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Meningococcal Conjugate Vaccine in the United States: Remaining Challenges for Adolescent Vaccination

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Meningococcal disease is a serious bacterial infection caused by *Neisseria meningitidis* that can lead to meningitis and sepsis. Overall, 10%–15% of patients die despite appropriate antimicrobial therapy and among survivors, 10%–20% experience long-term sequelae such as hearing loss, cognitive deficits, or limb amputations [1]. Although rates of disease are highest in infants, older adolescents and young adults have an increased incidence of invasive meningococcal disease and the highest rates of asymptomatic oropharyngeal colonization and thus are likely the main source of transmission of the organism to other age groups [2,3]. For these reasons, adolescents are the primary group recommended for meningococcal vaccination in the United States.

In 2005, the Advisory Committee on Immunization Practices (ACIP) recommended that all adolescents receive quadrivalent (serogroups A, C, W, and Y) meningococcal conjugate vaccine (MenACWY) starting at age 11–12 years. The timing of vaccine administration in early adolescence was made in part to facilitate implementation, as ACIP and other organizations recommend appropriate vaccinations and other services at the preadolescent health visit, assuming duration of MenACWY protection through late adolescence and early adulthood [4]. Soon after MenACWY became available, ACIP recommended two additional vaccines, tetanus and reduced diphtheria toxoids and acellular pertussis vaccine and human papillomavirus vaccine, to be given at this age (subsequently referred to as the “11- to 12-year-old vaccination platform”). However, as data emerged demonstrating earlier antibody waning and shorter duration of protection of MenACWY than anticipated, ACIP recommended a booster dose in 2010 for adolescents aged 16 years [5]. This MenACWY booster dose is critical for maintaining protection during late adolescence and early adulthood when the risk of disease is greatest.

Coverage with at least one MenACWY dose among adolescents aged 13–17 years has steadily increased to over 85% by 2017; however, coverage of the booster dose remains suboptimal, with only 44% of 17-year-olds vaccinated with two or more doses, according to data from the National Immunization Survey–Teen [6]. Whether these differences in uptake among younger and older adolescents are due to the strength of the 11- to 12-year-old vaccination platform, the high proportion of states that mandate MenACWY vaccination

(with fewer mandating the booster dose specifically) [7], or other factors, has remained unknown.

Evaluating impact of the adolescent MenACWY program has been challenging, as incidence of meningococcal disease in the U.S. began declining before vaccine introduction and is currently at historic lows; furthermore, reductions have been observed across age groups and predominant serogroups (B, C, and Y) [8]. However, adolescents and young adults have experienced the greatest percent declines in meningococcal disease incidence due to vaccine-preventable serogroups, with more than 90% reduction in incidence in the 10 years following the initial ACIP MenACWY recommendation [8]. Although vaccination alone cannot explain the changing epidemiology of meningococcal disease in the U.S., data suggest that MenACWY vaccine has had an impact among adolescents [8]. Among older adolescents aged 16–23 years, *N. meningitidis* serogroup B now accounts for more than two thirds of cases and, in recent years, has accounted for all known outbreaks on university campuses [9,10].

These findings may lead to some questions: why should patients and providers care about the MenACWY booster dose since meningococcal disease incidence is so low in older adolescents in spite of poor booster dose coverage? Should we be focusing instead on serogroup B meningococcal disease and the serogroup B meningococcal (MenB) vaccines, recently licensed and recommended by ACIP for adolescents aged 16–23 years based on individual clinical decision-making [11]?

Until we understand why MenACWY booster coverage has remained lowand take steps to improve uptake, unvaccinated and undervaccinated older adolescents may remain at risk for a preventable, devastating infection. In addition, understanding factors related to low MenACWY booster dose coverage among 16-year-olds likely has implications for uptake of a multidose MenB vaccine series among older adolescents, as well as for informing the strategy for the next generation of meningococcal vaccines—those that combine serogroups A, B, C, W, and Y into a single vaccine. Furthermore, with low booster coverage in older adolescents, we have yet to discover the full potential of the vaccination program in terms of potential herd immunity to other age groups, such as infants.

In this issue of the *Journal of Adolescent Health*, Kurosky et al.[12] report findings on MenACWY uptake among adolescents using *Marketscan* commercial and Medicaid claims data, demonstrating that uptake among older adolescents (defined as those aged 15.5 through 18 years) is lower than that of younger adolescents (10.5 through 13 years). Although receipt of the primary versus booster dose among older adolescents could not be distinguished in this analysis, these findings are likely consistent with National Immunization Survey–Teen data demonstrating low booster dose uptake. Further analysis of healthcare utilization patterns demonstrated that this lower uptake among older adolescents was likely due to fewer preventative health visits in this age group, care received from nonpediatric providers who may be less familiar with meningococcal vaccines, and missed opportunities for vaccination. The authors advocate for strategies to improve healthcare utilization in older adolescents, such as implementation of a 16- to 18-year-old vaccination platform, improving

adherence to preventative health visits in older adolescents, and promoting increased awareness among healthcare providers.

A second adolescent vaccination platform is a strategy endorsed by the Society for Adolescent Health and Medicine and other organizations to provide a structured opportunity to improve uptake of the second MenACWY dose, discuss MenB vaccination, catch up on incomplete vaccination of other recommended vaccines, and improve adherence to other recommended screenings and services in this age group [13]. The activities outlined in the strategy essentially reflect the Standards for Pediatric and Adolescent Immunization and are considered the standard of care [14]; thus, the platform itself is not new, but perhaps, giving it a name may help improve visibility and highlight the importance of vaccination of older adolescents. Regardless of whether a second platform is promoted, provider education remains important to optimize MenACWY booster coverage and improve awareness of recommendations for both MenACWY and MenB vaccines. For instance, although all adolescents should be vaccinated with MenACWY at age 16 years, MenB vaccination should be based on individual clinical decision-making. Furthermore, although the preferred age of MenB vaccination is 16–18 years, providers of college-bound adolescents may choose to defer MenB vaccination until right before college matriculation, given the increased risk of serogroup B meningococcal disease among college students aged 18–20 years and the presumed relatively short duration of MenB vaccine protection [15,16]. These nuances and need for clinical decision-making for MenB vaccines create challenges that a second vaccination platform will not fully address, although may help to create opportunities for further discussion among providers, adolescents, and parents.

This article from Kurosky et al. [12] provides additional insight into the unique challenges in vaccinating older adolescents against a now very uncommon, yet among the most feared, infectious disease. Through awareness of meningococcal vaccine recommendations and making use of every opportunity to ensure that both the MenACWY primary and booster doses have been administered, providers can help ensure that the gains achieved in reducing meningococcal disease burden in the past 14 years since the vaccine first became available are sustained.

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