

# Archived Editions (COVID-19 Genomics and Precision Public Health Weekly Update)

#### Published on 01/06/2022

COVID-19 Genomics and Precision Public Health Weekly Update Content

- Pathogen and Human Genomics Studies
- Non-Genomics Precision Health Studies
- News, Reviews and Commentaries

## Pathogen and Human Genomics Studies

Interim Estimate of Vaccine Effectiveness of BNT162b2 (Pfizer-BioNTech) Vaccine in Preventing SARS-CoV-2 Infection Among Adolescents Aged 12–17 Years — Arizona, July-December 2021 (https://www.cdc.gov/mmwr/volumes/70/wr/mm705152a2.htm?s\_cid=mm705152a2\_x)
 K Lutrik et al, MMWR, December 30, 2021

The Pfizer-BioNTech COVID-19 vaccine has been shown to be effective in preventing SARS-CoV-2 infection in adolescents in randomized placebo-controlled Phase III trials. A prospective cohort of 243 adolescents aged 12–17 years in Arizona completed weekly SARS-CoV-2 testing by nasal swab for 19 consecutive weeks. Under real-world conditions, vaccine effectiveness of full immunization (completion of the second in a 2-dose series =14 days earlier) was 92% against SARS-CoV-2 infections irrespective of symptom status.

COVID-19 Vaccine Safety in Children Aged 5–11 Years — United States, November 3–December 19, 2021 (https://www.cdc.gov/mmwr/volumes/70/wr/mm705152a1.htm?s\_cid=mm705152a1\_x)
 AM Hause et al, MMWR, December 31, 2021

In preauthorization trials for Pfizer-BioNTech (BNT162b2) COVID-19 vaccine, vaccinated children aged 5–11 years reported mild to moderately severe local and systemic reactions; no serious vaccination-related events were noted. After authorization of Pfizer-BioNTech COVID-19 vaccine for children aged 5–11 years during October 2021, and administration of approximately 8 million doses, local and systemic reactions after vaccination were commonly reported to VAERS and v-safe for vaccinated children aged 5–11 years. Serious adverse events were rarely reported.

Characteristics and Clinical Outcomes of Children and Adolescents Aged < 18 Years Hospitalized with COVID-19 — Six Hospitals, United States, July–August 2021 (https://www.cdc.gov/mmwr/volumes/70/wr/mm705152a3.htm?s\_cid=mm705152a3\_x) V Wanga et al, MMWR, December 31, 2021

Pediatric COVID-19–related hospitalization rates increased when the highly transmissible SARS-CoV-2 B.1.617.2 (Delta) variant became the predominant circulating strain. Among children and adolescents with SARS-CoV-2 infection admitted to six hospitals during July-August 2021, 77.9% were hospitalized for acute COVID-19. Among these patients, approximately one third aged <5 years had a viral coinfection (approximately two thirds of which were respiratory syncytial virus) and approximately two thirds of those aged 12–17 years had obesity; only 0.4% of age-eligible patients were fully vaccinated.

 Characteristics and Outcomes of Hospitalized Patients in South Africa During the COVID-19 Omicron Wave Compared With Previous Waves (https://jamanetwork.com/journals/jama/fullarticle/2787776)
 C Maslo et al, JAMA, December 30, 2021

A different pattern of characteristics and outcomes in patients hospitalized with COVID-19 was observed in the early phase of the fourth wave compared with earlier waves in South Africa, with younger patients having fewer comorbidities, fewer hospitalizations and respiratory diagnoses, and a decrease in severity and mortality.

 COVID-19 vaccine effectiveness among immunocompromised populations: a targeted literature review of real-world studies (https://www.medrxiv.org/content/10.1101/2021.12.29.21268511v1)
 M Difusco et al, MEDRXIV, December 31, 2021

A total of 10 studies from four countries were identified and summarized in this review. Expert opinion/commentary: VE of the widely available COVID-19 vaccines, including BNT162b2 (Pfizer/BioNTech), mRNA-1273 (Moderna), Ad26.COV2.S (Janssen), and ChAdOx1 nCoV-19 (Oxford/AstraZeneca), ranged from 64%-90% against SARS-CoV-2 infection, 73%-84% against symptomatic illness, 70%-100% against severe illness, and 63%-100% against COVID-19-related hospitalization among the fully vaccinated IC populations included in the studies. COVID-19 VE for most outcomes in the IC populations included in these studies was lower than in the general populations.

- Neutralization of ancestral SARS-CoV-2 and variants Alpha, Beta, Gamma, Delta, Zeta and Omicron by mRNA vaccination and infection-derived immunity through homologous and heterologous variants (https://www.medrxiv.org/content/10.1101/2021.12.28.21268491v1)
   M Bekliz et al, MEDRXIV, December 31, 2021
- Plasma Neutralization of the SARS-CoV-2 Omicron Variant (https://www.nejm.org/doi/full/10.1056/NEJMc2119641)
   F Schmidt et al, NEJM

In plasma specimens from persons who had received two doses of an mRNA vaccine (BNT162b2 [Pfizer–BioNTech] or mRNA-1273 [Moderna]) 1.3 months before sampling, the NT50 values were 187±24 times lower for PMS20 and 127±66 times lower for omicron than for Wuhan-hu-1. At 5 months after vaccination, the neutralization potency was 58±23 times lower for PMS20 and 27±17 times lower for omicron. Although these findings indicate that the omicron variant shows an unprecedented degree of neutralizing antibody escape, they also suggest that boosting and promoting affinity maturation of antibodies in persons who have previously been infected or vaccinated, with the use of existing Wuhan-hu-1–based vaccine immunogens, will provide additional protection against infection with the omicron variant and subsequent disease.

 Activity of convalescent and vaccine serum against SARS-CoV-2 Omicron (https://www.nature.com/articles/d41586-021-03846-z)
 JM Carreno et al, December 31, 2021

We investigated the neutralizing and binding activity of sera from convalescent, mRNA double vaccinated, mRNA boosted, convalescent double vaccinated, and convalescent boosted individuals against wild type, B.1.351 and B.1.1.529 SARS-CoV-2 isolates. Neutralizing activity of sera from convalescent and double vaccinated participants was undetectable to very low against B.1.1.529 while neutralizing activity of sera from individuals who had been exposed to spike three or four times was maintained, albeit at significantly reduced levels. Binding to the B.1.1.529 receptor binding domain (RBD) and N-terminal domain (NTD) was reduced in convalescent not vaccinated individuals, but was mostly retained in vaccinated individuals.

 Country-level factors dynamics and ABO/Rh blood groups contribution to COVID-19 mortality (https://www.nature.com/articles/s41598-021-04162-2)

A Monaco et al, Scientific Reports, December 31, 2021

In this work, we investigated the role of ABO/Rh blood groups at three different stages of the pandemic while accounting for demographic, economic, and health system related confounding factors. Using a machine learning approach, we found that the "B+" blood group frequency is an important factor at all stages of the pandemic, confirming previous findings that blood groups are linked to COVID-19 severity and fatal outcome.

- Understanding Gene Expression and Transcriptome Profiling of COVID-19: An Initiative Towards the Mapping of Protective Immunity Genes Against SARS-CoV-2 Infection.
  - (https://pubmed.ncbi.nlm.nih.gov/34975833)
  - Chakraborty Chiranjib et al. Frontiers in immunology 2022 1 724936
- A global analysis of conservative and non-conservative mutations in SARS-CoV-2 detected in the first year of the COVID-19 world-wide diffusion. (https://pubmed.ncbi.nlm.nih.gov/34969951)
   Balasco Nicole et al. Scientific reports 2021 12 (1) 24495

We evaluated the SARS-CoV-2 amino acid mutations and their progression by analyzing publicly available viral genomes at three stages of the pandemic (2020 March 15th and October 7th, 2021

February 7th). Mutations were classified in conservative and non-conservative based on the probability to be accepted during the evolution according to the Point Accepted Mutation substitution matrices and on the similarity of the encoding codons. We found that the most frequent substitutions are T > I, L > F, and A > V and we observe accumulation of hydrophobic residue.

- Mathematical modelling of SARS-CoV-2 variant outbreaks reveals their probability of extinction. (https://pubmed.ncbi.nlm.nih.gov/34969959)
   Schiøler Henrik et al. Scientific reports 2021 12 (1) 24498
- Preliminary modeling estimates of the relative transmissibility and immune escape of the Omicron SARS-CoV-2 variant of concern in South Africa
  (https://www.medrxiv.org/content/10.1101/2022.01.04.22268721v1)
  N Gozzi et al, MEDRXIV, January 5, 2022

We develop a stochastic, multi-strain, compartmental epidemic model to estimate the relative transmissibility and immune escape of the Omicron variant of concern (VOC) in South Africa. The model integrates population, non-pharmaceutical interventions, vaccines, and epidemiological data and it is calibrated in the period May 1st, 2021 - November 23rd, 2021. We explore a parameter space of relative transmissibility with respect to the Delta variant and immune escape for Omicron by assuming an initial seeding, from unknown origin, in the first week of October 2021.

- The runaway evolution of SARS-CoV-2 leading to the highly evolved Delta strain (https://www.biorxiv.org/content/10.1101/2021.12.30.474592v1)
   Y Ruan et al, BIORXIV, January 4, 2022
- Effect of Covid-19 Vaccination on Transmission of Alpha and Delta Variants
   (https://www.nejm.org/doi/full/10.1056/NEJMoa2116597?query=featured\_home)
   DW Eyre et al, NEJM, January 5, 2022

We used contact-testing data from England to perform a retrospective observational cohort study involving adult contacts of SARS-CoV-2-infected adult index patients. We used multivariable Poisson regression to investigate associations between transmission and the vaccination status of index patients and contacts and to determine how these associations varied with the B.1.1.7 (alpha) and delta variants and time since the second vaccination. Vaccination was associated with a smaller reduction in transmission of the delta variant than of the alpha variant, and the effects of vaccination decreased over time. PCR Ct values at diagnosis of the index patient only partially explained decreased transmission.

### Non-Genomics Precision Health Studies

 Interim Estimate of Vaccine Effectiveness of BNT162b2 (Pfizer-BioNTech) Vaccine in Preventing SARS-CoV-2 Infection Among Adolescents Aged 12–17 Years — Arizona, July-December 2021 (https://www.cdc.gov/mmwr/volumes/70/wr/mm705152a2.htm?s\_cid=mm705152a2\_x) K Lutrik et al, MMWR, December 30, 2021

The Pfizer-BioNTech COVID-19 vaccine has been shown to be effective in preventing SARS-CoV-2 infection in adolescents in randomized placebo-controlled Phase III trials. A prospective cohort of 243 adolescents aged 12–17 years in Arizona completed weekly SARS-CoV-2 testing by nasal swab for 19 consecutive weeks. Under real-world conditions, vaccine effectiveness of full immunization (completion of the second in a 2-dose series =14 days earlier) was 92% against SARS-CoV-2 infections irrespective of symptom status.

COVID-19 Vaccine Safety in Children Aged 5–11 Years — United States, November 3–December 19, 2021 (https://www.cdc.gov/mmwr/volumes/70/wr/mm705152a1.htm?s\_cid=mm705152a1\_x)
 AM Hause et al, MMWR, December 31, 2021

In preauthorization trials for Pfizer-BioNTech (BNT162b2) COVID-19 vaccine, vaccinated children aged 5–11 years reported mild to moderately severe local and systemic reactions; no serious vaccination-related events were noted. After authorization of Pfizer-BioNTech COVID-19 vaccine for children aged 5–11 years during October 2021, and administration of approximately 8 million doses, local and systemic reactions after vaccination were commonly reported to VAERS and v-safe for vaccinated children aged 5–11 years. Serious adverse events were rarely reported.

Characteristics and Clinical Outcomes of Children and Adolescents Aged <18 Years Hospitalized with COVID-19 — Six Hospitals, United States, July-August 2021
 <p>(https://www.cdc.gov/mmwr/volumes/70/wr/mm705152a3.htm?s\_cid=mm705152a3\_x)

 V Wanga et al, MMWR, December 31, 2021

Pediatric COVID-19–related hospitalization rates increased when the highly transmissible SARS-CoV-2 B.1.617.2 (Delta) variant became the predominant circulating strain. Among children and adolescents with SARS-CoV-2 infection admitted to six hospitals during July–August 2021, 77.9% were hospitalized for acute COVID-19. Among these patients, approximately one third aged <5 years had a viral coinfection (approximately two thirds of which were respiratory syncytial virus) and approximately two thirds of those aged 12–17 years had obesity; only 0.4% of age-eligible patients were fully vaccinated.

 Characteristics and Outcomes of Hospitalized Patients in South Africa During the COVID-19 Omicron Wave Compared With Previous Waves (https://jamanetwork.com/journals/jama/fullarticle/2787776)
 C Maslo et al, JAMA, December 30, 2021

A different pattern of characteristics and outcomes in patients hospitalized with COVID-19 was observed in the early phase of the fourth wave compared with earlier waves in South Africa, with younger patients having fewer comorbidities, fewer hospitalizations and respiratory diagnoses, and a decrease in severity and mortality.

 COVID-19 vaccine effectiveness among immunocompromised populations: a targeted literature review of real-world studies (https://www.medrxiv.org/content/10.1101/2021.12.29.21268511v1)
 M Difusco et al, MEDRXIV, December 31, 2021

A total of 10 studies from four countries were identified and summarized in this review. Expert opinion/commentary: VE of the widely available COVID-19 vaccines, including BNT162b2 (Pfizer/BioNTech), mRNA-1273 (Moderna), Ad26.COV2.S (Janssen), and ChAdOx1 nCoV-19 (Oxford/AstraZeneca), ranged from 64%-90% against SARS-CoV-2 infection, 73%-84% against symptomatic illness, 70%-100% against severe illness, and 63%-100% against COVID-19-related hospitalization among the fully vaccinated IC populations included in the studies. COVID-19 VE for most outcomes in the IC populations included in these studies was lower than in the general populations.

- Neutralization of ancestral SARS-CoV-2 and variants Alpha, Beta, Gamma, Delta, Zeta and Omicron by mRNA vaccination and infection-derived immunity through homologous and heterologous variants (https://www.medrxiv.org/content/10.1101/2021.12.28.21268491v1)
   M Bekliz et al, MEDRXIV, December 31, 2021
- Plasma Neutralization of the SARS-CoV-2 Omicron Variant (https://www.nejm.org/doi/full/10.1056/NEJMc2119641)
   F Schmidt et al, NEJM December 30, 2021

In plasma specimens from persons who had received two doses of an mRNA vaccine (BNT162b2 [Pfizer-BioNTech] or mRNA-1273 [Moderna]) 1.3 months before sampling, the NT50 values were 187±24 times lower for PMS20 and 127±66 times lower for omicron than for Wuhan-hu-1. At 5 months after vaccination, the neutralization potency was 58±23 times lower for PMS20 and 27±17 times lower for omicron. Although these findings indicate that the omicron variant shows an unprecedented degree of neutralizing antibody escape, they also suggest that boosting and promoting affinity maturation of antibodies in persons who have previously been infected or vaccinated, with the use of existing Wuhan-hu-1-based vaccine immunogens, will provide additional protection against infection with the omicron variant and subsequent disease.

 Activity of convalescent and vaccine serum against SARS-CoV-2 Omicron (https://www.nature.com/articles/d41586-021-03846-z)
 JM Carreno et al, December 31, 2021

We investigated the neutralizing and binding activity of sera from convalescent, mRNA double vaccinated, mRNA boosted, convalescent double vaccinated, and convalescent boosted individuals against wild type, B.1.351 and B.1.1.529 SARS-CoV-2 isolates. Neutralizing activity of sera from convalescent and double vaccinated participants was undetectable to very low against B.1.1.529 while neutralizing activity of sera from individuals who had been exposed to spike three or four times was maintained, albeit at significantly reduced levels. Binding to the B.1.1.529 receptor binding domain

(RBD) and N-terminal domain (NTD) was reduced in convalescent not vaccinated individuals, but was mostly retained in vaccinated individuals.

 Country-level factors dynamics and ABO/Rh blood groups contribution to COVID-19 mortality (https://www.nature.com/articles/s41598-021-04162-2)

A Monaco et al, Scientific Reports, December 31, 2021

In this work, we investigated the role of ABO/Rh blood groups at three different stages of the pandemic while accounting for demographic, economic, and health system related confounding factors. Using a machine learning approach, we found that the "B+" blood group frequency is an important factor at all stages of the pandemic, confirming previous findings that blood groups are linked to COVID-19 severity and fatal outcome.

- Understanding Gene Expression and Transcriptome Profiling of COVID-19: An Initiative Towards the Mapping of Protective Immunity Genes Against SARS-CoV-2 Infection. (https://pubmed.ncbi.nlm.nih.gov/34975833)
   Chakraborty Chiranjib et al. Frontiers in immunology 2022 1 724936
- A global analysis of conservative and non-conservative mutations in SARS-CoV-2 detected in the first year of the COVID-19 world-wide diffusion. (https://pubmed.ncbi.nlm.nih.gov/34969951)
   Balasco Nicole et al. Scientific reports 2021 12 (1) 24495

We evaluated the SARS-CoV-2 amino acid mutations and their progression by analyzing publicly available viral genomes at three stages of the pandemic (2020 March 15th and October 7th, 2021 February 7th). Mutations were classified in conservative and non-conservative based on the probability to be accepted during the evolution according to the Point Accepted Mutation substitution matrices and on the similarity of the encoding codons. We found that the most frequent substitutions are T > I, L > F, and A > V and we observe accumulation of hydrophobic residue.

- Mathematical modelling of SARS-CoV-2 variant outbreaks reveals their probability of extinction. (https://pubmed.ncbi.nlm.nih.gov/34969959)
   Schiøler Henrik et al. Scientific reports 2021 12 (1) 24498
- Preliminary modeling estimates of the relative transmissibility and immune escape of the Omicron SARS-CoV-2 variant of concern in South Africa
   (https://www.medrxiv.org/content/10.1101/2022.01.04.22268721v1)
  N Gozzi et al, MEDRXIV, January 5, 2022

We develop a stochastic, multi-strain, compartmental epidemic model to estimate the relative transmissibility and immune escape of the Omicron variant of concern (VOC) in South Africa. The model integrates population, non-pharmaceutical interventions, vaccines, and epidemiological data and it is calibrated in the period May 1st, 2021 - November 23rd, 2021. We explore a parameter space of relative transmissibility with respect to the Delta variant and immune escape for Omicron by assuming an initial seeding, from unknown origin, in the first week of October 2021.

- The runaway evolution of SARS-CoV-2 leading to the highly evolved Delta strain (https://www.biorxiv.org/content/10.1101/2021.12.30.474592v1)
   Y Ruan et al, BIORXIV, January 4, 2022
- Effect of Covid-19 Vaccination on Transmission of Alpha and Delta Variants (https://www.nejm.org/doi/full/10.1056/NEJMoa2116597?query=featured\_home)
   DW Eyre et al, NEJM, January 5, 2022

We used contact-testing data from England to perform a retrospective observational cohort study involving adult contacts of SARS-CoV-2-infected adult index patients. We used multivariable Poisson regression to investigate associations between transmission and the vaccination status of index patients and contacts and to determine how these associations varied with the B.1.1.7 (alpha) and delta variants and time since the second vaccination. Vaccination was associated with a smaller reduction in transmission of the delta variant than of the alpha variant, and the effects of vaccination decreased over time. PCR Ct values at diagnosis of the index patient only partially explained decreased transmission.

## News, Reviews and Commentaries

Interim Estimate of Vaccine Effectiveness of BNT162b2 (Pfizer-BioNTech) Vaccine in Preventing SARS-CoV-2 Infection Among Adolescents Aged 12–17 Years — Arizona, July-December 2021 (https://www.cdc.gov/mmwr/volumes/70/wr/mm705152a2.htm?s\_cid=mm705152a2\_x)
 K Lutrik et al, MMWR, December 30, 2021

The Pfizer-BioNTech COVID-19 vaccine has been shown to be effective in preventing SARS-CoV-2 infection in adolescents in randomized placebo-controlled Phase III trials. A prospective cohort of 243 adolescents aged 12–17 years in Arizona completed weekly SARS-CoV-2 testing by nasal swab for 19 consecutive weeks. Under real-world conditions, vaccine effectiveness of full immunization (completion of the second in a 2-dose series =14 days earlier) was 92% against SARS-CoV-2 infections irrespective of symptom status.

COVID-19 Vaccine Safety in Children Aged 5–11 Years — United States, November 3–December 19, 2021 (https://www.cdc.gov/mmwr/volumes/70/wr/mm705152a1.htm?s\_cid=mm705152a1\_x)
 AM Hause et al, MMWR, December 31, 2021

In preauthorization trials for Pfizer-BioNTech (BNT162b2) COVID-19 vaccine, vaccinated children aged 5–11 years reported mild to moderately severe local and systemic reactions; no serious vaccination-related events were noted. After authorization of Pfizer-BioNTech COVID-19 vaccine for children aged 5–11 years during October 2021, and administration of approximately 8 million doses, local and systemic reactions after vaccination were commonly reported to VAERS and v-safe for vaccinated children aged 5–11 years. Serious adverse events were rarely reported.

Characteristics and Clinical Outcomes of Children and Adolescents Aged < 18 Years Hospitalized with COVID-19 — Six Hospitals, United States, July-August 2021 (https://www.cdc.gov/mmwr/volumes/70/wr/mm705152a3.htm?s\_cid=mm705152a3\_x) V Wanga et al, MMWR, December 31, 2021

Pediatric COVID-19–related hospitalization rates increased when the highly transmissible SARS-CoV-2 B.1.617.2 (Delta) variant became the predominant circulating strain. Among children and adolescents with SARS-CoV-2 infection admitted to six hospitals during July-August 2021, 77.9% were hospitalized for acute COVID-19. Among these patients, approximately one third aged <5 years had a viral coinfection (approximately two thirds of which were respiratory syncytial virus) and approximately two thirds of those aged 12–17 years had obesity; only 0.4% of age-eligible patients were fully vaccinated.

 Characteristics and Outcomes of Hospitalized Patients in South Africa During the COVID-19 Omicron Wave Compared With Previous Waves (https://jamanetwork.com/journals/jama/fullarticle/2787776)
 C Maslo et al, JAMA, December 30, 2021

A different pattern of characteristics and outcomes in patients hospitalized with COVID-19 was observed in the early phase of the fourth wave compared with earlier waves in South Africa, with younger patients having fewer comorbidities, fewer hospitalizations and respiratory diagnoses, and a decrease in severity and mortality.

 COVID-19 vaccine effectiveness among immunocompromised populations: a targeted literature review of real-world studies (https://www.medrxiv.org/content/10.1101/2021.12.29.21268511v1)
 M Difusco et al, MEDRXIV, December 31, 2021

A total of 10 studies from four countries were identified and summarized in this review. Expert opinion/commentary: VE of the widely available COVID-19 vaccines, including BNT162b2 (Pfizer/BioNTech), mRNA-1273 (Moderna), Ad26.COV2.S (Janssen), and ChAdOx1 nCoV-19 (Oxford/AstraZeneca), ranged from 64%-90% against SARS-CoV-2 infection, 73%-84% against symptomatic illness, 70%-100% against severe illness, and 63%-100% against COVID-19-related hospitalization among the fully vaccinated IC populations included in the studies. COVID-19 VE for most outcomes in the IC populations included in these studies was lower than in the general populations.

 Neutralization of ancestral SARS-CoV-2 and variants Alpha, Beta, Gamma, Delta, Zeta and Omicron by mRNA vaccination and infection-derived immunity through homologous and heterologous variants (https://www.medrxiv.org/content/10.1101/2021.12.28.21268491v1)
 M Bekliz et al, MEDRXIV, December 31, 2021

 Plasma Neutralization of the SARS-CoV-2 Omicron Variant (https://www.nejm.org/doi/full/10.1056/NEJMc2119641)
 F Schmidt et al, NEJM In plasma specimens from persons who had received two doses of an mRNA vaccine (BNT162b2 [Pfizer-BioNTech] or mRNA-1273 [Moderna]) 1.3 months before sampling, the NT50 values were 187±24 times lower for PMS20 and 127±66 times lower for omicron than for Wuhan-hu-1. At 5 months after vaccination, the neutralization potency was 58±23 times lower for PMS20 and 27±17 times lower for omicron. Although these findings indicate that the omicron variant shows an unprecedented degree of neutralizing antibody escape, they also suggest that boosting and promoting affinity maturation of antibodies in persons who have previously been infected or vaccinated, with the use of existing Wuhan-hu-1-based vaccine immunogens, will provide additional protection against infection with the omicron variant and subsequent disease.

 Activity of convalescent and vaccine serum against SARS-CoV-2 Omicron (https://www.nature.com/articles/d41586-021-03846-z)
 JM Carreno et al, December 31, 2021

We investigated the neutralizing and binding activity of sera from convalescent, mRNA double vaccinated, mRNA boosted, convalescent double vaccinated, and convalescent boosted individuals against wild type, B.1.351 and B.1.1.529 SARS-CoV-2 isolates. Neutralizing activity of sera from convalescent and double vaccinated participants was undetectable to very low against B.1.1.529 while neutralizing activity of sera from individuals who had been exposed to spike three or four times was maintained, albeit at significantly reduced levels. Binding to the B.1.1.529 receptor binding domain (RBD) and N-terminal domain (NTD) was reduced in convalescent not vaccinated individuals, but was mostly retained in vaccinated individuals.

 Country-level factors dynamics and ABO/Rh blood groups contribution to COVID-19 mortality (https://www.nature.com/articles/s41598-021-04162-2)

A Monaco et al, Scientific Reports, December 31, 2021

In this work, we investigated the role of ABO/Rh blood groups at three different stages of the pandemic while accounting for demographic, economic, and health system related confounding factors. Using a machine learning approach, we found that the "B+" blood group frequency is an important factor at all stages of the pandemic, confirming previous findings that blood groups are linked to COVID-19 severity and fatal outcome.

 Understanding Gene Expression and Transcriptome Profiling of COVID-19: An Initiative Towards the Mapping of Protective Immunity Genes Against SARS-CoV-2 Infection. (https://pubmed.ncbi.nlm.nih.gov/34975833)
 Chakraborty Chiranjib et al. Frontiers in immunology 2022 1 724936

 A global analysis of conservative and non-conservative mutations in SARS-CoV-2 detected in the first year of the COVID-19 world-wide diffusion. (https://pubmed.ncbi.nlm.nih.gov/34969951)
 Balasco Nicole et al. Scientific reports 2021 12 (1) 24495 We evaluated the SARS-CoV-2 amino acid mutations and their progression by analyzing publicly available viral genomes at three stages of the pandemic (2020 March 15th and October 7th, 2021 February 7th). Mutations were classified in conservative and non-conservative based on the probability to be accepted during the evolution according to the Point Accepted Mutation substitution matrices and on the similarity of the encoding codons. We found that the most frequent substitutions are T > I, L > F, and A > V and we observe accumulation of hydrophobic residue.

- Mathematical modelling of SARS-CoV-2 variant outbreaks reveals their probability of extinction. (https://pubmed.ncbi.nlm.nih.gov/34969959)
   Schiøler Henrik et al. Scientific reports 2021 12 (1) 24498
- Preliminary modeling estimates of the relative transmissibility and immune escape of the Omicron SARS-CoV-2 variant of concern in South Africa
  (https://www.medrxiv.org/content/10.1101/2022.01.04.22268721v1)
  N Gozzi et al, MEDRXIV, January 5, 2022

We develop a stochastic, multi-strain, compartmental epidemic model to estimate the relative transmissibility and immune escape of the Omicron variant of concern (VOC) in South Africa. The model integrates population, non-pharmaceutical interventions, vaccines, and epidemiological data and it is calibrated in the period May 1st, 2021 - November 23rd, 2021. We explore a parameter space of relative transmissibility with respect to the Delta variant and immune escape for Omicron by assuming an initial seeding, from unknown origin, in the first week of October 2021.

- The runaway evolution of SARS-CoV-2 leading to the highly evolved Delta strain (https://www.biorxiv.org/content/10.1101/2021.12.30.474592v1)
   Y Ruan et al, BIORXIV, January 4, 2022
- Effect of Covid-19 Vaccination on Transmission of Alpha and Delta Variants
   (https://www.nejm.org/doi/full/10.1056/NEJMoa2116597?query=featured\_home)
   DW Eyre et al, NEJM, January 5, 2022

We used contact-testing data from England to perform a retrospective observational cohort study involving adult contacts of SARS-CoV-2-infected adult index patients. We used multivariable Poisson regression to investigate associations between transmission and the vaccination status of index patients and contacts and to determine how these associations varied with the B.1.1.7 (alpha) and delta variants and time since the second vaccination. Vaccination was associated with a smaller reduction in transmission of the delta variant than of the alpha variant, and the effects of vaccination decreased over time. PCR Ct values at diagnosis of the index patient only partially explained decreased transmission.

Inclusion in the update does not necessarily represent the views of the Centers for Disease Control and Prevention nor does it imply endorsement of the article's methods or findings. CDC and DHHS assume no responsibility for the factual accuracy of the items presented. The selection, omission, or content of items does not imply any endorsement or other position taken by CDC or DHHS. Opinion, findings and conclusions expressed by the original authors of items included in the Clips, or persons quoted therein, are strictly their own and are in no way meant to represent the opinion or views of CDC or DHHS. References to publications, news sources, and non-CDC Websites are provided solely for informational purposes and do not imply endorsement by CDC or DHHS.

Page last reviewed: Oct 1, 2021 Page last updated: Jan 06, 2022

Content source: Office of Genomics and Precision Public Health (http://www.cdc.gov/genomics/), CDC Office of Science

(https://www.cdc.gov/od/science/index.htm)