Assessing the impact of revising MenACWY vaccination schedule for adolescents in the United States: A modelling study

Invasive Meningococcal Disease (IMD)

- IMD generally presents as meningitis, septicaemia, or a combination thereof, and is linked to significant morbidity and mortality, with survivors often experiencing lifelong challenges. It is caused by ***Neisseria meningitidis***[1]
- **Twelve serogroups** of *Neisseria meningitidis* have been identified, but most cases of IMD are caused by serogroups A, B, C, W, X, and Y worldwide[2]
- In the United States, the four serogroups B, C, W, and Y circulate, while serogroup A does not[3]

Methods: Overview[4]

- The current MenACWY vaccination schedule includes two doses: the first dose is administered at ages 11–12 and the second (booster) dose at 16 years of age
- In February 2024, the ACIP within the US CDC proposed potential changes to the vaccination schedules to either[5]
  i. Replace the current program with a **single-dose of the MenACWY vaccine at age 16** (Revised Vaccination Schedule 1, **RVS1**), or
  ii. Adjust the age for the **first dose to 15 years** and the **second dose to 17–18 years** (Revised Vaccination Schedule 2, **RVS2**)

- **The goal of the study was to estimate the IMD burden associated with RVS1 and RVS2 from 2025 to 2035, based on 1st and 2nd dose uptake rates, and compare it with the burden under the current vaccination schedule (CVS)**
- An **age-stratified Monte Carlo model** was developed to assess MenACWY (C, W, Y) vaccination impact, **calibrated** with 1997–2004 IMD data, and used to **simulate** the CVS from 2005 and **compare** it with alternative schedules for 2025–2035

Comparative Analysis of CVS with RVS1 and RVS2[4]

- **RVS1 (61% and 90% uptake)**
  - A single-dose vaccine at age 16 could lead to **significant** health burden from 2025–2035
  - IMD incidence in the 16–23 age group dropped by **86%** in RVS2-90 vs. RVS2-61
- **RVS2 (61% and 90% uptake)**
  - The 1st dose at 15 yrs and booster at 17–18 yrs showed an estimated drop in the IMD incidences in the 16–23 age group by **83%** in RVS2-90 vs. RVS2-61

- **Adolescents (11–15 years) bear the greatest impact: 52%** of additional cases and **33%** of extra deaths **(RVS1)**; **62%** of additional cases and **39%** of extra deaths **(RVS2 – 90)**

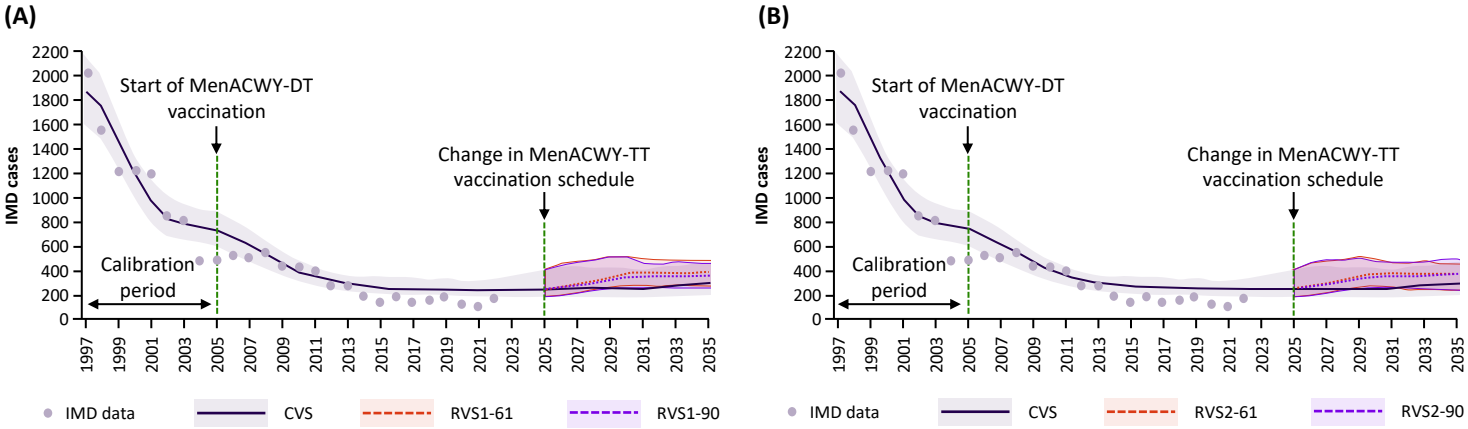

Figure 1. Simulated IMD cases under CVS vs. revised schedules: **(A)** single dose at age 16 (RVS1), and **(B)** 1st dose at 15 yrs and booster at 17–18yrs (RVS2). Assumes MenACWY-DT use (2005–2019) and MenACWY-TT from 2020 onward

Statistical modeling showed the prospective revised MenACWY vaccination schedules would lead to a higher incidence of IMD and increased mortality, especially among adolescents aged 11–15 years[4]

Limitations[4]

- Assumes **fixed duration** and **levels of protection**
- Focused on serogroups **C, W, and Y**, as serogroup A is not present in the US
- Does not include **MenB cross-protection**
- Treats **vaccine effectiveness as constant**, ignoring waning
- Model's immune protection with **Poisson distributions**, which may change with skewness
- Assumes **single probability** of developing IMD, ignoring variations by serogroup and age

Conclusion[4]

The current **MenACWY schedule** was found to be **most effective** as it prevents the most IMD cases and deaths

Even with higher vaccine uptake, both RVS1 (single dose at 16 yrs) and RVS2 (1st dose at 15 yrs and booster at 17–18 yrs) could lead to significantly more IMD cases and fatalities than the CVS

Proposed changes to vaccination schedules are expected to increase disease burden, especially among adolescents aged 11–15 yrs, who have experienced comparatively lower disease rates since the implementation of the vaccination program in 2005

Improving booster uptake at age 16 within the CVS - from 61% to 90% could substantially reduce disease burden

Declaration of Interests

SM Moghadas previously had advisory roles for Janssen Canada and Sanofi for cost-effectiveness of their products. A Shoukat, SM Moghadas and AP Galvani have received consulting fees from Sanofi for evaluation of vaccine products. T Shin is an employee of Sanofi. Other authors declare that they have no competing interests

Acknowledgements

Canada Foundation for Innovation for the establishment of Areto Compute Cluster and CDC

Abbreviations

ACIP, Advisory Committee on Immunization Practices; CDC, Centers for Disease Control and Prevention; CVS, current vaccination schedule; IMD, invasive meningococcal disease; MenACWY, meningococcal quadrivalent conjugate vaccine; RVS, revised vaccination schedule; US; United Sates; yrs, years

References

1. Campbell H, et al. *Lancet Child Adolesc Health*. 2022;6:96–105.
2. Shin T, et al. *JAMA Netw Open*. 2024;7:e2443551.
3. Harrison, Lee H. *Clin Infect Dis.* 2010;50:S37-44.
4. Shoukat A, et al. *Lancet Reg Health Am*. 2025;44.
5. Schillie S. Revising the adolescent meningococcal vaccine schedule: term of reference and considerations. Available from: https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2024-02-28-29/02-Meningitis-Schillie-508.pdf. Accessed March 16, 2024.