HPV Vaccination & Cancer Prevention

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Disclosures

Nothing to disclose

Human Papillomavirus

dsDNA virus

- Replication in the host cell nucleus using normal host cell mechanisms for proliferation

Highly Epitheliotropic

- Establish productive infections in stratified epithelia (skin, anogenital tract, oral cavity)

Most common sexually transmitted infection in the US

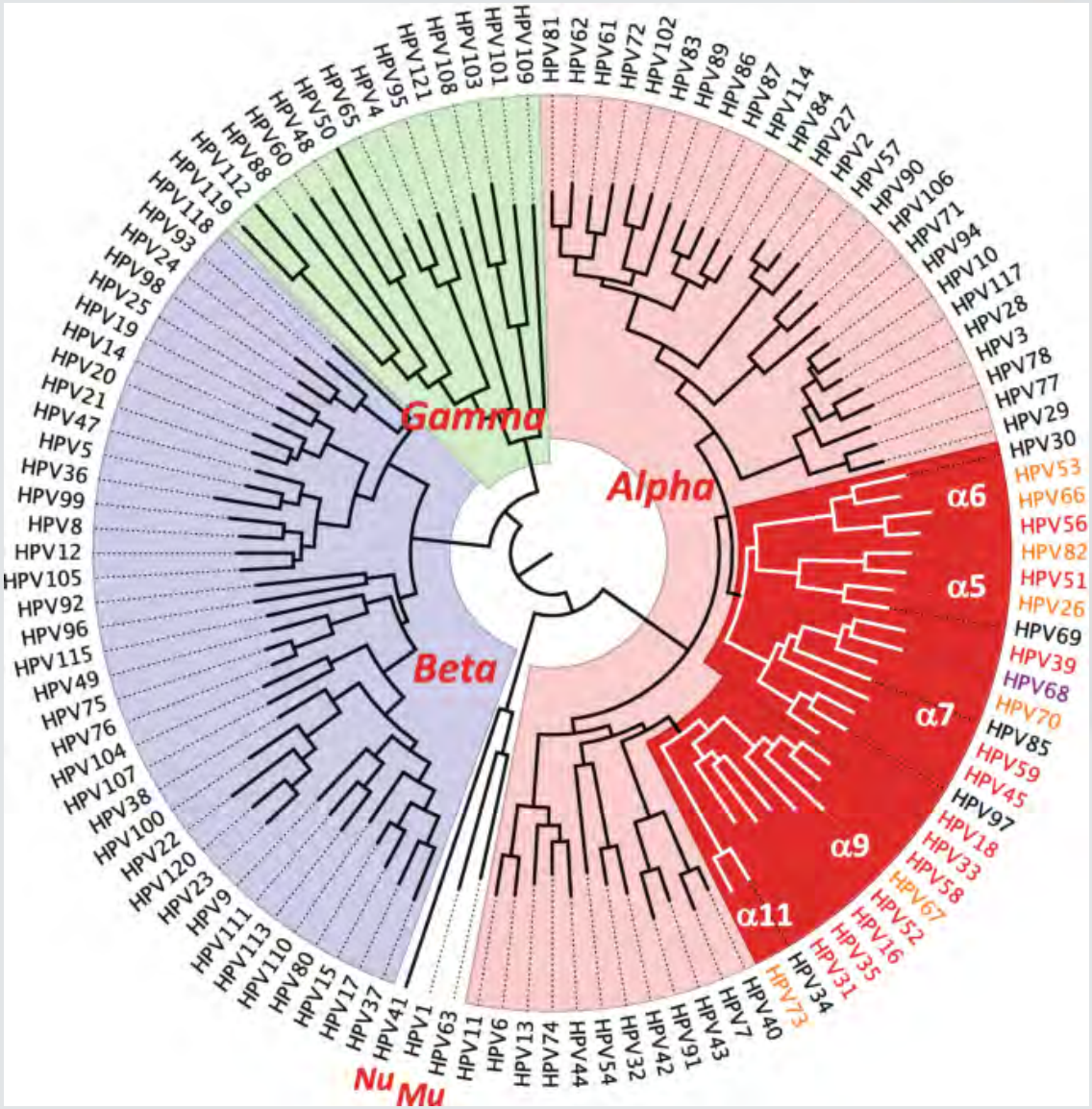
- 70 million **KNOWN** cases

Over 200 types of HPV

High-risk

&

Low-risk



High-risk:

16
18
31
33
35
39
45
51
52
56
58
59
68

Kukimoto, I. (2024). Recent Topics of Human Papillomavirus and Cervical Cancer. In: Aoki, D. (eds) Recent Topics on Prevention, Diagnosis, and Clinical Management of Cervical Cancer. Comprehensive Gynecology and Obstetrics. Springer, Singapore. https://doi.org/10.1007/978-981-99-9396-3_1

HPV Epidemiology

Most common STI worldwide

- Estimated ~80% of sexually active individuals will acquire it at some point in their lives

Disproportionate Burden

- Highest prevalence in sub-Saharan Africa

HPV differs by sex

- Among young women prevalence peaks at approximately 20-25 years
- Does not vary as much by age among men

US HPV Prevalence

Oral HPV

- Men: 11.5%
- Women: 3.3%

Anogenital HPV

- Men: 45.2%
- Women: 39.9%

HPV and Cancer

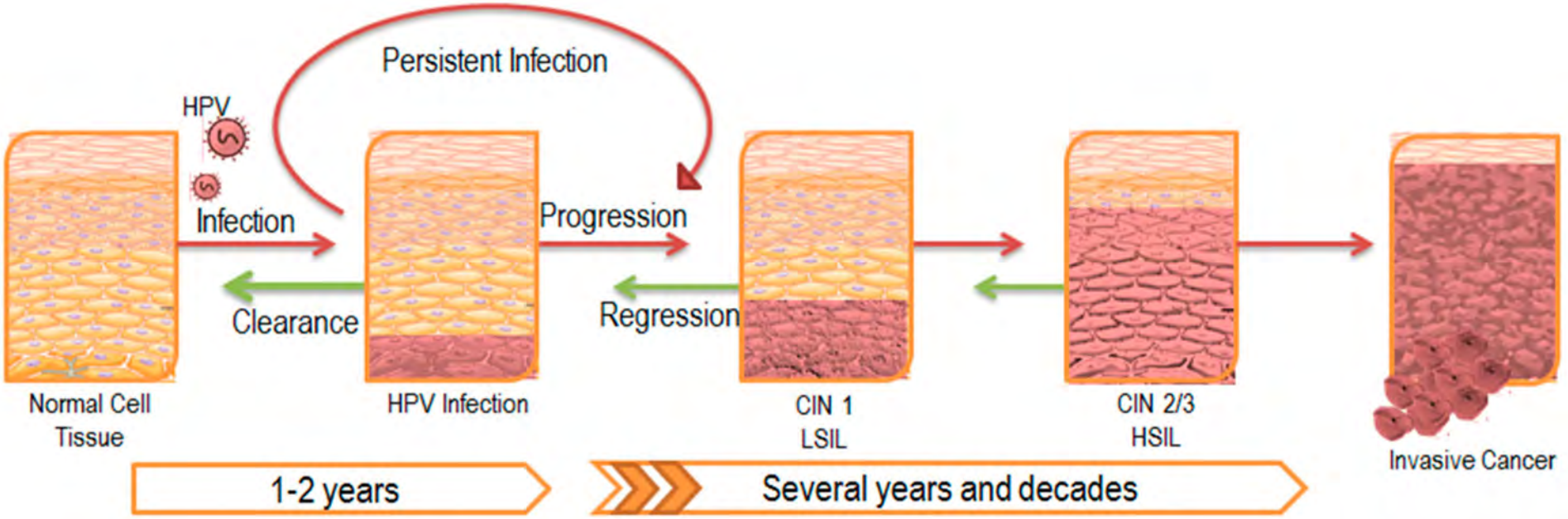
From Infection to Cancer

Most people (~90%) are able to control and clear an HPV infection

In some cases, HPV persists (with no symptoms)

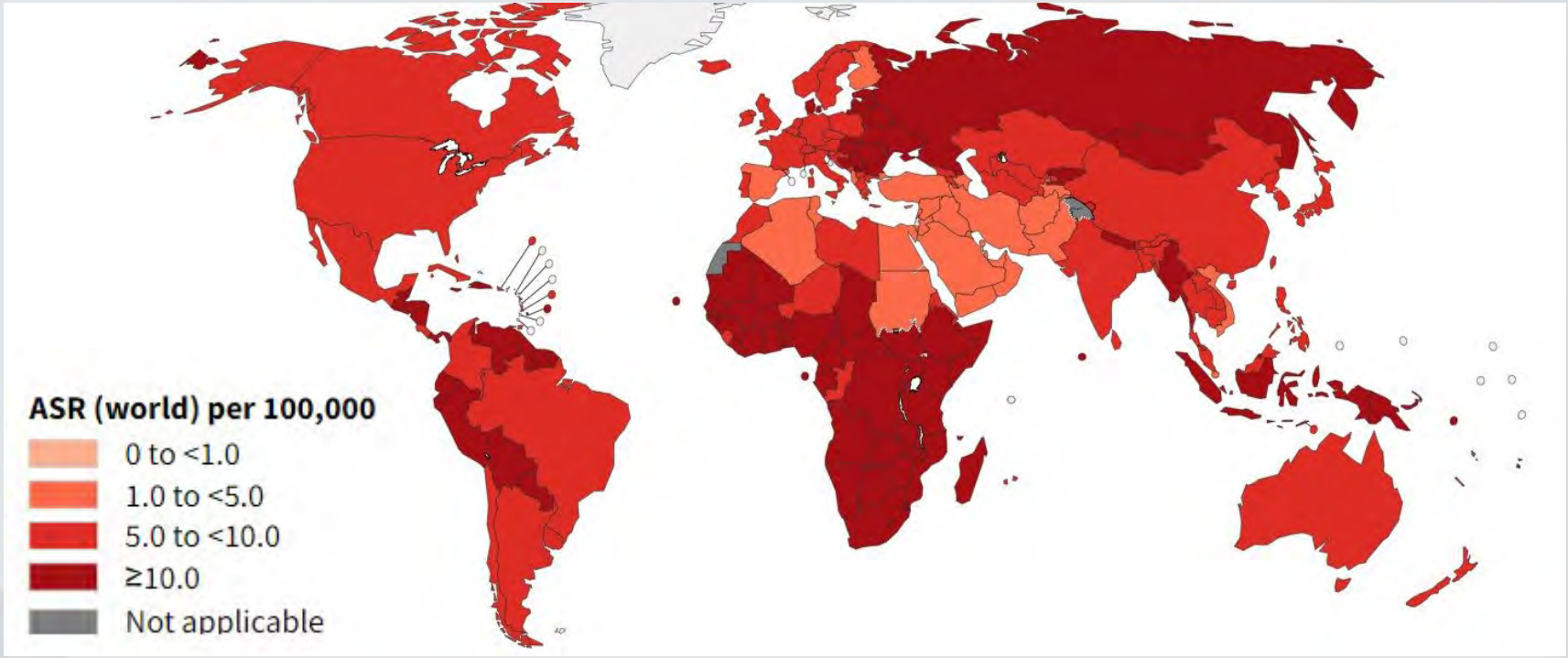
- Persistence of 15-20 years before cancer

HPV persistence is the obligate precursor to HPV-associated cancers



Shanmugasundaram, S., & You, J. (2017). Targeting persistent human papillomavirus infection. *Viruses*, *9*(8), 229.

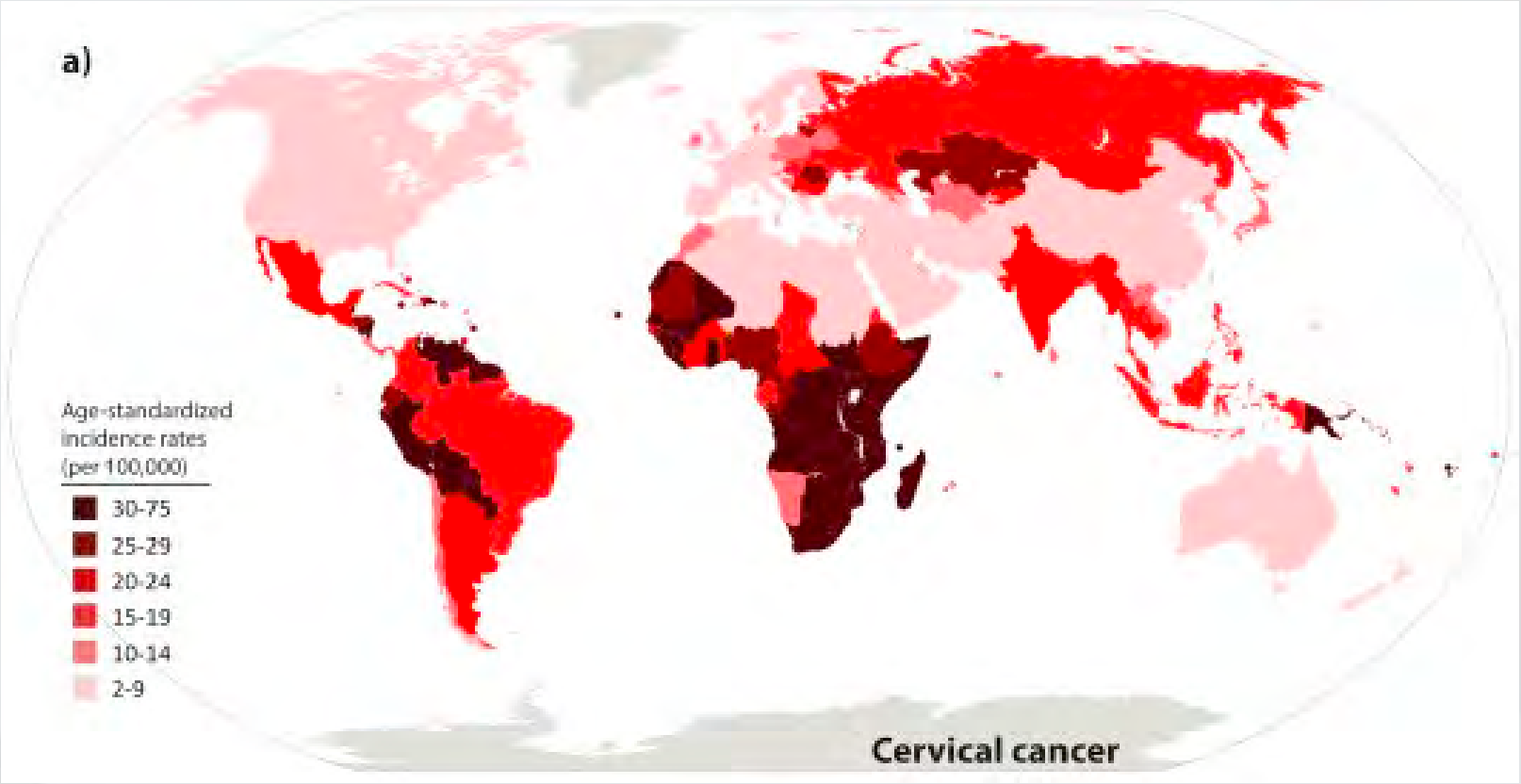
Age-standardized incidence of all cancers caused by HPV, 2018



GLOBOCAN 2020; Graph production: IARC (http://gco.iarc.fr/today); World Health Organization; de Martel et al, *Int J Cancer* 2017

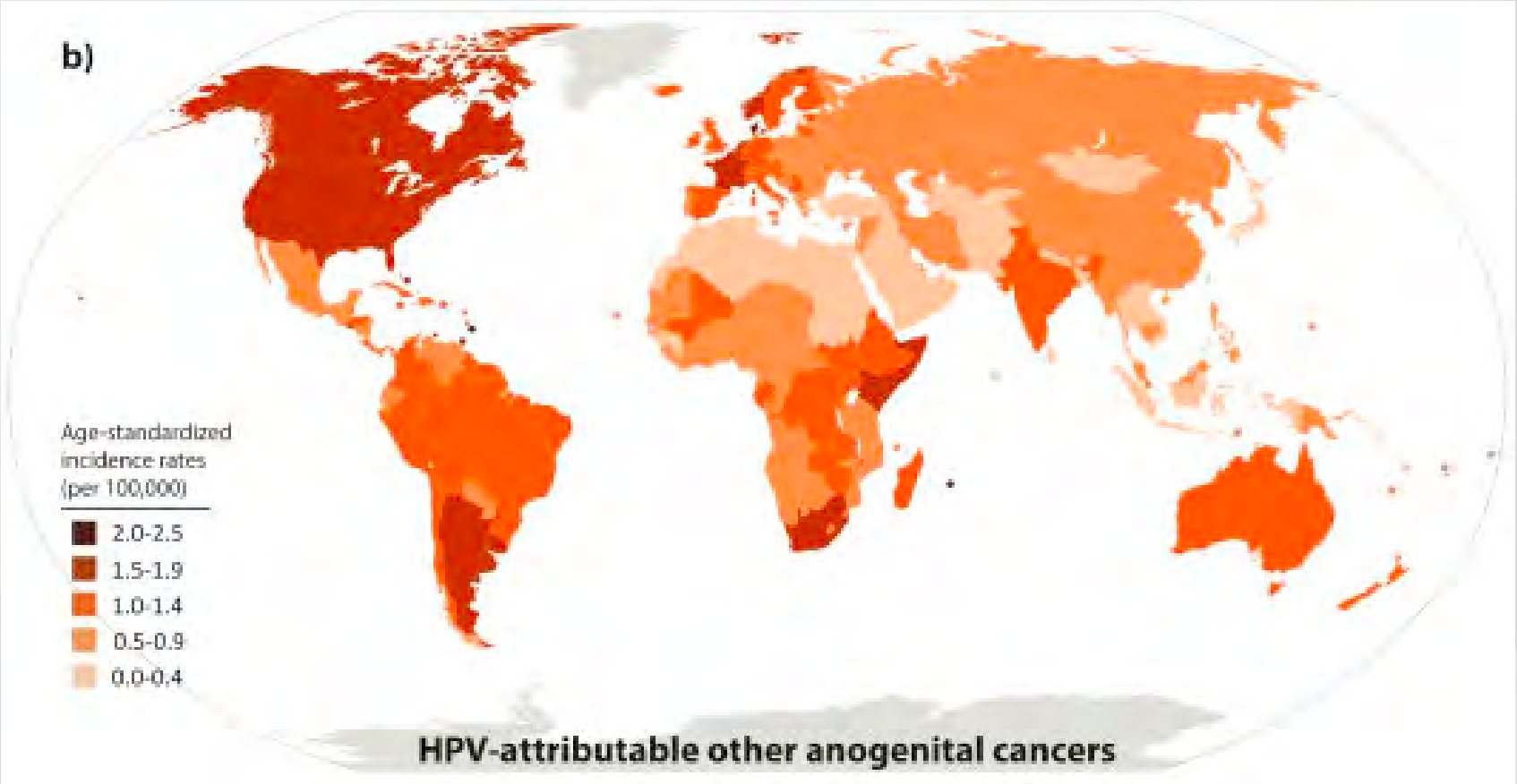
Cancers attributed to HPV

Global cervical cancer incidence

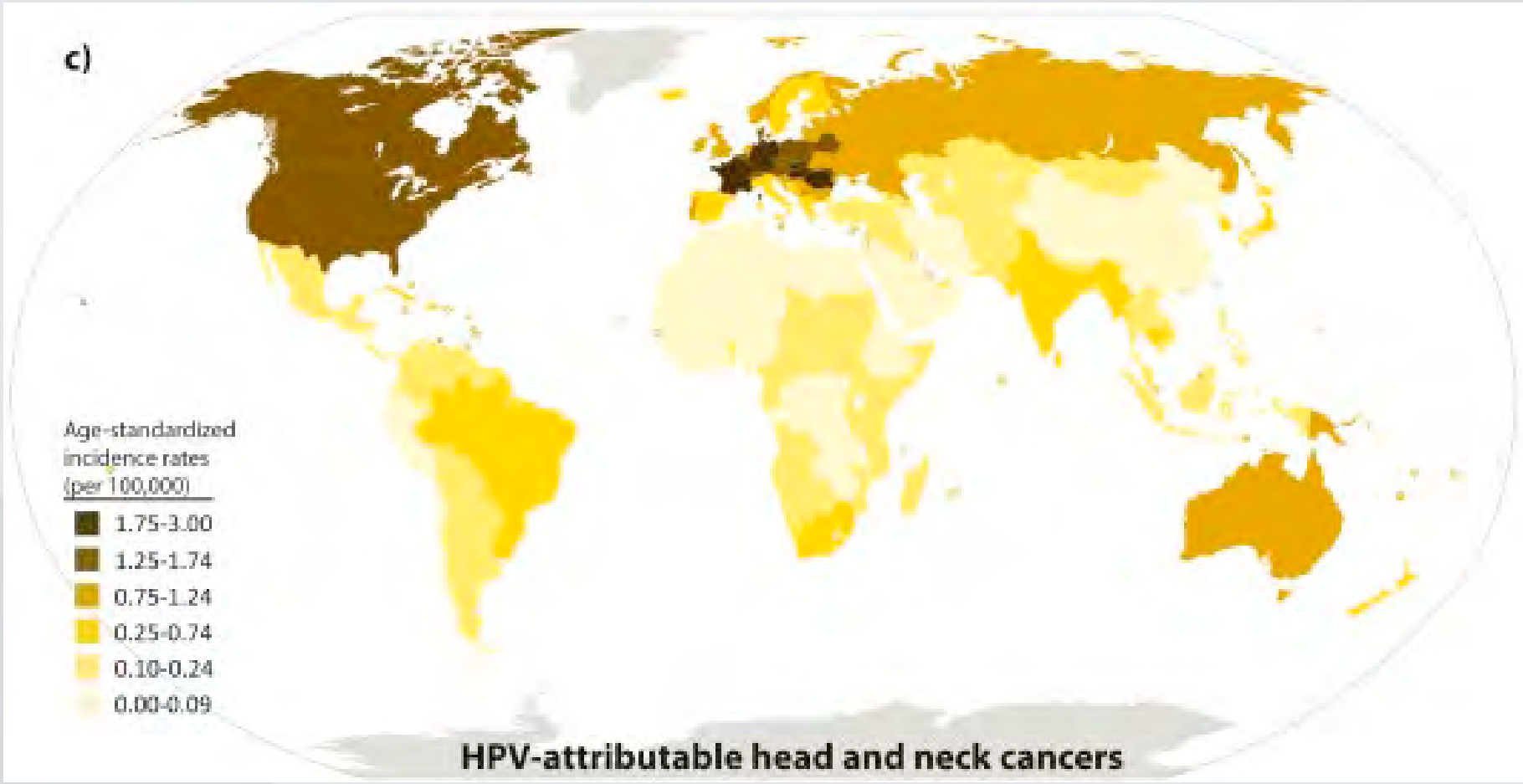


- 650,000 new cases and 350,000 deaths worldwide
- 4th leading cause of cancer and cancer deaths in women in 2022

Global anogenital cancer incidence (HPV-associated)

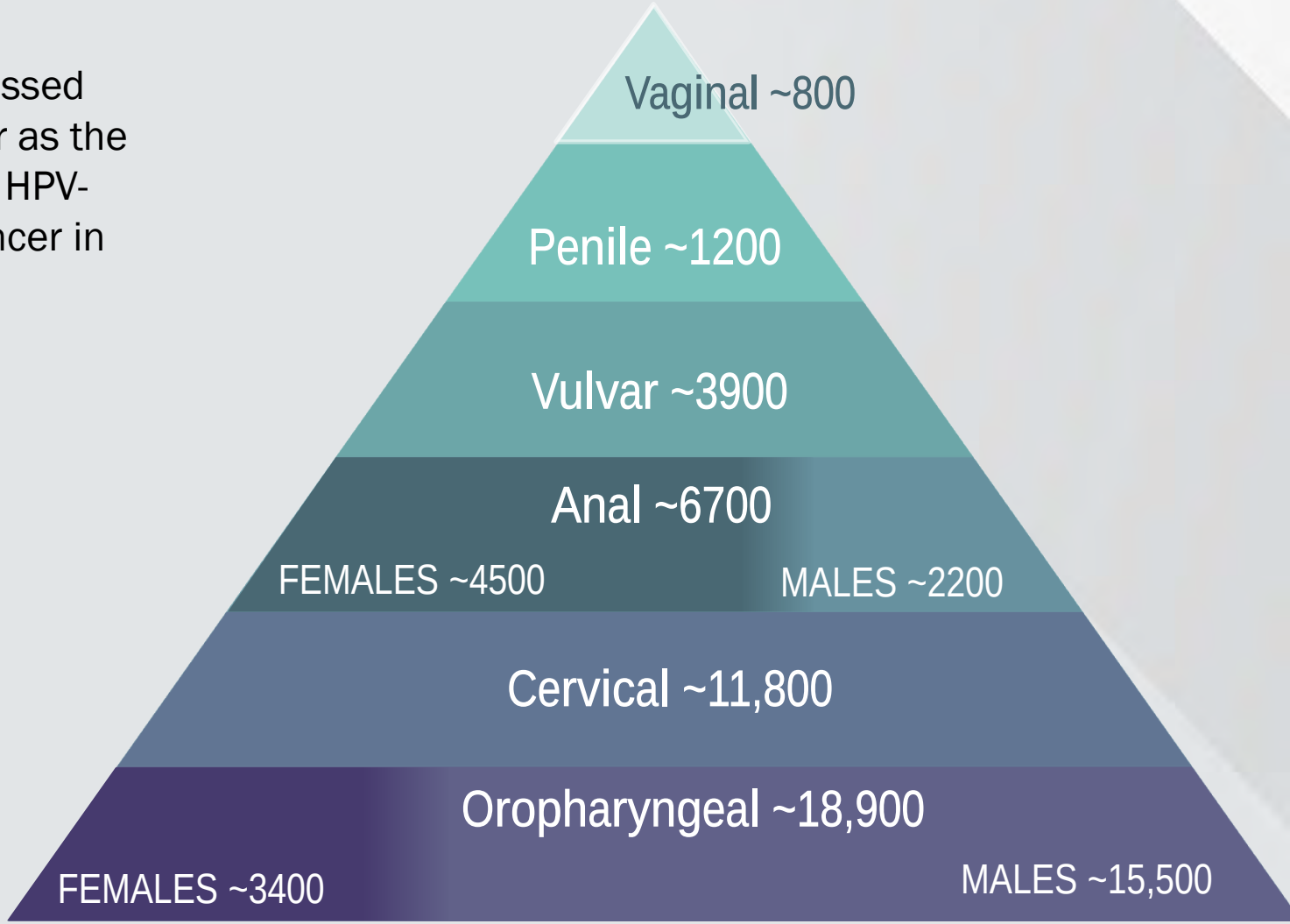


Global head and neck cancer incidence (HPV-associated)



U.S. HPV-associated cancers

OPC has surpassed cervical cancer as the most common HPV-associated cancer in the U.S.

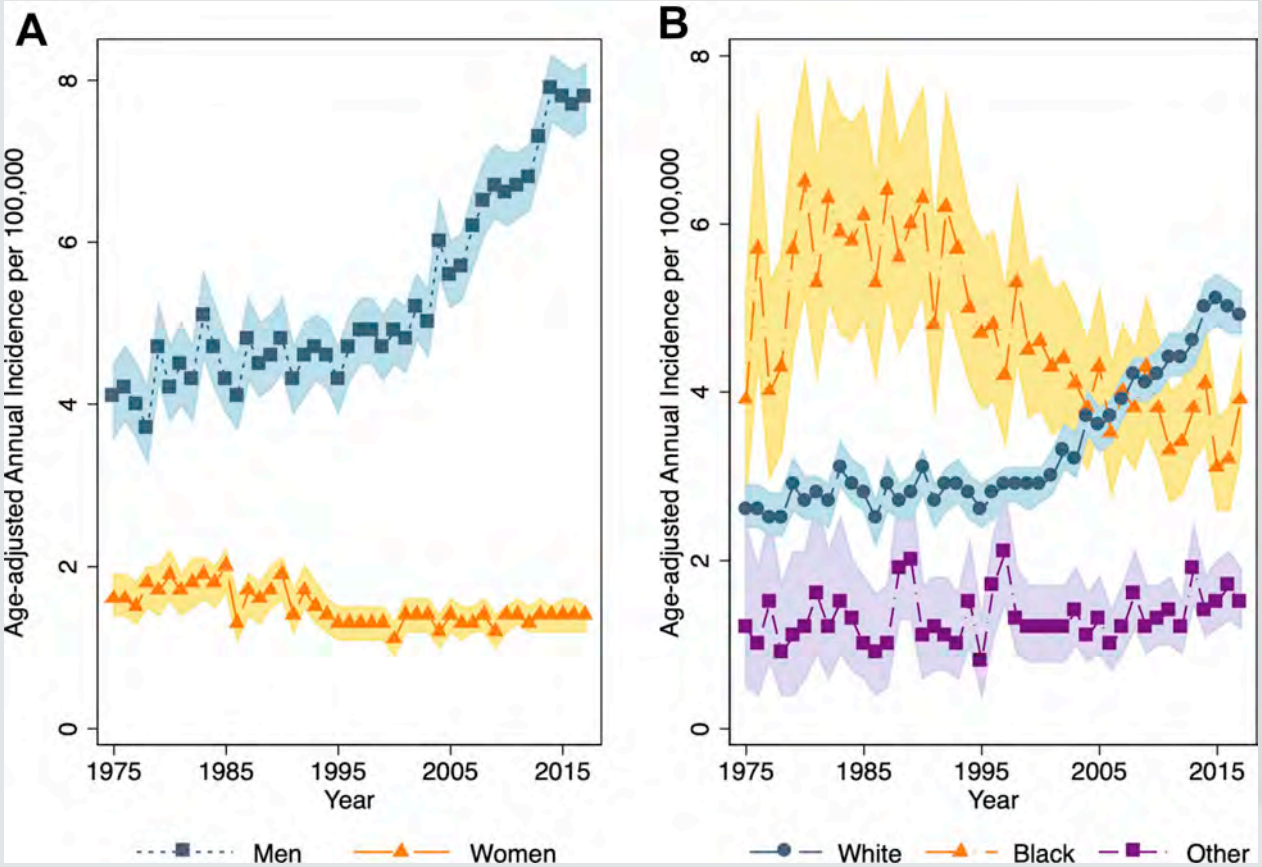


HPV-associated OPC

In 2000 OPC began to increase among white males, despite decreased smoking rates

OPC is most common among middle to older aged men

OPC is projected to continue this trend, with >30,000 new cases by 2029



Incidence rates of OPC per 100,000 adjusted to the 2000 US Standard Population. Shaded regions are 95% confidence intervals

Prevention of HPV-associated cancers

3 types of prevention

Primary: disease is prevented from ever developing

Secondary: disease is detected early

Tertiary: existing disease is managed to prevent complications

Primary Prevention of HPV-associated cancers

HPV vaccines prevent infection with High-risk HPV and Low-risk HPV in men and women

Bivalent: HPV 16/18

Quadrivalent: HPV 16/18/6/11

9-valent: HPV 16/18/6/11/31/33/45/52/58

HPV Vaccination

Works best prior to ANY exposure

Recommendations:

- Routine at age 11-12 (as young as 9)
- Through age 26
- Some adults 27-45 with clinician guidance
  - Most sexually active adults have already been exposed, *though not to all types*
  - *A new partner is a risk for infection, AT ANY AGE*

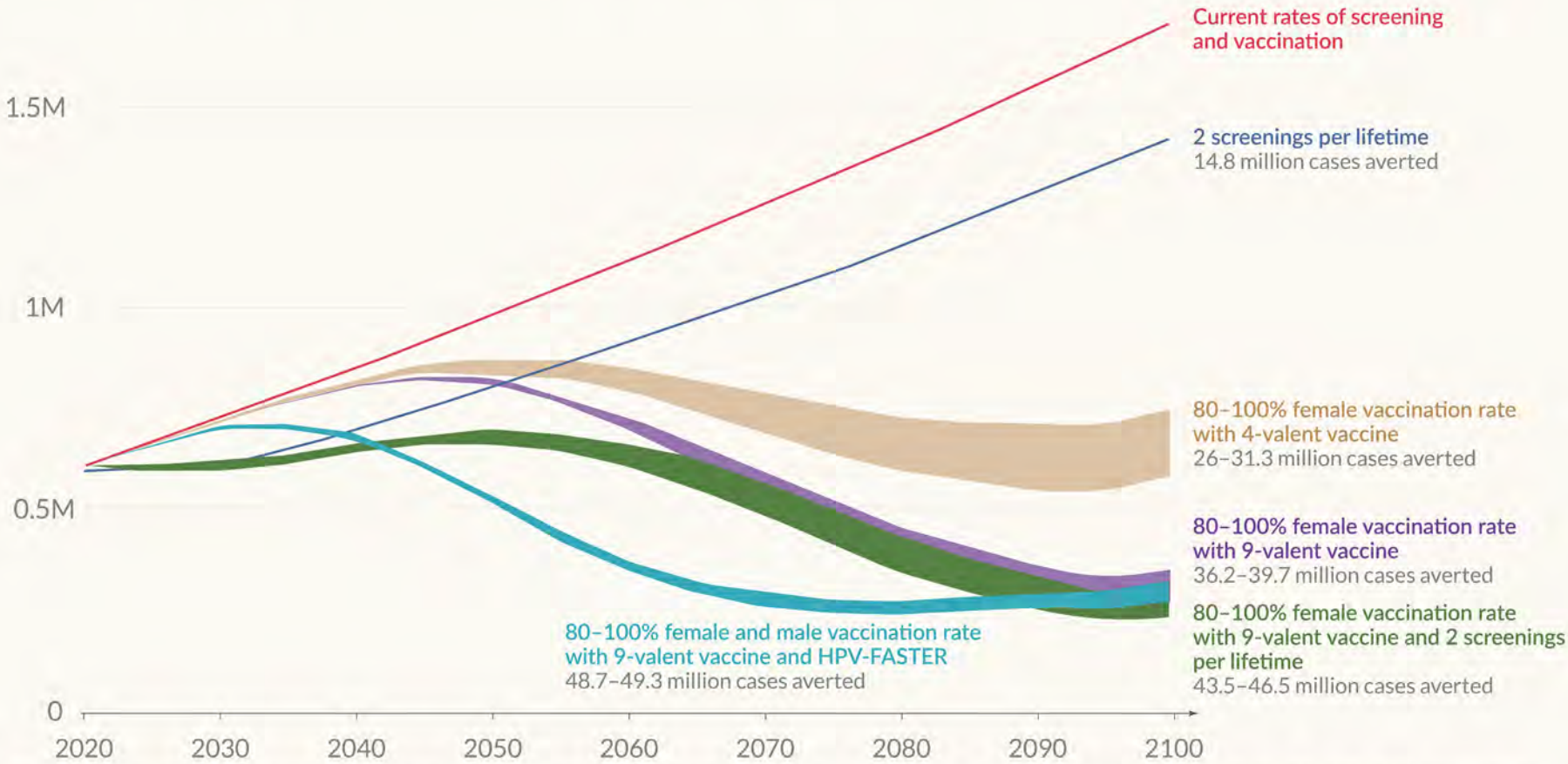
CDC: https://www.cdc.gov/vaccines/vpd/hpv/hcp/recommendations.html

Vaccine Effectiveness

Scaling up HPV vaccination could prevent millions of cervical cancer cases worldwide

Our World in Data

Annual global number of cervical cancer cases, estimated under different hypothetical scenarios



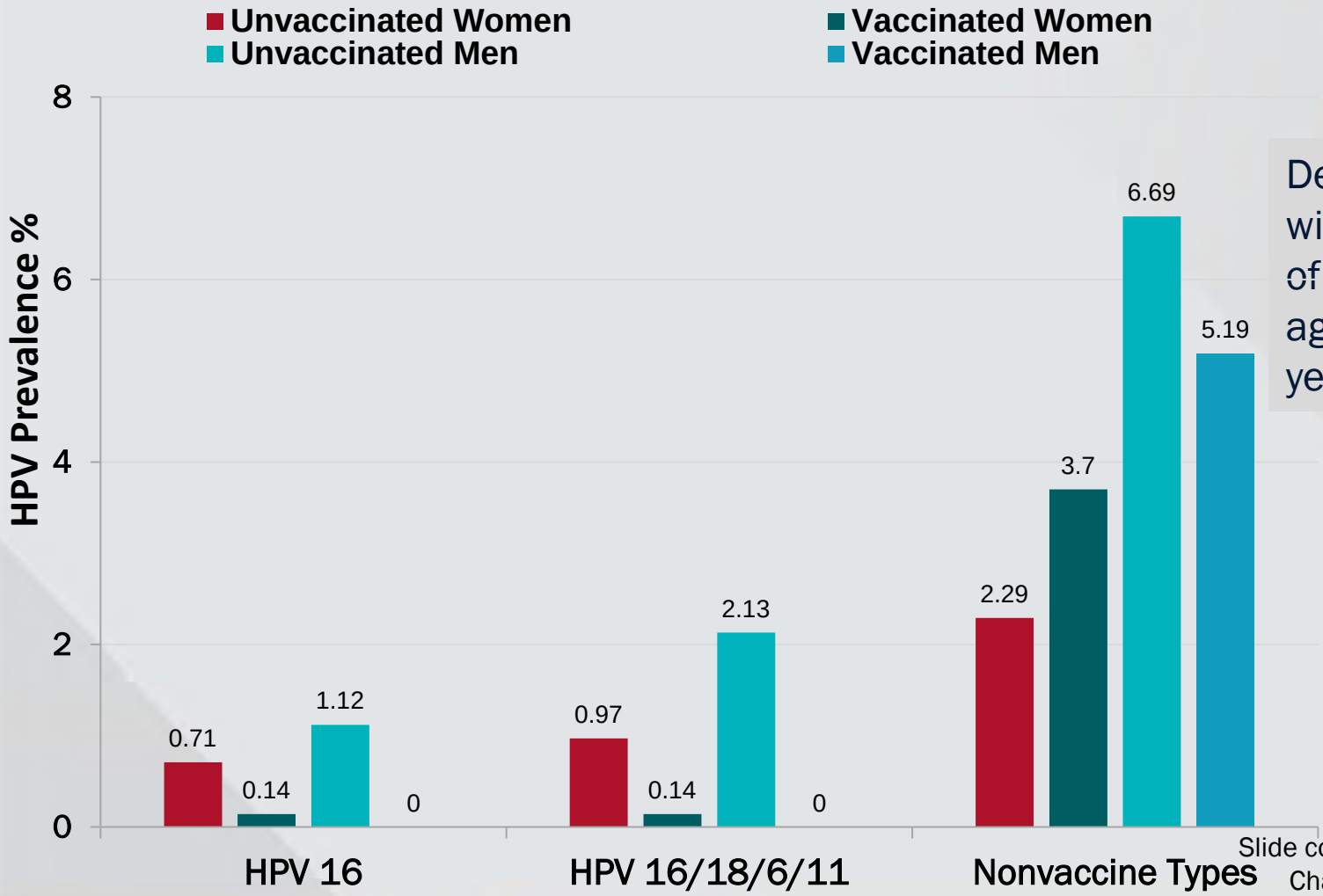
Note: Shaded regions correspond to ranges of inputs. HPV-FASTER refers to catch-up vaccination programs for people aged 16–49, with 70% vaccination.
Source: Kate T. Simms et al. (2019) Impact of scaled up human papillomavirus vaccination and cervical screening and the potential for global elimination of cervical cancer in 181 countries, 2020–99: a modelling study. *The Lancet Oncology.*

Adult HPV Vaccination

4vHPV Vaccine reduces recurrence of:	abnormal paps by 70-80%
	genital warts by 75%
	vulvar pre-cancer by 78%
	anal precancer (males) by 52%
	genital warts (males) by 50%

1. Swedish KA et al. *Clin Infect Dis*. 2012;54:891–898; **2.** Swedish KA et al. *PLoS One*. 2014;9:e93393. **3.** Kang WD et al. *Gynecol Oncol*. 2013;130:264–268. **4.** Ghelardi A et al. *Gynecol Oncol*. 2018;151:229–234. **5.** Pieralli A et al. *Arch Gynecol Obstet*.. 2018;298:1205–1210; **6.** Ghelardi A et al. Vaccines 2021; 9:83-94.

Oral HPV decline ages 18-33 post-vaccination, USA



Declines even with only ~18% of US population ages 18-33 years vaccinated

Slide courtesy of Anna Giuliano
Chaturvedi et al, *JCO* 2018

HPV Vaccine: A lesson in bad marketing

Vaccine Introduction

Gardasil introduced in 2006 (quadrivalent)

- 60-70% cancer risk reduction

Gardasil 9 approved by the FDA in 2014

- 90% of all cervical cancer

FDA provisional approval for oral HPV protection in 2020

Barriers to Vaccine uptake

Sensationalist coverage

Cost and access

Suspicion of pharmaceutical motive

Religious/moral concern

The impact of national barriers

Australia	UK	Japan
Prerequesite for school registration	*Completely covers vaccination*	*Unverified media reports of side effects led to withdrawal from national insurance*
>70% coverage among school age children	*>88% of 12-13 yr old females*	*Plummeting rates: 70% to 0.6%*

U.S. HPV Vaccine Uptake

Remains mediocre

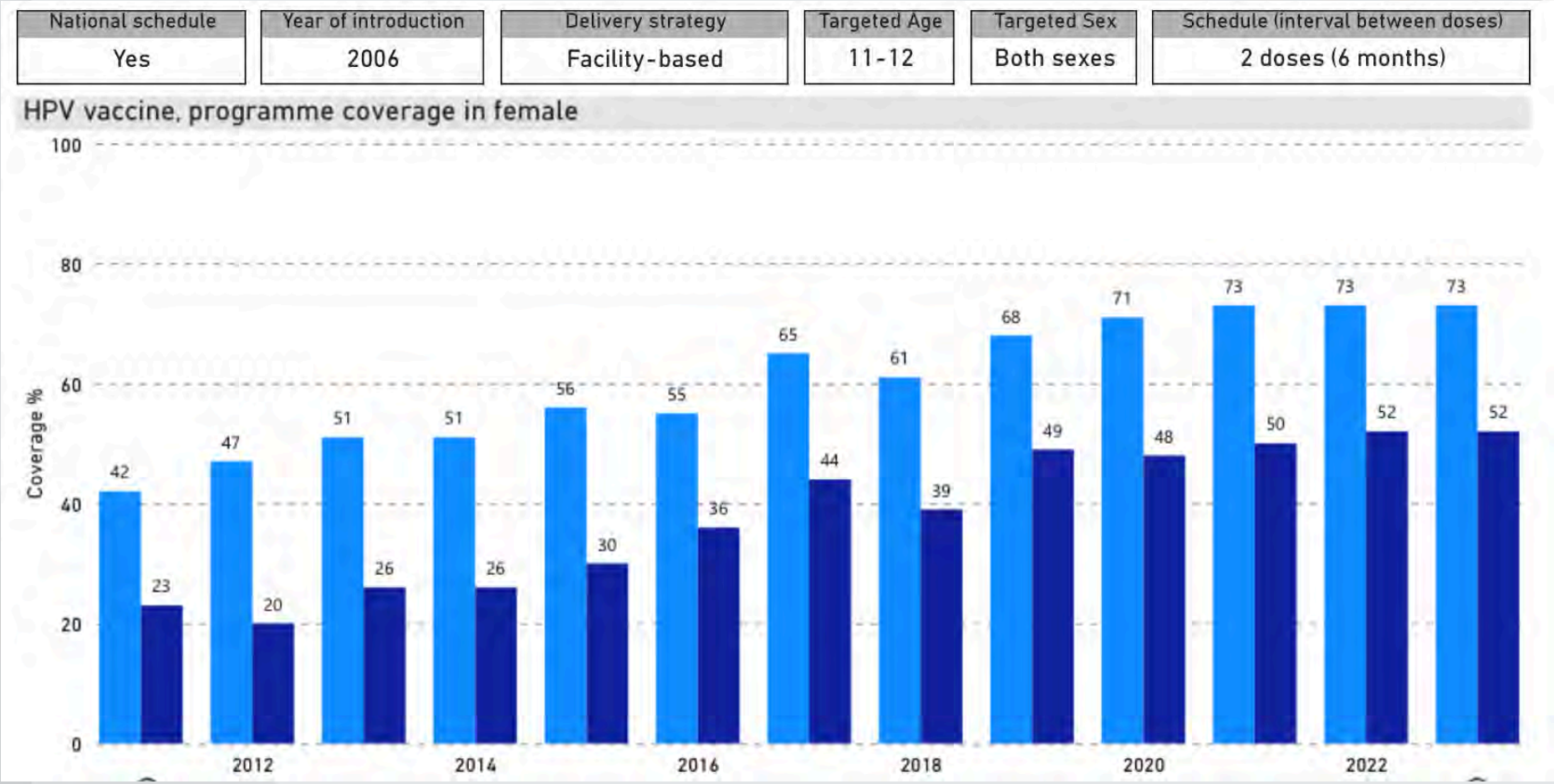
>50% of eligible teens have not complete vaccination

Compared to 88% receipt of Tdap

Some areas <15%

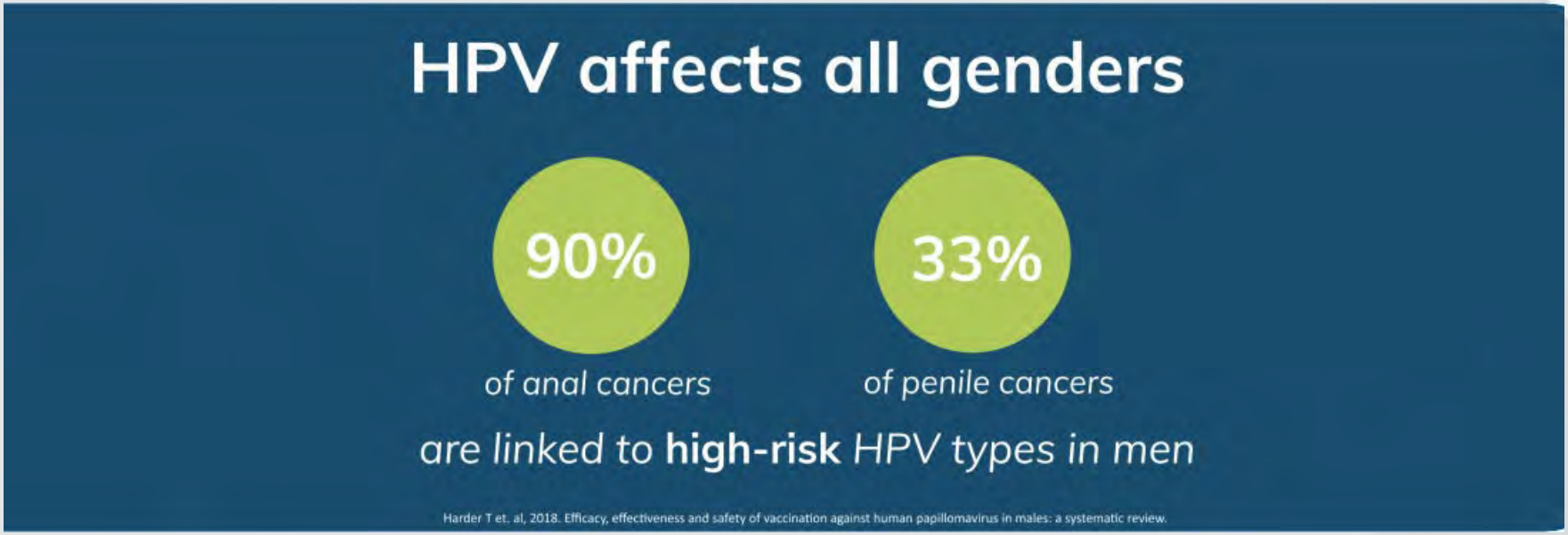
HPV Vaccine Coverage (US)

National schedule	Year of introduction	Delivery strategy	Targeted Age	Targeted Sex	Schedule (interval between doses)
Yes	2006	Facility-based	11-12	Both sexes	2 doses (6 months)



*Light blue represents one dose; Dark blue represents complete uptake (all doses)

HPV vaccine awareness

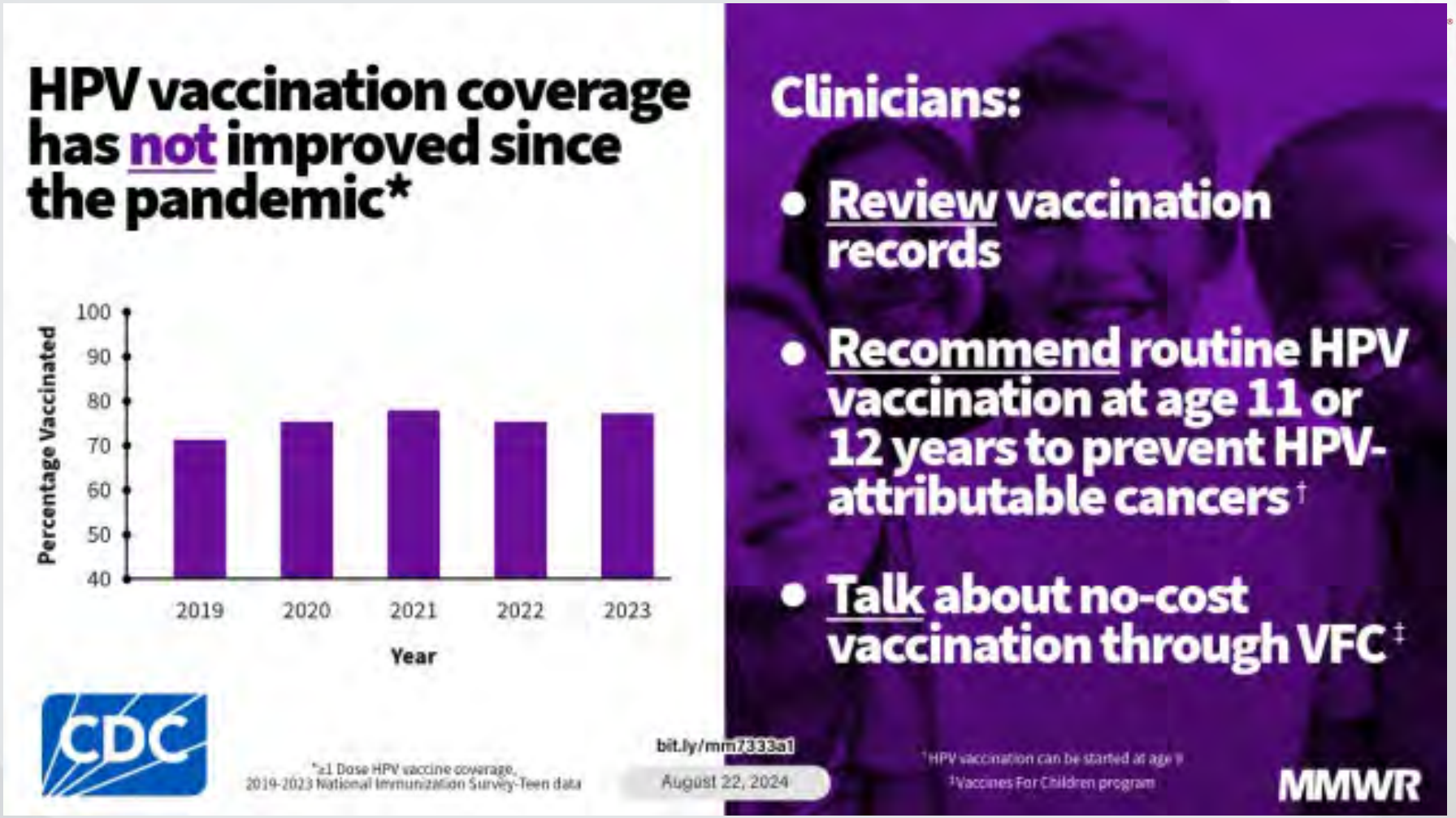


42% of Americans believe HPV is more common in women

- 1 in 3 sexually active men are HPV reservoirs

45% didn't know HPV was linked to cancer beyond cervical cancer

https://cancerletter.com/clinical/20250307_3/



CDC estimates 60% of qualifying children have received the vaccine

- Rates fell by 75% during the pandemic

https://cancerletter.com/clinical/20250307_3/

Interventions to improve HPV vaccine uptake

- Educational interventions show minimal effects
- Measures to increase access and availability are most effective
- School-based programs show promise
- Reducing the financial burden increases uptake

Walling, E. B., Benzoni, N., Dornfeld, J., Bhandari, R., Sisk, B. A., Garbutt, J., & Colditz, G. (2016). Interventions to improve HPV vaccine uptake: a systematic review. *Pediatrics*, *138*(1).

“Positive health messages to counter fear, uncertainty, and doubt”

5 Key Steps to Improve HPV Vaccination Rates

LEARN

HPV vaccination helps prevent certain cancers

INFORM

Ensure staff delivers accurate and consistent HPV vaccination messages

COMMUNICATE

Share benefits of HPV vaccination with patients at every opportunity

RECOMMEND

Offer HPV along with other routine vaccines (same way, same day)

VACCINATE

Develop routine procedures to reduce missed opportunities

HPV Vaccination = Cancer Prevention

National Foundation of Infectious Diseases https://www.nfid.org/resource/5-key-steps-to-improve-hpv-vaccination-rates/

HPV Vaccine Messaging

Emphasize cancer, not STDs

Cervical cancer is preventable

Compare cervical cancer to other {non-vaccine preventable} cancers

Appeal to moral responsibility to prevent cancer

Normalize HPV as part of normal vaccination routine

Emphasize vaccine uptake among males

Tailored messaging (i.e. culturally credible messengesrs)

Talking to Parents about HPV Vaccine

HPV VACCINE IS CANCER PREVENTION

Recommend HPV vaccination in the **same way** and on the **same day** as all adolescent vaccines. You can say, "Now that your son is 11, he is due for vaccinations today to help protect him from meningitis, HPV cancers, and whooping cough. Do you have any questions?" Taking the time to listen and understand parents' concerns can help you respond to their concerns more effectively.

Why does my child need HPV vaccine?

HPV vaccine is important because it prevents infections that can cause cancer. That's why we need to start the shot series today.

How do you know the vaccine works?

Studies continue to prove HPV vaccination works extremely well, decreasing the number of infections and HPV precancers in young people since it has been available.

Why do they need HPV vaccine at such a young age?

Vaccines protect your child before they are exposed to a disease. That's why we give the HPV vaccine earlier rather than later, to protect them long before they are ever exposed.

Also, if your child gets the shot now, they will only need two doses. If you wait until your child is older, they may end up needing three shots.

Why do boys need the HPV vaccine?

HPV vaccination can help prevent future infections that can lead to cancers of the penis, anus, and back of the throat in men.

Are all of these vaccines actually required?

I strongly recommend each of these vaccines and so do experts at the CDC and major medical organizations. School entry requirements are developed for public health and safety, but don't always reflect the most current medical recommendations for your child's health.

What diseases are caused by HPV?

Some HPV infections can cause cancer—like cancer of the cervix or in the back of the throat—but we can protect your child from these cancers in the future by getting the first HPV shot today.

Is my child really at risk for HPV?

HPV is a very common infection in women and men that can cause cancer. Starting the vaccine series today will help protect your child from the cancers and diseases caused by HPV.

I'm worried my child will think that getting this vaccine makes it OK to have sex.

Studies tell us that getting HPV vaccine doesn't make kids more likely to start having sex. I made sure my child (or grandchild, etc.) got HPV vaccine, and I recommend we give your child her first HPV shot today.

I'm worried about the safety of HPV vaccine. Do you think it's safe?

Yes, HPV vaccination is very safe. Like any medication, vaccines can cause side effects, including pain, swelling, or redness where the shot was given. That's normal for HPV vaccine too and should go away in a day or two. Sometimes kids faint after they get shots and they could be injured if they fall from fainting. We'll have your child stay seated after the shot to help protect him/her.

Can HPV vaccine cause infertility in my child?

There is no evidence available to suggest that getting HPV vaccine will have an effect on future fertility. However, women who develop an HPV precancer or cancer could require treatment that would limit their ability to have children.

For more information, visit
cdc.gov/vaccines/conversations

Secondary Prevention

CERVICAL CANCER SCREENING RECOMMENDED TESTS

Ages
25-65

Screening for cervical cancer is recommended for individuals with a cervix aged 25 to 65 years.

Every
5 years

Primary HPV testing (HPV testing without the Pap test) every 5 years is the preferred method of testing through age 65.

Using HPV testing in combination with a Pap test (called cotesting) every 5 years or Pap tests alone every 3 years are also acceptable testing options.

Cervical Cancer Screening for Individuals at Average Risk: 2020 Guideline Update from the American Cancer Society
CA Cancer J Clin. DOI: 10.3322/caac.21628

American Cancer Society®

Shifting screening guidelines

HPV testing has improved screening sensitivity and specificity for HSIL and/or cancer

TABLE 3

Cervical cancer screening recommendations, ACOG, ASCCP, USPSTF

	ACOG[17]	ASCCP[18]	USPSTF[19]
Pap only	Every 3 years	Every 3 years	Every 3 years
Pap-HPV cotest	Every 5 years, age 30–65	Every 5 years, age 30–65	Every 5 years, age 30–65
High-risk HPV only	Every 3 years, age > 25	Every 3 years, age > 25	Every 5 years, age 30–65

ACOG = American College of Obstetricians and Gynecologists; ASCCP = American Society for Colposcopy and Cervical Pathology; HPV = human papillomavirus; USPSTF = US Preventive Services Task Force

USPSTF Guidelines: https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/cervical-cancer-screening

Optimizing Cervical Cancer Screening

Different specimen collections

- Urine, self-swab

Alternative markers

- mRNA, DNAm

AI-based screening

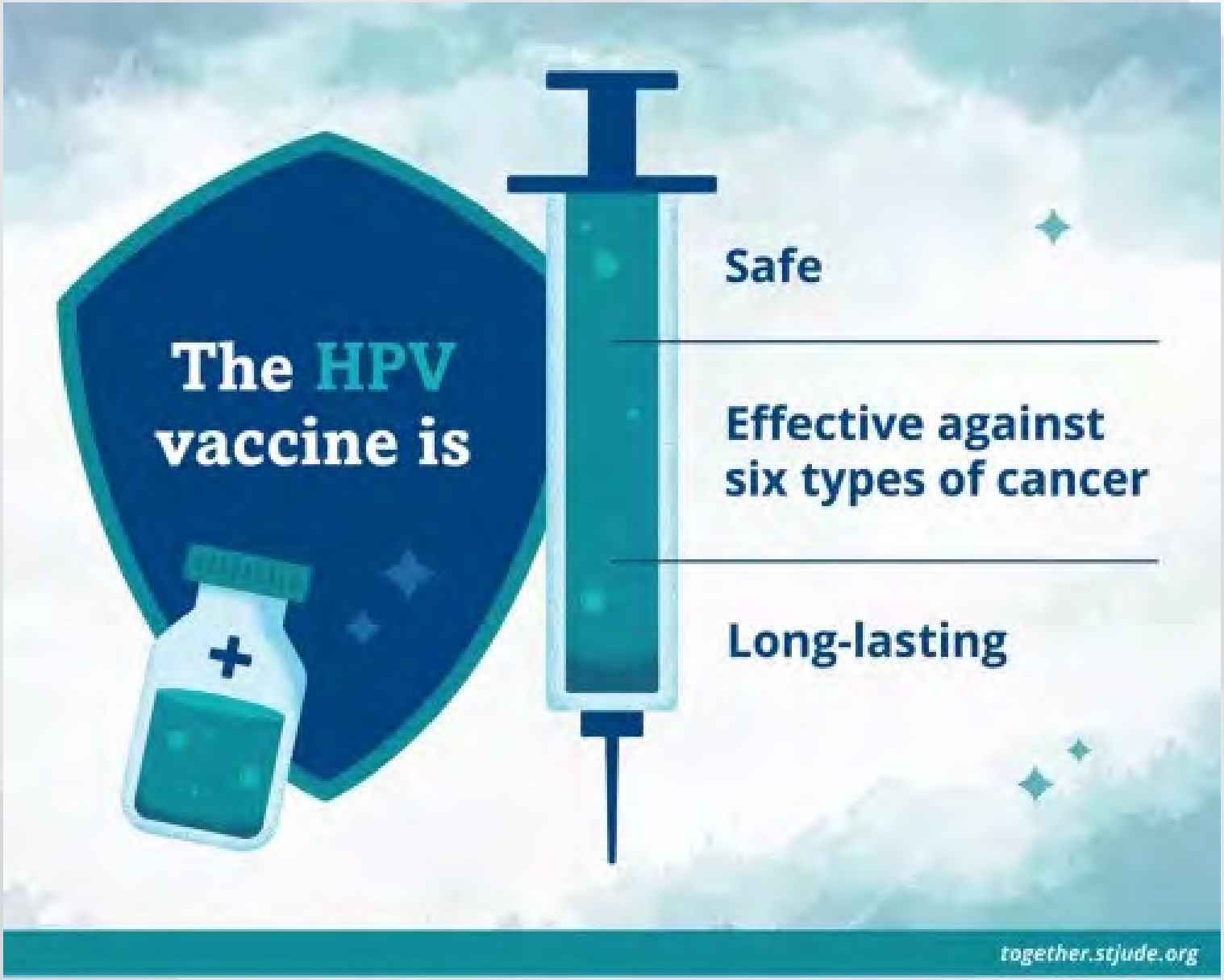
- Digital colposcopy

Secondary Prevention of HPV-associated cancers

Clinical screening tests are only available for cervical cancer

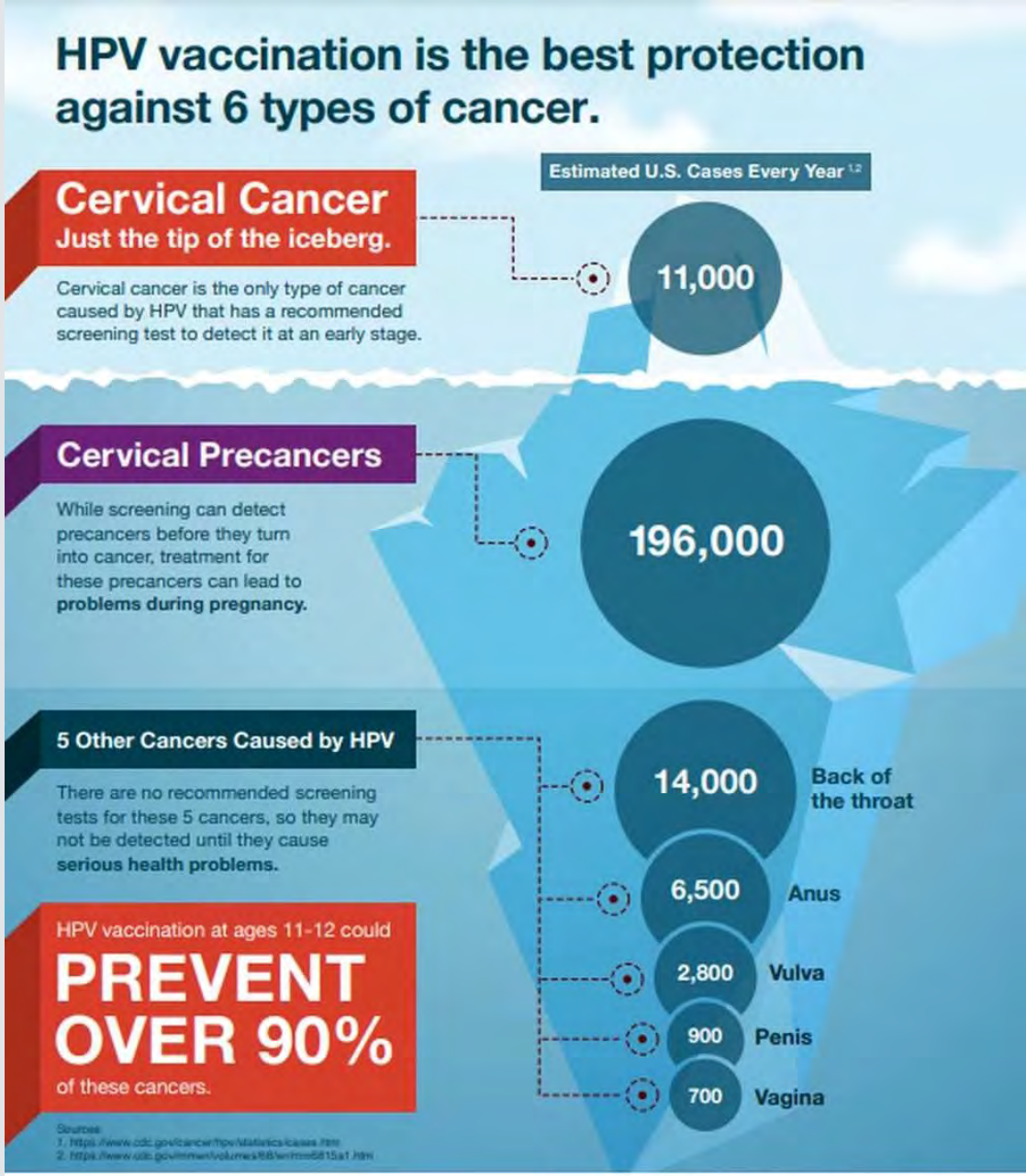
Screening for anal cancer in research and trials

Screening for other cancers is difficult due to lack of pre-cancerous lesion


The HPV vaccine is
Safe
Effective against six types of cancer
Long-lasting
together.stjude.org

When it comes to HPV, cervical cancer is just the tip of the iceberg

https://fhsid.org/health-education/hpv-vaccination-is-cancer-prevention/



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https://fhsid.org/health-education/hpv-vaccination-is-cancer-prevention/

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