National Immunisation Advisory Committee
An Coiste Comhairleach Náisiúnta um Imdhíonadh

UPDATED RECOMMENDATIONS FOR VACCINATION AGAINST COVID-19 MAY 2025

NIAC | 06.05.2025

About NIAC

NIAC membership includes nominees from the Royal College of Physicians in Ireland, its Faculties and Institutes, the Royal College of Surgeons in Ireland, the Irish College of General Practitioners, the National Immunisation Office, the Nursing and Midwifery Board of Ireland, the Infectious Diseases Society of Ireland, the Travel Medicine Society, the National Virus Reference Laboratory and lay members. Meetings are attended by representatives from the Department of Health and the HSE. Representatives of the Health Products Regulatory Agency attend to provide regulatory advice in relation to vaccines.

NIAC considers the evidence about vaccines and provides advice to the Chief Medical Officer and the Department of Health. The Department and the Minister for Health make policy decisions on vaccines which are implemented by the Health Service Executive.

RECOMMENDATIONS

1. **A COVID-19 vaccine is recommended twice each year for:**
    - all those aged 80 years and above
    - those aged 18-79 years living in long term care facilities for older adults
    - those aged 6 months and older with immunocompromise associated with a suboptimal response to vaccination.

2. **A COVID-19 vaccine is recommended once each year for:**
    - all those aged 60-79 years
    - those aged 6 months-59 years with medical conditions associated with a higher risk of COVID-19 hospitalisation, severe disease or death.

3. **Access to a COVID-19 vaccine once each year should be available for:**
    - health and care workers* who chose to receive a vaccine
    - pregnant adolescents and adults* who following discussion with a healthcare provider, chose to receive a vaccine
    - adults aged 18-59 not included in the groups listed in points 1. or 2. who following discussion with a healthcare provider (e.g., GP, pharmacist or vaccination centre), choose to receive a vaccine.

4. Although there is no established COVID-19 seasonality, for operational reasons autumn and spring continue to be the preferred time for COVID-19 vaccination campaigns. However, the timing of these campaigns may be altered in response to changing epidemiology. Vaccines should also be available outside of defined seasonal campaigns where clinically indicated, e.g., pregnancy, previously unvaccinated, or new period of immunosuppression.

5. COVID-19 vaccines may be given irrespective of the number of previous doses or types of COVID-19 vaccines, with an interval of six-months recommended following any previous COVID-19 vaccine dose or SARS-CoV-2 infection. A minimum interval of three months is permissible in exceptional circumstances e.g., planned immunosuppressive therapy or operational reasons.

6. Antigenically updated COVID-19 mRNA vaccines are the preferred vaccine for use.

7. Protein based vaccines may be used as alternatives in those for whom an mRNA vaccine is contraindicated or declined. Nuvaxovid (antigenically updated) is the preferred alternate.

8. COVID-19 vaccines and most ǂ other adult vaccines, including influenza vaccine may be administered at the same time or at any interval.

Recommendations may be updated when more information becomes available.

*Pregnant adolescents and adults or health and care workers who also fall into the risk groups outlined in 1. and 2. above should follow the corresponding recommendations.
ǂ There should be an interval of at least four weeks between mpox vaccine and a subsequent COVID-19 vaccine because of the unknown risk of myocarditis. No interval is required between a COVID-19 vaccine and a subsequent mpox vaccine.

1. EXECUTIVE SUMMARY

- These recommendations aim to provide a set of standing COVID-19 vaccination recommendations for Ireland, moving away from date stamped interim recommendations, reflecting the evolution from a pandemic to endemic phase of SARS-CoV-2.
- SARS-CoV-2 continues to lack seasonality. In 2024 Ireland experienced a peak in cases and hospitalisations during the summer months and for the first time did not experience a significant increase in cases in the autumn and winter months.
- Those of advanced age, and those with medical comorbidities continue to be at increased risk of hospitalisation and severe disease.
- Rates of hospitalisation increase with increasing age with a notable increase observed in those over 70 years of age.
- While healthcare settings represent potentially high-exposure environments for COVID-19, the number of reported health and care workers (HCWs) contracting COVID-19 in outbreaks in healthcare settings has decreased since the peak in 2022.
- Pregnant women faced a higher risk of severe COVID-19 complications including ICU admission and mechanical ventilation early in the pandemic, particularly during the Alpha and Delta waves. In Ireland, between March 2020 and August 2021, 28 pregnant women and 12 postpartum women were admitted to ICU with over half requiring invasive ventilation.
- COVID-19 vaccination was first recommended in Ireland for pregnant women in April 2021. Since 2022, rates of maternal morbidity have declined.
- In 2024, three pregnant or postpartum women were admitted to ICU with COVID-19, all with a length of stay of less than three days. None had received a COVID-19 vaccine in pregnancy.
- While hospitalisation rates of infants less than six months of age have been relatively high at approximately 800 per 100,000 for the last three COVID-19 waves, ICU admissions in this age have been low since the end of 2022; in 2024 only two ICU admissions were reported, both in infants with underlying medical conditions.
- Data reported on pregnant women and infants from the UK were similar to Ireland. During the Omicron era from autumn 2022 to spring 2024 hospitalisations in pregnant women due to COVID-19 decreased with only four severe cases and no ICU admissions or deaths reported. In infants, over the same period, ICU admissions were reported in 1 per 100,000 infants aged 0-2 months, with less than five deaths reported, mainly in infants with serious underlying medical conditions.
- The SARS-CoV-2 virus continues to evolve. The XEC variant is still the predominant variant in Ireland and globally. The LP.8.1 lineage has begun to increase recently with no indication of increased severity at this time.
- No new safety signals regarding COVID-19 vaccination in the general population were identified since NIAC's last review in January 2025.
- Three recent systematic reviews of COVID-19 vaccination in pregnancy yielded similar results reporting no association between COVID-19 vaccination and adverse maternal or perinatal outcomes.

- Two preprint studies on the updated BTN162b2 KP2 vaccine effectiveness (VE) in winter 2024/2025 were available. One reported VE of 75% against hospitalisation and 58% against outpatient visits in those aged 65 years and above, and the other reported VE of 57% against moderate infection in 18-64 year olds and 24% in those aged 65 and above, with good variant matching.
- Studies investigating the VE in HCWs reported modest protection against infection or moderate illness. During the 2023/2024 winter wave VE against infection was highest during XBB sublineage dominance when the vaccine was well matched (42 to 49%), but dropped when JN.1 became predominant (-11% to 19%).
- Systematic reviews of observational studies demonstrate that COVID-19 vaccination during pregnancy protected against severe COVID-19 associated maternal and neonatal outcomes during Alpha, Delta and early Omicron predominance. Vaccine effectiveness was reduced in the Omicron era compared to Alpha and Delta eras, though there have been fewer studies of VE in pregnancy in recent years.
- The most recent vaccination campaign in winter 2024/2025 again noted uptake to be highest in those of most advanced age; 61.5% in those aged 80 years and above compared to 27.7% in those aged 60-69 years. Uptake was relatively low in HCWs (9.1%) and pregnant women (6.3%).
- Data from a small Irish survey (n=595) of HCWs suggest that HCWs deem COVID-19 vaccination to be important and support annual vaccination of HCWs, despite 42% having concerns over side effects.
- Internationally, recommendations regarding HCW vaccination vary from annual vaccination to no recommendation.
- Regarding vaccination in pregnancy, while WHO, Canada and USA continue to recommend a dose in each pregnancy, some countries such as the UK, Australia and Germany have removed their recommendations for vaccination in pregnancy due to reduced disease severity in pregnancy.
- Most countries continue to recommend once or twice yearly vaccination for those who are immunocompromised, those with high risk medical conditions and those living in long term care facilities. Aged based recommendations for once and twice yearly vaccination vary.
- While the overall prevalence of severe outcomes from COVID-19 in the population has greatly reduced, there are still certain groups who remain at increased risk of hospitalisation, ICU admission and death, most notably those of advanced age. The aim of these recommendations is to offer year round protection against severe disease to those most at risk. This can be achieved through vaccination once a year for some cohorts of the population, for others in whom protection from the vaccine wanes faster, twice yearly vaccination is required.
- SARS-CoV-2 continues to lack seasonality, however NIAC note that defined campaigns in autumn and spring facilitate improved uptake and efficiencies through alignment with other

winter vaccine programmes. Continuous monitoring of the virus is important to adjust campaign timing if necessary.

- Since the emergence of Omicron, COVID-19 severity in pregnancy has declined - likely due to virus evolution and increased background immunity. While vaccination remains safe in pregnancy, the benefits are now less pronounced than they were previously. As a result NIAC no longer recommends a COVID-19 vaccine in every pregnancy. However, there will be some women and infants with additional risk factors who would benefit from the vaccine more than others, and thus the vaccine should remain available, year round, for those who following a discussion with their healthcare provider, chose to receive it.
- Pregnant adolescents and adults who are immunocompromised or who have medical conditions associated with a higher risk of COVID-19 hospitalisation, severe disease or death should continue to receive a COVID-19 vaccine in each pregnancy.
- The primary goals of HCW vaccination are to prevent severe disease in HCWs and reduce transmission in healthcare settings. Health and care workers under the age of 60 years without comorbidities are now at low risk of severe COVID-19. The effectiveness of COVID-19 vaccination against infection and onwards transmission is modest and short lived, and timing of SARS-CoV-2 peaks is unpredictable. There is currently insufficient evidence to support a strong recommendation for yearly vaccination of all HCWs, however NIAC supports continued access to vaccines for HCWs who choose to be vaccinated.
- Health and care workers aged 60 years and above or those aged 18-59 years with medical conditions associated with a higher risk of COVID-19 hospitalisation, severe disease or death should continue to receive a COVID-19 vaccine once or twice each year as indicated by their underlying condition.
- NIAC has issued standing recommendations to support longer term COVID-19 immunisation planning as the virus enters a more stable endemic phase. NIAC recognises however, that SARS-CoV-2 continues to evolve and COVID-19 recommendations will be subject to ongoing review as new information becomes available.

2. INTRODUCTION

SARS-CoV-2 continues to circulate. While there has been an overall decline in the numbers of COVID-19-related hospitalisations and fatalities, intermittent surges in hospitalisations continue. Unlike many respiratory viruses, SARS-CoV-2 has thus far not exhibited a distinct seasonal pattern. Advanced age remains the leading risk factor for COVID-19 hospitalisation and severe disease. COVID-19 vaccination continues to be an important intervention to prevent severe outcomes from COVID-19 in those at increased risk. Up until this time point, NIAC has issued interim COVID-19 recommendations which were updated frequently, at least twice per year. With the move from a pandemic to endemic phase, it is timely to consider the scope of the COVID-19 vaccine recommendations going forward. This document outlines the updated recommendations for COVID-19 vaccination and the evidence and considerations which underpin this advice.

3. METHODS

An updated review of COVID-19 vaccine safety and effectiveness in pregnant women, infants and health and care workers (HCWs) was conducted by the NIAC Secretariat. Data summarised in the document below, were presented to the COVID-19 working group on 13 March 2025 in the format of NIAC's Evidence to Recommendation framework (EtR). Draft recommendations were agreed by the working group and presented along with the summarised evidence and working group considerations to the Full Committee on 24 March 2025. Updated epidemiology and safety and effectiveness evidence in the general population was also presented and discussed at this meeting. The final recommendations outlined in this document were agreed by consensus at this Full Committee meeting. The data presented by the NIAC Secretariat and the considerations of the working group and Committee are presented in the document below.

4. EVIDENCE TO RECOMMENDATION FRAMEWORK

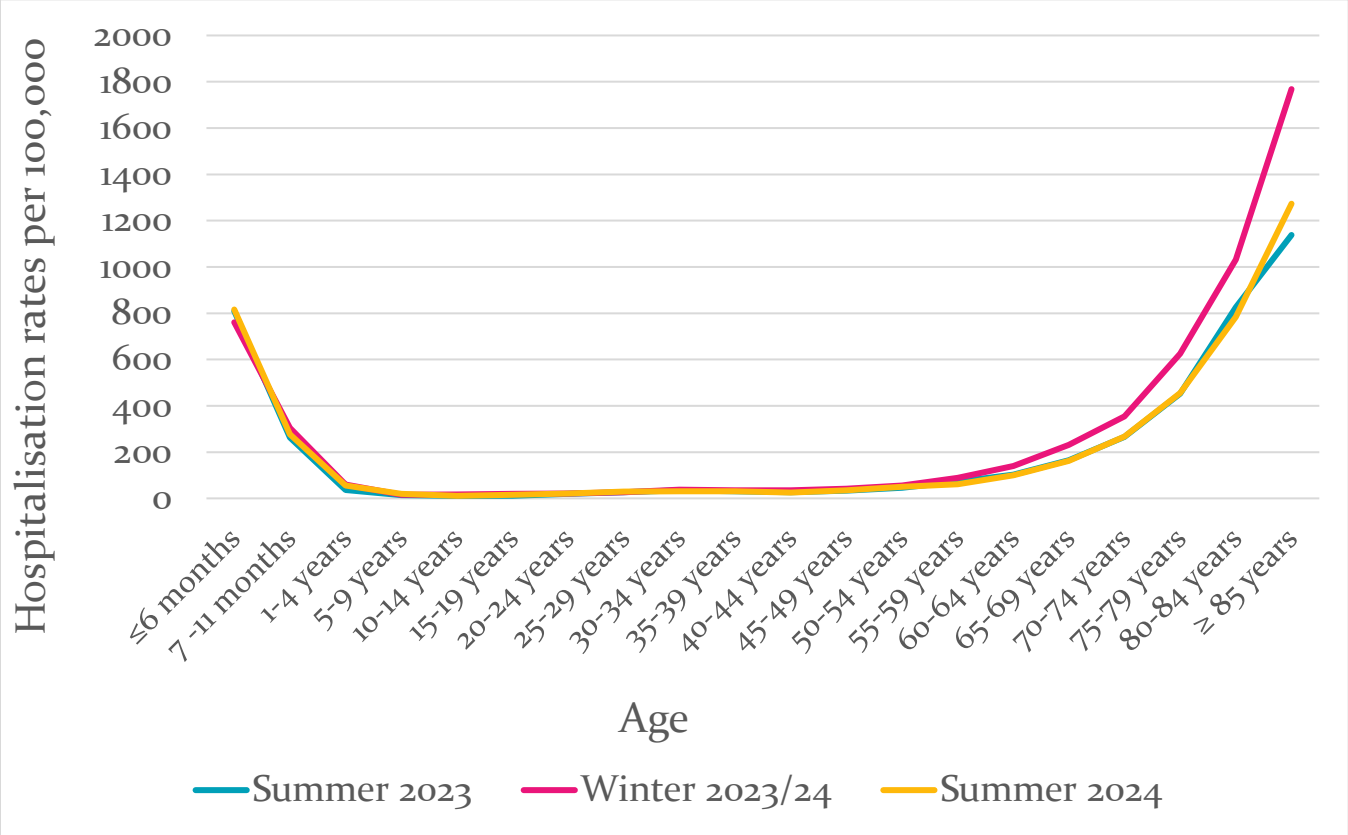
DOMAIN 1: THE PROBLEM

EPIDEMIOLOGY

The severity of SARS-CoV-2 infection has reduced over time with the evolution of the virus and the establishment of immunity within the population through vaccination and natural infection. Hospitalisation rates remain highest in at risk populations including older adults, infants, those with underlying medical conditions and those who are immunocompromised. A winter surge in COVID-19 infection did not occur during the 2024/2025 respiratory viral season. In the three last waves of COVID-19 which occurred in summer 2023 and 2024 and winter 2023/24 the rate of hospitalisations per 100,000 were low for those aged between 1-60 years old. (Figure 1)[1] Rates of hospitalisation increased with increasing age with a notable increase observed in those over 70

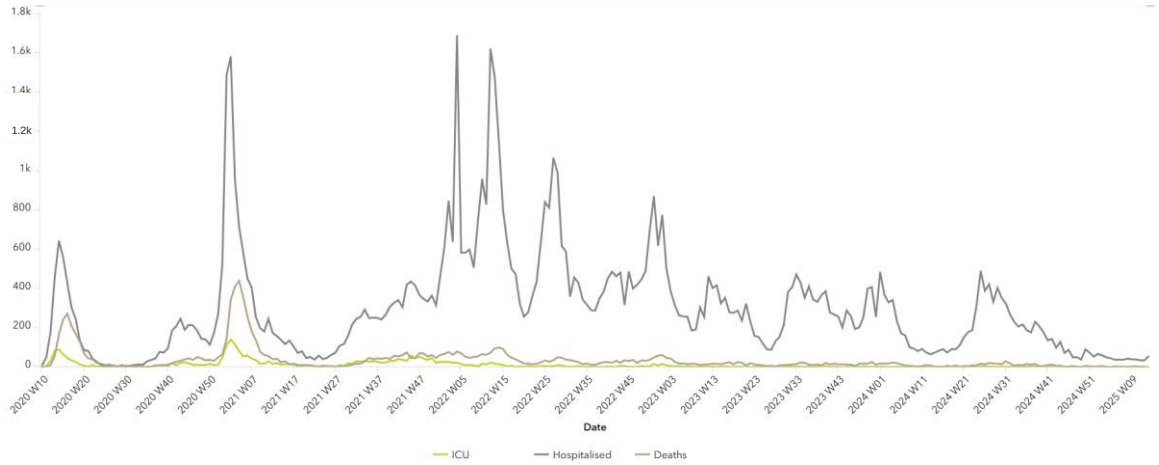
years of age. Hospitalisation rates of between 100 and 150 per 100,000 population were recorded in those aged 60-65 years in the last three waves of COVID-19 and rates of between 150 and 250 per 100,000 population in those aged 65-69 years old. In those aged 70-74 years old hospitalisation rates were between 300 and 400 per 100,000 over the same time period and between 700 and 1,000 per 100,000 population in those aged 80-84 years old.

Figure 1. COVID-19 Hospitalisation rates per 100,000 by age for the summer waves in 2023 and 2024 and the winter wave 2023/2024 (There was no winter wave in 2024/2025). Source: HPSC.[1]



Despite ongoing hospitalisations in at-risk populations COVID-19 associated ICU admissions and deaths have remained low. (Figure 2)[2] Weekly ICU admissions in all age groups have remained below 0.15 per 100,000 population in the last two winter seasons. In winter 2024/25 from week 40 2024 to week 1 2025 there were a total of 30 ICU cases due to COVID-19 across all age groups.[3] Of these ICU admissions 63.3% were ≤65 years old and 83.3% had underlying medical conditions, 60% did not require mechanical ventilation.[3] From week 40 to week 13 2025 there have been eight COVID-19 associated deaths in those <65 years old and 104 deaths in those >65 years old. A COVID-19 associated death is defined as a death in a person with laboratory confirmed COVID-19 where COVID-19 is reported as one of a possible four causes of death.[4]

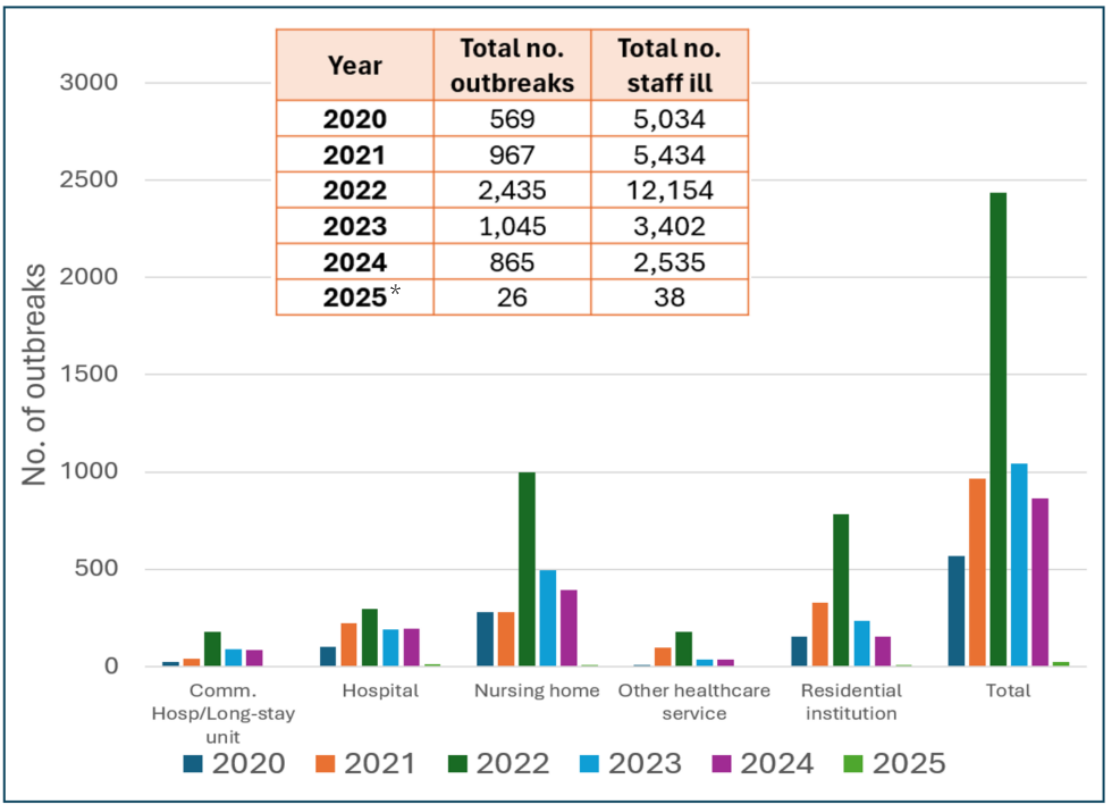
Figure 2. Weekly confirmed COVID-19 associated hospitalisations, ICU admissions and deaths Week 10 2020 to Week 13 2025. Source: HPSC Respiratory virus data hub.[2]



Health and care workers

Healthcare settings represent potentially high-exposure environments for COVID-19 due to high patient volume, close contact, vulnerable populations and shared indoor spaces. Since 2020, outbreaks of COVID-19 have occurred among health and care workers (HCWs), with the highest number of outbreaks, 2,435, occurring in 2022 in which 12,135 staff were recorded as ill. (Figure 3)[5] Regardless of the year, the highest number of outbreaks in healthcare settings which included infected HCWs occurred in nursing homes and residential institutions. Outbreaks also frequently occurred in hospital settings and to a lesser extent in community hospitals and long stay units and other healthcare services facilities. Although 865 outbreaks occurred in 2024, the number of HCWs who were ill during these outbreaks was the lowest per year since the beginning of the pandemic at 2,535.[5]

Figure 3. COVID-19 outbreaks in health and care workers by year and setting. No. of ill staff consists of staff at a service facility outbreak with positive test results reported (including PCR and antigen positive individuals). Source: HPSC.[5]



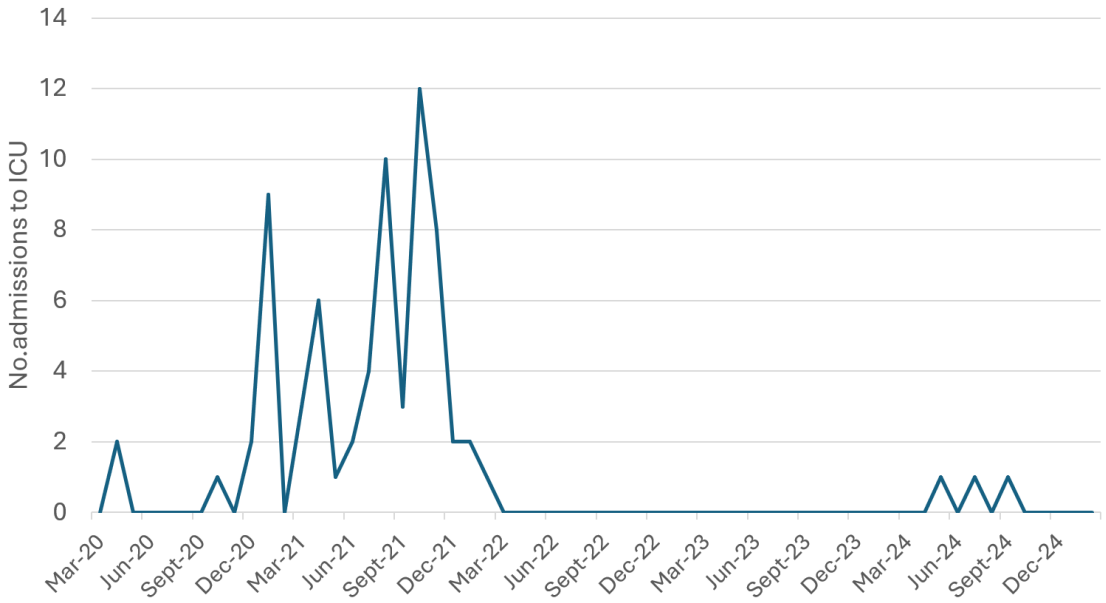
*Outbreaks in HCWs in 2025 include data up to end February 2025 only.

Pregnant women and infants

Pregnant women have experienced a higher risk of severe COVID-19 complications, including hospitalisation, intensive care unit (ICU) admission, and the need for mechanical ventilation compared to non-pregnant individuals.[6 7] This was particularly so in 2020 and 2021 during Alpha and Delta variant predominance and before the availability of COVID-19 vaccines. NIAC first recommended that pregnant women should be offered a COVID-19 vaccine between 14-36 weeks of pregnancy in April 2021. In August 2021 these recommendations were updated to remove the gestational age limits due to new safety and effectiveness evidence. The risk of severe complications for pregnant women including ICU admission has reduced significantly in the Omicron era since the beginning of 2022. (Figure 4) Between March 2020 and August 2021 there were 23 pregnant and 12 postpartum women admitted to ICU in Ireland.[8] Of these admissions, 61% of pregnant and 50% of postpartum women required invasive ventilation, and three required extracorporeal membrane oxygenation.[8] Overall mean length of stay was 13.3 days, and none of the women had received a vaccine. The average BMI of pregnant women admitted to ICU between March 2020 and August 2021 was 31 kg/m^2 and that of postpartum women was 35 kg/m^2.[8]

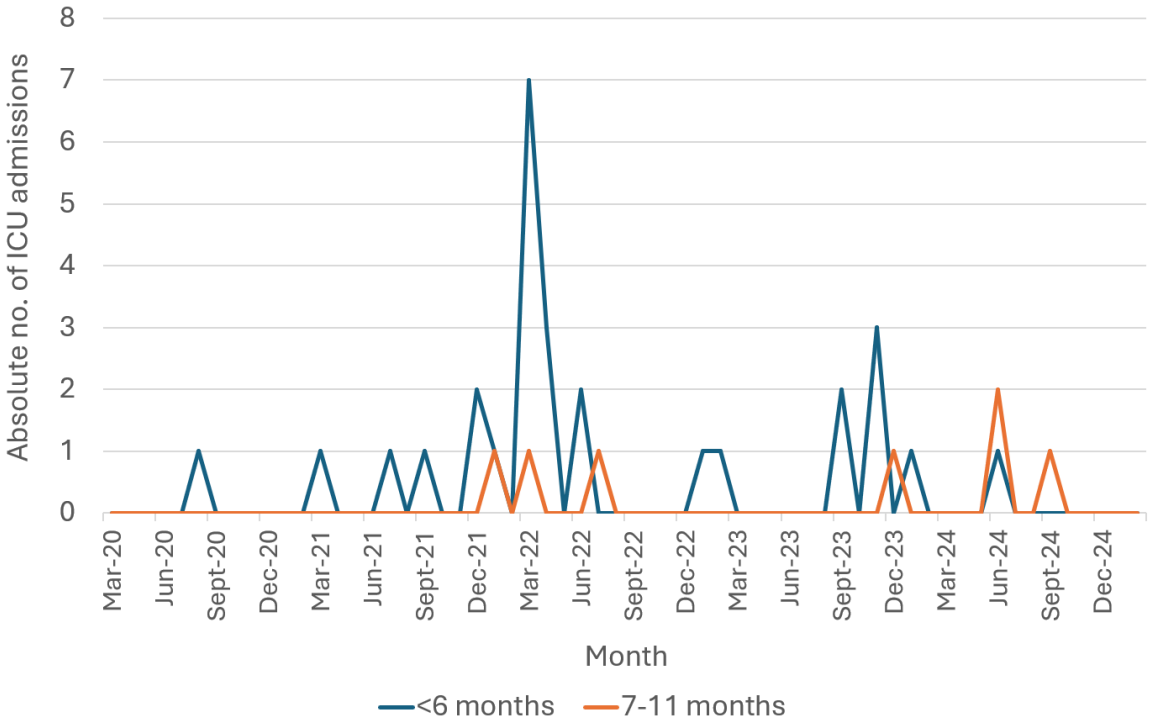
In contrast, in 2022 neither of the two pregnant women admitted to ICU with COVID-19 required mechanical ventilation[9] and in 2023 no pregnant or postpartum women were admitted to ICU due to COVID-19.[10] In 2024 two pregnant women and one postpartum woman were admitted to ICU due to COVID-19 with relatively short lengths of stay of three, two and one days, respectively. Of the three women admitted to ICU in 2024, none had underlying medical conditions, two had no record of vaccination, and one had a last documented vaccination >2.5 years prior to admission. None had a record of vaccination during pregnancy.[10]

Figure 4. ICU admissions due to COVID-19 in those pregnant and ≤6 months postpartum by month since 2020. Source: HPSC (Data extracted from CIDR March 3, 2025).[10]



Although COVID-19 hospitalisation rates in infants ≤6 months old have been relatively high at close to 800 per 100,000 population for the summer 2023, winter 2023/24 and summer 2024 COVID-19 waves (as shown in Figure 1), ICU admissions due to COVID-19 in this age group have been low since the end of 2022. (Figure 5)[11] In 2023 there were seven ICU admissions in infants aged <6 months old, they had a median length of stay of three days and one of these infants had at least one underlying medical condition. In 2024, there were a total of two infants aged <6 months old admitted to ICU due to COVID-19, both had underlying medical conditions. One had a length of stay of five days and the other had a length of stay of one day. There have been no ICU admissions in this age group due to COVID-19 in the first two months of 2025.[11]

Figure 5. ICU admissions due to COVID-19 in infants aged <6 months and 7-11 months old by month of ICU admission since 2020. Source: HPSC (Data extracted from CIDR March 3, 2025).[11]



SARS-CoV-2 associated serious adverse perinatal outcomes have reduced since the earlier waves of the pandemic. In 2021 in Ireland, one early neonatal death and nine stillbirths due to SARS-CoV-2 placentitis were reported.[12] There were no perinatal deaths due to SARS-CoV-2 placentitis in Ireland in 2022.[13] National perinatal clinical audit data are not yet available for 2023 and 2024, however no perinatal deaths due to SARS-CoV-2 placentitis were reported in 2023 annual reports from The National Maternity Hospital, The Coombe Hospital, and The Rotunda Hospital where collectively 40.6% of all babies born in Ireland in 2023 were delivered.[14-16]

UK Health Security Agency Surveillance Data

During the Omicron period (autumn 2022-spring 2024), COVID-19 associated hospital admissions in the UK in pregnancy were rare, with a rate of 120 per 100,000 in the third trimester among 532,567 pregnant individuals and only four severe cases (0.8 per 100,000) and with no ICU admissions or deaths. Over the same period, in 682,835 infants aged 0-2 months, COVID-19 associated hospitalisation rates were 479 per 100,000, with severe disease occurring in 17 per 100,000 and ICU admissions in 1 per 100,000 (eight infants in total). The mean length of stay of these infants was three days. While mean length of stay was longer in infants admitted with severe disease, such admissions were more likely in babies born prematurely. Of all deaths in infants 0-2 months old during the Omicron period (autumn 2022-spring 2024), SARS-CoV-2 was

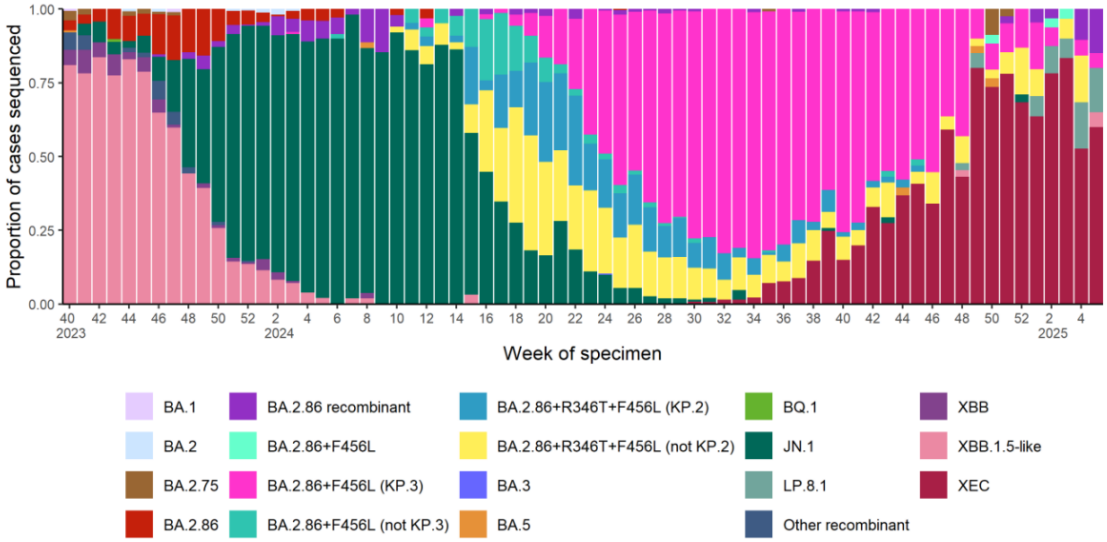
considered likely responsible or a contributory factor in fewer than five deaths and mainly in infants with serious and potentially life-limiting underlying conditions.[17]

Vaccine uptake in pregnancy was low (18% in 2022/23 and 15% in 2023/24), despite lower hospitalisation rates among vaccinated individuals. Hospitalisation rates in those who were pregnant were comparable to adults aged 60-74 years, rising to be comparable to adults aged 75-79 years in the third trimester. However, those who were pregnant had shorter lengths of stay that were similar to those who were not pregnant of the same age. Infant hospitalisation rates were similar to those in high-risk adults aged 60-70 years, but most stays were short.[17]

Variants

Since December 2023, JN.1 Omicron sublineages derived from BA.2 were the most prevalent in Ireland. Since week 35, 2024, the XEC variant (KS.1.1 and KP.3.3 recombinant, WHO variant under monitoring (VUM)) has steadily risen in prevalence in Ireland and globally. (Figure 6)[18] Other lineages, particularly LP.8.1 (a WHO VUM), are beginning to increase in prevalence, however with no indication of increased disease severity or immune escape reduced VE.[19]

Figure 6. SARS-CoV-2 whole genome sequencing results, specimen collection dates from week 40 2023 to week 5 2025, Ireland. Source: HPSC.[18]



Working group and Committee Considerations

COVID-19 continues to be an important public health problem. Advanced age remains the most important risk factor for severe COVID-19 infection. While COVID-19 hospitalisations start to increase at age 60 years, the steepest incline is seen from age 70 years. COVID-19 in health care settings is an important problem but it was noted the magnitude of cases among HCWs is now less certain due to decreased home testing.

Early in the pandemic, COVID-19 was an important problem in pregnant women, and the significant impact of an ICU admission on the mother-infant dyad and their family was emphasised in Committee discussions. Thankfully severe COVID-19 in pregnant women requiring ICU admission and perinatal complications such as placentitis are now rare. The importance of ongoing surveillance in pregnant women and the acknowledgement that SARS-CoV-2 is a relatively new virus, and epidemiology and risk could change again was highlighted.

DOMAIN 2: BENEFITS AND HARMS

SAFETY

The safety of COVID-19 vaccines was reviewed by NIAC in January 2025 as part of the Spring 2025 COVID-19 recommendations. Since that review no new safety signals have been reported.

Safety in pregnancy

There is a considerable body of evidence demonstrating the safety profile of COVID-19 vaccines in pregnancy including three systematic reviews. These reviews demonstrate no increased risk of adverse outcomes for mothers or infants following maternal vaccination with COVID-19 vaccines regardless of the trimester of vaccination.

A 2024 systematic review and meta-analysis conducted according to Cochrane guidelines including 177 studies with 638,791 participants (who mostly received mRNA vaccines), found minimal differences in maternal and infant outcomes in women vaccinated in pregnancy compared to unvaccinated individuals, aside from a reduction in lower segment caesarean section (LSCS) and stillbirth rates among vaccinated cohorts.[6] Similarly, a further 2024 systematic review analysed 67 studies with 1,813,947 participants and reported a reduction in LSCS (9%) and neonatal intensive care unit (NICU) admissions (8%), with no significant increase in adverse pregnancy or perinatal outcomes.[7]

Hameed (2023) reviewed 10 studies (n=326,499) and found no association between vaccination and adverse pregnancy outcomes, stillbirth, or neonatal complications.[20] A matched case-control study in England (n=514,013) reported no association of COVID-19 vaccination with stillbirth, neonatal death, or maternal venous thromboembolism (VTE).[21] In a further analysis of data from

276 stillbirths and 822 livebirths, no link between COVID-19 vaccination and stillbirth was found.[22] Across studies, findings consistently support the safety of COVID-19 vaccination in pregnancy.

EFFECTIVENESS

The effectiveness of COVID-19 mRNA vaccines was reviewed by NIAC in January 2025 as part of the Spring 2025 COVID-19 recommendations. New effectiveness evidence available for consideration as part of that review consisted primarily of studies focused on the XBB.1.5 antigenically updated vaccines administered in timeframes of XBB.1.5 and subsequently JN.1 and KP.2 predominance. These studies highlighted vaccine effectiveness (VE) against hospitalisation of 63-76% when vaccine and circulating variant were well matched and somewhat lower VE against hospitalisation of 43-52% due to variant mismatch with JN.1 and KP.2, two closely related variants.

Since this most recent NIAC review two new preprint studies examining the VE of the antigenically updated BNT162b2 KP.2 vaccine in winter 2024/25 have been completed. Both studies were test-negative case control studies. In one study VE in ≥65 year olds was estimated to be 75% (95% CI:49-88%) against hospitalisation, 56% (95% CI:44-66%) against emergency department (ED)/urgent care, and 58% (95% CI:36-73%) against outpatient visits in a predominantly male US veteran cohort with a higher prevalence of underlying conditions than the general population.[23] In the second study VE against moderate infection (defined as a pharmacy visit and positive test at walk-in clinics of a large US pharmacy chain) was reported as 57% (95% CI:41-68%) in 18-64 year olds and 24% (95% CI:2-44%) in those ≥65 years, with good variant matching.[24]

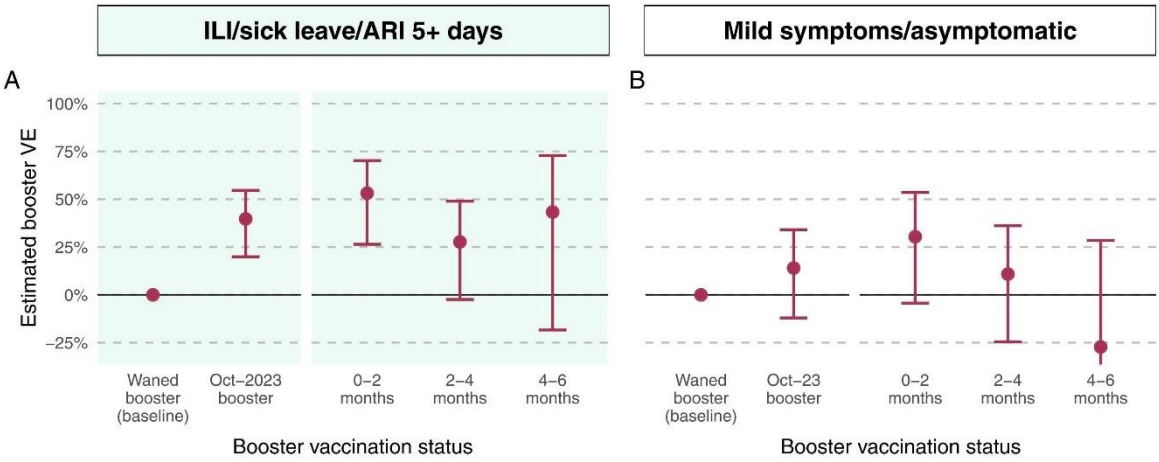
Health and care workers

Studies in health and care workers (HCWs) are typically focused on effectiveness of COVID-19 vaccines against infection and moderate illness as opposed to severe COVID-19. In four studies published in 2024 which were specifically studying VE in HCWs, across the full winter season which included periods of XBB and JN.1 predominance, VE against any infection ranged from 19 to 27.2%, VE against moderate or symptomatic infection ranged from 17 to 39.7% and VE against mild infection from 14 to 26%.[25-28] In two of the studies which focused on the 2023/24 winter season, sub-analyses were conducted for different parts of the season when different variants were dominant. VE estimates against any infection in HCWs were highest (42% and 49%) when XBB sublineages were the dominant circulating variants and well matched with that season's vaccine but reported to be very low or not statistically significant (19% and minus 11%) when JN.1 was the dominant circulating variant.[27 28] When the targeted variant and circulating variant are well matched as in the 2022/23 winter wave and VE estimates are higher, vaccination in HCWs may result in reduced absenteeism (aOR 0.42 95% CI: 0.21-0.83).[26]

As previously established, effectiveness against infection appears to wane quickly, within six months for mild infection, but may last longer against moderate infection, defined as an influenza-

like illness or >5 days sick leave. (Figure 7)[25] Protection against moderate infection from previous infection and vaccination has been found to be comparable in HCWs.[25]

Figure 7. VE results from UK SIREN study. Data collected from n=2867 HCWs fortnightly between Oct 2023 to March 2024. Source: Kirwan et al.[25]



Pregnancy

Although no clinical trials of COVID-19 vaccination in pregnant populations have been conducted many observational studies have been conducted and three systematic reviews on the effectiveness of COVID-19 vaccines in pregnancy have been published.[6 7 20] These studies estimate significant protection from COVID-19 vaccination against severe COVID-19 associated maternal and neonatal outcomes. All three studies report lower VE in the period of Omicron predominance compared to earlier Alpha and Delta eras. (Figure 8)[7] Study timeframes included in the systematic reviews extend up to mid-2022. The current evidence review did not identify any recent studies investigating the effectiveness of COVID-19 vaccinations in pregnancy.

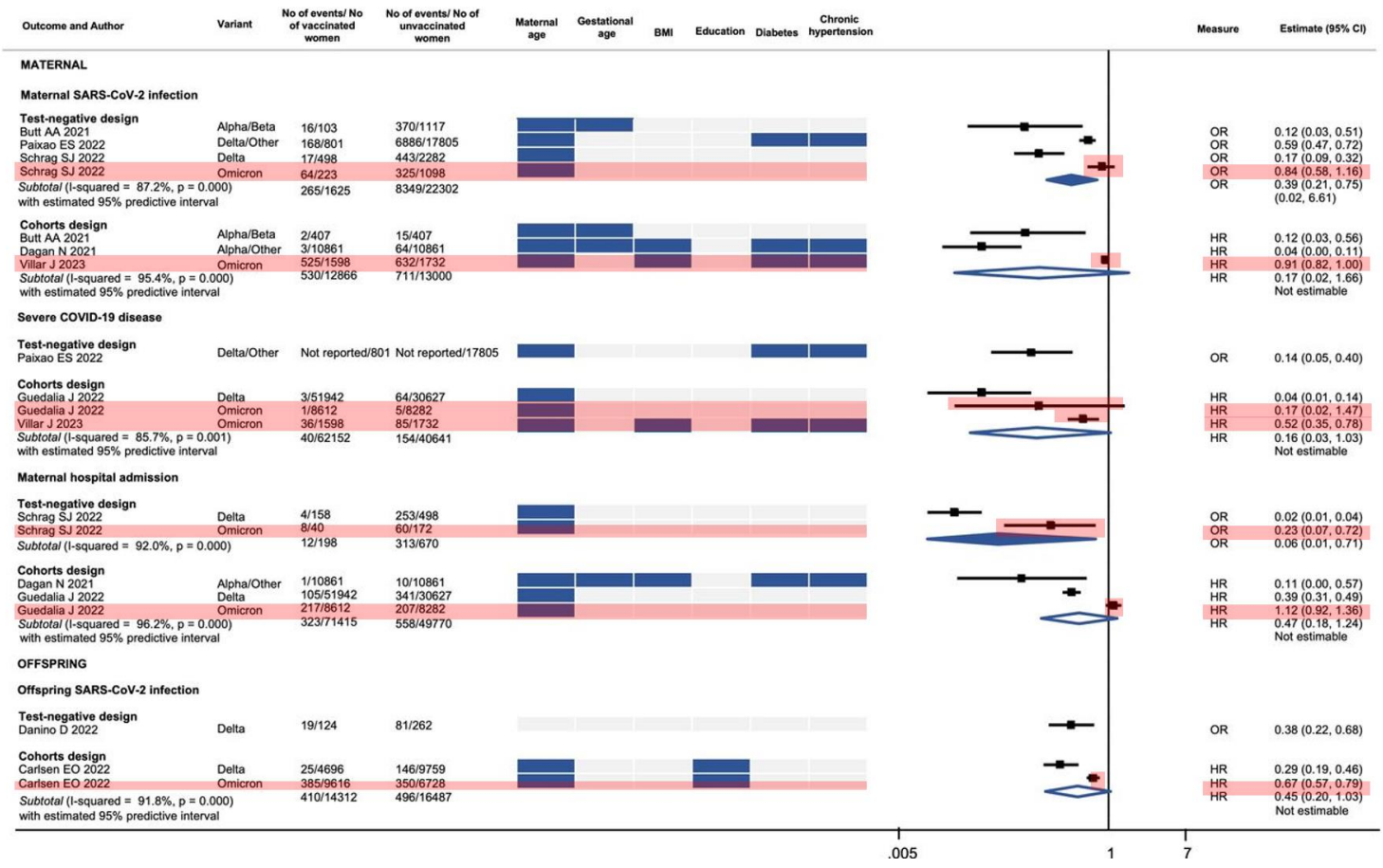
The most recent relevant study identified is a US COVID-19 Network, case-control study investigating protection of maternal COVID-19 vaccination against hospitalisation of infants <6 months old and a subset of infants <3 months old between March 2022 and May 2023.[29] Case-patients (infants hospitalised for COVID-19 outside of birth hospitalisation and who had a positive SARS-CoV-2 test result) and control patients (infants hospitalised for COVID-19-like illness with a negative SARS-CoV-2 test result) were compared. Vaccine effectiveness of maternal vaccination during pregnancy against COVID-19-related infant hospitalisation was estimated at 35% (95% CI: 15%-51%) among infants aged <6 months and 54% (95% CI: 32%-68%) among infants aged <3 months. Of case patients, 153 (21%) had at least one underlying condition and there was no significant difference in the presence and type of underlying conditions in the control group except for cardiac conditions which were present in 9% of the case group and 5% of the control group. In this study, the control group were defined as those who had never received a COVID-19 vaccination.[29]

With respect to earlier estimates of VE in pregnancy which include periods of Alpha, Delta and early Omicron predominance, a systematic review and meta-analysis including 67 studies with 1,813,947 women, reported that vaccinated pregnant women had a 61% reduction in the odds of SARS-CoV-2 infection during pregnancy (OR 0.39, 95% CI: 0.21-0.75) and a 94% reduction in the odds of hospital admission due to SARS-CoV-2 infection (OR 0.06, 95% CI: 0.01-0.71). Additionally, vaccination was associated with a 12% reduced risk of hypertensive disorders in pregnancy (RR 0.88, 95% CI: 0.82-0.92) and a 9% reduction in the odds of caesarean section (OR 0.91, 95% CI: 0.85-0.98). For infants, there was an 8% reduction in the risk of neonatal intensive care unit admission (RR 0.92, 95% CI: 0.87-0.97) among those born to vaccinated mothers.[7]

Studies included in the meta-analysis of this systematic review which specifically estimated VE during Omicron predominance are shaded in red in Figure 8. Vaccine effectiveness against maternal infection during Omicron was estimated at 16% (OR 0.84; 95% CI: 0.58-1.16) in one study and 9% (OR 0.91; 95% CI: 0.82-1.00) in another study within the meta-analysis. Vaccine effectiveness against severe COVID-19 infection during Omicron was estimated at 48% (OR 0.52; 95% CI: 0.35-0.78). Vaccine effectiveness against COVID-19 related maternal hospitalisation was estimated at 77% (OR 0.23; 95% CI: 0.07-0.72) and VE against offspring SARS-CoV-2 infection was estimated at 33% (OR 0.67; 95% CI: 0.57-0.79) during Omicron.[7]

Figure 8. Vaccine effectiveness for SARS-CoV-2 infection-related maternal and infant outcomes*. Source: Adapted from Systematic Review and Meta-analysis by Fernandez-Garcia et al, BMJ Global Health 2024.[7]

*Red highlights indicate results of studies from Omicron era.



A 2024 living systematic review and meta-analysis also covering periods of Alpha, Delta and early Omicron predominance including 177 studies involving 638,791 participants was identified. Significant protection for mothers against severe COVID-19 infection or COVID-19 associated hospitalisation (72%; 95% CI: 42-86), symptomatic COVID-19 infection (78%; 95% CI: 21-94), and virologically confirmed SARS-CoV-2 infection (82%; 95% CI: 39-95) from vaccination was estimated. For infants, there was a notable reduction in severe cases or hospitalisations due to COVID-19 infection (64%; 95% CI: 37-80) and laboratory-confirmed SARS-CoV-2 infection (66%; 95% CI: 37-81). The study also observed that VE was lower with non-mRNA vaccines compared to other vaccine types.[6]

The analysis of a further 2023 systematic review also covering periods of Alpha, Delta and early Omicron predominance including 10 observational studies comprising 326,499 pregnant women estimated that COVID-19 vaccination effectively prevented maternal infection (OR 0.56, 95% CI: 0.47-0.67) and related hospitalisations (OR 0.50, 95% CI: 0.31-0.82). Vaccination was also found to be protective against neonatal ICU admissions (OR 0.85; 95% CI: 0.81-0.90).[20]

Working Group and Committee Considerations

COVID-19 vaccines are safe. Following review of the data presented above, there were no concerns regarding safety in the general population, HCWs or pregnant women. COVID-19 vaccines are effective at preventing hospitalisation and severe disease but are less effective at preventing symptomatic infection and transmission. Effect on symptomatic infection wanes quickly and is further reduced by strain mismatch. Depending on these factors, the vaccine may at times have a modest effect on transmission and mild infection, and at other times have low or no effect. Due to the nature in which SARS-CoV-2 virus mutates and the lack of predicted seasonality there is potential for both significant waning and strain mismatch between time of vaccine receipt by a HCW and the next COVID-19 peak. Thus, the impact of vaccinating HCWs once per year on symptomatic infection, absenteeism and transmission to patients is uncertain. The Committee discussed that removing a recommendation for all HCWs could be premature, given that SARS-CoV-2 is a relatively new virus and that HCWs care for those at most risk of severe infection. The landscape for vaccines may change with the introduction of combination COVID-19 and influenza vaccines. However, most Committee members felt that given the variable effect on transmission and absenteeism, there was insufficient evidence to suggest that there is a large benefit from providing COVID-19 vaccination to all HCWs. It was highlighted that COVID-19 vaccines are effective at preventing against severe disease, thus any HCW who is at increased risk of severe disease should receive COVID-19 vaccine(s) once or twice yearly as recommended according to their risk factor.

Regarding pregnant women, it was noted that severe disease is now rare, and while hospitalisation rates in infants under six months of age remain high, ICU admissions in this age group are low. However, it was highlighted that there are subgroups of pregnant adolescents and adults who would benefit from the vaccine, for example those with additional known risk factors for severe COVID-19 infection (e.g., obesity and diabetes) or those with high-risk pregnancies. It was also noted that there may be infants who would benefit more than others from maternal COVID-19 vaccination, for example those with an antenatal diagnosis of congenital heart or lung disease.

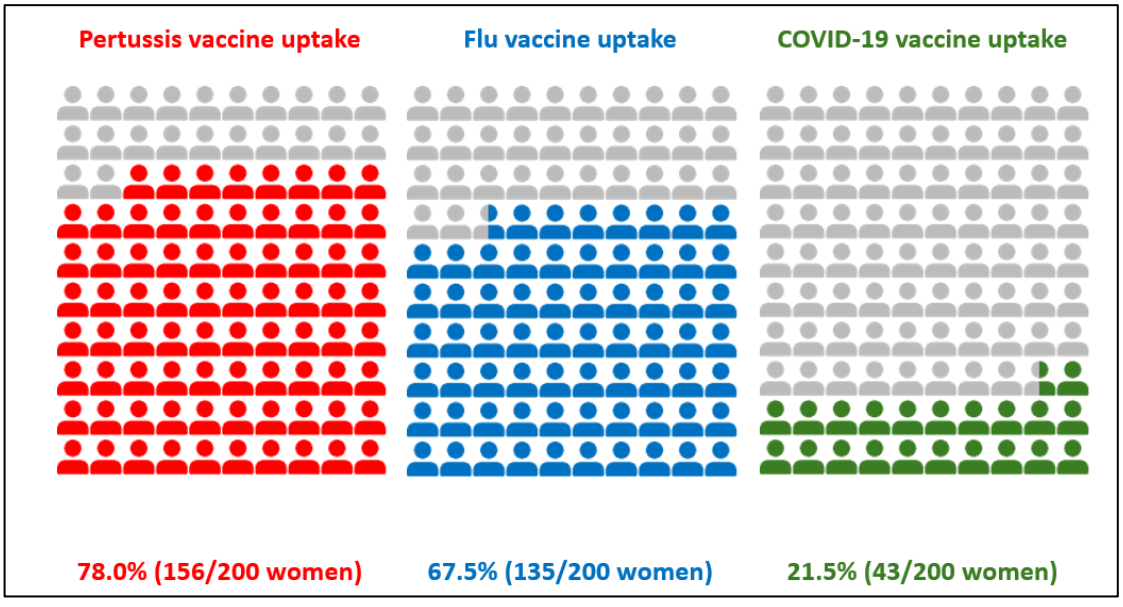
DOMAINS 3 AND 4: VALUES, PREFERENCES AND ACCEPTABILITY

Uptake of COVID-19 vaccination

The uptake of COVID-19 booster vaccination consistently increases with advancing age. As of 23 February 2025, the uptake of boosters in the winter 2024/2025 campaign was 27.7% in those aged 60-69 years, 46.9% in those aged 70-79 years, and 61.5% in those aged 80 years and above. Uptake among long term care residents was reported to be 63%, and uptake among those who are immunocompromised was 44.5%. HCWs had an overall uptake of 9.1%, again this increased with increasing age with the highest uptake in HCWs aged 50-59 years.[30]

The uptake of COVID-19 boosters in pregnant woman as of 23 February 2025 was reported by the HPSC to be 6.3%. It was also noted that the majority (57.6%) of vaccinated pregnant women were aged 30-39 years, and 91.6% were vaccinated in pharmacies. A limitation of these data is the potential for inaccurate reporting of pregnancy status on the COVAX system.[30] Preliminary data from a point prevalence study carried out in the Rotunda Hospital in Dublin over eight non-consecutive days between December 2024 and January 2025 were presented directly to NIAC. Data were collected from 200 of the 461 obstetric patients eligible for inclusion in the study. Of respondents, 21.5% (43/200) had received a COVID-19 vaccination during pregnancy, compared to 78% (156/200) who had received a pertussis vaccine and 67.5% (135/200) who had received an influenza vaccine. (Figure 9)[31]

Figure 9. Uptake of Pertussis, Flu and COVID-19 vaccination during pregnancy in a sample of 200 postnatal obstetric patients in the Rotunda Hospital, Dec 2024 to Jan 2025. Source: Provided directly to NIAC by Croke et al.[31]



Values and preferences

A survey conducted in Ireland in September 2023 assessed health and care workers' (HCWs) attitudes toward COVID-19 and influenza vaccination. Distributed via Public Health, HSE Dublin and North-East, the survey received 595 responses, with 46% of respondents based in acute hospitals and 40% in long term care facilities.[32]

The findings indicate that 90% of respondents felt COVID-19 vaccination was considered important in their workplace, while 43% believed it should be mandatory for HSE staff. Just over half (52%) were not in favour of co-administering COVID-19 and influenza vaccines. Concerns about vaccine safety were also evident, with 42% worried about side effects and 32% fearing that vaccination would make them unwell. Despite these concerns, 61% of respondents supported annual COVID-19 vaccination for HCWs.[32]

While these results suggest a generally positive attitude toward COVID-19 vaccination among Irish HCWs, it is important to acknowledge potential limitations of this survey. A response rate was not reported, making it difficult to assess response bias. Additionally, attitudes expressed in September 2023 may have shifted over time due to the evolving nature of the COVID-19 pandemic.

There were no recent publications of studies assessing values or preferences of pregnant women about the COVID-19 vaccination in Ireland.

Working Group and Committee Considerations

Uptake among pregnant women and HCWs has fallen and continues to decrease. The limitations of the national uptake data in pregnancy and discrepancies with these data and uptake rates in a recent point prevalence study conducted in the Rotunda Hospital were highlighted. There is concern that overcrowding the maternal vaccine schedule may impact uptake of other important vaccines recommended in pregnancy such as influenza and pertussis. Similarly, concerns were raised that attitudes towards COVID-19 vaccines may be negatively impacting uptake rates of influenza vaccine among HCWs particularly due to the emphasis placed on co-administration.

DOMAINS 5 AND 6: RESOURCE USE AND FEASIBILITY

Working Group and Committee Considerations

To date, there has been no formal evaluation of cost effectiveness of COVID-19 vaccination strategies in Ireland. The COVID-19 vaccine programme has important resource implications, and

these were considered in discussions by the Committee. In particular, the diversion of resources such as vaccinators from other immunisation programmes, such as the Schools Immunisation Programme, to deliver the COVID-19 programme each year was highlighted.

The feasibility of providing year-round availability of vaccines was also discussed. This is challenging due to the short shelf life of the currently available vaccines. It was highlighted that most eligible patients should be vaccinated during designated campaigns where feasible.

Continuing to align age and risk factor based recommendations with the funded influenza programme, where clinically appropriate was thought to improve the feasibility of the programme by facilitating simple and clear messaging and improved uptake.

DOMAIN 7: EQUITY

Working Group and Committee Considerations

Whether a particular recommendation will impact health equities and any additional ethical aspects of proposed advice are considered by NIAC as part of the Committee's deliberations. It was highlighted that risk-based recommendations can increase health inequities, as co-morbidities may be under diagnosed or under recognised in more vulnerable populations who have more barriers accessing health care and health information. This was taken into consideration both when discussing the change in recommendations in pregnancy and in discussions around age cut-offs for annual vaccination in older adults. Given that the steepest increase in COVID-19 related hospitalisations occurs in those aged ≥70 years, moving the age based recommendation for yearly vaccination from 60 to 70 years was discussed by NIAC, but it was highlighted that relying only on a comorbidity-based recommendation in those aged 60-70 years could increase health inequities as more vulnerable populations may have yet unrecognised comorbidities due to multifactorial barriers to accessing healthcare, including language barriers. In regards to pregnancy, moving towards a shared decision making model based on risk could increase health inequities for similar reasons. Finally, regardless of the strength of the vaccine recommendation, based on ethical principles COVID-19 vaccine should be available to all HCWs who choose to receive it.

5. INTERNATIONAL POSITIONS

Table 1: International recommendations for COVID-19 vaccination as of 24 March 2025.

Country	Vaccination of Health and Care Workers (HCW)	Vaccination in Pregnancy	Inclusion for autumn or annual vaccination
WHO, (SAGE)[33]	**Recommended** for HCWs annually	**Recommended** one dose each pregnancy	Recommended for adults aged over 50/60 years and adults with comorbidities
Germany, (STIKO)[34]	**Recommended** for HCWs	No longer recommended if already vaccinated	**Recommended** for those aged ≥60 years, those aged ≥6 months with underlying high risk medical conditions or those who are immunocompromised, and LTC residents
UK, (JCVI)[35]	HCWs not included in recommendations	No longer recommended	**Recommended** for those aged ≥75, older adult LTC residents, and those aged ≥6 months with immunosuppression
Australia, (ATAGI)[36]	HCWs not included in recommendations	Recommended in unvaccinated pregnant women. No longer recommended in those previously vaccinated, however it is available based on an individual risk-benefit assessment."	**Recommended** for those aged ≥65, and those aged ≥18 with severe immunocompromise **Consider** in those aged ≥18 with a risk-benefit assessment, and in immunocompromised aged 5-17 years
Canada, (NACI)[37]	**Recommended** for HCWs annually	**Recommended**	**Recommended** for those aged ≥6 months who are: LTC residents, underlying medical conditions, first nations, Inuit and Metis communities, and all those aged ≥65 One dose per year **may be given** to all others aged ≥6 months
USA, (ACIP, (CDC))[38]	HCWs not included in recommendations. However, vaccination **recommended for all** aged 6 months and above	**Recommended**	One dose of a 2024-2025 vaccine is **recommended** for everyone aged ≥6 months

LTC: Long term care residents

HCW: Health and care worker

6. CONSIDERATIONS FOR THE LONG-TERM SCOPE OF THE COVID-19 VACCINE PROGRAMME

At the request of the Chief Medical Officer, NIAC discussed the scope of the COVID-19 vaccine programme going forward, the key points discussed are summarised in this section.

Much has been learned about SARS-CoV-2 and COVID-19 since the onset of the pandemic in 2020 but it is still a relatively new virus and new information continues to emerge. Thankfully, due to protection provided by vaccination and natural infection and changes in the virulence of the virus there are now fewer COVID-19 related hospitalisations, ICU admissions and deaths. However, certain vulnerable groups continue to face severe outcomes from SARS-CoV-2 infection, with advanced age remaining the most important risk factor for severe COVID-19 infection.

Since the onset of the pandemic in 2020, NIAC has issued interim date stamped recommendations, with the Committee reviewing and updating recommendations very frequently initially and subsequently moving to at least twice each year. These frequent reviews were necessary in response to a new virus and new vaccines. However, with the move to an endemic phase it is time to move towards standing recommendations that can facilitate the planning of the COVID-19 vaccination programme in Ireland going forward and its integration within established vaccination programmes. This approach has been reflected internationally. In 2022, STIKO in Germany became the first National Immunisation Technical Advisory Group in the European Union to integrate COVID-19 vaccination into their standing recommendations. More recently Australia has moved away from date stamped recommendations and both Canada and the UK have issued recommendations covering an 18 month period instead of a previous 6-12 month period.

The aim of the COVID-19 vaccine programme going forward should be to offer year-round protection against severe disease in those populations that are at increased risk of hospitalisation, ICU admissions and death from COVID-19 infection. To achieve this aim, vaccination once per year is recommended for most at-risk individuals, but for those in whom immunity wanes more quickly, twice-yearly vaccination is required. These recommendations for once-yearly and twice-yearly vaccination will likely continue unless a new vaccine with improved duration of protection emerges or SARS-CoV-2 begins to demonstrate a seasonal pattern. While it is clear that advanced age is the leading risk factor for severe COVID-19 infection, the optimal precise age cut offs for yearly and twice-yearly vaccine recommendations are less certain and NIAC will continue to review surveillance data each year and adjust recommendations if needed. Thus far there has not been a formal evaluation of cost effectiveness of COVID-19 vaccination in different age cohorts in Ireland.

Lack of seasonality is an important consideration for the COVID-19 vaccine programme. Defined campaigns in autumn and spring likely facilitate improved uptake, and timing campaigns in autumn will provide protection against hospitalisations during the busy winter respiratory virus season when other serious respiratory viruses such as respiratory syncytial virus (RSV) and influenza are also circulating at high levels in the population. However, it is notable that this year, there was no winter peak of SARS-CoV-2. It is important that seasonality continues to be monitored, and timing of campaigns adjusted if clear patterns emerge. The lack of a predictable seasonal pattern also highlights the importance of year-round availability of the vaccines for vulnerable people who, for clinical reasons, require a vaccine outside of the seasonal campaigns, for example pregnant women with additional risk factors, or patients starting a period of immunosuppression. The need for year-round availability of vaccines should be considered in any long-term planning for the COVID-19 vaccination programme in Ireland.

Finally, NIAC has a horizon scanning function and will continue to review emerging evidence on COVID-19 vaccines and update recommendations as needed. There are new vaccines in development including next generation mRNA vaccines and combination influenza and COVID-19 vaccines.

7. CONCLUSION

The landscape of COVID-19 continues to evolve. Due to changes in the virulence of the virus, and protection provided by vaccination and natural infection there are now fewer COVID-19 related hospitalisations, ICU admissions, and deaths. However, despite this positive trend, certain vulnerable groups continue to face severe outcomes from COVID-19. COVID-19 vaccines continue to be safe and are effective at preventing severe disease and hospitalisation. As SARS-CoV-2 has not yet demonstrated seasonality, the aim of the COVID-19 vaccination programme should be to provide year-round protection for those at risk of COVID-19 related hospitalisation, severe disease, and death. NIAC recommends twice yearly vaccination for all those aged 80 years and above, those aged 18-79 years living in long term care facilities for older adults, and those aged 6 months and older with immunocompromise associated with a suboptimal response to vaccination. NIAC recommends yearly vaccination for all those aged 60-79 years and those aged 6 months-59 years with medical conditions associated with a higher risk of COVID-19 hospitalisation, severe disease, or death. The vaccine should also be available annually for all HCWs, for pregnant adolescents and adults, and for adults aged 18-59 years, who do not fall into the above risk groups and who following discussion with their healthcare provider, request vaccination. Availability of the vaccine outside of defined seasonal programmes remains important. NIAC is making standing recommendations to support longer term COVID-19 immunisation planning as the virus enters a more stable endemic phase. However, SARS-CoV-2 continues to evolve and new vaccines are on the horizon. NIAC will continue to review emerging

evidence related to SARS-CoV-2 and COVID-19 vaccines, and update these recommendations as needed.

ACKNOWLEDGEMENTS

NIAC would like to thank all the individuals and organisations who provided data, time, advice and information in support of this work.

REFERENCES

1. Health Protection Surveillance Centre: COVID-19 hospitalisation rates by age Summer 2023, Summer 2024 and Winter 2023/24. Data provided directly to NIAC from the HPSC, 2025.
2. Health Protection Surveillance Centre (HPSC): Respiratory virus notification data hub 2025 [Available from: https://respiratoryvirus.hpsc.ie/ accessed April 2025.
3. Health Protection Surveillance Centre: COVID-19 associated ICU admissions summer 2023, summer 2024 and winter 2023/24. Data provided directly to NIAC from HPSC, 2025.
4. Health Protection Surveillance Centre (HPSC): Integrated Respiratory Virus Bulletin Week 13 2025: Health Protection Surveillance Centre (HPSC); 2025 [Available from: https://www.hpsc.ie/a-z/respiratory/acuterespiratoryinfection/surveillance/integratedreports/ accessed April 2025.
5. Health Protection Surveillance Centre (HPSC): COVID-19 outbreaks in health and care workers by year and setting, 2025.
6. Ciapponi A, Berrueta M, Argento FJ, et al. Safety and Effectiveness of COVID-19 Vaccines During Pregnancy: A Living Systematic Review and Meta-analysis. *Drug Safety* 2024;47(10):991-1010. doi: 10.1007/s40264-024-01458-w
7. Fernández-García S, Laura del C-A, Dharshini S, et al. Effectiveness and safety of COVID-19 vaccines on maternal and perinatal outcomes: a systematic review and meta-analysis. *BMJ Global Health* 2024;9(4):e014247. doi: 10.1136/bmjgh-2023-014247
8. National Office of Clinical Audit (NOCA): Report on ICU activity during COVID-19 pandemic 2021 [Available from: https://www.noca.ie/documents/noca-report-on-icu-activity-during-covid-19-pandemic/ accessed April 2025.
9. National Perinatal Epidemiology Centre (NPEC): Severe Maternal Morbidity Annual Report 2022 2024 [Available from: https://www.ucc.ie/en/npec/clinical-audits/severematernalmorbiditynationalaudit/ accessed April 2025.
10. Health Protection Surveillance Centre (HPSC): COVID-19 associated outcomes in those pregnant and postpartum. Data provided directly to NIAC from HPSC, 2025.

11. Health Protection Surveillance Centre (HPSC): COVID-19 associated outcomes in infants <12 months old. Data provided directly to NIAC from HPSC, 2025.

12. National Perinatal Epidemiology Centre (NPEC): Perinatal Mortality National Clincal Audit in Ireland Annual Report 2021 2023 [Available from: https://www.ucc.ie/en/npec/clinical-audits/perinatalmortalitynationalclinicalaudit/ accessed April 2025.

13. National Perinatal Epidemiology Centre (NPEC): Perinatal Mortality National Clincal Audit in Ireland Annual Report 2022 2024 [Available from: https://www.ucc.ie/en/npec/clinical-audits/perinatalmortalitynationalclinicalaudit/ accessed April 2025.

14. The National Maternity Hospital Annual Report 2023 The National Maternity Hospital2024 [Available from: http://www.nmh.ie/news/the-national-maternity-hospital-annual-report-2023.21211.html accessed April 2025.

15. The Rotunda Hospital Annual Report 2023 The Rotunda Hospital Dublin2024 [Available from: https://rotunda.ie/rotunda-hospital-annual-report-2023/ accessed April 2025.

16. The Coombe Hospital Annual Report The Coombe Hospital Dublin2024 [Available from: https://www.coombe.ie/annual-report accessed April 2025.

17. UK Health Security Agency (HSA): COVID-19 vaccine surveillance report November 2024 2024 [Available from: https://www.gov.uk/government/publications/covid-19-vaccine-weekly-surveillance-reports accessed April 2025.

18. Health Protection Surveillance Centre (HPSC): COVID-19 virus variant report up to week 5 2025 2025 [accessed April 2025.

19. World Health Organisation (WHO): Risk evaluation for SARS-CoV-2 Variant Under Monitoring: LP.8.1 2025 [accessed April 2025.

20. Hameed I, Khan MO, Nusrat K, et al. Is it safe and effective to administer COVID-19 vaccines during pregnancy? A systematic review and meta-analysis. *American Journal of Infection Control* 2023;51(5):582-93. doi: https://doi.org/10.1016/j.ajic.2022.08.014

21. Mensah Anna A, Stowe J, Jardine Jennifer E, et al. COVID-19 Vaccine Safety in Pregnancy, A Nested Case–Control Study in Births From April 2021 to March 2022, England. *BJOG: An International Journal of Obstetrics & Gynaecology* 2024;131(13):1882-93. doi: https://doi.org/10.1111/1471-0528.17949

22. Denoble AE, Vazquez-Benitez G, Sheth SS, et al. Coronavirus Disease 2019 (COVID-19) Vaccination and Stillbirth in the Vaccine Safety Datalink. *Obstetrics & Gynecology* 2024;144(2):215-22. doi: 10.1097/aog.0000000000005632

23. Appaneal HJ, Lopes VV, Puzniak L, et al. Early effectiveness of the BNT162b2 KP.2 vaccine against COVID-19 in the US Veterans Affairs Healthcare System. *medRxiv* 2024:2024.12.26.24319566. doi: 10.1101/2024.12.26.24319566

24. Rudolph AE, Khan FL, Sun X, et al. Receipt of BNT162b2 KP.2 Vaccine and COVID-19 CVS MinuteClinic Visits in US Adults. *medRxiv* 2025:2025.01.15.24319342. doi: 10.1101/2025.01.15.24319342

25. Kirwan PD, Foulkes S, Munro K, et al. Protection of vaccine boosters and prior infection against mild/asymptomatic and moderate COVID-19 infection in the UK SIREN

healthcare worker cohort: October 2023 to March 2024. *Journal of Infection* 2024;89(5):106293. doi: https://doi.org/10.1016/j.jinf.2024.106293

26. Maltezou HC, Gamaletsou MN, Giannouchos TV, et al. Effectiveness of COVID-19 booster vaccination, morbidity and absenteeism among healthcare personnel during the 2022–2023 season dominated by Omicron BA.5 and BA.2 subvariants. *Vaccine* 2024;42(17):3693-98. doi: https://doi.org/10.1016/j.vaccine.2024.04.083

27. Savulescu C, Prats-Uribe A, Brolin K, et al. Effectiveness of the autumn 2023 COVID-19 vaccine dose in hospital-based healthcare workers: results of the VEBIS healthcare worker vaccine effectiveness cohort study, seven European countries, season 2023/24. *Eurosurveillance* 2024;29(44):2400680.

28. Shrestha NK, Burke PC, Nowacki AS, et al. Effectiveness of the 2023–2024 Formulation of the COVID-19 Messenger RNA Vaccine. *Clinical Infectious Diseases* 2024;79(2):405-11. doi: 10.1093/cid/ciae132

29. Simeone RM, Zambrano LD, Halasa NB, et al. Effectiveness of Maternal mRNA COVID-19 Vaccination During Pregnancy Against COVID-19-Associated Hospitalizations in Infants Aged <6 Months During SARS-CoV-2 Omicron Predominance - 20 States, March 9, 2022-May 31, 2023. *MMWR Morb Mortal Wkly Rep* 2023;72(39):1057-64. doi: 10.15585/mmwr.mm7239a3 [published Online First: 2023/10/24]

30. Health Protection Surveillance Centre (HPSC): COVID-19 vaccination uptake data 2025. Data provided directly to NIAC from HPSC, 2025.

31. Croke ED, Joan; Cleary, Brian. Vaccination uptake in pregnancy in women attending the Rotunda Hospital: results of a point prevalence study. Unpublished data provided directly to NIAC: Irish Medicines Pregnancy Service. The Rotunda Hospital 2025.

32. Quintyne KI, Reilly C, Carpenter C, et al. Attitudes towards COVID-19 and influenza vaccination in healthcare workers. *Ir Med J* 2024;117(7):992. [published Online First: 2024/08/26]

33. World Heatlh Organisation (WHO): Interim recommendations for the use of mRNA

COVID-19 vaccines 2023 [Available from: https://iris.who.int/bitstream/handle/10665/371402/WHO-2019-nCoV-vaccines-SAGE-recommendation-mRNA-2023.1-eng.pdf?sequence=1 accessed April 2025.

34. Robert Koch Institute, STIKO: Epidemiologisches Bulletin 23 Februar 2023 2023 [Available from: https://www.rki.de/DE/Aktuelles/Publikationen/Epidemiologisches-Bulletin/2023/08_23.pdf?__blob=publicationFile&v=3 accessed April 2025.

35. UK Government, Department of Health & Social Care: JCVI Statement on COVID-19 vaccination in 2025 and spring 2026 2024 [Available from: https://www.gov.uk/government/publications/covid-19-vaccination-in-2025-and-spring-2026-jcvi-advice/jcvi-statement-on-covid-19-vaccination-in-2025-and-spring-2026 accessed April 2025.

36. Australian Government, Department of Health and Aged Care: COVID-19 Chapter Australian Immunisation Handbook Australian Government Department of Health and Aged Care2024 [Available from:

https://immunisationhandbook.health.gov.au/contents/vaccine-preventable-diseases/covid-19#recommendations accessed April 2025.

37. National Advisory Committee on Immunisation (NACI) Government of Canada: Summary of NACI statement of January 10, 2025: Guidance on the use of COVID-19 vaccines for 2025 to summer 2026 2025 [Available from: https://www.canada.ca/en/public-health/services/publications/vaccines-immunization/national-advisory-committee-immunization-summary-guidance-covid-19-vaccines-2025-summer-2026.html accessed April 2025.

38. Centre for Disease Control (CDC) United States Government: Interim Clinical Considerations for Use of COVID-19 Vaccines in the United States 2024 [Available from: https://www.cdc.gov/vaccines/covid-19/clinical-considerations/interim-considerations-us.html accessed April 2025.