PREVENTION and CHEMOPROPHYLAXIS of BACTERIAL MENINGITIS

CHI Formulary Development Project

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Council of Health Insurance

INDICATION UPDATE

ADDENDUM- October 2023

To the CHI Original Prevention and Chemoprophylaxis of Meningococcal Disease Clinical Guidance- Issued May 2020

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Related Documents

Related SOPs

- IDF-FR-P-02-01-IndicationsReview&IDFUpdates
- IDF-FR-P-05-01-UpdatedIndicationReview&IDFUpdates

Related WI:

- IDF-FR-WI-01-01SearchMethodologyGuideForNewIndications

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Abbreviations

ACIP	Advisory Committee on Immunization Practices
CADTH	Canadian Agency for Drugs and Technologies in Health
CDC	Centers for Disease Control and Prevention
CHI	Council of Health Insurance
CPG	Clinical Practice Guideline
ECDC	European Centre for Disease Prevention and Control
FDA	Food and Drug Administration
HAS	Haute Autorité de Santé
HTA	Health Technology Assessment
IDF	CHI Drug Formulary
IMD	Invasive Meningococcal Disease
IQWIG	Institute for Quality and Efficiency in Health Care
MenACWY	Quadrivalent meningococcal conjugate vaccines
MenB	Serogroup B vaccines
N/A	Not Available/Not Applicable
NICE	National Institute for Health and Care Excellence
PBAC	Pharmaceutical Benefits Advisory Committee
SFDA	Saudi Food and Drug Authority
WHO	World Health Organization

Executive Summary

Meningococcal disease, caused by the *Neisseria meningitidis* bacterium, can lead to severe infections in both the meninges and the bloodstream[1]. These infections present with symptoms like fever, headache, stiff neck, photophobia, and a distinctive rash[1]. The disease is contagious through close contact and droplet transmission, with potential long-term consequences for survivors, including deafness, limb loss, nerve, kidney, or brain damage[1]. To prevent meningococcal disease, vaccination is important, in addition to practicing good hygiene such as thorough hand washing and avoiding contact with sick individuals[1].

At a global level, it is projected that there are a minimum of 1.2 million instances of invasive diseases every year, leading to approximately 135,000 fatalities connected to invasive meningococcal disease (IMD)[2].

Between 1995 and 2019, KSA experienced varying trends in invasive meningococcal disease (IMD) cases, with notable outbreaks in 2000-2001 linked to pilgrimages[3,4]. Between 2002 and 2011, Saudi Arabia recorded 184 cases of meningococcal disease, with MenW responsible for 40%, MenA for 36%, and MenB for 16% of these cases[4]. More recent data spanning from 2012 to 2021, provided by the Saudi Arabian Ministry of Health, identified a total of 48 cases. Notably, 33% of these cases affected individuals under the age of 5, and another 33% were in the 5-14 age group[4]. Although specific serogroup information and clinical outcomes were lacking, the data indicated the presence of MenW, MenA, MenB, and MenY serogroups during this period.

CHI issued Prevention and Chemoprophylaxis of Bacterial Meningitis clinical guidelines after thorough review of renowned international and national clinical guidelines in May 2020. Updating clinical practice guidelines (CPGs) is a crucial process for maintaining the validity of recommendations.

This report functions as an addendum to the prior CHI Prevention and Chemoprophylaxis of Bacterial Meningitis clinical guidance and seeks to offer guidance for the effective management of Prevention and Chemoprophylaxis of Bacterial Meningitis. It provides an **update on the Prevention and Chemoprophylaxis of Bacterial Meningitis Guidelines** for CHI Formulary with the ultimate objective of updating the IDF (CHI Drug Formulary) while addressing **the most updated best available clinical and economic evidence related to drug therapies.**

Main triggers for the update were summarized, being **the issuance updated versions of previously reviewed guidelines** namely the Treatment and Prevention of Meningococcal Infection (2022), and the WHO Meningococcal disease Vaccine. Moreover, **new guidelines are added to the report** such as Meningococcal

Vaccination: Recommendations of the Advisory Committee on Immunization Practices, United States, (2020), Meningococcal vaccination in children and adults (2023), ECDC Meningococcal Disease: Recommended vaccinations (2023), ECDC Factsheet about meningococcal disease (2019), CDC Meningococcal Vaccines (2021), CDC Administering Meningococcal Vaccines (2022), CDC Meningococcal Vaccination for Adolescents: Information for Healthcare Professionals, the Health Requirements and Recommendations for Travelers to Saudi Arabia for Hajj (Saudi Arabia Ministry of Health, 2023), Bacterial Meningitis (CDC, 2021), Meningococcal Disease (CDC, 2022), Preventing Group B Strep Disease (CDC, 2022), and the German guidelines on community-acquired acute bacterial meningitis in adults (2023).

After carefully examining clinical guidelines and reviewing the SFDA drug list, Phenoxymethylpenicillin, Trumenba® Vaccine, and Bexsero® Vaccine need to be added to the CHI formulary, but there are no new drugs approved by the FDA/EMA. The following are no longer SFDA-registered, and it is advisable to delist them from CHI formulary: Polysaccharide of Neisseria meningitidis group A and polysaccharide of Neisseria meningitidis group C, and benzylpenicillin.

All recommendations are well supported by reference guidelines, Grade of Recommendation (GoR), Level of Evidence (LoE) and Strength of Agreement (SoA) in all tables reflecting specific drug classes' role in prevention and chemoprophylaxis of bacterial meningitis.

Below is a table summarizing the major changes based on the different guidelines for the Prevention and Chemoprophylaxis of Bacterial Meningitis used to issue this report:

Table 1. General Recommendations for the Prevention and Chemoprophylaxis of Bacterial Meningitis

Prevention and Chemoprophylaxis of Bacterial Meningitis		
General Recommendations	**Level of Evidence/Grade of Recommendation**	**Reference**
Prevention		
Antimicrobial prophylaxis, droplet precautions, vaccination before exposure, and avoiding exposure are prevention strategies.	N/A	Treatment and prevention of meningococcal infection (UpToDate 2022)[5]

Vaccination is a crucial preventive measure against specific bacterial strains causing meningitis, including Meningococcal, Pneumococcal, Haemophilus influenzae serotype b (Hib), and Bacille Calmette-Guérin (TB) vaccines. Prophylaxis, involving antibiotic administration to prevent transmission, is recommended for close contacts in specific cases.	N/A	Bacterial Meningitis (CDC, 2021)[17]
Chemoprophylaxis: Indications and Timing		
Close contacts defined as prolonged exposure to the patient (more than 8 hours within 3 feet) or direct exposure to oral secretions.	N/A	Treatment and prevention of meningococcal infection (UpToDate 2022)[5]
Chemoprophylaxis recommended within 24 hours of exposure; efficacy diminishes after 14 days.	N/A	Treatment and prevention of meningococcal infection (UpToDate 2022)[5]
Healthcare workers not directly exposed to respiratory secretions usually don't require prophylaxis	N/A	Treatment and prevention of meningococcal infection (UpToDate 2022)[5]
Antimicrobial Regimens and Follow-Up		
Preferred: rifampin, ciprofloxacin, ceftriaxone for prophylaxis. Azithromycin is an alternative when preferred agents are unsuitable.	N/A	Treatment and prevention of meningococcal infection (UpToDate 2022)[5]
Individuals using C5 inhibitors should receive prophylaxis and meningococcal vaccination. Penicillin V is preferred, azithromycin is an alternative if allergic to penicillin.	N/A	Treatment and prevention of meningococcal infection (UpToDate 2022)[5]

Close contacts should be monitored for at least 10 days after prophylaxis and educated about meningococcal infection symptoms.	N/A	Treatment and prevention of meningococcal infection (UpToDate 2022)[5]
Vaccinations		
Quadrivalent meningococcal conjugate vaccines (MenACWY) cover serogroups A, C, W, and Y. MenACWY vaccines are inactivated and contain antigens from serogroups A, C, W, and Y.	N/A	Meningococcal Vaccination in Children and Adults (UpToDate 2023)[6]
Serogroup B vaccines: MenB-FHbp (Trumenba) and MenB-4C (Bexsero).	N/A	Meningococcal Vaccination in Children and Adults (UpToDate 2023)[6]
MenACWY and MenB vaccines can often be administered together.	N/A	Meningococcal Vaccination in Children and Adults (UpToDate 2023)[6]
Recommendations of Adolescents and Young Adults		
MenACWY Vaccines		
Routine single dose at age 11 or 12, followed by a booster at age 16 is recommended.	N/A	Meningococcal Vaccination (ACIP 2020)[7]
Adolescents getting first dose at 13–15 need a booster at 16–18 (8-week interval). Booster not needed if first dose after 16, unless increased risk.	N/A	Meningococcal Vaccination (ACIP 2020)[7]
Different MenACWY vaccine products can be used interchangeably.	N/A	Meningococcal Vaccination (ACIP 2020)[7]
MenACWY-TT does not replace tetanus toxoid vaccines	N/A	Meningococcal Vaccination (ACIP 2020)[7]
MenB Vaccines		

MenB (serogroup B meningococcal) vaccine series recommended for those aged 16–23 years based on shared clinical decision-making.	N/A	Meningococcal Vaccination (ACIP 2020)[7]
Two-dose MenB vaccine series recommended for some individuals.	N/A	Meningococcal Vaccination (ACIP 2020)[7]
Choice between MenB-FHbp and MenB-4C; no preference, but not interchangeable.	N/A	Meningococcal Vaccination (ACIP 2020)[7]
Establishment of Vaccine-Mediated Immunity		
ACIP advises against using antibody titers to determine immunity.	N/A	Meningococcal Vaccination (ACIP 2020)[7]
Commercial immunoglobulin tests are not suitable for assessing protection.	N/A	Meningococcal Vaccination (ACIP 2020)[7]
Pregnancy and Lactation		
MenACWY considered safe if needed.	N/A	Meningococcal Vaccination (ACIP 2020)[7]
MenB vaccination during pregnancy deferred unless benefits outweigh risks.	N/A	Meningococcal Vaccination (ACIP 2020)[7]
<u>Administration of antibiotics During labor</u>: Women identified as having an elevated risk of their newborn developing GBS disease are given antibiotics during labor. Antibiotics are delivered intravenously (IV) and typically consist of beta-lactams such as penicillin or ampicillin.	N/A	Preventing Group B Strep Disease (CDC, 2022)[19]
Meningococcal Disease and travel		
Current travel guidelines vary by country; general WHO recommendation to consider	N/A	WHO Consensus recommendation for meningococcal disease

vaccination for countries with known outbreaks.		prevention for Hajj and Umra pilgrimage/ travel medicine (2013)[8]
ACWY conjugate vaccination recommended for Hajj and Umra pilgrims, travelers to African meningitis belt, outbreak-prone countries, military personnel, healthcare workers, exchange program participants, and high-risk individuals.	N/A	WHO Consensus recommendation for meningococcal disease prevention for Hajj and Umra pilgrimage/ travel medicine (2013)[8]
Chemoprophylaxis		
Rifampin, ceftriaxone, and ciprofloxacin are considered 90%-95% effective in reducing nasopharyngeal carriage of N. meningitidis and are acceptable agents for chemoprophylaxis.		Chapter 8: Meningococcal Disease (CDC, 2022)[18]
Although not a first-line choice, azithromycin may be recommended in situations of sustained ciprofloxacin resistance in a community. Azithromycin, administered as a single oral dose, has proven effective for eradicating nasopharyngeal carriage and may be used in limited circumstances where ciprofloxacin resistance is identified.		Chapter 8: Meningococcal Disease (CDC, 2022)[18]

At the end of the report, a key recommendation synthesis section is added highlighting the latest updates in **the prevention and chemoprophylaxis of bacterial meningitis**.

Section 1.0 Summary of Reviewed Clinical Guidelines and Evidence

This section is divided into two parts: the first includes recommendations from **updated versions of guidelines** mentioned in the previous CHI Prevention and Chemoprophylaxis of Bacterial Meningitis report, and the second includes **newly added guidelines** that have helped generate this report.

1.1 Revised Guidelines

This part contains the updated versions of the guidelines mentioned in the May 2020 CHI Prevention and Chemoprophylaxis of Bacterial Meningitis Report and the corresponding recommendations:

Table 2. Clinical Guidelines Requiring Revision

Guidelines Requiring Revision	
Old Versions	**Updated Versions**
Section 1.1 Prevention of Meningococcal Infection Up to Date (Mar 03, 2020)	UpToDate: Treatment and Prevention of Meningococcal Infection (Dec 01, 2022)[5]
Section 1.2 Aseptic and Bacterial Meningitis: Evaluation, Treatment, and Prevention American Family Physician Association (2017)[9]	N/A*
Section 1.3 WHO Consensus recommendation for meningococcal disease prevention for Hajj and Umra pilgrimage/ travel medicine (2013)[8]	N/A*
Section 1.4 WHO Meningococcal Disease Vaccine (2014)	WHO Meningococcal Disease Vaccine (No Date)[10]

*: No updated versions available

1.1.1 UpToDate: Treatment and Prevention of Meningococcal Infection (Dec 01, 2022)

*Please refer to **Section 1.1** of CHI Prevention and Chemoprophylaxis of Bacterial Meningitis Report.*

UpToDate authors and editors review the available clinical evidence and best clinical practices to provide a detailed synthesis on a specific topic. While not typically used as a clinical guideline, it was detailed in the previous CHI report, and it was therefore relevant to include the revised edition of the "Treatment and Prevention of Meningococcal Infection" released in December 2022[5].

The recommendations were not accompanied by a grading scheme, and are presented below:

Prevention: Antimicrobial prophylaxis, use of droplet precautions, vaccination prior to exposure, and avoidance of exposure

Droplet precautions: to be continued for 24 hours after administration of antibiotics in patients with suspected or confirmed infection. After 24hours, viable organisms can no longer be isolated from treated patients.

Antimicrobial chemoprophylaxis:

- **Indications**: Chemoprophylaxis is recommended for individuals who have been in close contact with patients suffering from meningococcal infection. This preventive treatment should be administered promptly after exposure. Although the term "close contact" lacks a precise definition, it typically pertains to people who have spent extended periods (more than 8 hours) in proximity (within 3 feet) to the patient. This also includes those who have had direct exposure to the patient's oral secretions in the week leading up to the onset of the patient's symptoms and up to 24 hours after the beginning of appropriate antibiotic treatment. Prophylactic measures are not necessary when the contact with the infected person is brief. This applies to most healthcare workers unless they are directly exposed to respiratory secretions during procedures like suctioning or intubation. While healthcare workers at risk have a slightly higher chance of contracting the infection compared to the general population, the overall increase in risk is very minor. Therefore, healthcare workers who haven't been directly exposed to respiratory secretions are not advised to take antimicrobial prophylaxis. Using oropharyngeal or nasopharyngeal cultures isn't useful for determining the need for preventive treatment and could slow down the implementation of such measures. The evidence supporting the use of chemoprophylaxis is limited, but we tend to recommend it due to the potential seriousness of meningococcal infection, especially for individuals with high-risk exposure.
- **Timing of prophylaxis**: The ideal timing for administering antimicrobial chemoprophylaxis is as soon as possible, preferably within 24 hours after identifying the infected individual. Offering chemoprophylaxis more than 14 days after being exposed to the person with the infection is likely to have little to no effectiveness, which is why the United States Centers for Disease Control and

Prevention (CDC) do not recommend it. The risk of secondary infection among contacts is highest right after the primary case shows symptoms. Typically, secondary cases arise within 10 days of the initial case, although there have been rare instances reported with longer intervals. During a suspected outbreak of meningococcal disease where confirmed cases have already occurred, it's not essential to wait for confirmation of N. meningitidis in subsequent cases before starting chemoprophylaxis for close contacts. This is especially true when there is strong suspicion of meningococcal disease, such as identifying gram-negative diplococci, detecting N. meningitidis antigen in cerebrospinal fluid (CSF) through latex testing, or using immunohistochemistry on formalin-fixed tissue. Clinical signs like purpura also indicate the need for initiating preventive treatment.

Regimens: Clinicians should consult with local public health authorities to help inform regimen selection.

- **Preferred approaches** for antimicrobial prophylaxis encompass the use of rifampin, ciprofloxacin, and ceftriaxone. The selection of a specific agent depends partly on the susceptibility of microbes to antimicrobials within the local community. For instance, ciprofloxacin should not be employed for preventive treatment of individuals in close contact with those affected by meningococcal disease if there's evidence of ciprofloxacin-resistant N. meningitidis in the community.
- **Alternative regimens:** In cases where the preferred agents are unsuitable, azithromycin is an alternative option for prophylaxis. This applies, for example, if rifampin or ceftriaxone are contraindicated due to exposure to ciprofloxacin-resistant N. meningitidis. In adults, azithromycin is taken orally at a single dose of 500 mg, while in children, the dose is 10 mg/kg orally as a single dose, with a maximum dose of 500 mg. Despite its notable effectiveness against meningococcus, azithromycin isn't recommended as a primary choice for preventive treatment since its use for this purpose has not been extensively studied. The available evidence regarding the clinical effectiveness of antimicrobial prophylaxis in preventing disease is limited. The potential clinical advantage of prophylaxis is deduced from studies demonstrating the elimination of nasopharyngeal carriage using antimicrobials.

Table 3 provides the recommended chemoprophylaxis regimens for protection against meningococcal disease:

Table 3. Recommended Chemoprophylaxis Regimens for Protection Against Meningococcal Disease (Adapted from UpToDate)

Drug	Age group	Dose	Duration and route of administration
Preferred regimens			
Rifampin[a]	Infants < 1 month	5 mg/kg/dose every 12 hours	2 days (4 doses) of oral therapy
	Infants and children ≥ 1 month	10 mg/kg/dose (maximum: 600 mg) every 12 hours	
	Adults	600 mg every 12 hours	
Ciprofloxacin[b]	Infants and children ≥ 1 month	20 mg/kg (maximum 500 mg)	Single oral dose
	Adults	500 mg	
Ceftriaxone	Children < 15 years	125 mg	Single IM dose
	Adults and adolescents ≥ 15 years	250 mg	
Alternative regimen (eg, if rifampin or ceftriaxone cannot be used in the setting of ciprofloxacin-resistant *Neisseria meningitidis* exposure)			
Azithromycin[c]	Infants and children	10 mg/kg (maximum 500 mg)	Single oral dose
	Adults	500 mg	

IM: intramuscular.

[a] Rifampin is not recommended for pregnant women because the drug is teratogenic in laboratory animals. Because the reliability of oral contraceptives might be affected by rifampin therapy, consideration should be given to using alternative contraceptive measures while rifampin is being administered. For additional information on drug interactions, refer to the Lexicomp drug interaction program within UpToDate.

[b] Ciprofloxacin should not be used if fluoroquinolone-resistant strains of N. meningitidis have been identified in the community. In addition, ciprofloxacin is not recommended for pregnant women. Although systemic fluoroquinolones are not routinely used as a first-line agent in children less than 18 years of age, it is reasonable to use a single dose of ciprofloxacin for chemoprophylaxis for meningococcal disease.

[c] Although azithromycin has activity against meningococcus, it has not been well studied for this indication.

Follow-Up of Close contacts: Close contacts should be closely monitored for at least 10 days after receiving prophylaxis following exposure. They should also be counseled about the symptoms of meningococcal infection to ensure timely treatment of any secondary cases that might emerge.

Patients receiving C5 inhibitors: For patients being treated with C5 inhibitors (such as eculizumab and ravulizumab), it's recommended that they receive antimicrobial prophylaxis throughout their C5 inhibitor treatment period, alongside meningococcal vaccination. Keeping their vaccinations up to date is crucial. Penicillin V is the preferred antimicrobial prophylaxis for preventing meningococcal infection in the context of C5 inhibitor use. The dosage for adults is 500 mg orally twice daily, for children ≥3 years old it's 250 mg orally twice daily, and for children <3 years old it's 125 mg orally twice daily. If there's a penicillin allergy, azithromycin can be used as an alternative (500 mg orally once daily for adults, 5 mg/kg orally once daily for children, with a maximum dose of 500 mg), given its relatively narrow spectrum and effectiveness against meningococcus. Since neither vaccination nor antimicrobial prophylaxis can guarantee the prevention of all cases of meningococcal disease, patients on C5 inhibitors should be educated about the risk of infection. They should be encouraged to seek immediate medical care if they experience symptoms like fever, headache, altered mental state, or rash that could indicate meningococcal disease.

C5 inhibitors are monoclonal antibody terminal complement inhibitors utilized for treating conditions such as hemolytic uremic syndrome, paroxysmal nocturnal hemoglobinuria, myasthenia gravis, and other autoimmune diseases. The use of C5 inhibitors is linked to a significantly increased risk (1000- to 2000-fold) of meningococcal infection, including severe and potentially fatal cases. Infections have been documented in patients who received meningococcal vaccines (both MenA/C/W/Y protein-polysaccharide vaccines and MenB-directed vaccines), including infections caused by nontypeable strains not included as the targets of these vaccines), and this is due to the inhibitory effects of C5 inhibitors on both complement-mediated bactericidal activity and opsonic functions. Although the evidence supporting the use of prophylactic antibiotics is not definitive, there is a tendency toward a longer time interval between exposure and onset of infection among those using prophylaxis. However, there's also a trend toward increased resistance to penicillin if an infection occurs, which could influence the choice of treatment regimen.

Vaccination: The topic of meningococcal vaccines and their indications for immunization is discussed in the Meningococcal Vaccine Guideline from UpToDate below.

1.1.2 Aseptic and Bacterial Meningitis: Evaluation, Treatment, and Prevention American Family Physician Association (2017)

*Please refer to **Section 1.2** of CHI Prevention and Chemoprophylaxis of Bacterial Meningitis Report.*

There are no new updates. The recommendations of this guideline remain unchanged[9].

1.1.3 WHO Consensus Recommendation for Meningococcal Disease Prevention for Hajj and Umra Pilgrimage/Travel Medicine (2013)

*Please refer to **Section 1.3** of CHI Prevention and Chemoprophylaxis of Bacterial Meningitis Report.*

There are no new updates. The recommendations of this guideline remain unchanged[8].

1.1.4 WHO Meningococcal Disease Vaccine

*Please refer to **Section 1.4** of CHI Prevention and Chemoprophylaxis of Bacterial Meningitis Report.*

WHO has introduced a revised edition on Meningococcal Infection. The recommendations were not accompanied by a grading scheme, and are presented below[10]:

Vaccine and Immunization for Meningococcal Disease:

The existing options for meningococcal vaccines include:

1. Conjugate Meningococcal Vaccine
    - Monovalent (A or C) meningococcal vaccine protects against meningococcal group A and C infections.
        - Monovalent C meningococcal vaccine is recommended for routine immunization of all one-year-old children and individuals with a history of meningococcal disease.
        - Infants aged 2–11 months receive two doses, spaced at least 2 months apart, followed by a booster dose around one year later.
        - Monovalent A meningococcal vaccine is approved for individuals aged 1–29 years.
2. Combined Haemophilus Influenzae Type B (HIB) and Monovalent C Meningococcal Vaccine

- Administered in 3 doses at 2, 4, and 6 months of age, followed by a booster at 12–15 months of age.

3. Quadrivalent (A, C, Y, and W135) Meningococcal Vaccine
    - Licensed for use in children and adults in some countries since 2005.
    - Initially given as a single dose, approved for individuals aged 2–55 years.
    - A two-dose series of this vaccine is licensed for use in children aged 9–23 months.
4. Polysaccharide Meningococcal Vaccine
    - Recommended for specific risk groups and controlling outbreaks, available in various forms.
    - Bivalent: Protects against groups A and C. Single dose for individuals ≥ 2 years old, which provides protection for 2–3 years, with the option for a booster dose, which provides protection for at least 3 years.
    - Trivalent: Provides protection against groups A, C, and W-135.
    - Tetravalent: Offers protection against groups A, C, Y, and W-135, advisable for travelers to regions with meningococcal epidemics (eg. sub-Saharan Africa and people travelling to perform Hajj in Saudi Arabia).

It's important to note that these vaccines do not cover meningococcal groups B and X. Serogroup B vaccines, derived from outbreak strains, are employed in some countries to mitigate outbreaks. The available vaccines are proven to be both safe and effective, with mild and infrequent side effects like localized redness and pain at the injection site, typically lasting up to two days.

1.2 New Guidelines

This part includes the added guidelines to the previous CHI Prevention and Chemoprophylaxis of Bacterial Meningitis report, along with their recommendations.

Table 4. List of Additional Guidelines

Additional Guidelines
UpToDate: Meningococcal Vaccination in Children and Adults (2023)[6]
Meningococcal Vaccination: Recommendations of the Advisory Committee on Immunization Practices (ACIP), United States (2020)[7]
ECDC Meningococcal Disease: Recommended vaccinations (2023)[11]
ECDC Factsheet about meningococcal disease (2019)[12]
CDC Meningococcal Vaccines (2021)[13]
CDC Administering Meningococcal Vaccines (2022)[14]
CDC Meningococcal Vaccination for Adolescents: Information for Healthcare Professionals[15]
Health Requirements and Recommendations for Travelers to Saudi Arabia for Hajj (Saudi Arabia Ministry of Health, 2023)[16]
CDC Bacterial Meningitis (2021)[17]
CDC Meningococcal Disease (2022)[18]
CDC Preventing Group B Strep Disease (2022)[19]
German Guidelines on Community-Acquired Acute Bacterial Meningitis in Adults (2023)[20]

1.2.1 UpToDate: Meningococcal Vaccination in Children and Adults (2023)

UpToDate provides a thorough synthesis based on recommendations by other medical societies/associations (CDC, WHO, etc.) UpToDate authors and editors review the available clinical evidence and best clinical practices to provide a detailed synthesis on a specific topic. UpToDate has introduced a set of recommendations regarding meningococcal vaccination that were not accompanied by a grading scheme, and are presented below[6]:

- Available formulations (all are inactivated): quadrivalent meningococcal conjugate vaccines for serogroups A, C, W, and Y (MenACWY) and monovalent vaccines (e.g., serogroup B).
    - MenACWY formulations in the US:

        - Meningococcal groups A, C, W, and Y oligosaccharide diphtheria CRM197 conjugate vaccine (MenACWY-CRM, Menveo)
        - Meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine (MenACWY-TT, MenQuadfi)
    - Additional MenACWY formulations outside the US:
        - Meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine (Men-C-ACYW-TT, Nimenrix)
        - The quadrivalent meningococcal polysaccharide vaccine (Menomune, MPSV4), previously available in the United States and elsewhere, was discontinued in 2017.
    - Monovalent Vaccines:
        - Serogroup A meningococcal polysaccharide-tetanus toxoid conjugate vaccine (PsA-TT, MenAfriVac)
        - Serogroup B meningococcal vaccine formulations (MenB-FHbp [Trumenba] and MenB-4C [Bexsero])
        - Meningococcal serogroup C conjugate vaccine formulations (eg, Men-C-C-CRM [Menjugate], Men-C-C-TT [NeisVac-C])
        - Bivalent serogroups A and C polysaccharide vaccine
        - Combination Haemophilus influenzae type b and N. meningitidis serogroup C vaccine (HibMecC)
        - A pentavalent conjugate vaccine (NmCV-5) targeting the A, C, W, Y, and X serogroups has been developed but has not yet been licensed for use.
- **Approach to Vaccination in the US**: depends on the predominant serogroup in the geographic area, in addition to the patient's age and risk. MenACWY and serogroup B meningococcal vaccines (MenB) are immunogenic and associated with a very low risk of serious adverse reactions.
    - **Routine immunization of adolescents and young adults:**
        - **Quadrivalent Meningococcal Conjugate Vaccine**
        - **Preferred schedule:** Ages 11-18 in the US: routine vaccination with MenACWY (MenACWY-CRM [Menveo] or MenACWY-TT [MenQuadfi]) is recommended. First dose is recommended at age 11-12 and booster dose at age 16. This schedule is appropriate for children who received MenACWY before age 10 years (eg, because of an outbreak or for travel). Those who received MenACWY at age 10 years do not need a dose at age 11 through 12 years but should receive a booster dose at age 16 years.

- **Catch-Up schedule:** Adolescents who receive the first dose at age 13 through 15 years should receive a booster dose at age 16 through 18 years; the booster dose can be administered at any time ≥8 weeks after the first dose. Adolescents who get their first meningococcal vaccine dose at 16 years or older generally do not need a booster dose, unless their risk for meningococcal disease increases due to factors like travel to an affected area or undergoing a splenectomy. If a booster is needed, it should be given at least 5 years after the previous dose, as the immune response to the vaccine diminishes within five years. For individuals aged 19 to 21 years who didn't receive a dose at 16 years or older, a single dose of MenACWY is recommended, even if they received a dose at 11 to 12 years. This is especially important for college-bound individuals and those in similar group living situations. College students up to 21 years old should have received a MenACWY dose within 5 years before enrolling.

  - **Serogroup B Meningococcal Vaccine**

- Ages 16-23, immunization with MenB is recommended particularly for those going to attend college. Absolute incidence of disease is low, but invasive disease is associated with serious long-term sequelae.

- **Immunization of persons at increased risk**: approach to immunization depends on age, exposure risk, and type of immunodeficiency.

  - **Target Groups:** The target groups for meningococcal vaccination can be divided into two main categories: individuals with an increased risk of meningococcal disease due to immunodeficiency, and those with a higher likelihood of exposure to the meningococcus bacteria (N. meningitidis). The vaccination approach for each group varies, including options for MenACWY and MenB vaccines, depending on the specific situation and potential outbreaks.

  - **Target Groups: Immunodeficiency Risk Group:**

  - Conditions in this group include anatomical or functional asplenia (including sickle cell disease), HIV infection, and deficiencies in complement components (such as properdin, factor D, factor H, and late complement components C5 through C9).

  - Individuals receiving C5 inhibitors (like eculizumab, ravulizumab) should ideally be vaccinated at least two weeks before starting complement inhibitor therapy, unless the potential risk of delaying complement therapy outweighs the risk of meningococcal disease.

- **Increase Exposure Risk Group**:
  - Individuals at an elevated risk of exposure to meningococcus include:
  - Microbiologists frequently in contact with N. meningitidis.
  - Travelers or residents in regions where meningococcal disease is prevalent, such as the meningitis belt in sub-Saharan Africa (December to June) or during the Hajj pilgrimage.
  - Those caught in outbreaks due to serogroup A, B, C, W, or Y.
  - Military recruits and college freshmen living in dorms who haven't been adequately vaccinated.
  - People previously immunized with MenACWY, requiring a booster if over five years since the last dose.
  - Some experts consider MenACWY for children over six weeks with complex serotype B meningococcal infections, to prevent future infections from other serogroups.
- **Age 2-23 months:** MenACWY-CRM (Menveo) is the only available quadrivalent meningococcal conjugate vaccine. The primary immunization series consists of three doses, ≥8 weeks apart and a fourth dose at age 12 months.
- **Age 7-8 months (any risk factor):** MenACWY-CRM (Menveo) is the only available quadrivalent meningococcal conjugate vaccine. The primary immunization series consists of two doses of MenACWY-CRM (Menveo), ≥12 weeks apart; the second dose should be given at age ≥12 months.
- **Age 9-23 months: with anatomical or functional asplenia or HIV infection: t**he primary immunization series consists of two doses of MenACWY-CRM (Menveo), ≥12 weeks apart; the second dose should be given at age ≥12 months.
- **Age 9-23 months: with complement component deficiency, treated with C5 inhibitors, or who travel to or live in countries where meningococcal disease is hyperendemic or epidemic,** the primary immunization series consists of Two doses of MenACWY-CRM (Menveo), ≥12 weeks apart; the second dose should be given at age ≥12 months.
- **Age greater than or equal to 2 years and immunodeficiency that increases risk,** The ACIP recommends meningococcal immunization for previously unimmunized persons ≥2 years of age with an immunodeficiency that increases the risk of meningococcal disease, including anatomic or functional asplenia (including sickle cell disease), HIV infection, complement component deficiency (eg,

properdin, factor D, factor H, and late complement component [C5 through C9]), use of C5 inhibitors (eg, eculizumab, ravulizumab).

- **MenACWY primary series** – For previously unvaccinated immunocompromised persons at increased risk for meningococcal disease, the primary MenACWY immunization series consists of two doses of any MenACWY vaccine (MenACWY-CRM [Menveo] or MenACWY-TT [MenQuadfi]), ≥8 weeks apart- and can be given at any time in relation to routine vaccines. Healthy persons ≥2 years of age who received a single dose of MenACWY (eg, for travel) and subsequently develop a condition that requires a two-dose primary series (eg, asplenia, HIV, complement component deficiency) should receive a second dose to complete the primary series as soon as possible, provided that the two doses are ≥8 weeks apart.
- **MenACWY booster doses** – Immunocompromised persons who remain at increased risk of meningococcal disease should receive booster doses of MenACWY. The booster schedule varies with age: Age <7 years – Initial booster three years after completion of the primary series and every five years thereafter. Age ≥7 years – Booster doses every five years. If MenACWY-TT (MenQuadfi) is not available for those ≥56 years of age, MenACWY-CRM (Menveo) may be used off-label.
- **MenB primary series** – Persons ≥10 years of age with anatomic or functional asplenia, complement component deficiency, and use of C5 inhibitors should be immunized against serogroup B meningococcal disease. While MenB (meningococcal B) vaccine is not officially approved for children under 10 in the US, MenB-4C (Bexsero) has been administered to this age group in other countries. Some experts recommend vaccinating high-risk children against meningococcal disease, such as those taking C5 inhibitors, with MenB-4C instead of MenB-FHbp (Trumenba). This preference is due to limited data on MenB-FHbp and its history of causing adverse reactions in infants, leading to its discontinuation. (ACIP) doesn't provide a specific recommendation for administering the MenB vaccine to individuals with HIV, unless there are other factors indicating its use, such as ages 16 through 23 years based on shared decision-making or during an outbreak. Meningococcal cases in people with HIV in the US are primarily caused by serogroups C, W, or Y.
- **MenB booster doses -** Individuals aged 10 and above who have conditions like asplenia, complement component deficiency, or are using C5 inhibitors should receive booster doses of the same MenB vaccine they received during the primary series. These booster doses

should be given one year after completing the primary series and then repeated every two to three years. The antibody titers to MenB vaccines start to decrease within one to two years after initial immunization.

- **Age greater than or equal to 2 years and increased risk of exposure,** for previously unimmunized persons who are at increased risk for exposure to meningococcal disease, including microbiologists who routinely work with N. meningitidis, college freshmen, military recruits, persons who travel to or live in countries where meningococcal disease is hyperendemic or epidemic.
  - **MenACWY Primary Series:** Immunocompetent individuals ≥2 years old at higher risk of meningococcal disease exposure should receive a single dose of any MenACWY (MenACWY-CRM [Menveo] or MenACWY-TT [MenQuadfi]), which can be administered at any time in relation to DTaP. College students who haven't received a MenACWY dose at ≥16 years or whose last dose was ≥5 years ago should get a single MenACWY dose.
  - **MenACWY Booster Doses:**
  - **Microbiologists** working frequently with N. meningitidis should get a MenACWY booster every five years. MenACWY-CRM (Menveo) can be used off-label if MenACWY-TT ((MenQuadfi)) is unavailable.
  - **College students** generally don't need MenACWY booster doses unless indicated, e.g., they require C5 inhibitor treatment.
  - **Military recruits'** need for boosters is determined by the Department of Defense based on their assignments.
  - **Travelers** who previously completed the primary MenACWY series for outbreak purposes should get a booster:
    - Three years after primary series if <7 years old
    - Five years after primary series if ≥7 years old
  - Subsequent boosters every five years if the elevated risk persists.
  - **MenB Primary Series and Booster Doses**:
  - **Microbiologists** who routinely work with N. meningitidis should receive MenB vaccination. For ongoing exposure, a booster with the same MenB formulation as the primary series should be given a year after completion and repeated every two to three years.
  - MenB is suggested for **college students** aged 16 to 23 years.

        - MenB isn't routinely recommended for **military recruits or travelers**, unless circumstances indicate (e.g., outbreak, age 16-23 years).
    - **Meningococcal outbreak Control**: During a meningococcal disease outbreak caused by a specific vaccine serogroup (A, C, W, Y, or B), meningococcal vaccination is utilized to minimize secondary cases. The objective is to establish herd protection within the target population to curb infection spread via the nasopharyngeal route. Decisions regarding outbreak vaccination are made on a case-by-case basis in collaboration with public health authorities. The guidelines set by the United States Centers for Disease Control and Prevention (CDC) are followed:
        - **Organization-based outbreak**: If there are two to three outbreak-related cases within three months, and they share a common affiliation (e.g., university, school, correctional facility) rather than a geographic location, vaccination is generally recommended.
        - **Community-based outbreak**: When a geographically defined community (e.g., neighborhood, town) or a population with shared characteristics (e.g., men who have sex with men) experiences multiple outbreak-associated cases within three months, and the incidence surpasses the expected incidence for that community. The expected incidence can be gauged by comparing it to a similar period in previous years, the annual incidence over the past few years, or historical state/national incidence if the community's incidence is historically low or negligible.
        - The choice of vaccine depends on the responsible serogroup for the outbreak.
        - It's noted that regional vaccination campaigns aimed at controlling outbreaks of serogroup B meningococcal infections have been effective in reducing infection rates. However, these vaccines might offer limited protection during outbreaks caused by strains not included in the vaccine (those with the B antigen but differing noncapsular proteins).
        - Additionally, serogroup C conjugate vaccination has shown efficacy in controlling emerging epidemics of meningococcal disease.
- **Approach to Vaccination outside of the US:** varies by country, and schedules are available through the European Center for Disease Prevention and control, and the WHO.

- **Vaccine Information**
  - **MenACWY (quadrivalent meningococcal conjugate vaccines):**
    - Vaccine Description: MenACWY vaccines are inactivated vaccines that contain capsular polysaccharide antigens from serogroups A, C, W, and Y, conjugated to a protein carrier (e.g., CRM197 or tetanus toxoid).
    - Immunogenicity: Conjugation to the protein carrier prompts a T cell-dependent memory response, leading to enhanced primary and anamnestic responses, as well as reduced nasopharyngeal carriage compared to non-carrier polysaccharide vaccines. MenACWY vaccines have been evaluated for immunogenicity across different age groups, with high antibody response rates for all four serogroups.
    - Effectiveness: MenACWY vaccines have been effective in controlling meningococcal disease outbreaks.
    - Contraindications and Precautions:
      - Severe allergic reaction to the vaccine components is a contraindication.
      - Precautions should be considered for those with moderate to severe illness, preterm birth (for MenACWY-CRM in infants <9 months), and syncope following immunization. History of Guillain-Barré syndrome is not a precaution for MenACWY vaccines as per ACIP.
    - Dose and Route:
      - MenACWY-CRM (Menveo) and MenACWY-TT (MenQuadfi) are administered intramuscularly (IM) at a dose of 0.5 mL.
      - Although the same vaccine formulation is preferred for all doses, the available MenACWY vaccines are interchangeable.
      - In cases where MenACWY-CRM is available in a two-vial format, it's important to combine the lyophilized MenA component with the liquid MenCWY component just before giving the vaccine. If, by mistake, only the liquid MenCWY component is administered without the lyophilized MenA component, individuals in the United States who have no plans for international travel don't need to be revaccinated. This is because cases of

serogroup A meningococcal disease are infrequently reported in the US. However, if international travel is on the agenda, especially to an area where serogroup A meningococcal disease is common or if vaccination is a requirement (e.g., for the Hajj pilgrimage), re-vaccination should be pursued as soon as possible.

- Administration in Relation to Other Vaccines:
    - Routine administration alongside other recommended vaccines is possible.
    - Simultaneous administration has shown similar safety and immune response results in a randomized trial involving over 1300 adolescents who received both Tdap and MenACWY-D (Menactra). This study observed comparable safety profiles and immune responses against meningococcus, pertussis, diphtheria, and tetanus whether the vaccines were given on the same day or with a 30-day interval between them. Similarly, an observational study found that the risk of adverse events remained similarly low whether Tdap and MenACWY-D were administered at the same time or separately.
- Adverse Events:
    - Common adverse events include erythema, swelling at the injection site, myalgia, fever, fatigue, headache, irritability, and drowsiness.
    - Syncope (fainting) has been reported, particularly for MenACWY-D (Menactra) and MenACWY-CRM (Menveo) in adolescents.
    - No proven association with Guillain-Barré syndrome (GBS) after MenACWY vaccines; GBS cases following MenACWY-D were not found in subsequent large studies.
    - Adverse events, including GBS, should be reported to the Vaccine Adverse Event Reporting System (VAERS) in the US.

- Serogroup B Vaccines:
    - Two vaccines, MenB-FHbp (Trumenba) and MenB-4C (Bexsero), are available for serogroup B meningococcal disease in the US, Europe, and other countries.

- **Vaccine Schedules (US)**: MenB vaccines are not interchangeable; the same formulation should be used for all doses.
    - For MenB-4C (Bexsero), routine and at-risk individuals receive a primary series of two doses, separated by ≥1 month. Booster doses might be necessary for those at risk.
    - For MenB-FHbp (Trumenba), the schedule varies based on the indication:
        - For routine vaccination of healthy individuals: give two doses, separated by ≥6 months. If the second dose is administered <6 months after the first dose, a third dose should be given ≥4 months after the second.
        - For individuals at increased risk for serogroup B meningococcal disease and during outbreaks: administer three doses: at 0, 1 to 2, and 6 months; if the third dose is administered <4 months after the second dose, a fourth dose should be given ≥4 months after the third dose.
- Different schedules apply to other countries, available from the European Centre for Disease Prevention and Control and World Health Organization.
- **Immunogenicity and Effectiveness**:
    - MenB vaccines are immunogenic and well-tolerated.
    - Initial antibody responses are high, but titers decline one to two years post-vaccination for both MenB-FHbp (Trumenba) and MenB-4C (Bexsero).
    - Booster doses induce robust immune responses lasting at least two years.
    - MenB vaccines may not substantially reduce disease-causing carriage in adolescents and young adults compared to MenACWY conjugate vaccines.
- **Effectiveness in Different Age Groups**:
    - MenB vaccines are effective and well-tolerated in adolescents, young adults, and children.

- Although they are not licensed in the United States for children <10 years of age, MenB-4C is licensed in Europe and other countries for children ≥2 months and is used for at-risk children.

- **Interchangeability of Formulations**:
  - MenB vaccines are not interchangeable.
  - If inadvertently receiving different MenB formulations, patients should complete the series with the chosen vaccine.
  - The patient should receive another dose at the appropriate interval for that product and ≥4 weeks after the most recent dose of MenB:
    - Example, for persons without a high-risk condition:
      - If MenB-FHbp (Trumenba) is chosen, the second (final) dose of MenB-FHbp should be given ≥6 months after the previous dose of MenB-FHbp and ≥4 weeks after the invalid dose of MenB-4C.
      - If MenB-4C (Bexsero) is chosen, the second (final dose) of MenB-4C should be given one month after the previous dose of MenB-4C and ≥4 weeks after the invalid dose of MenB-FHbp.

- **Administration and Precautions**:
- Severe allergic reaction to a previous dose or to any component is a contraindication to MenB.
- Precautions include moderate to severe illness with or without fever, pregnancy, and latex sensitivity (for MenB-4C [Bexsero]) because the tip caps of some prefilled MenB-4C syringes contain natural rubber latex.
- MenB vaccines are administered intramuscularly at a dose of 0.5 mL.
- MenB may be given at the same visit with quadrivalent meningococcal conjugate vaccines and other vaccines routinely administered to adolescents and young adults, preferably at different sites.

- Common adverse events include pain at the injection site, fatigue, headache, myalgia, and arthralgia.

Figure 1 provides an overview of meningococcal vaccine recommendations for persons aged 2 years and older who are at an increased risk of meningococcal disease in the United States; tables 5 through 7 detail meningococcal vaccination recommendations for different age groups in various settings.

Box: Target groups for meningococcal vaccination

Immunodeficiencies that increase the risk of meningococcal disease:
- Complement component deficiency (eg, C3, C5-9, properdin, factor H, factor D)
- Use of C5 inhibitors (eg, eculizumab, ravulizumab)
- Anatomic or functional asplenia, including sickle cell disease
- HIV infection

Increased exposure or risk of exposure to *Neisseria meningitidis*:
- Microbiologists routinely exposed to *N. meningitidis*
- Travel to or residence in a country where *N. meningitidis* is hyperendemic or endemic
- Exposed during an outbreak caused by serogroup A, B, C, W, or Y*
- Unimmunized or underimmunized college freshman living in residence hall
- Unimmunized or underimmunized military recruit

The number of doses in the MenACWY primary series depends upon the target group:
- 2 doses ≥8 weeks apart for those with immunodeficiency that increases the risk of meningococcal disease: complement component deficiency, use of C5 inhibitors, anatomic or functional asplenia, and HIV infection.
- 1 dose for those at increased exposure or risk of exposure to *N. meningitidis*: microbiologists routinely exposed to *N. meningitidis*, those who traveled to/reside in hyperendemic/epidemic area, those with exposure during an outbreak, college freshmen, and military recruits.

The MenB primary series varies with the MenB formulation:
- MenB-FHbp (Trumenba): 3 doses at 0, 1 to 2, and 6 months
- MenB-4C (Bexsero): 2 doses ≥1 month apart

MenACWY: quadrivalent meningococcal conjugate vaccine; MenB: meningococcal serogroup B vaccine.

* The decision to vaccinate during an outbreak is determined on a case-by-case basis in consultation with public health officials. In some patients (eg, those with high-risk exposures, those aged <10 years during an outbreak due to serogroup B), chemoprophylaxis may be warranted.

¶ For those aged 16 to 23 years, MenB may be given in the context of shared decision-making (to avoid a missed opportunity for routine immunization).

Δ In the United States, MenB is not licensed for those <10 years of age. However, some experts choose to vaccinate children at substantial risk for meningococcal disease (eg, those receiving C5 inhibitors) with MenB-4C before age 10 years.

◇ For those aged 11 to 18 years, MenACWY may be indicated for routine administration.

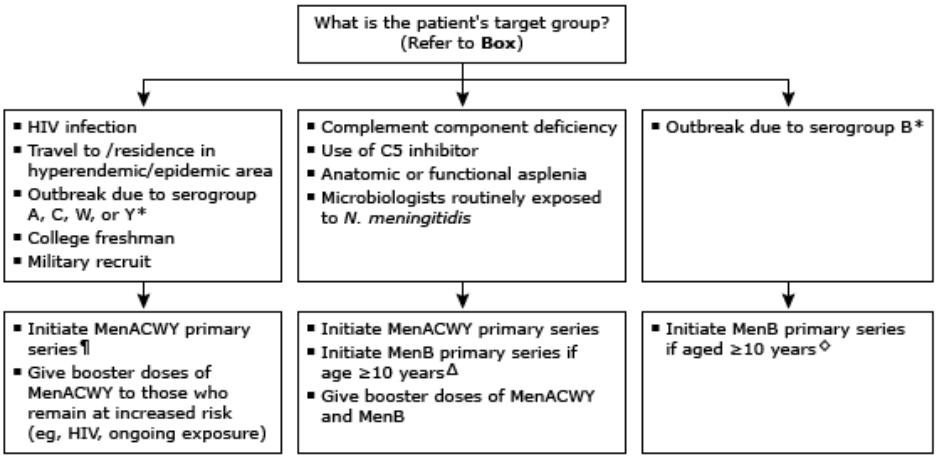

Figure 1. *Overview of Meningococcal Vaccine Recommendations for Persons Aged 2 Years and Older Who Are at an Increased Risk of Meningococcal Disease in the United States (Retrieved from UpToDate)*

Table 5. Meningococcal Vaccination Recommendations for Children Aged 2 through 23 Months Who Are at Increased Risk of Meningococcal Disease in the United States (Retrieved from UpToDate)

Targeted group by risk factor and current age	Primary dose(s) of MenACWY	Future booster dose(s) of MenACWY if increased risk persists
Children with anatomic or functional asplenia* (including sickle cell disease) or HIV infection		
Age 2 through 6 months	Initiate series with MenACWY-CRM as soon as possible: ▪ 3 doses, ≥8 weeks apart ▪ 4th dose at age 12 months	▪ Primary series completed at age <7 years: 3 years after completion of primary series and every 5 years thereafter ▪ Primary series completed at age ≥7 years: every 5 years
Age 7 through 23 months	2 doses of MenACWY-CRM¶, ≥12 weeks apart	
Children with complement component deficiency* (eg, C3, C5-C9, properdin, factor H, factor D) or using complement inhibitors (eg, eculizumab, ravulizumab)*		
Age 2 through 6 months	Initiate series with MenACWY-CRM as soon as possible: ▪ 3 doses, ≥8 weeks apart ▪ 4th dose at age 12 months	▪ Primary series completed at age <7 years: 3 years after completion of primary series and every 5 years thereafter ▪ Primary series complete at age ≥7 years: every 5 years
Age 7 through 23 months	2 doses of MenACWY-CRM¶, ≥12 weeks apart	
Children who travel to or are residents of countries where meningococcal disease is hyperendemic or epidemicΔ		
Age 2 through 6 months	Initiate series with MenACWY-CRM as soon as possible: ▪ 3 doses, ≥8 weeks apart ▪ 4th dose at age 12 months	Not applicable
Age 7 through 23 months	2 doses of MenACWY-CRM¶, 12 weeks apart◇	

This table is meant for use with UpToDate content on meningococcal vaccination. Refer to UpToDate content for additional details, including information about immunizations during meningococcal outbreaks. For children ≥9 months of age, if available, the same MenACWY product should be used for all doses of the primary series. Some of the recommendations are considered off-label (eg, administration of a 2-dose primary series, repeated booster doses).

MenACWY: meningococcal groups A, C, W, and Y conjugate vaccine; MenACWY-CRM (Menveo); CDC: United States Centers for Disease Control and Prevention.

* Children with these conditions should also receive serogroup B meningococcal vaccine at age ≥10 years.

¶ For children age 7 through 23 months, the second dose of MenACWY-CRM should be given at age ≥12 months.

Δ Vaccination is recommended for international travelers visiting the parts of sub-Saharan Africa known as the meningitis belt during the dry season (December to June). The CDC issues advisories for other countries during epidemics of vaccine-preventable serogroups. Additional traveler's health information is available from the CDC.

◇ The interval may be shortened to ≥2 months if the travel is scheduled in <3 months.

Table 6. Meningococcal Vaccination Recommendations for Persons Age ≥ 2 Years Who Are at Increased Risk of Meningococcal Disease in the United States (Retrieved from UpToDate)

Risk factor	MenACWY		MenB for those ≥10 years of age	
	Primary dose(s)	Booster dose(s) if increased risk persists	Primary dose(s)	Booster dose(s) if increased risk persists
Immunodeficiency that increases the risk of meningococcal disease				
Complement component deficiency (eg, C3, C5-C9, properdin, factor H, factor D) or use of complement inhibitors (eg, eculizumab, ravulizumab)*	2 doses of any MenACWY, ≥8 weeks apart	▪ Age <7 years: 3 years after completion of primary series and every 5 years thereafter ▪ Age ≥7 years: every 5 years	Either: ▪ MenB-4C: 2 doses, ≥4 weeks apart **or** ▪ MenB-FHbp: 3 doses on a 0-, 1- to 2-, and 6-month schedule	1 year after completion of primary series and every 2 to 3 years thereafter.
Anatomic or functional asplenia including sickle cell disease	2 doses of any MenACWY, ≥8 weeks apart	▪ Age <7 years: 3 years after completion of primary series and every 5 years thereafter ▪ Age ≥7 years: every 5 years	Either: ▪ MenB-4C: 2 doses, ≥4 weeks apart **or** ▪ MenB-FHbp: 3 doses on a 0-, 1- to 2-, and 6-month schedule	1 year after completion of primary series and every 2 to 3 years thereafter.
Persons with HIV	2 doses of any MenACWY, ≥8 weeks apart	▪ Age <7 years: 3 years after completion of primary series and every 5 years thereafter ▪ Age ≥7 years: every 5 years	MenB is not recommended unless it is otherwise indicated (eg, age 16 through 23 years based on shared decision-making).	
Increased risk of exposure to meningococcal disease				
Microbiologists routinely exposed to meningococcus	1 dose of any MenACWY¶	▪ Every 5 years	Either: ▪ MenB-4C: 2 doses, ≥4 weeks apart **or** ▪ MenB-FHbp: 3 doses on a 0-, 1- to 2-, and 6-month schedule	1 year after completion of primary series and every 2 to 3 years thereafter.
Persons who travel to or are residents of countries where meningococcal disease is hyperendemic or epidemicΔ	1 dose of any MenACWY¶	▪ Age <7 years: 3 years after completion of primary series and every 5 years thereafter ▪ Age ≥7 years: every 5 years	MenB is not recommended unless it is otherwise indicated (eg, age 16 through 23 years based on shared decision-making).	
Unvaccinated or undervaccinated college freshmen living in residence hall◇	1 dose of any MenACWY¶	▪ No recommendation unless otherwise indicated		
Unvaccinated or undervaccinated military recruits	1 dose of any MenACWY¶	▪ Every 5 years depending on assignment§		

This table is meant for use with UpToDate content on meningococcal vaccination. Refer to UpToDate content for additional details, including meningococcal vaccination of persons at risk who are <2 years of age, routine meningococcal vaccination of adolescents and young adults, and information about immunizations during meningococcal outbreaks. Some of the recommendations above are considered off-label (eg, administration of a 2-dose primary series for MenACWY, repeated booster doses of MenACWY or MenB).

- Two MenACWY are licensed in the United States:
  - MenACWY-CRM (Menveo)
  - MenACWY-TT (MenQuadfi)

  MenACWY-D (Menactra) was discontinued in 2022.

  Although each of the MenACWY vaccine formulations use a different protein conjugate, the products are considered interchangeable in persons ≥2 years of age. The same vaccine product is recommended, but not required, for all doses.
- Two MenB vaccines are licensed in the United States:
  - MenB-4C (Bexsero)
  - MenB-FHbp (Trumenba)

  MenB vaccines are not interchangeable; the same brand must be used for each dose of the primary series and all booster doses.

MenACWY: meningococcal groups A, C, W, and Y conjugate vaccine; MenB: serogroup B meningococcal vaccine; CDC: United States Centers for Disease Control and Prevention.

* Meningococcal vaccines should be administered ≥2 weeks before the first dose of complement inhibitor, unless the risk for delaying complement therapy outweighs the risk for developing meningococcal disease.

¶ Patients at increased risk of exposure who also have an immunodeficiency that increases the risk of meningococcal disease should receive the 2-dose primary series.

Δ Vaccination is recommended for international travelers visiting the parts of sub-Saharan Africa known as the meningitis belt during the dry season (December to June). The CDC issues advisories for other countries during epidemics of vaccine-preventable serogroups. Additional traveler's health information is available from the CDC.

◇ College freshmen living in residence halls should receive ≥1 dose of MenACWY ≤5 years before college entry (preferably at age ≥16 years). If only 1 dose of vaccine was administered before the 16th birthday, a booster dose should be administered before enrollment.

§ Vaccination recommendations for military personnel are made by the United States Department of Defense on the basis of high-risk travel requirements.

Table 7. Meningococcal Vaccination Recommendations for Persons Age ≥ 2 years During an Outbreak in the United States (Retrieved from UpToDate)

Persons who are at risk during an outbreak attributable to a vaccine group	Individuals with exposure to group A, C, W, Y	Individuals with exposure to serogroup B*
Healthy persons with no immunizations against meningococcal disease		
2 through 6 months old	MenACWY-CRM: ▪ 3 doses, ≥8 weeks apart ▪ 4th dose at age 12 months	No recommendations
7 through 23 months old	2 doses of MenACWY-CRM¶, 12 weeks apart	No recommendations
2 through 9 years old	1 dose of MenACWY	No recommendations
≥10 years old	1 dose of MenACWY	Either: ▪ MenB-4C: 2 doses, ≥4 weeks apart, **or** ▪ MenB-FHbp: 3 doses on a 0-, 1- to 2-, and 6-month schedule
Patients who have completed an age-appropriate primary series of meningococcal vaccine		
2 through 6 years old	1 dose if ≥3 years since last dose of MenACWY vaccine	No recommendations
7 through 9 years old	1 dose if ≥5 years since last dose of MenACWY vaccine	No recommendations
≥10 years	1 dose if ≥5 years since last dose of MenACWY vaccine	1 dose if ≥1 year since completing primary MenB vaccineΔ

This table is meant for use with UpToDate content related to meningococcal vaccination. Refer to UpToDate content for additional details. Detailed recommendations for outbreak management are available from the CDC. Consult local public health authorities to identify persons who require vaccination.

- Two MenACWY are licensed in the United States:
  - MenACWY-CRM (Menveo)
  - MenACWY-TT (MenQuadfi)

  MenACWY-D (Menactra) was discontinued in 2022.

  Although each of the MenACWY vaccine formulations use a different protein conjugate, the products are considered interchangeable in persons ≥2 years of age. The same vaccine product is recommended, but not required, for all doses.
- Two MenB vaccines are licensed in the United States:
  - MenB-4C (Bexsero)
  - MenB-FHbp (Trumenba)

  MenB vaccines are not interchangeable; the same brand must be used for each dose of the primary series and all booster doses.

MenACWY: meningococcal groups A, C, W, and Y conjugate vaccine; MenB: serogroup B meningococcal vaccine; CDC: United States Centers for Disease Control and Prevention.

* For healthy persons ≥10 years of age with incomplete MenB immunization, the schedule varies with the vaccine formulation and number of doses received:
  - Single dose of MenB-4C: Give second dose of MenB-4C ≥1 month after the first dose.
  - Single dose of MenB-FHbp: Complete a 3-dose series (0-, 1-, and 6-month schedule).
  - Two doses of MenB-FHbp with second dose <6 months after the first: Give a third dose according to the recommended schedule. If the second dose was given at ≥6 months after the first dose, no additional doses are needed.

If the vaccine type of any previous doses received is not known, the primary series should be restarted and completed using either MenB-4C or MenB-FHbp, since the MenB vaccines are not interchangeable.

¶ For children age 7 through 23 months, the second dose of MenACWY-CRM should be given at age ≥12 months.

Δ A booster dose interval of ≥6 months may be considered by public health officials to avoid missed opportunities for vaccination. Similarly, if the formulation used for the primary series is unavailable or unknown and cannot be quickly determined, any type of MenB vaccine may be administered. However, if possible, the same formulation of MenB vaccine that was used for the primary series should be used, since there are no data on the efficacy of using a different formulation for the booster dose.

1.2.2 Meningococcal Vaccination: Recommendations of the Advisory Committee on Immunization Practices (ACIP), United States (2020)

There are no evidence levels and/or recommendation grades outlined in this guideline.

The following recommendations are provided by the Advisory Committee on Immunization Practices on Meningococcal Vaccination[7]:

Recommendations for Use of Meningococcal Vaccines

Adolescents and Young Adults

The Advisory Committee on Immunization Practices (ACIP) provides recommendations for the routine MenACWY (meningococcal conjugate vaccine) administration for individuals aged 11–18 years. Additionally, a MenB (serogroup B meningococcal) vaccine series is recommended for those aged 16–23 years, decided through shared clinical decision-making, offering short-term protection against many strains of serogroup B meningococcal disease.

For MenACWY vaccines:

- A single dose is recommended at age 11 or 12 years, followed by a booster dose at age 16 years.
- Those who received MenACWY at age 10 years don't need an extra dose at 11–12 years but should get the booster at 16 years.
- Children who got MenACWY before age 10 years without ongoing risk for meningococcal disease still need the recommended doses at 11–12 and 16 years.
- Adolescents getting their first dose at 13–15 years should receive a booster at 16–18 years, with a minimum interval of 8 weeks between doses.
- If a first dose is received after the 16th birthday, a booster isn't necessary unless there's an increased risk for meningococcal disease.
- Those aged 19–21 years who haven't been vaccinated since their 16th birthday can receive a single MenACWY dose for catch-up vaccination.
- Different MenACWY vaccine products can be used interchangeably. The same vaccine product is recommended for all doses but not required.
- MenACWY vaccines can be given concurrently with other vaccines for this age group at a separate injection site.
- MenACWY-TT, conjugated to tetanus toxoid, is only for meningococcal disease prevention and doesn't replace or affect the schedule of recommended tetanus toxoid–containing vaccines in any age group.

MenB Vaccines Recommendations

MenB (serogroup B meningococcal) vaccination is not routinely advised for all adolescents. Instead, ACIP recommends a MenB vaccine series for individuals aged 16–23 years (preferably 16–18 years) based on shared clinical decision-making. This approach involves discussions between healthcare providers and patients or parents/guardians to make informed vaccine choices. Factors for such decisions include:

- The severity of meningococcal infections, which can result in high rates of death and lasting complications.
- The relatively low incidence of serogroup B meningococcal cases (averaging 34 cases annually among those aged 16–23 years in the US between 2015 and 2018).
- Higher risk among college students, especially freshmen, those at 4-year universities, on-campus residents, and sorority/fraternity members.
- Efficacy of MenB vaccines against most serogroup B N. meningitidis strains.
- The relatively short duration of MenB protection (antibodies decrease 1–2 years after the primary series).
- Current evidence suggesting MenB vaccination doesn't impact meningococcal carriage (individual protection is likely, but herd protection is doubtful).

For adolescents without other heightened meningococcal disease risk, a 2-dose MenB vaccine series is recommended as follows:

- 2 doses of MenB-FHbp at 0 and 6 months, or
- 2 doses of MenB-4C at 0 and ≥1 month.
- If the second MenB-FHbp dose is administered earlier than 6 months after the first dose, a third dose should follow at least 4 months after the second dose.

Either of the MenB vaccines may be used as indicated; no preference is stated. However, they are not interchangeable, and the same product must be used for all doses. If a MenB dose was received with an unknown vaccine product, the series should restart with either product. If two doses were given using different MenB products, one product should be chosen for series completion, with the other considered invalid. In cases needing MenB dose repetition, at least 4 weeks should separate any two doses. MenB vaccines can be administered concurrently with other age-appropriate vaccines, at different injection sites if possible.

Recommendations for Persons at Increased Risk of Meningococcal Disease

People with an elevated risk of meningococcal disease are advised to receive routine meningococcal vaccination. The specific vaccine, number of doses, and booster recommendations depend on age and risk factors. Although some evidence suggests that vaccination might not fully prevent meningococcal infections in individuals with certain complement deficiencies or those using complement inhibitors, these individuals should still be vaccinated based on potential benefits for those at high risk.

For individuals using complement inhibitors, vaccination should ideally occur at least 2 weeks before starting the inhibitor, unless delaying treatment would pose greater risks. In situations where complement inhibitor treatment cannot be postponed, antimicrobial prophylaxis (e.g., penicillin) should be given alongside meningococcal vaccination and continued for 2 weeks after vaccination. Furthermore, healthcare professionals could contemplate using antimicrobial preventive treatment throughout the duration of complement inhibitor therapy. For individuals undergoing planned spleen removal surgery, it is advisable to administer meningococcal vaccines a minimum of 2 weeks before the procedure, if feasible. Alternatively, if that is not possible, the vaccines should be given after the surgery once the patient's health has stabilized.

MenACWY Vaccines:

- Children at increased risk for serogroups A, C, W, or Y meningococcal disease, who received MenACWY before age 11 years, and need boosters due to ongoing risk, should follow the booster schedule for high-risk individuals rather than the routine adolescent schedule.
- Children at high risk who received MenACWY at age <15 years, repeated boosters, or boosters with intervals of <4 years are considered off-label and not licensed in the US.
- Because of the high risk for invasive pneumococcal disease, children with functional or anatomic asplenia or HIV infection should not be vaccinated with MenACWY-D before age 2 years to avoid interference with the immune response to 13-valent pneumococcal conjugate vaccine (PCV13). MenACWY-CRM should be used instead. If MenACWY-D is used in persons of any age with these conditions, it should not be administered until at least 4 weeks after completion of all PCV doses.
- MenACWY-D vaccines should be administered before or concurrently with DTaP to avoid immune response interference. If not possible, MenACWY-D should be administered 6 months after DTaP, unless the child is at increased risk for meningococcal disease because of travel to an area where disease is hyperendemic or epidemic or where an outbreak is occurring, in which case

MenACWY-D should be administered regardless of timing of DTaP. If MenACWY-D is inadvertently administered in the 6 months after DTaP administration, the dose does not need to be repeated.

- MenACWY vaccines are interchangeable.
- If an otherwise healthy individual aged ≥2 years, who has previously received a solitary MenACWY vaccine dose, develops a medical condition necessitating meningococcal vaccination through a 2-dose primary series, the second dose should be promptly administered, ensuring a minimum interval of 8 weeks between doses.
- Administering MenACWY-D or MenACWY-CRM to individuals aged ≥56 years, offering a 2-dose MenACWY primary series to those aged ≥2 years with an elevated risk of meningococcal disease, providing more than one booster dose, and delivering a booster dose to individuals aged <15 years or within an interval of <4 years since the last dose, are not authorized practices in the United States. These actions represent off-label recommendations by ACIP.
- For first-year college students residing in dormitories, it is recommended to receive at least one MenACWY dose within 5 years before entering college. It is preferable for the most recent dose to be given on or after their 16th birthday. If only one vaccine dose was received prior to the 16th birthday, an additional booster dose should be administered before enrollment. Adolescents who received their first dose after their 16th birthday are not required to receive another dose before college entry, unless more than 5 years have elapsed since the dose was administered.

MenB Vaccines:

- Individuals at increased risk for meningococcal disease, including outbreaks, should receive a 3-dose MenB-FHbp series or a 2-dose MenB-4C primary series.
- Boosters should be given per dosing schedules for those who previously completed a MenB primary series and remain or become at increased risk.
- The administration of the primary series of vaccines in individuals aged 26 years and older, as well as booster vaccination for those at an elevated risk of meningococcal disease, is not authorized in the United States and is classified as off-label.
- Regarding the MenB-FHbp primary series, a 3-dose regimen (given at 0, 1–2, and 6 months) is recommended to ensure quicker protection and optimize short-term immune response.

- For MenB-FHbp, if the second dose is >6 months after the first, a third dose is unnecessary. If the third dose is <4 months after the second, a fourth dose should follow at least 4 months after the third dose.
- For MenB-4C, doses should be administered at 0 and ≥1 months.
- The two MenB vaccines are non-interchangeable. Administering the same vaccine product for all doses, including boosters, is vital, because receiving mismatched MenB vaccine products might result in inadequate protection.
- In cases where doses need to be repeated, a minimum gap of 4 weeks should be maintained between any two doses. MenB vaccines can be given at the same time as other vaccines recommended for individuals in the same age group. However, if possible, they should be administered at separate injection sites.

Establishment of Vaccine-Mediated Immunity

- ACIP advises against using antibody titers against specific meningococcal serogroups to determine immunity or the necessity for vaccination. The use of commercially available immunoglobulin tests, such as IgG testing, should not be employed to deduce individual protection against meningococcal disease.

Precautions and Contraindications

- Postvaccine syncope can occur with all injectable vaccines.
- Premature birth is a precaution for MenACWY-CRM vaccination, and latex sensitivity is a precaution for MenB-4C.
- Appropriate medical treatment must be available should an acute allergic reaction, including an anaphylactic reaction, occur.
- Severe allergic reactions to a previous vaccine dose or any vaccine component are contraindications to vaccination. For MenACWY-D and MenACWY-CRM, severe allergic reaction to any diphtheria toxoid– or CRM197–containing vaccine is also a contraindication. For MenACWY-TT, severe allergic reaction to a tetanus toxoid–containing vaccine is also a contraindication.
- Previous history of Guillain-Barré syndrome is listed as a precaution for MenACWY-D in the package insert.

Pregnancy and Lactation

- MenACWY is safe if needed.
- MenB vaccination during pregnancy should be deferred unless benefits outweigh risks after consultation with a healthcare provider.

Adverse events following meningococcal vaccination can be reported to VAERS (**Vaccine Adverse Event Reporting System**).

Tables 8 through 17 provided below cover the recommended meningococcal vaccines and their administration schedules for specific patient populations.

Table 8. Recommended Meningococcal Vaccines and Administration Schedules for Children and Adults (Retrieved from the 2020 ACIP Recommendations)

Age group	Serogroups A, C, W, and Y meningococcal conjugate vaccines MenACWY-D (Menactra, Sanofi Pasteur) *or* MenACWY-CRM (Menveo, GlaxoSmithKline) *or* MenACWY-TT (MenQuadfi, Sanofi Pasteur)	Serogroup B meningococcal vaccines MenB-FHbp (Trumenba, Pfizer) *or* MenB-4C (Bexsero, GlaxoSmithKline)
2 mos–10 yrs	Not routinely recommended See Table 3 for persons at increased risk	No recommendations for use of MenB vaccines in this population*
11–23 yrs	**Primary vaccination**†**:** 1 dose at age 11–12 yrs **Booster:** 1 dose at age 16 yrs if first dose administered before 16th birthday **Catch-up vaccination:** Although routine vaccination is only recommended for adolescents aged 11–18 yrs, MenACWY may be administered to persons aged 19–21 yrs who have not received a dose after their 16th birthday **Note:** MenACWY vaccines are interchangeable	**Primary vaccination:** MenB series at age 16–23 yrs on basis of shared clinical decision-making (preferred age 16–18 yrs) • MenB-FHbp§: 2 doses at 0 and 6 mos • MenB-4C: 2 doses ≥1 mo apart **Booster:** Not routinely recommended unless the person becomes at increased risk for meningococcal disease **Note:** MenB-FHbp and MenB-4C are not interchangeable
≥24 yrs	Not routinely recommended See Table 3 for persons at increased risk	Not routinely recommended See Table 3 for persons at increased risk

Abbreviations: MenACWY-CRM = meningococcal groups A, C, W, and Y oligosaccharide diphtheria CRM_{197} conjugate vaccine; MenACWY-D = meningococcal groups A, C, W, and Y polysaccharide diphtheria toxoid conjugate vaccine; MenACWY-TT = meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine; MenB-4C = four-component meningococcal group B vaccine; MenB-FHbp = meningococcal group B factor H binding protein vaccine.

* MenB vaccines are licensed in the United States only for persons aged 10–25 years.

† College freshmen living in residence halls should receive at least 1 dose of MenACWY within 5 years before college entry. The preferred timing of the most recent dose is on or after their 16th birthday. If only 1 dose of vaccine was administered before the 16th birthday, a booster dose should be administered before enrollment. Adolescents who received a first dose after their 16th birthday do not need another dose before college entry unless it has been more than 5 years since the dose. Certain schools, colleges, and universities have policies requiring vaccination against meningococcal disease as a condition of enrollment.

§ When given to healthy adolescents who are not otherwise at increased risk for meningococcal disease, 2 doses of MenB-FHbp should be administered at 0 and 6 months. For persons at increased risk for meningococcal disease and for use during serogroup B meningococcal disease outbreaks, 3 doses of MenB-FHbp should be administered at 0, 1–2, and 6 months to provide earlier protection and maximize short-term immunogenicity.

Table 9. Recommended Meningococcal Vaccines for Persons at Increased Risk for Meningococcal Disease (Retrieved from the 2020 ACIP Recommendations)

Risk group	MenACWY vaccine	MenB vaccine	Table
Persons with complement component deficiency (e.g., C5–C9, properdin, factor H, or factor D), including patients using a complement inhibitor	Aged ≥2 mos	Aged ≥10 yrs	4
Persons with functional or anatomic asplenia (including sickle cell disease)	Aged ≥2 mos	Aged ≥10 yrs	5
Persons with HIV infection	Aged ≥2 mos	No recommendation	6
Microbiologists routinely exposed to *Neisseria meningitidis*	Age appropriate*	Age appropriate†	7
Persons exposed during an outbreak of meningococcal disease due to a vaccine-preventable serogroup	Aged ≥2 mos	Aged ≥10 yrs	8
Persons who travel to or live in countries where meningococcal disease is hyperendemic or epidemic	Aged ≥2 mos	No recommendation	9
College freshmen living in residence halls	Age appropriate*	No recommendation	10
Military recruits	Age appropriate*	No recommendation	10

Abbreviations: HIV = human immunodeficiency virus; MenACWY = meningococcal groups A, C, W, and Y; MenB = meningococcal group B.

* Persons aged ≥2 months in these risk groups are recommended to receive MenACWY vaccination.

† Persons aged ≥10 years in this risk group are recommended to receive MenB vaccination.

Table 10. Recommended Vaccination Schedule and Intervals for Persons with Persistent Complement Deficiencies (including patients using a complement inhibitor) (Retrieved from the 2020 ACIP Recommendations)

Age group	Serogroups A, C, W, and Y meningococcal conjugate vaccines MenACWY-D (Menactra, Sanofi Pasteur)[§] *or* MenACWY-CRM (Menveo, GlaxoSmithKline)[¶] *or* MenACWY-TT (MenQuadfi, Sanofi Pasteur)[**]	Serogroup B meningococcal vaccines MenB-FHbp (Trumenba, Pfizer) *or* MenB-4C (Bexsero, GlaxoSmithKline)
2–23 mos	**Primary vaccination:** MenACWY-D (aged ≥9 mos): 2 doses ≥12 wks apart *or* MenACWY-CRM if first dose at age • 2 mos: 4 doses at 2, 4, 6, and 12 mos • 3–6 mos: See catch-up schedule[§§] • 7–23 mos: 2 doses (second dose ≥12 wks after the first dose and after the 1st birthday)	No recommendations for use of MenB vaccines in this population[††]
2–9 yrs	**Primary vaccination[¶¶]:** MenACWY-D[***] *or* MenACWY-CRM *or* MenACWY-TT: 2 doses ≥8 wks apart **Boosters (if person remains at increased risk)[†††]:** • Aged <7 yrs: Single dose at 3 yrs after primary vaccination and every 5 yrs thereafter • Aged ≥7 yrs: Single dose at 5 yrs after primary vaccination and every 5 yrs thereafter	No recommendations for use of MenB vaccines in this population[††]
≥10 yrs	**Primary vaccination[††]:** MenACWY-D *or* MenACWY-CRM *or* MenACWY-TT: 2 doses ≥8 wks apart **Boosters (if person remains at increased risk)[†††]:** Single dose at 5 yrs after primary vaccination and every 5 yrs thereafter	**Primary vaccination[††]:** MenB-FHbp: 3 doses at 0, 1–2, and 6 mos *or* MenB-4C: 2 doses ≥1 mo apart **Boosters (if person remains at increased risk)[§§§]:** Single dose at 1 yr after completion of primary vaccination and every 2–3 yrs thereafter **Note:** MenB-FHbp and MenB-4C are not interchangeable

Abbreviations: DTaP = diphtheria and tetanus toxoids and acellular pertussis vaccine; MenACWY-CRM = meningococcal groups A, C, W, and Y oligosaccharide diphtheria CRM_{197} conjugate vaccine; MenACWY-D = meningococcal groups A, C, W, and Y polysaccharide diphtheria toxoid conjugate vaccine; MenACWY-TT = meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine; MenB-4C = four-component meningococcal group B vaccine; MenB-FHbp = meningococcal group B factor H binding protein vaccine.

* Persistent complement deficiencies include C3, C5–C9, properdin, factor H, or factor D.

† Includes eculizumab (Soliris) and ravulizumab (Ultomiris). Meningococcal vaccines should be administered at least 2 weeks before the first dose of complement inhibitor, unless the risk for delaying complement therapy outweighs the risk for developing meningococcal disease.

§ Licensed in the United States only for persons aged 9 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

¶ Licensed in the United States only for persons aged 2 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

** Licensed in the United States only for persons aged ≥2 years.

†† Licensed in the United States only for persons aged 10–25 years. Vaccination of persons aged ≥26 years is considered off-label.

§§ If MenACWY-CRM is initiated at ages 3–6 months, catch-up vaccination includes doses at intervals of 8 weeks until the infant is aged ≥7 months, at which time an additional dose is administered at age ≥7 months, followed by a dose at least 12 weeks later and after the 1st birthday.

¶¶ Primary vaccination licensed as a single dose in persons aged 2–55 years for MenACWY-D and MenACWY-CRM or ≥2 years for MenACWY-TT. Two-dose primary series is considered off-label.

*** MenACWY-D should be given either before or at the same time as DTaP to avoid interference with the immune response to meningococcal vaccine in children.

††† Licensed in the United States only for a single booster dose for persons aged 15–55 years for MenACWY-D and MenACWY-CRM or aged ≥15 years for MenACWY-TT. Booster doses administered outside of these ages or administration of >1 booster dose are considered off-label.

§§§ Licensed in the United States only for a primary series. Administration of booster doses is considered off-label.

Table 11. Recommended Vaccination Schedule and Intervals for Persons with Anatomic and Functional Asplenia (Including Sickle Cell Disease) (Retrieved from the 2020 ACIP Recommendations)

Age group	Serogroups A, C, W, and Y meningococcal conjugate vaccines MenACWY-D (Menactra, Sanofi Pasteur)* *or* MenACWY-CRM (Menveo, GlaxoSmithKline)† *or* MenACWY-TT (MenQuadfi, Sanofi Pasteur)§	Serogroup B meningococcal vaccines MenB-FHbp (Trumenba, Pfizer) *or* MenB-4C (Bexsero, GlaxoSmithKline)
2–23 mos	**Primary vaccination:** MenACWY-CRM: If first dose at age • 2 mos: 4 doses at 2, 4, 6, and 12 mos • 3–6 mos: See catch-up schedule¶ • 7–23 mos: 2 doses (second dose ≥12 wks after the first dose and after the 1st birthday)	No recommendations for use of MenB vaccines in this population**
2–9 yrs	**Primary vaccination††:** MenACWY-D§§,¶¶: 2 doses ≥8 wks apart and ≥4 wks after completion of PCV13 series ***or*** MenACWY-CRM ***or*** MenACWY-TT: 2 doses ≥8 wks apart **Boosters (if person remains at increased risk)***:** • Aged <7 yrs: Single dose at 3 yrs after vaccination and every 5 yrs thereafter • Aged ≥7 yrs: Single dose at 5 yrs and every 5 yrs thereafter	No recommendations for use of MenB vaccines in this population**
≥10 yrs	**Primary vaccination††:** MenACWY-D¶¶: 2 doses ≥8 wks apart and ≥4 wks after completion of PCV13 series ***or*** MenACWY-CRM ***or*** MenACWY-TT: 2 doses ≥8 wks apart **Boosters (if person remains at increased risk)***:** Single dose at 5 yrs after primary vaccination and every 5 yrs thereafter	**Primary vaccination**:** MenB-FHbp: 3 doses at 0, 1–2, and 6 mos ***or*** MenB-4C: 2 doses ≥1 mo apart **Boosters (if person remains at increased risk)†††:** Single dose at 1 yr after completion of primary vaccination and every 2–3 yrs thereafter **Note:** MenB-FHbp and MenB-4C are not interchangeable

Abbreviations: DTaP = diphtheria and tetanus toxoids and acellular pertussis vaccine; MenACWY-CRM = meningococcal groups A, C, W, and Y oligosaccharide diphtheria CRM_{197} conjugate vaccine; MenACWY-D = meningococcal groups A, C, W, and Y polysaccharide diphtheria toxoid conjugate vaccine; MenACWY-TT = meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine; MenB-4C = four-component meningococcal group B vaccine; MenB-FHbp = meningococcal group B factor H binding protein vaccine; PCV = pneumococcal conjugate vaccine.

* Licensed in the United States only for persons aged 9 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

† Licensed in the United States only for persons aged 2 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

§ Licensed in the United States only for persons aged ≥2 years.

¶ If MenACWY-CRM is initiated at ages 3–6 months, catch-up vaccination includes doses at intervals of 8 weeks until the infant is aged ≥7 months, at which time an additional dose is administered at age ≥7 months, followed by a dose at least 12 weeks later and after the 1st birthday.

** Licensed in the United States only for persons aged 10–25 years. Vaccination of persons aged ≥26 years is considered off-label.

†† Primary vaccination licensed as a single dose in persons aged 2–55 years for MenACWY-D and MenACWY-CRM or ≥2 years for MenACWY-TT. Two-dose primary series is considered off-label.

§§ MenACWY-D should be given either before or at the same time as DTaP to avoid interference with the immune response to meningococcal vaccine in children.

¶¶ Because of the high risk for invasive pneumococcal disease, children with functional or anatomic asplenia or human immunodeficiency virus infection should not be vaccinated with MenACWY-D (Menactra) before age 2 years to avoid interference with the immune response to PCV. If MenACWY-D is used in a person (of any age) with these conditions, it should not be administered until at least 4 weeks after completion of all PCV doses.

*** Licensed in the United States only for a single booster dose for persons aged 15–55 years for MenACWY-D and MenACWY-CRM or aged ≥15 years for MenACWY-TT. Booster doses administered outside of these ages or administration of >1 booster dose are considered off-label.

††† Licensed in the United States only for a primary series. Administration of booster doses is considered off-label.

Table 12. Recommended Vaccination Schedule and Intervals for Persons with Human Immunodeficiency Virus (HIV) Infection (Retrieved from the 2020 ACIP Recommendations)

Age group	Serogroups A, C, W, and Y meningococcal conjugate vaccines MenACWY-D (Menactra, Sanofi Pasteur)* *or* MenACWY-CRM (Menveo, GlaxoSmithKline)† *or* MenACWY-TT (MenQuadfi, Sanofi Pasteur)§	Serogroup B meningococcal vaccines MenB-FHbp (Trumenba, Pfizer) *or* MenB-4C (Bexsero, GlaxoSmithKline)
2–23 mos	**Primary vaccination:** MenACWY-CRM: If first dose at age • 2 mos: 4 doses at 2, 4, 6, and 12 mos • 3–6 mos: See catch-up schedule¶ • 7–23 mos: 2 doses (second dose ≥12 wks after the first dose and after the 1st birthday)	No recommendations for use of MenB vaccines in these populations unless otherwise indicated (in persons aged ≥10 yrs)
≥2 yrs	**Primary vaccination**:** MenACWY-D††,§§: 2 doses ≥8 wks apart and ≥4 wks after completion of PCV13 series ***or*** MenACWY-CRM ***or*** MenACWY-TT: 2 doses ≥8 wks apart **Boosters (if person remains at increased risk)¶¶:** • Aged <7 yrs: Single dose at 3 yrs after primary vaccination and every 5 yrs thereafter • Aged ≥7 yrs: Single dose at 5 yrs after primary vaccination and every 5 yrs thereafter	See Table 2 for recommendations in persons aged 16–23 yrs

Abbreviations: DTaP = diphtheria and tetanus toxoids and acellular pertussis vaccine; MenACWY-CRM = meningococcal groups A, C, W, and Y oligosaccharide diphtheria CRM_{197} conjugate vaccine; MenACWY-D = meningococcal groups A, C, W, and Y polysaccharide diphtheria toxoid conjugate vaccine; MenACWY-TT = meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine; MenB-4C = four-component meningococcal group B vaccine; MenB-FHbp = meningococcal group B factor H binding protein vaccine; PCV = pneumococcal conjugate vaccine; Td = tetanus and diphtheria toxoids vaccine; Tdap = tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine.

* Licensed in the United States only for persons aged 9 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

† Licensed in the United States only for persons aged 2 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

§ Licensed in the United States only for persons aged ≥2 years.

¶ If MenACWY-CRM is initiated at ages 3–6 months, catch-up vaccination includes doses at intervals of 8 weeks until the infant is aged ≥7 months, at which time an additional dose is administered at age ≥7 months, followed by a dose at least 12 weeks later and after the 1st birthday.

** Primary vaccination licensed as a single dose in persons aged 2–55 years for MenACWY-D and MenACWY-CRM or ≥2 years for MenACWY-TT. Two-dose primary series is considered off-label.

†† MenACWY-D should be given either before or at the same time as DTaP to avoid interference with the immune response to meningococcal vaccine in children. MenACWY-D may be given at any time in relation to Tdap or Td.

§§ Because of the high risk for invasive pneumococcal disease, children with functional or anatomic asplenia or human immunodeficiency virus infection should not be vaccinated with MenACWY-D (Menactra) before age 2 years to avoid interference with the immune response to PCV. If MenACWY-D is used in a person (of any age) with functional or anatomic asplenia or HIV infection, it should not be administered until at least 4 weeks after completion of all PCV doses.

¶¶ Licensed in the United States only for a single booster dose for persons aged 15–55 years for MenACWY-D and MenACWY-CRM or aged ≥15 years for MenACWY-TT. Booster doses administered outside of these ages or administration of >1 booster dose are considered off-label.

Table 13. Recommended Vaccination Schedule and Intervals for Microbiologists Routinely Exposed to Isolates of Neisseria Meningitidis (Retrieved from the 2020 ACIP Recommendations)

Age group	Serogroups A, C, W, and Y meningococcal conjugate vaccines MenACWY-D (Menactra, Sanofi Pasteur)* *or* MenACWY-CRM (Menveo, GlaxoSmithKline)† *or* MenACWY-TT (MenQuadfi, Sanofi Pasteur)§	Serogroup B meningococcal vaccines MenB-FHbp (Trumenba, Pfizer) *or* MenB-4C (Bexsero, GlaxoSmithKline)
≥10 yrs	**Primary vaccination:** MenACWY-D ***or*** MenACWY-CRM ***or*** MenACWY-TT: 1 dose **Boosters (if person remains at increased risk)**:** Single dose at 5 yrs after primary vaccination and every 5 yrs thereafter	**Primary vaccination¶:** MenB-FHbp: 3 doses at 0, 1–2, and 6 mos ***or*** MenB-4C: 2 doses ≥1 mo apart **Boosters (if person remains at increased risk)††:** Single dose at 1 yr after completion of primary vaccination and every 2–3 yrs thereafter **Note:** MenB-FHbp and MenB-4C are not interchangeable

Abbreviations: MenACWY-CRM = meningococcal groups A, C, W, and Y oligosaccharide diphtheria CRM_{197} conjugate vaccine; MenACWY-D = meningococcal groups A, C, W, and Y polysaccharide diphtheria toxoid conjugate vaccine; MenACWY-TT = meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine; MenB-4C = four-component meningococcal group B vaccine; MenB-FHbp = meningococcal group B factor H binding protein vaccine.

* Licensed in the United States only for persons aged 9 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

† Licensed in the United States only for persons aged 2 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

§ Licensed in the United States only for persons aged ≥2 years.

¶ Licensed in the United States only for persons aged 10–25 years. Vaccination of persons aged ≥26 years is considered off-label.

** Licensed in the United States only for a single booster dose for persons aged 15–55 years for MenACWY-D and MenACWY-CRM or aged ≥15 years for MenACWY-TT. Booster doses administered outside of these ages or administration of >1 booster dose are considered off-label.

†† Licensed in the United States only for a primary series. Administration of booster doses is considered off-label.

Table 14. Recommended Vaccination Schedule and Intervals for Persons Who Are at Risk During an Outbreak Attributable to a Vaccine Serogroup (Retrieved from the 2020 ACIP Recommendations)

Age group	Serogroups A, C, W, and Y meningococcal conjugate vaccines MenACWY-D (Menactra, Sanofi Pasteur)† *or* MenACWY-CRM (Menveo, GlaxoSmithKline)§ *or* MenACWY-TT (MenQuadfi, Sanofi Pasteur)¶	Serogroup B meningococcal vaccines MenB-FHbp (Trumenba, Pfizer) *or* MenB-4C (Bexsero, GlaxoSmithKline)
2–23 mos	**Primary vaccination:** MenACWY-D (aged ≥9 mos): 2 doses ≥12 wks apart ***or*** MenACWY-CRM: If first dose at age • 2 mos: 4 doses at 2, 4, 6, and 12 mos • 3–6 mos: See catch-up schedule†† • 7–23 mos: 2 doses (second dose ≥12 wks after the first dose and after the 1st birthday)	No recommendations for use of MenB vaccines in this population**
2–9 yrs	**Primary vaccination:** MenACWY-D§§ ***or*** MenACWY-CRM ***or*** MenACWY-TT: 1 dose **Boosters (if previously vaccinated and identified as being at increased risk)¶¶:** • Aged <7 yrs: Single dose if ≥3 yrs since vaccination • Aged ≥7 yrs: single dose if ≥5 yrs since vaccination	No recommendations for use of MenB vaccines in this population**
≥10 yrs	**Primary vaccination:** MenACWY-D ***or*** MenACWY-CRM ***or*** MenACWY-TT: 1 dose **Boosters (if person previously vaccinated and identified as being at increased risk during an outbreak)¶¶:** • Aged <7 yrs: Single dose if ≥3 yrs since vaccination • Aged ≥7 yrs: Single dose if ≥5 yrs since vaccination	**Primary vaccination:** MenB-FHbp: 3 doses at 0, 1–2, and 6 mos ***or*** MenB-4C: 2 doses ≥1 mo apart **Boosters (if person previously vaccinated and identified as being at increased risk during an outbreak)***:** Single dose if ≥1 yr after MenB primary series completion (≥6 mos interval might also be considered by public health professionals) **Note:** MenB-FHbp and MenB-4C are not interchangeable

Abbreviations: DTaP = diphtheria and tetanus toxoids and acellular pertussis vaccine; MenACWY-CRM = meningococcal groups A, C, W, and Y oligosaccharide diphtheria CRM_{197} conjugate vaccine; MenACWY-D = meningococcal groups A, C, W, and Y polysaccharide diphtheria toxoid conjugate vaccine; MenACWY-TT = meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine; MenB-4C = four-component meningococcal group B vaccine; MenB-FHbp = meningococcal group B factor H binding protein vaccine.

* Detailed recommendations on outbreak management are available at https://www.cdc.gov/meningococcal/downloads/meningococcal-outbreak-guidance.pdf.

† Licensed in the United States only for persons aged 9 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

§ Licensed in the United States only for persons aged 2 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

¶ Licensed in the United States only for persons aged ≥2 years.

** Licensed in the United States only for persons aged 10–25 years. Vaccination of persons aged ≥26 years is considered off-label.

†† If MenACWY-CRM is initiated at ages 3–6 months, catch-up vaccination includes doses at intervals of 8 weeks until the infant is aged ≥7 months, at which time an additional dose is administered at age ≥7 months, followed by a dose at least 12 weeks later and after the 1st birthday.

§§ MenACWY-D should be given either before or at the same time as DTaP to avoid interference with the immune response to meningococcal vaccine in children.

¶¶ Licensed in the United States only for a single booster dose for persons aged 15–55 years for MenACWY-D and MenACWY-CRM or aged ≥15 years for MenACWY-TT. Booster doses administered outside of these ages or administration of >1 booster dose are considered off-label.

*** Licensed in the United States only for a primary series. Administration of booster doses is considered off-label.

Table 15. Recommended Vaccination Schedule and Intervals for Persons Who Travel to or are Residents of Countries Where Meningococcal Disease is Hyperendemic or Epidemic (Retrieved from the 2020 ACIP Recommendations)

Age group	Serogroups A, C, W, and Y meningococcal conjugate vaccines MenACWY-D (Menactra, Sanofi Pasteur)† *or* MenACWY-CRM (Menveo, GlaxoSmithKline)§ *or* MenACWY-TT (MenQuadfi, Sanofi Pasteur)¶	Serogroup B meningococcal vaccines MenB-FHbp (Trumenba, Pfizer) *or* MenB-4C (Bexsero, GlaxoSmithKline)
2–23 mos	**Primary vaccination:** MenACWY-D (aged ≥9 mos)**: 2 doses ≥12 wks apart (may be administered as early as ≥8 wks apart in travelers) ***or*** MenACWY-CRM: If first dose at age • 2 mos: 4 doses at 2, 4, 6, and 12 mos • 3–6 mos: See catch-up schedule§§ • 7–23 mos: 2 doses (second dose ≥12 wks after the first dose and after the 1st birthday)	No recommendations for use of MenB vaccines in this population unless otherwise indicated††
≥2 yrs	**Primary vaccination:** MenACWY-D** ***or*** MenACWY-CRM ***or*** MenACWY-TT: 1 dose **Boosters (if person remains at increased risk)¶¶,***** • Aged <7 yrs: Single dose at 3 yrs after primary vaccination and every 5 yrs thereafter • Aged ≥7 yrs: Single dose at 5 yrs after primary vaccination and every 5 yrs thereafter	See Table 2 for recommendations in persons aged 16–23 yrs

Abbreviations: DTaP = diphtheria and tetanus toxoids and acellular pertussis vaccine; MenACWY-CRM = meningococcal groups A, C, W, and Y oligosaccharide diphtheria CRM_{197} conjugate vaccine; MenACWY-D = meningococcal groups A, C, W, and Y polysaccharide diphtheria toxoid conjugate vaccine; MenACWY-TT = meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine; MenB-4C = four-component meningococcal group B vaccine; MenB-FHbp = meningococcal group B factor H binding protein vaccine; Td = tetanus and diphtheria toxoids vaccine; Tdap = tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine.

* For international travelers, vaccination is recommended for those visiting the parts of sub-Saharan Africa known as the meningitis belt during the dry season (December–June). Vaccination may also be considered for travelers to countries that contain areas included in the meningitis belt but who travel to areas outside of the meningitis belt zone. Advisories for travelers to other countries are issued by CDC when epidemics of meningococcal disease caused by vaccine-preventable serogroups are detected. Traveler's health information is available from CDC toll free by calling 1-877-394-8747 (1-877-FYI-TRIP) or at https://wwwnc.cdc.gov/travel. Additional information about geographic areas for which vaccination is recommended can be obtained from international health clinics for travelers and state health departments.

† Licensed in the United States only for persons aged 9 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

§ Licensed in the United States only for persons aged 2 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

¶ Licensed in the United States only for persons aged ≥2 years.

** MenACWY-D should be given either before or at the same time as DTaP to avoid interference with the immune response to meningococcal vaccine in children. MenACWY-D may be given at any time in relation to Tdap or Td.

†† Some countries recommend routine use of MenB vaccines for infants; persons living in these countries might follow the vaccination recommendations of these countries.

§§ If MenACWY-CRM is initiated at ages 3–6 months, catch-up vaccination includes doses at intervals of 8 weeks until the infant is aged ≥7 months, at which time an additional dose is administered at age ≥7 months, followed by a dose at least 12 weeks later and after the 1st birthday.

¶¶ Licensed in the United States only for a single booster dose for persons aged 15–55 years for MenACWY-D and MenACWY-CRM or aged ≥15 years for MenACWY-TT. Booster doses administered outside of these ages or administration of >1 booster dose are considered off-label.

*** International travelers should receive a booster dose of MenACWY if the last dose was administered 3–5 or more years previously (depending on the age at most recent dose received). Vaccination is required by the Kingdom of Saudi Arabia (KSA) for all travelers to Mecca during the Hajj and Umrah pilgrimages. Travelers should confirm current vaccination requirements with the KSA embassy.

Table 16. Recommended Vaccination Schedule and Intervals for College Freshman Living in Residence Halls and Military Recruits (Retrieved from the 2020 ACIP Recommendations)

Age group	Serogroups A, C, W, and Y meningococcal conjugate vaccines MenACWY-D (Menactra, Sanofi Pasteur)† *or* MenACWY-CRM (Menveo, GlaxoSmithKline)§ *or* MenACWY-TT (MenQuadfi, Sanofi Pasteur)¶	Serogroup B meningococcal vaccines MenB-FHbp (Trumenba, Pfizer) *or* MenB-4C (Bexsero, GlaxoSmithKline)
≥10 yrs	**Primary vaccination:** MenACWY-D ***or*** MenACWY-CRM ***or*** MenACWY-TT: 1 dose **Boosters**:** • College freshmen living in residence halls: Not routinely recommended unless person becomes at increased risk due to another indication • Military recruits: Every 5 yrs on basis of assignment††	No recommendations for use of MenB vaccines in this population unless otherwise indicated See Table 2 for recommendations in persons aged 16–23 yrs

Abbreviations: MenACWY-CRM = meningococcal groups A, C, W, and Y oligosaccharide diphtheria CRM_{197} conjugate vaccine; MenACWY-D = meningococcal groups A, C, W, and Y polysaccharide diphtheria toxoid conjugate vaccine; MenACWY-TT = meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine; MenB-4C = four-component meningococcal group B vaccine; MenB-FHbp = meningococcal group B factor H binding protein vaccine.

* College freshmen living in residence halls should receive at least 1 dose of MenACWY within 5 years before college entry. The preferred timing of the most recent dose is on or after their 16th birthday. If only 1 dose of vaccine was administered before the 16th birthday, a booster dose should be administered before enrollment. Adolescents who received a first dose after their 16th birthday do not need another dose before college entry unless it has been more than 5 years since the dose. Some schools, colleges, and universities have policies requiring vaccination against meningococcal disease as a condition of enrollment.

† Licensed in the United States only for persons aged 9 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

§ Licensed in the United States only for persons aged 2 months–55 years. Vaccination of persons aged ≥56 years is considered off-label.

¶ Licensed in the United States only for persons aged ≥2 years.

** Licensed in the United States only for a single booster dose for persons aged 15–55 years for MenACWY-D and MenACWY-CRM or aged ≥15 years for MenACWY-TT. Booster doses administered outside of these ages or administration of >1 booster dose are considered off-label.

†† Vaccination recommendations for military personnel are made by the U.S. Department of Defense on the basis of high-risk travel requirements.

Table 17. Off-label Meningococcal Vaccination Recommendations for Persons at Increased Risk for Meningococcal Disease, by Age Group and Indication (Retrieved from the 2020 ACIP Recommendations)

Age group	Indication
≥2 yrs	Administration of a 2-dose MenACWY primary series in persons at increased risk for serogroups A, C, W, or Y meningococcal disease Repeated booster doses of MenACWY for certain persons who remain at increased risk for serogroups A, C, W, or Y meningococcal disease (MenACWY-D and MenACWY-CRM are licensed for a single booster dose for persons aged 15–55 yrs if at least 4 yrs have elapsed since the last dose. MenACWY-TT is licensed for a single booster dose for persons aged ≥15 yrs if at least 4 yrs have elapsed since the last dose of MenACWY)
≥10 yrs	MenB booster doses in certain persons who remain at increased risk for serogroup B meningococcal disease
≥26 yrs	MenB primary series administration in persons at increased risk for serogroup B meningococcal disease
≥56 yrs	Administration of MenACWY-D or MenACWY-CRM in persons at increased risk for serogroups A, C, W, or Y meningococcal disease

Abbreviations: MenACWY = quadrivalent meningococcal conjugate vaccine; MenACWY-CRM = meningococcal groups A, C, W, and Y oligosaccharide diphtheria CRM_{197} conjugate vaccine; MenACWY-D = meningococcal groups A, C, W, and Y polysaccharide diphtheria toxoid conjugate vaccine; MenACWY-TT = meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine; MenB = serogroup B meningococcal vaccine.

1.2.3 European Centre for Disease Prevention and Control (ECDC) Meningococcal Disease: Recommended Vaccinations (2023)

The following figure is provided by the ECDC on the recommended vaccination schedule by country[11]:

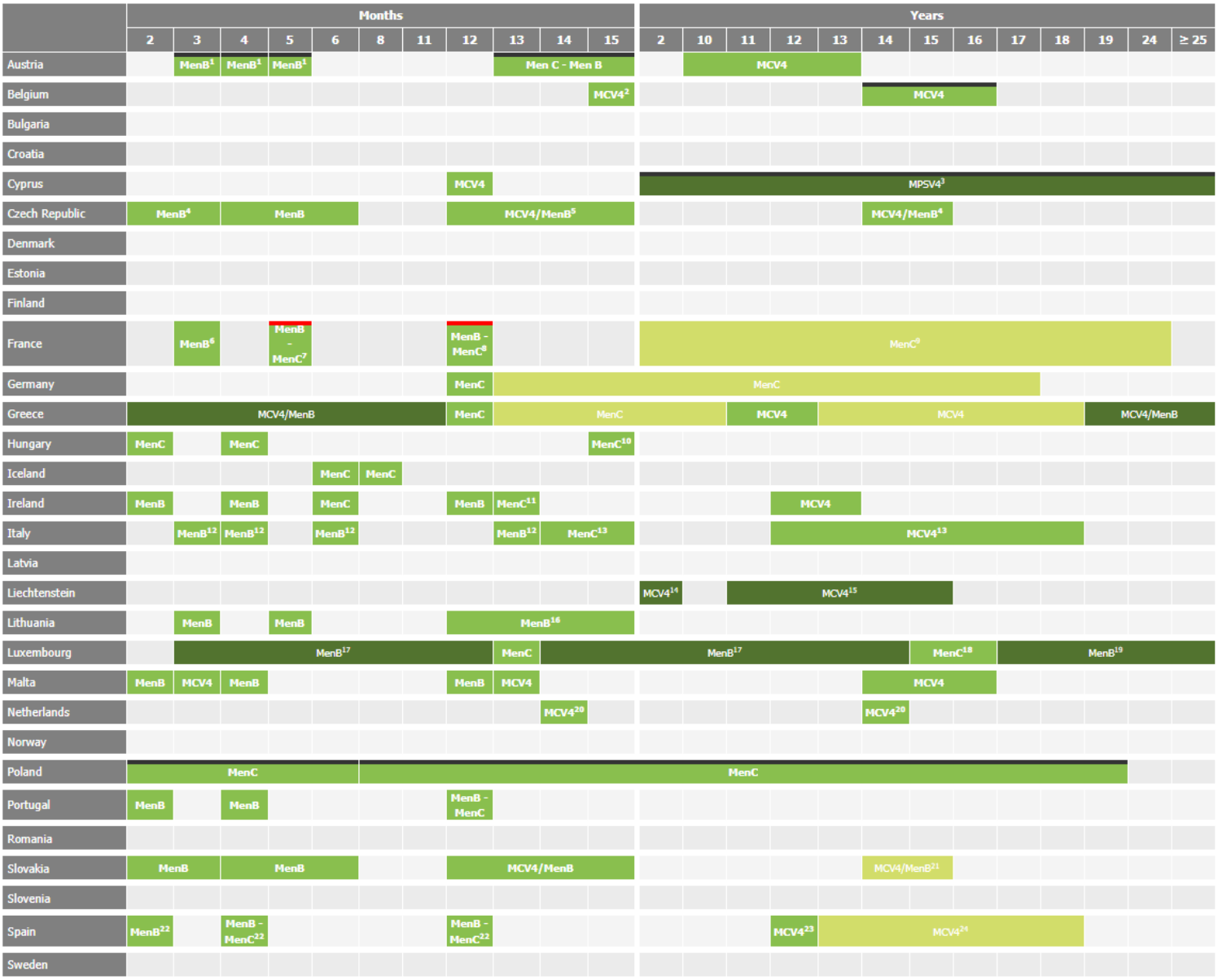

Figure 2. *Recommended Vaccination Schedule by Country (Europe). Retrieved from the 2023 ECDC Recommendations.*

Footnotes:

9: 1 dose until 24 years

11: Hib/MenC combined vaccine

12: Please refer to local recommendations for age of administration. MenB should not to be co-administered with other vaccinations.

13: Meningococcal C vaccination, one dose for children between 13-15 months. Meningococcal ACWY, one dose for adolescents age 12-14

14: Not part of the routine vaccination program but can be offered by health professionals. Catch-up possible until 5 years of age.

15: Not part of the routine vaccination program but can be offered by health professionals. Catch-up possible until 20 years of age.

16: Can be administered concomitantly with MMR

17: Two/three doses recommended in at-risk groups, depending on age. -

19: Two/three doses recommended in at-risk groups, depending on age. -

21: One dose of each vaccine if given between 14 and 15 years

23: One dose at 12 years to individuals who have not received any doses of MCV4 since 10 years of age.

1.2.4 European Centre for Disease Prevention and Control (ECDC) Factsheet About Meningococcal Disease (2019)

The following recommendations are provided by the ECDC on meningococcal disease, but they do not come with levels of evidence[12]:

Public Health Control Measures

Progress has been made in the control of meningococcal disease in recent decades through the implementation of preventative vaccination strategies. Immunization against invasive meningococcal disease (IMD) is integrated into general vaccination initiatives in select EU/EEA countries, while in other nations, it is recommended only for specific high-risk populations.

All authorized meningococcal vaccines are non-active, meaning they do not contain live pathogens. These vaccines consist of polysaccharide and polysaccharide-conjugated variants targeting the capsules of serotypes A, C, Y, and W. Conjugate vaccines offer the advantage of building immunological memory. The serogroup B capsule has limited immunogenicity due to its similarity to a human glycoprotein called the neural cell adhesive molecule. Vaccines for serogroup B utilize surface proteins from Neisseria meningitidis group B.

The following meningococcal vaccines have received approval for usage in the EU through a centralized licensing procedure:

1. Menveo®: Designed to immunize children aged two and above, adolescents, and at-risk adults against Neisseria meningitidis groups A, C, W-135, and Y, thus preventing invasive disease.
2. Nimenrix®: Intended for individuals starting from six weeks of age, providing immunization against IMD caused by Neisseria meningitidis groups A, C, W-135, and Y.
3. Bexsero®: Developed to safeguard individuals from two months of age against IMD caused by Neisseria meningitidis serogroup B, utilizing surface protein-based vaccination.
4. Trumemba®: Recommended for active immunization in individuals aged 10 and above, preventing IMD resulting from Neisseria meningitidis serogroup B.

Additional meningococcal vaccines, like meningococcal serogroup C conjugate vaccines, meningococcal A polysaccharide vaccines, meningococcal groups A, C, W-135, and Y polysaccharide vaccine, and a combination vaccine incorporating a Haemophilus influenzae B (Hib) component, have been granted licenses by national health authorities within their respective Member States.

1.2.5 CDC Meningococcal Vaccines (2021)

The following recommendations are provided by the CDC on meningococcal vaccines, but they do not come with levels of evidence[13]:

Meningococcal Disease Overview

Meningococcal disease encompasses a range of severe illnesses caused by Neisseria meningitidis bacteria, also known as meningococcus. These illnesses are often severe and exhibit high fatality rates. They manifest as infections of the brain and spinal cord linings (meningitis) and bloodstream infections (bacteremia or septicemia).

Most of meningococcal disease worldwide is caused by 6 serogroups (closely related bacterial groups) of N. meningitidis: serogroups A, B, C, W, X, and Y. Transmission occurs through the exchange of respiratory and throat secretions, such as saliva. This transmission can take place in close living conditions, during the sharing of food or drinks, or through kissing.

Available Vaccines

Two types of vaccines are accessible in the United States for the prevention of meningococcal disease:

1. Quadrivalent meningococcal conjugate (MenACWY) vaccines: These protect against meningococcal disease caused by serogroups A, C, W, and Y.

2. Serogroup B meningococcal (MenB) vaccines: These offer protection against meningococcal disease caused by serogroup B.

MenACWY Vaccine Recommendations

The CDC advises adolescents to receive two doses of the MenACWY vaccine:

- The first dose is administered to 11- or 12-year-olds.
- A second dose, serving as a booster, is given to 16-year-olds.

Apart from adolescents, the MenACWY vaccine is recommended for individuals aged 2 months and above who:

- Are at risk due to outbreaks of serogroup A, C, W, or Y meningococcal disease.
- Have HIV.
- Have a damaged or removed spleen, including those with sickle cell disease.
- Suffer from a rare immune condition known as persistent complement component deficiency.
- Are taking a complement inhibitor drug, like eculizumab (brand name: Soliris®) or ravulizumab (brand name: Ultomiris®).
- Work as a microbiologist who routinely deal with meningitidis isolates.
- Reside in or are traveling to areas with frequent epidemics of meningococcal disease, particularly the sub-Saharan Africa region extending from Senegal to Ethiopia as indicated on this map.
- Are college freshmen living in dormitories and have not completed their MenACWY vaccine regimen.
- Are U.S. military recruits.

Who Should Receive the MenB Vaccine

Adolescents and young adults aged 16 through 23 years may receive the MenB vaccine. The optimal age range for MenB vaccination is between 16 and 18 years. It's important to note that several doses of the same brand are required for the most effective protection. Younger children and adults generally do not require the MenB vaccine. However, the CDC recommends the MenB vaccine for individuals aged 10 years or older who:

- Are at risk due to an outbreak of serogroup meningococcal B disease.
- Have experienced damage to or removal of their spleen, including individuals with sickle cell disease.
- Have a rare immune condition called persistent complement component deficiency.

- Are taking a complement inhibitor medication, like eculizumab (brand name: Soliris®) or ravulizumab (brand name: Ultomiris®).
- Work as a microbiologist dealing routinely with isolates of meningitidis.

Common Side Effects and Precautions

Both MenACWY and MenB vaccines are recognized as safe and effective methods to prevent meningococcal disease. However, like any medication, vaccines can lead to side effects. Typically, the most common side effects are mild and transient.

Severe allergic reactions after vaccination are extremely rare but can be life-threatening. Signs of a severe allergic reaction may encompass hives, swelling of the face and throat, breathing difficulties, rapid heartbeat, dizziness, and weakness. If such reactions occur, immediate action should be taken. Take the affected person to the nearest hospital.

MenACWY Vaccine

Common Side Effects:

- Soreness, redness, or swelling at the injection site
- Muscle pain
- Headache
- Fatigue

Most side effects are mild to moderate and typically resolve within 1 to 3 days.

Who Should Avoid MenACWY Vaccine:

- Individuals who had a severe allergic reaction after a previous dose of MenACWY vaccine.
- Those who experienced a severe allergic reaction following a prior dose of a vaccine containing diphtheria toxoid, CRM197-, or tetanus toxoid (e.g., Menactra, Menveo, Menquadfi, or any DTaP vaccine).
- People with severe life-threatening allergies.

In certain cases, healthcare providers might opt to delay MenACWY vaccination to a future appointment. Minor illnesses, such as a cold, generally don't preclude vaccination. However, individuals who are moderately or severely ill should wait until they have recovered before receiving the MenACWY vaccine.

MenB Vaccine

Common Side Effects:

- Soreness, redness, or swelling at the injection site
- Headache

- Fatigue
- Muscle or joint pain
- Fever

Most side effects are mild to moderate and usually resolve within 1 to 3 days.

Who Should Avoid MenB Vaccine:

- MenB vaccines are not recommended for individuals under 10 years of age.
- Those who had an allergic reaction after a previous dose of MenB vaccine.
- People with severe, life-threatening allergies.
- Pregnant or breastfeeding individuals.
- Those with a latex allergy (precaution for Bexsero).

As with the MenACWY vaccine, healthcare providers may choose to postpone MenB vaccination based on individual circumstances. Mild illnesses generally don't contraindicate vaccination, but moderate to severe illnesses should prompt individuals to wait until they have recovered before receiving the MenB vaccine.

Assessing Serious Adverse Events

According to the Code of Federal Regulations (CFR) Title 21, an adverse event is classified as serious if it results in any of the following outcomes:

- Death
- A life-threatening adverse event
- Prolonged or significant disability or incapacity
- A congenital anomaly or birth defect
- Hospitalization or extended existing hospitalization.

Extensive safety monitoring and scientific investigations have demonstrated that MenACWY and MenB vaccines exhibit a positive safety profile. Substantial scientific evidence supports the safety of these vaccines.

Safety Data for Menactra

After the licensure of Menactra (MenACWY vaccine) in 2005, there were reports submitted to VAERS suggesting a potential link between Menactra vaccination and an increased risk of Guillain-Barré syndrome (GBS).

GBS is a rare disorder where the immune system damages nerve cells, resulting in muscle weakness and, at times, paralysis. While the exact cause is not fully understood, GBS often emerges following viral or bacterial infections.

In response to the VAERS data, the package insert for Menactra was altered to identify a history of GBS as a precaution to vaccination. This cautionary information was subsequently incorporated into other MenACWY vaccines.

Subsequent to these VAERS findings, two extensive safety studies were conducted to assess the GBS risk post Menactra vaccination. The combined results of these studies indicated that the GBS risk after Menactra vaccination did not surpass the usual GBS rate (unrelated to vaccination) among individuals aged 11 to 21 years.

Based on these findings, the Advisory Committee on Immunization Practices (ACIP) no longer considers a history of GBS to be a contraindication or precaution for meningococcal vaccination.

1.2.6 CDC Administering Meningococcal Vaccines (2022)

The following recommendations are provided by the CDC on meningococcal vaccine administration, but they do not come with levels of evidence[14]:

Visual Inspection

Do not use any meningococcal vaccine or diluent beyond the expiration date indicated on the label. Before administering, visually inspect the vaccine for any particles or unusual color. If any of these conditions are observed, refrain from using the vaccine.

Route, Site, and Needle Size

Administer meningococcal conjugate (MenACWY) and serogroup B meningococcal (MenB) vaccines using the intramuscular route. For infants and young children, the recommended injection site is the vastus lateralis muscle in the anterolateral thigh. Older children and adults should receive the injection in the deltoid muscle. Ensure that the needle length is appropriate for the recipient's age and size.

Number and Timing of Doses

MenACWY Vaccines

Give MenACWY vaccines (Menactra®, Menveo® [single- or dual-vial presentation], or MenQuadfi®) as the initial dose to adolescents at 11 to 12 years old. Administer a booster dose at 16 years old. Maintain a minimum interval of at least 8 weeks between doses.

For individuals aged 2 years and above with conditions such as complement deficiencies, complement inhibitor use (including Soliris® or Ultomiris®), asplenia, or HIV, provide a 2-dose primary series (Menactra®, Menveo® [only dual-vial presentation], or MenQuadfi®) spaced 2 months apart.

The dosing schedule for patients under 2 years varies by vaccine product; consult package inserts for details.

For individuals with prolonged heightened risk of meningococcal disease, offer MenACWY booster doses after completing the primary series. If the most recent dose was before age 7, administer the booster 3 years later. If taken at age 7 or older, administer the booster 5 years later. Subsequently, provide boosters every 5 years as long as the risk of meningococcal disease persists.

MenB Vaccines

BothMenB vaccine products require multiple doses for maximum protection, using the same product for all doses.

- Bexsero®: Administer 2 doses, with the second given at least 1 month after the first.
- Trumenba®: Administer 2 or 3 doses. Give 2 doses to healthy adolescents not at increased risk for serogroup B meningococcal disease, with the second dose 6 months after the first. Administer 3 doses to those 10 years and older at increased risk for meningococcal disease, including outbreaks of serogroup B meningococcal disease, spacing the second dose 1 to 2 months after the first, and the third dose 6 months after the first.

For individuals at prolonged heightened risk, administer a MenB booster dose 1 year after series completion, followed by subsequent boosters every 2 to 3 years.

Predrawing Vaccine Doses

Avoid predrawing vaccine doses in advance. There's no data on the stability of vaccines stored in pre-filled syringes. Open vaccine vials only at the time of administration. After reconstitution, use Menveo® two-vial presentation within 8 hours or discard.

Administering with Other Vaccines

It's possible to administer MenACWY and MenB vaccines during the same visit, but at separate injection sites. Healthcare professionals also have the option to provide meningococcal and other vaccines during the same appointment, as long as they are administered at different injection sites, if possible. Use different syringes for each vaccine.

MenACWY Vaccines

- You can administer MenACWY with tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap), human papillomavirus (HPV), and MenB vaccines.

- Healthy children aged 9 to 23 months can receive Menactra® with other vaccines. However, children with asplenia or HIV should avoid Menactra® before age 2 to prevent interference with the immunologic response to the infant series of pneumococcal conjugate vaccine (PCV). Infants aged 2 to 23 months with asplenia or HIV should receive Menveo® dual-vial presentation. For individuals aged 2 and above with these conditions, allow a minimum of 4 weeks after completing PCV doses before using Menactra®.
- Children can receive Menactra® before or concurrently with diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccines. This prevents interference with the immunological response to the meningococcal vaccine antigens that occurs when administering Menactra® after DTaP. Alternatively, children can receive Menveo® dual-vial presentation or MenQuadfi®, regardless of DTaP timing.

MenB Vaccines

Based on available data and expert opinion, administer Bexsero® or Trumenba® with Tdap, HPV, and MenACWY vaccines. If given together, use separate injection sites, if possible.

1.2.7 CDC Meningococcal Vaccination for Adolescents: Information for Healthcare Professionals

The following recommendations are provided by the CDC on meningococcal vaccination, but they do not come with levels of evidence[15]:

The CDC advocates for meningococcal vaccination among adolescents. Adhere to the recommended vaccination schedule to ensure appropriate protection for your patients through meningococcal vaccines.

- All individuals aged 11 to 12 should be administered a single dose of meningococcal conjugate (MenACWY) vaccine.
- Due to diminishing protection, a booster dose is advised at 16 years of age, which safeguards adolescents during their most vulnerable years for meningococcal disease.
- Adolescents and young adults aged 16 to 23 can also receive a serogroup B meningococcal (MenB) vaccine, preferably between 16 and 18 years of age.
- CDC recommends MenB vaccination for specific adolescents, particularly those facing increased risk due to a serogroup B meningococcal disease outbreak or certain medical conditions.

Meningococcal Vaccines Meningococcal conjugate (MenACWY) vaccines:

- Menactra®
- Menveo® (available in one- and two-vial formats)
- MenQuadfi®

Serogroup B meningococcal (MenB) vaccines:

- Bexsero®
- Trumenba®

Adolescents are at increased risk for meningococcal disease.

Adolescents are at heightened risk of meningococcal disease, especially those aged 16 to 23. This age group, including college students, faces a slightly elevated risk compared to their non-college attending counterparts. Meningococcal bacteria can result in severe conditions such as meningitis, bacteremia, and septicemia, which can lead to lasting disabilities or fatality.

Two types of meningococcal vaccines are accessible in the U.S., each targeting different serogroups. MenACWY vaccines protect against serogroups A, C, W, and Y, while MenB vaccines protect against serogroup B. Presently, no single vaccine guards against all five serogroups.

It is possible to administer both MenACWY and MenB vaccines concurrently or along with other recommended adolescent vaccines. Healthcare providers can offer these vaccines during the same visit, using different injection sites if feasible.

CDC advises meningococcal vaccination for individuals at escalated risk during outbreaks. State and local health departments are supported by the CDC in managing outbreaks. During a serogroup A, C, W, or Y meningococcal disease outbreak, MenACWY vaccination is recommended for those at increased risk. In a serogroup B meningococcal disease outbreak, MenB vaccination is advised for those at elevated risk. Individuals who have previously been vaccinated with MenACWY or MenB vaccines and subsequently face an elevated risk due to an outbreak might be advised to receive an additional booster dose, the timing of which depends on the duration since their previous vaccination.

MenACWY Vaccines

Adverse events post-vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS).

A MenACWY booster dose is pivotal in safeguarding adolescents during their highest-risk years. Protection from MenACWY vaccination wanes within around 5 years, warranting a booster dose at 16 years to cover the period of maximum risk for meningococcal disease.

MenACWY vaccines are deemed safe, with CDC consistently monitoring their safety.

Many colleges require proof of MenACWY vaccination within 5 years before enrollment. It is advised that students receive a MenACWY vaccine within this timeframe before starting college.

For MenACWY vaccines, the minimum interval for a booster dose is 8 weeks. However, healthy adolescents receiving the initial dose at or after 16 years do not necessitate a booster.

Individuals with certain medical conditions necessitate a 2-dose primary series of MenACWY vaccine, followed by regular booster doses. Administer two doses of MenACWY vaccine 8 weeks apart to those with complement component deficiency (e.g., C5-C9, properdin, factor H, factor D, or are taking a complement inhibitor such as Soliris® or Ultomiris®), functional or anatomic asplenia, or HIV. Routine booster doses every 5 years are recommended to maintain protection.

MenB Vaccines: Routine MenB vaccination for all adolescents is not standard. Vaccination with MenB vaccine is an option for those aged 16 to 23. Administering the vaccine between 16 and 18 years is advised. The decision for MenB vaccination can be made collaboratively between clinicians, patients, and parents.

- Meningococcal disease is uncommon but deadly. It also includes a lot of complications such as loss of limbs, deafness, nervous system problems, or brain damage.
- MenB vaccines offer protection against many serogroup B strains, but studies indicate short-term efficacy. Protective antibodies decline rapidly (within 1 to 2 years) after MenB vaccination.
- College students, especially freshmen and those residing on campus or in fraternities/sororities, face a higher risk of meningococcal disease. Outbreaks have occurred on college campuses. Some colleges mandate MenB vaccination.
- Clinical trials and ongoing safety monitoring have demonstrated MenB vaccines' safety. However, MenB vaccines only protect vaccinated individuals and don't confer population-wide immunity.

Administer MenB vaccines between 16 and 18 years to maximize protection when adolescents are most susceptible. This timing aligns with pre-college visits for college-bound adolescents, providing a suitable opportunity to initiate the MenB vaccine series.

People with specific medical conditions require a primary MenB vaccine series and regular boosters. Administer the primary series accordingly and provide a

booster dose one year after series completion, followed by subsequent boosters every 2 to 3 years.

Both MenB vaccine types require multiple doses. For Bexsero®, administer two doses with a one-month interval between them. For Trumenba®, administer two or three doses as per the indicated schedule. Administer the second dose 1 to 2 months after the first dose. Administer the third dose 6 months after the first dose.

The choice between Bexsero® and Trumenba® doesn't significantly impact efficacy. However, consistency in using the same vaccine product for all doses is essential.

MenB vaccines have been shown to be safe. Based on available data, these vaccines typically cause common side effects such as pain at the injection site, fever, and headaches, which usually resolve within 3 to 5 days after vaccination. MenB vaccines tend to produce more reactions compared to other adolescent vaccines like HPV, MenACWY, and Tdap, with expected short-term effects, particularly localized pain. No unusual serious reactions have been associated with these vaccines.

MenB vaccines necessitate multiple doses for optimal protection. Both types of MenB vaccines require more than one dose to achieve maximum effectiveness. Adolescents should receive the same vaccine product for all doses.

- For Bexsero®: Two doses should be administered, with the second dose given at least one month after the first dose.
- For Trumenba®: Two or three doses should be given.
    1. Two doses are suitable for healthy adolescents without an elevated risk of serogroup B meningococcal disease, with the second dose administered six months after the first dose.
    2. Three doses are recommended for adolescents at increased risk, including during outbreaks of serogroup B meningococcal disease. In such cases, the second dose should be administered 1 to 2 months after the first dose, and the third dose should be given 6 months after the first dose.

The specific MenB vaccine used doesn't matter. The CDC does not have a preference for a particular MenB vaccine, as long as the same product is used for all doses in adolescents. If different products are administered for different doses, the next scheduled dose of the chosen product should be given, with at least a month since the last dose of either product.

1.2.8 CDC Meningococcal Disease (2022)

The following recommendations (ungraded) are provided by the CDC on the chemoprophylaxis of meningococcal disease[18]:

Chemoprophylaxis

Close contacts of individuals with meningococcal disease, regardless of their immunization status, should receive antimicrobial chemoprophylaxis due to the heightened risk of infection. Close contacts include household members, childcare center contacts, and anyone directly exposed to an infected patient's oral secretions (e.g., through kissing, mouth-to-mouth resuscitation, endotracheal intubation) in the seven days before symptom onset. Healthcare personnel involved in managing airways or exposed to respiratory secretions of a patient with meningococcal disease should also undergo chemoprophylaxis.

Chemoprophylaxis is not recommended for close contacts of patients with evidence of N. meningitidis only in non-sterile sites, such as oropharyngeal swabs, endotracheal secretions, or conjunctival swabs. Furthermore, asymptomatic nasopharyngeal carriers without known close contact with a meningococcal disease patient do not require treatment.

To be most effective, chemoprophylaxis should be administered as soon as possible, especially within the initial days after the onset of disease symptoms. Administering chemoprophylaxis more than 14 days after the onset of disease is likely to have limited or no benefit. Oropharyngeal or nasopharyngeal cultures are not reliable indicators for determining the need for chemoprophylaxis and may unnecessarily delay preventive measures.

Rifampin, ceftriaxone, and ciprofloxacin are considered 90%-95% effective in reducing nasopharyngeal carriage of N. meningitidis and are acceptable agents for chemoprophylaxis. Although not a first-line choice, azithromycin may be recommended in situations of sustained ciprofloxacin resistance in a community. Azithromycin, administered as a single oral dose, has proven effective for eradicating nasopharyngeal carriage and may be used in limited circumstances where ciprofloxacin resistance is identified.

Table 18. Recommended Chemoprophylaxis Regimens for High-Risk Contacts of Persons with Invasive Meningococcal Disease

Recommended chemoprophylaxis regimens for high-risk contacts and persons with invasive meningococcal disease					
Drug	**Age**	**Dose**	**Duration**	**Efficacy (%)**	**Cautions**
Rifampin	<1 month	5 mg/kg, orally, every 12 hours	2 days		Discussion with an expert for infants <1 month

	≥1 month	10 mg/kg (maximum 600 mg), orally, every 12 hours	2 days	90–95	Can interfere with efficacy of oral contraceptives and some seizure prevention and anticoagulant medications; may stain soft contact lenses. Not recommended for pregnant women.
Ceftriaxone	<15 years	125 mg, intramuscularly	Single dose	90–95	**To decrease pain at injection site, dilute with 1% lidocaine.**
	≥15 years	250 mg, intramuscularly	Single dose	90–95	
Ciprofloxacin[a]	≥1 month	20mg/kg (maximum 500 mg), orally	Single dose	90-95	Not recommended for pregnant women.
Azithromycin		10 mg/kg (maximum 500 mg)	Single dose	90	Not recommended routinely. Equivalent to rifampin for eradication of *N. meningitidis* from nasopharynx in one study

[a]Use only if fluoroquinolone-resistant strains of *N. meningitidis* have not been identified in the community.

1.2.9 Health Requirements and Recommendations for Travelers to Saudi Arabia for Hajj (Saudi Arabia Ministry of Health, 2023)

Evidence levels and grades of recommendations were not outlined[16]. The following recommendations are provided by the Saudi Arabia Ministry of Health on the Health Requirements and Recommendations for Travelers to Saudi Arabia for Hajj[16]:

- Required vaccinations: Meningococcal meningitis.
    - Target group: all individuals, aged 1 year and over, arriving for Hajj or for work in Hajj zones: Makkah (the holy city), Madinah, Jeddah and Taif.
    - Target countries: all
    - Approved vaccines:
        - Quadrivalent (ACYW) polysaccharide vaccine within the last 3 years.
        - Quadrivalent (ACYW) conjugate vaccine within the last 5 years.
        - Health authorities at the pilgrims' country of origin should ensure their vaccination within the required validity period and make sure that the type of vaccine is clearly shown in the vaccination certificate. If the vaccine type is not indicated on the certificate, it will be considered valid for 3 years only.
- Preventive measures by health authority at points of entry: Meningococcal meningitis
    - Target countries: countries with frequent epidemics of meningococcal meningitis, countries at risk for meningitis epidemics, and countries with outbreaks of non-vaccine groups of N. meningitides.
    - The figure below shows the countries/areas with frequent epidemics of meningococcal meningitis and countries at risk for meningitis epidemics.
    - Approved vaccines: administer prophylactic antibiotics at the points of entry if deemed necessary.

Table 19. Countries/Areas with Frequent Epidemics of Meningococcal Meningitis and Countries at Risk for Meningitis Epidemics. Retrieved from the Health Requirements and Recommendations for Travelers to Saudi Arabia for Hajj (Saudi Arabia Ministry of Health, 2023)

Africa		
Nigeria	Ethiopia	Benin
South Sudan	Gambia	Burkina Faso
Rwanda	Ghana	Burundi
Senegal	Guinea	Cameroon
Sudan	Guinea-Bissau	Central African Republic
Tanzania	Kenya	Chad

Togo	Mali	Ivory Coast
Uganda	Mauritania	DR Congo
	Niger	Eritrea

1.2.10 CDC Bacterial Meningitis (2021)

The following recommendations (ungraded) are provided by the CDC on meningococcal vaccines[17]:

Causes

Meningitis can be caused by various bacteria, with prevalent strains in the United States including *Streptococcus pneumoniae*, Group B *Streptococcus*, *Neisseria meningitidis*, *Haemophilus influenzae*, *Listeria monocytogenes*, *Escherichia coli*, and *Mycobacterium tuberculosis* (TB). TB meningitis is a less common bacterial meningitis subtype.

These bacteria can also be linked to sepsis, an extreme response to infection that poses a life-threatening emergency, leading to tissue damage, organ failure, and potential death if not promptly treated.

Certain age groups are more susceptible to specific causes of bacterial meningitis:

- Newborns: Group B *Streptococcus*, *S. pneumoniae*, *L. monocytogenes*, *E. coli*
- Babies and young children: *S. pneumoniae*, *N. meningitidis*, *H. influenzae*, Group B *Streptococcus*, *M. tuberculosis*
- Teens and young adults: *N. meningitidis*, *S. pneumoniae*
- Older adults: *S. pneumoniae*, *N. meningitidis*, *H. influenzae*, Group B *Streptococcus*, *L. monocytogenes*

Risk Factors

Several elements contribute to an individual's susceptibility to bacterial meningitis. These risk factors include:

- Age: babies face an elevated risk of bacterial meningitis compared to other age groups. However, bacterial meningitis can affect individuals of any age; refer to the section above for details on which bacteria are more prevalent in specific age groups.
- Group settings: infectious diseases tend to proliferate in areas where large gatherings occur. For instance, there have been documented outbreaks of meningococcal disease, attributed to N. meningitidis, on college campuses.

- Certain medical Conditions: Specific medical conditions, medications, and surgical procedures heighten the risk of meningitis. Conditions such as HIV infection, cerebrospinal fluid leaks, or the absence of spleen can increase susceptibility to various types of bacterial meningitis.
- Occupational Exposure to Meningitis-Causing Pathogens: Microbiologists regularly exposed to bacteria responsible for meningitis face an increased risk of contracting the infection.
- Travel: Travelers may encounter a heightened risk of meningococcal disease, caused by N. meningitidis, in specific locations, including:
    - The meningitis belt in sub-Saharan Africa, particularly during the dry season.
    - Mecca during the annual Hajj and Umrah pilgrimage.
    - In many countries, tuberculosis (TB) is more prevalent than in the United States. Travelers should avoid close contact or extended periods with known TB patients in crowded, enclosed settings such as clinics, hospitals, prisons, or homeless shelters.

How it spreads

Certain microorganisms responsible for bacterial meningitis, such as L. monocytogenes, can be transmitted through food. However, most of these germs are typically spread from one person to another.

The method of germ transmission often varies depending on the specific bacteria involved. It is crucial to note that individuals can carry these bacteria in or on their bodies without displaying any symptoms, making them "carriers." While most carriers do not fall ill, they can still transmit the bacteria to others.

Some common examples of how different types of bacteria are transmitted among individuals:

- Group B *Streptococcus* and *E. coli*: Mothers can transmit these bacteria to their babies during childbirth.
- *H. influenzae*, *M. tuberculosis*, and *S. pneumoniae*: Transmission of these bacteria occurs when individuals cough or sneeze in close proximity to others, who then inhale the bacteria.
- *N. meningitidis*: The spread of these bacteria happens through the sharing of respiratory or throat secretions (saliva or spit), commonly during close interactions like coughing, kissing, or prolonged cohabitation.
- *E. coli*: Individuals can contract these bacteria by consuming food prepared by individuals who did not adequately wash their hands after using the toilet.

- People typically become infected with *E. coli* and *L. monocytogenes* by ingesting contaminated food.

Pregnancy

Pregnancy increases the likelihood of contracting a Listeria infection (L. monocytogenes). Expectant individuals with a Listeria infection might not exhibit symptoms, or they may only experience fever and flu-like manifestations such as fatigue and muscle aches. Nevertheless, infection during pregnancy can result in miscarriage, stillbirth, premature delivery, or severe infections in newborns, including meningitis. It is essential to identify foods more prone to Listeria contamination and adopt measures to safeguard both your and your baby's well-being.

Moreover, pregnant women can transmit Group B Streptococcus (group B strep) to their infants during childbirth. Newborns infected with group B strep may develop meningitis or other critical infections shortly after birth. To address this concern, it is advisable to discuss undergoing a group B test with your healthcare provider when you reach 36 to 37 weeks of pregnancy. In cases where the test yields positive results, doctors administer antibiotics during labor to prevent infections in newborns.

Prevention

Vaccination is a crucial preventive measure against specific bacterial strains causing meningitis, including Meningococcal, Pneumococcal, Haemophilus influenzae serotype b (Hib), and Bacille Calmette-Guérin (TB) vaccines. Prophylaxis, involving antibiotic administration to prevent transmission, is recommended for close contacts in specific cases.

Prophylaxis, in the context of bacterial meningitis, involves the prescription of antibiotics by a doctor to prevent individuals in close proximity to the patient from falling ill. The Centers for Disease Control and Prevention (CDC) recommends prophylaxis for:

Prophylaxis

Individuals in close contact with someone affected by meningitis caused by N. meningitidis. Household members of an individual with a severe Hib infection, particularly when the household includes one or more individuals at an elevated risk of Hib based on factors such as age, vaccination status, and/or immunocompromising conditions.

Decisions regarding who should undergo prophylaxis are typically made by doctors or local health departments based on specific circumstances and risk factors.

Healthy pregnancy practices

Expectant mothers are advised to engage in open communication with their healthcare provider regarding the screening for Group B Streptococcus. The test is typically administered during the 36th to 37th weeks of pregnancy. If a woman tests positive, doctors administer antibiotics during labor to prevent the transmission of Group B strep to newborns.

Pregnant women can also minimize their risk of L. monocytogenes-induced meningitis by avoiding specific foods during pregnancy and ensuring the safe preparation of others.

Healthy habits

To safeguard against bacterial meningitis and other health issues, individuals are encouraged to adopt healthy habits, including:

- Avoid Smoking: Refrain from smoking and minimize exposure to cigarette smoke.
- Prioritize Rest: Ensure an ample amount of rest for overall well-being.
- Preventive Measures Against Infections: Steer clear of close contact with individuals who are unwell.
- Hygiene Practices: Maintain good hand hygiene by washing hands regularly with soap and water, or using hand sanitizer when soap and water are unavailable.
- Responsible Respiratory Etiquette: Cover the mouth and nose with a tissue when coughing or sneezing or use the upper sleeve or elbow if a tissue is not accessible.

These healthy habits hold particular significance for individuals at an elevated risk of disease, including young babies, older adults, those with compromised immune systems, and individuals without a functional spleen.

1.2.11 CDC Preventing Group B Strep Disease (2022)

The following recommendations (ungraded) are provided by the CDC on meningococcal vaccines[19]:

Preventing newborn illness

The most effective measures to prevent Group B Streptococcus (GBS) disease in newborns during their first week of life involve:

Testing pregnant women for GBS bacteria

The American College of Obstetricians and Gynecologists (ACOG) and American College of Nurse-Midwives (ACNM) recommend testing women for GBS bacteria at 36 to 37 weeks of pregnancy.

The testing process involves a simple and painless procedure where a sterile swab is used to collect samples from the vagina and rectum. The samples are then sent to a laboratory for analysis.

Testing is important as GBS bacteria naturally fluctuate in the body, and a positive result indicates an increased risk of transmitting the bacteria to the baby during childbirth.

Administration of antibiotics during labor

Women identified as having an elevated risk of their newborn developing GBS disease are given antibiotics during labor.

Antibiotics are delivered intravenously (IV) and typically consist of beta-lactams such as **penicillin** or **ampicillin**. Alternatives are available for women severely allergic to these antibiotics. They must be administered during labor since giving them before labor allows the bacteria to quickly regenerate.

While antibiotics are generally safe, mild side effects occur in approximately 1 in 10 women, and severe allergic reactions, although rare (about 1 in 10,000 women), necessitate emergency treatment.

Antibiotics are highly effective in preventing GBS disease in newborns.

It's important to note that strategies such as taking antibiotics orally, using antibiotics before labor, or employing birth canal washes with the disinfectant chlorhexidine have not proven effective in preventing GBS disease in newborns.

1.2.12 German Guidelines on Community-Acquired Acute Bacterial Meningitis in Adults (2023)

The German S2k-guidelines give up to date recommendations for workup, diagnostics, and treatment in adult patients with acute bacterial meningitis. All recommendations were voted on in a final consensus conference[20]. For this report, only recommendations related to chemoprophylaxis have been detailed.

Close contact persons (e.g. close household members) must be reported to the appropriate health authorities and informed about the increased risk and possible symptoms of meningococcal disease (e.g. fever, chills, headaches). Chemoprophylaxis should be started as soon as possible; it makes sense for a maximum of 10 days after the last contact with the sick person.

Table 20. Chemoprophylaxis of Invasive Meningococcal Disease

Antibiotic	Age group	Dosage
Rifampicin	Adolescents and adults > 60 kg	600 mg q 12 hour for 2 days PO
	Infants, children, and adolescents < 60 kg	10 mg/kg q 12 hours for 2 days PO
	Newborns	5 mg/kg q 12 hours for 2 days PO
Ciprofloxacin	Adults	500 mg PO once
Ceftriaxone	Adults and children ≥ 12 years	250 mg IM once
	Children < 12 years	125 mg IM once
Azithromycin	Adults	500 mg PO once

Section 2.0 Drug Therapy in Prevention and Chemoprophylaxis of Bacterial Meningitis

This section comprises three subsections: the first one contains the newly recommended drugs, the second one covers drug modifications, and the third one outlines the drugs that have been withdrawn from the market.

2.1 Additions

The antibiotics Ampicillin and Phenoxymethylpenicillin were added to CHI for the Prevention and Chemoprophylaxis of Bacterial Meningitis. Hemophilus B Influenza Vaccines, Pneumococcal Vaccines, and Meningococcal Vaccines were also added to CHI for the Prevention and Chemoprophylaxis of Bacterial Meningitis.

2.1.1 Antibiotics

2.1.1.1 Phenoxymethylpenicillin

Table 21. Phenoxymethylpenicillin Drug Information

SCIENTIFIC NAME PHENOXYMETHYLPENICILLIN (Oral Penicillin V)	
SFDA Classification	Prescription
SFDA Approval	Yes
US FDA	Yes
EMA	No
MHRA	Yes

PMDA	No
Indication (ICD-10)	A39
Drug Class	Beta-Lactam Antibacterial, Penicillin
Drug Sub-class	Penicillin
ATC Code	**J01CE02**
Pharmacological Class (ASHP)	N/A
DRUG INFORMATION	
Dosage Form	**Tablet**
Route of Administration	Oral Use
Dose (Adult) [DDD]*	250 to 500 mg twice daily; duration varies based on patient-specific factors
Maximum Daily Dose Adults*	1000 mg/day
Dose (pediatrics)	Children ≥3 years old it's 250 mg orally twice daily, and for children <3 years old it's 125 mg orally twice daily. Adolescents: 250 to 500 mg twice daily or 500 to 1,000 mg once daily.
Maximum Daily Dose Pediatrics*	children ≥3 years old: 250 mg orally twice daily, for children <3 years old: 125 mg orally twice daily. Adolescents: 1,000 mg once daily.
Adjustment	No renal or hepatic dose adjustments recommended by manufacturer's label but use with caution in altered kidney function since excretion is prolonged in patients with renal impairment.
Prescribing edits*	CU
AGE (Age Edit): N/A	
CU (Concurrent Use Edit): in addition to meningococcal vaccination; for those taking a C5 inhibitor, give for the duration of C5 inhibitor therapy	
G (Gender Edit): N/A	
MD (Physician Specialty Edit): N/A	
PA (Prior Authorization): N/A	
QL (Quantity Limit): N/A	
ST (Step Therapy): N/A	
EU (Emergency Use Only): N/A	
PE (Protocol Edit): N/A	

SAFETY	
Main Adverse Drug Reactions (Most common and most serious)	Gastrointestinal SE: Melanoglossia, mild diarrhea, nausea, oral candidiasis, vomiting
Drug Interactions*	X - BCG (Intravesical) X - Cholera Vaccine X - Fecal Microbiota (Live) (Oral) X - Fecal Microbiota (Live) (Rectal) D - Bacillus clausii D - Sodium Picosulfate D - Typhoid Vaccine (Depends on Route)
Special Population	Dosage adjustment in the elderly is usually not necessary.
Pregnancy	Penicillin crosses the placenta. Due to pregnancy-induced physiologic changes, some pharmacokinetic parameters of penicillin V may be altered in the second and third trimester. Penicillin is widely used in pregnant patients. Based on available data, penicillin is generally considered compatible for use during pregnancy
Lactation	Penicillin V is present in breastmilk and may be detected in the urine of some breastfeeding infants. Loose stools and rash have been reported in breastfeeding infants exposed to penicillin V (Matheson 1988). In general, antibiotics that are present in breast milk may cause nondose-related modification of bowel flora. Monitor infants for GI disturbances. Penicillin V is considered compatible with breastfeeding when used in usual recommended doses (WHO 2002).
Contraindications	Hypersensitivity to penicillin or any component of the formulation.
Monitoring Requirements	Check labs results and report abnormalities. Monitor closely for signs

	of hypersensitivity (shortness-of-breath, dyspnea, chest pain, complaints of difficulty swallowing or throat tightness, or change in vital signs). Monitor for severe or bloody diarrhea and send a specimen to the lab for C.difficile . Monitor for improvement with infection. Monitor for CNS adverse events, including seizures or confusion, especially in patients with a history of seizure activity.
Precautions	• Concerns related to adverse effects: ◦ Anaphylactic/hypersensitivity reactions: Serious and occasionally severe or fatal hypersensitivity (anaphylactic) reactions have been reported in patients on penicillin therapy, especially with a history of beta-lactam hypersensitivity or history of sensitivity to multiple allergens.). Use with caution in asthmatic patients. If a serious reaction occurs, treatment with supportive care measures and airway protection should be instituted immediately. ◦ Superinfection: Prolonged use may result in fungal or bacterial superinfection, including C. difficile-associated diarrhea (CDAD) and pseudomembranous colitis; CDAD has been observed >2 months postantibiotic treatment. • Disease-related concerns: ◦ Renal impairment: Use with caution in patients with severe renal impairment. ◦ Seizure disorders: Use with caution in patients with a history of seizure disorder; high levels, particularly in

	the presence of renal impairment, may increase risk of seizures.
	• Dosage form specific issues:
	  ◦ Benzyl alcohol and derivatives: Some dosage forms may contain sodium benzoate/benzoic acid; benzoic acid (benzoate) is a metabolite of benzyl alcohol; large amounts of benzyl alcohol (≥99 mg/kg/day) have been associated with a potentially fatal toxicity ("gasping syndrome") in neonates; the "gasping syndrome" consists of metabolic acidosis, respiratory distress, gasping respirations, CNS dysfunction (including convulsions, intracranial hemorrhage), hypotension, and cardiovascular collapse; some data suggests that benzoate displaces bilirubin from protein binding sites (Ahlfors 2001); avoid or use dosage forms containing benzyl alcohol derivative with caution in neonates.
	• Other warnings/precautions:
	  ◦ Prolonged use: Extended duration of therapy or use associated with high serum concentrations (eg, in renal insufficiency) may be associated with an increased risk for some adverse reactions (neutropenia, hemolytic anemia, serum sickness).

Black Box Warning	n/a
REMS*	n/a

HEALTH TECHNOLOGY ASSESSMENT (HTA)

The table below lists the HTA reviews and recommendations of bacterial meningitis prevention options by the following agencies/institutes/authorities: National Institute for Health and Care Excellence (NICE), Canadian Agency for Drugs and Technologies in Health (CADTH), Haute Autorité de Santé (HAS), Institute for Quality

and Efficiency in Health Care (IQWIG), and Pharmaceutical Benefits Advisory Committee (PBAC) as applicable. **The recommendations are for Phenoxymethylpenicillin.**

Table 22. Phenoxymethylpenicillin HTA Analysis

MEDICATION	AGENCY	DATE – HTA RECOMMENDATION
Phenoxymethylpenicillin	NICE	No recommendations found for this indication.
	CADTH	No recommendations found for this indication.
	HAS	No results found.
	IQWIG	No recommendations found for this indication.
	PBAC	No recommendations found for this indication.

CONCLUSION STATEMENT – Phenoxymethylpenicillin

No HTA recommendations were found for the use of Phenoxymethylpenicillin in the prevention of meningococcal disease. Antimicrobial chemoprophylaxis is recommended for close contacts of meningococcal infection cases: in which case Phenoxymethylpenicillin is preferred for individuals using C5 inhibitors.

2.1.2 Quadrivalent Meningococcal Conjugate Vaccines

Quadrivalent vaccines, including Menactra®, Menveo®, and Nimenrix®, are designed to protect against specific serogroups of Neisseria meningitidis bacteria, which are responsible for bacterial meningitis. These vaccines target four main serogroups: A, C, W-135, and Y. They are typically recommended for adolescents and young adults who are at higher risk of contracting meningococcal disease. The vaccination is often advised before entering environments with increased risk, such as college campuses or military barracks.

Menactra® and Menveo® are both conjugate vaccines, which means they contain polysaccharides from the bacterial surface conjugated to a protein. This conjugation enhances their effectiveness and provides longer-lasting immunity. Menactra® can be administered to individuals aged 9 months to 55 years, while Menveo® is approved starting for those aged 2 months. Nimenrix® is another quadrivalent conjugate vaccine available in certain regions, serving the same purpose as Menactra® and Menveo®.

Regarding interchangeability, these quadrivalent vaccines can sometimes be used interchangeably, especially when one vaccine is unavailable. However, specific

recommendations should be obtained from a healthcare professional based on factors like age, medical history, and regional guidelines.

2.1.2.1 Menactra® Vaccine

Table 23. Menactra® Vaccine Information

SCIENTIFIC NAME Quadrivalent meningococcal conjugate vaccine (MenACWY-D, MenACWY-CRM, MenACWY-TT) MENACTRA® Vaccine	
SFDA Classification	Prescription
SFDA Approval	Yes
US FDA	Yes
EMA	No
MHRA	No
PMDA	Yes
Indication (ICD-10)	A39
Drug Class	Vaccine
Drug Sub-class	Inactivated (bacterial)
ATC Code	**J07AH04**
Pharmacological Class (ASHP)	n/a
DRUG INFORMATION	
Dosage Form	**Solution for injection**
Route of Administration	Intramuscular use
Dose (Adult) [DDD]*	**Routine for persons NOT at increased risk for meningococcal disease**: Adults 19 to 21 years of age: IM: Not routinely recommended; may receive one 0.5 mL dose as a catch-up vaccination if no dose was received after the sixteenth birthday. Adults ≥22 years of age: Not routinely recommended; see dosing for persons at increased risk. **Routine for persons at increased risk for meningococcal disease**: Adults not previously vaccinated: IM: Two 0.5 mL doses, given ≥2 months apart. Adults not previously vaccinated who are first-year college students living in residential housing; traveling to or

	residing in areas where meningococcal disease is endemic/hyperendemic; at risk during a community outbreak; military recruits; or microbiologists routinely exposed to N. meningitidis: IM: One 0.5 mL dose. Adults previously vaccinated with a single dose of MenACWY who later develop an underlying condition for which meningococcal 2-dose vaccination is recommended: IM: Administer second dose as soon as possible (≥8 week interval between doses); restarting the 2-dose series is not necessary. **Booster vaccination**: **Persons NOT at increased risk for meningococcal disease** (routine vaccination): Adults ≤21 years of age: IM: One 0.5 mL dose if the first dose was given prior to the sixteenth birthday. A booster dose is not needed if the primary dose was given after the sixteenth birthday unless the person becomes at increased risk for meningococcal disease. **Persons at increased risk for meningococcal disease**: Repeat dose every 5 years if the person remains at increased risk.
Maximum Daily Dose Adults*	0.5 mL as a single dose
Dose (pediatrics)	**Children 9 to 23 months**: IM: 0.5 mL per dose for a total of 2 doses; administered at least 12 weeks after the first dose. May be given as early as 8 weeks apart if needed prior to travel. Note: Administer before or concomitantly with DTaP and ≥4 weeks after completion of all PCV doses. **Children 2 and older (not previously vaccinated)**: Persistent complement

	deficiencies: IM: 0.5 mL per dose for a total of 2 doses administered at least 8 weeks apart. At risk during an outbreak or traveling to or residing in areas where meningococcal disease is endemic/ hyperendemic: IM: 0.5 mL as a single dose. **Booster dose: for patients not at increased risk:** Adolescents ≥16 years: M: 0.5 mL as a single dose. If primary vaccination was at 11 to 12 years, the booster dose should be given at age 16. If the primary vaccination was given at 13 to 15 years, the booster dose should be given at age 16 to 18. The minimum interval between MenACWY doses is 8 weeks. A booster dose is not needed if the primary dose was given after the 16th birthday unless the person becomes at increased risk for meningococcal disease. **Patients remaining at increased risk**: **Children 3 to ≥10 years**: If first dose received at <7 years of age: IM: 0.5 mL per dose; administer booster dose 3 years after primary vaccination and every 5 years thereafter if the person remains at increased risk. If first dose received at ≥7 years of age: IM: 0.5 mL per dose; administer booster dose 5 years after primary vaccination and every 5 years thereafter if the person remains at increased risk.
Maximum Daily Dose Pediatrics*	0.5 mL as a single dose
Adjustment	No dosage adjustments provided in the manufacturer's labeling for renal or hepatic impairment**.**
Prescribing edits*	AGE, QL
AGE (Age Edit): ≥ 9 months to ≤ 55 years of age	
CU (Concurrent Use Edit): N/A	

G (Gender Edit): N/A	
MD (Physician Specialty Edit): N/A	
PA (Prior Authorization): N/A	
QL (Quantity Limit): 0.5 mL as a single dose for a total of 3 or 4 doses.	
ST (Step Therapy): N/A	
EU (Emergency Use Only): N/A	
PE (Protocol Edit): N/A	
SAFETY	
Main Adverse Drug Reactions (Most common and most serious)	Anorexia, change in appetite, diarrhea, nausea, vomiting, erythema/ induration/ pain/ swelling/ tenderness at injection site, drowsiness, malaise, pain
Drug Interactions*	X Elivaldogene Autotemcel D Abatacept D Abemaciclib D Abrocitinib D Acalabrutinib D Aceclofenac Depends on Indication D Acemetacin Depends on Indication D Acetaminophen Depends on Indication D Adalimumab D Alemtuzumab D Amsacrine D Anakinra D Anifrolumab D Antithymocyte Globulin (Equine) D Antithymocyte Globulin (Rabbit) D Asciminib D Aspirin Depends on Indication D Axicabtagene Ciloleucel D AzaCITIDine D AzaTHIOprine D Baricitinib D Basiliximab D Belatacept D Belimumab D Belinostat

	D Betamethasone (Systemic) Depends on Dose and Duration D Bimekizumab D Blinatumomab D Brentuximab Vedotin D Brexucabtagene Autoleucel D Brodalumab D Busulfan D Cabazitaxel D Canakinumab D Capecitabine D CARBOplatin D Carfilzomib D Carmustine D Celecoxib Depends on Indication D Certolizumab Pegol D Chlorambucil D Ciltacabtagene Autoleucel D CISplatin D Cladribine D Clofarabine D Clonixin Depends on Indication D Copanlisib D Corticotropin Depends on Dose and Duration D Cortisone Depends on Dose and Duration D CycloPHOSphamide D CycloSPORINE (Systemic) D Cytarabine (Conventional) D Dacarbazine D DACTINomycin D Daratumumab D Dasatinib D DAUNOrubicin (Conventional) D DAUNOrubicin (Liposomal) D Deflazacort Depends on Dose and Duration D Deucravacitinib

	D DexAMETHasone (Systemic) Depends on Dose and Duration D Dexibuprofen Depends on Indication D Dexketoprofen Depends on Indication D Diclofenac (Systemic) Depends on Indication D Diflunisal Depends on Indication D Dinutuximab D Diphtheria and Tetanus Toxoids Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Acellular Pertussis, and Poliovirus Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Acellular Pertussis, Hepatitis B (Recombinant), Poliovirus (Inactivated), and Haemophilus influenzae B Conjugate (Adsorbed) Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Acellular Pertussis, Poliovirus and Haemophilus b Conjugate Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, and Acellular Pertussis Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Whole-Cell Pertussis, Hepatitis B (Recombinant), and Haemophilus influenzae b Conjugate Vaccine Depends on Age and Brand Name D Diphtheria, Tetanus Toxoids, Acellular Pertussis, Hepatitis B (Recombinant), and Poliovirus (Inactivated) Vaccine Depends on Age and Brand Name D Dipyrone Depends on Indication D DOCEtaxel D Doxifluridine

	D DOXOrubicin (Conventional) D DOXOrubicin (Liposomal) D Duvelisib D Efgartigimod Alfa D Elotuzumab D Emapalumab D Epcoritamab D EpiRUBicin D Etanercept D Etodolac Depends on Indication D Etoposide D Etoposide Phosphate D Etoricoxib Depends on Indication D Everolimus D Fenbufen Depends on Indication D Fenoprofen Depends on Indication D Filgotinib D Fingolimod D Floxuridine D Fludarabine D Fludrocortisone Depends on Dose and Duration D Fluorouracil (Systemic) D Flurbiprofen (Systemic) Depends on Indication D Fotemustine D Gemcitabine D Gemtuzumab Ozogamicin D Glofitamab D Golimumab D Guselkumab D Hydrocortisone (Systemic) Depends on Dose and Duration D Hydroxyurea D Ibritumomab Tiuxetan D Ibrutinib D Ibuprofen Depends on Indication D IDArubicin D Idecabtagene Vicleucel

	D Idelalisib D Ifosfamide D Imatinib D Indomethacin Depends on Indication D Inebilizumab D InFLIXimab D Inotuzumab Ozogamicin D Irinotecan (Conventional) D Irinotecan (Liposomal) D Isatuximab D Ixabepilone D Ixekizumab D Ketoprofen Depends on Indication D Ketorolac (Nasal) Depends on Indication D Ketorolac (Systemic) Depends on Indication D Leflunomide D Lenalidomide D Lisocabtagene Maraleucel D Lomustine D Loncastuximab Tesirine D Lornoxicam Depends on Indication D Loxoprofen Depends on Indication D Lurbinectedin D Lutetium Lu 177 Dotatate D Lutetium Lu 177 Vipivotide Tetraxetan D Meclofenamate Depends on Indication D Mefenamic Acid Depends on Indication D Meloxicam Depends on Indication D Melphalan D Melphalan Flufenamide D Mercaptopurine D Methotrexate D MethylPREDNISolone Depends on Dose and Duration D Mirikizumab

	D MitoMYcin (Systemic) D MitoXANTRONE D Mizoribine D Mogamulizumab D Morniflumate Depends on Indication D Mosunetuzumab D Mycophenolate D Nabumetone Depends on Indication D Naproxen Depends on Indication D Natalizumab D Nelarabine D Nimesulide Depends on Indication D Niraparib D Obinutuzumab D Ocrelizumab D Ofatumumab D Omacetaxine D Oxaprozin Depends on Indication D Ozanimod D PACLitaxel (Conventional) D PACLitaxel (Protein Bound) D Pacritinib D Palbociclib D Panobinostat D Parecoxib Depends on Indication D PAZOPanib D Pelubiprofen Depends on Indication D PEMEtrexed D Pentostatin D Phenylbutazone Depends on Indication D Piroxicam (Systemic) Depends on Indication D Pirtobrutinib D Pixantrone D Pneumococcal Conjugate Vaccine (13-Valent) Depends on Age, Brand Name, and Comorbidity D Polatuzumab Vedotin

	D Pomalidomide D PONATinib D Ponesimod D PRALAtrexate D Pranoprofen Depends on Indication D PrednisoLONE (Systemic) Depends on Dose and Duration D PredniSONE Depends on Dose and Duration D Procarbazine D Proglumetacin Depends on Indication D Propacetamol Depends on Indication D Propyphenazone Depends on Indication D Raltitrexed D Ribociclib D Rilonacept D Risankizumab D Ritlecitinib D RiTUXimab D RomiDEPsin D Rozanolixizumab D Ruxolitinib (Systemic) D Ruxolitinib (Topical) D Sacituzumab Govitecan D Sarilumab D Satralizumab D Secukinumab D Selinexor D Siltuximab D Siponimod D Sirolimus (Conventional) D Sirolimus (Protein Bound) D Sirolimus (Topical) D Spesolimab D Sulindac Depends on Indication D Tacrolimus (Systemic) D Tafasitamab

	D Talniflumate Depends on Indication D Talquetamab D Tazemetostat D Teclistamab D Tegafur D Temozolomide D Temsirolimus D Teniposide D Tenoxicam Depends on Indication D Teplizumab D Teriflunomide D Tetanus Toxoid (Adsorbed) Depends on Age and Brand Name D Thioguanine D Thiotepa D Tiaprofenic Acid Depends on Indication D Tisagenlecleucel D Tocilizumab D Tofacitinib D Tolfenamic Acid Depends on Indication D Tolmetin Depends on Indication D Trabectedin D Treosulfan D Triamcinolone (Systemic) Depends on Dose and Duration D Trifluridine and Tipiracil D Ublituximab D Umbralisib D Upadacitinib D Ustekinumab D Vedolizumab D Venetoclax D VinBLAStine D Vinflunine D Vinorelbine D Voclosporin D Zaltoprofen Depends on Indication

	D Zanubrutinib
Special Population	May be used though safety and efficacy have not been established in patients >55 years of age. **Altered immunocompetence:** Patients with certain complement deficiencies, HIV infection, or with anatomic or functional asplenia, and patients receiving complement inhibitors (eg, eculizumab, ravulizumab) are at an increased risk for invasive meningococcal infection, including post vaccination. Consider deferring immunization during periods of severe immunosuppression (eg, patients receiving chemo/radiation therapy or other immunosuppressive therapy [including high-dose corticosteroids]); may have a reduced response to vaccination. In general, household and close contacts of persons with altered immunocompetence may receive all age-appropriate vaccines. Inactivated vaccines should be administered ≥2 weeks prior to planned immunosuppression when feasible; inactivated vaccines administered during chemotherapy should be readministered after immune competence is regained. • **Pediatric:** Apnea has been reported following IM vaccine administration in premature infants; consider clinical status implications. In general, preterm infants should be vaccinated at the same chronological age as full-term infants. Children with functional or anatomic asplenia or HIV infection should delay receiving Menactra (MenACWY-D) until 2 years of age to avoid immune interference with the 13-

	valent pneumococcal conjugate vaccine (PCV13); Menactra should be given at least 4 weeks after completion of the PCV13 series; if meningococcal immunity is required in pediatric patients 2 to 23 months of age, the alternative is administration of Menveo.
Pregnancy	Based on available data, an increased risk of adverse pregnancy outcomes has not been observed following maternal vaccination with a meningococcal (Groups A / C / Y and W-135) diphtheria conjugate vaccine. Inactivated bacterial vaccines have not been shown to cause increased risks to the fetus. Use of meningococcal conjugate vaccines may be considered for use in pregnant patients at increased risk of infection. Pregnant patients should be vaccinated if otherwise indicated. Data collection to monitor pregnancy and infant outcomes following exposure to Menactra or MenQuadfi is ongoing. Health care providers are encouraged to enroll patients exposed to Menactra or MedQuadfi during pregnancy in the Sanofi Pasteur Inc vaccine registry (1-800-822-2463).
Lactation	It is not known if this vaccine is present in breast milk. According to the manufacturer, the decision to continue or discontinue breastfeeding following immunization should consider the risk of infant exposure, the benefits of breastfeeding to the infant, and the benefits of vaccination to the mother. Inactivated vaccines do not affect the safety of breastfeeding for the mother or the infant. Lactating patients should be vaccinated if otherwise indicated. Breastfeeding infants should be

	vaccinated according to the recommended schedules.
Contraindications	Severe hypersensitivity (eg, anaphylaxis) to other meningococcal-containing vaccines or any component of the formulation including diphtheria toxoid or CRM197 (a diphtheria toxin carrier protein)
Monitoring Requirements	Ensure appropriate aged patients have received proper vaccine regimen. May inquire about college patient is attending; may affect additional vaccine needs. Have emergency treatment for anaphylactic or hypersensitivity reaction available. Monitor for syncope for at least 15 minutes following administration. Educate patient on need for booster. Instruct patient to report serious hypersensitivity reaction symptoms including respiratory distress, hypotension, urticaria, upper airway swelling, or symptoms of swelling (eg, dizziness or trouble breathing).
Precautions	**Concerns related to adverse effects:** • Anaphylactoid/hypersensitivity reactions: Immediate treatment (including epinephrine 1 mg/mL) for anaphylactoid and/or hypersensitivity reactions should be available during vaccine use. • Shoulder injury related to vaccine administration: Vaccine administration that is too high on the upper arm may cause shoulder injury (eg, shoulder bursitis, tendinopathy) resulting in shoulder pain and reduced range of motion following injection. Use proper injection technique for vaccines administered in the deltoid muscle (eg, injecting in the central, thickest part of

	the muscle) to reduce the risk of shoulder injury related to vaccine administration. • Syncope: Syncope has been reported with use of injectable vaccines and may result in serious secondary injury (eg, skull fracture, cerebral hemorrhage); typically reported in adolescents and young adults and within 15 minutes after vaccination. Procedures should be in place to avoid injuries from falling and to restore cerebral perfusion if syncope occurs. •**Disease-related concerns**: • Acute illness: The decision to administer or delay vaccination because of current or recent febrile illness depends on the severity of symptoms and the etiology of the disease. Defer administration in patients with moderate or severe acute illness (with or without fever); vaccination should not be delayed for patients with mild acute illness (with or without fever). • Bleeding disorders: Use with caution in patients with a history of bleeding disorders (including thrombocytopenia); bleeding/hematoma may occur from IM administration; if the patient receives antihemophilia or other similar therapy, IM injection can be scheduled shortly after such therapy is administered. • Diphtheria or tetanus immunization: Immunization with Menveo or Menactra does not substitute for routine diphtheria immunization; immunization with MenQuadfi or Nimenrix (Canadian product) does not

	substitute for routine tetanus immunization. • Guillain-Barré syndrome: Has been temporally associated with Menactra; use with caution in patients with a history of Guillain-Barré syndrome. • Meningococcal infections: Not to be used to treat meningococcal infections or to provide immunity against N. meningitidis serogroup B. **Concurrent drug therapy issues**: • Anticoagulant therapy: Use with caution in patients receiving anticoagulant therapy; bleeding/hematoma may occur from IM administration. • Vaccines: In order to maximize vaccination rates, the ACIP recommends simultaneous administration (ie, >1 vaccine on the same day at different anatomic sites) of all age-appropriate vaccines (live or inactivated) for which a person is eligible at a single clinic visit, unless contraindications exist. The ACIP prefers each dose of a specific vaccine in a series come from the same manufacturer when possible; however, vaccination should not be deferred because a specific brand name is unavailable. o Administration of Menactra (MenACWY-D) 1 month after Daptacel (DTaP) has been shown to have reduced meningococcal antibody responses in children; these vaccines should be administered simultaneously or Menactra should be administered prior to or 6 months after Daptacel. If a child is traveling to a

	hyperendemic or epidemic area or where an outbreak is occurring, administer MenACWY-D regardless of the timing of DTaP receipt. This interaction does not apply to Menveo (MenACWY-CRM) or MenQuadfi ○ Simultaneous administration of Menactra (MenACWY-D) and pneumococcal conjugate vaccine (7-valent) (PCV7) produced reduced concentrations of 3 serotypes of pneumococcus. Therefore, ACIP recommends that in persons with anatomic or functional asplenia or HIV, Menactra should be given ≥4 weeks after completion of the PCV13 series ▪ Antipyretics: Antipyretics have not been shown to prevent febrile seizures; antipyretics may be used to treat fever or discomfort following vaccination. One study reported that routine prophylactic administration of acetaminophen to prevent fever prior to vaccination decreased the immune response of some vaccines; the clinical significance of this reduction in immune response has not been established. ▪ Appropriate use: Use of this vaccine for specific medical and/or other indications (eg, immunocompromising conditions, hepatic or kidney disease, diabetes) is also addressed in the annual ACIP Recommended Immunization Schedules (refer to CDC schedule for detailed information). Specific recommendations for use of this vaccine in immunocompromised

	patients with asplenia, cancer, HIV infection, cerebrospinal fluid leaks, cochlear implants, hematopoietic stem cell transplant (prior to or after), sickle cell disease, solid organ transplant (prior to or after), or those receiving immunosuppressive therapy for chronic conditions are available from the IDSA. ▪ • Effective immunity: Vaccination may not result in effective immunity in all patients. Response depends upon multiple factors (eg, type of vaccine, age of patient) and may be improved by administering the vaccine at the recommended dose, route, and interval. Vaccines may not be effective if administered during periods of altered immune competence.
Black Box Warning	n/a
REMS*	n/a

HEALTH TECHNOLOGY ASSESSMENT (HTA)

The table below lists the HTA reviews and recommendations of bacterial meningitis prevention options by the following agencies/institutes/authorities: National Institute for Health and Care Excellence (NICE), Canadian Agency for Drugs and Technologies in Health (CADTH), Haute Autorité de Santé (HAS), Institute for Quality and Efficiency in Health Care (IQWIG), and Pharmaceutical Benefits Advisory Committee (PBAC) as applicable. **The recommendations are for MENACTRA.**

Table 24. MENACTRA® HTA Analysis

MEDICATION	AGENCY	DATE – HTA RECOMMENDATION
MENACTRA	NICE	No results found
	CADTH	No results found
	HAS	No results found
	IQWIG	No results found
	PBAC	No results found

CONCLUSION STATEMENT - MENACTRA®

No results found for the use of MENACTRA®. Give MenACWY vaccines (Menactra®, Menveo®) as the initial dose to adolescents at 11 to 12 years old, with a booster dose at 16 years old. It is also given to individuals aged 2 years and above with conditions such as complement deficiencies, complement inhibitor use, asplenia, or HIV, provided via a 2-dose primary series spaced 2 months apart.

2.1.2.2 Nimenrix® Vaccine

Table 25. Nimenrix® Vaccine Information

SCIENTIFIC NAME **Quadrivalent meningococcal conjugate vaccine (MenACWY-D, MenACWY-CRM, MenACWY-TT) NIMENRIX® Vaccine**	
SFDA Classification	Prescription
SFDA Approval	Yes
US FDA	No
EMA	Yes
MHRA	Yes
PMDA	No
Indication (ICD-10)	A39
Drug Class	Bacterial Vaccines
Drug Sub-class	Meningococcal Vaccine
ATC Code	**J07AH08**
Pharmacological Class (ASHP)	n/a
DRUG INFORMATION	
Dosage Form	**Solution for injection**
Route of Administration	Intramuscular use
Dose (Adult) [DDD]*	**Routine for persons NOT at increased risk for meningococcal disease**: Adults 19 to 21 years of age: IM: Not routinely recommended; may receive one 0.5 mL dose as a catch-up vaccination if no dose was received after the sixteenth birthday. Adults ≥22 years of age: Not routinely recommended; see dosing for persons at increased risk. **Routine for persons at increased risk for meningococcal disease**: Adults not

	previously vaccinated: IM: Two 0.5 mL doses, given ≥2 months apart. Adults not previously vaccinated who are first-year college students living in residential housing; traveling to or residing in areas where meningococcal disease is endemic/hyperendemic; at risk during a community outbreak; military recruits; or microbiologists routinely exposed to N. meningitidis: IM: One 0.5 mL dose. Adults previously vaccinated with a single dose of MenACWY who later develop an underlying condition for which meningococcal 2-dose vaccination is recommended: IM: Administer second dose as soon as possible (≥8 week interval between doses); restarting the 2-dose series is not necessary. **Booster vaccination**: **Persons NOT at increased risk for meningococcal disease** (routine vaccination): Adults ≤21 years of age: IM: One 0.5 mL dose if the first dose was given prior to the sixteenth birthday. A booster dose is not needed if the primary dose was given after the sixteenth birthday unless the person becomes at increased risk for meningococcal disease. **Persons at increased risk for meningococcal disease**: Repeat dose every 5 years if the person remains at increased risk.
Maximum Daily Dose Adults*	0.5 mL as a single dose
Dose (pediatrics)	**Patients not at increased risk for meningococcal disease** **Children ≥12 years and adolescents:** IM: 0.5 mL as a single dose. Note: Routinely administered at 12 years of

	age, regardless of if previously immunized as an infant or toddler **Patients at increased risk for meningococcal disease (due to underlying medical conditions or exposure risk) who have not been previously vaccinated: Children ≥2 years and Adolescents:** Increased risk due to underlying medical conditions: IM: 0.5 mL per dose for a total of 2 doses ≥8 weeks apart; doses may be administered ≥4 weeks apart if accelerated vaccination is needed. Increased risk due to travel: IM: 0.5 mL as a single dose. **Booster vaccination: Patients remaining at increased risk for meningococcal disease due to underlying medical conditions or exposure risk:** Initially vaccinated at <7 years of age: IM: 0.5 mL per dose every 3 to 5 years. Initially vaccinated at ≥7 years of age: IM: 0.5 mL per dose every 5 years.
Maximum Daily Dose Pediatrics*	0.5 mL as a single dose
Adjustment	No dosage adjustments provided in the manufacturer's labeling for renal or hepatic impairment**.**
Prescribing edits*	AGE, QL
AGE (Age Edit): ≥ 6 weeks to ≤ 55 years of age	
CU (Concurrent Use Edit): N/A	
G (Gender Edit): N/A	
MD (Physician Specialty Edit): N/A	
PA (Prior Authorization): N/A	
QL (Quantity Limit): 0.5 mL as a single dose for a total of 3 or 4 doses	
ST (Step Therapy): N/A	
EU (Emergency Use Only): N/A	
PE (Protocol Edit): N/A	
SAFETY	

Main Adverse Drug Reactions (most common and most serious)	Anorexia, change in appetite, diarrhea, nausea, vomiting, erythema/ induration/ pain/ swelling/ tenderness at injection site, drowsiness, malaise, pain
Drug Interactions*	X Elivaldogene Autotemcel D Abatacept D Abemaciclib D Abrocitinib D Acalabrutinib D Aceclofenac Depends on Indication D Acemetacin Depends on Indication D Acetaminophen Depends on Indication D Adalimumab D Alemtuzumab D Amsacrine D Anakinra D Anifrolumab D Antithymocyte Globulin (Equine) D Antithymocyte Globulin (Rabbit) D Asciminib D Aspirin Depends on Indication D Axicabtagene Ciloleucel D AzaCITIDine D AzaTHIOprine D Baricitinib D Basiliximab D Belatacept D Belimumab D Belinostat D Betamethasone (Systemic) Depends on Dose and Duration D Bimekizumab D Blinatumomab D Brentuximab Vedotin D Brexucabtagene Autoleucel D Brodalumab D Busulfan D Cabazitaxel

	D Canakinumab D Capecitabine D CARBOplatin D Carfilzomib D Carmustine D Celecoxib Depends on Indication D Certolizumab Pegol D Chlorambucil D Ciltacabtagene Autoleucel D CISplatin D Cladribine D Clofarabine D Clonixin Depends on Indication D Copanlisib D Corticotropin Depends on Dose and Duration D Cortisone Depends on Dose and Duration D CycloPHOSphamide D CycloSPORINE (Systemic) D Cytarabine (Conventional) D Dacarbazine D DACTINomycin D Daratumumab D Dasatinib D DAUNOrubicin (Conventional) D DAUNOrubicin (Liposomal) D Deflazacort Depends on Dose and Duration D Deucravacitinib D DexAMETHasone (Systemic) Depends on Dose and Duration D Dexibuprofen Depends on Indication D Dexketoprofen Depends on Indication D Diclofenac (Systemic) Depends on Indication D Diflunisal Depends on Indication D Dinutuximab

	D Diphtheria and Tetanus Toxoids Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Acellular Pertussis, and Poliovirus Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Acellular Pertussis, Hepatitis B (Recombinant), Poliovirus (Inactivated), and Haemophilus influenzae B Conjugate (Adsorbed) Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Acellular Pertussis, Poliovirus and Haemophilus b Conjugate Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, and Acellular Pertussis Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Whole-Cell Pertussis, Hepatitis B (Recombinant), and Haemophilus influenzae b Conjugate Vaccine Depends on Age and Brand Name D Diphtheria, Tetanus Toxoids, Acellular Pertussis, Hepatitis B (Recombinant), and Poliovirus (Inactivated) Vaccine Depends on Age and Brand Name D Dipyrone Depends on Indication D DOCEtaxel D Doxifluridine D DOXOrubicin (Conventional) D DOXOrubicin (Liposomal) D Duvelisib D Efgartigimod Alfa D Elotuzumab D Emapalumab D Epcoritamab D EpiRUBicin D Etanercept

	D Etodolac Depends on Indication D Etoposide D Etoposide Phosphate D Etoricoxib Depends on Indication D Everolimus D Fenbufen Depends on Indication D Fenoprofen Depends on Indication D Filgotinib D Fingolimod D Floxuridine D Fludarabine D Fludrocortisone Depends on Dose and Duration D Fluorouracil (Systemic) D Flurbiprofen (Systemic) Depends on Indication D Fotemustine D Gemcitabine D Gemtuzumab Ozogamicin D Glofitamab D Golimumab D Guselkumab D Hydrocortisone (Systemic) Depends on Dose and Duration D Hydroxyurea D Ibritumomab Tiuxetan D Ibrutinib D Ibuprofen Depends on Indication D IDArubicin D Idecabtagene Vicleucel D Idelalisib D Ifosfamide D Imatinib D Indomethacin Depends on Indication D Inebilizumab D InFLIXimab D Inotuzumab Ozogamicin D Irinotecan (Conventional) D Irinotecan (Liposomal)

	D Isatuximab D Ixabepilone D Ixekizumab D Ketoprofen Depends on Indication D Ketorolac (Nasal) Depends on Indication D Ketorolac (Systemic) Depends on Indication D Leflunomide D Lenalidomide D Lisocabtagene Maraleucel D Lomustine D Loncastuximab Tesirine D Lornoxicam Depends on Indication D Loxoprofen Depends on Indication D Lurbinectedin D Lutetium Lu 177 Dotatate D Lutetium Lu 177 Vipivotide Tetraxetan D Meclofenamate Depends on Indication D Mefenamic Acid Depends on Indication D Meloxicam Depends on Indication D Melphalan D Melphalan Flufenamide D Mercaptopurine D Methotrexate D MethylPREDNISolone Depends on Dose and Duration D Mirikizumab D MitoMYcin (Systemic) D MitoXANTRONE D Mizoribine D Mogamulizumab D Morniflumate Depends on Indication D Mosunetuzumab D Mycophenolate D Nabumetone Depends on Indication D Naproxen Depends on Indication

	D Natalizumab D Nelarabine D Nimesulide Depends on Indication D Niraparib D Obinutuzumab D Ocrelizumab D Ofatumumab D Omacetaxine D Oxaprozin Depends on Indication D Ozanimod D PACLitaxel (Conventional) D PACLitaxel (Protein Bound) D Pacritinib D Palbociclib D Panobinostat D Parecoxib Depends on Indication D PAZOPanib D Pelubiprofen Depends on Indication D PEMEtrexed D Pentostatin D Phenylbutazone Depends on Indication D Piroxicam (Systemic) Depends on Indication D Pirtobrutinib D Pixantrone D Pneumococcal Conjugate Vaccine (13-Valent) Depends on Age, Brand Name, and Comorbidity D Polatuzumab Vedotin D Pomalidomide D PONATinib D Ponesimod D PRALAtrexate D Pranoprofen Depends on Indication D PrednisoLONE (Systemic) Depends on Dose and Duration D PredniSONE Depends on Dose and Duration

	D Procarbazine D Proglumetacin Depends on Indication D Propacetamol Depends on Indication D Propyphenazone Depends on Indication D Raltitrexed D Ribociclib D Rilonacept D Risankizumab D Ritlecitinib D RiTUXimab D RomiDEPsin D Rozanolixizumab D Ruxolitinib (Systemic) D Ruxolitinib (Topical) D Sacituzumab Govitecan D Sarilumab D Satralizumab D Secukinumab D Selinexor D Siltuximab D Siponimod D Sirolimus (Conventional) D Sirolimus (Protein Bound) D Sirolimus (Topical) D Spesolimab D Sulindac Depends on Indication D Tacrolimus (Systemic) D Tafasitamab D Talniflumate Depends on Indication D Talquetamab D Tazemetostat D Teclistamab D Tegafur D Temozolomide D Temsirolimus D Teniposide D Tenoxicam Depends on Indication

	D Teplizumab D Teriflunomide D Tetanus Toxoid (Adsorbed) Depends on Age and Brand Name D Thioguanine D Thiotepa D Tiaprofenic Acid Depends on Indication D Tisagenlecleucel D Tocilizumab D Tofacitinib D Tolfenamic Acid Depends on Indication D Tolmetin Depends on Indication D Trabectedin D Treosulfan D Triamcinolone (Systemic) Depends on Dose and Duration D Trifluridine and Tipiracil D Ublituximab D Umbralisib D Upadacitinib D Ustekinumab D Vedolizumab D Venetoclax D VinBLAStine D Vinflunine D Vinorelbine D Voclosporin D Zaltoprofen Depends on Indication D Zanubrutinib
Special Population	May be used though safety and efficacy have not been established in patients >55 years of age. **Altered immunocompetence:** Patients with certain complement deficiencies, HIV infection, or with anatomic or functional asplenia, and patients receiving complement inhibitors (eg, eculizumab, ravulizumab) are at an

	increased risk for invasive meningococcal infection, including post vaccination. Consider deferring immunization during periods of severe immunosuppression (eg, patients receiving chemo/radiation therapy or other immunosuppressive therapy [including high-dose corticosteroids]); may have a reduced response to vaccination. In general, household and close contacts of persons with altered immunocompetence may receive all age-appropriate vaccines. Inactivated vaccines should be administered ≥2 weeks prior to planned immunosuppression when feasible; inactivated vaccines administered during chemotherapy should be readministered after immune competence is regained. • **Pediatric:** Apnea has been reported following IM vaccine administration in premature infants; consider clinical status implications. In general, preterm infants should be vaccinated at the same chronological age as full-term infants. Children with functional or anatomic asplenia or HIV infection should delay receiving Menactra (MenACWY-D) until 2 years of age to avoid immune interference with the 13-valent pneumococcal conjugate vaccine (PCV13); Menactra should be given at least 4 weeks after completion of the PCV13 series; if meningococcal immunity is required in pediatric patients 2 to 23 months of age, the alternative is administration of Menveo.
Pregnancy	Based on available data, an increased risk of adverse pregnancy outcomes has not been observed following maternal

	vaccination with a meningococcal (Groups A / C / Y and W-135) diphtheria conjugate vaccine. Inactivated bacterial vaccines have not been shown to cause increased risks to the fetus. Use of meningococcal conjugate vaccines may be considered for use in pregnant patients at increased risk of infection. Pregnant patients should be vaccinated if otherwise indicated. Data collection to monitor pregnancy and infant outcomes following exposure to Menactra or MenQuadfi is ongoing. Health care providers are encouraged to enroll patients exposed to Menactra or MedQuadfi during pregnancy in the Sanofi Pasteur Inc vaccine registry (1-800-822-2463).
Lactation	It is not known if this vaccine is present in breast milk. According to the manufacturer, the decision to continue or discontinue breastfeeding following immunization should consider the risk of infant exposure, the benefits of breastfeeding to the infant, and the benefits of vaccination to the mother. Inactivated vaccines do not affect the safety of breastfeeding for the mother or the infant. Lactating patients should be vaccinated if otherwise indicated. Breastfeeding infants should be vaccinated according to the recommended schedules.
Contraindications	Severe hypersensitivity (eg, anaphylaxis) to other meningococcal-containing vaccines or any component of the formulation including diphtheria toxoid or CRM197 (a diphtheria toxin carrier protein)
Monitoring Requirements	Ensure appropriate aged patients have received proper vaccine regimen. May

	inquire about college patient is attending; may affect additional vaccine needs. Have emergency treatment for anaphylactic or hypersensitivity reaction available. Monitor for syncope for at least 15 minutes following administration. Educate patient on need for booster. Instruct patient to report serious hypersensitivity reaction symptoms including respiratory distress, hypotension, urticaria, upper airway swelling, or symptoms of swelling (eg, dizziness or trouble breathing).
Precautions	**Concerns related to adverse effects:** • Anaphylactoid/hypersensitivity reactions: Immediate treatment (including epinephrine 1 mg/mL) for anaphylactoid and/or hypersensitivity reactions should be available during vaccine use. • Shoulder injury related to vaccine administration: Vaccine administration that is too high on the upper arm may cause shoulder injury (eg, shoulder bursitis, tendinopathy) resulting in shoulder pain and reduced range of motion following injection. Use proper injection technique for vaccines administered in the deltoid muscle (eg, injecting in the central, thickest part of the muscle) to reduce the risk of shoulder injury related to vaccine administration. • Syncope: Syncope has been reported with use of injectable vaccines and may result in serious secondary injury (eg, skull fracture, cerebral hemorrhage); typically reported in adolescents and young adults and within 15 minutes after vaccination.

	Procedures should be in place to avoid injuries from falling and to restore cerebral perfusion if syncope occurs. •**Disease-related concerns**: • Acute illness: The decision to administer or delay vaccination because of current or recent febrile illness depends on the severity of symptoms and the etiology of the disease. Defer administration in patients with moderate or severe acute illness (with or without fever); vaccination should not be delayed for patients with mild acute illness (with or without fever). • Bleeding disorders: Use with caution in patients with a history of bleeding disorders (including thrombocytopenia); bleeding/hematoma may occur from IM administration; if the patient receives antihemophilia or other similar therapy, IM injection can be scheduled shortly after such therapy is administered. • Diphtheria or tetanus immunization: Immunization with Menveo or Menactra does not substitute for routine diphtheria immunization; immunization with MenQuadfi or Nimenrix (Canadian product) does not substitute for routine tetanus immunization. • Guillain-Barré syndrome: Has been temporally associated with Menactra; use with caution in patients with a history of Guillain-Barré syndrome. • Meningococcal infections: Not to be used to treat meningococcal infections or to provide immunity against N. meningitidis serogroup B.

	Concurrent drug therapy issues: • Anticoagulant therapy: Use with caution in patients receiving anticoagulant therapy; bleeding/hematoma may occur from IM administration. • Vaccines: In order to maximize vaccination rates, the ACIP recommends simultaneous administration (ie, >1 vaccine on the same day at different anatomic sites) of all age-appropriate vaccines (live or inactivated) for which a person is eligible at a single clinic visit, unless contraindications exist. The ACIP prefers each dose of a specific vaccine in a series come from the same manufacturer when possible; however, vaccination should not be deferred because a specific brand name is unavailable. o Administration of Menactra (MenACWY-D) 1 month after Daptacel (DTaP) has been shown to have reduced meningococcal antibody responses in children; these vaccines should be administered simultaneously or Menactra should be administered prior to or 6 months after Daptacel. If a child is traveling to a hyperendemic or epidemic area or where an outbreak is occurring, administer MenACWY-D regardless of the timing of DTaP receipt. This interaction does not apply to Menveo (MenACWY-CRM) or MenQuadfi o Simultaneous administration of Menactra (MenACWY-D) and pneumococcal conjugate vaccine (7-

	valent) (PCV7) produced reduced concentrations of 3 serotypes of pneumococcus. Therefore, ACIP recommends that in persons with anatomic or functional asplenia or HIV, Menactra should be given ≥4 weeks after completion of the PCV13 series ▪ Antipyretics: Antipyretics have not been shown to prevent febrile seizures; antipyretics may be used to treat fever or discomfort following vaccination. One study reported that routine prophylactic administration of acetaminophen to prevent fever prior to vaccination decreased the immune response of some vaccines; the clinical significance of this reduction in immune response has not been established. ▪ Appropriate use: Use of this vaccine for specific medical and/or other indications (eg, immunocompromising conditions, hepatic or kidney disease, diabetes) is also addressed in the annual ACIP Recommended Immunization Schedules (refer to CDC schedule for detailed information). Specific recommendations for use of this vaccine in immunocompromised patients with asplenia, cancer, HIV infection, cerebrospinal fluid leaks, cochlear implants, hematopoietic stem cell transplant (prior to or after), sickle cell disease, solid organ transplant (prior to or after), or those receiving immunosuppressive therapy for chronic conditions are available from the IDSA.

	▪ • Effective immunity: Vaccination may not result in effective immunity in all patients. Response depends upon multiple factors (eg, type of vaccine, age of patient) and may be improved by administering the vaccine at the recommended dose, route, and interval. Vaccines may not be effective if administered during periods of altered immune competence.
Black Box Warning	n/a
REMS*	n/a

HEALTH TECHNOLOGY ASSESSMENT (HTA)

The table below lists the HTA reviews and recommendations of bacterial meningitis prevention options by the following agencies/institutes/authorities: National Institute for Health and Care Excellence (NICE), Canadian Agency for Drugs and Technologies in Health (CADTH), Haute Autorité de Santé (HAS), Institute for Quality and Efficiency in Health Care (IQWIG), and Pharmaceutical Benefits Advisory Committee (PBAC) as applicable. **The recommendations are for NIMENRIX.**

Table 26. NIMENRIX® HTA Analysis

MEDICATION	AGENCY	DATE – HTA RECOMMENDATION
NIMENRIX	NICE	No results found.
	CADTH	No results found.
	HAS	There is a favorable opinion for the reimbursement of Nimenrix in patients aged 6weeks-12months for active immunization against invasive meningococcal disease caused by group A, C, W135 and Y strains, in addition to the maintenance of reimbursement in patients aged 12 months and older, only in the populations recommended by the HAS on 11 March 2021. Nimenrix has substantial clinical benefit in the active immunisation against invasive meningococcal disease caused by group A, C, W and Y strains, in

		individuals from the age of 12 months and older, and major clinical added value.
	IQWIG	No results found.
	PBAC	No results found.

CONCLUSION STATEMENT – NIMENRIX

The use of NIMENRIX is recommended by the HAS HTA body to be reimbursed for immunization against meningococcal disease. Nimenrix is another quadrivalent conjugate vaccine that protects against the same serogroups as Menactra. It is intended for individuals starting from six weeks of age, providing immunization against IMD caused by Neisseria meningitidis groups A, C, W-135, and Y. It is generally used in Europe and other regions.

2.1.2.3 Menveo® Vaccine

Table 27. Menveo® Vaccine Information

SCIENTIFIC NAME Quadrivalent meningococcal conjugate vaccine (MenACWY-D, MenACWY-CRM, MenACWY-TT) MENVEO® Vaccine	
SFDA Classification	Prescription
SFDA Approval	Yes
US FDA	Yes
EMA	Yes
MHRA	Yes
PMDA	No
Indication (ICD-10)	A39
Drug Class	Bacterial Vaccines (Inactivated)
Drug Sub-class	Meningococcal Vaccines
ATC Code	J07AH08
Pharmacological Class (ASHP)	n/a
DRUG INFORMATION	
Dosage Form	**Solution for injection**
Route of Administration	Intramuscular use
Dose (Adult) [DDD]*	**Routine for persons NOT at increased risk for meningococcal disease**: Adults 19 to 21 years of age: IM: Not routinely recommended; may receive one 0.5 mL dose as a catch-up vaccination if no

	dose was received after the sixteenth birthday. Adults ≥22 years of age: Not routinely recommended; see dosing for persons at increased risk. **Routine for persons at increased risk for meningococcal disease**: Adults not previously vaccinated: IM: Two 0.5 mL doses, given ≥2 months apart. Adults not previously vaccinated who are first-year college students living in residential housing; traveling to or residing in areas where meningococcal disease is endemic/hyperendemic; at risk during a community outbreak; military recruits; or microbiologists routinely exposed to N. meningitidis: IM: One 0.5 mL dose. Adults previously vaccinated with a single dose of MenACWY who later develop an underlying condition for which meningococcal 2-dose vaccination is recommended: IM: Administer second dose as soon as possible (≥8week interval between doses); restarting the 2-dose series is not necessary. **Booster vaccination**: **Persons NOT at increased risk for meningococcal disease** (routine vaccination): Adults ≤21 years of age: IM: One 0.5 mL dose if the first dose was given prior to the sixteenth birthday. A booster dose is not needed if the primary dose was given after the sixteenth birthday unless the person becomes at increased risk for meningococcal disease. **Persons at increased risk for meningococcal disease**: Repeat dose every 5 years if the person remains at increased risk.

Maximum Daily Dose Adults*	0.5 mL as a single dose
Dose (pediatrics)	**Patients not at increased risk for meningococcal disease** **Children 11 or 12 years and adolescents:** IM: 0.5 mL as a single dose. Children not currently at increased risk for meningococcal disease who were previously vaccinated prior to their 10th birthday should receive the routinely recommended dose of MenACWY at 11 to 12 years. Children who received MenACWY at 10 years of age do not need an additional dose at 11 to 12 years **Patients at increased risk for meningococcal disease (due to underlying medical conditions or exposure risk) who have not been previously vaccinated:** Infants 2 to <3 months: MenACWY-CRM (Menveo [2-vial formulation]): IM: 0.5 mL per dose for a total of 4 doses administered at 2, 4, 6, and 12 months of age. Infants 3 to 6 months: MenACWY-CRM (Menveo [2-vial formulation]): IM: 0.5 mL per dose at 8-week intervals for 1 or 2 doses until patient is ≥7 months of age; once patient ≥7 months of age, administer an additional dose; once patient ≥12 months of age and at least 12 weeks after the last dose, administer a final dose. Infants and Children 7 to 23 months: Note: MenACWY-CRM (Menveo) preferred in patients with HIV infection or asplenia. MenACWY-CRM (Menveo [2-vial formulation]): Infants and Children 7 to 23 months: IM: 0.5 mL per dose for a total of 2 doses; the second dose should

	be administered at age ≥12 months and at least 12 weeks after the first dose. Children 2 to <10 years (not previously vaccinated): Note: Administer MenACWY-D (Menactra) before or concomitantly with DTaP and ≥4 weeks after completion of all PCV doses; may be given at any time in relation to Tdap or Td. Persistent complement deficiencies (including complement inhibitor use [eg, eculizumab, ravulizumab]); functional or anatomic asplenia; HIV infection: IM: 0.5 mL per dose for a total of 2 doses administered at least 8 weeks apart. At risk during an outbreak or traveling to or residing in areas where meningococcal disease is endemic/hyperendemic: MenACWY-CRM (Menveo [2-vial formulation]), IM: 0.5 mL as a single dose. Children ≥10 years and Adolescents (not previously vaccinated): Note: Administer MenACWY-D (Menactra) before or concomitantly with DTaP and ≥4 weeks after completion of all PCV doses; may be given at any time in relation to Tdap or Td. Persistent complement deficiencies (including complement inhibitor use [eg, eculizumab, ravulizumab]); functional or anatomic asplenia; HIV infection: MenACWY-CRM (Menveo [1- or 2-vial formulation]): IM: 0.5 mL per dose for a total of 2 doses administered at least 8 weeks apart. At risk during an outbreak (due to vaccine serogroup); traveling to or residing in areas where meningococcal disease is endemic/hyperendemic;

	military recruits; first-year college students living in residential halls; or microbiologists routinely exposed to N. meningitidis: MenACWY-CRM (Menveo [1- or 2-vial formulation]): IM: 0.5 mL as a single dose. Note: College students living in residence halls should have documentation of a vaccination not more than 5 years before entry (preferably a dose on or after their 16th birthday). **Booster vaccination:** **Patients NOT at increased risk for meningococcal disease:** **Adolescents ≥16 years:** MenACWY-CRM (Menveo [1- or 2-vial formulation]): IM: 0.5 mL as a single dose. If primary vaccination was at 11 to 12 years, the booster dose should be given at age 16. If the primary vaccination was given at 13 to 15 years, the booster dose should be given at age 16 to 18. Minimum interval between MenACWY doses is 8 weeks. A booster dose is not needed if the primary dose was given after the 16th birthday unless the person becomes at increased risk for meningococcal disease. **Patients remaining at increased risk for meningococcal disease due to underlying medical conditions or exposure risk:** Initially vaccinated at <7 years of age: IM: 0.5 mL per dose every 3 to 5 years. Initially vaccinated at ≥7 years of age: IM: 0.5 mL per dose every 5 years.
Maximum Daily Dose Pediatrics*	0.5 mL as a single dose
Adjustment	No dosage adjustments provided in the manufacturer's labeling for renal or hepatic impairment**.**
Prescribing edits*	AGE, QL

AGE (Age Edit): ≥2 months to ≤ 55 years of age (2-vial formulation); ≥10 years to ≤55 years of age (1-vial formulation)	
CU (Concurrent Use Edit): N/A	
G (Gender Edit): N/A	
MD (Physician Specialty Edit): N/A	
PA (Prior Authorization): N/A	
QL (Quantity Limit): 0.5 mL as a single dose for a total of 3 or 4 doses	
ST (Step Therapy): N/A	
EU (Emergency Use Only): N/A	
PE (Protocol Edit): N/A	
SAFETY	
Main Adverse Drug Reactions (Most common and most serious)	Anorexia, change in appetite, diarrhea, nausea, vomiting, erythema/ induration/ pain/ swelling/ tenderness at injection site, drowsiness, malaise, pain
Drug Interactions*	X Elivaldogene Autotemcel D Abatacept D Abemaciclib D Abrocitinib D Acalabrutinib D Aceclofenac Depends on Indication D Acemetacin Depends on Indication D Acetaminophen Depends on Indication D Adalimumab D Alemtuzumab D Amsacrine D Anakinra D Anifrolumab D Antithymocyte Globulin (Equine) D Antithymocyte Globulin (Rabbit) D Asciminib D Aspirin Depends on Indication D Axicabtagene Ciloleucel D AzaCITIDine D AzaTHIOprine D Baricitinib D Basiliximab

	D Belatacept D Belimumab D Belinostat D Betamethasone (Systemic) Depends on Dose and Duration D Bimekizumab D Blinatumomab D Brentuximab Vedotin D Brexucabtagene Autoleucel D Brodalumab D Busulfan D Cabazitaxel D Canakinumab D Capecitabine D CARBOplatin D Carfilzomib D Carmustine D Celecoxib Depends on Indication D Certolizumab Pegol D Chlorambucil D Ciltacabtagene Autoleucel D CISplatin D Cladribine D Clofarabine D Clonixin Depends on Indication D Copanlisib D Corticotropin Depends on Dose and Duration D Cortisone Depends on Dose and Duration D CycloPHOSphamide D CycloSPORINE (Systemic) D Cytarabine (Conventional) D Dacarbazine D DACTINomycin D Daratumumab D Dasatinib D DAUNOrubicin (Conventional) D DAUNOrubicin (Liposomal)

	D Deflazacort Depends on Dose and Duration D Deucravacitinib D DexAMETHasone (Systemic) Depends on Dose and Duration D Dexibuprofen Depends on Indication D Dexketoprofen Depends on Indication D Diclofenac (Systemic) Depends on Indication D Diflunisal Depends on Indication D Dinutuximab D Diphtheria and Tetanus Toxoids Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Acellular Pertussis, and Poliovirus Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Acellular Pertussis, Hepatitis B (Recombinant), Poliovirus (Inactivated), and Haemophilus influenzae B Conjugate (Adsorbed) Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Acellular Pertussis, Poliovirus and Haemophilus b Conjugate Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, and Acellular Pertussis Vaccine Depends on Age and Brand Name D Diphtheria and Tetanus Toxoids, Whole-Cell Pertussis, Hepatitis B (Recombinant), and Haemophilus influenzae b Conjugate Vaccine Depends on Age and Brand Name D Diphtheria, Tetanus Toxoids, Acellular Pertussis, Hepatitis B (Recombinant), and Poliovirus (Inactivated) Vaccine Depends on Age and Brand Name

	D Dipyrone Depends on Indication D DOCEtaxel D Doxifluridine D DOXOrubicin (Conventional) D DOXOrubicin (Liposomal) D Duvelisib D Efgartigimod Alfa D Elotuzumab D Emapalumab D Epcoritamab D EpiRUBicin D Etanercept D Etodolac Depends on Indication D Etoposide D Etoposide Phosphate D Etoricoxib Depends on Indication D Everolimus D Fenbufen Depends on Indication D Fenoprofen Depends on Indication D Filgotinib D Fingolimod D Floxuridine D Fludarabine D Fludrocortisone Depends on Dose and Duration D Fluorouracil (Systemic) D Flurbiprofen (Systemic) Depends on Indication D Fotemustine D Gemcitabine D Gemtuzumab Ozogamicin D Glofitamab D Golimumab D Guselkumab D Hydrocortisone (Systemic) Depends on Dose and Duration D Hydroxyurea D Ibritumomab Tiuxetan D Ibrutinib

	D Ibuprofen Depends on Indication D IDArubicin D Idecabtagene Vicleucel D Idelalisib D Ifosfamide D Imatinib D Indomethacin Depends on Indication D Inebilizumab D InFLIXimab D Inotuzumab Ozogamicin D Irinotecan (Conventional) D Irinotecan (Liposomal) D Isatuximab D Ixabepilone D Ixekizumab D Ketoprofen Depends on Indication D Ketorolac (Nasal) Depends on Indication D Ketorolac (Systemic) Depends on Indication D Leflunomide D Lenalidomide D Lisocabtagene Maraleucel D Lomustine D Loncastuximab Tesirine D Lornoxicam Depends on Indication D Loxoprofen Depends on Indication D Lurbinectedin D Lutetium Lu 177 Dotatate D Lutetium Lu 177 Vipivotide Tetraxetan D Meclofenamate Depends on Indication D Mefenamic Acid Depends on Indication D Meloxicam Depends on Indication D Melphalan D Melphalan Flufenamide D Mercaptopurine D Methotrexate

	D MethylPREDNISolone Depends on Dose and Duration D Mirikizumab D MitoMYcin (Systemic) D MitoXANTRONE D Mizoribine D Mogamulizumab D Morniflumate Depends on Indication D Mosunetuzumab D Mycophenolate D Nabumetone Depends on Indication D Naproxen Depends on Indication D Natalizumab D Nelarabine D Nimesulide Depends on Indication D Niraparib D Obinutuzumab D Ocrelizumab D Ofatumumab D Omacetaxine D Oxaprozin Depends on Indication D Ozanimod D PACLitaxel (Conventional) D PACLitaxel (Protein Bound) D Pacritinib D Palbociclib D Panobinostat D Parecoxib Depends on Indication D PAZOPanib D Pelubiprofen Depends on Indication D PEMEtrexed D Pentostatin D Phenylbutazone Depends on Indication D Piroxicam (Systemic) Depends on Indication D Pirtobrutinib D Pixantrone

	D Pneumococcal Conjugate Vaccine (13-Valent) Depends on Age, Brand Name, and Comorbidity D Polatuzumab Vedotin D Pomalidomide D PONATinib D Ponesimod D PRALAtrexate D Pranoprofen Depends on Indication D PrednisoLONE (Systemic) Depends on Dose and Duration D PredniSONE Depends on Dose and Duration D Procarbazine D Proglumetacin Depends on Indication D Propacetamol Depends on Indication D Propyphenazone Depends on Indication D Raltitrexed D Ribociclib D Rilonacept D Risankizumab D Ritlecitinib D RiTUXimab D RomiDEPsin D Rozanolixizumab D Ruxolitinib (Systemic) D Ruxolitinib (Topical) D Sacituzumab Govitecan D Sarilumab D Satralizumab D Secukinumab D Selinexor D Siltuximab D Siponimod D Sirolimus (Conventional) D Sirolimus (Protein Bound) D Sirolimus (Topical)

	D Spesolimab D Sulindac Depends on Indication D Tacrolimus (Systemic) D Tafasitamab D Talniflumate Depends on Indication D Talquetamab D Tazemetostat D Teclistamab D Tegafur D Temozolomide D Temsirolimus D Teniposide D Tenoxicam Depends on Indication D Teplizumab D Teriflunomide D Tetanus Toxoid (Adsorbed) Depends on Age and Brand Name D Thioguanine D Thiotepa D Tiaprofenic Acid Depends on Indication D Tisagenlecleucel D Tocilizumab D Tofacitinib D Tolfenamic Acid Depends on Indication D Tolmetin Depends on Indication D Trabectedin D Treosulfan D Triamcinolone (Systemic) Depends on Dose and Duration D Trifluridine and Tipiracil D Ublituximab D Umbralisib D Upadacitinib D Ustekinumab D Vedolizumab D Venetoclax D VinBLAStine

	D Vinflunine D Vinorelbine D Voclosporin D Zaltoprofen Depends on Indication D Zanubrutinib
Special Population	May be used though safety and efficacy have not been established in patients >55 years of age. **Altered immunocompetence:** Patients with certain complement deficiencies, HIV infection, or with anatomic or functional asplenia, and patients receiving complement inhibitors (eg, eculizumab, ravulizumab) are at an increased risk for invasive meningococcal infection, including post vaccination. Consider deferring immunization during periods of severe immunosuppression (eg, patients receiving chemo/radiation therapy or other immunosuppressive therapy [including high-dose corticosteroids]); may have a reduced response to vaccination. In general, household and close contacts of persons with altered immunocompetence may receive all age-appropriate vaccines. Inactivated vaccines should be administered ≥2 weeks prior to planned immunosuppression when feasible; inactivated vaccines administered during chemotherapy should be readministered after immune competence is regained. • **Pediatric:** Apnea has been reported following IM vaccine administration in premature infants; consider clinical status implications. In general, preterm infants should be vaccinated at the same chronological age as full-term infants. Children with functional or

	anatomic asplenia or HIV infection should delay receiving Menactra (MenACWY-D) until 2 years of age to avoid immune interference with the 13-valent pneumococcal conjugate vaccine (PCV13); Menactra should be given at least 4 weeks after completion of the PCV13 series; if meningococcal immunity is required in pediatric patients 2 to 23 months of age, the alternative is administration of Menveo.
Pregnancy	Based on available data, an increased risk of adverse pregnancy outcomes has not been observed following maternal vaccination with a meningococcal (Groups A / C / Y and W-135) diphtheria conjugate vaccine. Inactivated bacterial vaccines have not been shown to cause increased risks to the fetus. Use of meningococcal conjugate vaccines may be considered for use in pregnant patients at increased risk of infection. Pregnant patients should be vaccinated if otherwise indicated. Data collection to monitor pregnancy and infant outcomes following exposure to Menactra or MenQuadfi is ongoing. Health care providers are encouraged to enroll patients exposed to Menactra or MedQuadfi during pregnancy in the Sanofi Pasteur Inc vaccine registry (1-800-822-2463).
Lactation	It is not known if this vaccine is present in breast milk. According to the manufacturer, the decision to continue or discontinue breastfeeding following immunization should consider the risk of infant exposure, the benefits of breastfeeding to the infant, and the benefits of vaccination to the mother. Inactivated vaccines do not affect the

	safety of breastfeeding for the mother or the infant. Lactating patients should be vaccinated if otherwise indicated. Breastfeeding infants should be vaccinated according to the recommended schedules.
Contraindications	Severe hypersensitivity (eg, anaphylaxis) to other meningococcal-containing vaccines or any component of the formulation including diphtheria toxoid or CRM197 (a diphtheria toxin carrier protein)
Monitoring Requirements	Ensure appropriate aged patients have received proper vaccine regimen. May inquire about college patient is attending; may affect additional vaccine needs. Have emergency treatment for anaphylactic or hypersensitivity reaction available. Monitor for syncope for at least 15 minutes following administration. Educate patient on need for booster. Instruct patient to report serious hypersensitivity reaction symptoms including respiratory distress, hypotension, urticaria, upper airway swelling, or symptoms of swelling (eg, dizziness or trouble breathing).
Precautions	**Concerns related to adverse effects:** • Anaphylactoid/hypersensitivity reactions: Immediate treatment (including epinephrine 1 mg/mL) for anaphylactoid and/or hypersensitivity reactions should be available during vaccine use. • Shoulder injury related to vaccine administration: Vaccine administration that is too high on the upper arm may cause shoulder injury (eg, shoulder bursitis, tendinopathy) resulting in shoulder pain and reduced range of

	motion following injection. Use proper injection technique for vaccines administered in the deltoid muscle (eg, injecting in the central, thickest part of the muscle) to reduce the risk of shoulder injury related to vaccine administration. • Syncope: Syncope has been reported with use of injectable vaccines and may result in serious secondary injury (eg, skull fracture, cerebral hemorrhage); typically reported in adolescents and young adults and within 15 minutes after vaccination. Procedures should be in place to avoid injuries from falling and to restore cerebral perfusion if syncope occurs. • **Disease-related concerns**: • Acute illness: The decision to administer or delay vaccination because of current or recent febrile illness depends on the severity of symptoms and the etiology of the disease. Defer administration in patients with moderate or severe acute illness (with or without fever); vaccination should not be delayed for patients with mild acute illness (with or without fever). • Bleeding disorders: Use with caution in patients with a history of bleeding disorders (including thrombocytopenia); bleeding/hematoma may occur from IM administration; if the patient receives antihemophilia or other similar therapy, IM injection can be scheduled shortly after such therapy is administered. • Diphtheria or tetanus immunization: Immunization with Menveo or

	Menactra does not substitute for routine diphtheria immunization; immunization with MenQuadfi or Nimenrix (Canadian product) does not substitute for routine tetanus immunization. • Guillain-Barré syndrome: Has been temporally associated with Menactra; use with caution in patients with a history of Guillain-Barré syndrome. • Meningococcal infections: Not to be used to treat meningococcal infections or to provide immunity against N. meningitidis serogroup B. **Concurrent drug therapy issues**: • Anticoagulant therapy: Use with caution in patients receiving anticoagulant therapy; bleeding/hematoma may occur from IM administration. • Vaccines: In order to maximize vaccination rates, the ACIP recommends simultaneous administration (ie, >1 vaccine on the same day at different anatomic sites) of all age-appropriate vaccines (live or inactivated) for which a person is eligible at a single clinic visit, unless contraindications exist. The ACIP prefers each dose of a specific vaccine in a series come from the same manufacturer when possible; however, vaccination should not be deferred because a specific brand name is unavailable. o Administration of Menactra (MenACWY-D) 1 month after Daptacel (DTaP) has been shown to have reduced meningococcal antibody responses in children; these vaccines should be

	administered simultaneously or Menactra should be administered prior to or 6 months after Daptacel. If a child is traveling to a hyperendemic or epidemic area or where an outbreak is occurring, administer MenACWY-D regardless of the timing of DTaP receipt. This interaction does not apply to Menveo (MenACWY-CRM) or MenQuadfi ○ Simultaneous administration of Menactra (MenACWY-D) and pneumococcal conjugate vaccine (7-valent) (PCV7) produced reduced concentrations of 3 serotypes of pneumococcus. Therefore, ACIP recommends that in persons with anatomic or functional asplenia or HIV, Menactra should be given ≥4 weeks after completion of the PCV13 series ▪ Antipyretics: Antipyretics have not been shown to prevent febrile seizures; antipyretics may be used to treat fever or discomfort following vaccination. One study reported that routine prophylactic administration of acetaminophen to prevent fever prior to vaccination decreased the immune response of some vaccines; the clinical significance of this reduction in immune response has not been established. ▪ Appropriate use: Use of this vaccine for specific medical and/or other indications (eg, immunocompromising conditions, hepatic or kidney disease, diabetes) is also addressed in the annual ACIP Recommended Immunization

	Schedules (refer to CDC schedule for detailed information). Specific recommendations for use of this vaccine in immunocompromised patients with asplenia, cancer, HIV infection, cerebrospinal fluid leaks, cochlear implants, hematopoietic stem cell transplant (prior to or after), sickle cell disease, solid organ transplant (prior to or after), or those receiving immunosuppressive therapy for chronic conditions are available from the IDSA. ▪ · Effective immunity: Vaccination may not result in effective immunity in all patients. Response depends upon multiple factors (eg, type of vaccine, age of patient) and may be improved by administering the vaccine at the recommended dose, route, and interval. Vaccines may not be effective if administered during periods of altered immune competence.
Black Box Warning	N/A
REMS*	N/A

HEALTH TECHNOLOGY ASSESSMENT (HTA)

The table below lists the HTA reviews and recommendations of bacterial meningitis prevention options by the following agencies/institutes/authorities: National Institute for Health and Care Excellence (NICE), Canadian Agency for Drugs and Technologies in Health (CADTH), Haute Autorité de Santé (HAS), Institute for Quality and Efficiency in Health Care (IQWIG), and Pharmaceutical Benefits Advisory Committee (PBAC) as applicable. **The recommendations are for MENVEO®.**

Table 28. MENVEO® HTA Analysis

MEDICATION	AGENCY	DATE – HTA RECOMMENDATION
MENVEO	NICE	No results found.
	CADTH	No results found.

	HAS	Opinion in favor of maintaining reimbursement in subjects aged 2 years and over only in the populations recommended following the update of the vaccination recommendations by the HAS on March 11, 2021, including situations of hyperendemic meningococcal serogroup W. It was deemed to have substantial clinical benefit in the active immunization against invasive meningococcal infections of serogroups A, C, W-135 and Y, in subjects from the age of 2 years, only in the populations recommended by the HAS of March 2021 but unspecified clinical added value.
	IQWIG	No results found.
	PBAC	No results found.

CONCLUSION STATEMENT – MENVEO®

The use of MENVEO is recommended by the HAS HTA for maintaining reimbursement in active immunization against meningococcal infections. Give MenACWY vaccines (Menactra®, Menveo®) as the initial dose to adolescents at 11 to 12 years old, with a booster dose at 16 years old. It is also given to individuals with conditions such as complement deficiencies, complement inhibitor use, asplenia, or HIV, provided via a 2-dose primary series spaced 2 months apart.

2.1.3 Meningococcal Group B Vaccines

Group B vaccines, such as Bexsero® and Trumenba®, focus on providing protection against serogroup B of *Neisseria meningitidis*, a significant contributor to meningococcal disease cases in some regions. These vaccines are recommended for individuals at higher risk of serogroup B meningococcal disease, including certain college students living in close quarters, individuals with specific medical conditions, and during outbreaks.

Bexsero® and Trumenba® differ in their formulations and age recommendations. Bexsero® is a protein-based vaccine that targets specific components of serogroup B and is approved for use in various age groups, including infants as young as two months and adults. In contrast, Trumenba® is another protein-based vaccine targeting serogroup B and is approved for use starting in individuals aged 10 years.

It's crucial to note that these group B vaccines are not interchangeable with the quadrivalent vaccines (Menactra®, Menveo®, Nimenrix®). They target different serogroups of the bacteria and have distinct formulations. If protection against both serogroup B and other serogroups is necessary, a healthcare professional will determine the appropriate vaccination schedule. Always consult a healthcare provider for personalized vaccination recommendations. MenB vaccines are not interchangeable; the same formulation should be used for all doses.

2.1.3.1 Bexsero® Vaccine

Table 29. Bexsero® Vaccine Information

SCIENTIFIC NAME **Meningococcal group B vaccine (MenB-4C and MenB-FHbp) BEXSERO® Vaccine**	
SFDA Classification	Prescription
SFDA Approval	Yes
US FDA	Yes
EMA	Yes
MHRA	Yes
PMDA	No
Indication (ICD-10)	A39
Drug Class	Bacterial Vaccines (Inactivated)
Drug Sub-class	Meningococcal Vaccines
ATC Code	**J07AH09**
Pharmacological Class (ASHP)	80:12 - Vaccines
DRUG INFORMATION	
Dosage Form	Suspension for injection in pre-filled syringe
Route of Administration	Intramuscular use
Dose (Adult) [DDD]*	**ACIP recommendations**: Patients at increased risk for serogroup B meningococcal disease or during serogroup B meningococcal disease outbreak: IM: 0.5 mL per dose given as 2 doses ≥1 month apart. Administer a booster dose 1 year after primary series and every 2 to 3 years thereafter if risk remains. A one-time booster dose is also recommended during an outbreak if it

	has been ≥1 year since completion of the primary series (≥6-month interval may be considered by public health professionals). Patients 16 to 23 years of age (preferred 16 to 18 years) who are not at increased risk for meningococcal disease (per shared clinical decision-making): IM: 0.5 mL per dose given as 2 doses ≥1 month apart. **NACI recommendations**: Patients at high risk for serogroup B meningococcal disease or healthy patients ≤24 years of age who are not at high risk for meningococcal disease (per clinical discretion): IM: 0.5 mL per dose given as a 2-dose series ≥4 weeks apart. Close contacts and outbreak control of meningococcal serogroup B disease: Unvaccinated: IM: 0.5 mL immediately after exposure; revaccinate with a single dose ≥4 weeks after first dose. Previously vaccinated: IM: 0.5 mL immediately after exposure. Booster dose: Consider a single booster dose for those individuals at continued risk of exposure to meningococcal disease as per current guideline recommendations.
Maximum Daily Dose Adults*	**IM: 0.5 mL per dose**
Dose (pediatrics)	According to ACIP, doses administered ≤4 days before minimum interval or age are considered valid; however, local or state mandates may supersede this timeframe. ACIP Recommendations: Patients at increased risk for serogroup B meningococcal disease or during serogroup B meningococcal disease outbreak:

	Children ≥10 years and Adolescents: Primary vaccination: IM: 0.5 mL per dose for a total of 2 doses administered at least 1 month apart. Booster: Administer a booster dose 1 year after primary series and every 2 to 3 years thereafter if risk remains. A one-time booster dose is also recommended during an outbreak if it has been ≥1 year since completion of the primary series (≥6-month interval may be considered by public health professionals). Patients not at increased risk (per shared clinical decision-making): Adolescents ≥16 years: IM: 0.5 mL per dose given as 2 doses ≥1 month apart. **NACI recommendations and Canadian labeling**: Patients at high risk for serogroup B meningococcal disease or healthy patients who are not at high risk for meningococcal disease (per clinical discretion): Infants 2 to 5 months: IM: 3-dose primary infant series: Total of 4 doses (0.5 mL each); a primary infant series is administered at 2, 4, and 6 months of age followed by a booster dose between 12 to 23 months of age; alternatively, may give first 3 doses at 2, 3, and 4 months of age; however, the immune response to 1 component (NHBA) of the vaccine is reduced with this regimen. 2-dose primary infant series: Total of 3 doses (0.5 mL each) with first and second dose administered at least 2 months apart; followed by a booster dose between 12 to 23 months of age. Infants 6 months to <12 months (unvaccinated): IM: Total of 3 doses (0.5

	mL each) with first and second dose administered at least 2 months apart; third dose is administered during second year of life at least 2 months after the second dose. The necessity of further booster doses has not yet been determined. Children ≥1 year to <2 years of age (unvaccinated): IM: Total of 3 doses (0.5 mL each) with first and second dose administered at least 2 months apart; third dose is administered 12 to 23 months after the second dose. The necessity of further booster doses has not yet been determined. Children ≥2 years and Adolescents: IM: Total of 2 doses (0.5 mL each) administered at least 1 month apart. Consider a single booster dose for those individuals at continued risk of exposure to meningococcal disease as per current guideline recommendations. Close contacts and outbreak control of meningococcal serogroup B disease: Consider risk of exposure and patient's susceptibility to the disease when choosing a schedule. Infants 2 months to <6 months: Unvaccinated: IM: 0.5 mL immediately after exposure; revaccinate with 2 additional doses with ≥4-week interval between doses. Previously vaccinated: IM: 0.5 mL immediately after exposure. Infants 6 months to Children <10 years: Unvaccinated: IM: 0.5 mL immediately after exposure; revaccinate with a single dose ≥8 weeks after first dose. Previously vaccinated: IM: 0.5 mL immediately after exposure. Children ≥10 years and Adolescents: Unvaccinated: IM: 0.5 mL immediately

	after exposure; revaccinate with a single dose ≥4 weeks after first dose. Previously vaccinated: IM: 0.5 mL immediately after exposure. **Note: Product used for previous doses should be used, not interchangeable.**
Maximum Daily Dose Pediatrics*	**IM: 0.5 mL per dose**
Adjustment	No dosage adjustments for hepatic or renal impairment
Prescribing edits*	AGE, QL
AGE (Age Edit): ≥ 10 years who are at increased risk for serogroup B meningococcal disease and adults ≤ 25 years of age	
CU (Concurrent Use Edit): N/A	
G (Gender Edit): N/A	
MD (Physician Specialty Edit): N/A	
PA (Prior Authorization): N/A	
QL (Quantity Limit): IM: 0.5 mL per dose for a two/three-dose series	
ST (Step Therapy): N/A	
EU (Emergency Use Only): N/A	
PE (Protocol Edit): N/A	
SAFETY	
Main Adverse Drug Reactions (Most common and most serious)	**Most common and most serious:** diarrhea, nausea, erythema/ induration/ pain/ swelling at injection site, fatigue, headache, arthralgia
Drug Interactions*	X Elivaldogene Autotemcel D Abatacept D Abemaciclib D Abrocitinib D Acalabrutinib D Aceclofenac Depends on Indication D Acemetacin Depends on Indication D Acetaminophen Depends on Indication D Adalimumab D Alemtuzumab D Amsacrine D Anakinra

	D Anifrolumab D Antithymocyte Globulin (Equine) D Antithymocyte Globulin (Rabbit) D Asciminib D Aspirin Depends on Indication D Axicabtagene Ciloleucel D AzaCITIDine D AzaTHIOprine D Baricitinib D Basiliximab D Belatacept D Belimumab D Belinostat D Betamethasone (Systemic) Depends on Dose and Duration D Bimekizumab D Blinatumomab D Brentuximab Vedotin D Brexucabtagene Autoleucel D Brodalumab D Busulfan D Cabazitaxel D Canakinumab D Capecitabine D CARBOplatin D Carfilzomib D Carmustine D Celecoxib Depends on Indication D Certolizumab Pegol D Chlorambucil D Ciltacabtagene Autoleucel D CISplatin D Cladribine D Clofarabine D Clonixin Depends on Indication D Copanlisib D Corticotropin Depends on Dose and Duration

	D Cortisone Depends on Dose and Duration D CycloPHOSphamide D CycloSPORINE (Systemic) D Cytarabine (Conventional) D Dacarbazine D DACTINomycin D Daratumumab D Dasatinib D DAUNOrubicin (Conventional) D DAUNOrubicin (Liposomal) D Deflazacort Depends on Dose and Duration D Deucravacitinib D DexAMETHasone (Systemic) Depends on Dose and Duration D Dexibuprofen Depends on Indication D Dexketoprofen Depends on Indication D Diclofenac (Systemic) Depends on Indication D Diflunisal Depends on Indication D Dinutuximab D Dipyrone Depends on Indication D DOCEtaxel D Doxifluridine D DOXOrubicin (Conventional) D DOXOrubicin (Liposomal) D Duvelisib D Eculizumab D Efgartigimod Alfa D Elotuzumab D Emapalumab D Epcoritamab D EpiRUBicin D Etanercept D Etodolac Depends on Indication D Etoposide D Etoposide Phosphate

	D Etoricoxib Depends on Indication D Everolimus D Fenbufen Depends on Indication D Fenoprofen Depends on Indication D Filgotinib D Fingolimod D Floxuridine D Fludarabine D Fludrocortisone Depends on Dose and Duration D Fluorouracil (Systemic) D Flurbiprofen (Systemic) Depends on Indication D Fotemustine D Gemcitabine D Gemtuzumab Ozogamicin D Glofitamab D Golimumab D Guselkumab D Hydrocortisone (Systemic) Depends on Dose and Duration D Hydroxyurea D Ibritumomab Tiuxetan D Ibrutinib D Ibuprofen Depends on Indication D IDArubicin D Idecabtagene Vicleucel D Idelalisib D Ifosfamide D Imatinib D Indomethacin Depends on Indication D Inebilizumab D InFLIXimab D Inotuzumab Ozogamicin D Irinotecan (Conventional) D Irinotecan (Liposomal) D Isatuximab D Ixabepilone D Ixekizumab

	D Ketoprofen Depends on Indication D Ketorolac (Nasal) Depends on Indication D Ketorolac (Systemic) Depends on Indication D Leflunomide D Lenalidomide D Lisocabtagene Maraleucel D Lomustine D Loncastuximab Tesirine D Lornoxicam Depends on Indication D Loxoprofen Depends on Indication D Lurbinectedin D Lutetium Lu 177 Dotatate D Lutetium Lu 177 Vipivotide Tetraxetan D Meclofenamate Depends on Indication D Mefenamic Acid Depends on Indication D Meloxicam Depends on Indication D Melphalan D Melphalan Flufenamide D Mercaptopurine D Methotrexate D MethylPREDNISolone Depends on Dose and Duration D Mirikizumab D MitoMYcin (Systemic) D MitoXANTRONE D Mizoribine D Mogamulizumab D Morniflumate Depends on Indication D Mosunetuzumab D Mycophenolate D Nabumetone Depends on Indication D Naproxen Depends on Indication D Natalizumab D Nelarabine D Nimesulide Depends on Indication

	D Niraparib D Obinutuzumab D Ocrelizumab D Ofatumumab D Omacetaxine D Oxaprozin Depends on Indication D Ozanimod D PACLitaxel (Conventional) D PACLitaxel (Protein Bound) D Pacritinib D Palbociclib D Panobinostat D Parecoxib Depends on Indication D PAZOPanib D Pelubiprofen Depends on Indication D PEMEtrexed D Pentostatin D Phenylbutazone Depends on Indication D Piroxicam (Systemic) Depends on Indication D Pirtobrutinib D Pixantrone D Polatuzumab Vedotin D Pomalidomide D PONATinib D Ponesimod D PRALAtrexate D Pranoprofen Depends on Indication D PrednisoLONE (Systemic) Depends on Dose and Duration D PredniSONE Depends on Dose and Duration D Procarbazine D Proglumetacin Depends on Indication D Propacetamol Depends on Indication D Propyphenazone Depends on Indication

	D Raltitrexed D Ribociclib D Rilonacept D Risankizumab D Ritlecitinib D RiTUXimab D RomiDEPsin D Rozanolixizumab D Ruxolitinib (Systemic) D Ruxolitinib (Topical) D Sacituzumab Govitecan D Sarilumab D Satralizumab D Secukinumab D Selinexor D Siltuximab D Siponimod D Sirolimus (Conventional) D Sirolimus (Protein Bound) D Sirolimus (Topical) D Spesolimab D Sulindac Depends on Indication D Tacrolimus (Systemic) D Tafasitamab D Talniflumate Depends on Indication D Talquetamab D Tazemetostat D Teclistamab D Tegafur D Temozolomide D Temsirolimus D Teniposide D Tenoxicam Depends on Indication D Teplizumab D Teriflunomide D Thioguanine D Thiotepa D Tiaprofenic Acid Depends on Indication

	D Tisagenlecleucel D Tocilizumab D Tofacitinib D Tolfenamic Acid Depends on Indication D Tolmetin Depends on Indication D Trabectedin D Treosulfan D Triamcinolone (Systemic) Depends on Dose and Duration D Trifluridine and Tipiracil D Ublituximab D Umbralisib D Upadacitinib D Ustekinumab D Vedolizumab D Venetoclax D VinBLAStine D Vinflunine D Vinorelbine D Voclosporin D Zaltoprofen Depends on Indication D Zanubrutinib
Special Population	**Altered immunocompetence:** Patients with complement component deficiencies, anatomic or functional asplenia, and patients receiving complement inhibitors (eg, eculizumab, ravulizumab) are at an increased risk for invasive meningococcal infection, including post-vaccination. Consider deferring immunization during periods of severe immunosuppression (eg, patients receiving chemo/radiation therapy or other immunosuppressive therapy [including high-dose corticosteroids]); may have a reduced response to vaccination. In general, household and close contacts of persons with altered

	immunocompetence may receive all age-appropriate vaccines. Inactivated vaccines should be administered ≥2 weeks prior to planned immunosuppression when feasible; inactivated vaccines administered during chemotherapy should be readministered after immune competence is regained. **Pediatric:** Apnea has occurred following intramuscular vaccine administration in premature infants; consider clinical status implications. In general, preterm infants should be vaccinated at the same chronological age as full-term infants
Pregnancy	Information related to the use of meningococcal group B vaccines in pregnancy is limited. Inactivated vaccines have not been shown to cause increased risks to the fetus. However, the Advisory Committee on Immunization Practices recommends deferring meningococcal group B vaccination during pregnancy unless the patient is at increased risk for meningococcal disease and vaccination benefits outweigh the potential risks.
Lactation	It is not known if components of this vaccine are present in breast milk. According to the manufacturer, the decision to continue or discontinue breastfeeding following immunization should consider the risk of infant exposure, the benefits of breastfeeding to the infant, and benefits of vaccination to the mother.
Contraindications	Severe hypersensitivity to the meningococcal group B vaccine or any component of the formulation.

Monitoring Requirements	Assess hypersensitivity history and health status prior to administration. Monitor for syncope for at least 15 minutes following administration. If seizure-like activity associated with syncope occurs, maintain patient in supine position to reestablish adequate cerebral perfusion. Treatment must be immediately available in event of anaphylactic or serious allergic reactions. Monitor for fever, seizure, and rash. Ensure CDC vaccine information statement offered and given.
Precautions	**Concerns related to adverse effects**: • Anaphylactoid/hypersensitivity reactions: Immediate treatment (including epinephrine 1 mg/mL) for anaphylactoid and/or hypersensitivity reactions should be available during vaccine use. • Shoulder injury related to vaccine administration: Vaccine administration that is too high on the upper arm may cause shoulder injury (eg, shoulder bursitis, tendinopathy) resulting in shoulder pain and reduced range of motion following injection. Use proper injection technique for vaccines administered in the deltoid muscle (eg, injecting in the central, thickest part of the muscle) to reduce the risk of shoulder injury related to vaccine administration. • Syncope: Syncope has been reported with use of injectable vaccines and may result in serious secondary injury (eg, skull fracture, cerebral hemorrhage); typically reported in adolescents and young adults and within 15 minutes after vaccination.

	Procedures should be in place to avoid injuries from falling and to restore cerebral perfusion if syncope occurs. **Disease-related concerns**: • Acute illness: The decision to administer or delay vaccination because of current or recent febrile illness depends on the severity of symptoms and the etiology of the disease. Defer administration in patients with moderate or severe acute illness (with or without fever); vaccination should not be delayed for patients with mild acute illness (with or without fever). • Bleeding disorders: Use with caution in patients with bleeding disorders (including thrombocytopenia); bleeding/hematoma may occur from IM administration; if the patient receives antihemophilia or other similar therapy, IM injection can be scheduled shortly after such therapy is administered. • Meningococcal infections: Not to be used to treat meningococcal infections or to provide immunity against N. meningitidis serogroups A, C, W-135, or Y. In addition, vaccine does not provide protection against all circulating meningococcal group B strains. **Concurrent drug therapy issues**: • Anticoagulant therapy: Use with caution in patients receiving anticoagulant therapy; bleeding/hematoma may occur from IM administration; ideally, vaccinations should be administered prior to

	initiation of anticoagulant therapy if possible. • Vaccines: To maximize vaccination rates, the ACIP recommends simultaneous administration (ie, >1 vaccine on the same day at different anatomic sites) of all age-appropriate vaccines (live or inactivated) for which a person is eligible at a single clinic visit, unless contraindications exist. Because of differences in components and dosing regimen, meningococcal group B vaccines are not interchangeable. **Dosage form specific issues**: • Kanamycin: May contain kanamycin. • Latex: Note: Prior to April 2023, the Bexsero prescribing information stated the product packaging contained latex. The Bexsero prescribing information approved by the FDA in April 2023 states the packaging is not made with latex. Providers should confirm if product in inventory contains latex prior to administering to patients with a latex allergy. • Polysorbate 80: Some dosage forms may contain polysorbate 80 (also known as Tweens). Hypersensitivity reactions, usually a delayed reaction, have been reported following exposure to pharmaceutical products containing polysorbate 80 in certain individuals. Thrombocytopenia, ascites, pulmonary deterioration, and renal and hepatic failure have been reported in premature neonates after receiving parenteral products containing polysorbate 80. See manufacturer's labeling.

	Other warnings/precautions: • Antipyretics: Antipyretics have not been shown to prevent febrile seizures; antipyretics may be used to treat fever or discomfort following vaccination. One study reported that routine prophylactic administration of acetaminophen to prevent fever prior to vaccination decreased the immune response of some vaccines; the clinical significance of this reduction in immune response has not been established. • Appropriate use: Use of this vaccine for specific medical and/or other indications (eg, immunocompromising conditions, hepatic or kidney disease, diabetes) is also addressed in the annual ACIP Recommended Immunization Schedules (refer to CDC schedule for detailed information). • Effective immunity: Vaccination may not result in effective immunity in all patients. Response depends on multiple factors (eg, type of vaccine, age of patient) and may be improved by administering the vaccine at the recommended dose, route, and interval. Vaccines may not be effective if administered during periods of altered immune competence
Black Box Warning	n/a
REMS*	n/a

HEALTH TECHNOLOGY ASSESSMENT (HTA)

The table below lists the HTA reviews and recommendations of bacterial meningitis prevention options by the following agencies/institutes/authorities: National Institute for Health and Care Excellence (NICE), Canadian Agency for Drugs and Technologies in Health (CADTH), Haute Autorité de Santé (HAS), Institute for Quality

and Efficiency in Health Care (IQWIG), and Pharmaceutical Benefits Advisory Committee (PBAC) as applicable. **The recommendations are for BEXSERO®.**

Table 30. BEXSERO® HTA Analysis

MEDICATION	AGENCY	DATE – HTA RECOMMENDATION
BEXSERO	NICE	No results found
	CADTH	No results found
	HAS	No results found
	IQWIG	No results found
	PBAC	No results found

CONCLUSION STATEMENT – BEXSERO

No results found for the use of BEXSERO in the prevention of meningococcal disease. MenB vaccines are not interchangeable; the same formulation should be used for all doses. For MenB-4C (Bexsero), routine and at-risk individuals receive a primary series of two doses, separated by ≥1 month. Booster doses might be necessary for those at risk. Some experts recommend vaccinating high-risk children against meningococcal disease, such as those taking C5 inhibitors.

2.1.3.2 Trumenba® Vaccine

Table 31. Trumenba® Vaccine Information

SCIENTIFIC NAME **Meningococcal group B vaccine (MenB-4C and MenB-FHbp) TRUMENBA® Vaccine**	
SFDA Classification	Prescription
SFDA Approval	Yes
US FDA	Yes
EMA	Yes
MHRA	Yes
PMDA	No
Indication (ICD-10)	A39
Drug Class	Bacterial Vaccines (Inactivated)
Drug Sub-class	Meningococcal Vaccines
ATC Code	**J07AH09**
Pharmacological Class (ASHP)	80:12 - Vaccines
DRUG INFORMATION	

Dosage Form	Suspension for injection in pre-filled syringe
Route of Administration	Intramuscular use
Dose (Adult) [DDD]*	**ACIP recommendations**: Patients at increased risk for serogroup B meningococcal disease or during serogroup B meningococcal disease outbreak: IM: 0.5 mL per dose given as 3-dose series at 0, 1 to 2 months, and 6 months. If the interval between the first and second dose is ≥6 months, then the third dose is not needed. If the third dose is administered <4 months after the second dose, then a fourth dose should be given ≥4 months after the third dose. Administer a booster dose 1 year after primary series and every 2 to 3 years thereafter if risk remains. A one-time booster dose is also recommended during an outbreak if it has been ≥1 year since completion of the primary series (≥6-month interval may be considered by public health professionals). Patients 16 to 23 years of age (preferred 16 to 18 years) who are not at increased risk for meningococcal disease (per shared clinical decision-making): Note: To provide short-term protection against most strains of serogroup B meningococcal disease: IM: 0.5 mL per dose given as 2 doses 6 months apart. If the second dose is given earlier than 6 months, a third dose should be administered ≥4 months after the second dose. **NACI recommendations**: Note: Vaccines are approved in adults ≤25 years of age; however, NACI recommends consideration for vaccination of any adults who are at high risk for serogroup B

	meningococcal disease. Consider risk of exposure and patient's susceptibility to the disease when choosing a schedule. Patients with underlying medical conditions at higher risk for serogroup B meningococcal disease if exposed: IM: 0.5 mL per dose administered as a 3-dose series at 0, 1 to 2 months, and 6 months. Patients at higher risk of exposure to serogroup B meningococcal disease or healthy patients ≤25 years of age who are not at high risk for meningococcal disease (per clinical discretion): IM: 0.5 mL per dose given as 2-dose series 6 months apart.
Maximum Daily Dose Adults*	**IM: 0.5 mL per dose**
Dose (pediatrics)	ACIP Recommendations: Patients at increased risk for serogroup B meningococcal disease or during serogroup B meningococcal disease outbreak: Children ≥10 years and Adolescents: Primary vaccination: IM: 0.5 mL per dose given as 3-dose series at 0, 1 to 2 months, and 6 months. If the interval between the first and second dose is ≥6 months, then the third dose is not needed. If the third dose is administered <4 months after the second dose, then a fourth dose should be given ≥4 months after the third dose. Booster: Administer a booster dose 1 year after primary series and every 2 to 3 years thereafter if risk remains. A one-time booster dose is also recommended during an outbreak if it has been ≥1 year since completion of the primary series (≥6-month interval may be considered by public health professionals).

	Patients not at increased risk (per shared clinical decision-making): Note: To provide short-term protection against most strains of serogroup B meningococcal disease: Adolescents ≥16 years: IM: 0.5 mL per dose given as 2 doses 6 months apart. If the second dose is given earlier than 6 months, a third dose should be administered ≥4 months after the second dose. **NACI recommendations and Canadian labeling:** Patients at high risk for serogroup B meningococcal disease or healthy patients who are not at high risk for meningococcal disease (per clinical discretion): Consider risk of exposure and patient's susceptibility to the disease when choosing a schedule. Children ≥10 years and Adolescents: Patients at increased risk for meningococcal serogroup B disease: IM: 0.5 mL per dose as a 3-dose series with dose 1 and 2 separated by ≥1 month, followed by a third dose administered ≥4 months after the second dose. Patients not at increased risk (ie, use per clinical discretion): IM: 0.5 mL per dose as a 2-dose series administered 6 months apart (eg, a 0- and 6-month schedule). Close contacts and outbreak control of meningococcal serogroup B disease: Consider risk of exposure and patient's susceptibility to the disease when choosing a schedule. Children ≥10 years and Adolescents: Unvaccinated: IM: 0.5 mL immediately after exposure; revaccinate with a single dose ≥4 weeks after first dose.

	Previously vaccinated: IM: 0.5 mL immediately after exposure. **Note: Product used for previous doses should be used.**
Maximum Daily Dose Pediatrics*	**IM: 0.5 mL per dose**
Adjustment	No dosage adjustments for hepatic or renal impairment
Prescribing edits*	AGE, QL
AGE (Age Edit): ≥ 10 years who are at increased risk for serogroup B meningococcal disease and adults ≤ 25 years of age	
CU (Concurrent Use Edit): N/A	
G (Gender Edit): N/A	
MD (Physician Specialty Edit): N/A	
PA (Prior Authorization): N/A	
QL (Quantity Limit): IM: 0.5 mL per dose for a two/three-dose series	
ST (Step Therapy): N/A	
EU (Emergency Use Only): N/A	
PE (Protocol Edit): N/A	
SAFETY	
Main Adverse Drug Reactions (Most common and most serious)	**Most common and most serious:** diarrhea, nausea, erythema/ induration/ pain/ swelling at injection site, fatigue, headache, arthralgia
Drug Interactions*	X Elivaldogene Autotemcel D Abatacept D Abemaciclib D Abrocitinib D Acalabrutinib D Aceclofenac Depends on Indication D Acemetacin Depends on Indication D Acetaminophen Depends on Indication D Adalimumab D Alemtuzumab D Amsacrine D Anakinra D Anifrolumab D Antithymocyte Globulin (Equine)

	D Antithymocyte Globulin (Rabbit) D Asciminib D Aspirin Depends on Indication D Axicabtagene Ciloleucel D AzaCITIDine D AzaTHIOprine D Baricitinib D Basiliximab D Belatacept D Belimumab D Belinostat D Betamethasone (Systemic) Depends on Dose and Duration D Bimekizumab D Blinatumomab D Brentuximab Vedotin D Brexucabtagene Autoleucel D Brodalumab D Busulfan D Cabazitaxel D Canakinumab D Capecitabine D CARBOplatin D Carfilzomib D Carmustine D Celecoxib Depends on Indication D Certolizumab Pegol D Chlorambucil D Ciltacabtagene Autoleucel D CISplatin D Cladribine D Clofarabine D Clonixin Depends on Indication D Copanlisib D Corticotropin Depends on Dose and Duration D Cortisone Depends on Dose and Duration D CycloPHOSphamide

	D CycloSPORINE (Systemic) D Cytarabine (Conventional) D Dacarbazine D DACTINomycin D Daratumumab D Dasatinib D DAUNOrubicin (Conventional) D DAUNOrubicin (Liposomal) D Deflazacort Depends on Dose and Duration D Deucravacitinib D DexAMETHasone (Systemic) Depends on Dose and Duration D Dexibuprofen Depends on Indication D Dexketoprofen Depends on Indication D Diclofenac (Systemic) Depends on Indication D Diflunisal Depends on Indication D Dinutuximab D Dipyrone Depends on Indication D DOCEtaxel D Doxifluridine D DOXOrubicin (Conventional) D DOXOrubicin (Liposomal) D Duvelisib D Eculizumab D Efgartigimod Alfa D Elotuzumab D Emapalumab D Epcoritamab D EpiRUBicin D Etanercept D Etodolac Depends on Indication D Etoposide D Etoposide Phosphate D Etoricoxib Depends on Indication D Everolimus D Fenbufen Depends on Indication

	D Fenoprofen Depends on Indication D Filgotinib D Fingolimod D Floxuridine D Fludarabine D Fludrocortisone Depends on Dose and Duration D Fluorouracil (Systemic) D Flurbiprofen (Systemic) Depends on Indication D Fotemustine D Gemcitabine D Gemtuzumab Ozogamicin D Glofitamab D Golimumab D Guselkumab D Hydrocortisone (Systemic) Depends on Dose and Duration D Hydroxyurea D Ibritumomab Tiuxetan D Ibrutinib D Ibuprofen Depends on Indication D IDArubicin D Idecabtagene Vicleucel D Idelalisib D Ifosfamide D Imatinib D Indomethacin Depends on Indication D Inebilizumab D InFLIXimab D Inotuzumab Ozogamicin D Irinotecan (Conventional) D Irinotecan (Liposomal) D Isatuximab D Ixabepilone D Ixekizumab D Ketoprofen Depends on Indication D Ketorolac (Nasal) Depends on Indication

	D Ketorolac (Systemic) Depends on Indication D Leflunomide D Lenalidomide D Lisocabtagene Maraleucel D Lomustine D Loncastuximab Tesirine D Lornoxicam Depends on Indication D Loxoprofen Depends on Indication D Lurbinectedin D Lutetium Lu 177 Dotatate D Lutetium Lu 177 Vipivotide Tetraxetan D Meclofenamate Depends on Indication D Mefenamic Acid Depends on Indication D Meloxicam Depends on Indication D Melphalan D Melphalan Flufenamide D Mercaptopurine D Methotrexate D MethylPREDNISolone Depends on Dose and Duration D Mirikizumab D MitoMYcin (Systemic) D MitoXANTRONE D Mizoribine D Mogamulizumab D Morniflumate Depends on Indication D Mosunetuzumab D Mycophenolate D Nabumetone Depends on Indication D Naproxen Depends on Indication D Natalizumab D Nelarabine D Nimesulide Depends on Indication D Niraparib D Obinutuzumab D Ocrelizumab

	D Ofatumumab D Omacetaxine D Oxaprozin Depends on Indication D Ozanimod D PACLitaxel (Conventional) D PACLitaxel (Protein Bound) D Pacritinib D Palbociclib D Panobinostat D Parecoxib Depends on Indication D PAZOPanib D Pelubiprofen Depends on Indication D PEMEtrexed D Pentostatin D Phenylbutazone Depends on Indication D Piroxicam (Systemic) Depends on Indication D Pirtobrutinib D Pixantrone D Polatuzumab Vedotin D Pomalidomide D PONATinib D Ponesimod D PRALAtrexate D Pranoprofen Depends on Indication D PrednisoLONE (Systemic) Depends on Dose and Duration D PredniSONE Depends on Dose and Duration D Procarbazine D Proglumetacin Depends on Indication D Propacetamol Depends on Indication D Propyphenazone Depends on Indication D Raltitrexed D Ribociclib D Rilonacept

	D Risankizumab D Ritlecitinib D RiTUXimab D RomiDEPsin D Rozanolixizumab D Ruxolitinib (Systemic) D Ruxolitinib (Topical) D Sacituzumab Govitecan D Sarilumab D Satralizumab D Secukinumab D Selinexor D Siltuximab D Siponimod D Sirolimus (Conventional) D Sirolimus (Protein Bound) D Sirolimus (Topical) D Spesolimab D Sulindac Depends on Indication D Tacrolimus (Systemic) D Tafasitamab D Talniflumate Depends on Indication D Talquetamab D Tazemetostat D Teclistamab D Tegafur D Temozolomide D Temsirolimus D Teniposide D Tenoxicam Depends on Indication D Teplizumab D Teriflunomide D Thioguanine D Thiotepa D Tiaprofenic Acid Depends on Indication D Tisagenlecleucel D Tocilizumab D Tofacitinib

	D Tolfenamic Acid Depends on Indication D Tolmetin Depends on Indication D Trabectedin D Treosulfan D Triamcinolone (Systemic) Depends on Dose and Duration D Trifluridine and Tipiracil D Ublituximab D Umbralisib D Upadacitinib D Ustekinumab D Vedolizumab D Venetoclax D VinBLAStine D Vinflunine D Vinorelbine D Voclosporin D Zaltoprofen Depends on Indication D Zanubrutinib
Special Population	**Altered immunocompetence:** Patients with complement component deficiencies, anatomic or functional asplenia, and patients receiving complement inhibitors (eg, eculizumab, ravulizumab) are at an increased risk for invasive meningococcal infection, including post-vaccination. Consider deferring immunization during periods of severe immunosuppression (eg, patients receiving chemo/radiation therapy or other immunosuppressive therapy [including high-dose corticosteroids]); may have a reduced response to vaccination. In general, household and close contacts of persons with altered immunocompetence may receive all age-appropriate vaccines. Inactivated vaccines should be administered ≥2

	weeks prior to planned immunosuppression when feasible; inactivated vaccines administered during chemotherapy should be readministered after immune competence is regained. **Pediatric:** Apnea has occurred following intramuscular vaccine administration in premature infants; consider clinical status implications. In general, preterm infants should be vaccinated at the same chronological age as full-term infants
Pregnancy	Information related to the use of meningococcal group B vaccines in pregnancy is limited. Inactivated vaccines have not been shown to cause increased risks to the fetus. However, the Advisory Committee on Immunization Practices recommends deferring meningococcal group B vaccination during pregnancy unless the patient is at increased risk for meningococcal disease and vaccination benefits outweigh the potential risks.
Lactation	It is not known if components of this vaccine are present in breast milk. According to the manufacturer, the decision to continue or discontinue breastfeeding following immunization should consider the risk of infant exposure, the benefits of breastfeeding to the infant, and benefits of vaccination to the mother.
Contraindications	Severe hypersensitivity to the meningococcal group B vaccine or any component of the formulation.
Monitoring Requirements	Assess hypersensitivity history and health status prior to administration. Monitor for syncope for at least 15 minutes following administration. If

	seizure-like activity associated with syncope occurs, maintain patient in supine position to reestablish adequate cerebral perfusion. Treatment must be immediately available in event of anaphylactic or serious allergic reactions. Monitor for fever, seizure, and rash. Ensure CDC vaccine information statement offered and given.
Precautions	**Concerns related to adverse effects**: • Anaphylactoid/hypersensitivity reactions: Immediate treatment (including epinephrine 1 mg/mL) for anaphylactoid and/or hypersensitivity reactions should be available during vaccine use. • Shoulder injury related to vaccine administration: Vaccine administration that is too high on the upper arm may cause shoulder injury (eg, shoulder bursitis, tendinopathy) resulting in shoulder pain and reduced range of motion following injection. Use proper injection technique for vaccines administered in the deltoid muscle (eg, injecting in the central, thickest part of the muscle) to reduce the risk of shoulder injury related to vaccine administration. • Syncope: Syncope has been reported with use of injectable vaccines and may result in serious secondary injury (eg, skull fracture, cerebral hemorrhage); typically reported in adolescents and young adults and within 15 minutes after vaccination. Procedures should be in place to avoid injuries from falling and to restore cerebral perfusion if syncope occurs.

	Disease-related concerns: • Acute illness: The decision to administer or delay vaccination because of current or recent febrile illness depends on the severity of symptoms and the etiology of the disease. Defer administration in patients with moderate or severe acute illness (with or without fever); vaccination should not be delayed for patients with mild acute illness (with or without fever). • Bleeding disorders: Use with caution in patients with bleeding disorders (including thrombocytopenia); bleeding/hematoma may occur from IM administration; if the patient receives antihemophilia or other similar therapy, IM injection can be scheduled shortly after such therapy is administered. • Meningococcal infections: Not to be used to treat meningococcal infections or to provide immunity against N. meningitidis serogroups A, C, W-135, or Y. In addition, vaccine does not provide protection against all circulating meningococcal group B strains. **Concurrent drug therapy issues**: • Anticoagulant therapy: Use with caution in patients receiving anticoagulant therapy; bleeding/hematoma may occur from IM administration; ideally, vaccinations should be administered prior to initiation of anticoagulant therapy if possible. • Vaccines: To maximize vaccination rates, the ACIP recommends simultaneous administration (ie, >1

	vaccine on the same day at different anatomic sites) of all age-appropriate vaccines (live or inactivated) for which a person is eligible at a single clinic visit, unless contraindications exist. Because of differences in components and dosing regimen, meningococcal group B vaccines are not interchangeable. **Dosage form specific issues**: • Kanamycin: May contain kanamycin. • Latex: Note: Prior to April 2023, the Bexsero prescribing information stated the product packaging contained latex. The Bexsero prescribing information approved by the FDA in April 2023 states the packaging is not made with latex. Providers should confirm if product in inventory contains latex prior to administering to patients with a latex allergy. • Polysorbate 80: Some dosage forms may contain polysorbate 80 (also known as Tweens). Hypersensitivity reactions, usually a delayed reaction, have been reported following exposure to pharmaceutical products containing polysorbate 80 in certain individuals. Thrombocytopenia, ascites, pulmonary deterioration, and renal and hepatic failure have been reported in premature neonates after receiving parenteral products containing polysorbate 80. See manufacturer's labeling. **Other warnings/precautions**: • Antipyretics: Antipyretics have not been shown to prevent febrile seizures; antipyretics may be used to treat fever or discomfort following

	vaccination. One study reported that routine prophylactic administration of acetaminophen to prevent fever prior to vaccination decreased the immune response of some vaccines; the clinical significance of this reduction in immune response has not been established. • Appropriate use: Use of this vaccine for specific medical and/or other indications (eg, immunocompromising conditions, hepatic or kidney disease, diabetes) is also addressed in the annual ACIP Recommended Immunization Schedules (refer to CDC schedule for detailed information). • Effective immunity: Vaccination may not result in effective immunity in all patients. Response depends on multiple factors (eg, type of vaccine, age of patient) and may be improved by administering the vaccine at the recommended dose, route, and interval. Vaccines may not be effective if administered during periods of altered immune competence
Black Box Warning	N/A
REMS*	N/A

HEALTH TECHNOLOGY ASSESSMENT (HTA)

The table below lists the HTA reviews and recommendations of bacterial meningitis prevention options by the following agencies/institutes/authorities: National Institute for Health and Care Excellence (NICE), Canadian Agency for Drugs and Technologies in Health (CADTH), Haute Autorité de Santé (HAS), Institute for Quality and Efficiency in Health Care (IQWIG), and Pharmaceutical Benefits Advisory Committee (PBAC) as applicable. **The recommendations are for TRUMENBA.**

Table 32. TRUMENBA® HTA Analysis

MEDICATION	AGENCY	DATE – HTA RECOMMENDATION
TRUMENBA	NICE	No results found
	CADTH	No results found
	HAS	Favorable opinion for reimbursement in the active immunization to prevent invasive meningococcal disease caused by serogroup B strains, in individuals 10 years and older, only in the populations recommended by the HAS on 3 June 2021. It deems that the clinical benefit of TRUMENBA is substantial in the active immunization against invasive meningococcal disease caused by serogroup B strains, in individuals 10 years and older, in the populations recommended by the HAS on 3 June 2021, but that it has no clinical added value.
	IQWIG	No results found
	PBAC	No results found

CONCLUSION STATEMENT – Trumenba®

The use of TRUMENBA is recommended by the HAS HTA body to be reimbursed for active immunization to prevent invasive meningococcal disease caused by serogroup B strains. For MenB-FHbp (Trumenba), the schedule varies based on the indication: For routine vaccination of healthy individuals: give two doses, separated by ≥ 6 months. If the second dose is administered <6 months after the first dose, a third dose should be given ≥ 4 months after the second. For individuals at increased risk for serogroup B meningococcal disease and during outbreaks: administer three doses: at 0, 1 to 2, and 6 months; if the third dose is administered < 4 months after the second dose, a fourth dose should be given ≥ 4 months after the third dose.

2.2 Modifications

There were no modifications from the previous CHI report.

2.3 Delisting

The medications below are no longer SFDA registered[21], therefore, it is advisable to delist the following drugs from CHI formulary. *Please refer to* ***Drug Therapy in Prevention and Chemoprophylaxis of Bacterial Meningitis - Section 2*** *of CHI Endometriosis original clinical guidance.*

- POLYSACCHARIDE OF NEISSERIA MENINGITIDIS GROUP A, POLYSACCHARIDE OF NEISSERIA MENINGITIDIS GROUP C
- BENZYLPENICILLIN

Section 3.0 Key Recommendations Synthesis

- **Prevention:**
    - Antimicrobial prophylaxis, droplet precautions, vaccination before exposure, and avoiding exposure are prevention strategies.
    - Droplet precautions should continue for 24 hours after antibiotic administration in confirmed or suspected cases.
    - Antimicrobial chemoprophylaxis is recommended for close contacts of meningococcal infection cases.
    - Vaccination is a crucial preventive measure against specific bacterial strains causing meningitis, including Meningococcal, Pneumococcal, Haemophilus influenzae serotype b (Hib), and Bacille Calmette-Guérin (TB) vaccines. Prophylaxis, involving antibiotic administration to prevent transmission, is recommended for close contacts in specific cases.
- **Indications and Timing of Chemoprophylaxis:**
    - Close contacts defined as prolonged exposure to the patient (more than 8 hours within 3 feet) or direct exposure to oral secretions.
    - Chemoprophylaxis recommended within 24 hours of exposure; efficacy diminishes after 14 days.
    - Healthcare workers not directly exposed to respiratory secretions usually don't require prophylaxis.
- **Antimicrobial Regimens:**
    - Preferred: rifampin, ciprofloxacin, ceftriaxone for prophylaxis.
    - Azithromycin is an alternative when preferred agents are unsuitable.
    - Azithromycin's effectiveness for prophylaxis isn't extensively studied.
- **Follow-Up:**
    - Close contacts should be monitored for at least 10 days after prophylaxis and educated about meningococcal infection symptoms.

- **Patients on C5 Inhibitors:**
    - Individuals using C5 inhibitors should receive prophylaxis and meningococcal vaccination.
    - Penicillin V is preferred, azithromycin is an alternative if allergic to penicillin.
- **Vaccination:**
    - Quadrivalent meningococcal conjugate vaccines (MenACWY) cover serogroups A, C, W, and Y.
    - Serogroup B vaccines: MenB-FHbp (Trumenba) and MenB-4C (Bexsero).
    - Vaccination schedules vary based on age, risk, and location.
    - Vaccination recommended for at-risk individuals, microbiologists, travelers to endemic areas, etc.
    - Booster doses may be required depending on age and risk.
- **Outbreak Control:**
    - Vaccination used to control meningococcal outbreaks.
    - Decision to vaccinate based on the number of cases and risk factors.
    - Vaccines chosen based on the serogroup causing the outbreak.
- **Vaccine Information:**
    - MenACWY vaccines are inactivated and contain antigens from serogroups A, C, W, and Y.
    - MenB vaccines are available and have different schedules based on formulation and risk.
    - MenB vaccines are immunogenic and effective, with booster doses required.
- **Administration and Precautions:**
    - Specific contraindications and precautions for each vaccine.
    - MenACWY and MenB vaccines can often be administered together.
    - Common adverse events include local pain, fatigue, headache, myalgia.
- **Adolescents and Young Adults:**
    - Routine MenACWY (meningococcal conjugate vaccine) recommended for individuals aged 11–18 years.

- MenB (serogroup B meningococcal) vaccine series recommended for those aged 16–23 years based on shared clinical decision-making.
- MenB vaccination not routinely advised for all adolescents.
- **MenACWY Vaccines:**
  - Single dose at age 11 or 12, followed by a booster at age 16.
  - No extra dose needed for those vaccinated at age 10; booster at 16 is sufficient.
  - Adolescents getting first dose at 13–15 need a booster at 16–18 (8-week interval).
  - Booster not needed if first dose after 16, unless increased risk.
  - Ages 19–21 not vaccinated since age 16 can receive a single dose.
  - Different MenACWY vaccine products can be used interchangeably.
  - Can be given concurrently with other vaccines for this age group.
  - MenACWY-TT does not replace tetanus toxoid vaccines.
  - Specific recommendations for high-risk groups.
- **MenB Vaccines:**
  - MenB vaccination series based on shared clinical decision-making.
  - Factors for decision include severity, incidence, and risk factors.
  - Two-dose MenB vaccine series recommended for some individuals.
  - Choice between MenB-FHbp and MenB-4C; no preference.
  - Specific recommendations for high-risk individuals.

- **Recommendations for Persons at Increased Risk:**
  - People at elevated risk should receive routine meningococcal vaccination.
  - Specific vaccine, doses, and booster recommendations depend on age and risk factors.
  - Individuals using complement inhibitors should be vaccinated.
  - Vaccine administration in relation to complement inhibitor treatment.

- **Establishment of Vaccine-Mediated Immunity:**
    - ACIP advises against using antibody titers to determine immunity.
    - Commercial immunoglobulin tests are not suitable for assessing protection.
- **Precautions and Contraindications:**
    - Postvaccine syncope can occur.
    - Premature birth and latex sensitivity precautions.
    - Severe allergic reactions are contraindications.
    - History of Guillain-Barré syndrome listed as a precaution.
- **Pregnancy and Lactation:**
    - MenACWY considered safe if needed.
    - MenB vaccination during pregnancy deferred unless benefits outweigh risks.
- **Meningococcal Disease and travel**
    - Current travel guidelines vary by country; general WHO recommendation to consider vaccination for countries with known outbreaks.
    - Quadrivalent vaccination is mandatory for Hajj pilgrims and those traveling to the African meningitis belt; offers broad serogroup protection and reduces carriage.
    - ACWY conjugate vaccination recommended for Hajj and Umra pilgrims, travelers to African meningitis belt, outbreak-prone countries, military personnel, healthcare workers, exchange program participants, and high-risk individuals.
    - **ACWY Conjugate Vaccination:**
        - Experts advocate for conjugate vaccines over polysaccharide vaccines due to their better effectiveness.
        - Conjugate vaccines prevent transmission by clearing carriage, protecting contacts, and preventing global dissemination.
        - Conjugate vaccines show promise in preventing infection even in older age groups.
        - Conjugate vaccines can reduce antibiotic overuse; some concerns remain about coverage for all serogroups (B, X).

- Chemoprophylaxis:
    - Rifampin, ceftriaxone, and ciprofloxacin are considered 90%-95% effective in reducing nasopharyngeal carriage of N. meningitidis and are acceptable agents for chemoprophylaxis. Although not a first-line choice, azithromycin may be recommended in situations of sustained ciprofloxacin resistance in a community. Azithromycin, administered as a single oral dose, has proven effective for eradicating nasopharyngeal carriage and may be used in limited circumstances where ciprofloxacin resistance is identified.
- **Preventing Group B Strep Disease**
    - Administration of Antibiotics During Labor:
    - Women identified as having an elevated risk of their newborn developing GBS disease are given antibiotics during labor.
    - Antibiotics are delivered intravenously (IV) and typically consist of beta-lactams such as penicillin or ampicillin. Alternatives are available for women severely allergic to these antibiotics.
    - Antibiotics must be administered during labor since giving them before labor allows the bacteria to quickly regenerate.

Section 4.0 Conclusion

This report serves as **an annex to the previous CHI Prevention and Chemoprophylaxis of Bacterial Meningitis report** and aims to provide recommendations to aid in the prevention and chemoprophylaxis of bacterial meningitis. It is important to note that these recommendations should be utilized to support clinical decision-making and not replace it in the management of individual patients when it comes to the prevention and chemoprophylaxis of bacterial meningitis. Health professionals are expected to consider this guidance alongside the specific needs, preferences, and values of their patients when exercising their judgment.

Section 5.0 References

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Section 6.0 Appendices

Appendix A. Prescribing Edits Definition

I. Prescribing Edits (ensure consistent use of abbreviations, e.g., CU, ST)

Some covered drugs may have additional requirements, rules or limits on coverage. These requirements and limits may include:

Prescribing edits Tools	Description
AGE (Age):	Coverage may depend on patient age
CU (Concurrent Use):	Coverage may depend upon concurrent use of another drug
G (Gender):	Coverage may depend on patient gender
MD (Physician Specialty):	Coverage may depend on prescribing physician's specialty or board certification
PA (Prior Authorization):	Requires specific physician request process
QL (Quantity Limits):	Coverage may be limited to specific quantities per prescription and/or time period
ST (Step Therapy):	Coverage may depend on previous use of another drug
EU (Emergency Use only):	This drug status on Formulary is only for emergency use
PE (Protocol Edit):	Use of drug is dependent on protocol combination, doses and sequence of therapy

II. Adult and Pediatric Quantity Limit?

This is either the adult or pediatric maximum amount of a drug that can be administered per day based on a maximum daily dose. If there is no clinical evidence supporting the quantity limit for that relevant indication, this column will be left as Blank.

III. What information is available in the notes?

"Notes" section provides details of the prescribing edits, extra important drug information and special warning and precautions.

IV. Drug interactions

- A: No known interaction
- B: No action needed
- C: Monitor therapy
- D: Consider therapy modification
- X: Avoid combination

V. Defined Daily Dose

The Defined Daily Dose (DDD) is to be set based on the WHO recommendations https://www.whocc.no/ddd/definition_and_general_considera/

VI. REMS

A Risk Evaluation and Mitigation Strategy (REMS) is a drug safety program that the U.S. Food and Drug Administration (FDA) can require for certain medications with serious safety concerns to help ensure the benefits of the medication outweigh its risks.

Appendix B. Prevention and Chemoprophylaxis of Bacterial Meningitis Scope

Comparison of the 2020 and the 2023 Report

2020	Changes Performed	2023	Rationale
Section 1.0 Prevention and Chemoprophylaxis of Bacterial Meningitis Clinical Guidelines			
Prevention of Meningococcal Infection Up to Date Mar 03, 2020	**Updated**	**Treatment and prevention of meningococcal infection (Dec 01, 2022)**[5]	**Insert the section on prevention of meningococcal disease:** antimicrobial prophylaxis and vaccination recommendations: - Indication for antimicrobial prophylaxis - Timing of prophylaxis - Preferred and alternative regimens (insert table) - Recommendations for patients receiving C5 inhibitors. **<u>Medications to add (SFDA-registered):</u>** - Penicillin V (Phenoxymethylpenicillin)
Aseptic and Bacterial Meningitis: Evaluation, Treatment, and Prevention American Family Physician Association 2017[9]	**N/A**	**N/A**	
WHO Consensus recommendation for	**N/A**	**N/A**	

meningococcal disease prevention for Hajj and Umra pilgrimage/ travel medicine (2013)[8]			
WHO Meningococcal disease Vaccine (2014)	**Updated**	**(No Date)**[10]	**<u>Insert recommendations on:</u>** - Current available meningococcal vaccines: o Conjugate meningococcal vaccines: ▪ Monovalent (A or C) meningococcal vaccine, which protects against meningococcal group A and C disease. ▪ Monovalent C meningococcal vaccine is recommended for all children at one year of age as part of routine immunization and for people who have had meningococcal disease. ▪ A single dose of monovalent A meningococcal vaccine is licensed for individuals 1–29 years of age. ▪ Combined haemophilus influenzae type B (HIB) plus monovalent C meningococcal vaccine. ▪ Quadrivalent (A, C, Y and W135). o Polysaccharide meningococcal vaccines ▪ Bivalent: protects against groups A and C.

			▪ Trivalent: protects against groups A, C and W-135 ▪ Tetravalent: protects against groups A, C, Y and W-135
N/A	**Missing**	**Meningococcal vaccination in children and adults (July 2023)**[6]	**Insert the sections on:** - Available vaccine formulations - Indications and Schedules in the United States o Routine immunization of adolescents and young adults o Immunization of persons at increased risk o Outbreak control - Indications and Schedules in Other Countries - Vaccine Information: MenACWY and Serogroup B vaccines **<u>Vaccines SFDA-registered</u>:** - MenACWY-CRM, Menveo - Men-C-ACYW-TT, Nimenrix - MenACWY-D, Menactra - MenB-FHbp, Trumenba - MenB-4C, Bexsero **<u>Vaccines not SFDA-registered</u>:** - MenACWY-TT, MenQuadfi - PsA-TT, MenAfriVac - Men-C-C-CRM, Menjugate - Men-C-C-TT, NeisVac-C - Serogroup C vaccine, HibMecC
N/A	**Missing**	**Meningococcal Vaccination:**	**Insert ACIP recommendations for the MenACWY and MenB**

		Recommendations of the Advisory Committee on Immunization Practices, United States, 2020[7]	**vaccinations: for adolescents, for patients at increased risk, as well as precautions and contraindications.** **Insert tables of recommendations.** **<u>Vaccinations Not SFDA Registered</u>:** • MenACWY-TT (MenQuadfi, Sanofi Pasteur) **<u>Vaccinations SFDA Registered:</u>** • MenACWY-D (Menactra, Sanofi Pasteur) • MenACWY-CRM (Menveo, GlaxoSmithKline) • MenB-FHbp (Trumenba, Pfizer) • MenB-4C (Bexsero, GlaxoSmithKline
	Missing	**NICE Meningococcal vaccine Treatment summaries**[22]	Only available in the UK
	Missing	**ECDC Meningococcal Disease: Recommended vaccinations**[11]	Insert recommended vaccination schedule (by country).
	Missing	**ECDC Factsheet about meningococcal disease**[12]	Insert the recommendations on public health measures. **<u>Vaccinations SFDA Registered:</u>** • Menveo • Nimenrix • Trumemba • Bexsero

	Missing	**CDC Meningococcal Vaccines**[13]	Insert recommendations on: - Available Vaccines - Who should receive each vaccine. - Common side effects - Safety Data
	Missing	**CDC Administering Meningococcal Vaccines**[14]	Insert vaccine recommendations, safety recommendations, and administration recommendations. **<u>Vaccinations Not SFDA Registered</u>:** • MenQuadfi **<u>Vaccinations SFDA Registered:</u>** • Menactra • Menveo • Bexsero • Trumenba
	Missing	**CDC Meningococcal Vaccination for Adolescents: Information for Healthcare Professionals**[15]	Insert vaccine recommendations. **<u>Vaccinations Not SFDA Registered</u>:** • MenQuadfi **<u>Vaccinations SFDA Registered:</u>** • Menactra • Menveo • Bexsero • Trumenba

Appendix C. MeSH Terms PubMed

The following is the result of the PubMed search conducted for guideline search:

Query	Filters	Search Details	Results
(((((Meningococcal Infections[MeSH Major Topic]) OR (Infection, Meningococcal[MeSH Terms])) OR (Meningococcal Infection[MeSH Terms])) OR (Infections, Meningococcal[MeSH Terms])) OR (Meningococcal Disease[MeSH Terms])) OR (Meningococcal Diseases[MeSH Terms])	Guideline, in the last 5 years, English	("meningococcal infections"[MeSH Major Topic] OR "meningococcal infections"[MeSH Terms] OR "meningococcal infections"[MeSH Terms] OR "meningococcal infections"[MeSH Terms] OR "meningococcal infections"[MeSH Terms] OR "meningococcal infections"[MeSH Terms]) AND ((y_5[Filter]) AND (guideline[Filter]) AND (english[Filter]))	1

Appendix D. Treatment Algorithm

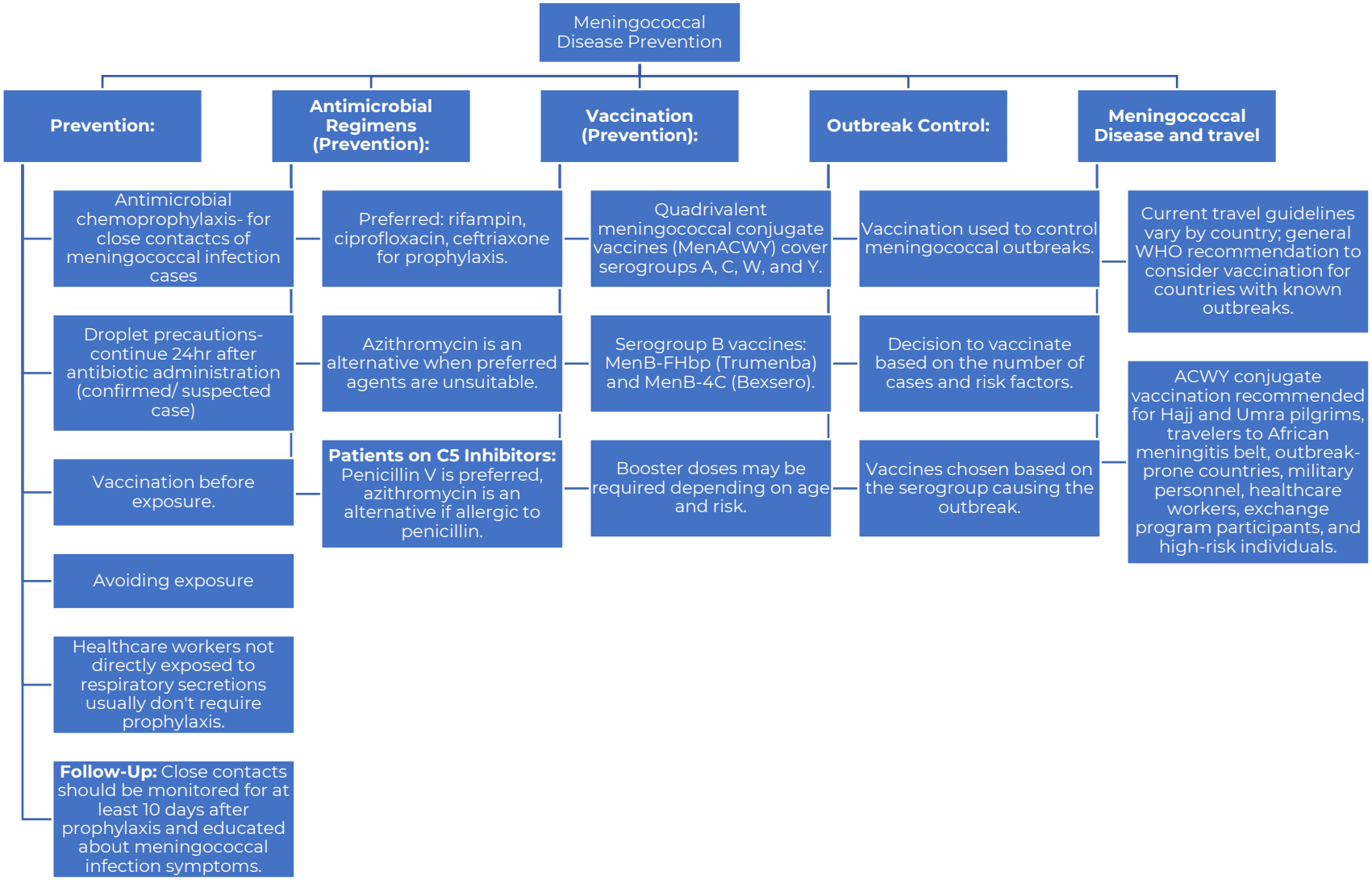

Figure 3. *Prevention and chemoprophylaxis of meningococcal disease*

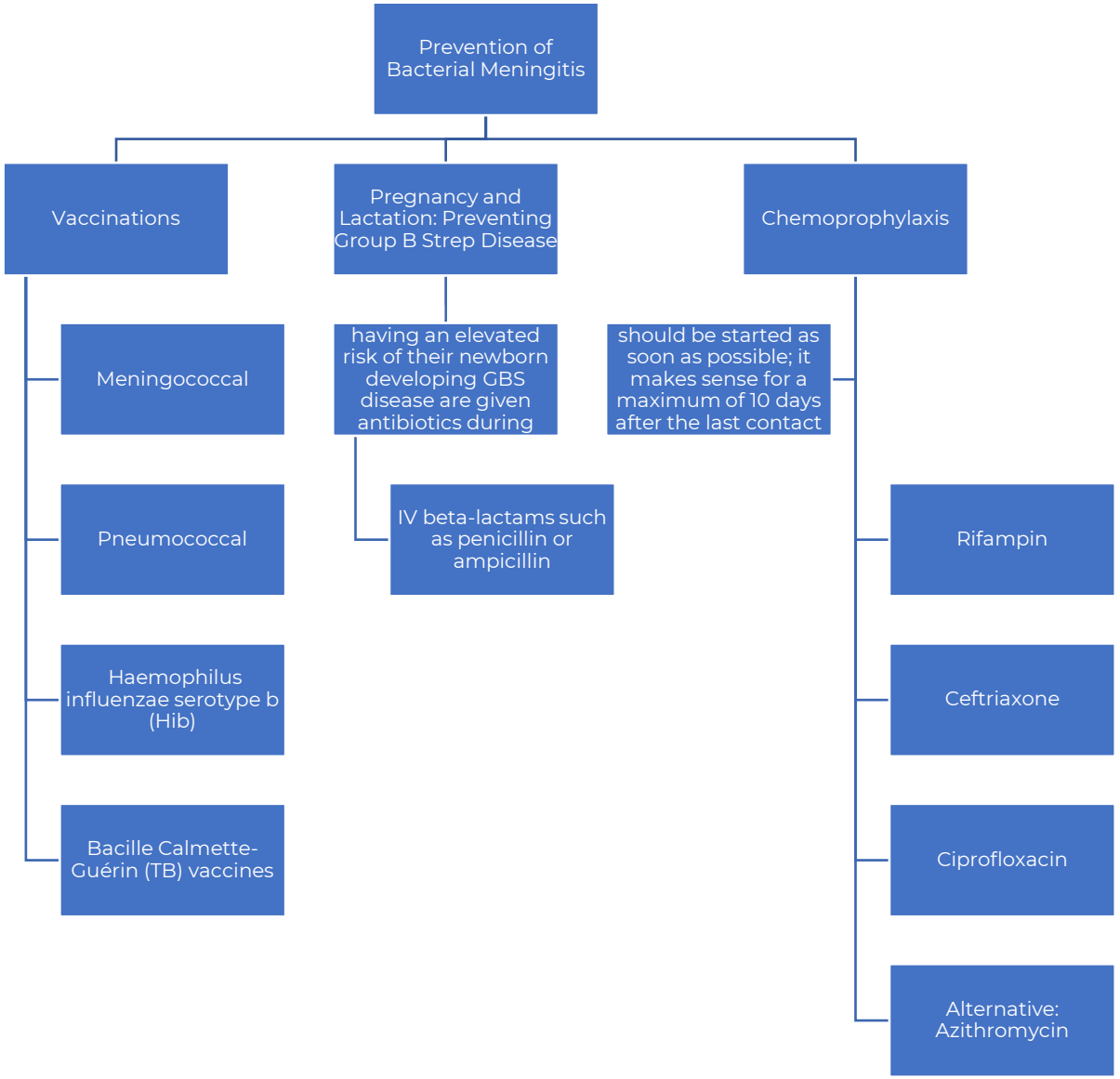

Figure 4. *Prevention of bacterial meningitis*