodilating agent” that relaxes the bronchial muscles, in turn expanding the airways and allowing more air to move in and out of lungs.⁸⁴ Magnesium is involved in hundreds of biochemical reactions in the human body.⁸⁵ Researchers have correlated magnesium deficiency with “chronic low-grade inflammation that increases the risk for chronic illness”⁸⁶(Nielsen 2018). Researchers in Iran, at Tehran University of Medical Sciences, have indicated that “magnesium supplementation is a prudent consideration to reduce chronic disease risk and improve overall health.”⁸⁷

MAGNESIUM DEFICIENCY

Magnesium is under-consumed in the United States; 50% of the American population has been estimated to be magnesium deficient.⁸⁸ According to the National Institutes of Health, populations with alcohol dependence, type 2 diabetes and gastrointestinal diseases exhibit greater magnesium inadequacy.⁸⁹ Numerous studies have indicated that increasing soil depletion is a critical factor contributing to the increasing prevalence of micronutrient deficiencies in both the developing and developed world.^{90 91}

VITAMIN D3 AND MAGNESIUM: AN EFFECTIVE COMBINATION

Preventing acute respiratory syndrome is strategically important to minimize the catastrophic loss of and long-term impacts on survivors of COVID-19. Through a combined intramuscular loading dose of vitamin D combined with magnesium, populations may potentially

83 “Magnesium has been advocated for the treatment of a variety of conditions seen in emergency medicine.” (Kaye, O’Sullivan 2002). This is a great resource: **The role of magnesium in the emergency department**. Emergency Medicine Journal <https://emj.bmj.com/content/19/4/288>

84 Source: Bronchodilation effect of intravenous magnesium sulfate in bronchial asthma. <https://www.ncbi.nlm.nih.gov/pubmed/3806898>

85 Source: Bronchodilating effect of intravenous magnesium sulfate in bronchial asthma. Journal of the American Medical Association Source: <https://www.ncbi.nlm.nih.gov/pubmed/3806898>

86 Source: **Magnesium deficiency and increased inflammation: current perspectives**. Journal of Inflammation Research <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5783146/>.

87 Source: Effects of oral magnesium supplementation on inflammatory markers in middle-aged overweight without men. Journal of research in Medical Sciences <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3685774/>

88 Source: Low magnesium levels make vitamin D ineffective

<https://www.sciencedaily.com/releases/2018/02/180226122548.htm> Source 2: Micronutrient Inadequacies in the US Population: An Overview. <https://lpi.oregonstate.edu/mic/micronutrient-inadequacies/overview>

89 Source: **Magnesium fact sheet for health professionals**. National Institute of Health Office of Dietary Supplements <https://ods.od.nih.gov/factsheets/Magnesium-HealthProfessional/>

90 Source: Are depleted soils causing a reduction in the mineral content of food crops?

https://soils.wisc.edu/facstaff/barak/poster_gallery/minneapolis2000a/

91 Dirt poor: have fruits and vegetables become less nutritious?

<https://www.scientificamerican.com/article/soil-depletion-and-nutrition-loss/>

acquire boosted immune function and enhanced resistance to respiratory infections through comprehensively decreased inflammation.

PATHOLOGY FINDINGS FOR COVID-19: ACUTE RESPIRATORY SYNDROME

According to early research published in The Lancet Respiratory Medicine on Feb 18, 2020, teams in Wuhan, China, at the frontline of the COVID-19 treatment effort, revealed early insights into move pathological findings that are helping to improve the local and now global clinical strategies against SARS-CoV-2 and the resulting disease COVID-19. The study was conducted in accordance with regulations issued by the National Health Commission of China complied with the Declaration of Helsinki. The authors observed the “pathological characteristics of a patient who died from severe infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by postmortem biopsies.”⁹²(Xu et al. 2020) Acute respiratory distress syndrome is a type of respiratory failure characterized by the rapid onset of inflammation in the lungs. According to the American Lung Association, it is rapidly progressive in critically ill patients.⁹³ According to the Mayo Clinic, "the majority of people who develop acute respiratory distress syndrome do not survive, and those that do recover may exhibit lasting damage to their lungs."⁹⁴(Mayo Clinic 2020)

TIMELINE FOR COVID-19 VACCINE OF 1–3 YEARS OR LONGER

Protecting the health of the American population is crucial until an effective COVID-19 vaccine is available. The realistic timeframe for a publicly available COVID-19 vaccine will likely be 1–3 years according to statements from numerous researchers and companies currently entering preclinical and phase 1 trials. Even with accelerated FDA approval mandates, the duration to complete phase three trails will potentially be 1–2 years away. According to Anthony Fauci, the head of the National Institutes of Allergy and Infectious Disease, who has advised six presidents, including Ronald Reagan during the HIV epidemic, "Despite the fast start, any vaccine needs to prove that it is safe and that it protects people from infection. Those steps are what locks in the inconvenient 18-month timeline. While a safety test might take only three months, the vaccine would then need to be given to hundreds or thousands of people at the core of an outbreak to see if recipients are protected. That could take a year no matter what technology is

92 Source: Pathological findings of COVID-19 associated with acute respiratory distress syndrome. The Lancet Respiratory Medicine [https://www.thelancet.com/journals/lancet/article/PIIS2213-2600\(20\)30076-X/fulltext#seccetitle20](https://www.thelancet.com/journals/lancet/article/PIIS2213-2600(20)30076-X/fulltext#seccetitle20)

93 Source: Acute respiratory distress syndrome (ARDS). American Lung Association. <https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/ards/>

94 Source: Mayo Clinic: acute respiratory distress syndrome <https://www.mayoclinic.org/diseases-conditions/ards/symptoms-causes/syc-20355576>

employed.”(Regalado 2020)¹¹² As a result, it may be wise to consider adopting a complementary system to boost the immunity of Americans for at least 1–3 years through-loading dose vitamin D and magnesium protocol.

COMMUNITY IMMUNITY PROTOCOL

THE TWO KEY STRATEGIES TO LIMIT INFECTION RISK

1. Containment - Preventing the transmission of pathogens through isolation, containment and quarantine.
2. Immune Optimization- Enhancing robust immune function in isolated and quarantined populations through immune system monitoring and enhancement through micronutrients such as vitamin D3 and Magnesium.

(The Community Immunity Protocol documentation is available upon request.)

AIR QUALITY

Air quality is a concern for isolated and quarantined populations, people are recommended to open windows daily to access fresh air. For people with access to a balcony or a yard, it is advisable to spend 20 minutes to 1 hour a day outside to access fresh air and ultraviolet light.

MOVEMENT CAMPAIGNS

Because movement plays a critical role in immune and respiratory health, populations should be encouraged to exercise 20 minutes to 1 hour per day while in isolation and quarantine. Collaboration with leading fitness platforms, and exercise and sports influencers, to develop fun messaging campaigns to inspire fitness activity in populations subject to quarantine or isolation is vital. In addition, working with leading sports and fitness influencers to launch fitness challenges for their target demographics should be considered. Integrating ‘gamified’¹¹⁵ national, state and county home fitness challenges across a wide variety of categories with daily, weekly

¹¹² Source: A coronavirus vaccine will take at least 18 months—if it works at all
<https://www.technologyreview.com/s/615331/a-coronavirus-vaccine-will-take-at-least-18-monthsif-it-works-at-all>

¹¹⁵ According to the Pew Research Center, "the word 'gamification'" describes an interactive online design that uses people's competitive instincts and often incorporates rewards to drive action, including virtual rewards such as points, payments, badges, discounts and 'free' gifts; and status indicators such as friend counts, retweets, leader boards, achievement data, progress bars and the ability to 'level up.'" Source: The future of gamification
<https://www.pewresearch.org/internet/2012/05/18/the-future-of-gamification/>

and monthly prizes that quarantined and isolated individuals can compete for would provide a fun way to stimulate movement and keep people busy. Gamified competitions with integrated social engagement would enable movement campaigns to be more productive and drive engagement.

SPANISH FLU GUNNISON, COLORADO

Gunnison, Colorado¹¹⁶, is often referred to as the town that dodged the Spanish Flu, because of its well-orchestrated and proactive sequestration measures.¹¹⁷ Gunnison was a farming and mining town with a population of approximately 1,300 people, two rail lines linking to Denver, and a high-density population center with high Spanish Flu infection rates. Through proactive, coordinated and bold measures, Gunnison focused on educating residents by providing practical tips about how to avoid the flu and explaining the treatment. Transparent messaging executed through key direct facing community leaders, doctors, police and newspapers were central to Gunnison's strategy. Through direct facing and coordinated engagement campaigns, Gunnison built a robust rapport of trust and repeatedly encouraged the population to expand their capacity for patience.¹¹⁸

Gunnison's success extends far beyond the physical practicality of sequestration; the brilliance was in the ability to apply coordinated information campaigns through direct facing members of the community and traditional channels such as the newspaper. Through all channels of communication, it is essential to relay practical and informative messages to the population describing how to protect oneself from the pandemic, what procedures to follow when sick and treatment to use when one is sick. The trust-building communication strategy deployed by Gunnison was coupled with repeated messaging asking and reminding people to be patient. Consistent and repeated messaging about patience may have played a pivotal role in community-wide compliance with the sick quarantine measures deployed by the town.

116, The center for the history of medicine has a fabulous 1918 influenza digital archive: Center for the History of Medicine University of Michigan Medical School.

<http://chm.med.umich.edu/research/1918-influenza-escape-communities/gunnison/>

117 Source: **Gunnison, Colorado: the town that dodges the 1918 Spanish flu pandemic.** The Guardian.

<https://www.theguardian.com/world/2020/mar/01/gunnison-colorado-the-town-that-dodged-the-1918-spanish-flu-pandemic>

118 The British Ministry of Information initiated one of the most iconic campaigns of in history that anchors a population in patience in 1939 in preparation for World War II. The intent of the catchy and beautifully designed slogan and the poster was to raise the morale of the British public. 'Keep Calm' is perhaps the most iconic viral message relevant to this day. Source: **Keep calm and carry on – the compromise behind the slogan**

Source 1: <https://history.blog.gov.uk/2014/06/27/keep-calm-and-carry-on-the-compromise-behind-the-slogan/>

Source 2: 'Keep Calm and Carry On' History <https://www.keepcalmandcarryon.com/history/>



HISTORY OF AMERICAN FOOD FORTIFICATION

INSIGHTS FROM THE 1920 'GOITER BELT'

During World War II, military recruiting efforts were hindered by the prevalence of micronutrient deficiencies in the population.¹¹⁹ In 1922, the Midwest and Great Lakes Region were named the 'Goiter Belt' because the incidence of goiter, a swelling of the thyroid gland was 30–40% higher than that outside the region.¹²⁰ The lack of Iodine in the regional soil caused low thyroid and goiter. In the first instance of a broad-reaching food fortification program, in the 1920s, the Michigan State Medical Society initiated the Iodized Salt Committee to add iodine to salt to introduce iodine fortification to the population. This method was demonstrated to be an effective channel of iodizing the population for many years. Notably, research evaluating the cognitive effects on military personnel found that “the cognitive abilities of men born in iodine-deficient regions rose relative to those born in non-deficient regions for cohorts in utero after the advent of iodization.”¹²¹(Feyrer et al. 2015).

Because modern populations may alter their salt consumption habits and the micronutrient depletion of our soil is accelerating, new fortification channels beyond salt should perhaps be considered to address the increasing low iodine levels and high volume of thyroid health problems faced by modern Americans. In Hashimoto’s thyroiditis, an inflammation of the thyroid, immune function malfunctions, attacking the thyroid. Thyroid hormones play essential roles in both the innate and adaptive immune responses.¹²² According to Kul C. Gautam, UNICEF Deputy Executive Director, “Iodine deficiency disorders are the single greatest cause of preventable mental retardation globally. Today over 1 billion people in the world suffer from iodine deficiency, and 38 million babies born every year are not protected from brain damage due to iodine deficiency disorders. These 38 million, or nearly 30 per cent of the world's newborns, come from families that are the least educated, most isolated and economically disadvantaged.”¹²³(UNICEF 2020). Iodine is one of the essential minerals supporting healthy cellular and metabolic functioning.¹²⁴

119 Source: **The price of inequality** page 128 by Joseph E. Stiglitz

120 Source: Iodine, a critically overlooked nutrient. Alternative and contemporary therapies <https://www.liebertpub.com/doi/abs/10.1089/act.2007.13309>

121 Source: The cognitive effects of micronutrient deficiency: evidence from salt iodization in the United States.

Source: https://homepages.econ.ed.ac.uk/~dpoliti/FPW_2015_02_26.pdf

122 Source: Thyroid hormone action on innate immunity

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6558108/>

123 Source: Kul. C. Gautam, UNICEF Deputy Executive Director: sustainable elimination of iodine deficiency: a public health triumph in the making. Unicef Annual Meeting. https://www.unicef.org/media/media_41175.html

124 Source: Iodine fact sheet for health professionals. National Institute of Health Office of Dietary Supplements.

<https://ods.od.nih.gov/factsheets/Iodine-HealthProfessional/>

RICKETS & VITAMIN D DEFICIENCY

Food fortification¹²⁵ has been a practical and systematic method to counterbalance identified nutrient deficiencies in populations. In the early 19th century, populations shifted to industrialized lifestyles that resulted in inadequate sun exposure, thus causing a high prevalence of vitamin D deficiency. Historical analysis of periods as far back as the 1600s has revealed that children growing up in polluted industrialized cities and high-density urban centers exhibited a higher prevalence of rickets.¹²⁶ In the 1930s, fortification of milk and other commonly eaten foods with vitamin D was instrumental in eradicating the first wave of rickets. Throughout history, immigrant and refugee populations have presented unique health challenges to host nations. According to research published in *Frontiers in Endocrinology*, in 1960–1970s, “Individuals with ‘darker-skin pigmentation’ immigrating to Europe and the U.K. were predisposed to vitamin D deficiency, in turn, launching a ‘second wave’ of rickets.”¹²⁷ (Wheeler et al. 2019)

Currently, a ‘third wave’ of nutritional rickets is increasing in high-income countries because of the influx of immigrant populations. According to researchers, nutritional rickets is predominantly observed in children from the Middle East, Africa and South Asia. Essential factors that contribute are darker skin pigmentation, sun avoidance practices and prolonged breastfeeding without vitamin D supplementation. Additionally, a lack of vitamin D in fortified dairy products in the diet contributes significantly to vitamin D deficiency.¹²⁸ Worldwide and in the United States, rickets is making a substantial comeback. In America, hypovitaminosis D is adversely affecting the vitamin D status of young children, because of the prevalence of vitamin D deficiency in breast milk. According to research, “Approximately 83% of the children with rickets were described as African American or black, and 96% were breastfed.”¹²⁹ (Weisberg et al. 2003) Socio-economic status is a critical factor in evaluating the prevalence of vitamin D in the American population.

At present, socio-economic inequalities are further accelerating micronutrient deficiencies in the most vulnerable populations. Unhealthy eating choices correlate with food cost, food accessibility and the cultural preferences of demographic populations.¹³⁰ Furthermore, according to the 2011 Food Survey in the U.K., after the recession of 2008, people purchased 10–20% less fruit and vegetables and significantly reduced quantities of milk, bread and fish.¹³¹ As we move into a recession, it is essential to consider how consumer behavior will amplify

125 Great resource on the history of food fortification: the history of food fortification in the United States: its relevance for current fortification efforts in developing countries. *Economic Development and Cultural Change*

Source: http://web1.sph.emory.edu/users/hpacho2/PartnershipsMaize/Bishai_2002.pdf

126 Source: **Resurrection of vitamin D deficiency and rickets.** *Journal of Clinical Investigation* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1523417/>

127 Source: A brief history of nutritional rickets. *Frontiers in Endocrinology* <https://www.frontiersin.org/articles/10.3389/fendo.2019.00795/full>

128 Source: **Nutritional rickets in immigration and refugee children.** *Public Health Reviews* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5810111/>

129 Nutritional rickets among children in the United States: review of cases reported between 1986 and 2003 *American Journal of Clinical Nutrition* <https://www.ncbi.nlm.nih.gov/pubmed/15585790>

130 Source: Socioeconomic inequalities in the healthiness of food choices: exploring the contributions of food expenditures. *Preventive Medicine* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4910945/>

131 Source: **So rickets in back. Blame poverty, not a lack of sun.** *The Guardian* <https://www.theguardian.com/commentisfree/2012/dec/16/rickets-down-to-poverty-not-sun>



preexisting nutritional deficiencies in global populations. In this 2020 recession, not only price but also ease of access limited by the constraints of isolation and quarantine will be central factors altering consumer behavior. Consequently, consumer purchases of fresh nutrient-dense and fortified foods will significantly decrease across a wide range of economic strata in the coming recession compared with the 2008 recession. Recessional spending behaviors may potentially amplify existing nutritional deficiencies by 10–20% or more, in turn taxing healthcare systems by further decreasing immunity in populations.

PLANNING FOR A NEW FUTURE OF FORTIFIED FOODS STRATEGY

According to researchers at the FDA Center for Food Safety and Applied Nutrition, “Cross-sectional studies reveal that existing fortification practices in the United States and Canada are ineffective in preventing hypovitaminosis D, particularly in vulnerable socio-economic populations during the winter.”¹³²(Calvo et al. 2004) As cultural eating habits change, and the effects of quarantine alter consumer behavior, we evaluating the channels of fortification in our food supply will be crucial, so that the critical populations who are most vulnerable will have access to affordable fortified food to boost their immune and cognitive function. Expanding the existing fortification policy in the United States is advisable, to enable the fortification of food products most commonly eaten by the lower socio-economic strata in society. Currently, the FDA does not consider fortification of "snack or junk foods" appropriate.¹³³ Realistically, fortifying these foods may be the only effective channel for food fortification that can reach the lowest economic strata of our society. When developing new vitamin D and iodine fortification strategies, simultaneously including magnesium and other micronutrients essential to immune function will be crucial, so that micronutrient deficient populations can metabolize the vitamin D. Additionally, a future-forward food fortification strategy could potentially include launching a fortified snack food to distribute in refugee camps. This channeled distribution of targeted nutrition would enhance immune and brain function in immigrant populations and subsequently reduce healthcare costs when these populations arrive in host countries.

Evaluating the future of food fortification strategies globally is critical. Collectively as a species, we are micronutrient deficient, and our immune systems are operating at reduced capacity, thus leading to accelerating rates of illness and ever-increasing vulnerability both to the new coronavirus pathogen that we currently face and to future pathogens that will plague the next generation. To equip the next generation, which will face challenges beyond our comprehension today, it is our duty, as humans who care, to prepare the leaders, problem solvers and innovators of tomorrow with optimal immune and cognitive function to best equip them to

¹³² Source: Vitamin D fortification in the United States and Canada: current status and data needs. American Journal of Clinical Nutrition. <https://www.ncbi.nlm.nih.gov/pubmed/15585792>

¹³³ Source: Institute of Medicine (US) Committee on Use of Dietary References Intakes in Nutrition Labeling (2003). Overview of Food Fortification in the United States and Canada. National Academies Press (US). <https://www.ncbi.nlm.nih.gov/books/NBK208880/>



navigate the unknown future that awaits. This goal would be achievable through a comprehensive, globally coordinated food fortification strategy. By addressing the global and local micronutrient deficiencies of all socio-economic strata of our populations, this will help to reduce the current and future economic and capacity pressures on healthcare systems.

According to Megan Brown, a public health pharmacist, numerous conditions have been linked to vitamin D deficiency, including diabetes, heart disease, breast, colorectal and prostate cancer, dementia, depression, erectile dysfunction, osteoporosis and bone disorders.¹³⁴ For diabetes, as an example, the healthcare costs are substantial and pose critical challenges to clinical and public healthcare systems globally, thus raising increasing alarm and concern regarding the sustainability of existing healthcare models.¹³⁵ Developing a systematic and innovative solution through future-forward food fortification addressing micronutrient and vitamin D deficiency across the entire socio-economic spectrum, with particular emphasis on the populations at the bottom of the socioeconomic spectrum, would reduce our vulnerability to pathogens and optimize the cognitive and immune function of the next generation.

134 Source: 7 Health conditions linked to vitamin D deficiency, from diabetes to dementia
<https://www.goodrx.com/blog/diseases-linked-to-vitamin-d-deficiency-diabetes-dementia-cancer/>

135 Source: Impact of diabetes on healthcare costs in a population-based cohort: a cost analysis
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5014203/>

THE FUTURE OF PANDEMIC STRATEGIC PLANNING

We should consider evolving future pandemic strategy to include structured methods to boost population-wide immunity beyond through oral and intramuscular loading dose micronutrient optimization immediately before and during a pathogenetic threat. Post-quarantine strategies should be included to comprehensively and systematically address the resulting amplification of hypovitaminosis D and other micronutrient deficiencies in populations as a result of the effects of quarantine and recession on human behavior.

Preemptively administering vitamin D and immune-boosting micronutrients to populations before pathogen exposure will be critical. The immunological properties of vitamin D, in the case of tuberculosis studies, have been demonstrated to be more beneficial for "the prevention of the progression of the active disease rather than improving the cure of active disease." (Boer et al. 2017) In the case of COVID-19, studies emerging from China are indicating that people may not be dying from the virus itself but from the immune response of the cytokine storm that ravages healthy lung tissue.¹³⁶ It is essential to consider the role of vitamin D "metabolites in the downregulation of pro-inflammatory cytokines and stimulation of regulatory T-cells." (Boer et al. 2017) In studies of patients with cystic fibrosis, researchers have recommended vitamin D to reduce pro-inflammatory cytokine storms.¹³⁷ (Olszowiec-Chlebna et al. 2019)

Additionally, pneumococcal researchers at the Murdoch Children's Research Institute have found that "vitamin D enhances protection against infectious disease, particularly in high-risk settings involving low sunlight and increased exposure to pathogenic microorganisms."¹³⁸ (Hoe et al. 2016) Vitamin D may be a vital component in an immunomodulatory strategy to reduce viral pneumonia and complications from 'cytokine storms.' Vitamin D may be integral to suppressing redundant immune response in the treatment of patients with COVID-19.¹³⁹

In Wuhan, China, residents have been quarantined for more than 7 weeks,¹⁴⁰ thus altering their eating habits and significantly reducing their exercise and mobility patterns, while exposing the population to high volumes of toxic indoor air and significantly if not completely restricting access to UVB. The effects may potentially be catastrophic on human immune function. These factors are highly likely to compound, thus further reducing the critically low vitamin D levels, amplifying population-wide micronutrient deficiencies, and further hindering immune function

136 Source: How doctors can potentially significantly reduce the number of deaths from Covid-19
<https://www.vox.com/2020/3/12/21176783/coronavirus-covid-19-deaths-china-treatment-cytokine-storm-syndrome>

137 Source: Vitamin D inhibits pro-inflammatory cytokines in the airways of cystic fibrosis patients infected by *Pseudomonas aeruginosa*- a pilot study.
<https://www.ncbi.nlm.nih.gov/pubmed/30922377>

138 Source: Anti-inflammatory effects of vitamin D on human immune cells in the context of bacterial infection
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5188461/>

139 Source: The cytokine storm of severe influenza and development of immunomodulatory therapy
<https://www.nature.com/articles/cmi201574>

140 Source: How are Wuhan residents coping mentally after 7 weeks of quarantine?
<https://www.npr.org/2020/03/13/815307800/how-are-wuhan-residents-coping-mentally-after-7-weeks-of-quarantine>

in the Chinese population. Before COVID-19, researchers have estimated the vitamin D deficiency rate to be 87.1% overall, with rates of severe deficiency higher in females (59.3%) than in males (42.7%).¹⁴¹ Vitamin D inadequacy is common in Asian populations and particularly elderly people.¹⁴² The vitamin D status in mainland China preceding COVID-19 was a critically vulnerable situation that posed significant health risks.¹⁴³ Numerous researchers have called COVID-19 an urgent issue and recommended targeting prevention measures to mitigate the vitamin D deficiency in the population. Post quarantine, deploying advanced micronutrient strategies through loading dose oral or intramuscular channels in conjunction with innovative food fortification strategies will be imperative to address the effects of quarantine on the Chinese population.

According to researchers at the Department of Biomedical Sciences at the University of Messina, Italy, “Hypovitaminosis D has become a pandemic, being observed in all ethnicities and age groups worldwide. Environmental factors, such as increased air pollution and reduced ultraviolet B (UVB) irradiation, as well as lifestyle factors, i.e., decreased outdoor activities and/or poor intake of vitamin D-rich food, are likely involved in the etiology of a dramatic reduction of vitamin D circulation levels. Only in the last few decades, it has become a serious public health concern since it has been shown to be independently associated with various chronic pathological conditions such as cancer, coronary heart disease, neurological diseases, type II diabetes, autoimmune diseases, depression, with various inflammatory disorders, and with increased risk for all-cause mortality in the general population.”¹⁴⁴(Caccamo et al. 2018) Post quarantine micronutrient strategies centering on vitamin D must be immediately deployed to mitigate the full range of pathological conditions correlated to hypovitaminosis D. Considering that today the global population faces two pandemics—COVID-19 and hypovitaminosis D—is essential.

Furthermore, the role hypovitaminosis D and the channels of immune vulnerability in the human immune system should be considered in terms of susceptibility to cross-species viral transmissions. According to researchers at the School of Public Health Department of Immunology in Iran, there is “a complex interplay between viral infections and vitamin D, including the induction of anti-viral state, functional immunoregulatory features, interaction with cellular and viral factors, induction of autophagy and apoptosis, and genetic and epigenetic alterations. While crosstalk between vitamin D and intracellular signaling pathways may provide an essential modulatory effect on viral gene transcription, the immunomodulatory effect of

141 Source: Targeted prevention needed to battle ‘severe’ vitamin D deficiencies in Chinese urban populations
<https://www.nutraingredients-asia.com/Article/2016/06/19/Beijing-population-at-risk-of-severe-vitamin-D-deficiency#>

142 Source: Vitamin D status among the elderly Chinese population: a cross-sectional analysis of the 2010–2013 China national nutrition and health survey (CNNHS)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5237548/>

143 Source: A glimpse of vitamin D status in mainland China.

<https://www.ncbi.nlm.nih.gov/pubmed/23594582>

144 Source: Health risks of hypovitaminosis D: a review of new molecular insights

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5877753/>



vitamin D on viral infections appears to be transient.”¹⁴⁵(Teymoori-rad et al. 2019) Understanding the mechanisms underlying the anti-viral and immunomodulatory effects of vitamin D should aid in future pandemic strategic planning.

The future of pandemic strategy will center on preventive population-wide immune-enhancing strategic measures before, during and after a pandemic. Additionally, we must address the root of human vulnerability to pathogens, which is based on the prevalence of accelerated micronutrient deficiencies in the world-wide population, through globally coordinated advanced food fortification strategies.

IMPACT OF ISOLATION ON HUMAN IMMUNE AND MENTAL HEALTH

Numerous older adults worldwide are facing quarantines of 2–4 months or longer that will probably be followed by extreme social disruption for 2–3 years until a vaccine is publicly available. Designing intelligent systems to socially and meaningfully engage these communities remotely will be essential. Numerous studies have revealed that loneliness and social isolation adversely affect immune function and cardiovascular health and correlate with a higher risk of mortality.¹⁴⁶ Researchers at Brigham Young University and the University of North Carolina, Chapel Hill, have analyzed data from 148 studies correlating the frequency of human interaction and health outcomes and have concluded that meaningful quality social engagement is a critical factor affecting health. “Those with poor social connections had on average 50 percent higher odds of death. ... That boost in longevity is about as large as the mortality difference observed between smokers and nonsmokers, the study's authors say. And it's larger than differences in the risk of death associated with many other well-known lifestyle factors, including lack of exercise and obesity. ... The friend effect did not appear to vary by sex or by age, with men and women of all ages and health statuses showing roughly equal benefit. Nor were lonely people unusually susceptible to any one disease in particular.”¹⁴⁷(Steakley 2010).

In leveraging current technology, designing a system to match one or two volunteers to each elderly person in quarantine for remote check-ins daily will be crucial. Coordinating the ability to repeatedly provide meaningful social engagement can be achieved by matching volunteers and senior citizens by interests and life experience. Older adults have wisdom and lessons from history to share. These quarantines can become meaningfully engaging by facilitating the sharing of knowledge and insight from one generation to the next. In addition to matching a primary volunteer with each quarantined older adult, coordinating virtual social activities will be important. Pre-booking or near immediate virtual matchmaking enabling

¹⁴⁵ Source: The interplay between vitamin D and viral infections.
<https://www.ncbi.nlm.nih.gov/pubmed/30614127>

¹⁴⁶ Loneliness, social isolation, and cardiovascular health
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5831910/>

¹⁴⁷ Source: Can good friends help you live longer?
http://scopeblog.stanford.edu/2010/07/28/can_friends_help_you_live_longer/

attending remote experiences together, such as museums, lectures or concerts online, would be fun. Shared remote experiences will be pivotal in ensuring that quarantined populations are meaningfully engaged. Studies have revealed that the quality of social engagement is a critical factor in determining the positive effects of social engagement on human health.^{148 149}

In addition to facilitating meaningful one on one contact with older populations, leveraging technology to create group social experiences will be equally important. Bingo, a game with prizes, is multi-generational and all-inclusive, and it can even be played by people in early stages of dementia.¹⁵⁰ Innovating socialized gaming to design a system in which communities can play social bingo with their retirement community, nursing home, church, social club, neighborhood or city would provide a fun, active way to engage communities. Displaying the bingo numbers and recreating a bingo hall experience will be vital to generate a sense of social cohesion. In addition to displaying the drawing of bingo numbers, showing a grid of the faces of all the bingo players so that people have a sense of playing together will be strategically important. Furthermore, integrating a chat feed would facilitate interaction among these communities. Of strategic importance, when someone wins bingo, a keystroke should enable the winner's audio so that the winner can yell "bingo" to the whole community. Designing intelligent systems to recreate the true bingo hall experience would drive engagement and enhance the effectiveness of social cohesion among remote populations. Researchers at Case Western Reserve University have found that "high-contrast, large bingo cards boost thinking and playing skills for people with cognitive difficulties and visual perception problems produced by Alzheimer's disease (AD) and Parkinson's disease (PD)."¹⁵¹(Case Western Reserve University 2012) Socialized gamified bingo can be a fun and engaging way to bring intergenerational communities together to play while in quarantine.

REDIRECTING HUMAN ATTENTION

As we move forward into a future of globally integrated supply chains, frictionless world-wide travel and modern lifestyles plagued with micronutrient deficiencies and a tsunami of misinformation, we must adapt and evolve our pandemic and epidemic protocols. Building trust with populations and anchoring them with patience during pandemics is essential to any physical sequestration strategy. In the age of misinformation, coordinated factual information campaigns leveraging all channels of messaging and influence is strategically important. Working with community leaders and strategic influencers to launch systematic messaging campaigns, sharing

¹⁴⁸ Source: Social relationships and health: a flashpoint for health policy

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3150158/>

¹⁴⁹ Source: The brain and social connectedness

https://www.aarp.org/content/dam/aarp/health/brain_health/2017/02/gcbh-social-engagement-report.pdf

¹⁵⁰ Source: Why do seniors love bingo?

<https://www.leisurecare.com/resources/why-do-seniors-love-bingo/>

¹⁵¹ Source: 'BINGO!' game helps researchers study perception deficits

<https://www.sciencedaily.com/releases/2012/01/120103135327.htm>

practical data-driven insights about the pandemic integrated with repeated reminders about patience is essential. Redirecting the attention of bored quarantined populations to physical and mental activities through gamified movement, talent and knowledge competitions could be considered as a means to prevent social unrest and reduce the viral misinformation popularized by conspiracy theorists during times of quarantine.

The future of pandemic and epidemic protocols must move beyond existing physical sequestration methods, to include cost-effective strategies that center on boosting the immune systems of confined populations. Leveraging technology-based solutions to playfully engage populations both mentally and physically while in isolation will be pivotal to both the mental and immune function of individuals. Reframing the quarantine mindset is an important strategy to consider. For example, one to two months' 'isolation' in one's home could be an excellent growth opportunity to learn new skills and achieve new goals. During a quarantine, people could start and complete online certificate programs to upgrade their skill sets and change their job prospects. This time could also be used to achieve fitness goals by engaging daily with a social video fitness platform. Re-shifting the focus to introduce people to meaningful ways to leverage this time to grow would be incredibly valuable to society as a whole. Ensuring that the population's attention is focused and actively engaged with repeated messages of patience would enhance compliance and systematically reduce panic.

As COVID-19 gains traction in our state and our nation¹⁵²¹⁵³, we must remember that everyone in our country deserves to be protected, including the 48 million older adults, the 2.3 million people in incarceration and most importantly the 18 million healthcare workers who will be at the frontline of SARS-CoV-2 treatment in America. This Community Immunity Protocol is a complementary methodology for consideration to help reduce the catastrophic effects that COVID-19 will have on our society until vaccines become publicly available. In a future of anticipated acceleration of infectious diseases, evaluating innovative and comprehensive solutions to evolve existing pandemic preparedness strategies will be critical. The future of pandemic planning may consider this unique opportunity to advance existing pandemic protocols to include complementary strategies centering on immune enhancement coupled with physical and mental engagement of remote populations in isolation.

152 Valuable Resource: [Live visual data on global cases of Coronavirus COVID-19](#) by the Center for Systems Science and Engineering. "The GISAID Initiative promotes the international sharing of all influenza virus sequences, related clinical and epidemiological data associated with human viruses, and geographical as well as species-specific data associated with avian and other animal viruses, to help researchers understand how the viruses evolve, spread and potentially become pandemics." <https://www.gisaid.org/epiflu-applications/global-cases-covid-19/>

153 Valuable Resource: [Rolling updates on coronavirus disease \(COVID-19\) from World Health Organization](#) <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen>



THE POWER OF PLATFORM AND CROWDSOURCING INNOVATION

Designing platform-based systems to engage quarantined populations will be as crucial as designing platform-based systems to facilitate the global sharing of knowledge, thus providing organized access to verifiable data so that the many artificial intelligence, machine learning and deep learning enthusiasts and experts can frictionlessly coordinate. Leveraging the power of 'platform intelligence' to garner more insight about the pathogens affecting our lives will be integral to the future of pandemic strategy. Government Science advisors from 11 countries have called for free access to COVID-19 research, stating that "to assist efforts to contain and mitigate the rapidly evolving Covid-19 pandemic, basic science research and innovation will be vital to addressing this global crisis." Moreover, "given the urgency of the situation, it is particularly important that scientists and the public can access research outcomes as soon as possible."¹⁵⁴(Finley 2020) Designing intelligent platforms to facilitate interdisciplinary knowledge sharing among growth human and veterinary virologists will be integral in coordinating the multidisciplinary strategies that will be required in a future of cross-species viral transmissions. Coronaviruses have been significantly affecting livestock and industrial animal agriculture industry; consequently, insights from the extensive veterinary research on coronaviruses may shed light on adaptive and innovative ways to address coronaviruses in human populations.

Crowdsourcing collaborative innovation globally, though diverse multidisciplinary communities, anchored in data-driven insights, will be integral to the future of pandemic strategic planning. Optimizing population-wide immune function is centrally important to the future of pandemic prevention and containment. In addition, deploying post-quarantine strategies to mitigate the negative effects of quarantine and viral infections on human immune¹⁵⁵ and psychological function will be critical.¹⁵⁶ Designing intelligent systems to protect communities from biological pathogens by focusing on immune optimization will be as crucial as protecting communities from viral misinformation. The future of pandemic strategy rests in leveraging the tools of today to unleash the power of coordinated human-machine intelligence worldwide. Only as a cooperative global community can we swiftly combat the pathogenetic threats of today and tomorrow. Our collective immune signature as a species is only as strong as the most vulnerable and underserved populations worldwide.

¹⁵⁴ Source: Global officials call for free access to Covid-19 research
<https://www.wired.com/story/global-officials-call-free-access-covid-19-research/>

¹⁵⁵ Source: Anxiety and depression: linkages with viral diseases
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4175921/>

¹⁵⁶ Source: Coronavirus and the isolation paradox
<https://www.nytimes.com/2020/03/13/opinion/coronavirus-social-distancing.html>

“To advance the future of pandemic strategic planning in the face of present and future pathogens, may we cooperatively coordinate globally to embrace and design innovative solutions. This pandemic has the potential to inspire humans to begin to recalibrate and optimize the collective immune signature of our species.”

– Stephanie J. Fisher

Strategiccreative.io

I wrote this paper in early March 2020 intended for the Surgeon General in the State of Florida where I reside. The current draft is pared down temporarily for a sharable version. In the future, I will publish the comprehensive analysis drawn from months of continued research and include the edit out Community Immunity Protocol components. I am not a professional in the healthcare, biomedical or virology sector; but I am a concerned citizen who believes an individual can inspire a ripple of change to be a part of helping to craft proactive solutions. In my experience, I have witnessed the power of infectious ideas and inspired conversations. In writing this, and diving into research databases for days on end; one of the essential kernels I discovered is there is a wealth of qualified professionals with quantified research that are an untapped resource. I think interdisciplinary, integrated, innovative solutions drawn from the diverse untapped resources globally will help inform advanced strategies of pandemic management to shape the landscape for generations. I felt it was important to share the ideas in this paper, after months of hours a day emailing and leaving voicemails at local and regional officials, organizations, companies, and the press I have been ineffective in reaching people through traditional channels. So now, I post this online. In a future of potentially accelerated zoological coronavirus transmissions and theoretical threats of bioterrorism; I think it is critically essential to recalibrate our existing pandemic strategies to address root vulnerabilities in our society and structural design. May this tragedy inspire us to adapt, innovate and evolve to prepare for an uncertain future on this planet and beyond.

Resources:

AARP Global Council on Brain Health

<https://www.aarp.org/health/brain-health/global-council-on-brain-health/>

Center for the Mathematical Modeling of Infection Diseases

<https://cmmid.github.io>

Coalition for Epidemic Preparedness Innovation

<https://cepi.net>

Linus Pauling Institute Micronutrient Information Center

<https://lpi.oregonstate.edu>

London School of Hygiene & Tropical Medicine

<https://www.lshtm.ac.uk>

National Institute of Allergy and Infectious Disease

<https://www.niaid.nih.gov>

One Health Initiative

<http://www.onehealthinitiative.com>

Kresser Institute

<https://kresserinstitute.com>

Society for Nutrition Education and Behavior

<https://www.sneb.org>

Sunlight, Nutrition and Health Research Center

<https://www.sunarc.org>

The Center for Infectious Disease Research Policy

<http://www.cidrap.umn.edu>

United States Pharmacopeia

<https://www.usp.org>



****Many scholarly journals provide the contact information for authors.***

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