

HPV Vaccination Implementation & Status

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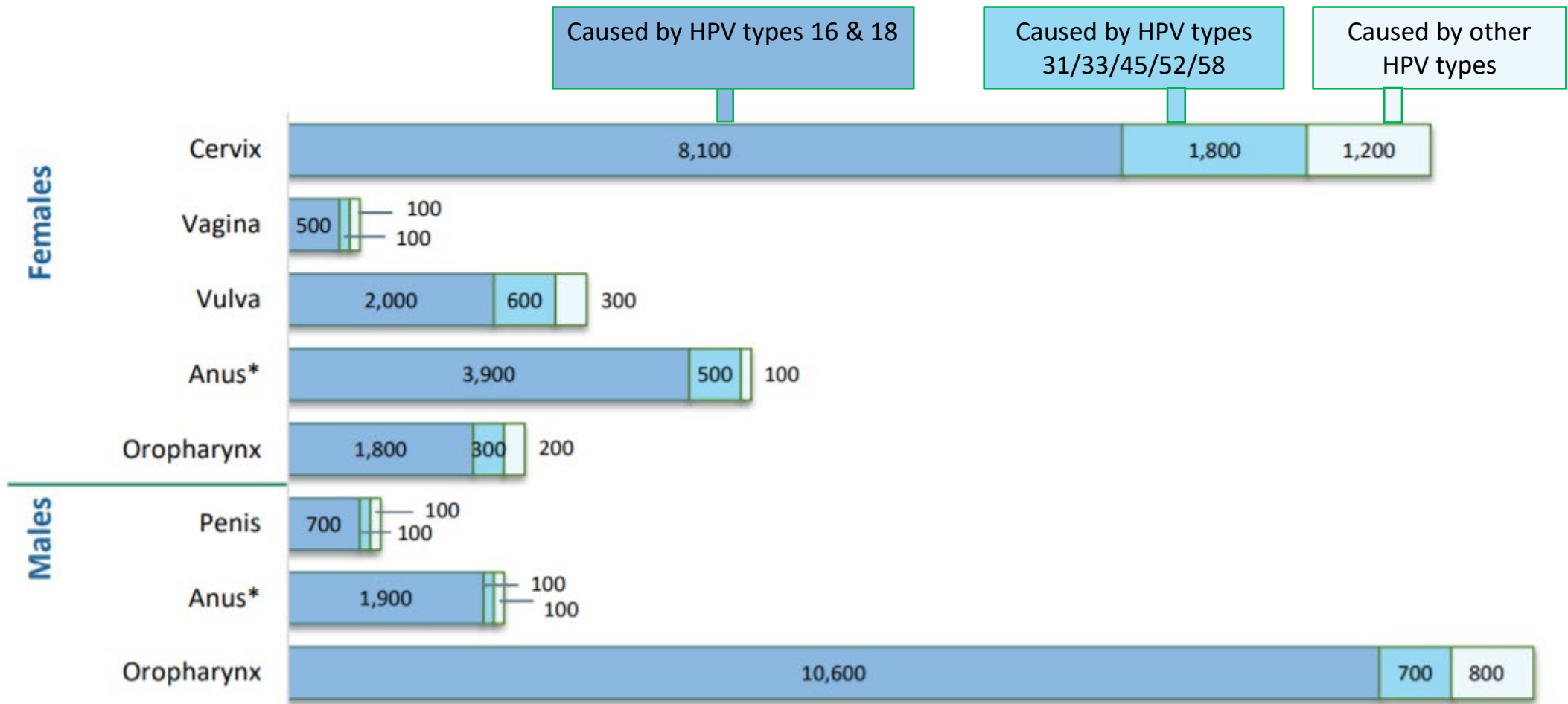
Advancing Progress in Cancer Prevention & Risk Reduction
A National Cancer Policy Forum Workshop
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*The views expressed are my own and do
not necessarily reflect those of NCI/NIH*

Disclosures

- National Institutes of Health (NIH) has patents on papillomavirus L1 virus-like particle (VLP) vaccine technology. I am an inventor.
- NIH has licensed L1 VLP technology to Merck and GlaxoSmithKline, the two companies with FDA-approved versions of the vaccine.
- **I will discuss a potential off-label use of the FDA-approved vaccines: fewer vaccine doses**
- Licensees of other NIH technologies of which I am an inventor: GlaxoSmithKline, Sanofi, Shanta Biotech, Cytos Biotech, Aura Biosciences, Etna Biotech, Acambis, PanVax

HPV-attributable cancer cases/year in US = 36,500



Centers for Disease Control and Prevention. Cancers Associated with Human Papillomavirus, United States—2014–2018 USCS Data Brief, no. 26. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services; 2021.

HPV vaccine = cancer prevention

1 + 2 = 6

vaccine

doses

*protection
against 6 types
of cancer*

Ask your child's doctor or nurse about HPV vaccine.



HPV VACCINE
IS CANCER PREVENTION

***FDA-approved HPV vaccines: L1 virus-like particles, multivalent;
Gardasil-9 is the only one currently sold in US***

Cervarix (GSK):

HPV16/18

Gardasil (Merck):

HPV6/11

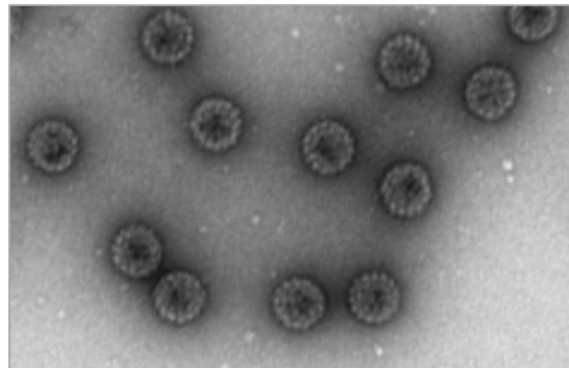
HPV16/18

Gardasil-9 (Merck):

HPV6/11

HPV16/18

HPV31/33/45/52/58

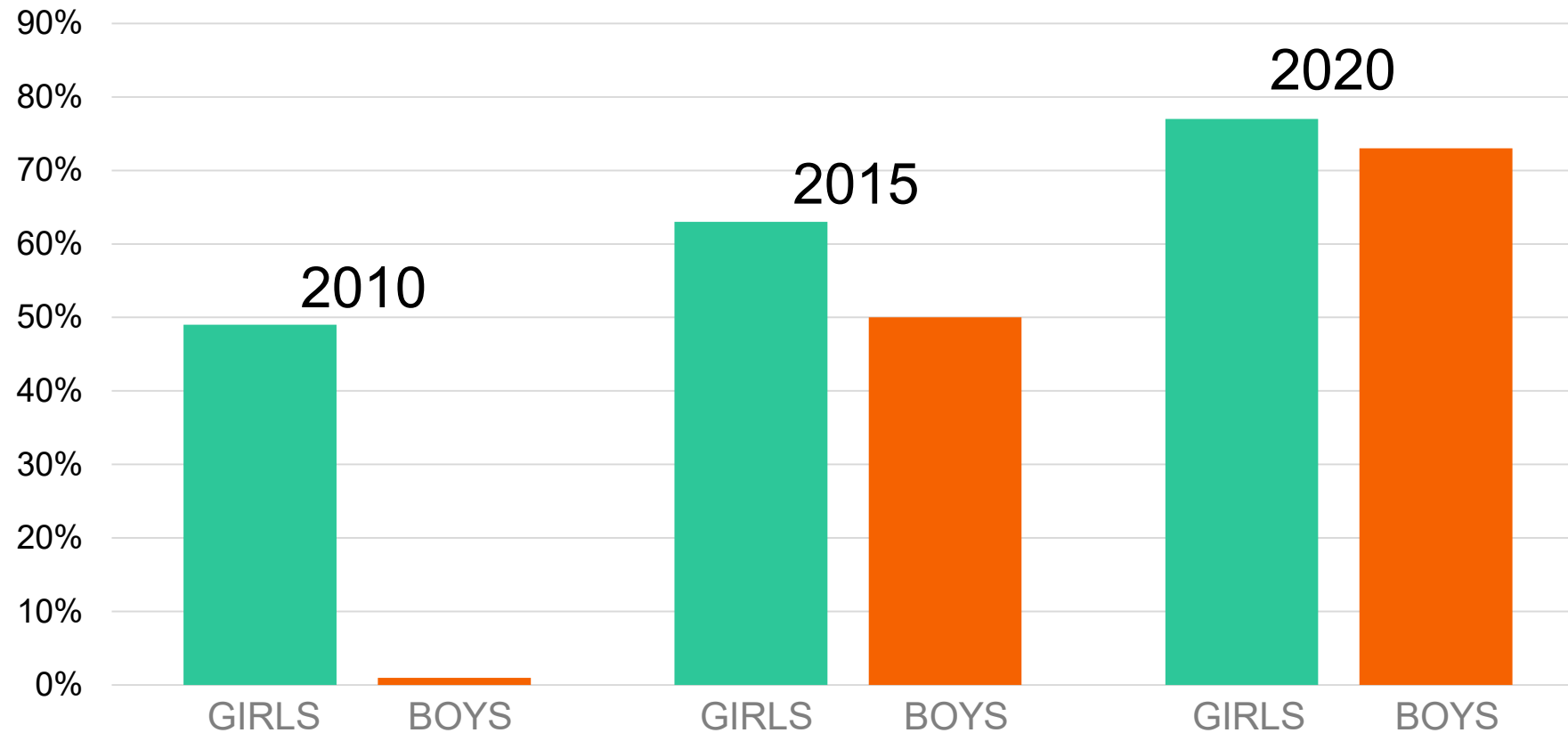


**HPV16 L1
Virus-like particles**

HPV vaccine: recommendations

- 9-14 year olds: Routine vaccination, 2-doses
- 15-26 year olds: Routine “catch-up” vaccination, 3-doses
- 27-45 year olds: Shared decision, 3-doses
 - <https://www.cdc.gov/vaccines/vpd/hpv/hcp/recommendations.html>
- Adolescents are the main target group for the vaccine because HPV infection occurs commonly soon after sexual debut
 - *Ho et al, N Engl J Med 338:423-8, 1998; Winer et al, Cancer Epidemiol Biomarkers Prev 20:699-707, 2011*

United States: Increasing HPV vaccine uptake for teens 13 – 17 years old, 1 or more doses



2006

For **females**:
FDA: approval for prevention of cancer and genital warts
ACIP: “Routine” (strong) recommendation

2009

For **males**: **FDA** approval for prevention of genital warts. **ACIP**: “permissive” (weak) recommendation

2011

For **males**: **FDA**: approval for prevention of **cancer**.
ACIP: “routine” (strong) recommendation

Data from MMWR 2011, 2016, 2021

REVIEW

 OPEN ACCESS

Quadrivalent HPV vaccine safety review and safety monitoring plans for nine-valent HPV vaccine in the United States

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ABSTRACT

Quadrivalent human papillomavirus (4vHPV) vaccine was licensed for use in the United States in 2006 and through 2015 was the predominate HPV vaccine used. With the exception of syncope, a known preventable adverse event after any injected vaccination, both pre-licensure and post-licensure 4vHPV safety data have been reassuring with no confirmed safety signals identified. Nine-valent HPV vaccine (9vHPV) was licensed in 2014. This review includes post-licensure 4vHPV safety findings published to date that have informed the US vaccination program; these data will inform US safety monitoring and evaluation for 9vHPV.

ARTICLE HISTORY

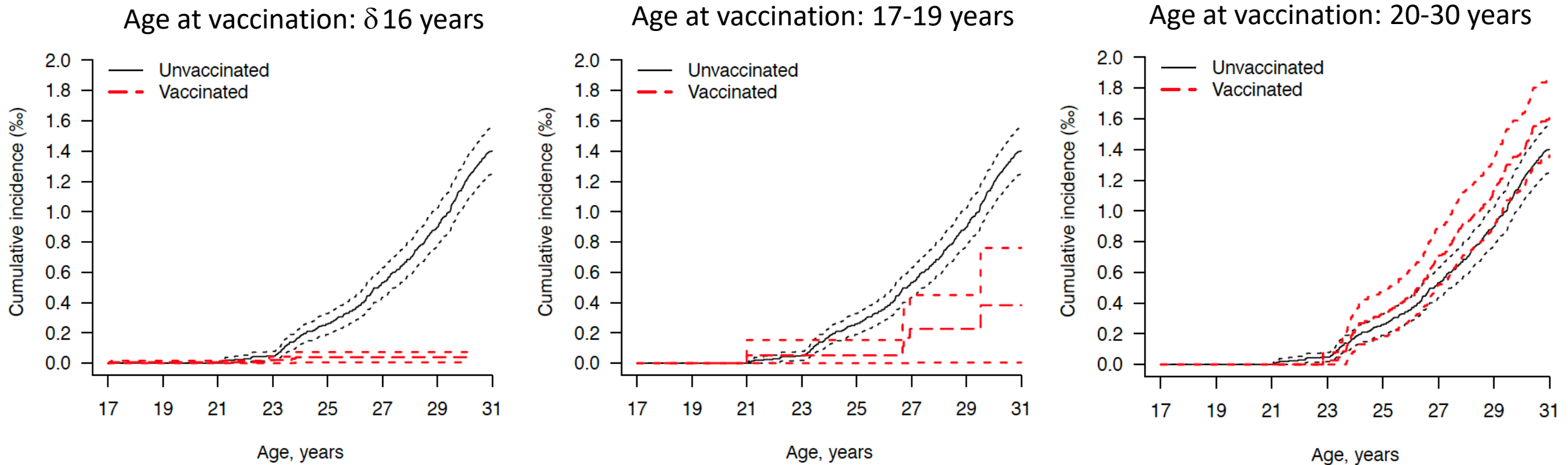
Received 25 January 2016
Revised 9 March 2016
Accepted 15 March 2016

Some important initial HPV vaccine results

- ✱ Initial vaccine studies used 3 doses over six months.
No precedent for effective vaccine against a local sexually transmitted disease
- ✱ Vaccine has very high efficacy (>95%): in principle can protect against the vast majority of cancers attributable to HPV infection
- ✱ Vaccine confers sterilizing immunity (i.e., **prevents infection**) in most vaccinees
- ✱ Vaccine does not treat established infection

Schiller & Lowy, Vaccine 36:4768-73, 2018; Hildesheim et al, Amer J Obstet Gynecol 215:212.e1-212.e15, 2016

~90% decrease in cervical cancer incidence in Danish women who received the HPV vaccine when they were ≤ 16 years old



From Kjaer et al, Real world effectiveness of human papillomavirus vaccination against cervical cancer. JNCI 113:1329-35, 2021

- Similar decreases reported for Sweden and the United Kingdom: Lei et al, New Eng J Med 383:1340-8, 2020; Falcaro et al, Lancet 398:2084-92, 2021**

Current research is evaluating efficacy of a single HPV vaccine dose

- **Post-hoc analyses: >10 years of strong protection (Cervarix or Gardasil):** *Kreimer et al, J Natl Cancer Inst 112:1038-46, 2020; Basu et al, Lancet Oncol 11:1518-29, 2021*
- **Ongoing efficacy trial comparing one-dose vs. two-doses of Cervarix or Gardasil-9:** *Porras et al, Vaccine 40:76-88, 2022*
- **18 month trial >95% efficacy (Cervarix or Gardasil-9):** *Barnabas et al. NEJM Evid. DOI: 10.1056/EVIDoa2100056, 2022*
- **WHO Strategic Advisory Group of Experts on Immunization (SAGE) has recommended one or two doses for 9-20 year old females (April 2022):**
[https://www.who.int/news/item/11-04-2022-one-dose-human-papillomavirus-\(hpv\)-vaccine-offers-solid-protection-against-cervical-cancer](https://www.who.int/news/item/11-04-2022-one-dose-human-papillomavirus-(hpv)-vaccine-offers-solid-protection-against-cervical-cancer)

Summary and Conclusions

- HPV vaccines induce high and durable efficacy against incident infection and disease caused by the HPV types targeted by the vaccines
- The vaccines are most cost-effective when administered prior to sexual debut
- HPV vaccine uptake in the US has increased in recent years and is associated with herd immunity
- Current research is evaluating the efficacy of a single vaccine dose

Additional slides

Some clinical differences between HPV vaccine and SARS-CoV-2 mRNA vaccine

HPV vaccine

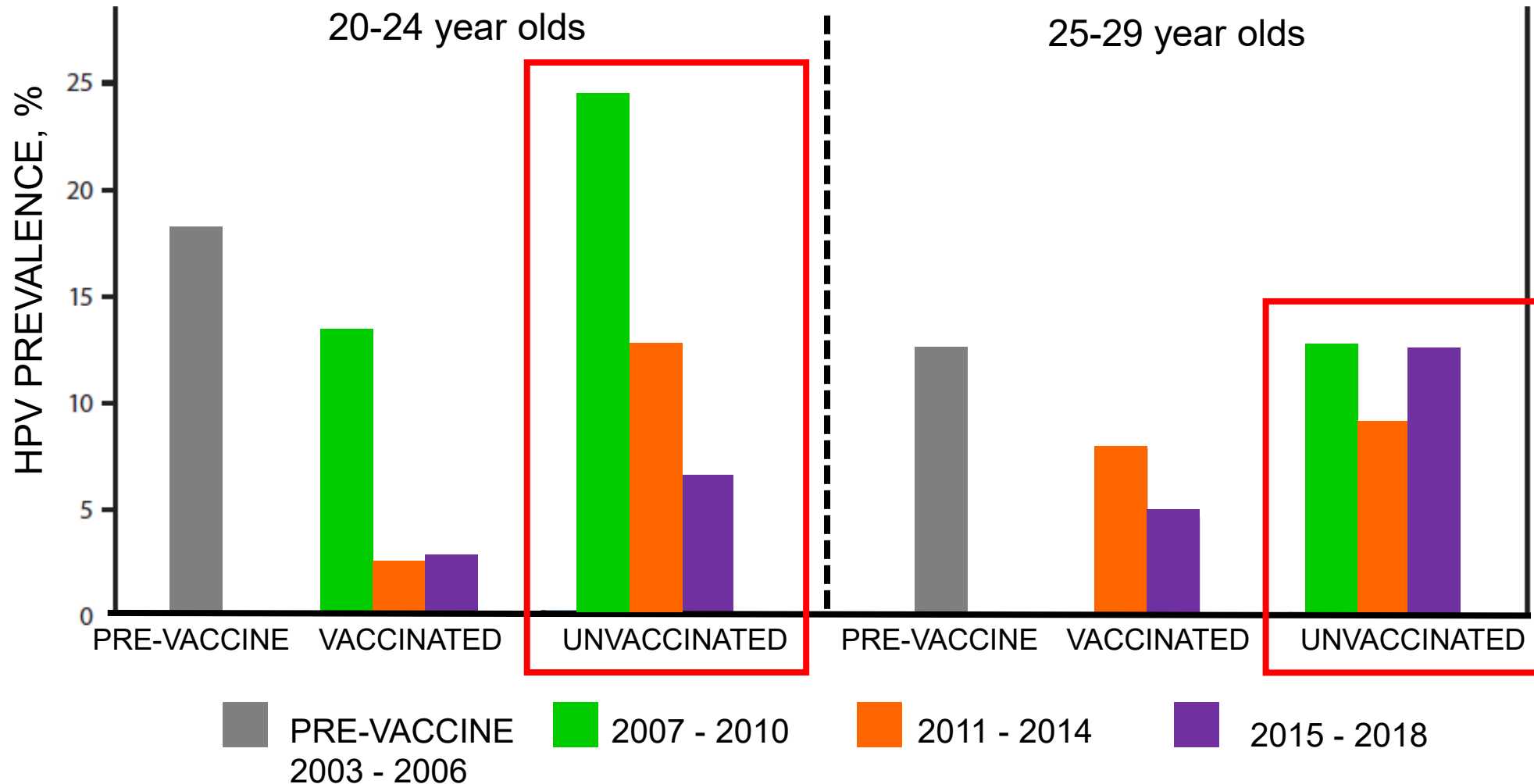
- High efficacy against all variants within a given HPV type
- Vaccine induces **>10 years of strong protection**
- Readily induces herd immunity

SARS-CoV-2 vaccine

- May have reduced protection against some variants
- Induces **several months of protection**
- Has not induced herd immunity

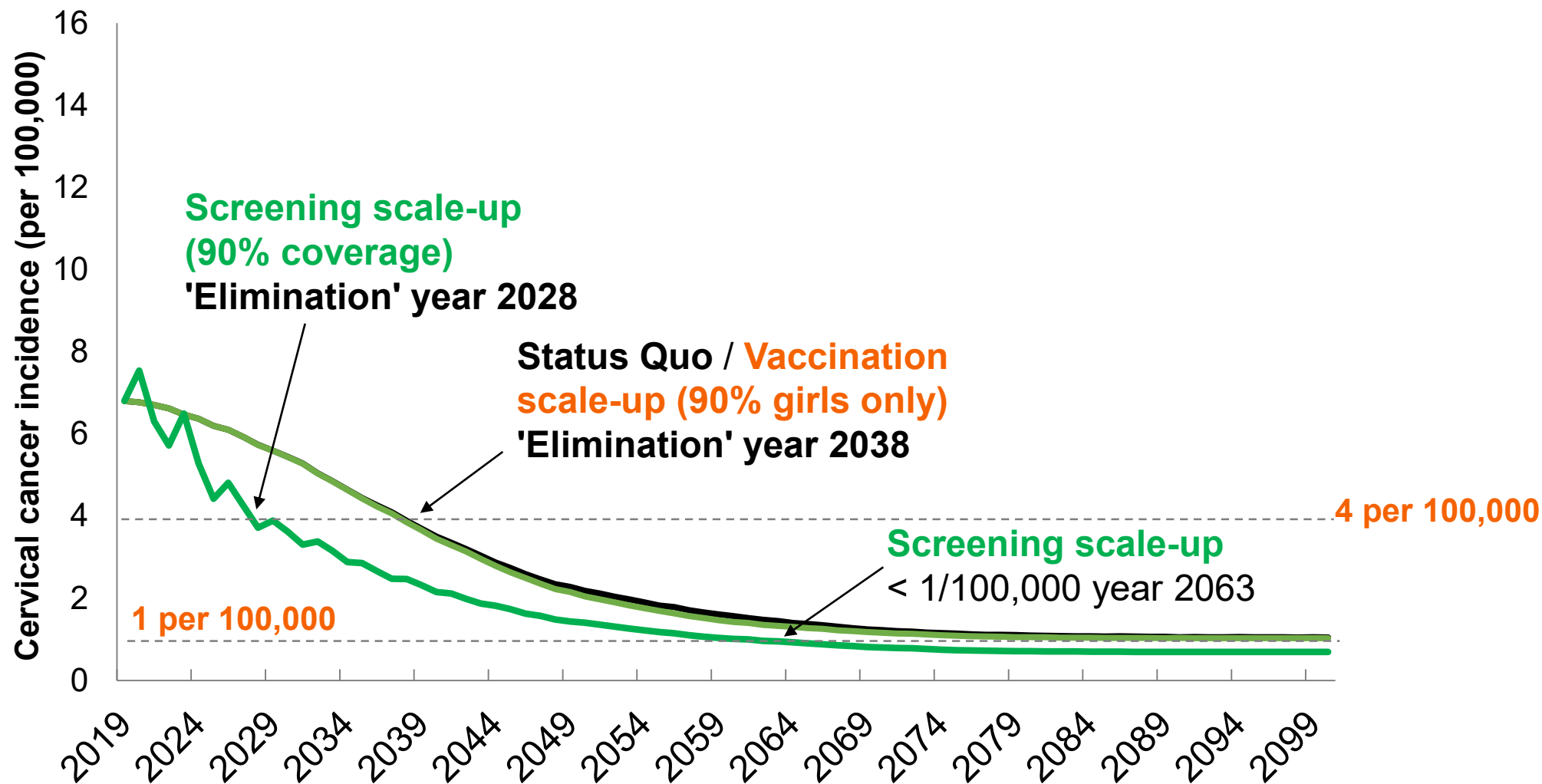
Kreimer et al, J Natl Cancer Inst 112:1038-46, 2020; Rosenblum et al, MMWR 70:415-420, 2021;
<https://www.cdc.gov/vaccines/vpd/hpv/hcp/vaccines.html#:~:text=All%20HPV%20vaccines%20have%20been,with%20the%20vaccine%20types%20at>

United States in 2018: Herd immunity for HPV vaccine types among 20-24 year old women but not yet among 25-29 year old women

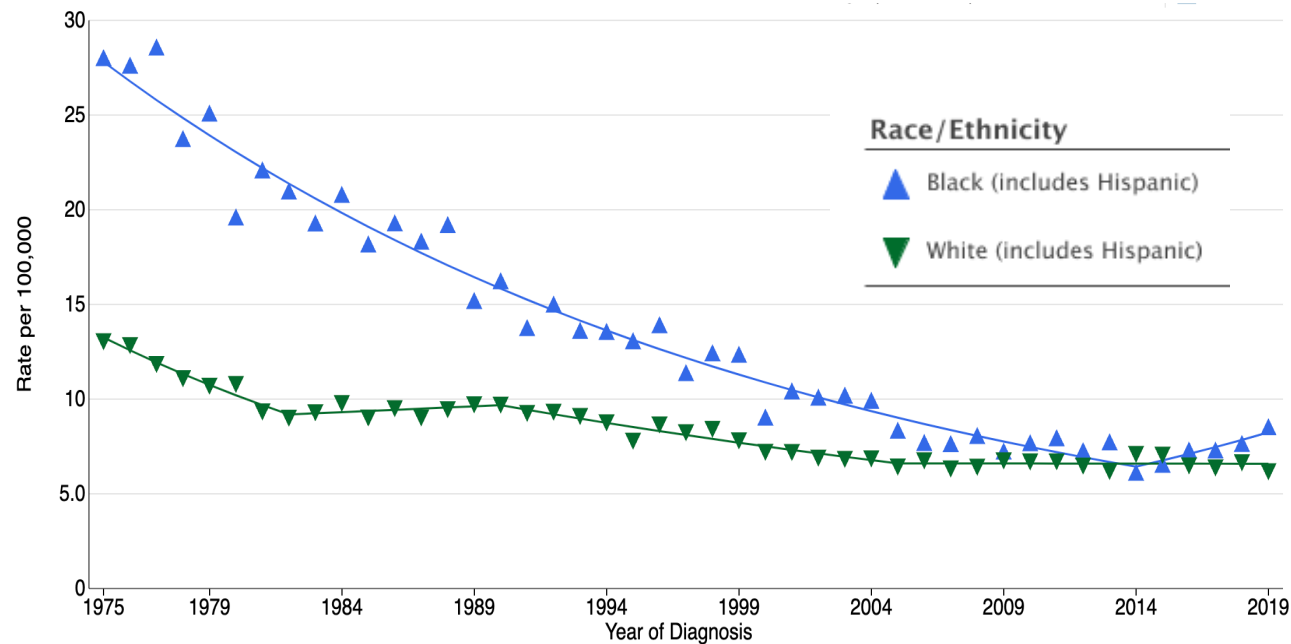


Adapted from Rosenblum et al, MMWR 70:415-420, 2021

Cervical cancer incidence in USA will decline more rapidly by increasing screening than by increasing HPV vaccination



US cervical cancer: Incidence rate disparities are smaller, but mortality rate disparities remain



Cervical cancer Incidence

Cervical Cancer Mortality Rates 2015-2019

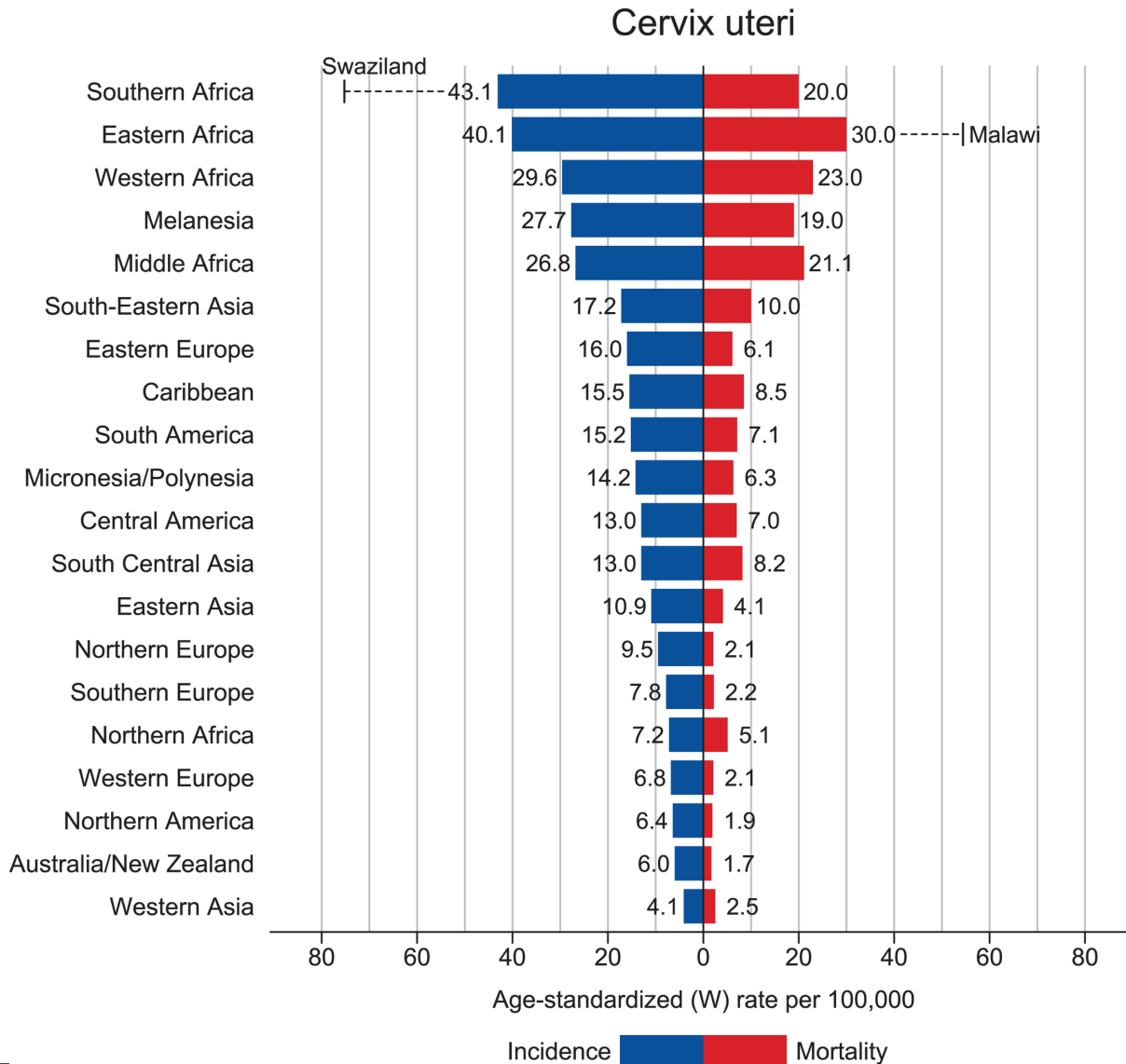
Blacks: 3.4
Native Americans: 3.1
Hispanics: 2.5
Whites: 2.0
Asian Pac. Islanders: 1.7

- Data from SEER Explorer: <https://seer.cancer.gov/statistics-network/explorer/overview.html>

2020 HPV and Meningococcal vaccination rates for 13-17 year olds: lower uptake in more affluent and in rural populations

	HPV vaccine (≥1 dose)	Meningococcal vaccine (≥1 dose)
United States: urban vs. rural	78% vs 68%	90% vs 86%
Below poverty: urban vs. rural	86% vs 74%	92% vs 86%
At or above poverty: urban vs. rural	76% vs 65%	89% vs 86%

Cervical cancer: a largely preventable cancer with wide global disparities



- Low- and Middle-income countries:
 - Where 90% of cervical cancer incidence and deaths occur
 - **Projected by WHO to increase by >2% every year**
 - <https://www.who.int/news/item/17-11-2020-a-cervical-cancer-free-future-first-ever-global-commitment-to-eliminate-a-cancer>
 - Where cervical cancer represents ~90% of HPV-associated cancer
- Pap testing and treatment of cervical precancer enabled USA to go from being high incidence/mortality in 1950's to low incidence/mortality now

Worldwide control of cervical cancer requires worldwide female vaccination

The need

- HPV vaccination of >40 million women in each birth cohort is needed
- most of these women live in LMICs
- Each birth cohort is ~60 million women



Current reality

- ~10% of eligible young women in LMICs get vaccinated each year



A possible solution

Single dose HPV vaccination

- Less expensive and logistically easier than two doses
- Not yet standard of care