

# EFFICACY, EFFECTIVENESS & IMMUNOGENICITY OF A SINGLE DOSE OF HPV VACCINE IN 9-14 YEAR OLDS

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*A Comprehensive Review of the Literature with Narrative  
Synthesis of Evidence Utilised to Inform National Vaccine Policy*

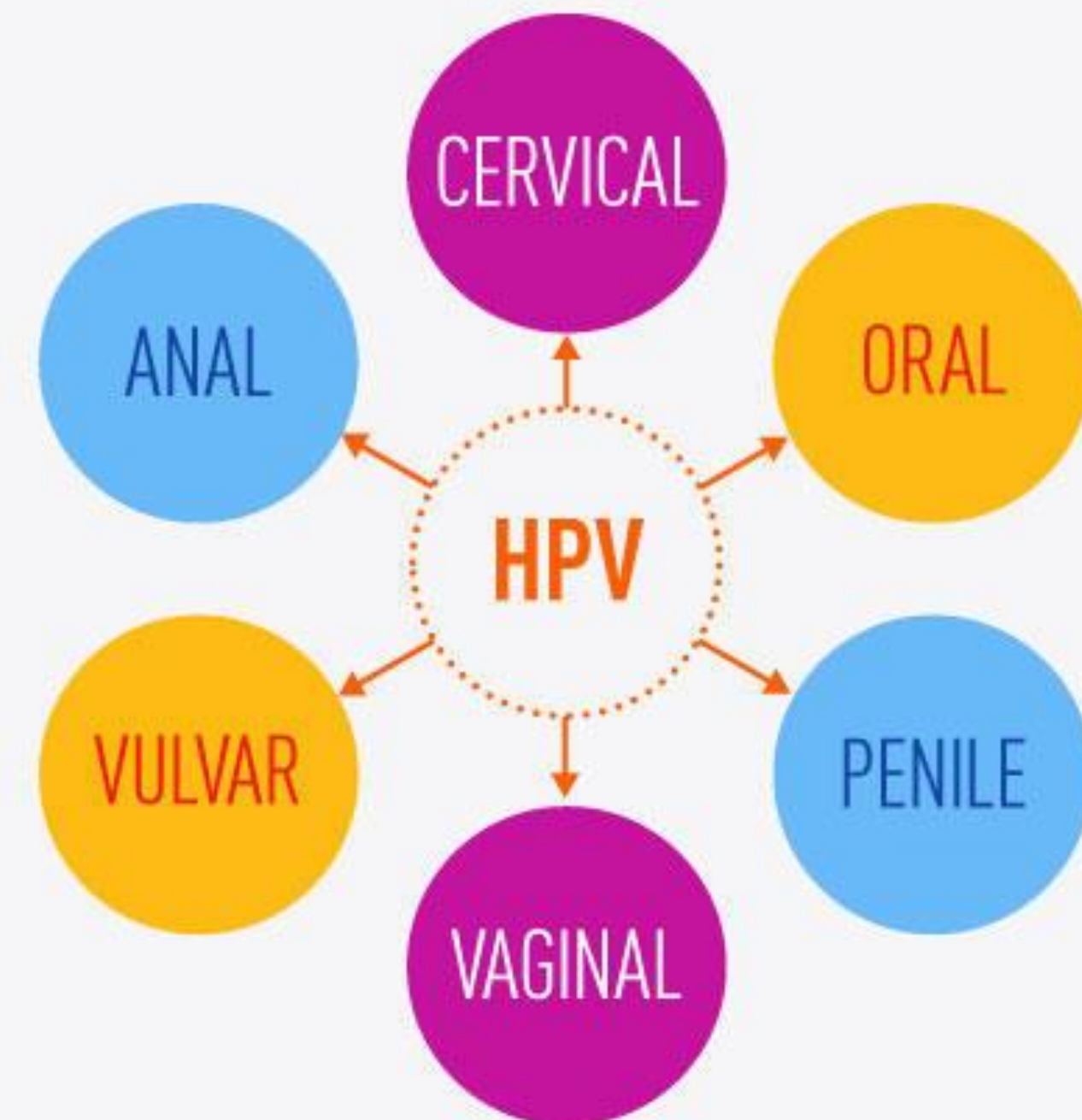
*MM Brennan, C O'Broin, LJ Jessop, K Kelleher, M Ward*



# HPV EPIDEMIOLOGY

- >100 types of human papillomaviruses
- Main mode of transmission is sexual
- Anogenital HPV is the most common STI worldwide.
- >90% infected clear the infection
- Persistent, oncogenic HPV infection is causally associated with anogenital and oropharyngeal cancers
- 4.5% of all cancers worldwide are attributable to HPV; >80% of which are cervical cancer

## HUMAN PAPILLOMAVIRUS CAN CAUSE SEVERAL TYPES OF CANCER



[cancer.gov/hpv](https://www.cancer.gov/hpv)

National Cancer Institute, 2022



# HPV VACCINES

- First HPV vaccine was licensed in 2006 and there are now 3 available
- Prophylactic, sub-unit vaccines
- Substantial population impact
- HPV vaccine schedule has been reduced before; 2014; 3 → 2 doses

...Can we go to 1 dose now?



2V



4V



9V



# IRISH CONTEXT

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- ▶ HPV vaccine in Irish immunisation schedule;

2010; girls in 1st year of secondary school (age ~12)

2019; gender neutral programme

- ▶ National uptake of 2 doses of the HPV vaccine in the schools programme in 2020/2021: 76.6%

- ▶ Lower uptake has been reported in disadvantaged schools (DEIS)





Global strategy to accelerate the elimination of cervical cancer as a public health problem

# WHO STRATEGIC PLAN FOR CERVICAL CANCER ELIMINATION



**90%**

of girls fully **vaccinated** against HPV by 15 years of age

**70%**

of women are **screened** with a high-performance test by 35 and 45 years of age

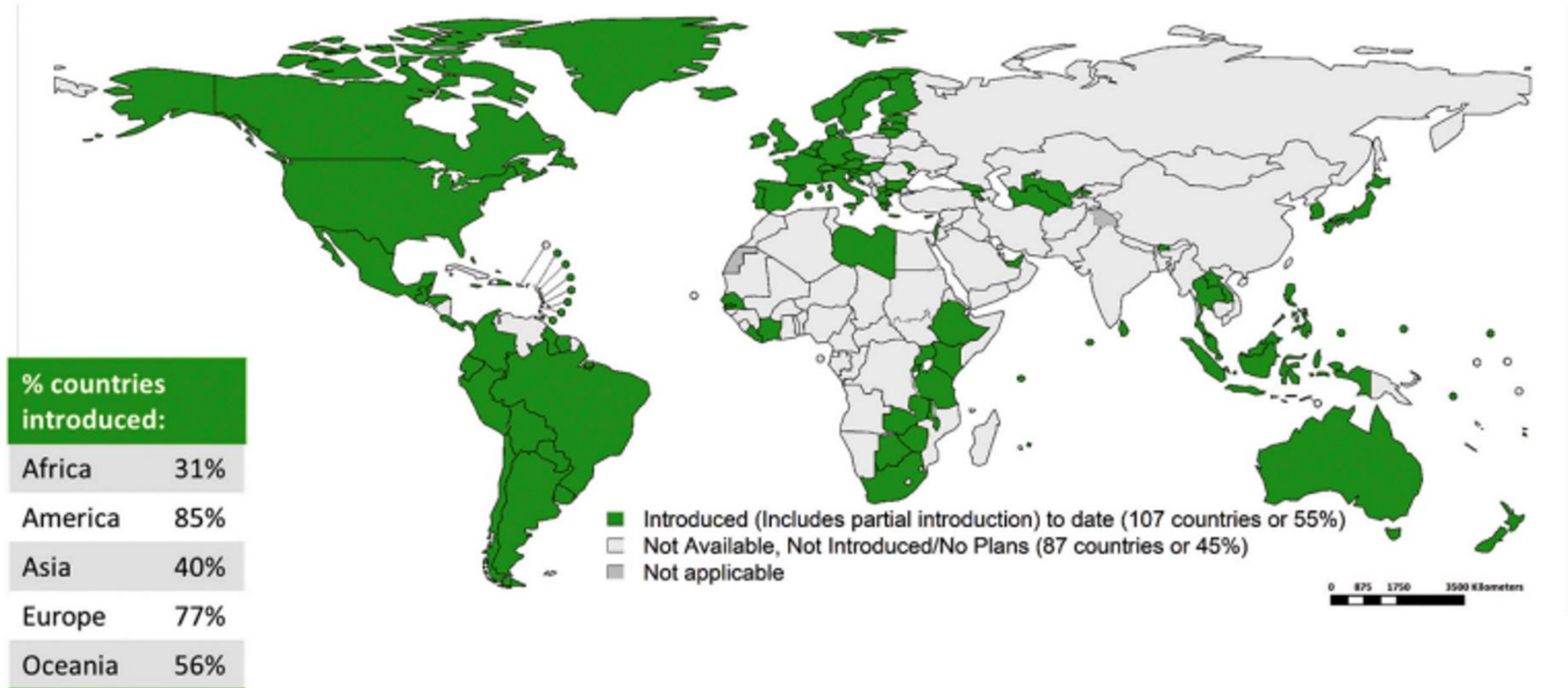
**90%**

of women identified with cervical disease receive **treatment** for precancerous lesions or invasive cancer





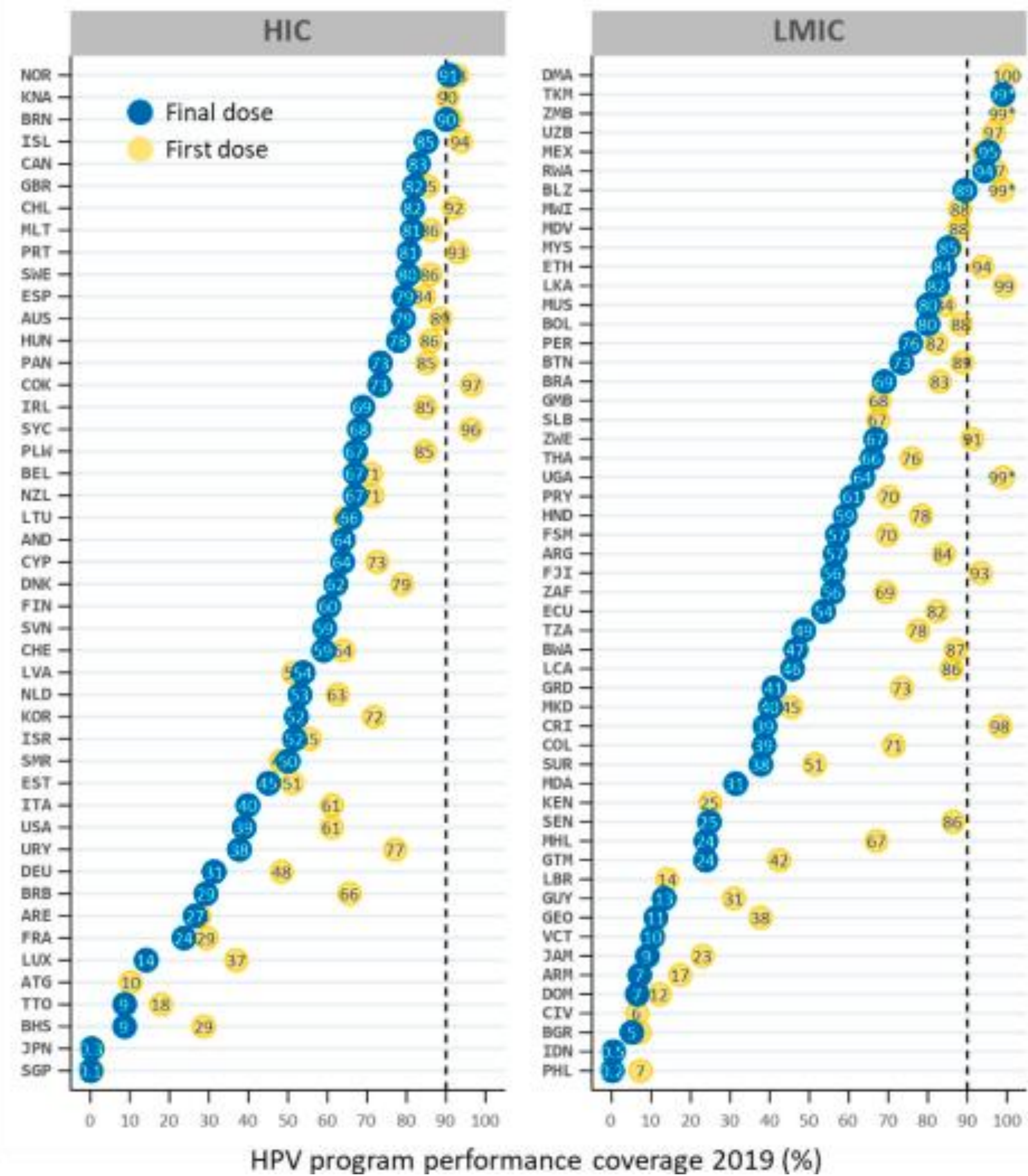
# GLOBAL INTRODUCTION OF THE HPV VACCINE





# INTERNATIONAL HPV VACCINE PROGRAM PERFORMANCE 2019

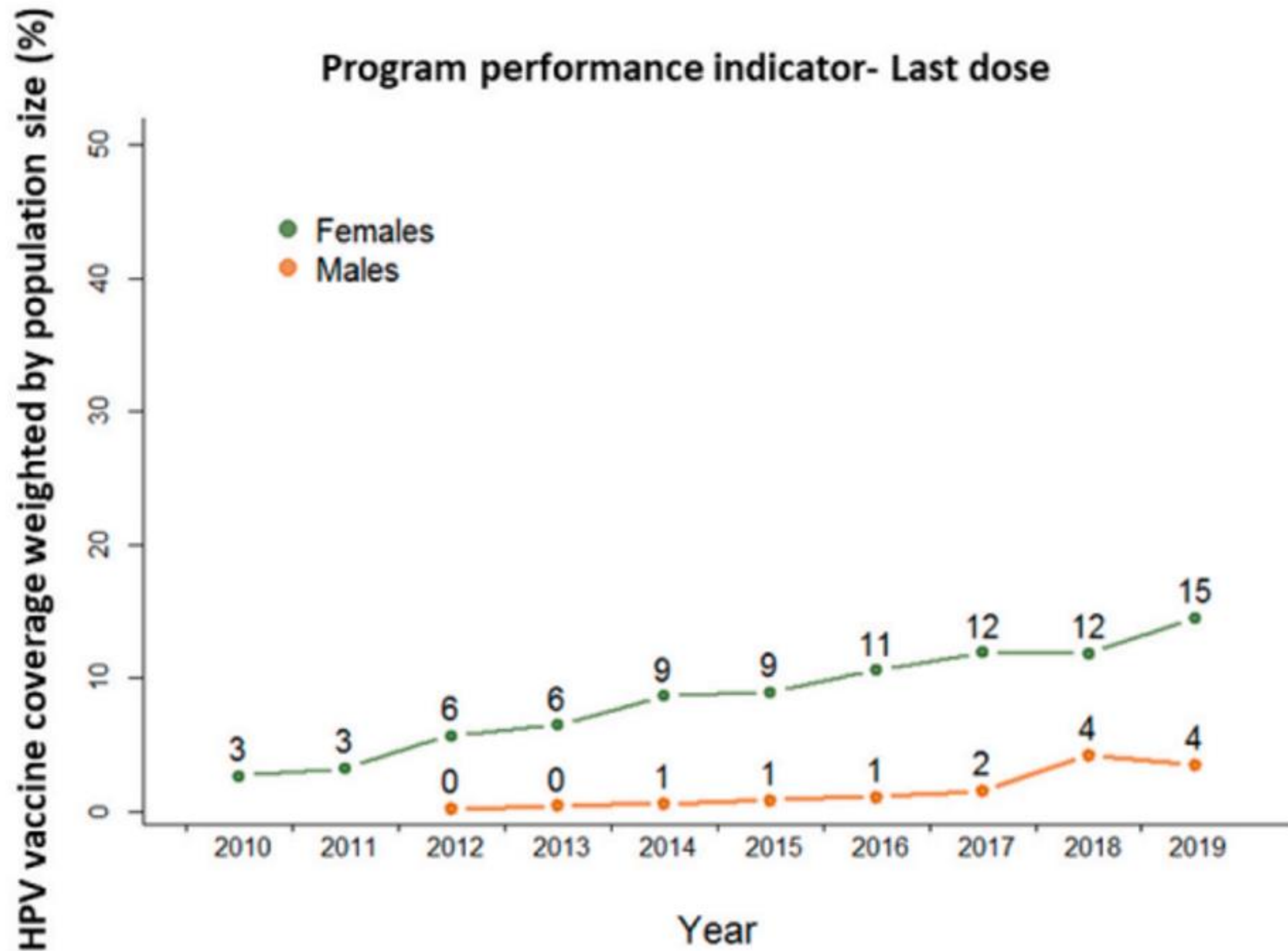
Countries



*Bruni et al, 2021*



# GLOBAL HPV VACCINATION COVERAGE



*Bruni et al, 2021*





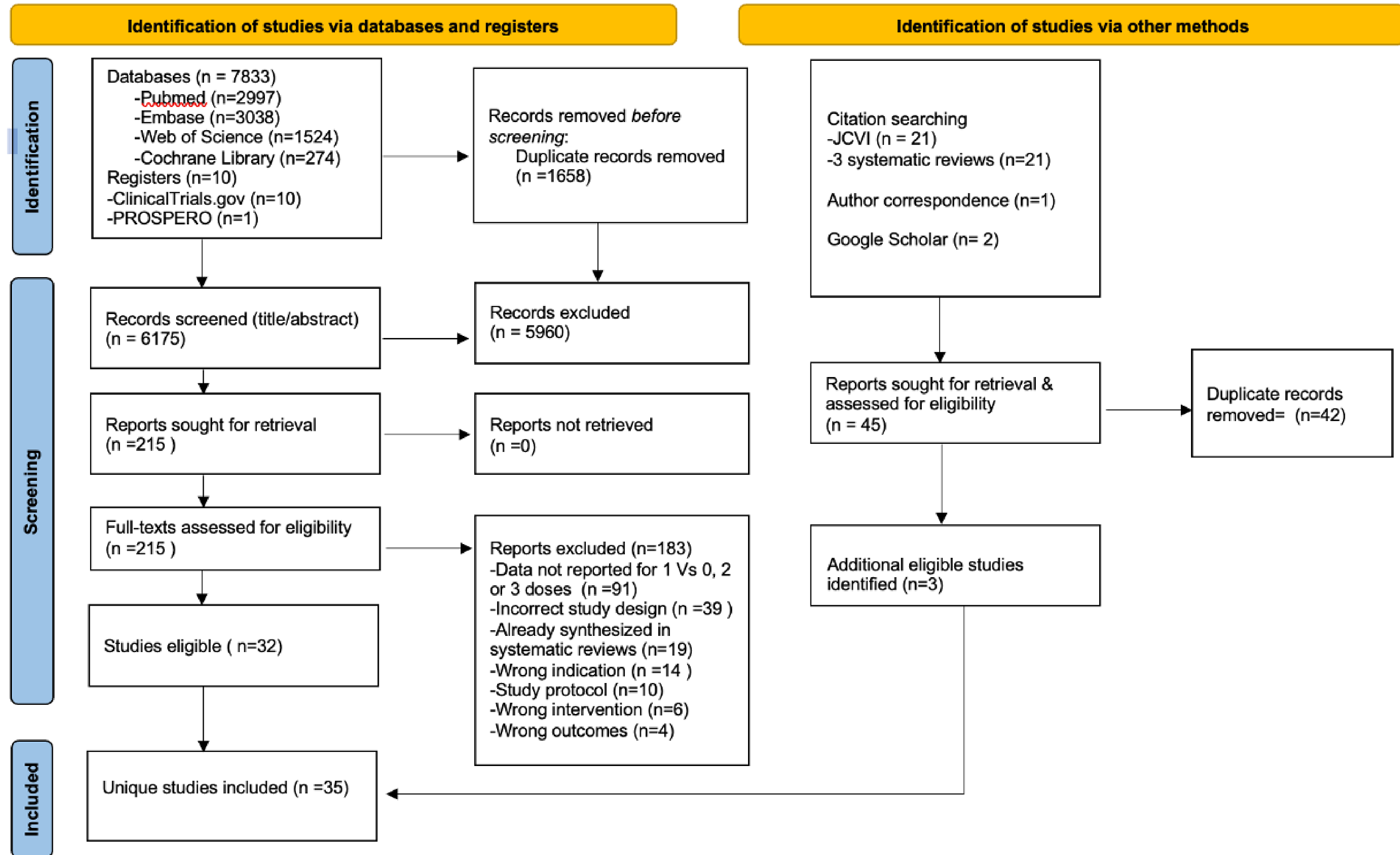
# METHODS: REVIEW QUESTION

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Population	9-14 years old
Intervention	One dose of HPV vaccine
Comparison	Two/Three/No doses of HPV vaccine
Outcomes	<ol style="list-style-type: none"><li>1. Efficacy</li><li>2. Effectiveness</li><li>3. Immunogenicity</li></ol>



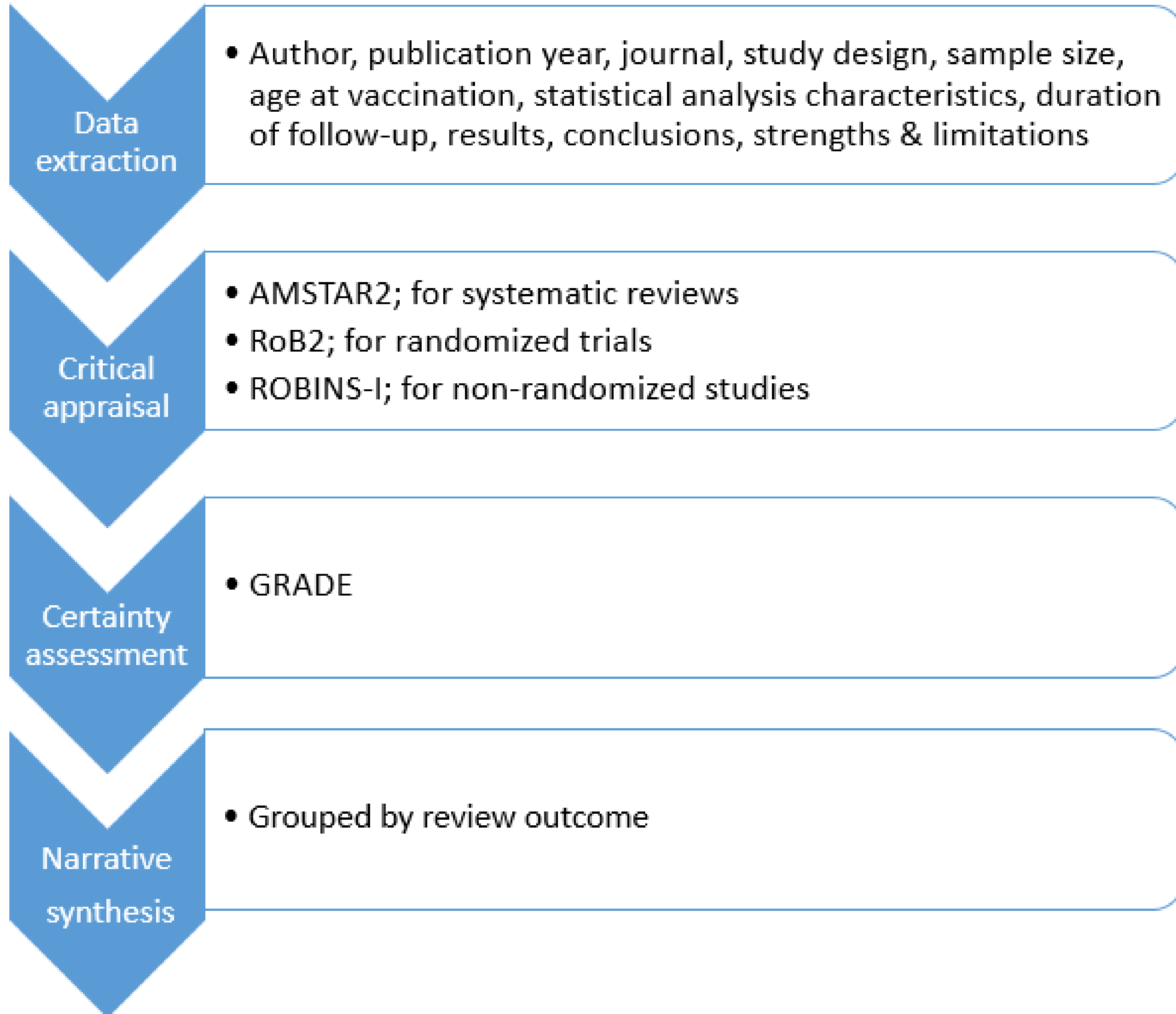
# METHODS





# METHODS

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# RESULTS: SYSTEMATIC REVIEWS (N=3)

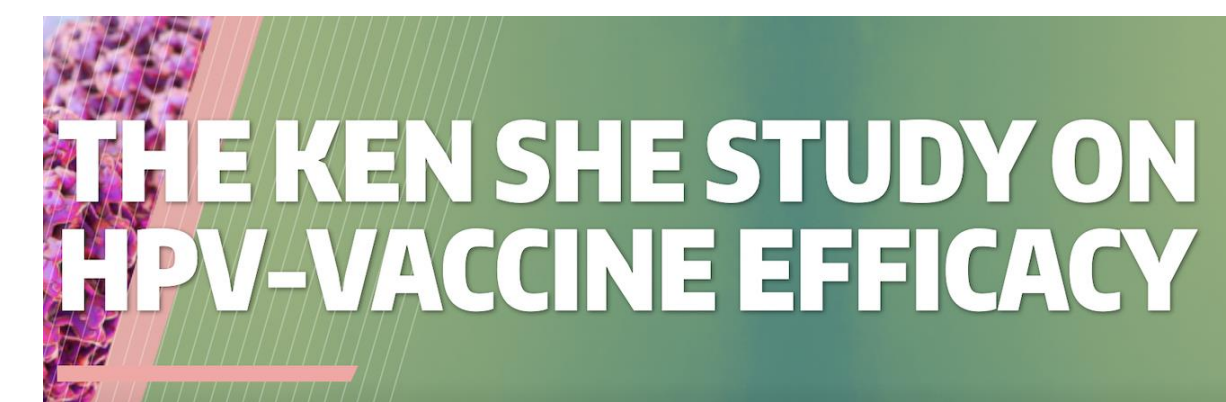
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Author, year	Study designs, N	Endpoint assessed	Evidence synthesis	Conclusion
Whitworth 2019	Observational, intervention  N=7	Efficacy & immunogenicity	Narrative	1 dose <b>may</b> be as efficacious as 2/3 but <b>more evidence needed</b>
Markowitz 2018	Observational  N=14	Effectiveness & study limitations	Narrative	<b>Higher effectiveness for 3 doses</b> than 1/2 but <b>several biases impact estimates</b>
Secor 2020	Observational, intervention  N=23	Immunogenicity	Non-inferiority analysis	<b>Antibody titres after 1 dose inferior</b> to 2/3 doses



# RESULTS: EFFICACY (N=4)

Reference	Study design	Results
Barnabas 2022	RCT	<p>VE (95%CI) at 18 months against;</p> <p>-persistent HPV 16/18  <b>1 dose 9V = 97.5% (81.7-99.7)</b>  <b>1 dose 2V = 97.5% (81.6-99.7)</b></p> <p>-persistent HPV 16/18/31/33/45/52  <b>1 dose 9V= 88.9% (68.5- 96.1)</b></p>
Basu 2021	Cohort	<p>VE (95%CI) against persistent HPV 16/18 at 10 years;</p> <p><b>1 = 95.4% (85-99.9)</b>            2 = 93.1% (77.3-99.8)            3 = 93.3% (77.5-99.7)</p>
Kreimer 2020	Post-hoc analysis	<p>VE(95%CI) against prevalent HPV 16/18 at 11 years;</p> <p><b>1 = 82.1% (40.2-97)</b>            2 = 83.8% (19.5-99.2)            3 = 80.2% (70.7-87.0)</p>
Tsang 2020	Post-hoc analysis	<p>VE (95%CI) against incident HPV 31/33/45 at 11 years.</p> <p><b>1 = 54.4% (21-73.7)</b>            3 = 64.4% (57.7-70)</p>



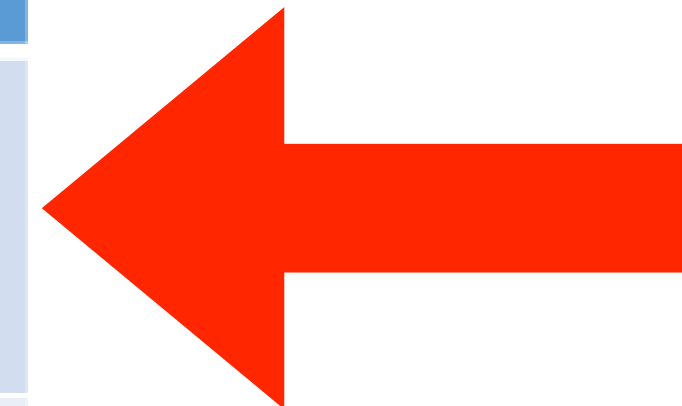
**GRADE:  
Moderate  
Certainty**



# RESULTS: EFFECTIVENESS (N=20)

Table 1: Studies with 0, 1, 2 & 3 dose arms (n=19)

Outcome	n
No significant difference between 1/2/3 doses	9
Significant 1-dose VE but significantly lower than multi-dose	4
No significant 1-dose VE	6



**GRADE:  
Low  
Certainty**

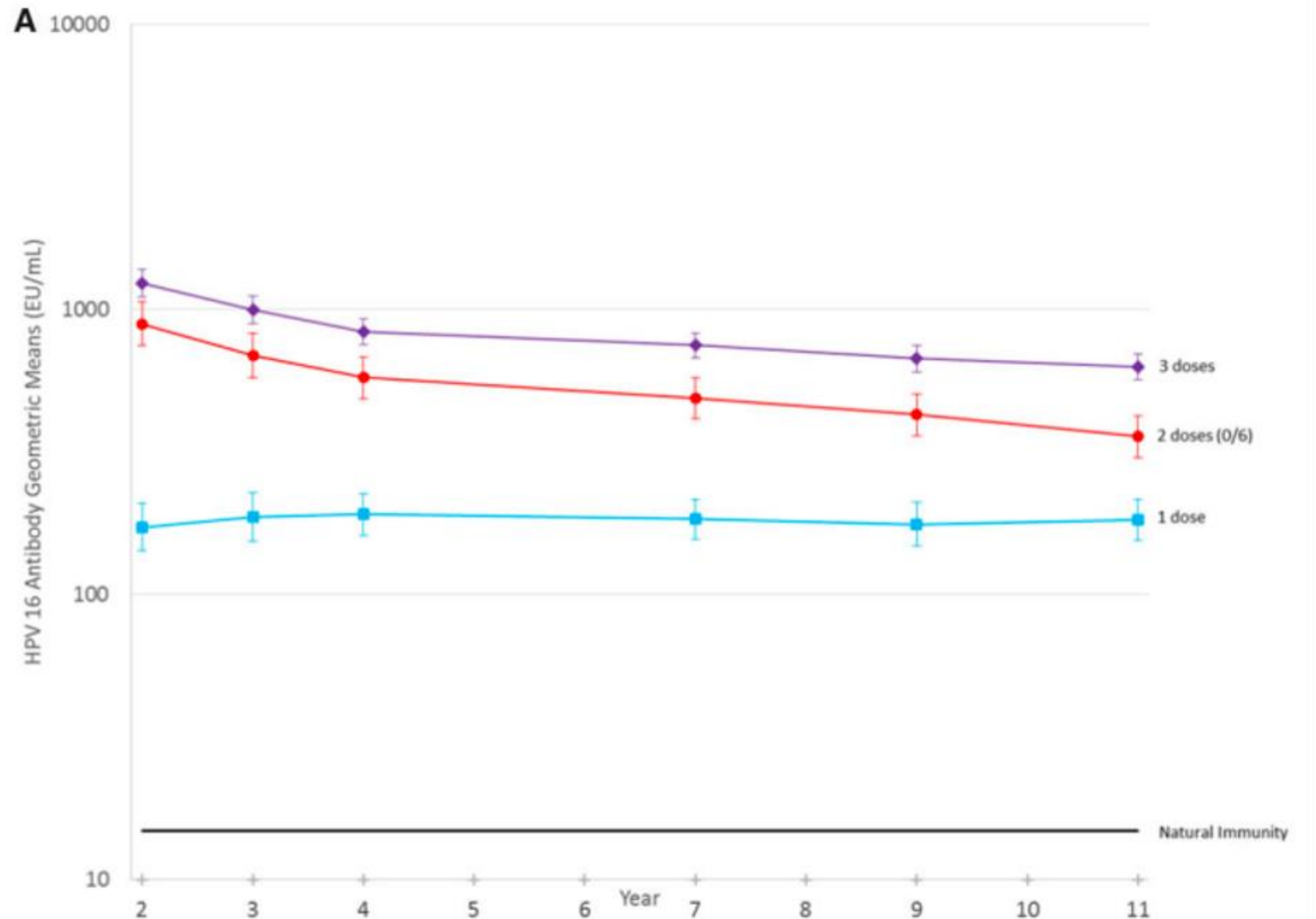
Table 2: Studies with 0 & 1 dose arms (n=1)

Reference	Results	Interpretation
Batmunkh 2020	1 dose VE= 92% (44% -99%)	High 1-dose VE but imprecise



# RESULTS: IMMUNOGENICITY (N=10)

*HPV 16 (A) antibody levels by doses received up to 11 years post-vaccination, Kreimer et al (2020)*





# CONCLUSION

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- ▶ Substantial evidence that single-dose HPV vaccination is likely to provide high levels of protection that is comparable to that provided by two or three doses and durable for at least 11 years
- ▶ Large implications for national and international public health

*Achieving the 90-70-90 targets by 2030 would result in over 62 million cervical cancer deaths averted by 2120.*

## Global Vaccine Equity



**DEIS**

[Delivering Equality Of Opportunity In Schools]  
An Action Plan for Educational Inclusion



# INTERNATIONAL VACCINE POLICY



Health Topics ▾

Countries ▾

Newsroom ▾

Emergencies

## One-dose Human Papillomavirus (HPV) vaccine offers solid protection against cervical cancer

Independent report

### JCVI statement on a one-dose schedule for the routine HPV immunisation programme

Published 5 August 2022

- “Those aged 9-14..and 15-20 may receive 1 or 2 doses.. recommended on the basis of providing comparable levels of individual protection while being more cost-effective and efficient (fewer doses per cancer case prevented)” (*Strategic Advisory Group of Experts on Immunisation, April 2022*)
- “Considers the evidence very strong that 1 dose provides similar protection to that induced by 2 doses.. advises a 1 dose schedule for the routine adolescent programme” (*Joint Committee on Vaccination and Immunisation, August 2022*)



# INTERNATIONAL VACCINE POLICY

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2022, 97, 645–672

No 50



**World Health  
Organization**

**Organisation mondiale de la Santé**

## Weekly epidemiological record Relevé épidémiologique hebdomadaire

16 DECEMBER 2022, 97th YEAR / 16 DÉCEMBRE 2022, 97<sup>e</sup> ANNÉE

No 50, 2022, 97, 645–672

<http://www.who.int/wer>

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vaccines: WHO position  
paper (2022 update)

**Human papillomavirus  
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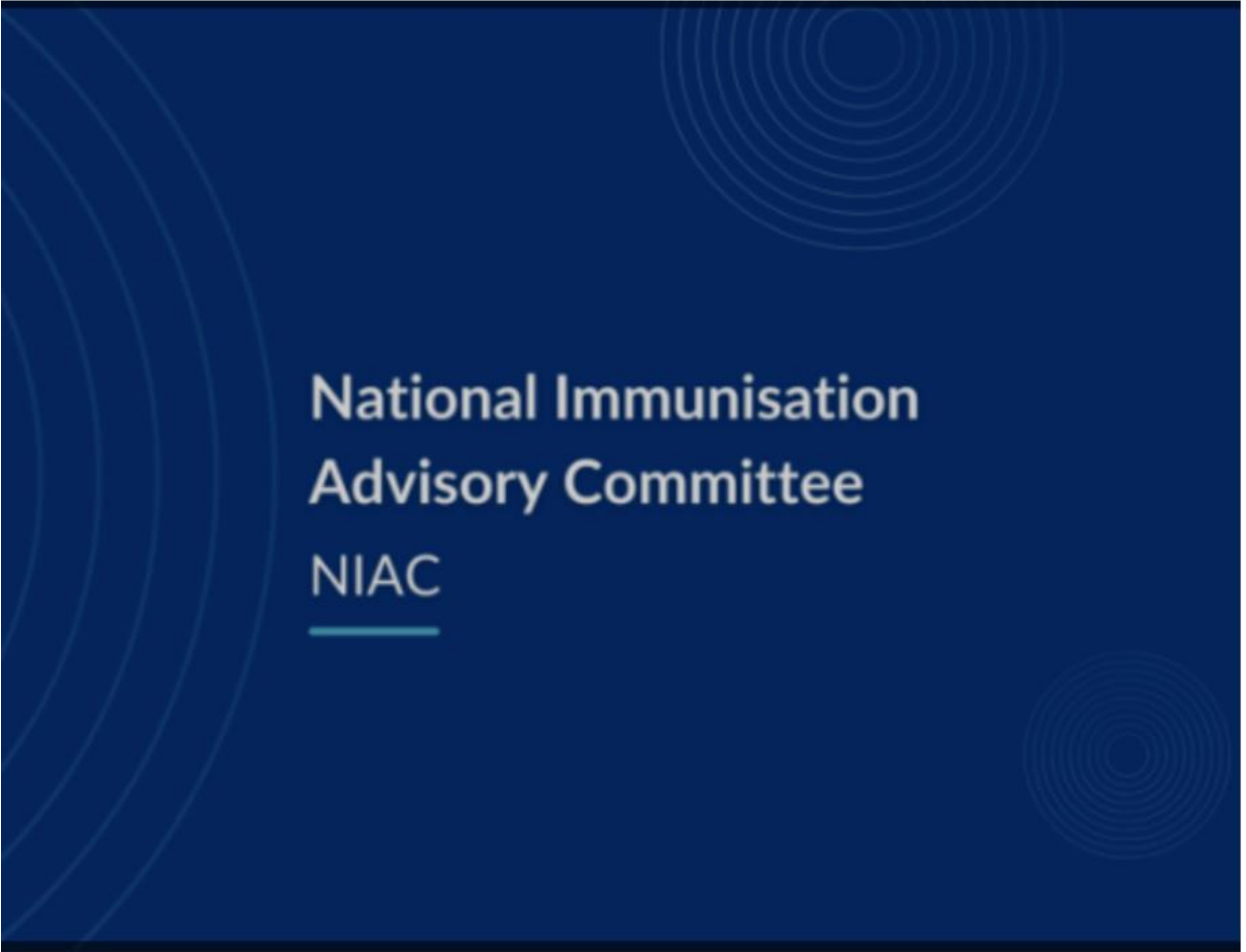
**Vaccins contre  
les papillomavirus humains:  
note de synthèse de l’OMS  
(mise à jour de 2022)**

- “Current evidence suggests that a single dose has comparable efficacy and duration of protection as a 2-dose schedule and may offer programme advantages, be more efficient and affordable, and contribute to improved coverage.” (*WHO, December 2022*)

# RECOMMENDATIONS

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1. Advise 1 dose of HPV vaccine for 9-14 year olds
2. Aim  $\geq$  90% uptake
3. Strengthen national HPV surveillance
4. Monitor evolving evidence base

The logo for the National Immunisation Advisory Committee (NIAC) is displayed on a dark blue background. It features the text "National Immunisation Advisory Committee" in a white, sans-serif font, with "NIAC" in a larger, bold, white font below it. A thin, light blue horizontal line is positioned under the "NIAC" text. The background of the logo area includes faint, concentric circular patterns in a lighter shade of blue.

National Immunisation  
Advisory Committee  
**NIAC**



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