Background

This interim guidance has been developed on the basis of the advice issued by the Strategic Advisory Group of Experts (SAGE) on Immunization at various extraordinary meetings since January 2021 (Strategic Advisory Group of Experts on Immunization (who.int)).

Declarations of interests were collected from all external contributors and assessed for any conflicts of interest before each meeting. Summaries of the reported interests can be found on the SAGE meeting website and SAGE Working Group website.

The guidance should be considered along with the broader COVID-19 policy advice to WHO Member States and in particular the advice on how to reach the COVID-19 vaccination targets.

These interim recommendations on the protein subunit vaccine platform for COVID-19 vaccines¹ summarize previous interim recommendations for protein subunit COVID-19 vaccines (Table 1).

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¹ The recommendations contained in this publication are based on the advice of independent experts, who have considered the best available evidence, a risk–benefit analysis and other factors, as appropriate. This publication may include recommendations on the use of medicinal products for an indication, in a dosage form, dose regimen, population or other use parameters that are not included in the approved labelling. Relevant stakeholders should familiarize themselves with applicable national legal and ethical requirements. WHO does not accept any liability for the procurement, distribution and/or administration of any product for any use.
Table 1. **Description of the current protein subunit COVID-19 vaccines**

<table>
<thead>
<tr>
<th>Vaccine name</th>
<th>Manufacturer</th>
<th>Composition</th>
<th>Regulatory authority</th>
<th>Intended use (age range)</th>
<th>Administration</th>
<th>Precautions</th>
<th>References</th>
</tr>
</thead>
</table>
| NVX-CoV2373 Nuvaxovid | Novavax       | • Recombinant SARS-CoV-2 spike protein nanoparticle  
• Adjuvant Matrix-M<sup>c</sup> | EUL                 | ≥18 yrs                  | 2 doses | 4 weeks  
Myocarditis and pericarditis are very rare adverse events that have been reported after receipt of NVX-CoV2373. Additionally, a few cases of paraesthesia and hypoesthesia have also been reported after receipt of NVX-CoV2373. Continued monitoring and surveillance of these conditions with the use of NVX-CoV2373 vaccine is recommended. | [Annexes to the interim recommendations for use of the Novavax NVX-CoV2373 vaccine against COVID-19 (who.int)]  
[Background document on the Novavax NVX-CoV2373 vaccine against COVID-19 (who.int)] |
| Corbevax (BECOV-2, CorbeVax, CORBEVAX) | Biological E Limited | • Recombinant protein SARS-CoV-2 receptor-binding domain(RBD)-based subunit  
• Aluminium hydroxide | EUL                 | ≥5 yrs                   | 2 doses | 4 weeks  | –                                                                                                                                                                                                      | –                                                                 |
Interim recommendations for the use of protein subunit COVID-19 vaccines

<table>
<thead>
<tr>
<th>Vaccine name</th>
<th>Manufacturer</th>
<th>Composition</th>
<th>Regulatory authority</th>
<th>Intended use (age range)</th>
<th>Administration</th>
<th>Precautions</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKY Cvone Bioscience GBP510</td>
<td>SK bioscience</td>
<td>• Toll-like receptor 9 (TLR9) agonist, cytosine phospho-guanine (CpG 1018) • Recombinant protein SARS-CoV-2 receptor-binding domain(RBD)-based subunit • AS03 adjuvant&lt;sup&gt;d&lt;/sup&gt;</td>
<td>EUL and SRA</td>
<td>≥18 yrs</td>
<td>2 doses</td>
<td>4 weeks</td>
<td>–</td>
</tr>
<tr>
<td>BIMERV AX</td>
<td>HIPRA Human Health S.L.U.</td>
<td>• Recombinant spike (S) protein SARS-CoV-2 receptor-binding domain (RBD) fusion heterodimer&lt;sup&gt;e&lt;/sup&gt; • SQBA adjuvant&lt;sup&gt;f&lt;/sup&gt;</td>
<td>SRA</td>
<td>≥16 yrs</td>
<td>One dose only for booster at least 4 months after vaccination with mRNA and viral vector COVID-19 vaccines. This vaccine was not tested for primary series vaccination</td>
<td>n/a</td>
<td>–</td>
</tr>
<tr>
<td>Vaccine name</td>
<td>Manufacturer</td>
<td>Composition</td>
<td>Regulatory authority&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Intended use (age range)</td>
<td>Administration</td>
<td>Precautions</td>
<td>References</td>
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<tr>
<td>VidPrevy n Beta CoV2 preS dTM- AS03 (strain B.1.351)</td>
<td>Sanofi-GSK</td>
<td>• Recombinant spike (S) protein SARS-CoV-2 receptor-binding domain (RBD) based subunit • AS03 adjuvant&lt;sup&gt;g&lt;/sup&gt;</td>
<td>SRA</td>
<td>≥18 yrs</td>
<td>Only for use as booster at least 4 months after vaccination with mRNA and viral vector COVID-19 vaccines</td>
<td>n/a</td>
<td>–</td>
</tr>
</tbody>
</table>

<sup>a</sup> Some of the manufacturers listed in the table may be updating the antigen composition of their COVID-19 vaccines to include the most recent SARS-CoV-2 variants (see: Statement on the antigen composition of COVID-19 vaccines (who.int)).

<sup>b</sup> EUL: WHO Emergency Use Listing; SRA: stringent regulatory authority.

<sup>c</sup> Matrix-M™, a novel saponin-based adjuvant, promotes the activation of innate immune cells and antigen processing.

<sup>d</sup> Developed by GlaxoSmithKline (GSK), AS03 is an Adjuvant System composed of α-tocopherol, squalene and polysorbate 80 in an oil-in-water emulsion previously used in flu vaccines.

<sup>e</sup> Produced by recombinant DNA technology using a plasmid expression vector in a CHO cell line.

<sup>f</sup> SQBA: squalene-based adjuvant, oil-in-water emulsion produced by HIPRA Human Health S.L.U.

<sup>g</sup> Developed by GlaxoSmithKline (GSK), AS03 is an Adjuvant System composed of α-tocopherol, squalene and polysorbate 80 in an oil-in-water emulsion previously used in flu vaccines.
Subunit vaccines contain fragments of proteins or polysaccharides of a pathogen which could elicit an immune response. Subunit vaccines do not contain live pathogens and are suitable for people who cannot receive live vaccines. Protein subunit COVID-19 vaccines platform contain vaccines created with fragments of proteins from SARS-CoV-2.

In the subsequent text, these vaccines will be referred to as protein subunit COVID-19 vaccines. Future interim recommendations will include additional protein subunit COVID-19 vaccines should such vaccines be licensed. In cases where a recommendation differs by product, product-specific names will be used. Timing, frequency and target populations for booster doses are derived from the revised 2023 WHO prioritization roadmap on the use of COVID-19 vaccines (1).

Methods

SAGE applies the principles of evidence-based medicine and has established thorough methodological processes for issuing or updating recommendations (2). Specifically for COVID-19 vaccines, a detailed description of these processes can be found in the SAGE evidence framework for COVID-19 vaccines which provides guidance for considering data emerging from clinical trials in support of issuing vaccine-specific evidence-based recommendations (3).

The guidance is based on the evidence-to-recommendation tables developed for protein subunit vaccines (Table 1), and further updated based on new data derived from scientific publications. All referenced documents are available on the SAGE COVID-19 webpage.

Evidence-to-recommendation tables and GRADEing on product-specific vaccine performance are available in the interim recommendations on the use of these vaccines (COVID-19 vaccines technical documents: product specific documentation).

Evidence on real-world vaccine effectiveness, in particular Omicron-specific vaccine effectiveness studies can be accessed on the International Vaccine Access Center (IVAC)’s View-hub website (COVID vaccines | ViewHub (view-hub.org)), including weekly literature tables, forest plots, neutralization plots, and methods used.

General goal and strategy for the use of the protein subunit vaccines against COVID-19

The COVID-19 pandemic has caused significant morbidity and mortality worldwide, as well as major social, educational and economic disruptions. Globally, population-level immunity has increased significantly, due to substantial, increasing vaccine use and infection-induced immunity, or a combination of both (hybrid immunity). Most countries have lifted most or all public health and social measures, and while the SARS-CoV-2 virus continues to circulate, the third year of the COVID-19 pandemic has seen a significant reduction in rates of hospitalization, admission to intensive care units and mortality across all age groups. This is due to a number of factors including increasing population-level immunity from infection and/or vaccination, and earlier testing and
access to COVID-19 therapeutics. Nonetheless, certain subgroups continue to be at greater risk of severe disease and mortality and account for most of the ongoing COVID-19-related mortality; thus, even a minor decrease in vaccine effectiveness with time in vulnerable subgroups translates into a rise in cases of severe disease and death.

While vaccine effectiveness remains substantial and relatively well maintained over time against severe disease from Omicron, protection against mild disease and infection is lower than against pre-Omicron variants of concern and declines rapidly with time since the last vaccination. New vaccines against Omicron variants, XBB sublineages, are currently being developed. Older adults and people with comorbidities continue to be at greatest risk of severe disease and mortality due to Omicron and make up most of the deaths.

**WHO SAGE roadmap on uses of COVID-19 vaccines in the context of Omicron and substantial population immunity**

Countries are recommended to use the WHO prioritization roadmap (1) and the WHO values framework (4) as guidance for prioritizing target groups. The WHO prioritization roadmap defines three priority-use groups: high, medium and low. WHO recommends that vaccine use be prioritized to the high priority-use groups (i.e. older persons, adults with multiple significant comorbidities or severe obesity, younger adults with significant comorbidities or severe obesity, persons with moderate to severe immunocompromising conditions (regardless of age), pregnant adults and adolescents, and frontline health workers). The medium priority-use group includes adults who do not fall into high-priority use groups, and children and adolescents with comorbidities and severe obesity. Healthy children and adolescents are in the low priority-use group. Within the capacity of programmes and vaccine availability, additional priority-use groups should be vaccinated as outlined in the WHO prioritization roadmap (1), taking into account national epidemiological data and other relevant considerations.

**Administration and dosage**

**Administration of the primary vaccine series**

The recommended vaccination schedule is two doses given intramuscularly into the deltoid muscle. WHO recommends that the second dose should be provided 4–8 weeks after the first dose, preferentially 8 weeks, as a longer interval between doses is associated with higher vaccine effectiveness.

**Booster doses**

First booster doses are recommended at 6–12 months after the completion of the primary series.

Second and additional booster doses:

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2 Healthy children and adolescents belong to the low priority-use group; children and adolescents with comorbidities belong to the medium priority-use group; and children and adolescents with moderate to severe immunocompromising conditions belong to the high priority-use group.
WHO recommends that for all older adults and adults with significant comorbidities or severe obesity (high priority-use group), second and additional booster doses should be given at an interval of 12 months after the previous dose. The age cut-off is to be decided by countries but is often 50–60 years.

For a subgroup of the high priority-use group (i.e. persons with the highest risk of severe disease and death, such as those who are very old and frail, those with multiple significant comorbidities, those with severe immunocompromising conditions, and those in long-term care facilities), an interval of 6 months after the previous dose should be considered, given that even a minor reduction in vaccine effectiveness after 6 months could translate into substantial mortality.

For healthy non-elderly adults (medium priority-use groups) and healthy children and adolescents aged below 18 years (low priority-use group), additional booster doses are not routinely recommended.

Further information on booster doses in priority-use groups is available in the WHO prioritization roadmap (1).

**Interchangeability with other COVID-19 vaccines (heterologous schedules)**

Use of the same vaccine for all doses (homologous schedule) is considered standard practice based on the substantial safety, immunogenicity, and efficacy data available; however, WHO supports a flexible approach to using different vaccines for different doses (heterologous schedule) (5). Heterologous schedules may enhance immunogenicity.

**Co-administration with other vaccines**

WHO recommends that countries consider co-administration of COVID-19 vaccines (including variant-containing vaccines) with seasonal influenza vaccines (6, 7), whenever epidemiologically justified. Based on several co-administration studies of COVID-19 vaccines and inferred from co-administration studies of other adult vaccines, COVID-19 vaccines may be given concomitantly, or at any time before or after other vaccines for adults and adolescents, including live-attenuated, protein subunit, adjuvanted, or non-adjuvanted vaccines. The same applies to maternal immunization for vaccines recommended during pregnancy.

When administered concomitantly, the vaccines should be injected in separate sites, preferably different extremities. Continued pharmacovigilance monitoring is recommended. WHO aims for a life-course approach for the implementation of all vaccines including COVID-19 vaccines. Such a programmatic approach will help to achieve a higher uptake of vaccines, increase the efficiency of vaccine roll-out and protect stretched health-care systems.

**Contraindications**

A history of anaphylaxis to any component of the vaccine is a contraindication to vaccination. If anaphylaxis occurs after any dose, a subsequent dose of the vaccine should not be administered.
Precautions

A history of anaphylaxis to any other vaccine or injectable therapy (i.e. intramuscular, intravenous, or subcutaneous vaccines or therapies) is not a contraindication to vaccination; however, for such persons, a risk assessment should be conducted by a health professional. It remains uncertain if there is an increased risk of anaphylaxis with use of protein subunit COVID-19 vaccines, but counselling should be given about the potential risk which should be weighed against the benefits of vaccination. Such persons should be observed for 30 minutes after vaccination in health-care settings where anaphylaxis can be immediately treated.

In general, persons with an immediate non-anaphylactic allergic reaction to the first dose (such as urticaria, angioedema or respiratory symptoms) without any other symptoms (cough, wheezing, stridor), that occur within 4 hours of administration) should not receive additional doses, unless recommended after review by a health professional with specialist expertise. However, subject to individual risk–benefit assessment, protein subunit COVID-19 vaccines could be provided under close medical supervision if it is the only available vaccine for persons at high risk of severe COVID-19.

As a small number of anaphylactic reactions have also been reported in vaccinees without a history of anaphylaxis, WHO recommends that protein subunit COVID-19 vaccines be administered only in settings where anaphylaxis can be treated. Until more data are available regarding anaphylaxis after protein subunit COVID-19 vaccination, all vaccinees should be observed for at least 15 minutes after vaccination.

Food, insect venom and contact allergies and allergic rhinitis, eczema and asthma are not considered a contraindication to vaccination. The vial stoppers are not made with natural rubber latex, and there is no contraindication or precaution to vaccination for persons with a latex allergy. In addition, as protein subunit COVID-19 vaccines do not contain eggs or gelatine, there is no contraindication or precaution to vaccination for persons with allergies to these food substances.

Anyone with an acute febrile illness (body temperature over 38.5 °C) should postpone vaccination until they are afebrile.

Vaccination of specific populations

Children and adolescents aged 6 months to 17 years

Children aged 6 months to 17 years with comorbidities that put them at higher risk of serious COVID-19 disease should be offered vaccination.

For healthy children and adolescents, COVID-19 is rarely lethal. Multisystem inflammatory syndrome in children (MIS-C) is a rare condition associated with SARS-CoV-2 infection. MIS-C (8) and post-COVID-19 conditions have decreased in the Omicron era. Children can experience significant morbidity but most infections are self-limiting, with only a small proportion requiring hospitalization. The benefit and cost–effectiveness of vaccinating healthy children and adolescents are substantially lower than for vaccinating high and medium priority-use groups and compared with most other vaccine preventable diseases in childhood.
Countries contemplating vaccinating children should consider the national disease burden in this age group, the benefit–risk, cost–effectiveness, other health and programmatic priorities, and opportunity costs. Additional booster doses are not routinely recommended in this age group. It is paramount that children continue to receive the recommended childhood vaccines for other infectious diseases.

In accordance with the WHO prioritization roadmap (1), the priority remains to prevent deaths by achieving high vaccine coverage (primary series and boosters) in the high priority-use groups.

**Pregnant adults and adolescents**

Pregnant adults and adolescents are a high priority-use group because of the potential adverse effects of COVID-19 on the pregnant adult or adolescent, the foetus, and the infant. Although the risk of severe disease in the Omicron era is less than that in the pre-Omicron era (9), pregnant women3 with COVID-19 continue to be at higher risk of severe maternal morbidity and/or adverse pregnancy outcomes such as preterm birth (10-12). They may also have an increased risk of maternal mortality (10, 11). COVID-19 in pregnancy has also been associated with increased risks of neonates being born having low birth weight and requiring neonatal intensive care (11). Pregnant women who are older (aged 35 years and above) or who have a high body mass index or an existing comorbidity, such as diabetes or hypertension, are at particularly high risk of severe outcomes from COVID-19.

Developmental and reproductive toxicology (DART) studies of protein subunit COVID-19 vaccines have not shown harmful effects in pregnant animals and their offspring. A growing body of post-introduction vaccine pharmacovigilance data and observational studies have not identified any acute safety problems, with no increased risk of adverse obstetric outcomes, including spontaneous abortion, and neonatal outcomes following vaccination during pregnancy (13-15). COVID-19 vaccines are immunogenic in pregnant women, and vaccine effectiveness studies have shown high effectiveness of COVID-19 vaccines in pregnant women, similar to effectiveness in nonpregnant people (15, 16). During the Omicron era, COVID-19 vaccination, including booster dose, given to pregnant adults and adolescents protects them against severe disease and hospitalization, particularly when the last dose was received within the previous 4–5 months(17). Further, vaccination with COVID-19 vaccines during pregnancy is associated with a reduced risk of severe COVID-19 in young infants (18). Even during Omicron predominance, the incidence of hospitalization for COVID-19 was lower during the first 6 months of life among infants of vaccinated (and especially boosted) mothers, compared to infants of unvaccinated mothers (19). The burden of severe COVID-19 in infants aged below 6 months is overall low, but nevertheless higher than in children aged 6 months to 5 years (20).

The recommendation for pregnant adults and adolescents is to receive the primary series and booster vaccination as soon as possible. An additional booster dose should be given once during pregnancy if the last dose was

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3 Some studies on COVID and pregnancy refer to “pregnant women”, and others to “pregnant people”. While most people who are, or can become, pregnant are cisgender women or adolescent girls who were born and identify as female, this guidance is also intended for transgender men and other gender diverse people who can become pregnant. All uses of the terms “pregnant women” and “mothers” in the guidance are intended to be inclusive of all those who are pregnant or give birth.
Interim recommendations for the use of protein subunit COVID-19 vaccines

administered more than 6 months prior. For this additional booster dose, vaccination in the mid-second trimester is preferred to optimize protection of the pregnant woman, the foetus, and the infant. However, the vaccine can be safely given at any time during pregnancy to avoid missing opportunities to vaccinate.

WHO does not recommend pregnancy testing prior to vaccination. WHO does not recommend delaying pregnancy or terminating pregnancy because of vaccination.

Breastfeeding adults and adolescents

Breastfeeding offers substantial health benefits to breastfeeding women and their breastfed children. Vaccine effectiveness is expected to be similar in breastfeeding women as in other adults. In addition, vaccine-elicited antibodies are found in breast milk following vaccination of breastfeeding women, suggesting possible neonatal as well as maternal protection (21). As an protein subunit COVID-19 vaccine is not a live virus vaccine and the protein subunit does not enter the nucleus of the cell and is degraded quickly, it is biologically and clinically unlikely to pose a risk to the breastfeeding child. WHO does not recommend discontinuing breastfeeding because of vaccination.

Moderately and severely immunocompromised persons, including persons living with HIV with CD4 cell count of <200 cells/µl

Moderately and severely immunocompromised persons (ICPs) are at higher risk of severe COVID-19, regardless of their age, although risk increases with age. Moderately and severely immunocompromised persons include those with active cancer, transplant recipients, immunodeficiency, and those receiving active treatment with immunosuppressives. Also included are people living with HIV with a current CD4 cell count of <200 cells/µl, evidence of an opportunistic infection, not on HIV treatment, and/or with a detectable viral load. Further information is available in WHO’s Interim recommendations for an extended primary series for ICPs (22).

Available data for COVID-19 vaccine products suggest that vaccine effectiveness and immunogenicity are lower in ICPs than in persons without immunocompromising conditions (22). The emerging evidence suggests that an additional dose included in an extended primary series enhances immune responses in some ICPs (23). Reactogenicity data of an additional dose given to ICPs, where reported, have generally been similar to those observed for the standard primary series of the vaccine being administered.

4 Active cancer: Active immunosuppressive treatment for solid tumour or hematologic malignancy (including leukemia, lymphoma, and myeloma), or within 12 months of ending such treatment. Transplant recipients: Receipt of solid organ transplant and taking immunosuppressive therapy; receipt of stem cell transplant (within 2 years of transplantation or taking immunosuppressive therapy). Immunodeficiency: Severe primary immunodeficiency; chronic dialysis. HIV with a current CD4 count of <200 cells/µl and/or lacking viral suppression. Immunosuppressives: Active treatment causing significant immunosuppression (including high-dose corticosteroids), alkylating agents, antimetabolites, transplant-related immunosuppressive drugs, cancer chemotherapeutic agents, tumour-necrosis factor blockers, and other drugs that are significantly immunosuppressive, or have received in the previous 6 months immunosuppressive chemotherapy or radiotherapy.
The most appropriate timing for the additional dose may vary depending on the epidemiological setting and the extent and timing of immune suppressive therapy, and should be discussed with the treating physician. Booster doses given 6 months after the previous dose are recommended for all ICPs.

Given that protection may remain inadequate in a portion of immunocompromised persons even after the administration of additional doses, WHO further recommends that close contacts and caregivers of such individuals should be vaccinated if eligible. Additional public health and social measures at household level to protect immunocompromised persons are also warranted depending on the local epidemic circumstances.

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References


WHO continues to monitor the situation closely for any changes that may affect this interim guidance. Should any factors change, WHO will issue a further update. Otherwise, this interim guidance document will expire 2 years after the date of publication.

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