Public Health England

Protecting and improving the nation's health

Public Health England vaccine effectiveness report

March 2021

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1. Main messages

Analysis of routine testing data continues to show a vaccine effect against symptomatic COVID-19 from either vaccine in those aged 70 year and over, for whom the vaccine effectiveness (VE) of a single dose reaches ~ 60%.

This analysis includes additional weeks' of data which gives us increased confidence in the levels of protection the vaccines are offering.

SIREN continues to show high protection against any COVID-19 infection in health care workers with no decline in protection after a single dose beyond 56 days (which is the length of time people have been studied).

An additional effect against hospitalisation continues to be seen when linking pillar 2 testing data linked to emergency admissions. As before, we find that among those who develop symptomatic infection, risk of hospitalisation is reduced by 35 to 45% after one dose of either vaccine. Combined with the reduced risk of becoming a case, this is consistent with a vaccine effectiveness against hospitalisation which is similar to previously reported value of 80%.

Data continue to show encouraging effects from a single dose of the Pfizer vaccination on risk of mortality in symptomatic cases over 80 who have been vaccinated, where the risk of death is reduced by 54%. Combined with the reduced risk of becoming a case, this is consistent with a vaccine effectiveness against mortality which is similar to previously reported value of 85%.

2. Purpose and scope

PHE is monitoring the effectiveness of COVID-19 vaccines using existing surveillance systems and studies as well as new enhanced surveillance. Vaccine effectiveness is being estimated against a range of outcomes including symptomatic disease, hospitalisations, infection and transmission.

This report presents data on the early effect of vaccination with the Pfizer/BioNTech (BNT162b2) and AstraZeneca (ChAdOx1) vaccines on symptomatic COVID-19, infection and hospitalisation, as well as the population level impact on hospitalisations and deaths. More details of individual study methodologies can be found in these papers:

- Early effectiveness of COVID-19 vaccination with BNT162b2 mRNA vaccine and ChAdOx1 adenovirus vector vaccine on symptomatic disease, hospitalisations and mortality in older adults in England
- Effectiveness of BNT162b2 mRNA Vaccine Against Infection and COVID-19 Vaccine Coverage in Healthcare Workers in England, Multicentre Prospective Cohort Study (the SIREN Study)

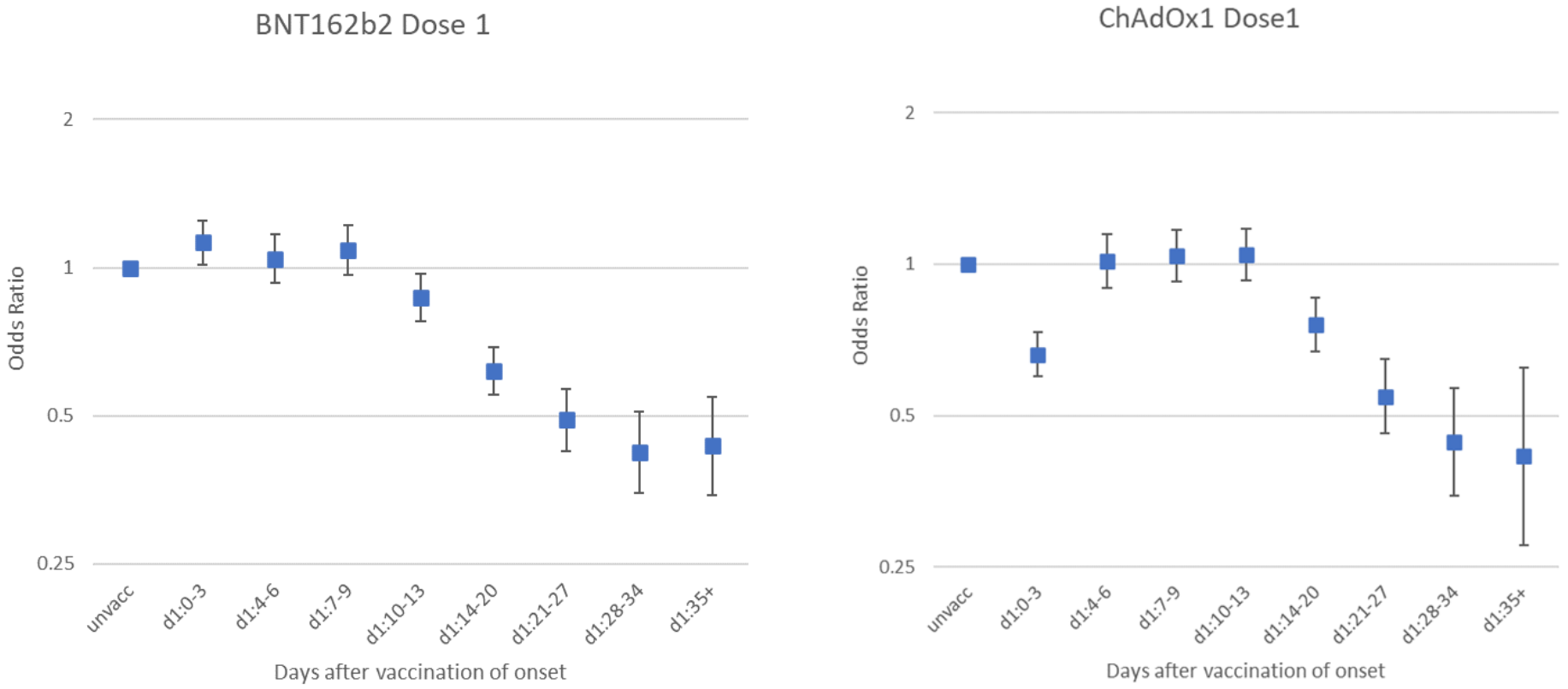
3. Vaccine effectiveness against symptomatic disease

3.1 Routine testing

Vaccine effectiveness against symptomatic disease has been assessed using data on routine COVID-19 testing through pillar 2. Results reported here are stratified by vaccination period: for those aged 80 and over, results for those vaccinated prior to 4 January are included; for those aged 70 and over, data since 4 January (the start of the AstraZeneca programme) only are included. Results for both analyses include data to 21 February.

Using a test negative case control design, results in the ≥70s age group for the Pfizer/BioNTech and AstraZeneca vaccines are shown in Figure 1. With the Pfizer/BioNTech vaccine, the odds ratio starts to decline from 10 to 13 days after vaccination, reaching 0.42 (95%CI 0.35-0.51) from 28 days after vaccination, equivalent to a vaccine effectiveness of 58%. With the AstraZeneca vaccine the decline begins from 14 to 20 days after vaccination and reaches and odds ratio of 0.44 (95%CI 0.35 to 0.57) from 28 to 35 and 0.42 (95%CI 0.28 to 0.62) from 35 days after vaccination equivalent to a vaccine effectiveness of 58%. Confidence intervals for the 2 vaccines overlap and further follow-up is needed to know whether the effects have plateaued in the case of AstraZeneca.

Figure 1. Adjusted odds ratios for confirmed case by interval after first dose vaccination for Pfizer/BioNTech and AstraZeneca vaccines for those aged ≥70 (top 2 panels, left and right respectively) and second dose Pfizer/BioNTech (lower panel), vaccinations administered since 4th January 2021, England.



Overall, the results of the routine testing analysis indicate a vaccine effect from the Pfizer/BioNTech vaccine from 21 days after vaccination in those aged ≥70 years. The vaccine effectiveness of a single dose of Pfizer vaccine reaches around 60% in those aged ≥70 years from the general population. The data beyond 35 days after the first dose show a plateauing of the effect. With 2 doses, vaccine effectiveness reaches approximately 85 to 90% in those aged ≥80 years. Vaccine effects from a single dose and 2 doses cannot be directly compared, again because numbers are small and those who received a second dose are likely to differ significantly to those who received a single dose. We also see an effect of the AstraZeneca vaccine against symptomatic disease of around 60%. The majority of those tested during this period had the Kent variant of concern and a sub-analysis restricted to the Kent variant yielded similar results.

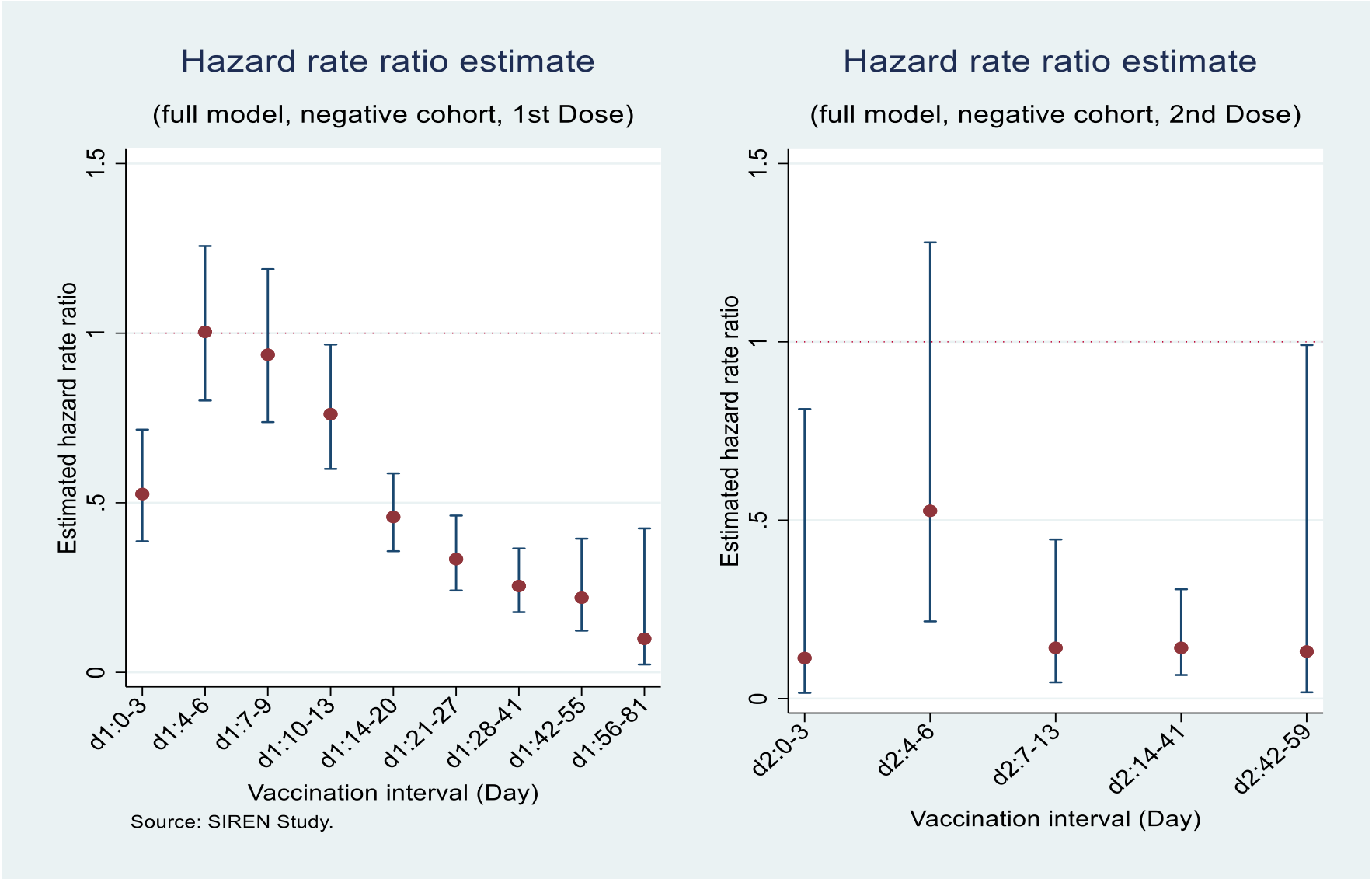
4. Vaccine effectiveness against infection

4.1 SIREN study

The SIREN (Sarscov2 Immunity & REinfection EvaluatioN) study is a multicentre prospective cohort study of healthcare workers which is being used to monitor reinfections and vaccine effectiveness.

Results are shown in Figure 2 (n=15,340 participants). The hazards ratio drops in the 0 to 3 day period which is likely because individuals with recent symptoms defer vaccination, therefore vaccinated individuals are less likely to have been recently symptomatic and therefore less likely to test positive. This is particularly noticeable because test date is used rather than onset date. The hazard ratio then returns to close to baseline until 13 days after vaccination and then drops to 0.46 from 14 to 20 days and 0.33 from 21 to 27 days (figures here are adjusted hazard ratios adjusting for age, ethnicity, comorbidities, region and a selection of other factors). Beyond 28 days results are similar but there is significant uncertainty beyond 41 days. Numbers of those in receipt of 2 doses are small and confidence intervals around estimates therefore wide, but from day 7 onwards there appear to be large reductions in the risk of infection. Vaccine effectiveness against infection is 72% (95% CI 63 to 78%) at ≥21 days post-dose 1, and 85% (95% CI 73 to 92%) at ≥7 days post-dose 2. There is no evidence of a decline in first dose protection with analysis currently showing good effectiveness out to the period between 58 and 81 days.

Figure 2. Adjusted hazard ratios for PCR confirmed case by interval after first and second doses of vaccination, SIREN study



5. Vaccine effectiveness against severe disease

5.1 Analysis of pillar 2 testing data and hospitalisation

Individual level effects of vaccination on risk of being hospitalised with COVID-19 can also be assessed by linking data on testing results through pillar 2, and data on hospitalisations via emergency departments through the Emergency Care Dataset (ECDS). This allows for calculation of hazard ratios for hospital admission from 14 days post-vaccination, using survival analysis. In this section, we present data on hospitalisations in individuals aged 80+ who had had the Pfizer vaccine while adjusting for age, gender and care home residency (as have been presented in previous weeks). We also include, for the first time, data on hospitalisations among recipients of the AstraZeneca vaccine.

Results are shown in Table 1. Hospitalisation rates were around 15% in unvaccinated individuals in both populations. Among those who had had their first dose at least 14 days previously, hospitalisation rates were 9% in those who had received the Pfizer vaccine and 8% in those who had received AstraZeneca. The survival analysis showed 42% (Pfizer) and 35% (AstraZeneca) reductions in the risk of hospitalisation among those who had been vaccinated but became symptomatic, compared with those who had not although confidence intervals around these estimates were broad and overlapping. Combined with the reduced risk of becoming a case (Section 3) this is consistent with vaccine effectiveness against hospitalisation of around 80%.

Table 1. Hazard ratios for hospital admission between unvaccinated individuals aged 80+, those within 13 days of dose one, and those at least 14 days post dose one for the Pfizer vaccine (columns on the left) and the AstraZeneca vaccine (right), after adjustment for age, gender, care home residency status and time period (with an assumption that more recent data are more likely to be complete).

	Pfizer				AstraZeneca			
Vaccination status	Total cases	Hospitalisations		Hazard ratio	Total cases	Hospitalisations		Hazard ratio
		n	%			n	%	
Unvaccinated	9,013	1361	15.1%	1	9,013	1,361	15.1%	1.00
Test date less than 14 days after first dose	2,173	311	14.3%	1.00 (0.88-1.13)	634	78	12.3%	1.03 (0.82-1.29)
Test date 14 days or more after first dose	1,689	152	9.0%	0.58 (0.49-0.68)	252	20	7.9%	0.65 (0.44-0.96)

5.2 Case fatality ratios

Case fatality ratios in vaccinated cases compared to unvaccinated cases can be assessed through linkage of routine testing data to mortality data.

Case fatality rates within 21 days of onset were estimated by vaccination at date of onset (unvaccinated, vaccinated within 0 to 13 days, vaccinated at least 14 days before) among cases aged ≥80 years who had received the Pfizer vaccine (equivalent data are not yet available for those who have received the AstraZeneca vaccine). Survival analysis was used to estimate the hazard ratios for the different groups with adjustment for age, care home residency status and gender. Results are shown in Table 2. Mortality rates were around 13% in unvaccinated cases, 10% in those recently vaccinated and 7% in those vaccinated ≥14 days prior to onset.

Table 2. Case fatality ratios for deaths within 21 days of onset in vaccinated compared to unvaccinated, Pfizer/BioNTech vaccine, after adjustment for age, gender, care home residency status, and for period (with an assumption that the most recent data are likely to be most complete).

Vaccination status	Total cases	Deaths		Hazard ratio
		n	%	
Unvaccinated	8,625	1,115	12.9%	1
Test date less than 14 days after first dose	1,367	131	9.6%	0.74 (0.62-0.88)
Test date 14 days or more after first dose	914	60	6.6%	0.46 (0.36-0.59)

About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. We do this through world-leading science, research, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health and Social Care, and a distinct delivery organisation with operational autonomy. We provide government, local government, the NHS, Parliament, industry and the public with evidence-based professional, scientific and delivery expertise and support.

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