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Collective Immune Defense Achieved Through Widespread Exposure and Immunization in Populations

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Abstract

The attainment of herd immunity is a critical factor in mitigating epidemics and safeguarding vulnerable populations, such as young children, the elderly, or immunocompromised individuals, who may not be eligible for vaccination or unable to develop immunity due to health constraints. The extent of herd immunity required is determined by the interplay between the infectious agent's transmissibility and the population's immunity, which can be acquired either

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through vaccination (artificial immunity) or natural infection (natural immunity). Vaccination is generally considered the most ethical and efficient method for achieving herds immunity, as it eliminates disease-related risks and mortality. Factors influencing the efficiency of herd immunity include the basic reproduction number (Ro) of the pathogen, vaccination coverage, community immunological response, and public health interventions. The required immunity levels for achieving herd immunity vary by disease, with higher Ro pathogens necessitating a larger proportion of the population to be immune. For example, nearly 95% of the population must be immune to prevent the spread of measles, which has an Ro of 12 to 18. While herd immunity is crucial, it is not a standalone solution. Its success depends on multiple determinants, such as social behavior, public health infrastructure, and vaccine accessibility. Additionally, the emergence of new pathogen variants (e.g., in COVID-19) poses a risk to herd immunity when immunity derived from previous infections or vaccinations is excluded. Therefore, herd immunity should be integrated into a comprehensive public health strategy encompassing surveillance, response, and disease prevention

Keywords: Immunity threshold, Infection spread, International health, Infection control, Fragile communities

Introduction

Herd immunity, also known as population immunity or community immunity, is achieved when a significant portion of the population becomes immune to a pathogen, thereby reducing its spread. Immunity can be acquired through various means, including passive transmission, vaccination, and spontaneous infection. Vaccination is the preferred method, as it eliminates the risks associated with disease transmission and mortality. (Michel et al.,2010When a larger proportion of the population is immunized, the virus has a reduced ability to propagate and utilize individuals to infect others or mutate into new forms. For highly contagious viruses, a higher percentage of immune individuals may be required to halt transmission.

Immunity is derived from antibodies produced by the body to protect against specific pathogens. Active immunity can be achieved through vaccination or natural infection, while passive immunity is acquired through passive transmission. Natural immunity, obtained by recovering from an illness, provides long-lasting protection. However, the emergence of new viral strains, such as Omicron and Delta, has led scientists to revise previous estimates of required immunity levels, potentially reaching up to 85% (Jiang et al.,2020). Achieving herd immunity through natural infection is not feasible due to the high risk of severe illness and mortality. (Treanor .,2012) While vaccines are safe and

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effective, vaccine hesitancy and refusal among some individuals hinder the attainment of herd immunity. Vaccines are particularly effective against organism-transmitted diseases like smallpox and measles, but their utility is limited for viruses with multiple strains, such as influenza (Heymann et al., 2010). The annual flu vaccine is designed based on studies of the most prevalent strains in a given year, and it covers four viruses in the United States. Receiving the flu vaccine reduces the risk of severe illness, hospitalizations, and deaths, particularly in children. However, despite these benefits, many individuals still choose not to get vaccinated (Bhopal et al.,2020)

This protection is particularly vital for several vulnerable groups, including infants who are too young to receive certain vaccines, individuals undergoing cancer treatment or taking immunosuppressive medications, those with primary immunodeficiencies, and those with medical contraindications to specific vaccines (Schwaneck et al., 2025). For these individuals, the immunity of others in their community becomes their primary defense against serious infectious diseases. Vaccination has been a critical tool for providing herd immunity to vulnerable populations, such as those with weakened immune systems or those unable to receive vaccinations. By immunizing ourselves, we protect not only ourselves but also those in our community who are at higher risk.

Required vaccine coverage to halt outbreak transmission

We derived the theoretical conditions under which heterogeneity leads to varying Herd Immunity Thresholds (HIT) values, considering factors such as the relative contact rates of each group, the type of group mixing, the relative efficacy of the vaccine, and the relative sizes of each group. It was demonstrated that, without rigorous mathematical analysis, the HIT obtained through standard vaccination in a homogeneous population can be significantly higher than the minimum HIT achievable when accounting for population heterogeneities, but only for certain types of heterogeneities. . To verify this assumption, we created and analyzed a model for a vaccine with variability and compared it to a model assuming a homogeneous population. Delmas et al. (2025) developed a simplified Susceptible-Infected-Susceptible (SIS) model to enable rapid statistical calculations for vaccine-related studies. For instance, we found that in the case of biased random mixing, vaccinating a group first is preferable, even if it results in a disproportionate increase in per capita spread. We also identified scenarios where, in biased assortative mixing, optimally vaccinating more than one group is the best approach. In all types of hybridization among groups, we observed that HIT values for a heterogeneous population are always lower than those derived in a matched model with a homogeneous population. Additionally, we demonstrated that a heterogeneity-sensitive model (e.g., biased assortative mixing) has a substantially lower HIT value (40%) compared to the 63% HIT value if the model is based on a homogeneous population.. (Bloom et al., 2018)

Symptoms and Underlying Mechanisms

Various parameters such as age, immunologic status, comorbidities, and viral strains govern the extensive range of clinical presentation of COVID-19. Incubation lasts for 5 days from 2 to 14 days (He et al., 2020). The presentation such as fever, sore throat, dry cough, and weakness, observed in Grant et al.

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(2020), is no different from other respiratory disease. In some cases, anosmia or loss of taste and ageusia or loss of smell has been reported as typical symptoms of SARS-CoV-2 infection (Menni et al., 2020). The mild illness recovers within two weeks, but moderate and severe illness results in pneumonia, hypoxemia, and dyspnea seven to ten days following the onset (Berlin et al., 2020). CT chest scans are generally characterized by bilateral patchy lung consolidation and ground-glass opacities based on the severity of the disease (Shi et al., 2021). The cases are generally most symptomatic and are likely to manifest acute respiratory distress syndrome (ARDS), which must be treated under critical care with severe hypoxemia, pulmonary infiltrates, and decreased lung compliance (Matthay et al., 2020). Severe extrapulmonary manifestations of COVID-19 exist. Viral replication within the intestinal epithelium also causes gastrointestinal symptoms like nausea, diarrhea, and abdominal pain in 10–20% of patients (D'Amico et al., 2020). Myocarditis, arrhythmias, and thrombosis are some among many cardiovascular symptoms reported; these are indirect effects of endothelial dysfunction and SARS-CoV-2-mediated systemic inflammation (Guo et al., 2020). Because of the neuroinvasive nature of the virus, presentation neurologic varies from mild headache and dizziness to more serious sequelae of Guillain-Barré syndrome, encephalopathy, and stroke (Paterson et al., 2020). While a grave and life-threatening illness, multisystem inflammatory syndrome in children (MIS-C) is milder in pediatric populations. Like Kawasaki syndrome, presentation of MIS-C is rash, fever, cardiac presentation, and elevated inflammatory markers (Riphagen et al., 2020). The immunocompromised individuals and older individuals are also at risk of death, serious disease, and prolonged viral shedding (Williamson et al., 2020). Long COVID, or post-acute sequelae, in which the symptoms persist for weeks or months before eventually improving, happens in the majority of survivors. The symptoms that are prevalent in all three cohorts and may be indicators of tissue damage, immune dysregulation, or chronic inflammation include fatigue, breathlessness, impaired cognition (or "brain fog"), and chest pain (Sudre et al., 2021). Urge as it may, lots of work have been done on COVID-19 long-term effects, but preliminary reports suggest that prolonged activation of the immune system and autoimmune disease are likely (Peluso et al., 2022).

Process of Infectious Disease Transmission

Vector-borne transmission refers to the process by which arthropod vectors, such as mosquitoes, ticks, or sandflies, acquire pathogens from infected hosts—including humans, animals, or birds—and subsequently transmit them to susceptible hosts during blood-feeding. This mode of transmission plays a pivotal role in the epidemiology of many infectious diseases. Food borne transmission occurs through the consumption of inadequately cooked or improperly processed foods, with botulism representing a notable example of illness associated with defective canning procedures. Waterborne pathogens, exemplified by *Vibrio cholerae*, have caused widespread cholera outbreaks affecting millions globally through contaminated water sources.

Zoonotic transmission occurs via animal bites, scratches, or exposure to infected animal excreta. Environmental reservoirs in soil, water, and vegetation serve as

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sources of human infection. Soil-transmitted helminths, such as hookworm species, exemplify infections acquired through contaminated environmental substrates, while *Legionella pneumophila* associated with cooling systems demonstrates waterborne environmental transmission (Yao et al., 2024). Direct contact transmission facilitates spread of dermatological and ocular infections, including dermatophytoses, conjunctivitis, varicella-zoster virus, and pediculosis capitis. Bloodborne and body fluid transmission occurs when infected biological materials contact mucous membranes or enter the bloodstream of susceptible individuals. Hepatitis B virus, human immunodeficiency virus, and cytomegalovirus represent significant pathogens transmitted through blood, reproductive fluids, breast milk, and other body fluids (Buckee et al.,2021)

Disease Transmission, Viral Variants, and Global Health Impact

The emergence of SARS-CoV-2 in Wuhan, China, precipitated unprecedented global transmission due to its elevated basic reproduction number (R0) and capacity for asymptomatic spread (Li et al., 2020). The World Health Organization's pandemic declaration in March 2020 fundamentally transformed global health priorities overnight (WHO, 2020). Since its initial identification in December 2019, COVID-19 has evolved into the most significant public health emergency of recent decades.

The predominantly airborne transmission of SARS-CoV-2 through respiratory aerosols and droplets enabled infection even following minimal exposure or within inadequately ventilated environments (Morawska & Milton, 2020). Exponential case growth precipitated critical shortages of essential medical resources, including mechanical ventilators, diagnostic testing materials, and personal protective equipment, particularly affecting low- and middle-income countries (Fisher & Heymann, 2020). The heterogeneous clinical presentation—ranging from mild influenza-like symptoms to severe pneumonia, acute respiratory distress syndrome, and multi-organ dysfunction—severely strained healthcare systems globally (Wu & McGoogan, 2020).

National public health responses varied considerably according to governance structures, healthcare infrastructure capacity, and population adherence to interventions. Countries implementing early decisive measures, including border closures, comprehensive contact tracing, and mass testing strategies—exemplified by New Zealand and South Korea—achieved effective transmission interruption during initial phases (Baker et al., 2020). Conversely, delayed implementation of control measures in other jurisdictions underscored the critical importance of rapid, coordinated responses (Peckham et al., 2020). Non-pharmaceutical interventions, including lockdown measures, travel restrictions, and mask mandates, were widely implemented to balance infection control against socioeconomic consequences (Flaxman et al., 2020).

The emergence of SARS-CoV-2 variants significantly altered pandemic dynamics and accelerated global spread. The Alpha variant (B.1.1.7), first identified in the United Kingdom, demonstrated enhanced transmissibility, while the Delta variant (B.1.617.2) was associated with increased viral loads and disease severity (Davies et al., 2021; Sheikh et al., 2021). The Omicron variant (B.1.1.529), emerging in late 2021, harbored extensive spike protein mutations that triggered

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additional infection waves and compromised vaccine effectiveness (Cao et al., 2022). These evolutionary pressures necessitated continuous genomic surveillance and adaptive public health strategies, including booster vaccination campaigns (Khan et al., 2022).

The pandemic's extensive socioeconomic impact resulted in widespread employment losses, educational disruption, and deteriorating mental health outcomes globally (Pfefferbaum & North, 2020). Disproportionate effects on marginalized populations exacerbated pre-existing healthcare access disparities and economic vulnerabilities (Ahmed et al., 2020). The COVID-19 pandemic has highlighted fundamental requirements for resilient health systems, enhanced international cooperation, and comprehensive pandemic preparedness frameworks to mitigate future threats (Murray & Piot, 2021)

High-risk populations are more susceptible to infection and severe outcomes

Individuals with chronic conditions are at a higher risk of illness and thus incur greater medical treatment costs compared to those in good health. These patients are twice as likely as the general population to experience days when they feel unwell. Similarly, individuals with disabilities often interact with the healthcare system like those with chronic conditions, but their impairments can complicate treatment access. People with impairments and chronic conditions may be more vulnerable to receiving less care. Lower-income individuals are more likely to have chronic conditions, which can have a more severe impact on their well-being. Furthermore, racial and ethnic minorities are disproportionately represented among low-income populations. Their financial constraints may reduce their ability to obtain insurance and, consequently, their likelihood of engaging with the healthcare system, according to Pamela Riley, MD, MPH, vice president of delivery system transformation at The Commonwealth Fund. Additionally, low-income individuals often have co-occurring diseases, meaning they are more likely to experience behavioral health conditions such as depression or substance abuse disorders alongside chronic illnesses like diabetes or obesity. Homeless individuals make up over 554,000 Americans in a single night (as reported by the U.S. government in 2017), are more susceptible to negative health outcomes. These individuals are more likely to forgo care and less likely to receive it regularly. A 2013 study published in The American Journal of Public Health found that homeless individuals often feel stigmatized or unwelcome, leading them to be reluctant to seek care. Rural Americans, on average, tend to have worse health outcomes than the general population. This disparity can be attributed to factors such as older demographics, isolation, lower socioeconomic status, and fewer job opportunities in rural communities.. (Torres-Gil et al.,2012)

Structured strategies to reduce extensive disease spread

The Central Emergency Response Committee (CERC), chaired by the chief minister, includes all administrative secretaries and some members of parliament. Its primary function is to assess the overall situation in the province and make timely decisions regarding dengue prevention and control. To monitor progress and review developments, the Ministry of Health, parliamentarians, and relevant agencies will meet more frequently as part of the Cabinet Committee on Dengue, which is chaired by the Chief Secretary. This committee is

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primarily responsible for overseeing the implementation of decisions made by the Cabinet Committee and the CERC.

All health center managers (primary, secondary, and tertiary) are obliged to enforce the Department of Health (DEAG) standard operating procedures (SOPs) for treating and referring dengue cases. The Technical Committee, composed of public health experts, is chaired by the Special Secretary and is tasked with reviewing existing strategies and providing advice as needed. The Vice President of KEMU chairs the Dengue Expert Committee.

According to DEAG guidelines, all Department of Health institutions and teaching hospitals must establish high dependency units (HDUs) with eight or four beds, respectively. These HDUs will be staffed by trained personnel, and specialists must visit the dengue ward and HDUs twice daily. Adequate supplies of intravenous fluids and necessary drugs should be ensured. Private hospitals collaborate with teaching hospitals for case management consultation in dengue. Additionally, clinical professionals from public teaching hospitals must visit private hospitals to assist in the clinical treatment of dengue patients (Dasaklis et al., 2012)

Multidrug Approaches to COVID-19: Learnings from a Global Pandemic

multimodal treatment strategy is necessary due to the diverse clinical presentations of COVID-19, which range from respiratory symptoms, multi-organ injury, acute respiratory distress syndrome (ARDS), to pneumonia. Therapeutic approaches have evolved from symptomatic management to antiviral and immunomodulation therapies, as our understanding of the disease has improved. For critically ill patients, the optimal treatment involves a combination of antiviral therapy, supportive care, and anti-inflammatory treatments to interrupt the virus's transmission and progression. Early administration of antiviral medications is crucial in curbing viral transmission, particularly in the early stages of the disease.

Remdesivir, an FDA-approved medication for COVID-19, is a viral RNA-dependent RNA polymerase inhibitor and a nucleoside analogue. Clinical trials have demonstrated that Remdesivir reduces hospitalization duration in inpatients, although the impact on mortality remains uncertain (Spinner et al., 2020). These attempts helped prove useful in the development of an HBV infection vaccine, affirming the pivotal role of PGLYRP2 in innate antiviral immunity (Li et al., 2025). Antiviral medications like Molnupiravir, a ribonucleoside analog, introduce a novel mechanism of action by inducing errors in viral replication. This approach has shown promise in reducing hospitalization and death rates when administered to high-risk, non-hospitalized patients within five days of symptom onset.(Fischer et al., 2022). When administered within three days of symptom onset, the combination protease inhibitor nirmatrelvir/ritonavir (Paxlovid) demonstrated an 89% reduction in hospitalization and mortality among high-risk, non-hospitalized patient(Hammond et al., 2022). Antiviral therapies represent a paradigm shift toward outpatient management, thereby alleviating strain on overwhelmed healthcare infrastructure. Given that the host immune response, particularly the dysregulated cytokine cascade, often contributes more substantially to pathogenesis than direct viral effects, immunomodulatory interventions are essential in managing severe and critical COVID-19 cases. Following

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demonstration in the RECOVERY trial that dexamethasone reduced mortality by 35% in mechanically ventilated patients and by 20% in those requiring supplemental oxygen, this corticosteroid has been established as standard therapeutic practice(Horby et al., 2021). This represented a fundamental shift in COVID-19 therapeutic strategy, providing mechanistic validation for targeting hyperinflammatory responses. Interleukin-6 (IL-6) receptor antagonists, including sarilumab and tocilizumab, achieved therapeutic efficacy through selective inhibition of pro-inflammatory signaling pathways. These agents specifically block IL-6-mediated signaling, thereby interrupt the primary cytokine responsible for initiating the inflammatory cascade. Corticosteroid administration demonstrated significant reductions in mortality and enhanced clinical recovery, with particular benefit observed in patients presenting with severe disease manifestations and elevated systemic inflammatory biomarkers.(Rosas et al., 2021). Furthermore, Janus kinase (JAK) inhibitors, including tofacitinib and baricitinib, demonstrated significant efficacy through broad-spectrum inhibition of inflammatory signaling pathways, showing promising results in reducing mortality among hospitalized patients and decreasing length of hospital stay (Guimarães et al., 2021). Restoration of immunological homeostasis mitigates tissue injury complications, including acute respiratory distress syndrome and multiple organ dysfunction syndromes. Monoclonal antibody (mAb) therapy emerged as a promising therapeutic intervention in early COVID-19 management, particularly for high-risk populations. These genetically engineered antibodies function by specifically binding to the receptor-binding domain (RBD) of the viral spike protein, thereby prevent viral attachment to the angiotensin-converting enzyme 2 (ACE2) receptors on host cells. Therapeutic combinations, including sotrovimab and casirivimab-imdevimab, demonstrated significant efficacy in preventing severe disease progression when administered during early infection stages. However, the rapid emergence and dissemination of highly mutated variants, notably the Omicron lineage and its subvariants, substantially reduced the clinical effectiveness of many first-generation monoclonal antibodies due to spike protein mutations that compromised antibody binding affinity and neutralizing capacity.(Takashita et al., 2022). To ensure the efficacy of monoclonal antibodies against future virus variants, newer strains have been designed to target conserved regions on the virus. During the initial outbreak phase, convalescent plasma therapy, a generic drug derived from antibodies of COVID-19 patients who have recovered, was widely discussed. Although preliminary test results were inconsistent, this therapy proved useful when administered early in the course of illness or among immunocompromised patients who are unable to develop their own antibody response.(Libster et al., 2021). The use of monoclonal antibody therapy declined due to variability in donor antibody titers and limited efficacy against emerging viral variants. Since COVID-19 is associated with a hypercoagulable state, patients are at increased risk of thrombotic events such as stroke, pulmonary embolism, and venous thromboembolism (Rhoades, et al. 2025) . Consequently, anticoagulation and supportive therapies are recommended. Hospitalized patients may receive prophylactic low-molecular-weight heparin (LMWH) or direct oral anticoagulants (DOACs) to prevent thrombotic complications, provided there is no significant bleeding risk. This strategy is supported by evidence

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demonstrating the high prevalence of endothelial damage and microvascular thrombosis in critically ill patients(Lopes et al., 2021). xtracorporeal membrane oxygenation (ECMO) provides prolonged cardiopulmonary support as a salvage intervention for critically ill patients with refractory acute respiratory distress syndrome (ARDS) or persistent severe hypoxemia, facilitating potential pulmonary recovery when conventional mechanical ventilation proves insufficient(Barbaro et al., 2021). Supportive care, including oxygen therapy, mechanical ventilation, and hydration management tailored to disease severity, remains the cornerstone of COVID-19 treatment. In adult patients with severe hypoxemia, non-invasive ventilation (NIV) and high-flow nasal oxygen (HFNO) have shown beneficial effects by improving oxygenation and reducing the need for intubation, particularly in critical care settings (Duca et al., 2025). The therapeutic landscape for COVID-19 continues to evolve with the development of novel pharmacological agents (Karunarathna et al.2025). To target viral entry mechanisms and prevent infection establishment, emerging protease inhibitors including ensitrelvir, alongside transmembrane serine protease 2 (TMPRSS2) inhibitors, are currently under clinical investigation as potential prophylactic and early therapeutic interventions (Iwata-Yoshikawa et al., 2022). For mild COVID-19 cases, inhaled corticosteroids such as budesonide have continued to be the standard of care, as they help shorten the duration of symptoms and lower the risk of hospitalization (Ramakrishnan et al., 2021). Investigators are concurrently evaluating interferon-based therapeutic interventions, specifically interferon-beta, as immunomodulatory agents to augment the innate antiviral immune response during early disease progression (Davoudi-Monfared et al., 2020). Investigations into host-directed therapies, immunomodulators, and pan-coronavirus treatments hold promise for a more robust and sustained response to pandemics and COVID-19 in the future. The emergence of SARS-CoV-2 necessitates a paradigm shift in treatment approaches, with combination therapies, variant-specific monoclonal antibodies, and adaptive antiviral regimens being paramount in the event of immune-evading variant emergence.

Health effects and strategies at the international level

Global health encompasses population health initiatives implemented within an international framework. The discipline traditionally focuses on health challenges that transcend national boundaries and exert significant political and economic impacts at a multinational level. Core objectives of global health include advancing worldwide health outcomes (encompassing mental health), addressing health inequities, and mitigating transnational health threats, particularly those contributing to leading causes of mortality and disability-adjusted life years globally.

Historical epidemiological data indicate that life expectancy in pre-modern societies averaged approximately 30 years worldwide, primarily attributed to elevated infant mortality rates Gaddy, H., & Gargiulo, M. (2025). The World Health Organization (WHO) serves as the principal international body coordinating global health initiatives. International health, as a distinct subdiscipline, specifically addresses health challenges in developing nations and examines foreign assistance programs implemented by industrialized countries. Additional key organizations influencing global health outcomes include the

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World Food Programme (WFP) and the United Nations Children's Fund (UNICEF).

Global health practitioners frequently navigate complex ethical dilemmas and human rights considerations. Rigorous analysis of health disparities is essential for evaluating the effectiveness of proposed interventions. To address these multifaceted challenges, National Ethics and Bioethics Councils convene biennial Global Summits to facilitate international dialogue and policy development (Koplan et al.,2009)

Conclusion

Herd immunity provides population-level protection by slowing down infection transmission and remains a cornerstone in infectious disease management. It plays a crucial role in preventing outbreaks and safeguarding vulnerable groups who cannot be vaccinated or are at greater risk of severe illness. The attainment of herd immunity, particularly through mass vaccination, depends on factors such as the basic reproductive number (Ro), which determines the threshold of immunity required to interrupt transmission. Importantly, herd immunity can be achieved through either natural infection or vaccination; however, reliance on natural infection carries significant risks, including increased morbidity, mortality, and the potential emergence of variants, as observed during the COVID-19 pandemic. In contrast, vaccination provides a safer and more controlled pathway to population immunity without the high health and societal costs associated with uncontrolled disease spread. While herd immunity is not a universal solution, it significantly reduces disease burden, lowers morbidity and mortality, and facilitates a return to societal normalcy following large epidemics. Achieving and sustaining herd immunity requires a multifaceted approach, including expansion of immunization coverage, removal of access barriers, and strengthened international collaboration to optimize global health outcomes.

References

Ahmed, Faheem, et al. "Why inequality could spread COVID-19." *The Lancet Public Health* 5.5 (2020): e240.

Baker, M. G., et al. (2020). Elimination of COVID-19 in New Zealand. The New England Journal of Medicine, 383(8), e56.

Barbaro, R. P., Brodie, D., & MacLaren, G. (2021). Bridging the gap between intensivists and primary care clinicians in extracorporeal membrane oxygenation for respiratory failure in children: a review. JAMA pediatrics, 175(5), 510-517.

Berlin, D. A., Gulick, R. M., & Martinez, F. J. (2020). Severe covid-19. New England Journal of Medicine, 383(25), 2451-2460.

Bhopal RS. COVID-19 zugzwang: potential public health moves towards population (herd) immunity. Public Health in Practice. 2020 Nov 1;1:100031.

Bloom, D. E., Khoury, A., & Subbaraman, R. (2018). The promise and peril of universal health care. *Science*, *361*(6404), eaat9644.

Buckee C, Noor A, Sattenspiel L. Thinking clearly about social aspects of infectious disease transmission. Nature. 2021 Jul 8;595(7866):205-13.

Cao, Y., Yisimayi, A., Jian, F., Song, W., Xiao, T., Wang, L., ... & Xie, X. S. (2022). BA. 2.12. 1, BA. 4 and BA. 5 escape antibodies elicited by Omicron infection. *Nature*, *608*(7923), 593-602.

ISSN Online: 3007-3154
ISSN Print: 3007-3146

Vol. 3 No. 8 (August) (2025)

Child abuse review: Journal of the British Association for the Study and Prevention of Child Abuse and Neglect. 2010 Mar;19(2):82-96.
D'Amico, F., Rahier, J. F., Leone, S., Peyrin-Biroulet, L., & Danese, S. (2020). Views of patients with inflammatory bowel disease on the COVID-19 pandemic: a global survey. *The lancet Gastroenterology & hepatology*, *5*(7), 631-632.
Dasaklis TK, Pappis CP, Rachaniotis NP. Epidemics control and logistics operations: A review. International Journal of Production Economics. 2012 Oct 1;139(2):393-410.
Davies, N. G., et al. (2021). Estimated Transmissibility and Impact of SARS-CoV-2 Lineage B.1.1.7 in England. Science, 372(6538), eabg3055.
Davoudi-Monfared, Effat, et al. "A randomized clinical trial of the efficacy and safety of interferon β-1a in treatment of severe COVID-19." *Antimicrobial agents and chemotherapy* 64.9 (2020): 10-1128.
Delmas, J. F., Dronnier, D., & Zitt, P. A. (2025). Vaccinating according to the maximal endemic equilibrium achieves herd immunity. *SIAM Journal on Applied Mathematics*, *85*(2), 806-820.
Duca, Andrea, et al. "Does helmet CPAP reduce carotid flow compared to oronasal mask CPAP? A randomized cross-over trial in healthy subjects." *Internal and Emergency Medicine* (2025): 1-8.
Fisher, D., & Heymann, D. (2020). Quarantine and Isolation: Lessons Learned from SARS. Lancet, 395(10234), 1021-1023.
Flaxman, S., et al. (2020). Estimating the Effects of Non-Pharmaceutical Interventions on COVID-19 in Europe. Nature, 584(7820), 257-261.
Gaddy, H., & Gargiulo, M. (2025). Can we estimate crisis death tolls by subtracting total population estimates? A critical review and appraisal. *Demographic Research*, *52*, 741-796
Grant, M. C., Geoghegan, L., Arbyn, M., Mohammed, Z., McGuinness, L., Clarke, E. L., & Wade, R. G. (2020). The prevalence of symptoms in 24,410 adults infected by the novel coronavirus (SARS-CoV-2; COVID-19): A systematic review and meta-analysis of 148 studies from 9 countries. *PloS one*, *15*(6), e0234765.
Guimarães, P. O., Quirk, D., Furtado, R. H., Maia, L. N., Saraiva, J. F., Antunes, M. O., ... & Berwanger, O. (2021). Tofacitinib in patients hospitalized with Covid-19 pneumonia. *New England Journal of Medicine*, *385*(5), 406-415.
Guo, T., Fan, Y., Chen, M., Wu, X., Zhang, L., He, T., ... & Lu, Z. (2020). Cardiovascular implications of fatal outcomes of patients with coronavirus disease 2019 (COVID-19). *JAMA cardiology*, *5*(7), 811-818.
Hammond, Jennifer, et al. "Oral nirmatrelvir for high-risk, nonhospitalized adults with Covid-19." *New England Journal of Medicine* 386.15 (2022): 1397-1408.
He, Wenqing, Grace Y. Yi, and Yayuan Zhu. "Estimation of the basic reproduction number, average incubation time, asymptomatic infection rate, and case fatality rate for COVID-19: Meta-analysis and sensitivity analysis." *Journal of medical virology* 92.11 (2020): 2543-2550.
Heymann, D. L., Fine, P. E., Griffiths, U. K., Hall, A. J., & Mounier-Jack, S. (2010). Measles eradication: past is prologue. *The Lancet*, *376*(9754), 1719-1720.
Horby, Peter W., et al. "Tocilizumab in patients admitted to hospital with COVID-19 (RECOVERY): preliminary results of a randomised, controlled, open-label, platform trial." *Medrxiv* (2021).

ISSN Online: 3007-3154
ISSN Print: 3007-3146

Iwata-Yoshikawa, N., Kakizaki, M., Shiwa-Sudo, N., Okura, T., Tahara, M., Fukushi, S., ... & Takeda, M. (2022). Essential role of TMPRSS2 in SARS-CoV-2 infection in murine airways. *Nature Communications*, *13*(1), 6100.

Jiang C, Yao X, Zhao Y, Wu J, Huang P, Pan C, Liu S, Pan C. Comparative review of respiratory diseases caused by coronaviruses and influenza A viruses during epidemic season. Microbes and infection. 2020 Jul 1;22(6-7):236-44.

Karunarathna, S. C., Lu, W., Patabedige, N., Zhao, C. L., & Hapuarachchi, K. K. (2025). Unlocking the therapeutic potential of edible mushrooms: Ganoderma and their secondary metabolites as novel antiviral agents for combating COVID-19. *New Zealand Journal of Botany*, *63*(5), 2470-2528.

Koplan JP, Bond TC, Merson MH, Reddy KS, Rodriguez MH, Sewankambo NK, Wasserheit JN. Towards a common definition of global health. The Lancet. 2009 Jun 6;373(9679):1993-5.

Li, Q., et al. (2020). Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia. New England Journal of Medicine, 382(13), 1199-1207.

Li, Y., Ma, H., Zhang, Y., He, T., Li, B., Ren, H., ... & Shi, M. (2025). PGLYRP2 drives hepatocyte-intrinsic innate immunity by trapping and clearing hepatitis B virus. *The Journal of Clinical Investigation*, *135*(8).

Libster, Romina, et al. "Early high-titer plasma therapy to prevent severe Covid-19 in older adults." *New England Journal of Medicine* 384.7 (2021): 610-618.

Lopes, R. D., Furtado, R. H., Macedo, A. V. S., Bronhara, B., Damiani, L. P., Barbosa, L. M., ... & Berwanger, O. (2021). Therapeutic versus prophylactic anticoagulation for patients admitted to hospital with COVID-19 and elevated D-dimer concentration (ACTION): an open-label, multicentre, randomised, controlled trial. *The Lancet*, *397*(10291), 2253-2263.

Matthay, Michael A., J. Matthew Aldrich, and Jeffrey E. Gotts. "Treatment for severe acute respiratory distress syndrome from COVID-19." *The Lancet Respiratory Medicine* 8.5 (2020): 433-434.

Menni, C., Sudre, C. H., Steves, C. J., Ourselin, S., & Spector, T. D. (2020). Quantifying additional COVID-19 symptoms will save lives. *The Lancet*, *395*(10241), e107-e108.

Michel JP, Gusmano M, Blank PR, Philp I. Vaccination and healthy ageing: how to make life-course vaccination a successful public health strategy. European Geriatric Medicine. 2010 Jun 1;1(3):155-65.

Morawska, L., & Milton, D. K. (2020). It is Time to Address Airborne Transmission of COVID-19. Clinical Infectious Diseases, 71(9), 2311-2313.

Murray, Christopher JL, and Peter Piot. "The potential future of the COVID-19 pandemic: will SARS-CoV-2 become a recurrent seasonal infection?." *Jama* 325.13 (2021): 1249-1250.

Paterson, Ross W., et al. "The emerging spectrum of COVID-19 neurology: clinical, radiological and laboratory findings." *Brain* 143.10 (2020): 3104-3120.

Peckham, T., et al. (2020). Global COVID-19 Epidemiology and Public Health Response. The Lancet, 396(10244), 758-759

Peluso, M. J., Deveau, T. M., Munter, S. E., Ryder, D., Buck, A., Beck-Engeser, G., ... & Henrich, T. J. (2022). Impact of pre-existing chronic viral infection and reactivation on the development of long COVID. *MedRxiv*.

ISSN Online: 3007-3154
ISSN Print: 3007-3146

Vol. 3 No. 8 (August) (2025)

Pfefferbaum, B., & North, C. S. (2020). The association between parent-reported child disaster reactions and posttraumatic stress disorder in parent survivors of disasters and terrorism. Annals of clinical psychiatry, 32(4), 256-265.
Ramakrishnan, S., Nicolau, D. V., Langford, B., Mahdi, M., Jeffers, H., Mwasuku, C., ... & Bafadhel, M. (2021). Inhaled budesonide in the treatment of early COVID-19 (STOIC): a phase 2, open-label, randomised controlled trial. *The Lancet Respiratory Medicine*, *9*(7), 763-772.
Riphagen, S., Gomez, X., Gonzalez-Martinez, C., Wilkinson, N., & Theocharis, P. (2020). Hyperinflammatory shock in children during COVID-19 pandemic. *The Lancet*, *395*(10237), 1607-1608.
Rhoades, R., McLaughlin, C., & Kaatz, S. (2025). COVID-19 and Pulmonary Embolism: Incidence and Pathophysiology. In *PERT Consortium Handbook of Pulmonary Embolism: Research, Care, and Management* (pp. 1-16). Cham: Springer Nature Switzerland
Rosas, Ivan O., et al. "Tocilizumab in hospitalized patients with severe Covid-19 pneumonia." *New England Journal of Medicine* 384.16 (2021): 1503-1516.
Sheikh, A., et al. (2021). The Impact of COVID-19 Variants on the Epidemiology of SARS-CoV-2. Journal of Global Health, 11, 05001.
Jack G, Gill O. The role of communities in safeguarding children and young people.
Schwaneck, E. C., Harasim, A. S., Tony, H. P., Gawlik, M., Witte, T., Joos, S., ... & Krone, M. (2025). Vaccination status of patients with primary immunodeficiencies in Germany—a multicentric epidemiologic analysis. *Zeitschrift für Rheumatologie*, *84*(1), 68-74.
Shi, Feng, et al. "Large-scale screening to distinguish between COVID-19 and community-acquired pneumonia using infection size-aware classification." *Physics in medicine & Biology* 66.6 (2021): 065031.
Spinner, Christoph D., et al. "Effect of remdesivir vs standard care on clinical status at 11 days in patients with moderate COVID-19: a randomized clinical trial." *Jama* 324.11 (2020): 1048-1057.
Sudre, C. H., Lee, K. A., Ni Lochlainn, M., Varsavsky, T., Murray, B., Graham, M. S., ... & Ourselin, S. (2021). Symptom clusters in COVID-19: A potential clinical prediction tool from the COVID Symptom Study app. *Science advances*, *7*(12), eabd4177.
Takashita, E., Yamayoshi, S., Simon, V., Van Bakel, H., Sordillo, E. M., Pekosz, A., ... & Kawaoka, Y. (2022). Efficacy of antibodies and antiviral drugs against Omicron BA. 2.12. 1, BA. 4, and BA. 5 subvariants. *New England Journal of Medicine*, *387*(5), 468-470.
Torres-Gil, F. and Hofland, B., 2012. Vulnerable populations. In Independent for life: Homes and neighborhoods for an aging America (pp. 221-232). University of Texas Press.
Treanor, J. J. (2012). *The biology and management of brucellosis in Yellowstone bison*. University of Kentucky.
Williamson, B. N., Feldmann, F., Schwarz, B., Meade-White, K., Porter, D. P., Schulz, J., ... & De Wit, E. (2020). Clinical benefit of remdesivir in rhesus macaques infected with SARS-CoV-2. *Nature*, *585*(7824), 273-276.
World Health Organization (WHO). (2020). COVID-19 Public Health Emergency of International Concern (PHEIC) Global Research and Innovation Forum: Towards a Research Roadmap. WHO.

ISSN Online: 3007-3154
ISSN Print: 3007-3146

Vol. 3 No. 8 (August) (2025)

Yao, X. H., Shen, F., Hao, J., Huang, L., & Keng, B. (2024). A review of Legionella transmission risk in built environments: sources, regulations, sampling, and detection. *Frontiers in Public Health*, *12*, 1415157.
Torres-Gil, F. and Hofland, B., 2012. Vulnerable populations. In Independent for life: Homes and neighborhoods for an aging America (pp. 221-232). University of Texas Press.
Wu, Z., & McGoogan, J. M. (2020). Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72,314 Cases From the Chinese Center for Disease Control and Prevention. JAMA, 323(13), 1239-1242.