Scientific Brief

Multiple Measures, Including Masks, Needed to Curb Covid-19

National Nurses United

Since the beginning of the pandemic, scientists have learned important information about how the virus that causes Covid-19 spreads. How the virus spreads determines which public health measures will be effective.

» We have learned that the virus spreads via **aerosol transmission** — when an infected person breathes, speaks, coughs, or sneezes they release aerosol particles containing infectious virus. These aerosol particles can travel long distances through and stay suspended in the air. An overwhelming amount of **scientific evidence** indicates that aerosol transmission is the primary mode of transmission for this virus.

» We have also learned that the virus can be transmitted by people who are infected but have no symptoms — **asymptomatic or pre-symptomatic transmission**. Studies indicate that approximately half of all transmission events are from cases that have no symptoms.[1,2]

Study after study has shown that **multiple measures** are needed to reduce and stop the spread of Covid-19, including **mask requirements**, physical/social distancing, avoiding large groups, testing and contact tracing, isolation of cases and contacts, protections for nurses and other essential workers in their workplaces, and vaccines.

Vaccines are a very **important element** to reducing the spread of Covid-19, but we cannot rely on vaccines alone to stop transmission of Covid. It is clear that Covid-19 vaccines are effective at preventing severe Covid-19, hospitalizations, and deaths, but no vaccine is 100 percent effective and there are many unanswered questions about the Covid-19 vaccines, including how long protection will last, what protection against mild and asymptomatic cases looks like, and how effective vaccines will be against variants of concern that are or may become resistant to vaccines.

It is also important to note that, as of May 16, 2021, only 37.1 percent of the U.S. population has been fully vaccinated for Covid-19.[3] Additionally, Covid-19 vaccines are currently authorized for adults and adolescents aged 12 years and older. Children under the age of 12 years comprise 15 percent of the country's population and currently have no access to Covid-19 vaccines.[4]

More transmissible variants that may be or may become resistant to vaccines make measures to reduce and stop transmission of Covid important to maintain even as vaccine roll out continues.

On May 13, 2021 the U.S. Centers for Disease Control and Prevention (CDC) updated its *Interim Public Health Recommendations for Fully Vaccinated People* to recommend that vaccinated individuals no longer needed to wear masks, get tested, or isolate after an exposure. This update **failed** to recognize the science on mask requirements and other measures to slow the spread of Covid and failed to account for questions about vaccines and variants that remain unanswered.

This scientific brief outlines the scientific evidence for multiple measures, including masks and Covid vaccination programs, to curb the spread of Covid-19 while monitoring variants of concern.

Studies Show That Multiple Measures, Including Masks, are Necessary to Mitigate Transmission of Covid-19

Studies have shown that multiple measures in a layered approach are necessary to stop and slow the spread of Covid-19. Countries that have effectively controlled the spread of Covid-19, such as Taiwan, South Korea, and New Zealand, have a multi-layered approach of both individual-level interventions (e.g., mask requirements) and public health-level interventions (e.g., widespread testing and contact tracing programs). Highlights from this body of research include:

» Researchers examined a large dataset of Covid cases from 190 countries and found that, "Distancing and the simultaneous implementation of two or more types of NPIs [non-pharmaceutical interventions, including mandatory mask, isolation and quarantine, and traffic restriction] seemed to be associated with a greater decrease in the Rt [reproduction number, a measure of how quickly the virus is spreading] of COVID-19."[5]

» A study from New South Wales, Australia found that, "A multifaceted strategy that combines all three [measures, including testing, contact tracing, and mask usage], alongside continued hygiene and distancing protocols, is likely to be the most robust means of controlling transmission of SARS-CoV-2."[6] As of May 16, 2021, New South Wales has reported just 5,371 total cases over the course of the entire pandemic, with a population of 7.95 million — just 0.068 percent of the population infected.[7,8] This is in contrast to the United States where nearly 10 percent of the population has been infected, with over 32 million total reported cases over the course of the pandemic, with a population of 328 million.[9,10]

» A study from Taiwan reported: "In this comparative effectiveness research study, the combination of case-based [contact tracing and quarantine] and population-based interventions (with wide adherence) [social distancing and facial masking] may explain the success of COVID-19 control in Taiwan in 2020. Either category of interventions alone would have been insufficient, even in a country with an effective public health system and comprehensive contact tracing program."[11]

Widespread Usage of Masks is Important to Reducing Covid-19 Spread

Mask and cloth face covering usage has proven to be a critical measure in reducing the spread of Covid-19. It is important to remember the science of mask-wearing. Wearing masks provides source control, meaning wearing a mask can reduce the respiratory droplets emitted by the wearer. The CDC posted the following information about masks, in comparison to respiratory protection, in Sept 2020:[12]

> The purpose of wearing masks is to help reduce the spread of COVID-19 by reducing the spread of the virus through respiratory droplets from asymptomatic individuals. Masks are recommended as a barrier to help prevent large respiratory droplets from traveling into the air and onto other people when the person wearing the mask coughs, sneezes, talks, or raises their voice. **Emerging evidence** from clinical and laboratory studies shows that masks help reduce the spray of droplets when worn over the nose and mouth. **Together with social distancing**, masks are most likely to reduce the spread of COVID-19 when they are widely used by people in public settings.

Consistent, widespread use of masks is necessary to providing protection from Covid-19. A report from the Proceedings of the National Academy of Sciences of the United States found that, "The preponderance of evidence indicates that mask wearing reduces transmissibility per contact by reducing transmission of infected respiratory particles in both laboratory and clinical contexts. Public mask wearing is most effective at reducing spread of the virus when compliance is high."[13]

The CDC's May 13 update to mask guidance for vaccinated individuals failed to recognize the basic science behind how

masks provide protection. Vaccinated individuals can still be infected and may transmit the virus.[14,15] As of May 16, 2021, only 37.1 percent of the U.S. population has been vaccinated. [16] By exempting vaccinated individuals from wearing masks, the CDC has placed vulnerable people, including children, babies, and immunocompromised individuals, at higher risk for Covid-19. The scientific evidence clearly indicates a continued need to maintain mask requirements.

Testing, Contact Tracing, and Case Isolation are Important Measures to Reducing Covid-19 Spread

The high rate of transmission from asymptomatic and pre-symptomatic cases means that testing, contact tracing, and isolation of cases and contacts are necessary measures to identify cases and prevent further transmission.[17]

But the CDC's May 13 update to guidance for vaccinated individuals, which recommends testing only for vaccinated individuals who develop symptoms, ignores what we have learned regarding the inadequacies of symptom-based testing programs.

Diagnostic testing based only on when symptoms are present detects, at most, a small portion of cases, thus bypassing an opportunity to prevent further transmission. For example, a study published in the *New England Journal of Medicine* reported that, while 1.9 percent of a cohort of Marine recruits became infected during a two-week isolation period, daily symptom screening detected no cases; all cases were detected by weekly surveillance testing.[18] Similarly, an analysis of contact tracing data from Singapore found that a symptom-based testing strategy missed 62 percent of Covid diagnoses.[19]

Because vaccinated individuals can be infected,[20] it is still important for them to be tested, not just based on symptoms. The available data indicate that a proportion of vaccinated individuals who become infected are asymptomatic. For example, an investigation into an outbreak at a Kentucky skilled nursing facility where a majority of residents and some staff had been vaccinated found that 63 percent of infected vaccinated individuals did not report symptoms.[21]

Further, the CDC announced earlier in May 2021 that the agency would no longer track breakthrough infections in vaccinated individuals unless they resulted in hospitalization or death. Failing to track asymptomatic and mild infections in vaccinated individuals hampers our ability to learn more about the efficacy of vaccines to prevent asymptomatic and mild infections, whether vaccines prevent transmission, and undermines our ability to fully comprehend the impact of variants.

It is worth noting that lack of testing has been an issue throughout the pandemic. **Nurses** and other health care workers have long had **difficulty** accessing testing, even when exposed at work or experiencing symptoms. The CDC and the federal government have **failed** to track infections, hospitalizations, and deaths among health care workers and other essential workers. The CDC's May 13 update on guidance for vaccinated individuals only increases essential workers' exposure to the virus, while also further inhibiting their ability to get tested.

Additionally, it is important to view the CDC's May 13 update in the context of decreased diagnostic testing overall and the lack of genomic surveillance in the United States. The past four months have seen a decline in weekly testing of 33 percent: the week of January 2 to 9, 2021 saw 10,049,946 tests conducted while the week of May 2 to 9, 2021 saw 6,705,644 tests conducted.[22] Genomic surveillance — sequencing of viruses to identify the variant responsible for the infection — is lagging severely in the United States.[23] The decline in testing plus inadequate genomic surveillance creates "**blindspots**" which inhibit our ability to respond effectively to the pandemic.

Protections for Nurses and Other Essential Workers Remain Necessary to Combatting Covid-19

Nurses and other essential workers have been placed at great risk of Covid exposure and infection during the pandemic. We have seen local transmission explode after outbreaks in workplaces. For example, a May 2020 analysis found that counties with meat-packing plants, which have notoriously failed to protect their employees from Covid-19, had double the cases per capita compared to the average.[24]

The COVID Symptom Study found that health care workers in the US and the UK were 11.61 times more likely to report a positive Covid-19 test than the general public.[25] A preprint analysis from University of California San Francisco researchers reported high relative excess mortality among multiple occupational groups including food/agriculture workers, transportation/logistics workers, facilities, and manufacturing workers.[26]

Protections for nurses and other essential workers remain a necessary measure to combat Covid-19. It is clear that **employers** have failed to provide the necessary protections. An Emergency Temporary Standard on Covid-19 from the U.S. Occupational Safety and Health Administration (OSHA) is an important part of holding employers accountable to protecting employees from Covid-19.

Additionally, extensive scientific research underlines the importance of protections for nurses and health care workers. For a listing of studies, visit **NNU's Covid-19 Bibliography page**.

Variants of Concern That May Be Resistant to Vaccines Continue to Emerge and Spread, Underlining the Importance of Maintaining Prevention Measures In Addition to Increasing Vaccination Rates

The emergence and spread of Covid-19 variants of concern that are more transmissible, deadlier, and are or may become resistant to vaccines should give us all pause when considering relaxing protective measures. Especially because genomic surveillance — sequencing of viruses to identify the variant responsible for the infection — is lagging severely in the United States.[27]

Dr. Francis Collins, the Director of the National Institutes of Health, shared his thoughts on variants at the end of April 2021:[28]

> We must continue to do absolutely everything possible, individually and collectively, to prevent these new SARS-CoV-2 variants from slowing or even canceling the progress made over the last year. We need to remain vigilant for just a while longer, while encouraging our friends, neighbors, and loved ones to get vaccinated.

Others have recognized the threat that variants play to our ability to control the Covid-19 pandemic. For example, a news feature in the scientific journal, *Nature*, reported in March 2021:[29]

> There's another problem to contend with as immunity grows in a population, Ferrari says. Higher rates of immunity can create selective pressure, which would favour variants that are able to infect people who have been immunized. Vaccinating quickly and thoroughly can prevent a new variant from gaining a foothold. But again, the unevenness of vaccine roll-outs creates a challenge, Ferrari says. "You've got a fair bit of immunity, but you still have a fair bit of disease, and you're stuck in the middle." Vaccines will almost inevitably create new evolutionary pressures that produce variants, which is a good reason to build infrastructure and processes to monitor for them, he adds.

What we have learned about variants of concern circulating in the United States is concerning:

» The B.1.1.7 variant, first identified in the U.K., has rapidly become the dominant variant in the United States. This variant is more transmissible, creates higher viral loads, and has been tied to higher mortality risk.[30,31] While initial studies (preprint) found "no biologically significant different in neutralization activity" between trials involving the original Covid-19 strain and B.1.1.7, others have reported B.1.1.7 acquiring concerning mutations that can lead

to reduced neutralization and reduced efficacy of vaccines.[32,33]

» The B.1.351 variant, first identified in South Africa, has concerning mutations. Studies have found 10-fold or more decreased efficacy of vaccines against this variant.[34] The CDC's genomic surveillance data reports that 0.9 percent of sequenced samples are due to this variant.[35] A recent CDC report makes clear that this variant has a foothold in the United States.[36]

» The P.1. variant, first identified in Brazil/Japan, has mutations tied to increased transmissibility and decreased efficacy of vaccines.[37,38] It is important to note that, despite serology evidence that more than 67 percent of the population of Manaus, Brazil was infected during a prior surge, the region has seen a rapid and devastating resurgence due to the P.1 variant.[39] The CDC reports that the P.1 variant is responsible for 5.0 percent of sequenced samples in the United States as of the week of April 24, an increase from 3.6 percent of samples two weeks prior, indicating the variant is spreading rapidly.[40]

» The B.1.526 variant, first identified in New York last fall, has spread rapidly. Preliminary data indicates it may be more infectious and that it has the same mutation as the variants first identified in South Africa and Brazil that is tied to reduced vaccine efficacy.[41]

» The B.1.617 variant, first identified in India, has been at least partly responsible for the devastating surge seen in India this spring, according to scientists.[42] This variant has mutations tied to increase transmissibility and reduced vaccine efficacy. Singapore reported a probable case of transmission from a case to a spouse, who had been vaccinated 16 days prior to developing symptoms.[43]

The combination of variants of concern that are or may become resistant to vaccines with the unanswered questions about vaccine efficacy underlines the continued importance of the precautionary principle — taking action to protect people's health must not await scientific certainty of harm.

Preventing Asymptomatic and Mild Infections Remains an Important Aspect of Combatting the Covid-19 Pandemic

Long-term impacts of Covid infections, including mild and asymptomatic infections, have been reported. Symptoms range from severe fatigue, cognitive dysfunction, gastrointestinal and musculoskeletal disorders to pulmonary and cardiovascular diseases.[44]

One study of health care workers with a documented Covid-19 infection found that 45 percent reported persistent symptoms and 32 percent reported struggling to cope three to four months following infection.[45]

A large study examined over 73,000 individuals with Covid-19 who used Veterans Health Administration services and nearly five million controls. Researchers found that individuals who had Covid and were not hospitalized reported excess negative health impacts over at least six months that affected nearly every organ and regulatory system.[46]

A pre-print article reported on analysis of medical records and found that 32 percent of the Covid cases who reported long-term symptoms at day 61 or later were initially asymptomatic at the time of SARS-CoV-2 testing.[47]

Chronic impacts of Covid-19 have also been reported among children. One study looking at a cohort of pediatric patients with a positive Covid test found that two-thirds reported at least one persisting symptom between 60 and 120 days after an initial Covid diagnosis.[48] The authors noted, "An important and unexpected finding is that also children with an asymptomatic or paucisymptomatic COVID-19 developed chronic, persisting symptoms, although followed-up for a relatively short time after the diagnosis."

Real-World Vaccine Efficacy Data Cited by CDC is Incomplete

The CDC has posted a **Science Brief: Background Rationale and Evidence for Public Health Recommendations for Fully Vaccinated People** (Updated April 2, 2021). While it is clear that Covid-19 vaccines effectively prevent severe Covid-19

disease, hospitalizations, and deaths, the studies cited by the CDC in this brief provide an incomplete picture of vaccine efficacy. Important questions remain unanswered about the longevity of vaccine protection, efficacy of vaccines against mild and asymptomatic Covid, and impact of variants of concern that are more transmissible and that are or may become resistant to vaccine protection.

Table 1a is adapted from the CDC's **Science Brief: Background Rationale and Evidence for Public Health Recommendations for Fully Vaccinated People**. Red text is commentary and additional information. It is important to note the following points:

» The CDC relies on a high number of pre-prints. The CDC's brief cites four pre-prints, two peer-reviewed studies, and one a press release from Pfizer. Note the disclaimer from medRxiv (a common place to post pre-prints) about how pre-prints should not be used to guide clinical practice or health-related behaviors:[49]

  Caution: Preprints are preliminary reports of work that have not been certified by peer review. They should not be relied on to guide clinical practice or health-related behavior and should not be reported in news media as established information.

» The CDC cites a number of studies authored by individuals who reported financial conflicts of interest and/or relationships with Pfizer and other companies.

» It is unclear why the CDC has chosen to cite a press release from Covid-19 vaccine-manufacturer Pfizer as data to guide public health recommendations and clinical guidelines.

» The CDC failed to report the 95 percent confidence intervals for the studies it cites. The 95 percent confidence intervals are indicators for how reliable a study is and are key to interpreting the results from a study. These are the ranges within which the true vaccine efficacy value lies: "Because the true population mean is unknown, this range describes possible values that the mean could be. If multiple samples were drawn from the same population and a 95 percent CI calculated for each sample, we would expect the population mean to be found within 95 percent of these CIs. CIs are sensitive to variability in the population (spread of values) and sample size."[50] The confidence intervals from studies cited by the CDC have been added to the table in red font, where reported. Note how wide some of these confidence intervals are, indicating lack of certainty in the findings.

Table 1a. Effectiveness against SARS-CoV-2 infection and symptomatic disease

Country	Population	Vaccine	Outcome	Vaccine Effectiveness	Conflict of interest? And other notes
United States[51]	General adult population- 31,069 vaccinated, 31,069 unvaccinated	Pfizer-BioNTech or Moderna (data not separated by vaccine)	SARS-CoV-2 infection (PCR positive test in HER, unclear criteria for testing)	89%* (95% CI: 68.4 – 97.1%)	(pre-print) Financial conflicts of interest reported by authors. Propensity score matching
United States[52]	Healthcare workers, first responders, and other essential and frontline workers (n=3,950)	Pfizer-BioNTech or Moderna (data not separated by vaccine)	SARS-CoV-2 infection (self-swab weekly and if symptoms, note evidence suggests that self-swab samples **are less sensitive** than HCW swab)	90%** (95% CI: 68 – 97%)	1 author receives funding from Pfizer for another project.
United Kingdom[53]	Healthcare workers (n=23,324)	Pfizer-BioNTech (6% of sample received Astra-Zeneca; data not separated by vaccine)	SARS-CoV-2 infection (biweekly asymptomatic PCR testing- anterior nasal swabs or combined nose and oropharyngeal swabs; twice weekly rapid antigen testing started Nov 2020)	86%* (95% CI: 76 – 97%)	(pre-print) Dominant circulating variant at time of study: B.1.1.7
United Kingdom[54]	Adults aged ≥ 80 years, including those with multiple underlying conditions N=62,484 who received Pfizer vaccine	Pfizer-BioNTech (also looked at Astra-Zeneca, reported results separately)	Symptomatic disease	89%**	(pre-print)
Israel[55]	General adult population	Pfizer-BioNTech	SARS-CoV-2 infection (if test result in health record, unclear testing criteria)	92%* (95% CI: 88 – 95%)	

Country	Population	Vaccine	Outcome	Vaccine Effectiveness	Conflict of interest? And other notes
	General adult population	Pfizer-BioNTech	Symptomatic disease (if in health record)	94%* (95% CI: 87 – 98%)	
	General adult population	Pfizer-BioNTech	Hospitalization	87%* (95% CI: 55 – 100%)	
	General adult population	Pfizer-BioNTech	Severe disease	92%* (95% CI: 75 – 100%)	
Israel[56]	General adult population	Pfizer-BioNTech	Symptomatic disease, severe/ critical disease, death	>97%**	This citation is a press release from Pfizer.
Denmark[57]	Long term care facility residents (n=39,040 residents and 331,039 HCW)	Pfizer-BioNTech	SARS-CoV-2 infection (data from national testing registry, unclear testing criteria)	64%* (95% CI: 14 – 84%)	(pre-print)
	Long term care facility ~~residents~~ staff	Pfizer-BioNTech	SARS-CoV-2 infection (data from national testing registry, unclear testing criteria)	90%* 95% CI: 82 – 95%)	

* >7 days after second dose
** >14 days after second dose

Additional Studies on Vaccines and Breakthrough Infections Underlines the Importance of Maintaining Prevention Measures, Including Masking, in Addition to Increasing Vaccination Rates

Since the CDC published its **Science Brief: Background Rationale and Evidence for Public Health Recommendations for Fully Vaccinated People** (Updated April 2, 2021), several additional studies have been published. These studies may have also factored into the CDC's May 13 update of guidance for vaccinated individuals. It is important to note that several of these studies support the continued use of multiple prevention measures, including masking, in addition to increasing vaccination rates.

Table 1b. Additional Studies on Vaccines and Breakthrough Infections

Citation	Date Published	Findings	Takeaways
Pilishvili, T., K.E. Fleming-Dutra, et al., "Interim Estimates of Vaccine Effectiveness of Pfizer-BioNTech and Moderna COVID-19 Vaccines Among Health Care Personnel — 33 U.S. Sites, January–March 2021," MMWR, **link**.	May 14, 2021	This is an interim analysis of data from a 33-site study of health care workers in 25 different states. Health care workers with the potential for SARS-CoV-2 exposure through direct patient contact or for indirect exposure (e.g., through infectious materials) were enrolled. Cases were defined as having a positive PCR or antigen test and at least 1 Covid symptom. As of March 18, 2021, 623 cases and 1,220 controls had been identified. The study reported a vaccine efficacy rate of 94 percent (95% CI 87 to 97 percent) for two doses of an mRNA Covid vaccines. It is important to note that this study combined two different vaccines (Moderna and Pfizer) in their analyses. It is also important to note that testing programs were different at each of the 33 study sites and details were not provided.	This study reports high vaccine efficacy rates but is missing information important to understanding the true implications of the study's results. The study looked only at symptomatic Covid cases, specifically requiring that the presence of one symptom be reported to be considered a Covid case. But we know that asymptomatic cases are important to consider in terms of both preventing transmission of the virus and in terms of limiting long-term impacts of long Covid. Additionally, the study did not assess personal protective equipment worn by cases and controls or other infection control measures implemented at the 33 study sites. These infection control measures could be the reason some groups of workers saw lower infection rates.

Citation	Date Published	Findings	Takeaways
Liu, Y., J. Liu, et al., "BNT162b2-Elicited Neutralization against New SARS-CoV-2 Spike Variants," NEJM, **link**.	May 12, 2021	This laboratory-based study recombined key mutations from circulating variants B.1.1.7 (UK), B.1.351 (South Africa), and B.1.429 (California) to create lab-based models to study neutralization by human serum samples collected two to four weeks after the second Pfizer Covid vaccine dose. They found effective neutralization by vaccinated-human sera of the key mutations in variant viruses. However, neutralization of the L452R key mutation from the B.1.429 (California) variant was reduced.	This study provides good news in terms of the Pfizer vaccine providing protection against key mutations in currently circulating variants. However, it also warns us that variants may impact vaccine efficacy and that we must continue to be vigilant as we learn more about variants and as we work to increase vaccination rates in the United States.
Damiani, V., D. Mandatori, et al., "SARS-CoV-2 infection in asymptomatic vaccinated-health-care workers," Infection Control & Hospital Epi, **link**.	May 10, 2021	A study from Italy analyzed 500 nasopharyngeal swab specimens via PCR testing and whole genome sequencing. The swabs were collected from health care workers and hospitalized patients daily at one hospital. Seven health care workers who were vaccinated for Covid-19 (Pfizer) had been infected. One had received only one dose of the vaccine. Three tested positive within eight days after the second dose. Three health care workers tested positive between 23 and 36 days after the second Pfizer dose. All were asymptomatic. All cases were due to the B.1.1.7 (UK) variant. Note that the total number of health care workers who were vaccinated at this hospital was not reported.	Infections can occur in vaccinated health care workers. This study found that all infections in fully vaccinated individuals (more than 14 days following the second Pfizer dose) were asymptomatic, underlining the continued importance of testing.

Citation	Date Published	Findings	Takeaways
Angel, Y., A. Spitzer, and O. Henig, "Association Between Vaccination With BNT162b2 and Incidence of Symptomatic and Asymptomatic SARS-CoV-2 Infections Among Health Care Workers," JAMA, **link**.	May 6, 2021	This is a study from one hospital in Israel where health care workers were routinely tested since May 2020. The authors reported Pfizer vaccine efficacy for symptomatic infections at 97% and vaccine efficacy for asymptomatic infections at 86%. It is important to note that the hospital's screening program changed during the study period: from Dec 20, 2020-Jan 2, 2021, all health care workers were screened biweekly or monthly depending on risk of exposure; Jan 3-14, 2021, hospital-wide screening occurred regardless of vaccination status; but then from Jan 15, 2021 onward, only health care workers with medium to high risk exposure (based on job location) and non-fully vaccinated HCWs were screened monthly to weekly. Of the health care workers included in the study, 85.2% were in the low risk level group, which means there is no testing data for them after Jan 15, 2021 unless they developed symptoms or elected to get tested. This change in policy calls into question the vaccine efficacy results reported by the authors. *Note that two authors reported receiving grants or consulting fees from Pfizer.	Data on vaccine efficacy from Israel is not directly applicable in the United States given the significantly higher rate of vaccination in Israel (58.9 people fully vaccinated per 100 people in Israel vs. 36.9 per 100 people in the United States, as of May 16, 2021).[58] Additionally, the differences in testing between vaccinated and unvaccinated health care workers in the study design call reliability of the study's results into question.

Citation	Date Published	Findings	Takeaways
Abu-Raddad, L.J., H. Chemaitelly, et al., "Effectiveness of the BNT162b2 Covid-19 Vaccine against the B.1.1.7 and B.1.351 Variants," NEJM, **link**.	May 5, 2021	This study reports on vaccine efficacy data from Qatar, looking specifically at impacts of the B.1.1.7 (UK) and B.1.351 (South Africa) variants. The study reports vaccine efficacy of Pfizer vaccine (more than 14 days after second dose) of 89.5 percent (95% CI 85.9 to 92.3%) for B.1.1.7 variant and 75.0 percent (95% CI, 70.5 to 78.9%) for the B.1.351 variant. Vaccine efficacy against the B.1.351 variant was significantly reduced compared to the clinical trial and other published studies. One author reports funding from Gilead Sciences.	This study provide good news in terms of vaccine efficacy (Qatar had vaccinated 26.6 people per 100 people as of March 29, 2021).[59] However, it also warns us that variants may impact vaccine efficacy and that we must continue to be vigilant as we learn more about variants and as we work to increase vaccination rates in the United States.

Citation	Date Published	Findings	Takeaways
Cavanaugh, A.M., S. Fortier, et al., "COVID-19 Outbreak Associated with a SARS-CoV-2 R.1 Lineage Variant in a Skilled Nursing Facility After Vaccination Program — Kentucky, March 2021," MMWR, **link**.	April 30, 2021	This study reported on an outbreak investigation at skilled nursing facility in Kentucky found that, despite vaccinations, there was an outbreak with an R.1 variant. 90.4% of residents and 52.6% of staff had received two Covid vaccine doses, and most were fully vaccinated. Once the outbreak was identified, daily rapid testing of residents and twice-weekly testing of workers was initiated. Positive antigen results were confirmed. It is important to note that antigen tests are less sensitive in detecting asymptomatic infections, so some infections may have been missed. The study reported vaccine efficacy rates of 66.2 percent in residents (95% CI 40.5%-80.8%) and 75.9 percent in health care workers (95% CI 32.5%-91.4%) 18 fully vaccinated residents were infected (out of 26 total infected residents), 4 fully vaccinated health care workers were infected (out of 20 total health care workers infected). Three residents died, one of whom was vaccinated. One health care worker had already had Covid, was vaccinated, and was still infected.	This study underlines the fact that outbreaks can still occur, even with moderate to high vaccination levels. It also underlines the ongoing concerns about variants.

Citation	Date Published	Findings	Takeaways
Hacisuleyman, E., C. Hale, et al., "Vaccine Breakthrough Infections with SARS-CoV-2 Variants," NEJM, **link**.	April 21, 2021	A cohort of 417 vaccinated university staff were tested weekly between January 21 and March 17, 2021. The study reports breakthrough infections in two fully vaccinated individuals — at 19 days post-second Moderna dose and 36 days post-second Pfizer dose. Authors reported, "Data from Patient 1 indicate that infection with variant virus can be sustained with a high viral load despite high levels of neutralizing antibodies to variants." The variant that caused infection in patient 1 was similar to both B.1.1.7 (UK) and B.1.526 (NYC) but with considerable differences.	Researchers concluded, "...our observations underscore the importance of the ongoing race between immunization and the natural selection of potential viral escape mutants. During this critical period, our data support the need to maintain layers of mitigation strategies, including serial testing of asymptomatic persons, open publication and analysis of vaccination and infection databases (such as those accruing data in New York City), and rapid sequencing of SARSCoV-2 RNA obtained from a variety of high-risk persons."
Edelstein, S., S. Tannous, et al., "BNT 13b2 Pfizer vaccine protects against SARS-CoV-2 respiratory mucosal colonization even after prolonged exposure to positive family members," J Hosp Infection, **link**.	March 31, 2021	This study looked at a small cohort of 14 vaccinated health care workers living with person who was Covid-positive in Israel. Health care workers were tested two to three times with PCR based on exposure. All tests were negative. It is important to note that the study did not provide information about Covid-positive individuals in households, what exposure actually looked like (e.g., did family members isolate within the home?).	Data on vaccine efficacy from Israel is not directly applicable in the United States given the significantly higher rate of vaccination in Israel (58.9 people fully vaccinated per 100 people in Israel vs. 36.9 per 100 people in the United States, as of May 16, 2021).[60] Additionally, missing information about the nature and amount of exposure to vaccinated health care workers leaves questions about whether vaccines prevent transmission unanswered.

Endnotes

1 Johansson, M.A., T.M. Quandelacy, et al., "SARS-CoV-2 Transmission From People Without COVID-19 Symptoms," JAMA, Jan 7, 2021, https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2774707.

2 Nogrady, B., "What the data say about asymptomatic COVID infections," Nature, Nov 18, 2020, https://www.nature.com/articles/d41586-020-03141-3.

3 U.S. Centers for Disease Control and Prevention, COVID Data Tracker, https://covid.cdc.gov/covid-data-tracker/#datatracker-home (Accessed May 16, 2021).

4 Population of children aged under 12 years: 48.9 million, Total population: 332.3 million

Forum on Child and Family Statistics, "POP1 CHILD POPULATION: NUMBER OF CHILDREN (IN MILLIONS) AGES 0–17 IN THE UNITED STATES BY AGE, 1950–2019 AND PROJECTED 2020–2050," https://www.childstats.gov/americaschildren/tables/pop1.asp (Accessed May 17, 2021).

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5 Bo, Y., C. Guo, et al., "Effectiveness of non-pharmaceutical interventions on COVID-19 transmission in 190 countries from 23 January to 13 April 2020," International Journal of Infectious Diseases, Jan 2021, 102: 247-53, https://www.sciencedirect.com/science/article/pii/S1201971220322700.

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