COVID-19 Update

Hospitalizations, Deaths, Repeat and Vaccine Breakthrough Infections

Through November 2021

The Section of Epidemiology, Alaska Division of Public Health

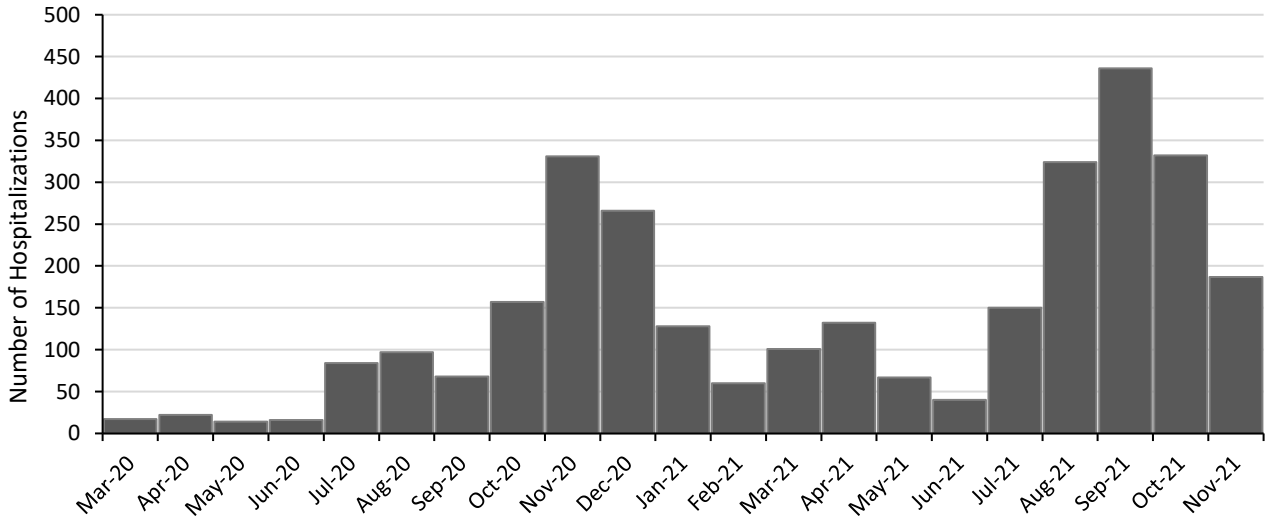
Introduction

This document is intended to provide routine updates on COVID-19 hospitalizations, deaths, repeat, and vaccine breakthrough infections in Alaska. Hospitalization and death data are those displayed on the Alaska Cases Dashboard. Vaccine breakthrough infections and multisystem inflammatory syndrome in children (MIS-C) statistics are produced with additional data collected by the Section of Epidemiology (SOE). This report is not designed to track the burden of COVID-19 on hospitals; other data sources, such as HHS Protect or facility-level statistics may be more appropriate for those questions. It is likely that some hospitalizations are missing from these data, particularly more recent events. Data included are not final; efforts to increase completion and ensure data quality are ongoing and these numbers will change. Additionally, more detailed summaries and reports will be produced in the future. Data are for cases from March 2020 through November 2021.

Hospitalizations

SOE removes hospitalizations that are not due to COVID-19; for example, asymptomatic behavioral health patients or laboring mothers tested on admission are excluded. A total of 3,029 COVID-19 hospitalizations with a known admission date among Alaska residents were included in this analysis (Figure 1). For people with multiple admissions, the most severe/longer admission was counted.

Figure 1. COVID-19 hospital admissions among Alaska residents, by month of admission — March 2020 through November 2021



Demographics

During March 2020 through November 2021, the mean age of COVID-19 hospitalized persons was 59 years (range: newborn to 99 years). For patients admitted in 2020, the mean age was 62 years (range: 1 month to 98 years). For patients admitted in 2021, the mean age was 4 years younger at 58 years (range: newborn to 99 years). Hospitalizations by sex and race are shown in Table 1.

Table 1. Sex and race among COVID-19 hospitalized Alaska residents — March 2020 through November 2021

Characteristic	Count (%)	Statewide population N (%)	Rate*
Sex			
Female	1,367 (45)	375,017 (51)	364.5
Male	1,662 (55)	353,886 (49)	469.6
Race			
American Indian and Alaska Native (AIAN)	686 (23)	113,010 (16)	607
Asian	204 (7)	48,382 (7)	421.6
Black	96 (3)	26,408 (4)	363.5
Native Hawaiian and Other Pacific Islander (NHOPI)	212 (7)	11,706 (2)	1811
White	1,237 (41)	472,386 (65)	261.9
Other	131 (4)		
Multiple	115 (4)	57,011 (8)	201.7
Unknown	348 (11)		
Total	3,029	728,903	415.6

**Rate is per 100,000 people within each group.*

Severity Indicators

This summary includes 2,270 hospitalizations among Alaska residents. Only hospitalization records for which both admission and discharge date had been entered are included. This restriction allows severity indicators and length of stay to be more adequately described but results in an undercount of total hospitalizations, especially those that occurred more recently. Tables 2 and 3 show severity indicators by all hospitalizations and hospitalizations with a fatality.

Table 2. COVID-19 hospitalizations (n=2,270) among Alaska residents with severity indicators — March 2020 through November 2021

	Yes N (%)	No N (%)	Unknown N (%)
ICU	623 (27)	1223 (54)	424 (19)
Ventilator	317 (14)	1231 (54)	722 (32)

Table 3. COVID-19 hospitalizations with fatality (n=617), among Alaska residents with severity indicators — March 2020 through November 2021

	Yes N (%)	No N (%)	Unknown N (%)
ICU	240 (50)	123 (26)	113 (24)
Ventilator	228 (37)	188 (30)	201 (33)

Length of Stay

Table 4 describes the amount of time patients stayed in the hospital. This analysis is restricted to 2,270 patients for whom both an admission and discharge date have been entered. Patients who were admitted and discharged on the same day were counted as one day of hospitalization. Similarly, patients who were intubated and extubated on the same day were counted as one day of ventilation.

Table 4. Duration of COVID-19 hospital stay — March 2020 through November 2021

	2020			2021 to date		
	N	**Mean**	**Range**	**N**	**Mean**	**Range**
All hospitalizations	982	9.5 days	1–124 days	1288	8.6 days	1–128 days
Non-ICU patients	584	7 days	1–124 days	425	6.5 days	1–128 days
ICU patient (total duration of hospital stay)	296	14.6 days	1–75 days	293	12.2 days	1–52 days
ICU patient (duration of ICU stay)	245*	9.4 days	1–75 days	260	8.2 days	1–50 days
Ventilator days	106	9.9 days	1–44 days	120	9.2 days	1–41 days

**Duration of ICU stay was not available at the time of this report for 63 patients who were known to have been in the ICU at some point during their hospital stay.*

Multisystem inflammatory syndrome in children

Twenty children hospitalized with multisystem inflammatory syndrome in children (MIS-C) have been reported to the Alaska Section of Epidemiology since the beginning of the pandemic. MIS-C is defined by fever, laboratory evidence of inflammation, and evidence of clinically severe illness requiring hospitalization with multisystem organ involvement. The definition requires that the patient is <21 years of age with current or recent SARS-CoV-2 infection or exposure to a suspected or confirmed COVID-19 case within the 4 weeks prior to the onset of symptoms and no alternative plausible diagnoses.

Eight of the 20 children met the MIS-C case definition because of a positive antibody test, so they are not included in the above description of SARS-CoV-2 positive hospitalized patients; the other 12 were included in analysis of that patient population provided above because they had a positive COVID diagnostic test (e.g., PCR or antigen). Eleven of the 20 children were male. Eleven were aged 0–4 years at the time of admission, five were aged 5–10 years, and four were aged 11–20 years. Four children had a pre-existing condition. All children were admitted to the hospital, and 10 were admitted to an intensive care unit. None of the children have died.

Deaths

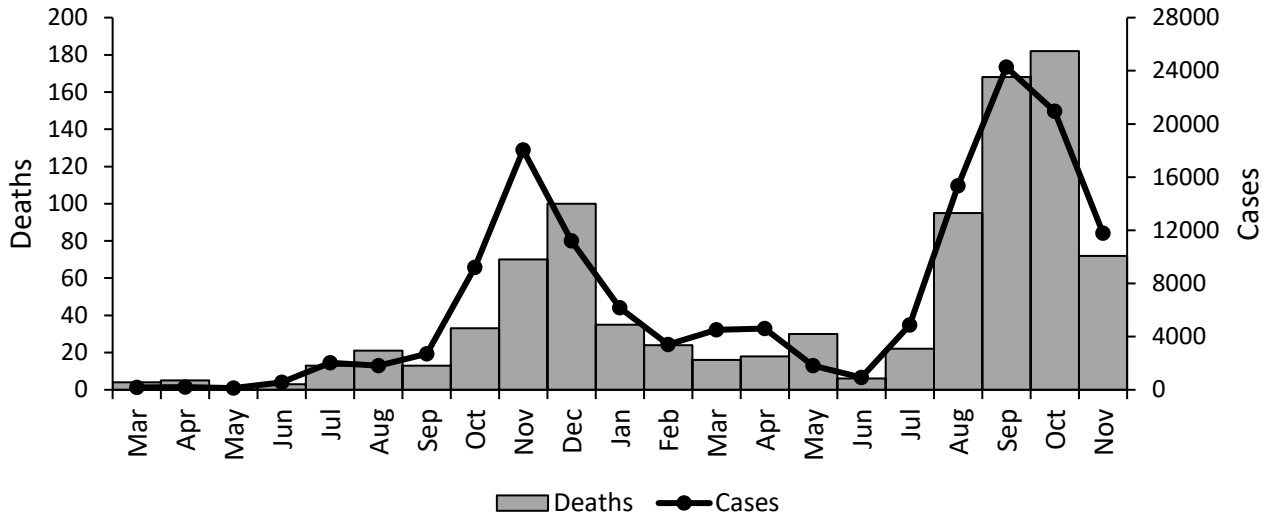
Methods

Deaths are counted as COVID-19-related in accordance with national standards and reflect recorded date of death. This process includes auditing death certificates to verify that COVID-19 was included as a primary or contributory cause of death, medical records review, or provider determination that the cause of death was COVID-19 based on laboratory testing and a consistent clinical presentation (e.g., respiratory signs and symptoms, fever or chills, and fatigue). Rates were calculated using Alaska Department of Labor and Workforce Development population estimates and are listed per 100,000 population. This makes them more comparable to the hospitalization numbers and to national numbers from the CDC data tracker. Cases are attributed geographically to their permanent residence, which may or may not correlate to location of exposure, illness, or death. Cases are attributed to report date and deaths to date of death. All data are preliminary, subject to change, and were congruent with public state data displays as of December 20, 2021.

Results

From January 1, 2020 through November 30, 2021, Alaska recorded 933 COVID-19-related deaths for a statewide death cumulative incidence of 128.0 per 100,000 persons (Figure 2). For this same period, the US death cumulative incidence was 235 per 100,000 persons, which was approximately 1.8-times higher than the Alaska death rate. Of these 933 deaths, 727 (77.9%) were known to have been hospitalized and 302 (32.4%) had been admitted to an intensive care unit.

Figure 2. COVID-19 deaths and cases, by month among Alaska residents — March 2020 through November 2021



Note: Data are shown beginning in March, which was the first month in which there was a death in an Alaska resident that was attributed to COVID-19.

Demographic characteristics

Table 5. Sex of Alaska residents with a COVID-19-related death — March 2020 through November 2021

Sex	Deaths N (%)	Statewide population N (%)	Deaths per 100,000 population
Male	565 (60.6)	375,017 (51.4)	150.7
Female	368 (39.4)	353,886 (48.6)	104.0
AK total	933	728,903	128.0

Table 6. Age of Alaska residents with a COVID-19-related death — March 2020 through November 2021

Age in Years	Deaths N (%)	Statewide population N (%)	Deaths per 100,000 population
≤19	0	199,809 (27.4)	n/a
20–29	18 (1.9)	98,606 (13.5)	18.3
30–39	34 (3.6)	111,831 (15.3)	30.4
40–49	60 (6.4)	85,855 (11.8)	69.9
50–59	120 (12.9)	90,703 (12.4)	132.3
60–69	208 (22.3)	85,259 (11.7)	244.0
70–79	252 (27.9)	41,509 (5.7)	607.1
80+	241 (25.8)	15,331 (2.1)	1572.0
AK total	933	728,903	128.0

Table 7. Race of Alaska residents with a COVID-19-related death — March 2020 through November 2021

Race/Ethnicity	Deaths N (%)	Statewide population N (%)	Deaths per 100,000 population
AIAN	250 (26.8)	113,010 (15.5)	221.2
Asian	68 (7.3)	48,382 (6.6)	140.5
Black	22 (2.4)	26,408 (3.6)	83.3
NHOPI	44 (4.7)	11,706 (1.6)	375.9
White	476 (51.0)	472,386 (64.8)	100.8
Multiple races	21 (2.3)	57,011 (7.8)	36.8
Race other/unknown	52 (5.6)	n/a	n/a
Hispanic (of any race)	28 (3.0)	53,202 (7.3)	52.6
Ethnicity unknown	90 (9.6)	n/a	n/a
AK total	933	728,903	128.0

n/a = not available

Vaccine Breakthrough Infections and Reinfections

Key Points

- COVID-19 vaccines continue to provide strong protection, especially against hospitalization and death.
- Most COVID-19 hospitalizations in Alaska might have been prevented by vaccination.
- COVID-19 cases have become more common among fully vaccinated persons than they were in the initial months after vaccine roll-out, but fully vaccinated people continue to be less likely to have COVID-19 than people who aren't fully vaccinated.
- Booster doses further reduce the risk of infection and hospitalization.
- CDC recommends that fully vaccinated persons wear masks in public indoor settings in areas with substantial to high community transmission.
- While people can be infected with SARS-CoV-2 multiple times, prior infection confers partial protection against COVID-19. Vaccination provides additional protection in those who have been infected and is recommended regardless of history of prior infection.

Introduction

COVID-19 vaccines were first administered in Alaska in mid-December 2020. In March 2021, all persons who lived or worked in Alaska and were aged ≥16 years became eligible for vaccination. After the Pfizer/BioNTech vaccine was authorized for persons aged ≥12 years, eligibility was expanded accordingly in May 2021 to anyone aged ≥12 years. (In November, vaccination was authorized for persons aged 5 to 11 years, but children in that age group would not have been considered fully vaccinated until December at the earliest; consequently, they are not included in this analysis of data through November.) Randomized clinical trials showed conclusively that COVID-19 vaccines provide strong protection against symptomatic COVID-19. Subsequent observational studies have confirmed this finding in numerous real-world settings and have further demonstrated that COVID-19 vaccines reduce the risk of infection with SARS-CoV-2 and greatly reduce the risk of COVID-19 hospitalizations and deaths.[1] However, waning immunity decreases the vaccine effectiveness (particularly against SARS-CoV2 infection and COVID-19 disease) over time, thus necessitating booster dosing.

While reinfections with SARS-CoV-2 are known to occur, they can be difficult to diagnose due to a lack of a widely accepted definition. Observational studies have found that prior infection with SARS-CoV-2 confers substantial partial

protection against reinfection with Delta and prior circulating variants for at least 6 months.[2] The extent to which prior infection confers protection against infection with the Omicron variant is unclear. There is evidence that even in persons with a history of SARS-CoV-2 infection, vaccination provides an added layer of protection.[3] During November 2021, nearly all circulating SARS-CoV-2 viruses in Alaska belonged to the Delta lineage. No Alaska-specific data are yet available on hospitalizations or deaths due to the Omicron variant surge in late December 2021.

Methods

A vaccine recipient is considered fully vaccinated 14 days after receiving the second dose in a two-dose series (e.g., Pfizer/BioNTech or Moderna) or a single dose in a one-dose series (e.g., Johnson & Johnson/Janssen). Cases of COVID-19 that occur in fully vaccinated persons are classified as "vaccine breakthrough" (VB) cases.

In late September, CDC recommended a booster dose for certain persons who received the Pfizer/BioNTech primary series. The following month, booster doses were recommended for persons who received the Moderna or Johnson & Johnson/Janssen primary series. It is not possible to definitively distinguish between booster doses and additional doses in the available data. In this analysis, a third dose administered more than 180 days after completion of an mRNA primary series, or a second dose administered more than 56 days after receiving the Janssen vaccine, was considered a booster dose. A third dose received more than 28 days but within 180 days of completion of a primary mRNA series was considered an additional dose if it was from the same manufacturer as the primary series. Persons who were classified as having received an additional dose were considered eligible for a booster dose (i.e., a fourth dose) after 180 days had elapsed following administration of the additional dose. A person was considered "fully" boosted beginning 14 days after receipt of a booster dose.

All case and hospitalizations data were obtained from the Section of Epidemiology's case-based surveillance system. Hospitalization and death data were identified as described above. This analysis is limited to data on Alaska residents; vaccination status of non-residents diagnosed in Alaska cannot be consistently ascertained. All data and analyses are preliminary and subject to change.

Cases, hospitalizations, and deaths were attributed to date of specimen collection in all analyses. This date was used because it corresponds most closely to the definition of vaccine breakthrough. For example, if a person tested positive 12 days after completing the vaccination series, that would not be counted as a vaccine breakthrough case and, consequently, neither would a subsequent hospitalization due to COVID-19, even if the hospitalization itself occurred 14 or more days after series completion. Hospitalizations and deaths are included in this analysis if the corresponding specimen collection date was on or before November 30, 2021 and the hospitalization or death was documented by the Section of Epidemiology by December 21, 2021.

VacTrAK data were linked to COVID-19 case records to determine vaccination status of cases and to estimate the amount of person-time at risk stratified by primary series vaccination status (including vaccine manufacturer and time since completion of primary vaccine series), vaccine booster status (whether person was eligibility for a booster and booster manufacturer among those who had received a booster dose), history of prior SARS-CoV-2 infection (including time since most recent prior infection), geographic region of residence (11 behavioral health regions), calendar day (January 16 through November 30, 2021), and age group (0–4, 5–9, 10–11, 12–14, 15–19, … 85–89, and ≥90 years). One limitation of the VacTrAK dataset is that it does not include vaccines administered by the Department of Defense or the Department of Veterans Affairs. Reports from case investigators on the vaccination status of COVID-19 cases was used to supplement VacTrAK data. The number of persons in each demographic group with no documented history of either SARS-CoV-2 infection or COVID-19 vaccination was inferred by subtracting the number of persons with a history of vaccination and/or infection from 2020 Alaska Department of Labor and Workforce Development population estimates. Cases were excluded from the analysis if the geographic region of residence (n = 6) or the date of birth (n = 2) were missing. None of the 8 excluded cases had a documented history of vaccination.

COVID-19 cases are classified as reinfections if positive specimen collection occurred ≥90 days after the specimen collection date of the prior case. Very rarely, the Section of Epidemiology may revise a classification based on health care provider input. For this analysis, all person-time <90 days from a case's first specimen collection date was excluded because per the surveillance definition of reinfection used here, reinfections occur at least 90 days after a prior infection. (Note that surveillance definitions may differ from clinical judgements; persons who develop symptoms compatible with COVID-19 within 90 days of a prior infection are advised to consult with a health care provider.)

Age-standardized COVID-19 case and hospitalization rates were calculated by direct standardization to the Alaska resident population aged 12 years and older using the age categories as above, except the 12–14 and 15–19 year age categories were combined.[4] Ninety-five percent confidence intervals were calculated using gamma distributions.[5]

Adjusted incidence rate ratios were calculated using the Mantel-Haenszel method.[6] Estimates were adjusted for age group, region, and calendar day.

Results

Vaccine breakthrough cases over time

Through the end of November 2021, a total of 23,979 vaccine breakthrough COVID-19 cases were documented among Alaska residents (Table 8). An additional 4,032 cases occurred among Alaska residents who were partially vaccinated. The incidence of COVID-19 among vaccinated persons has remained consistently lower than among persons who were not unvaccinated (Figure 3).

Table 8. Reported COVID-19 vaccine breakthrough cases by month of specimen collection among Alaska residents aged ≥12 years — January 16, 2021, through November 30, 2021

Month	Total cases	VB cases (% of total monthly cases)	Proportion of AK residents aged ≥12 years who were fully vaccinated*
January[‡]	2,001	2 (0.1)	1.2
February	2,948	46 (1.6)	6.1
March	3,956	119 (3.0)	19.0
April	3,949	206 (5.2)	31.9
May	1,528	137 (9.0)	43.7
June	791	180 (22.8)	48.4
July	4,146	1,245 (30.0)	52.1
August	12,832	4,364 (34.0)	53.9
September	19,891	7,007 (35.2)	56.1
October	18,008	6,970 (38.7)	58.5
November	8,850	3,703 (41.8)	60.4

**Mean daily estimated percentage of Alaska residents aged ≥12 years who were fully vaccinated.*

[‡]January data are from the period January 16, 2021, through January 31, 2021. January 16, 2021, was the first date that any Alaska residents were fully vaccinated.

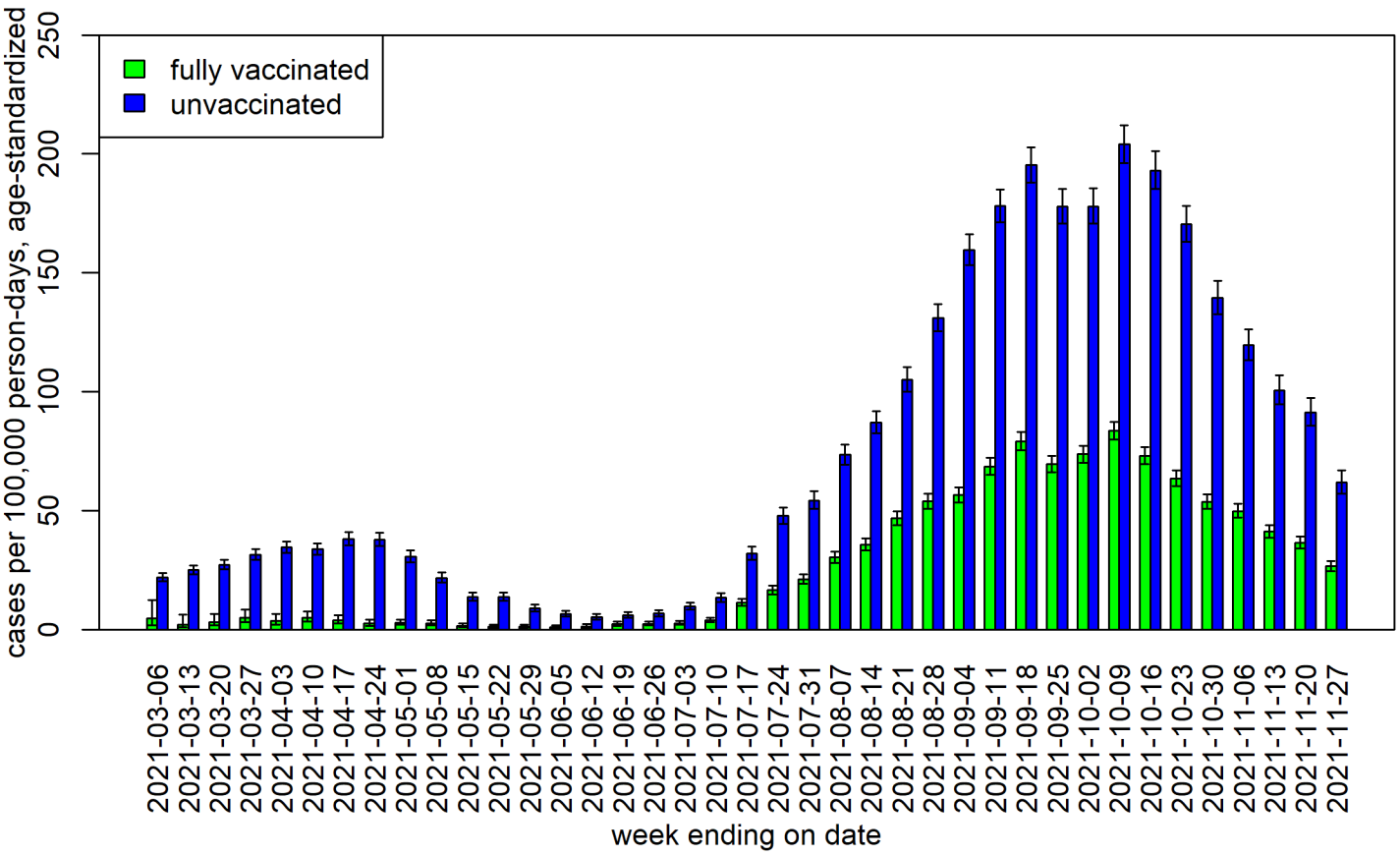


Figure 3. Weekly age-adjusted per capita incidence of COVID-19 among Alaska residents aged ≥12 years by vaccination status (fully vaccinated versus unvaccinated). *Data are shown beginning the week of February 28, 2021, which was the first week in which at least 20 vaccine breakthrough cases were documented. Incidence rate estimates from prior weeks with very few or no VB cases are imprecise.*

Vaccine breakthrough hospitalizations over time

Among vaccine breakthrough cases with specimen collection date on or prior to November 30, 2021, 326 hospitalizations due to COVID-19 were documented (Table 9). An additional 94 hospitalizations occurred among partially vaccinated Alaska residents.

Fully vaccinated persons were much less likely to be hospitalized due to COVID-19 than persons who were unvaccinated (Figure 4). Based on COVID-19 cases with specimen collection dates in November and adjusted for age, region, and calendar day, the incidence of hospitalization among persons aged ≥12 years who were not vaccinated was 12.9 times higher (95% CI: 8.6–19.1) than the incidence among fully vaccinated persons. This point estimate is slightly higher than the point estimate for October (incidence rate ratio: 10.6; 95% CI: 8.0–13.9), though the confidence intervals for the two estimates overlap.

Among Alaska residents aged ≥12 years with specimen collection dates in November who were hospitalized due to COVID-19, the median age among those who were fully vaccinated was 74.4 years, and the median age of those who were not fully vaccinated was 62.0 years (12.4 years younger).

Table 9. Reported hospitalizations due to COVID-19 vaccine breakthrough infections, by month of specimen collection among Alaska residents aged ≥12 years — January 16, 2021, through November 30, 2021

Month	Total hospitalizations	VB hospitalizations (% of total monthly hospitalizations)
January-March*	204	3 (1.5)
April	127	7 (5.5)
May	67	3 (4.5)
June	42	5 (11.9)
July	175	32 (18.3)
August	341	66 (19.4)
September	463	84 (18.1)
October	359	80 (22.3)
November	184	46 (25.0)

**Data are from January 16, 2021, onwards. January, February, and March data have been aggregated to protect patient privacy.*

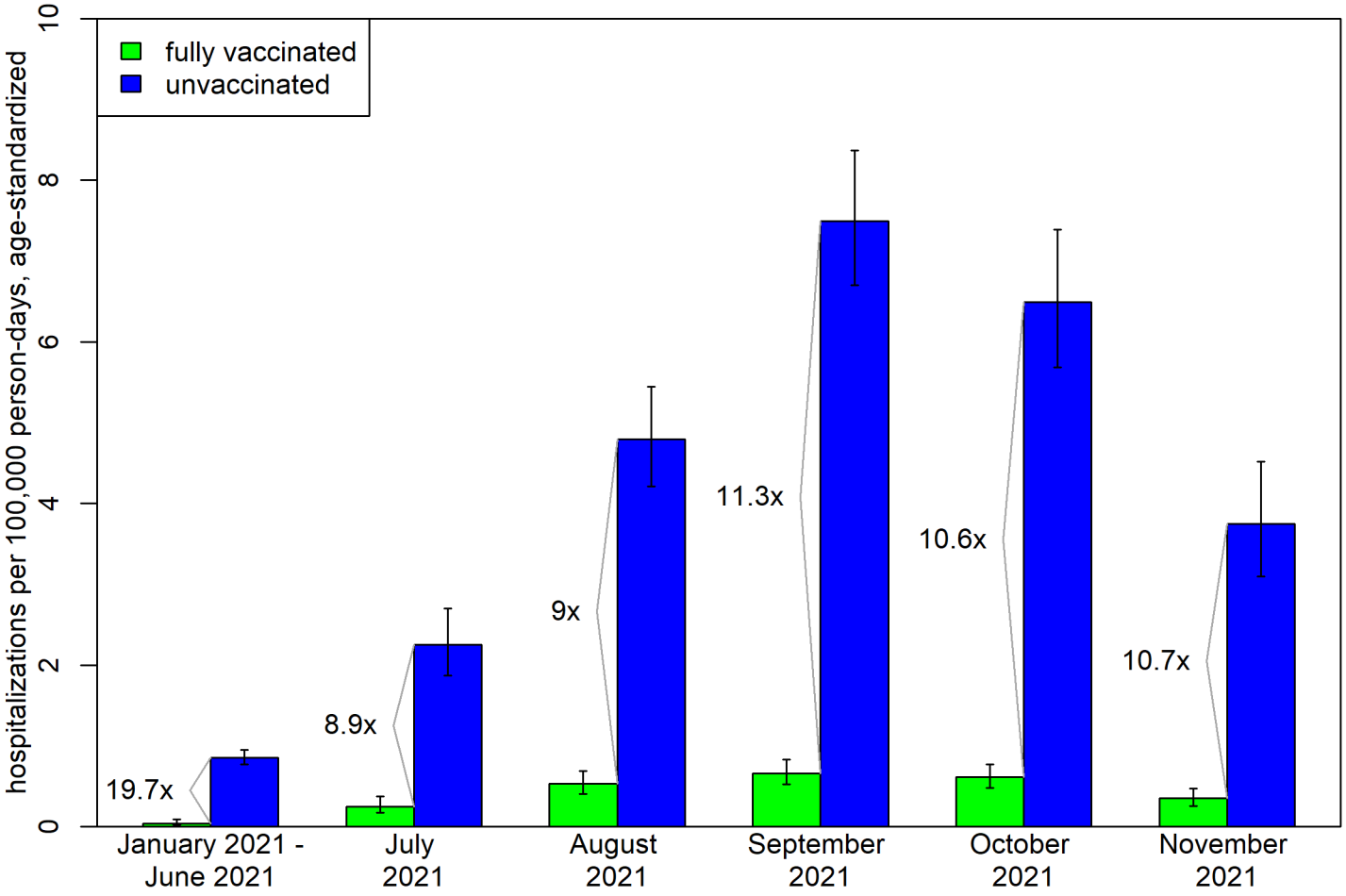


Figure 4. Age-adjusted incidence of hospitalization due to COVID-19 among Alaska residents aged ≥12 years by vaccination status (unvaccinated vs. fully vaccinated), stratified by hospitalizations among COVID-19 cases with first positive specimen collected from January–November 2021.

Vaccine breakthrough cases and hospitalizations by age

Vaccine breakthrough cases occurred during November 2021 among Alaskans of all vaccine-eligible age-groups (Table 10). The proportion of cases who were fully vaccinated increased with age, which primarily reflects the higher vaccination coverage at higher ages. The adjusted incidence rate ratios comparing unvaccinated to fully vaccinated persons were similar across most age-groups, though somewhat higher among adolescents and among persons aged 65 and older. This may be because younger persons may mount more protective immune responses to vaccines and were on average vaccinated more recently, whereas persons aged 65 and older are most likely to have received booster doses.

Table 10. Reported COVID-19 vaccine breakthrough cases by age group among Alaska residents and adjusted incidence rate ratios — November 2021

Age group	Total cases	VB cases (% of total cases per age group)	Proportion of AK residents who were fully vaccinated*	Incidence rate ratio for unvaccinated vs. fully vaccinated (95% C.I.)[+]
12–19	1,295	355 (27.4)	44.4	3.0 (2.6–3.4)
20–34	2,746	1,056 (38.5)	52.2	2.1 (2–2.3)
35–49	2,279	1,016 (44.6)	60.7	2.3 (2.1–2.5)
50–64	1,637	791 (48.3)	65.5	2.4 (2.2–2.6)
65+	893	485 (54.3)	79.2	4.4 (3.9–5.1)

[*]Mean of the daily estimated percentage for each day in November 2021 of Alaska residents who are fully vaccinated, by age group.

[+]Incidence rate ratio for cases among unvaccinated persons versus fully vaccinated persons, adjusted for age, region, and calendar day with 95% confidence intervals.

Vaccination greatly reduced the incidence of COVID-19 hospitalizations across all age groups, though the effect appears to be somewhat attenuated with increasing age (Table 11). Data were aggregated for July–November; younger age categories were combined to improve statistical precision.

Table 11. Reported hospitalizations due to COVID-19 vaccine breakthrough infections and adjusted incidence rate ratio, by age group among Alaska residents, July–November 2021

Age group	Total hospitalizations	VB hospitalizations (% of total hospitalizations per age group)	Proportion of AK residents who were fully vaccinated*	Incidence rate ratio for unvaccinated vs. fully vaccinated (95% C.I.)[+]
12–49	426	30 (7)	48.8	20.0 (13.4–29.9)
50–64	439	63 (14.4)	62.4	12.5 (9.4–16.5)
65+	657	215 (32.7)	76.2	9.0 (7.6–10.8)

[*]Mean of the daily estimated percentage for each day in July through November 2021 of Alaska residents who are fully vaccinated, by age group.

[+]Incidence rate ratio for hospitalizations among unvaccinated persons versus fully vaccinated persons, adjusted for age, region, and calendar day with 95% confidence intervals.

Vaccine breakthrough cases by manufacturer and time since completion of vaccine series

Among Alaska residents aged 20–64 years who had not received a booster dose, the incidence of COVID-19 during July through November 2021 was lower among persons who were fully vaccinated with each of the three FDA-authorized or approved vaccines compared to persons who were unvaccinated, regardless of time since vaccination. However, the largest differences in COVID-19 case incidence rates between unvaccinated and fully vaccinated persons were observed

for the Moderna COVID-19 vaccine, followed by the Pfizer and Janssen vaccines (Figure 5). This analysis indicates that protective immunity against COVID-19 decreases over time (in the absence of a booster vaccination).

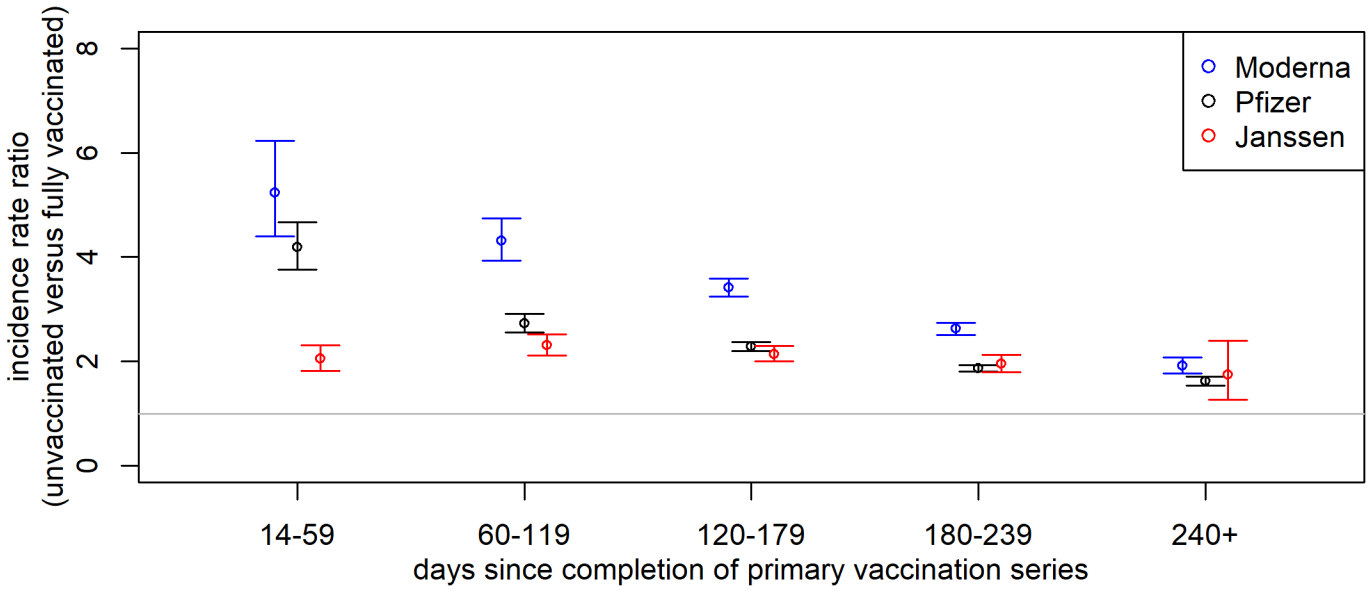


Figure 5. Adjusted incidence rate ratios comparing the incidence of COVID-19 during July through November 2021 among unvaccinated persons to fully vaccinated (but not boosted) persons, by vaccine manufacturer and time since completion of the primary vaccination series. *This analysis is restricted to persons aged 20–64 years. Incidence rate ratios are adjusted for age, region, and calendar day. 95% confidence intervals are shown. The grey horizontal line corresponds to a rate ratio of 1, which would mean that persons who were fully vaccinated and those who were unvaccinated were equally likely to have COVID-19. All estimates and all error bars are above this line, indicating that the incidence of COVID-19 is consistently higher in persons who are unvaccinated compared to those who are fully vaccinated, regardless of vaccine manufacturer or time since vaccination. However, the point estimates are highest for the Moderna vaccine and among those vaccinated more recently, suggesting that the Moderna vaccine confers stronger protection, and that the degree of protection decreases over time.*

Booster vaccination

During October and November 2021, among persons aged ≥20 years who received the initial primary series of the Pfizer vaccine and accounting for age, calendar day, and region, those who were eligible for a booster dose but had not received one had a COVID-19 case incidence rate that was 3.3 times higher (95% CI: 2.9–3.7) than the rate among those who had received a Pfizer booster dose at least 14 days prior. Likewise, those who had received the primary series of the Moderna vaccine and were eligible for a booster but had not been boosted had a COVID-19 incidence rate 4.3 times higher (95% CI: 3.3–5.7) than the rate among those who had received the Moderna booster at least 14 days prior. Not enough data were available to calculate incidence rate ratios for boosting among Janssen vaccine recipients or mRNA vaccine recipients with heterologous (i.e., “mix-and-match”) boosting. And while small numbers preclude precise estimates of the impact of booster doses on risk of hospitalization, person who were eligible for a booster but not boosted were hospitalized due to COVID-19 at 4.9 times (95% CI: 2.2–10.9) the rate of those who had received a booster dose at least 14 days prior.

Vaccine breakthrough deaths

Among cases with specimen collection dates during or prior to November 2021, 112 COVID-19 deaths were documented among fully vaccinated persons and 26 were documented among partially vaccinated persons. Among the 413 documented COVID-19 deaths with specimen collection dates during July–November 2021, 105 occurred in fully-vaccinated persons and 19 occurred in partially-vaccinated persons. Accounting for age, calendar day, and region, unvaccinated persons died from COVID-19 at 12.4 times the rate of fully vaccinated persons (95% CI: 9.9–15.6). These numbers may change as death certificates are completed and processed and ongoing data quality assurance processes are implemented.

Reinfection

A total of 2,555 SARS-CoV-2 reinfections were documented among Alaska residents since the beginning of the pandemic; 29 persons were reinfected twice (i.e., counted as a case 3 times). During July–November 2021 among unvaccinated persons, the incidence of COVID-19 in persons without a prior documented history of SARS-CoV-2 infection was 5.8 times higher (95% CI: 5.5–6.1) than the incidence in persons with a history of infection. While the estimated incidence rate ratios indicated a partially protective effect of prior infection regardless of time since infection, the degree of protection appears to decline after 179 days (Figure 6). The evidence also suggests that a prior infection is protective against subsequent COVID-19 hospitalization among unvaccinated persons (IRR: 0.06; 95% CI: 0.04–0.11).

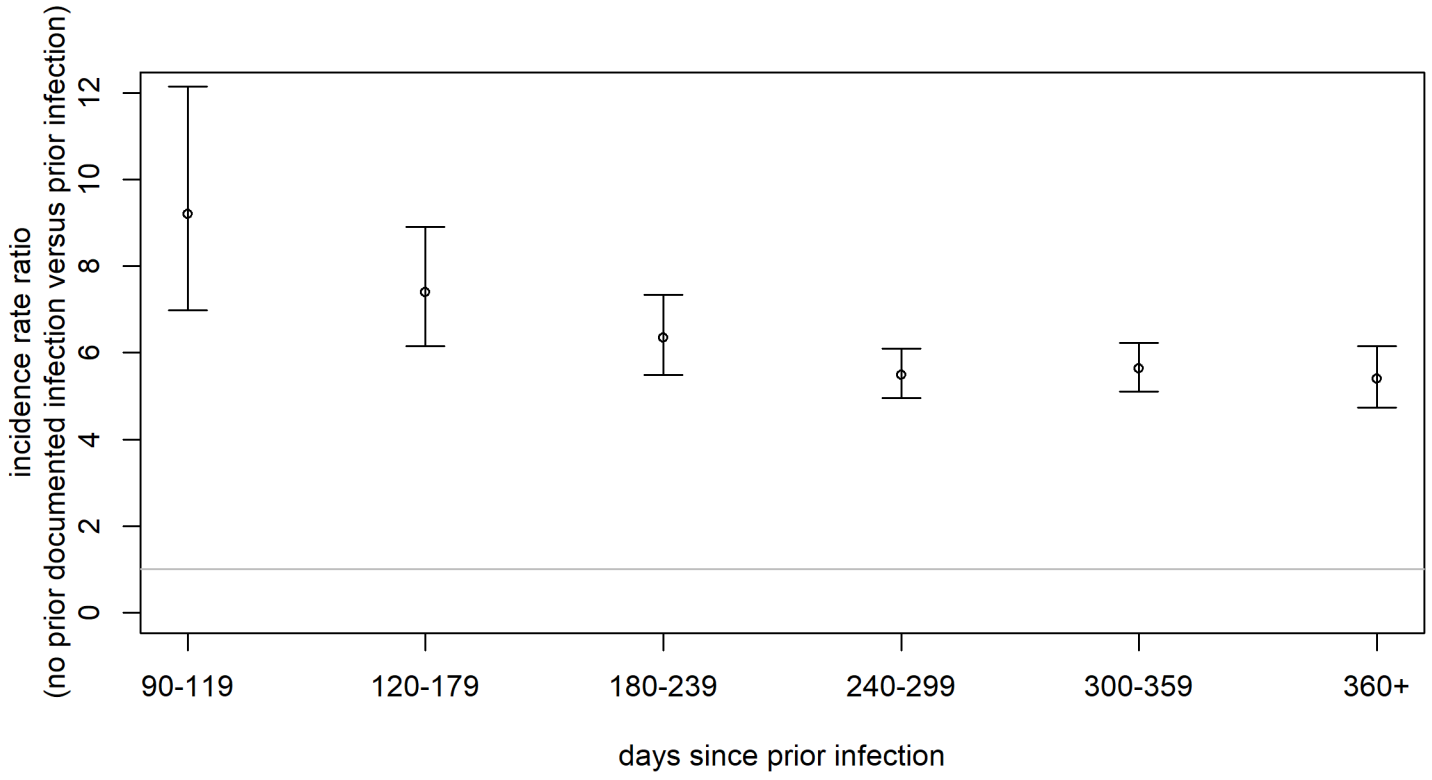


Figure 6. Adjusted incidence rate ratios comparing the incidence of COVID-19 during July through November 2021 among unvaccinated persons without a prior documented infection versus those with a prior documented infection, by time since prior infection. *Incidence rate ratios are adjusted for age, region, and calendar day and 95% confidence intervals are shown. The grey horizontal line corresponds to a rate ratio of 1, which would mean that persons with and without a prior documented history of COVID-19 were equally likely to have COVID-19. All estimates and all error bars are above this line, indicating that the incidence of COVID-19 was consistently higher in persons without a prior documented history of COVID-19 compared to those who previously had COVID-19.*

Reinfection and Vaccination

Of the 133,118 Alaska residents with at least one documented case of COVID-19, 33,790 became fully vaccinated after their first infection. Among persons aged ≥12 years with a prior history of COVID-19 during July–November 2021, the incidence of COVID-19 reinfection was 28% higher among persons who were unvaccinated compared to those who got vaccinated following their initial infection (IRR: 1.3, 95% CI: 1.2–1.4).

The number of hospitalizations and deaths due to reinfections was too small to reliably assess an effect of vaccination following infection. Twelve hospitalizations that occurred due to reinfection cases in July–November were in unvaccinated persons, four were in fully vaccinated persons, and one was partially vaccinated. Of the seven COVID-19 deaths in persons with a prior infection, five were unvaccinated.

Discussion

COVID-19 vaccines continue to be our single most important tool to prevent COVID-19 cases, hospitalizations, and deaths.

The proportion of vaccine breakthrough cases in November was somewhat higher than the proportion in October. Multiple factors determine the proportion of documented COVID-19 cases among fully vaccinated persons. When the proportion of the population that is fully vaccinated is higher, the expected proportion of cases among fully vaccinated persons is also larger. Another important factor is that waning immunity occurs over time. Waning immunity tends to occur more quickly in older people, which might contribute to increasing VB hospitalization rates because older people are known to be at increased risk for COVID hospitalization. Also, older persons may mount a weaker initial immune response to vaccination. Additionally, moderately or severely immunocompromised people do not always build the same level of immunity after vaccination the way non-immunocompromised people do, and they are now advised to receive an additional dose to ensure adequate protection against COVID-19. These individuals might also disproportionately contribute to higher VB hospitalizations in recent months. Finally, declines in vaccine effectiveness can lead to an increasing proportion of COVID-19 cases among fully vaccinated persons. The Delta variant rapidly became the dominant SARS-CoV-2 variant in Alaska during June and July and reductions in vaccine effectiveness against the Delta variant likely contributed to the increased proportion of vaccine breakthrough cases. Notably, since the Delta variant became dominant, the proportion of vaccine breakthrough cases has been more consistent over time.

The data presented here were collected for public health surveillance purposes and may be subject to unmeasured confounding and bias. For example, persons who were fully vaccinated and not fully vaccinated may differ in their adherence to COVID-19 mitigation measures (e.g., mask wearing and avoiding indoor crowded spaces). Moreover, the magnitude of these differences may vary over time. Additionally, COVID-19 cases among fully vaccinated persons may be more likely to be detected than COVID-19 cases among persons who are not fully vaccinated (e.g., health care workers are more likely to be vaccinated than the general population and may be more likely to get tested), which would artificially increase the proportion of detected cases among fully vaccinated persons. Finally, infection-induced immunity may build up in the unvaccinated population faster than in the vaccinated population (due to increased susceptibility to infection), thereby making vaccination appear less effective over time.[7]

The magnitude of bias and confounding may differ across settings; consequently, direct comparisons to data from other jurisdictions or to prospective evaluations of vaccine effectiveness are difficult. Additionally, this analysis is not a formal evaluation of vaccine effectiveness. It does not account for differential testing rates that might occur between vaccinated and unvaccinated people. It is biologically implausible that COVID-19 vaccines would perform differently in Alaska compared to other parts of the United States.

Interpreting differences in COVID-19 incidence by vaccine manufacturer is challenging because persons who received one type of COVID-19 vaccine may systematically differ from persons who received a different type. For example, the Pfizer vaccine was available before the Moderna vaccine and so health care workers and persons in long-term care

facilities may have been more likely to have received it. However, restricting the comparison of manufacturers to persons aged 20–64 years should limit the extent to which bias may reflect the use of a particular vaccine in long-term care facilities.

COVID-19 vaccines in Alaska continue to provide substantial protection against COVID-19 illness and provide highly effective protection against hospitalization and death. The level of protection of vaccination against hospitalization observed among Alaskans in November is similar to estimates from a large national COVID-19 hospitalization case-control study.[8] The vast majority of COVID-19 hospitalizations among Alaska residents since COVID-19 vaccines became widely available could have been prevented through vaccination.

In light of evidence on vaccine breakthrough cases and the potential for onward transmission from breakthrough infections, the Centers for Disease Control and Prevention (CDC) recommended on July 27, 2021 that all persons, including fully vaccinated persons, wear a mask when in public indoor settings in locations experiencing substantial or high levels of community transmission.[9] The Advisory Committee on Immunization Practices and CDC recommend that persons who are moderately or severely immunocompromised receive as part of their primary series a third dose of an mRNA vaccine at least 28 days after receiving the second dose.[10] As of January 4, 2022, CDC recommends a booster dose for all persons age 18 and older who received the Pfizer primary series at least 5 months ago, the Moderna primary series at least 6 months ago, or the Janssen vaccine at least 2 months ago.[11]

This analysis found that a booster dose further reduces the incidence of COVID-19 and hospitalizations due to COVID-19. While this analysis does not cover the period during which Omicron became the dominant SARS-CoV-2 variant in Alaska, analyses from other countries have found that persons who have received a COVID-19 vaccine booster are substantially better protected against Omicron than persons who are eligible for a booster but un-boosted.[12]

Prior infection with SARS-CoV-2 confers substantial but incomplete protection against subsequent reinfection. COVID-19 hospitalizations and deaths have been documented among Alaska residents who previously had COVID-19. Vaccination is safe in persons who have previously been infected and evidence from Alaska and published analyses indicate that vaccination confers additional protection among persons with a prior history of SARS-CoV-2 infection.[3]

The data in this report precede the surge of the Omicron variant in Alaska. As of early January, the surge is so recent that Alaska-specific conclusions cannot yet be drawn regarding the severity of Omicron or about the effect of vaccines, boosters, or prior infection on hospitalizations and deaths due to Omicron.

References

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10. CDC. Interim Clinical Considerations for Use of COVID-19 Vaccines Currently Authorized in the United States. Available at: https://www.cdc.gov/vaccines/covid-19/clinical-considerations/covid-19-vaccines-us.html
11. CDC. Who Is Eligible for a COVID-19 Vaccine Booster Shot? Available at: https://www.cdc.gov/coronavirus/2019-ncov/vaccines/booster-shot.html
12. CDC. Potential Rapid Increase of Omicron Variant Infections in the United States. Available at: https://www.cdc.gov/coronavirus/2019-ncov/science/forecasting/mathematical-modeling-outbreak.html

Additional Resources

- CDC. Older Adults and COVID-19. Available at: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/older-adults.html
- CDC. Certain Medical Conditions and Risk for Severe COVID-19 Illness. Available at: https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html
- CDC. Health Equity Considerations and Racial and Ethnic Minority Groups. Available at: https://www.cdc.gov/coronavirus/2019-ncov/community/health-equity/race-ethnicity.html
- CDC. Understanding Death Data Quality: Cause of Death from Death Certificates. Available at: https://www.cdc.gov/nchs/nvss/covid-19.htm#understanding-death-data-quality
- State of Alaska. Population Estimates. Available at: https://live.laborstats.alaska.gov/pop/
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- CDC. SARS-CoV-2 Variant Classifications and Definitions. Available at: https://www.cdc.gov/coronavirus/2019-ncov/variants/variant-info.html