COVID-19 Literature Review Group
Prepared by The Ohio State University

COVID-19 Vaccines, Vaccination for the Immunosuppressed, Herd Immunity, Emerging SARS-CoV-2 Variants, and Antibody Responses
COVID-19 Literature Review
Prepared by Eliana Burlotos, The Ohio State University
March 26, 2021

Topic: COVID-19 Vaccines

Title: Early Evidence of the Effect of SARS-CoV-2 Vaccine at One Medical Center
Source: The New England Journal of Medicine
Publication Date: March 23, 2021
Study Period: N/A
Study Location: N/A
Sample Size: N/A
Summary: This article discusses real-world evidence regarding the overall effect of the two COVID-19 vaccines, Pfizer-BioNTech and Moderna, on transmission of SARS-CoV-2 infection and related illness. Data in this article is reported from the University of Texas Southwestern Medical Center, which offered vaccines against SARS-CoV-2 to its frontline employees on December 15. From December 15, 2020 to January 28, 2021, the percentages of employees who became infected differed according to vaccination status. Of the nonvaccinated employees, 2.61% became infected. 1.82% of partially vaccinated employees became infected, and 0.05%, of fully vaccinated employees became infected. During the time period, the number of positive tests among the medical centers employees was consistently lower than the projected number that was based on the actual increasing SARS-CoV-2 positivity rate among patients in the center’s emergency department. There was a greater than 90% decrease in the number of employees in isolation or quarantine.

Key Findings Relevant to Ohio’s Response: There is evidence of COVID-19 vaccines being effective in real-world scenarios. Vaccine hesitancy is a huge obstacle that needs to be overcome to achieve the full benefit of vaccination and reduce the transmission of SARS-CoV-2.

Title: Dynamics of SARS-CoV-2 neutralising antibody responses and duration of immunity: a longitudinal study
Source: The Lancet
Publication Date: March 23, 2021
Link: https://www.thelancet.com/journals/lanmic/article/PIIS2666-5247(21)00025-2/fulltext
Study Period: N/A
Study Location: N/A
Sample Size: 164 patients who had recovered from COVID-19
Summary: This article discusses a longitudinal study of patients who had recovered from COVID-19. Changes in neutralising antibody levels were monitored using a previously validated surrogate virus neutralisation test. There were 164 patients who were followed up with blood and serum samples taken for analysis. Five distinctive patterns of neutralising antibody dynamics were found and include the following: negative, individuals who did not develop neutralising antibodies at the 30% inhibition level (12% of the patients); rapid waning, individuals who had varying levels of neutralising antibodies around 20 days after symptom onset, but seroreverted in less than 180 days (27% of the patients), slow waning, individuals who maintained neutralising antibodies at 180 days post-symptom onset (29% of patients); persistent, individuals that had minimal neutralising antibody decay with varying peak levels (32% of patients); and delayed response, individuals who’s neutralising antibodies unexpectedly increased at 90 or 180 days after symptom onset (3% of patients).

Key Findings Relevant to Ohio’s Response: Neutralising antibody response dynamics in patients who have recovered from COVID-19 vary greatly. Immune longevity cannot be predicted on the community level.
COVID-19 Literature Review  
Prepared by Elena McGoey, The Ohio State University  
March 26, 2021

**Topic:** SARS-CoV-2 vaccinations for the immunosuppressed

**Title:** Immunogenicity of a Single Dose of SARS-CoV-2 Messenger RNA Vaccine in Solid Organ Transplant Recipients  
**Source:** JAMA  
**Publication:** March 15, 2021  
**Link:** [https://jamanetwork.com/journals/jama/fullarticle/2777685](https://jamanetwork.com/journals/jama/fullarticle/2777685)  
**Study Period:** December 16, 2020 to February 5, 2021  
**Study Location:** US (Johns Hopkins University)  
**Sample Size:** 436  
**Summary:** Out of 436 transplant recipients, antibody for SARS-CoV-2 was detected at a median of 20 days after the first vaccine dose in 76 of those recipients (17%). Transplant recipients less likely to develop an antibody response included those receiving anti-metabolite maintenance immunosuppression therapy (37% versus 63%), older recipients, and those who received the Pfizer vaccine instead of the Moderna (31% versus 69%, respectively).

**Key findings most relevant to Ohio’s response:** All the participants were tested to be COVID-naïve. These results suggest that transplant recipients still remain at higher risk for COVID-19 despite vaccination and that vaccination that does guarantee an antibody response in immunosuppressed individuals. Further studies should investigate antibody responses in transplant recipients or other similarly immunocompromised groups after the second dose of Moderna and Pfizer vaccines.

**Title:** COVID Vax in the Immunosuppressed: Reason for Concern  
**Source:** MedPage Today  
**Publication:** March 15, 2021  
**Link:** [https://www.medpagetoday.com/infectiousdisease/vaccines/91631](https://www.medpagetoday.com/infectiousdisease/vaccines/91631)  
**Study Period:** N/a  
**Study Location:** N/a  
**Sample Size:** N/a  
**Summary:** This commentary responds to the John Hopkins study on organ transplant recipients, which found a 17% success rate of antibody response in transplant recipients after receiving the first dose of either the Pfizer or Moderna SARS-CoV-2 vaccine. 17% is significantly lower than the 100% antibody response mounted in immunocompetent people following vaccination. Immunosuppressed individuals need their second vaccine dose, and it is important for immunosuppressed individuals to realize that vaccination does not equate to immunity. Johns Hopkins is conducting further research for other vulnerable groups and data following the second dose of vaccination.

**Key findings most relevant to Ohio’s response:** State and healthcare system websites need to be updated to warn immunosuppressed groups that they may still be susceptible to COVID-19 despite vaccination. It is likely that the results of the transplant recipient study can be applied to other immunosuppressed patients (those who have autoimmune conditions, etc.). It is important to stress upon immunosuppressed patients that protective measures should not be relaxed following vaccination.
## COVID-19 Literature Review
Prepared by Anjali Prabhakaran, The Ohio State University
March 26, 2021

### COVID Vaccines and Herd Immunity

<table>
<thead>
<tr>
<th>Title</th>
<th>Projected COVID-19 epidemic in the United States in the context of the effectiveness of a potential vaccine and implications for social distancing and face mask use</th>
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</thead>
<tbody>
<tr>
<td>Source</td>
<td>Vaccine</td>
</tr>
<tr>
<td>Publication Date</td>
<td>02/27/2021</td>
</tr>
<tr>
<td>Study Period</td>
<td>January 26, 2020 – September 15, 2020</td>
</tr>
<tr>
<td>Study Location</td>
<td>United States</td>
</tr>
<tr>
<td>Sample Size</td>
<td>n/a</td>
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</tbody>
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### Summary
The aim of this study was to develop a model for COVID-19 transmission in the four most severely affected states (New York, Texas, Florida, and California) and evaluate the vaccine effectiveness and coverage necessary to suppress the epidemic when social contact returns to pre-pandemic levels. Without a vaccine, the spread of COVID-19 could be suppressed by maintaining strict social distancing measures and face mask usage. With a vaccine with 50% effectiveness and face mask usage reduced by 50%, vaccine coverage of 55-94% would be required to suppress the epidemic. A vaccine that is 80% effective (moderate vaccine) would only require 32-57% coverage. If face mask usage stops completely, a moderate vaccine with coverage of 48-78% or a strong vaccine (100% effective) with coverage of 33-58% would be necessary to suppress the epidemic.

### Key Findings Relevant to Ohio’s Response
As vaccine rollout continues, states are already removing mask mandates and COVID-19 safety precautions. The analysis performed in this paper can help policy makers calculate when it is safe to remove these measures to prevent a resurgence of COVID-19 cases. By closely monitoring vaccine rates, and removing public health mandates as certain vaccination rates are reached, a slow, yet safe, return to pre-pandemic society can be reached.
COVID-19 Literature Review
Prepared by Anjali Prabhakaran, The Ohio State University
March 22, 2021

Topic: COVID Vaccines

<table>
<thead>
<tr>
<th>Title</th>
<th>Prolonged Viral Shedding and Antibody Persistence in Patients with COVID-19</th>
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<tbody>
<tr>
<td>Source</td>
<td>Microbes and Infection</td>
</tr>
<tr>
<td>Publication Date</td>
<td>03/17/2021</td>
</tr>
<tr>
<td>Study Period</td>
<td>n/a</td>
</tr>
<tr>
<td>Study Location</td>
<td>Iran</td>
</tr>
<tr>
<td>Sample Size</td>
<td>113</td>
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Summary:
The aim of this study was to assess the viral shedding duration and antibody development against SARS-CoV-2 in COVID-19 patients. COVID-19 suspected patients were tested for the infection using RT-PCR analysis, and confirmed cases were followed until a negative test was attained. The median viral shedding among the study population was 34.16 (+/- 17.65) days. Patients who experienced gastrointestinal problems, shivers, and fever experienced longer viral shedding. No correlation was found with age, sex, or any other comorbidities. Furthermore, IgG antibodies were present in 84% of patients after 150 days.

Key Findings Relevant to Ohio’s Response:
This research suggests that a two-week quarantine period may not be sufficient for a majority of the population. Therefore, policymakers can use the data from this study to assess whether or not revisions to COVID-19 quarantine protocols should be made. Furthermore, the presence of antibodies in a majority of the patients for nearly 6 months also may suggest that a single dose of the COVID-19 vaccine may be sufficient for immunity, which could help streamline vaccine rollout.

Title
Effect of influenza vaccine on COVID-19 mortality: a retrospective study

<p>| Source | Internal and Emergency Medicine |
| Publication Date | 03/20/2021 |
| Study Period | 3/1/2020 - 06/30/2020 |
| Study Location | Rome, Italy |
| Sample Size | 635 |</p>
<table>
<thead>
<tr>
<th>Summary</th>
<th>The objective of this study was to determine whether the influenza vaccine may reduce the susceptibility and severity of SARS-CoV-2 infection. This retrospective study examined 635 patients who were admitted to the emergency department and diagnosed with COVID-19 through RT-PCR analysis. The clinical outcomes of the vaccinated and non-vaccinated patients were then analyzed by univariate and multivariate analysis. After correcting for gender, age, and comorbidities, vaccinated patients had a lower mortality risk at 60 days compared to non-vaccinated patients.</th>
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<tr>
<td>Key Findings Relevant to Ohio’s Response</td>
<td>This study provides additional support for the benefits of vaccination against infectious diseases. More importantly, this study provides evidence that vaccines can provide both specific and unspecific protective effects. This information can help policymakers develop new mandates for COVID-19 and influenza vaccine requirements in the future to prevent pandemics of even larger scales.</td>
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COVID 19 Literature Review  
Prepared by Amanda Seifferth, The Ohio State University  
March 26, 2021

Topic: The Implications of Emerging SARS-CoV-2 Variants

Title: Neutralizing Antibodies Against SARS-CoV-2 Variants After Infection and Vaccination  
Source: JAMA Network  
Publication Date: 03/19/2021  
Link: https://jamanetwork.com/journals/jama/fullarticle/2777898  
Study Period: March 2020-August 2020  
Study Location: Emory University, Atlanta, GA  
Sample Size: 54  
Summary: With the presence of emerging SARS-CoV-2 variants, concerns about the effectiveness of neutralizing antibodies, induced by infection and vaccination, have arisen. To investigate this concern, scientists compared neutralizing antibody responses to four variants in infected, recovered, and vaccinated individuals. They obtained 20 serum samples from infected individuals, 20 samples from recovered individuals, and 14 samples from fully vaccinated individuals. They then performed live-virus focus reduction neutralization tests (FRNTs) and calculated FRNT50GMs—measures of the reciprocal dilution of serum that neutralizes 50% of the virus. For currently infected individuals, FRNT50GM was 186 for the A.1 variant, 110 for the B.1 variant, 116 for the B.1.1.7. variant, and 141 for the N501Y variant. For recovered individuals, the FRNT50GM was 168 for the A.1 variant, 91 for the B.1 variant, 145 for the B.1.1.7 variant, and 145 for the N501Y variant. Regarding vaccinated participants, the FRNT50GMT was 1709 for the A.1 variant, 804 for the B.1 variant, 965 for the B.1.1.7 variant, and 994 for the N501Y variant. These results indicate that antibodies elicited in response to infection or vaccination offer a degree of protection against emerging SARS-CoV-2 variants.

Key Findings Relevant to Ohio’s Response: These findings show that vaccination and previous infection still offer a degree of protection against new variants. Thus, individuals should continue to accept Covid-19 vaccinations despite emerging variants. It must be emphasized to the public that the presence of new strains does not detract from the necessity of vaccination.

Title: Increased Mortality in Community-Tested Cases of SARS-CoV-2 Lineage B.1.1.7.  
Source: Nature  
Publication Date: 03/15/2021  
Link: https://www.nature.com/articles/s41586-021-03426-1_reference.pdf  
Study Period: 09/01/2020-02/14/2021  
Study Location: England  
Sample Size: 2,245,263  
Summary: The B.1.1.7 variant, first identified in the UK, has evoked great concern due to its increased transmissibility and potential heightened disease severity. Researchers investigated whether the B.1.1.7. variant is truly responsible for more serious illness by analyzing positive Covid-19 tests as well as associated deaths in England from September 2020 to February 2021. Fifty-one percent of the tests researchers analyzed were able to detect the presence or absence of the B.1.1.7 variant. The B.1.1.7 variant is characterized by spike gene target failure in (SGTF). After analysis, researchers concluded that there is 55% hazard of death associated with SGTF, and 4,945 deaths within their sample were associated with SGTF. Under the researchers’ findings, the risk of death for a 55-69 year old male increases from 0.6% to 0.9% with the B.1.1.7 variant, leading them to deduce a 61% higher risk of death from the B.1.1.7 variant. Researchers were unable to identify the direct cause of higher mortality, but they did note that higher viral loads were found in B.1.1.7 nasopharyngeal swabs.

Key Findings Relevant to Ohio’s Response: These findings further indicate the need for Covid-19 vaccination. With the emergence of new, more severe variants, it is important that the public be promptly vaccinated, as immunizations are
known to reduce severity if not completely prevent illness. Additionally, the presence of new variants implies the potential need for vaccine boosters in the future. Thus, it is advisable that increased vaccine acceptance be promoted among the public now in preparation for the future.

COVID-19 Literature Review
Prepared by Greta Warmbier, The Ohio State University
March 24, 2021

**Topic: Antibody Responses**

**Title:** Antibody Responses after a Single Dose of SARS-CoV-2 mRNA Vaccine

**Source:** The New England Journal of Medicine

**Publication Date:** March 23, 2021


**Study Period:** 3 weeks

**Study Location:** n/a

**Sample Size:** 188

**Summary:**

In this study, antibody levels were determined at baseline and 3 weeks after the first dose of the SARS-CoV-2 mRNA vaccine in 36 health care workers who received laboratory confirmation of SARS-CoV-2 infection 30 to 60 days before they received the vaccine and 152 health care workers without a history of SARS-CoV-2 infection. Using a multiplex bead-binding assay that measures levels of IgG against SARS-CoV-2 spike protein subunits S1 and S2, the spike receptor-binding domain, and nucleocapsid protein, the study found that after the first vaccine dose, antibody titers in both groups of participants were enhanced against all spike protein subunits but not against nucleocapsid protein, which is not a vaccine antigen. At baseline, 6 of the participants with no history of SARS-CoV-2 infection had antibody levels that matched those of participants with recent infection; these 6 participants may have had undiagnosed infection. The study then separated these participants into a different group (“undiagnosed”) for analysis and found that their week 3 serologic assay results resembled those of the participants with recent infection. After the first vaccine dose, recently infected participants had higher titers of antibody to S1, S2, and the receptor-binding domain than did those with no history of infection.

The study used an FDA-approved in vitro assay that allows indirect detection of potential SARS-CoV-2–neutralizing antibodies in the blood through determination of antibody blocking of the binding of the SARS-CoV-2 receptor-binding domain to the human host receptor angiotensin-converting enzyme 2. At baseline, blocking antibodies were undetectable in the group with no history of SARS-CoV-2 infection and were detectable at various levels in the recently infected group and the undiagnosed group. After primary immunization, levels of blocking antibodies were higher among seropositive participants than among seronegative participants.

3 weeks after a single vaccination, people with recent SARS-CoV-2 infection or seropositive status had higher levels of antibody to four SARS-CoV-2 antigens and higher levels of antibodies with neutralizing characteristics than did those without a history of infection.

**Relevance to Ohio’s COVID-19 Response:**

The duration of antibody responses and other potential measures of protective immunity need further investigation. Without an immune correlate of protection for SARS-CoV-2 vaccines in humans, protective immunity after vaccination cannot be precisely measured and variations in effective immunization programs cannot be confidently recommended.
New Zealand has a goal of eliminating COVID-19, which has resulted in a low incidence. Managed isolation and quarantine (MIQ) are a border control to minimize importation risk. International arrivals to New Zealand undergo a mandatory 14-day period of MIQ in designated facilities. Facilities are repurposed commercial hotels used exclusively for isolation. During the MIQ period, regular health monitoring, as well as PCR testing on days 3 and 12, is undertaken to identify persons with COVID-19, whether symptomatic or asymptomatic. After this study, a day 1 test has also been put in place, as have predeparture tests. Persons who complete their 14-day period, show negative PCR results, and remain asymptomatic are cleared to be released.

On September 18, 2020, a COVID-19 case was identified in New Zealand. The case was in a person who was a recent international arrival from India who had completed 14 days in MIQ in Christchurch, New Zealand, had shown negative results twice on days 3 and 12, and had subsequently been released. This case-patient is denoted as case-patient G.

Case-patient G flew from Christchurch to Auckland, New Zealand, on the day of release on a government-chartered flight with several other persons released from MIQ. This case-patient subsequently showed development of symptoms and showed positive results 4 days later. Persons who had close contact with case-patient G were subsequently monitored and tested.

Case-patient G had been part of a cohort of 149 New Zealand citizens who had returned from India to New Zealand on August 27, 2020. The entire cohort who arrived in Christchurch had traveled on the same chartered flight from Delhi, India, through Nadi, Fiji; all passengers disembarked from the flight in Fiji. Several passengers remained in Fiji, 3 of whom later showed positive results for SARS-CoV-2 during their quarantine period but who were not included in this investigation. Predeparture testing was not mandatory at the time and no passengers reported having been tested.

Of the persons who arrived in Christchurch on this flight, 8 showed positive results while in MIQ. Of these 8 case-patients, 3 were shown to be genome-linked and are denoted as case-patients A, B, and C. During the first flight from New Delhi to Nadi, case-patients A, B, and C sat within 2 rows of each other. The flight was at 35% occupancy, and passengers were evenly spaced throughout the aircraft. The timing at which case-patient C experienced symptoms was consistent with transmission during the flight from India to New Zealand by case-patient A or B. Case-patients A or B might have been infected during or before the flight from a common source. All passengers were required to wear facemasks. The passengers in question did not travel together and did not know each other. On arrival in Christchurch, passengers were disembarked in groups of 10 and each case-patient was provided with a fresh surgical mask. The cohort was transferred by bus to MIQ upon arrival in Christchurch. Physical distancing and surgical mask use were used while boarding and on board, but seating was not assigned.

Each MIQ room had its own bathroom and no balconies. Case-patient C was positive on day 12 and was relocated to the isolation section of the facility. Before their relocation, an adult and infant child, both of whom had returned from India on the same flight, were in the adjacent room. Both the adult and child completed their 14-day quarantine. Each person had 2 negative test results and no reported symptoms but later showed positive results while in the community (these 2 case-patients are denoted as case-patients D and E). It is considered that these 2 case-patients were infected while in MIQ.

Closed-circuit television review of the period between the arrival of case-patients C, D, and E and the transfer of case-patient C to the isolation section of MIQ showed that there were no instances where the 3 persons were outside of their rooms at the same time. Footage showed that during routine testing on day 12, which took place within the doorway of the hotel rooms, there was a 50-second window between closing the door to the room of case-patient C and opening the door to the room of case-patients D and E. It is hypothesized that suspended aerosol particles were the probable mode of transmission in this instance, and that the enclosed and unventilated space in the hotel corridor probably
facilitated this event. A commissioned review of the ventilation system found that the rooms in question had a net positive pressure compared with the corridor. Fomite transmission through use of communal bins in the corridor was a less probable route of transmission because contact with the bin lid by case-patient D was >20 hours after it was touched by case-patient C.

Following their 14-day completion of MIQ, case-patients A (who was deemed to be recovered), D, E, and G boarded an 85-min government-chartered domestic flight from Christchurch to Auckland. All passengers were required to wear masks, and the flight was at 50% occupancy. Case-patient G sat directly in front of case-patients D and E, and case-patient A sat at a distance. On arrival at Auckland airport, case-patients D and E were met by a household contact, denoted as case-patient F, and case-patient G was met by household contacts (case-patients H and I). These household contacts had not been in MIQ because they had no recent history of travel outside New Zealand. However, both contacts subsequently tested positive for SARS-CoV-2.

The genomes of the 9 positive samples from case-patients A–I were classified within the PANGO genomic lineage B.1.36.17. Because of the dynamic nature of this genomic nomenclature, this cluster from New Zealand is now classified as lineage F.1, which is now extinct. A genomic link was found between virus isolated from all 9 case-patients. Placing this cluster within the global context provides high confidence that it was a single introduction of the virus into New Zealand. Of the other 5 case-patients who were positive for SARS-CoV-2 and arrived on the same flight from India, 1 case-patient was definitively excluded from the cluster based on virus genome being within a different genomic PANGO lineage. Four samples did not contain adequate RNA for genomic sequencing.

**Relevance to Ohio’s COVID-19 Response:** These findings reinforce the need for rigorous border control processes for countries pursuing COVID-19 elimination, as well as real-time integration of genomic and epidemiologic data to inform outbreak investigations.