

Evaluating the Effectiveness of COVID-19 Vaccines Over Time

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VACCINE EFFICACY/EFFECTIVENESS (VE)

VE on hazard rate over time: 1—time-varying hazard ratio

- ▶ instantaneous (current) risk
- ▶ need for and optimal timing of booster vaccination
- ▶ Cox regression model with time-varying hazard ratio
- ▶ continuous piecewise log-linear function of time
- ▶ VE curve as a continuous function of time since dose 1

VE under proportional hazards model: 1—constant hazard ratio

- ▶ average of time-varying hazard ratio over time period
- ▶ non-informative about VE at end of time period

VACCINE EFFICACY IN CLINICAL TRIALS

VE Against Symptomatic COVID-19 in Phase 3 Trials

Pfizer Vaccine (Thomas et al, NEJM, 2021)

Time since Dose 2	VE (95% CI)
7 days – 2 months	96.2% (93.3%, 98.1%)
2 months – 4 months	90.1% (86.6%, 92.9%)
4 months – 6 months	83.7% (74.7%, 89.9%)

Moderna Vaccine (El Sahly et al., NEJM, 2021)

Time since Dose 2	VE (95% CI)
14 days – 2 months	94.1% (89.3%, 96.8%)
14 days – 6 months	93.2% (91.0%, 94.8%)

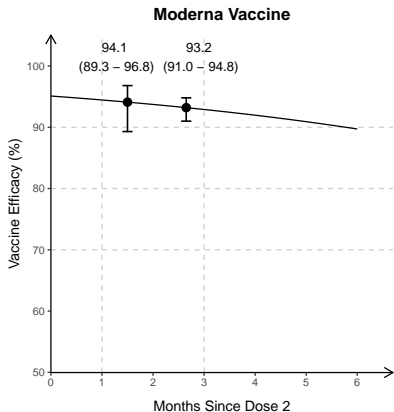
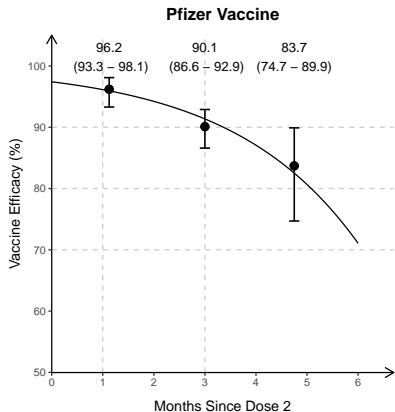


Figure 2. VE against COVID-19 in phase 3 vaccine trials.

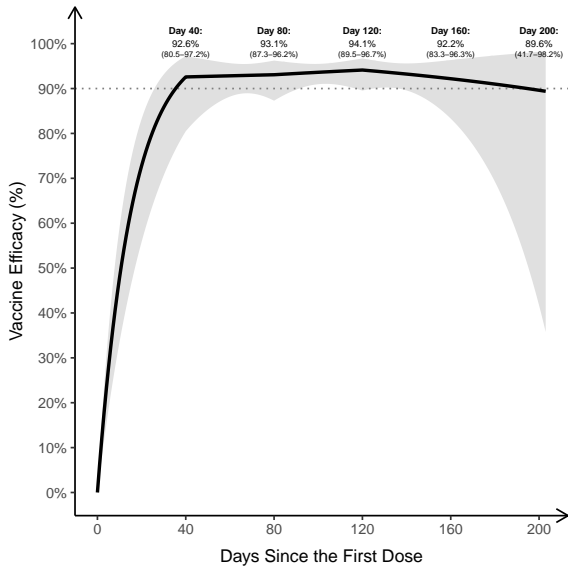


Figure 3. VE against COVID-19 in Moderna phase 3 trial.

Effectiveness of Covid-19 Vaccines over a 9-Month Period in North Carolina

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ABSTRACT

BACKGROUND

The duration of protection afforded by coronavirus disease 2019 (Covid-19) vaccines in the United States is unclear. Whether the increase in postvaccination infections during the summer of 2021 was caused by declining immunity over time, the emergence of the B.1.617.2 (delta) variant, or both is unknown.

METHODS

We extracted data regarding Covid-19–related vaccination and outcomes during a 9-month period (December 11, 2020, to September 8, 2021) for approximately 10.6 million North Carolina residents by linking data from the North Carolina Covid-19 Surveillance System and the Covid-19 Vaccine Management System. We used a Cox regression model to estimate the effectiveness of the BNT162b2 (Pfizer-BioNTech), mRNA-1273 (Moderna), and Ad26.COV2.S (Johnson & Johnson–Janssen) vaccines in reducing the current risks of Covid-19, hospitalization, and death, as a function of time elapsed since vaccination.

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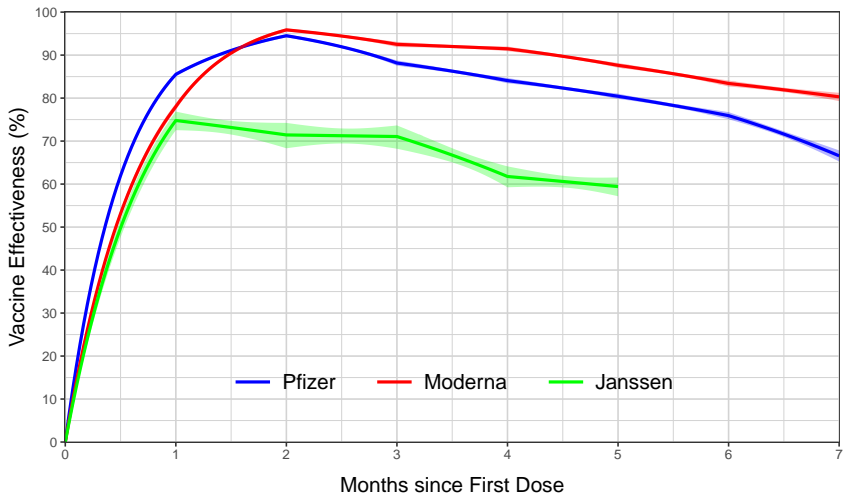


Figure 4. VE against COVID-19.

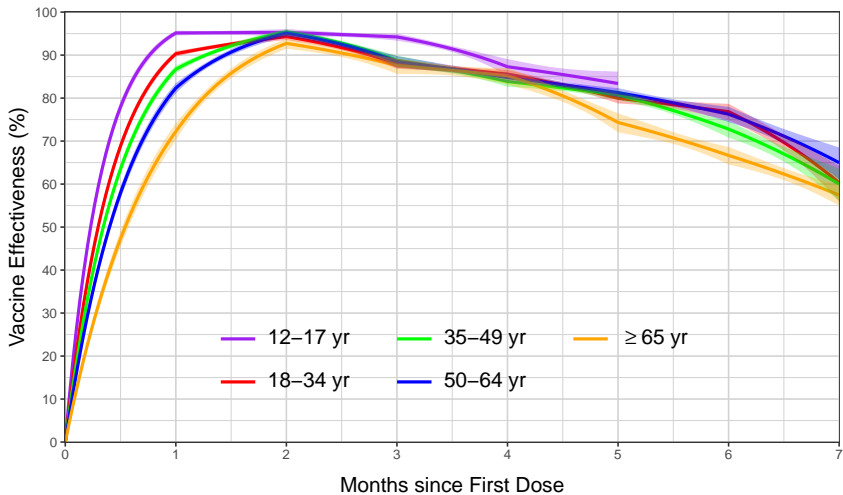


Figure 5. VE of Pfizer vaccine against COVID-19 by age group.

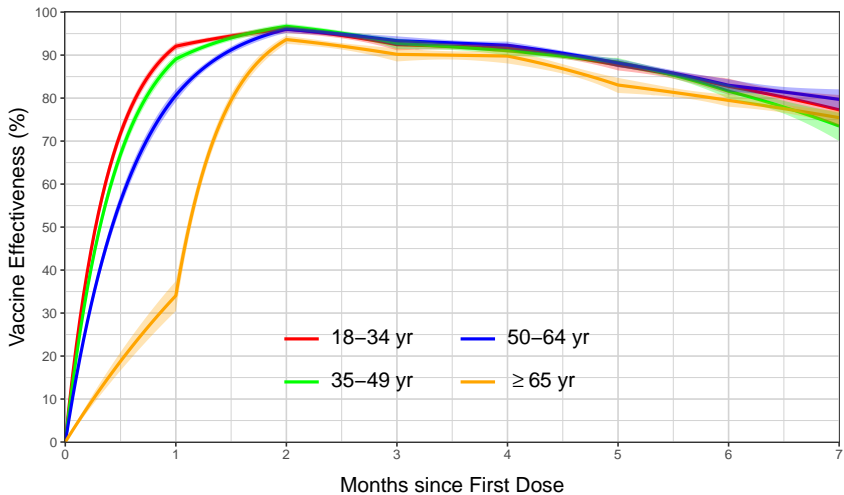


Figure 6. VE of Moderna vaccine against COVID-19 by age group.

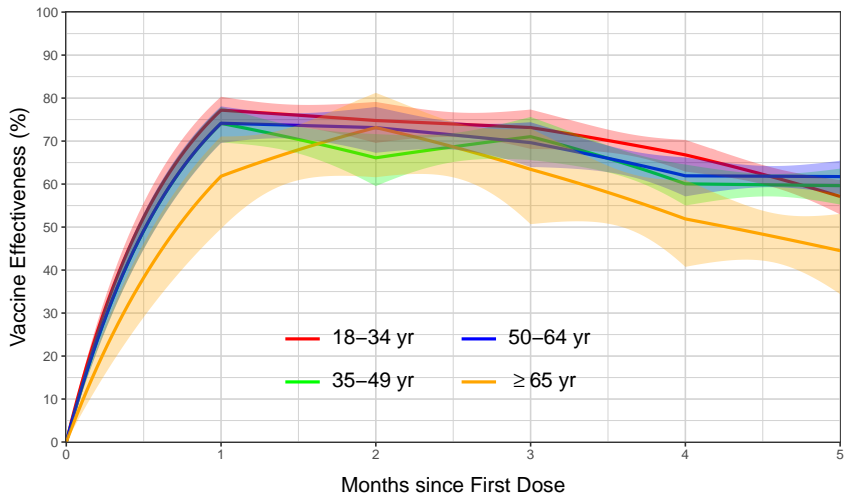


Figure 7. VE of Janssen vaccine against COVID-19 by age group.

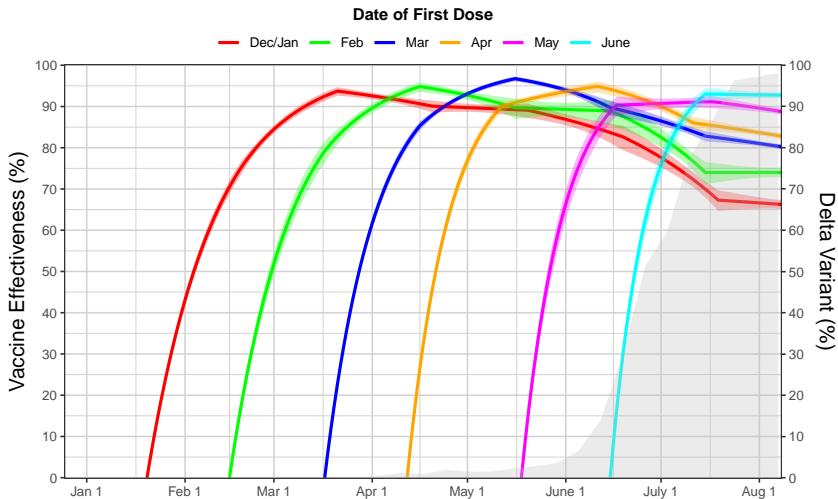


Figure 8. VE of Pfizer against COVID-19 by date of first dose.

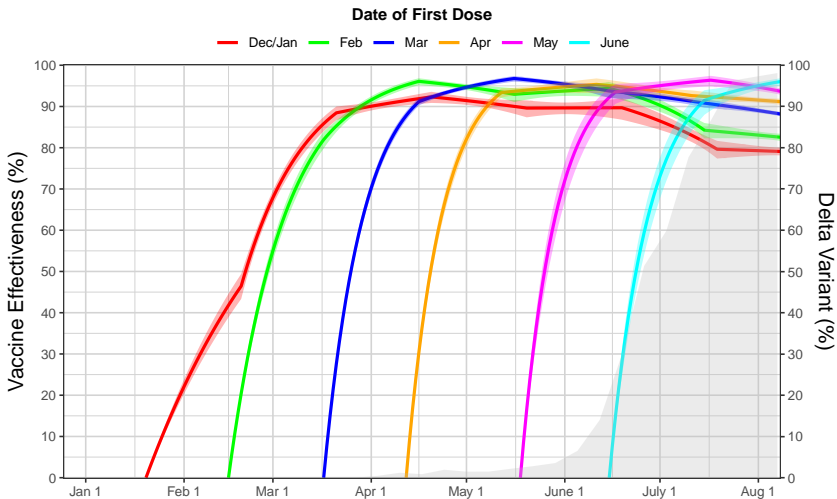


Figure 9. VE of Moderna against COVID-19 by date of first dose.

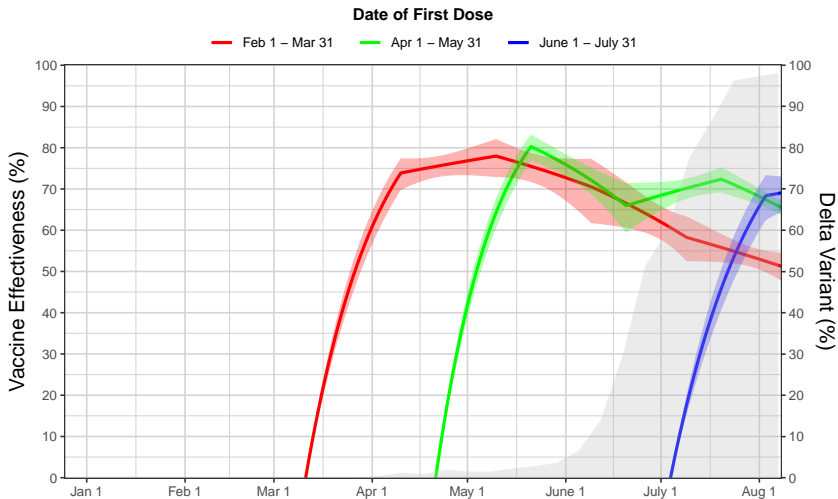


Figure 10. VE of Janssen against COVID-19 by date of first dose.

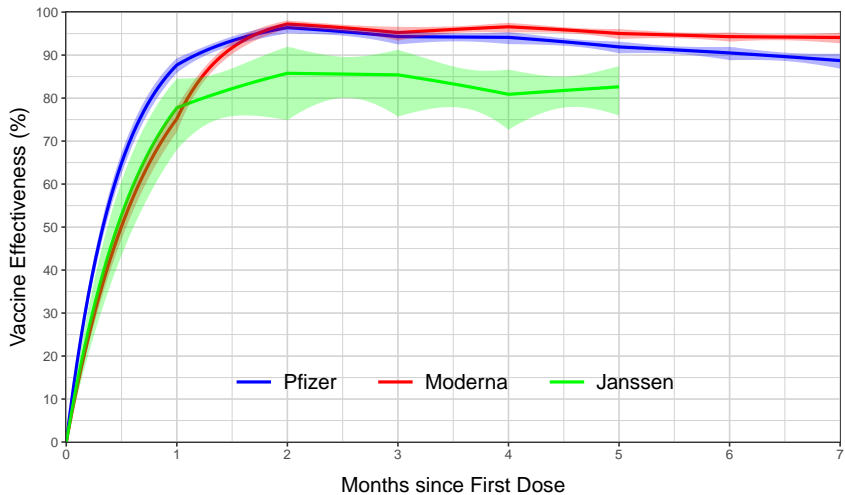


Figure 11. VE against hospitalization.

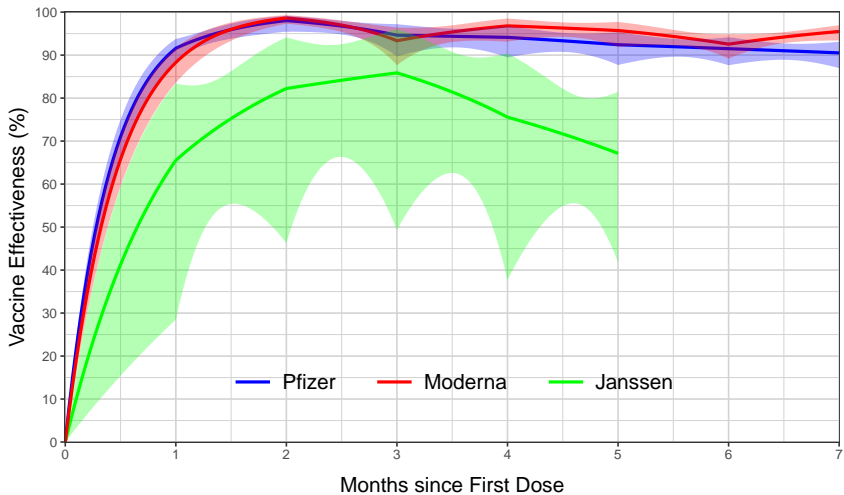
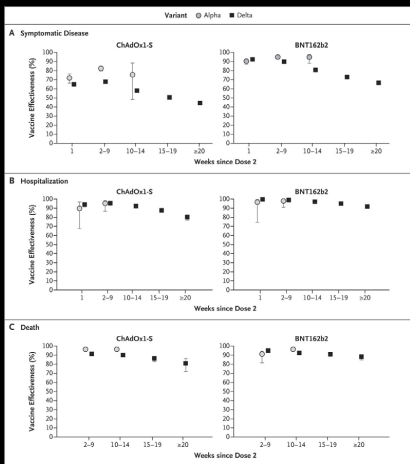


Figure 12. VE against death.

Vaccine Effectiveness against Symptomatic Covid-19 and Related Hospitalization and Death in England.



N Andrews et al. N Engl J Med 2022;386:340-350.



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ONGOING WORK

Phase 3 Trials

- ▶ Blinded follow-up data
- ▶ Post-crossover data
- ▶ Efficacy of boosters

Surveillance Data

- ▶ Effectiveness over one year
- ▶ Effectiveness of boosters
- ▶ Impact of Omicron variant

Other Collaborations?

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