Pfizer's BNT162b2 Vaccine Effectiveness (VE)

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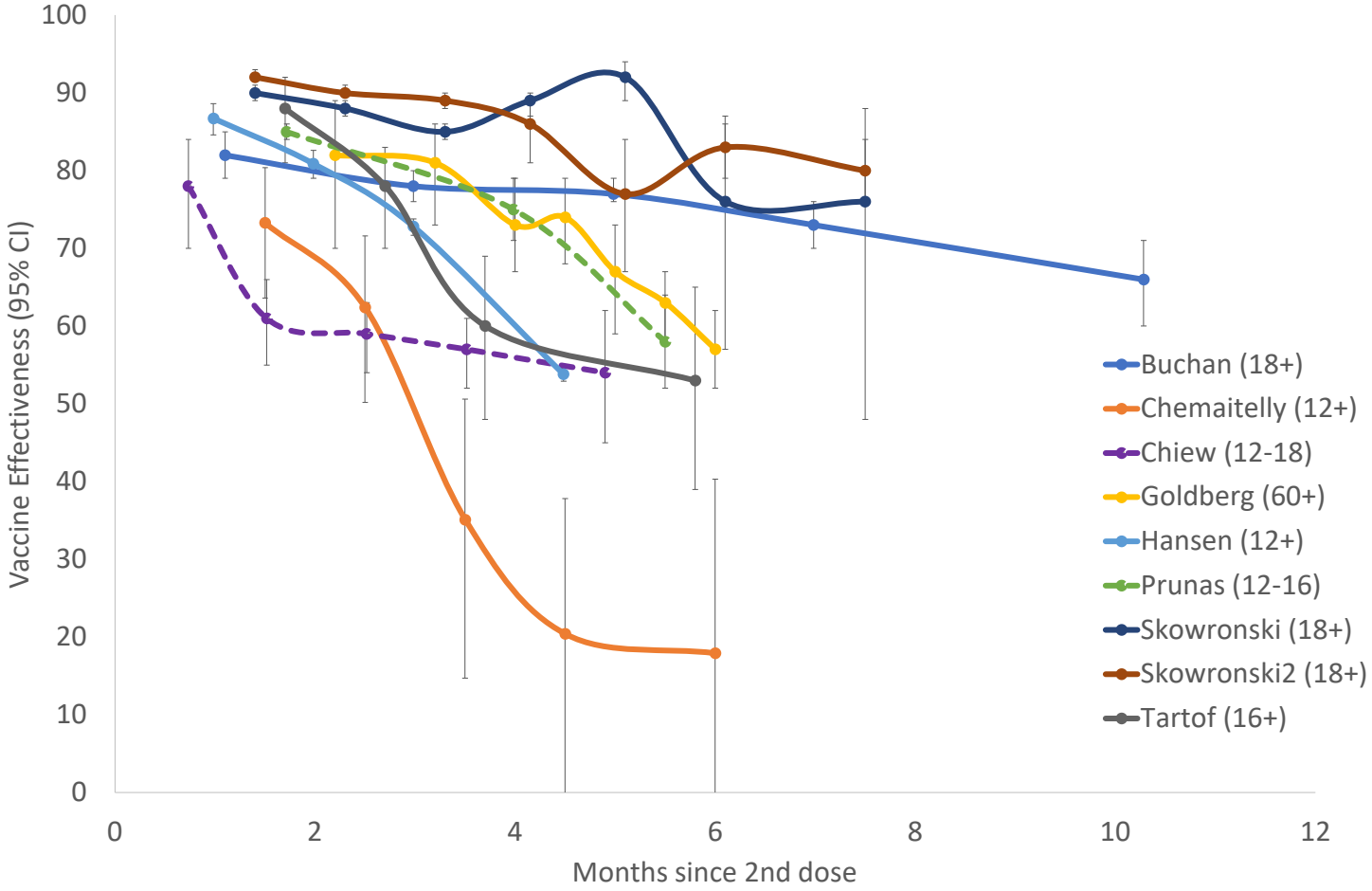
Primary Series VE Over Time: Delta and Omicron

Delta: VE Against Infection Over Time

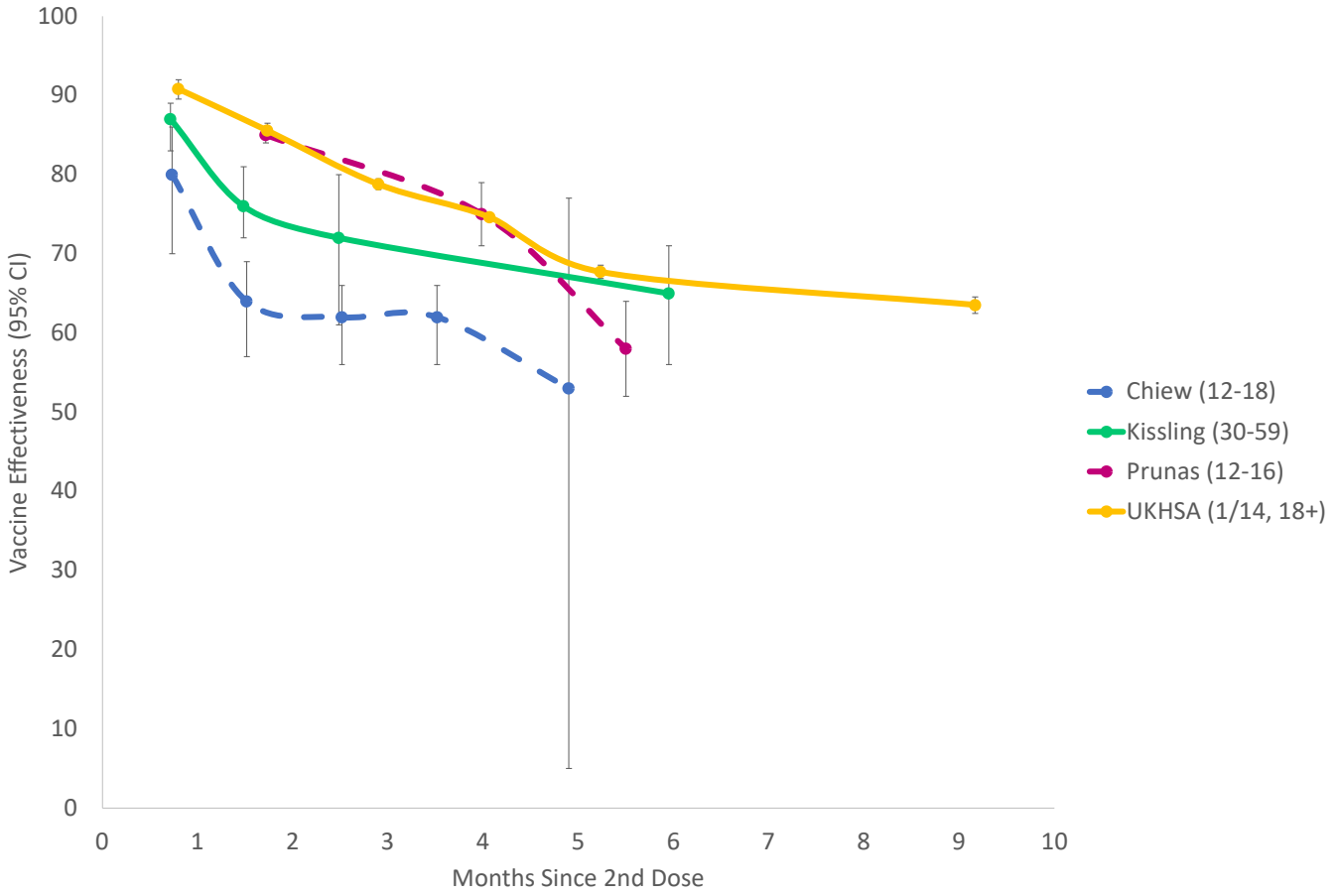
- 9 analyses have evaluated VE against Infection over time related to Delta
- Same general trend
  - VE ~1-2 months after 2nd dose 80-90%
  - Declines variably in each study
    - Wide CI at later time points
  - Waning in pediatric studies (dashed lines)
  - On average, VE decreased from 1-6 months 26 (11-48) percentage points
- Limitations
  - Early vaccinees at higher risk
  - Changes in behavior/testing patterns



Note all estimates plotted at midpoint of time frame from analysis (e.g. 14-30 day VE plotted at 0.75 months); average decline based on metagression methodology by Feikin et al with updated data

Delta: VE Against Disease Over Time

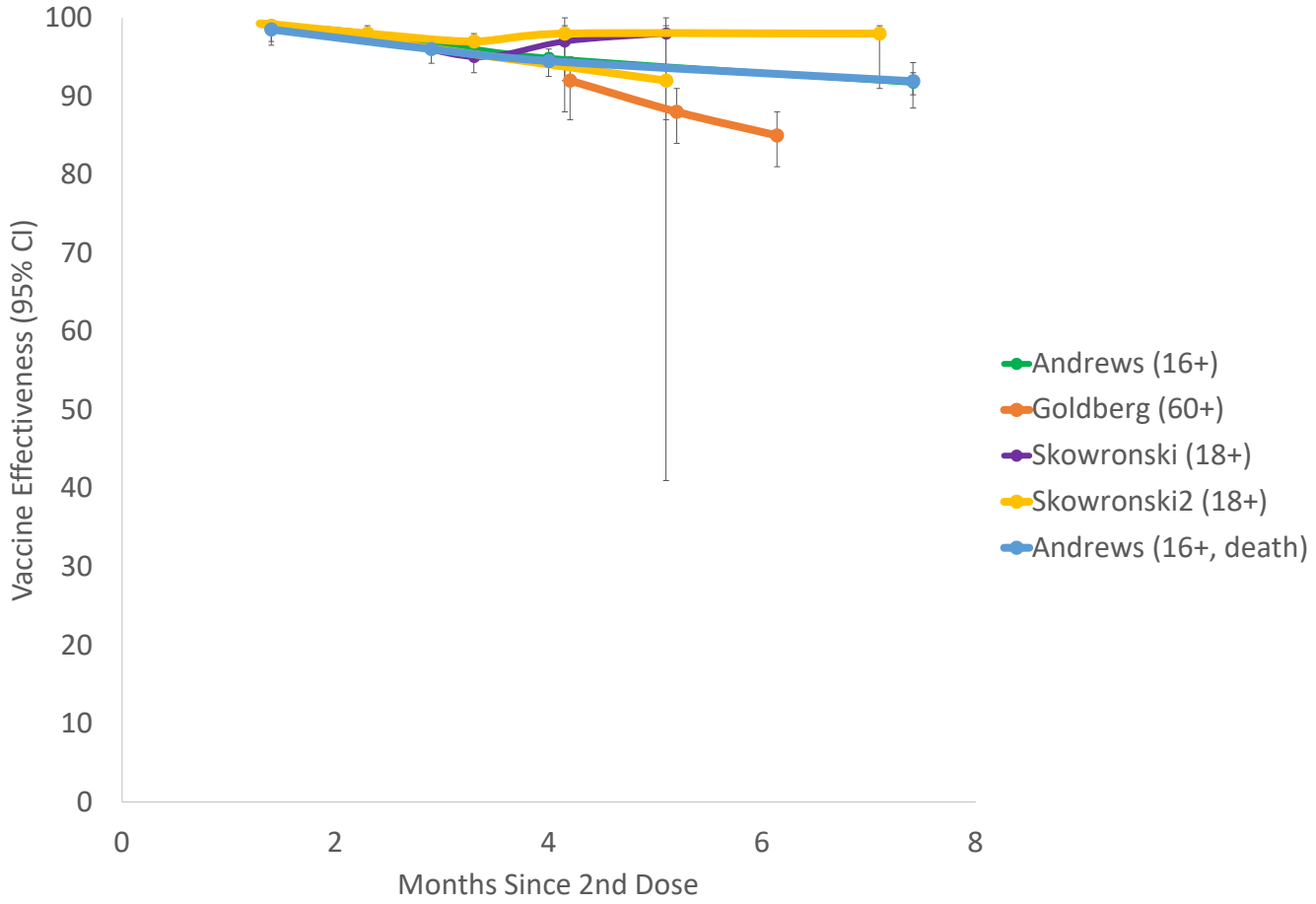
- 4 analyses have evaluated VE against disease over time related to Delta
- Same general trend
  - VE ~1 month after 2nd dose 80-90%
  - ~7% decline per month on average
- Waning in pediatric studies (dashed lines)
- On average, VE decreased from 1-6 months 29 (17-47) percentage points



Note all estimates plotted at midpoint of time frame from analysis (e.g. 14-30 day VE plotted at 0.75 months); average decline based on metagression methodology by Feikin et al with updated data

Delta: VE Against Hospitalization, Severe Disease and Death

- 5 analyses have evaluated VE against hospitalization, severe disease and/or death over time related to Delta
- Much less decline
  - On average, VE decreased from 1-6 months 7 (3-15) percentage points

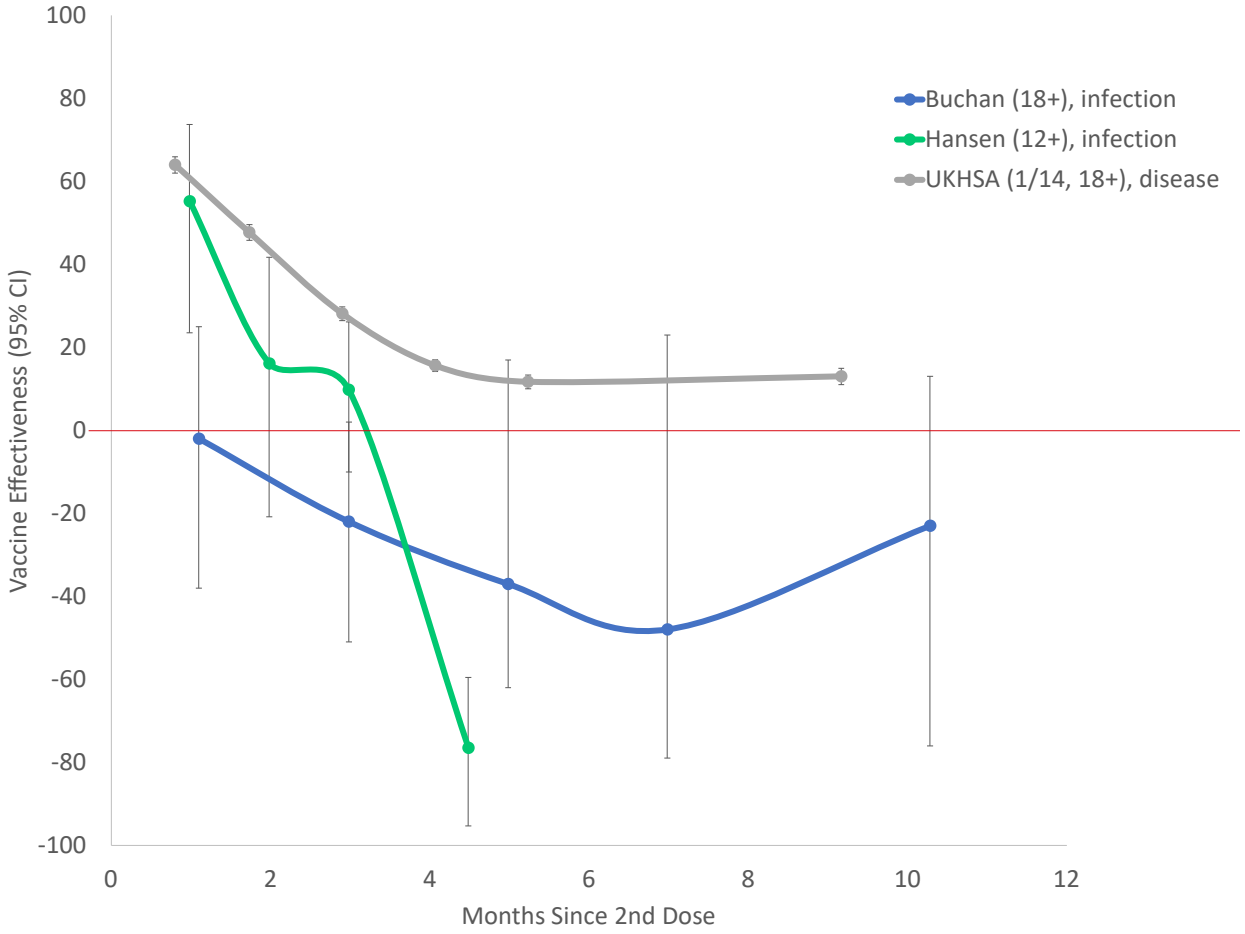


Note all estimates plotted at midpoint of time frame from analysis (e.g. 14-30 day VE plotted at 0.75 months); average decline based on metagression methodology by Feikin et al with updated data

Omicron: VE Against Infection and Disease

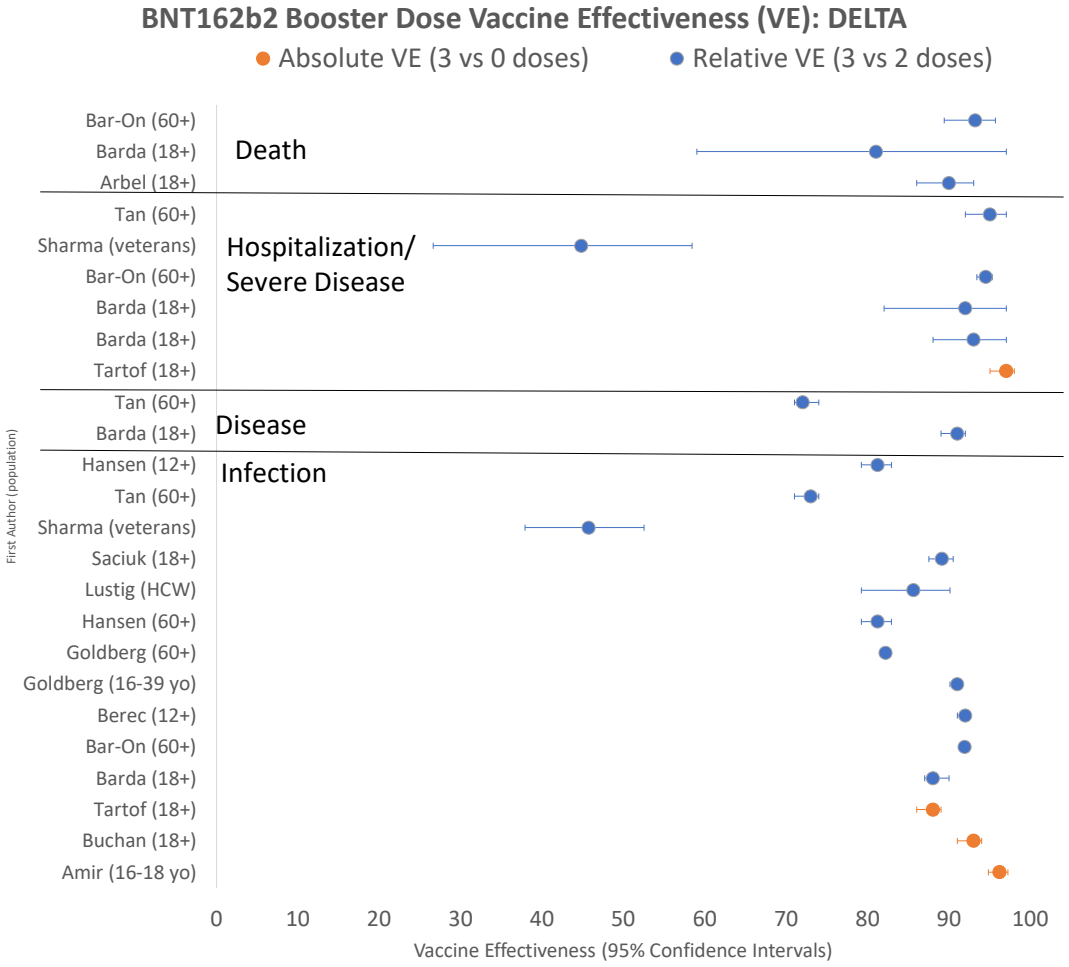
- 3 analyses have evaluated VE against infection or disease over time related to Omicron
- All studies compared to Delta and always lower VE at each time point
- Challenging to interpret if waning is more severe with Omicron due to wide CI and confounding due to early cases

- 1 study with Omicron VE against hospitalization with symptoms consistent with COVID at 14+ days post dose 2: 50% VE (35-62%)

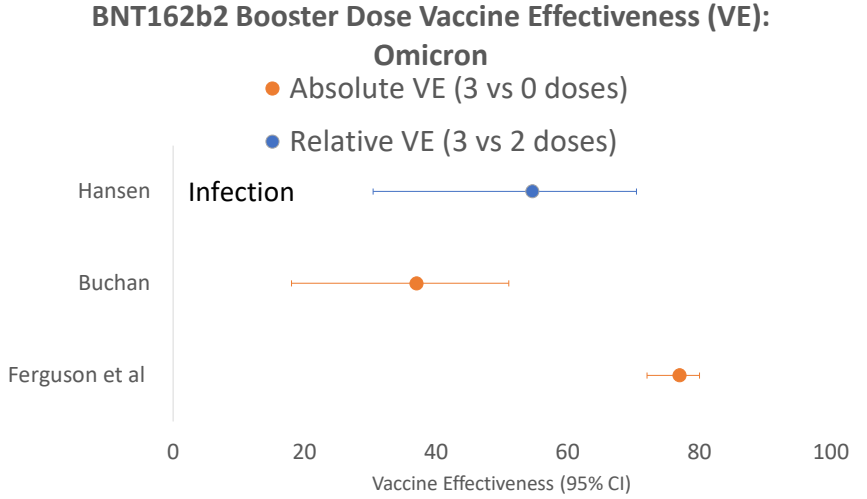


Note all estimates plotted at midpoint of time frame from analysis (e.g. 14-30 day VE plotted at 0.75 months)

Booster Dose VE

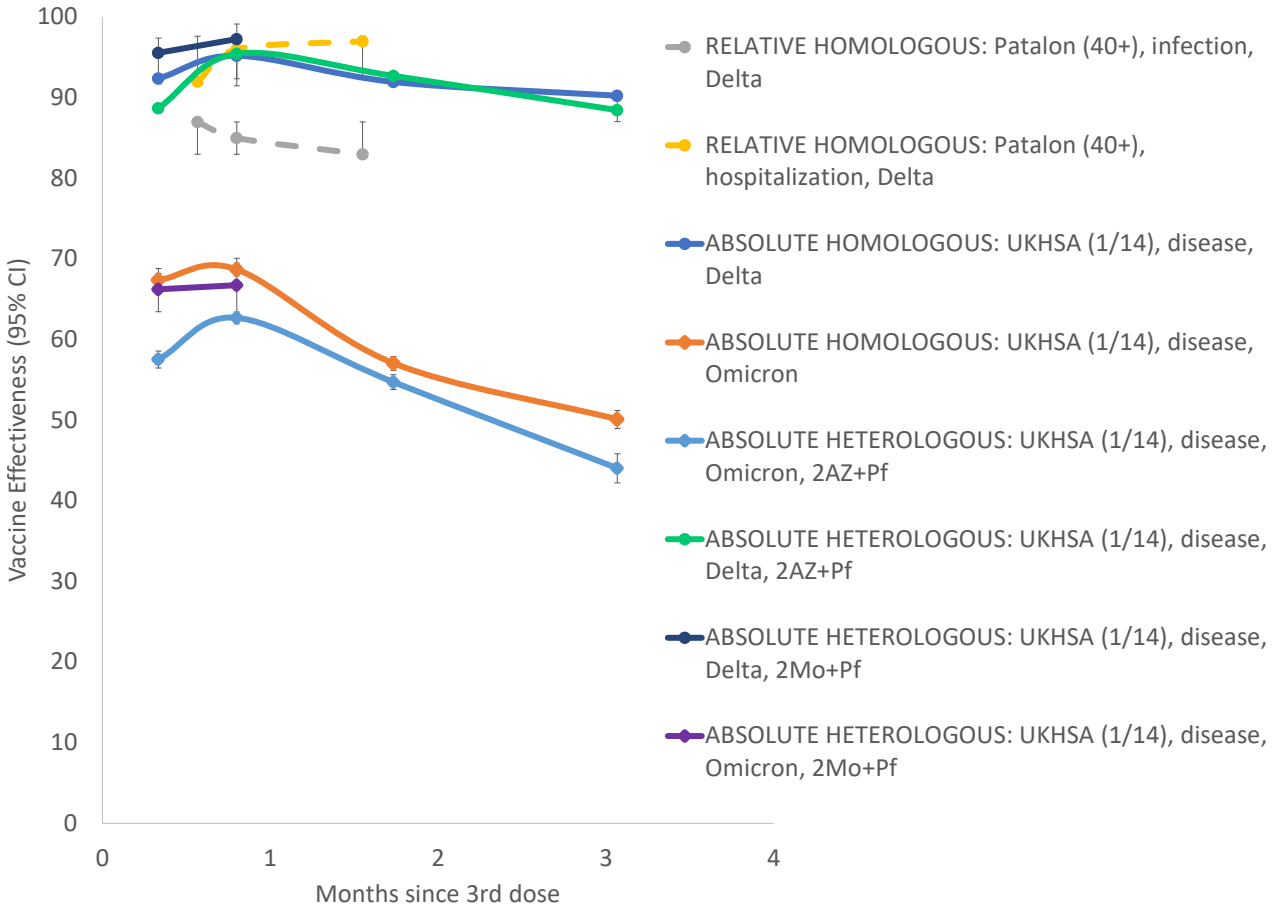


- For Delta, booster dose VE 1-2 weeks post dose 3 has almost universally high VE against most outcomes
  - Unclear against how much increase over absolute 2 dose VE since most are evaluating relative VE (3 vs 2 doses)
    - Relative VE always lower than absolute
    - At high absolute VE, relative VE can have a large variation but small % gain
- For Omicron, booster dose VE 1-2 weeks post dose 3 improves VE of primary series (but not many studies)
  - Lower than Delta



Booster Dose VE Over Time

- Only 2 studies, with short follow up time
  - Patalon et al evaluated relative VE(dashed lines) against infection and hospitalization against Delta up to Day 60 post dose 3
  - UKHSA evaluated VE against disease for Delta and Omicron up to ~3 months
- Minimal waning in short time against Delta
- Heterologous boosting with Pfizer with similar results to homologous boosting
- 1 study with evidence of waning over 3 months against disease with Omicron



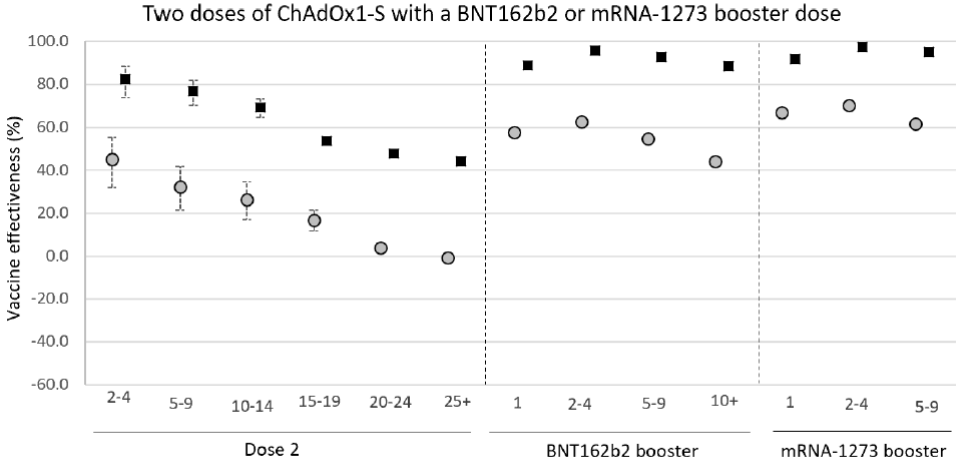
Note all estimates plotted at midpoint of time frame from analysis (e.g. 14-30 day VE plotted at 0.75 months)

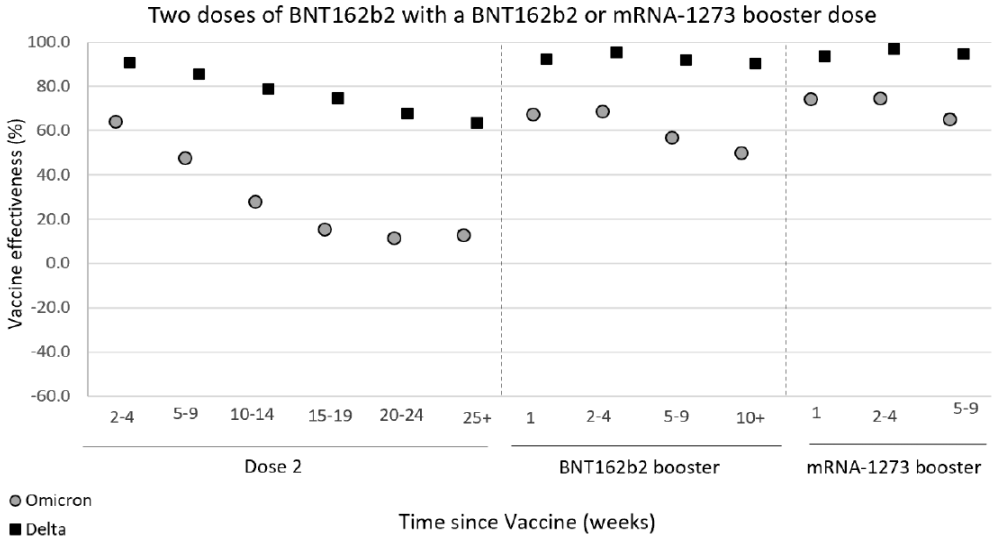
Summary

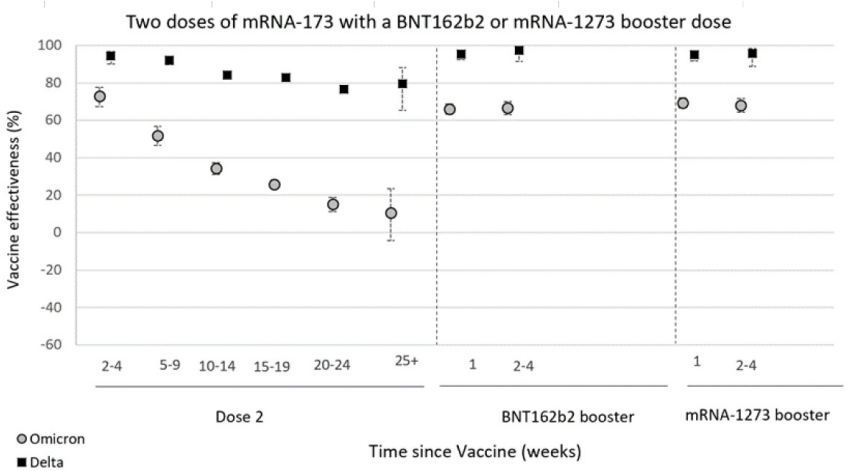
- Delta
  - Evidence of waning protection of the primary series against infection and disease
  - High protection against hospitalization, severe disease, and death, with some potential waning but minimal
- Omicron
  - Evidence of minimal protection against infection or disease of primary series but only 3 studies
    - Most robust data out of UKHSA ~4 months <20%
  - No long-term duration of protection data on hospitalization, severe disease, death
- Booster dose improves VE against Delta and Omicron
  - Potential waning of booster dose against disease with Omicron BUT 1 study
- VE at all time points of primary series and booster dose lower against Omicron than Delta
- Limitations of data
  - Only a few Omicron studies, with limited follow up, looking at early Omicron cases,
  - Only short follow up for booster dose
  - Not many studies evaluating severe outcomes
  - Some data points with wide CI

Extra Slides

England: VE against symptomatic disease for AZ, Moderna and Pfizer







- AZ
  - 2 dose VE <20% by week 15+ (compared to 40-60% for Delta)
  - Booster dose with mRNA increases VE to 40-70%
- Pfizer-BNT
  - 2 dose VE <20% by week 15+ (compared to 60-80% for Delta)
  - Booster dose with mRNA increases VE to 40-80%, but with waning over time for Pfizer booster, minimal for Moderna
- Moderna
  - 2 dose VE <~20% by week 20+ (compared to ~80% for Delta)
  - mRNA booster dose increases to 60-70% (compared to >90% for Delta)

UKHSA. (2022). *COVID-19 vaccine surveillance report - week 2*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1046431/Vaccine-surveillance-report-week-2-2022.pdf

Omicron: VE against hospitalization

- 1 study
- Population: Adult Discovery health members (3.7 million insured). Discovery health is largest private health insurance company
- Test-negative design study comparing two different time periods based on 211,610 samples
  - Pre-Omicron (Delta dominant): September 1-October 30 vs Proxy Omicron period: November 15-December 7
  - All persons with a positive test meeting a data-related diagnosis code consistent with COVID-19 (e.g. pneumonia) versus all negatives (regardless of symptoms, reason for testing etc).
  - Sensitivity analysis: positives meeting DRG code versus all negatives meeting DRG code consistent with COVID-19.
- Results

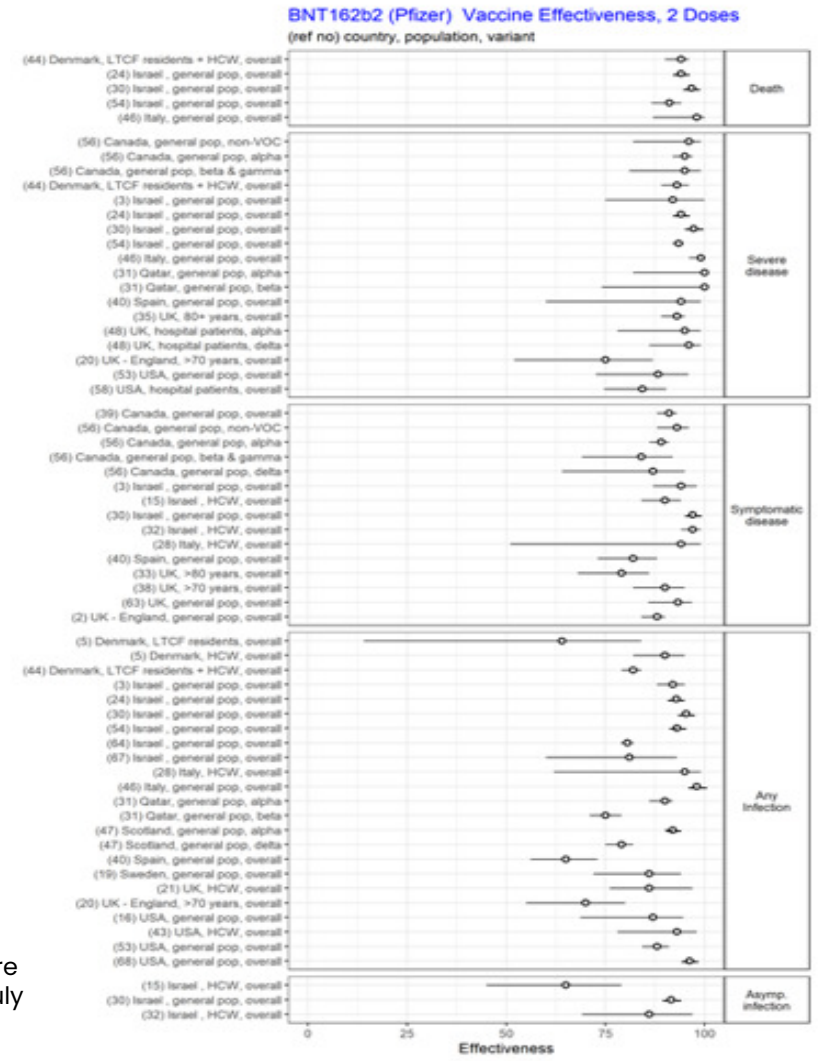
VE	Pre-Omicron	Proxy-Omicron
Hospitalization (vs all negative tests)	93% (90-94)	70% (62-76)
COVID symptomatic hospitalization		50% (35-62)

- Limitations
  - Last data on vaccination from August 25, so some misclassification potential for vaccinated to be considered unvaccinated, lowering VE (est <10%)
  - Unclear what is driving drop in sensitivity analysis but probably a less-biased estimate
  - Prior infection could be underestimated due to lack of testing early on
  - Unknown impact of selection bias in who has Discovery health and if applies to general population. DH tends to exclude low income sector of population who can't afford private insurance scheme.

Collie, S., Champion, J., Moultrie, H., Bekker, L.-G., & Gray, G. (2021). Effectiveness of BNT162b2 Vaccine against Omicron Variant in South Africa. *New England Journal of Medicine*. https://doi.org/10.1056/NEJMc2119270

Early Pfizer VE Results

- Early studies (prior to July 22) showed high VE at 1-2 weeks post dose 2
  - Infection VE 60-95% (mostly ~80-85%)
  - Asymptomatic infection VE 80-90%
  - Symptomatic Disease VE 80-95%
  - Hospitalization/Severe Disease VE 70-95% (mostly 90-95%)
  - Death VE 90-95%



Literature as of July 22, 2021