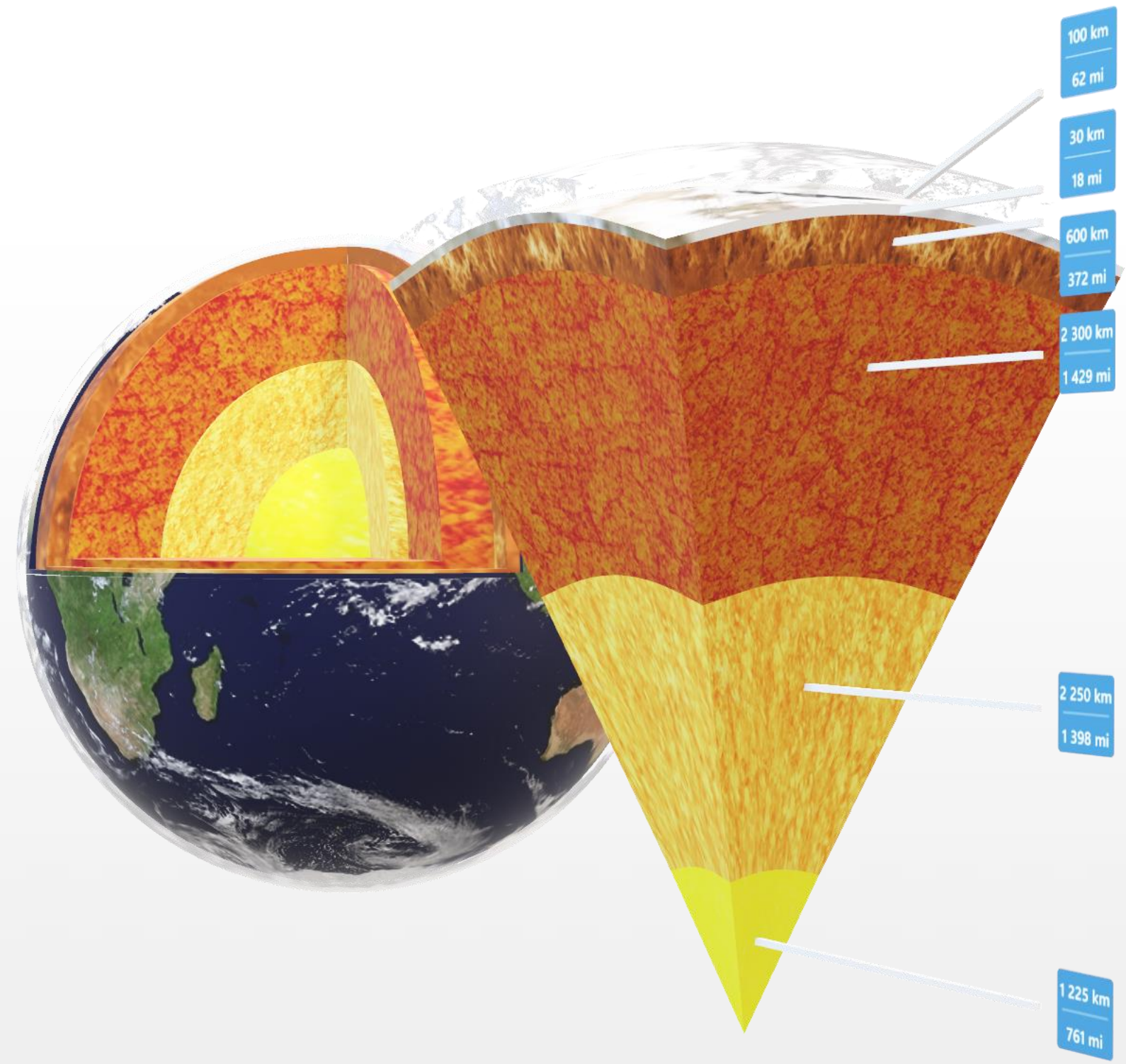


Reducing Health Disparities for People with Developmental Disabilities

HPV Vaccination: It's All About
Reducing Risk for Cancer



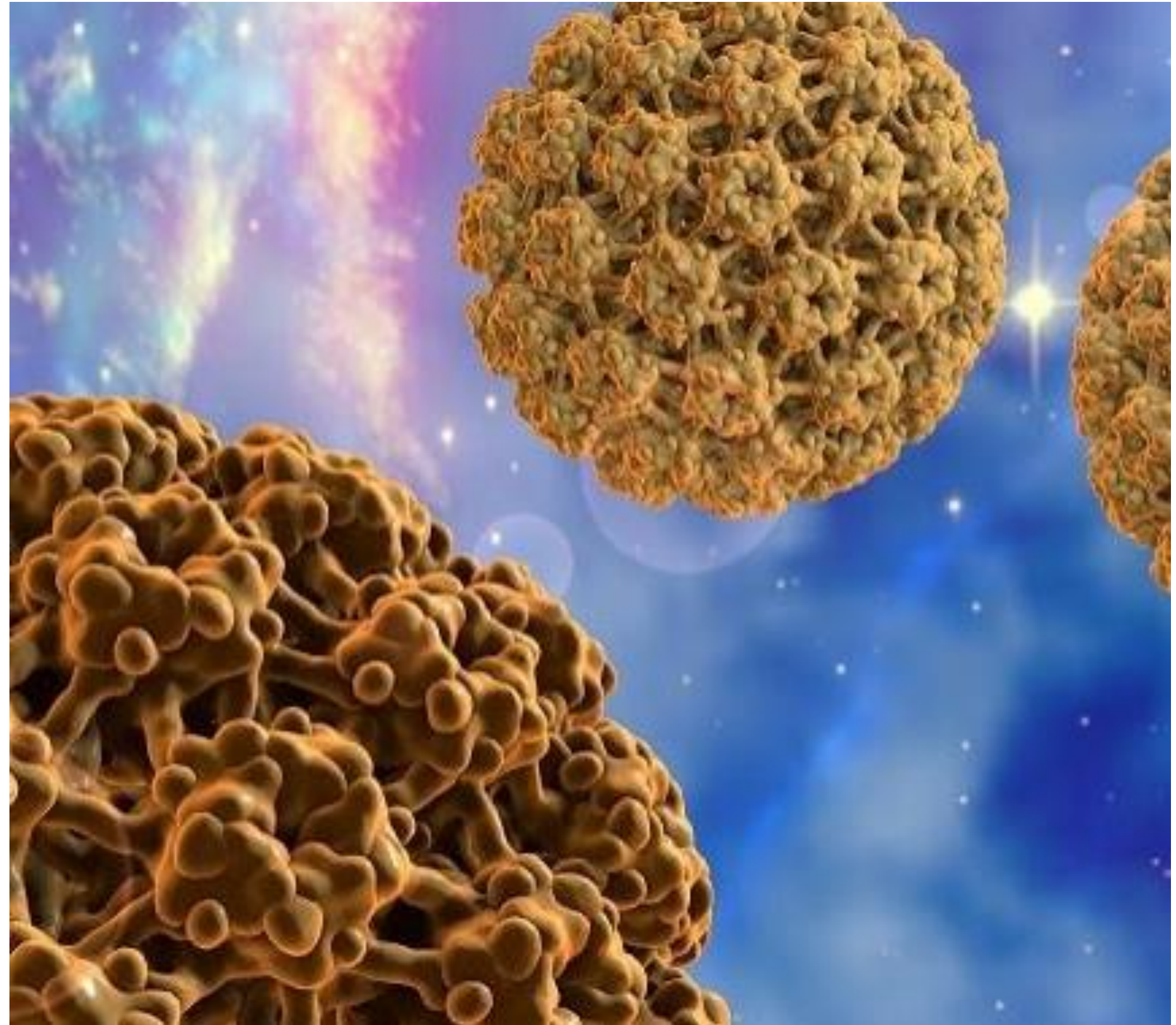


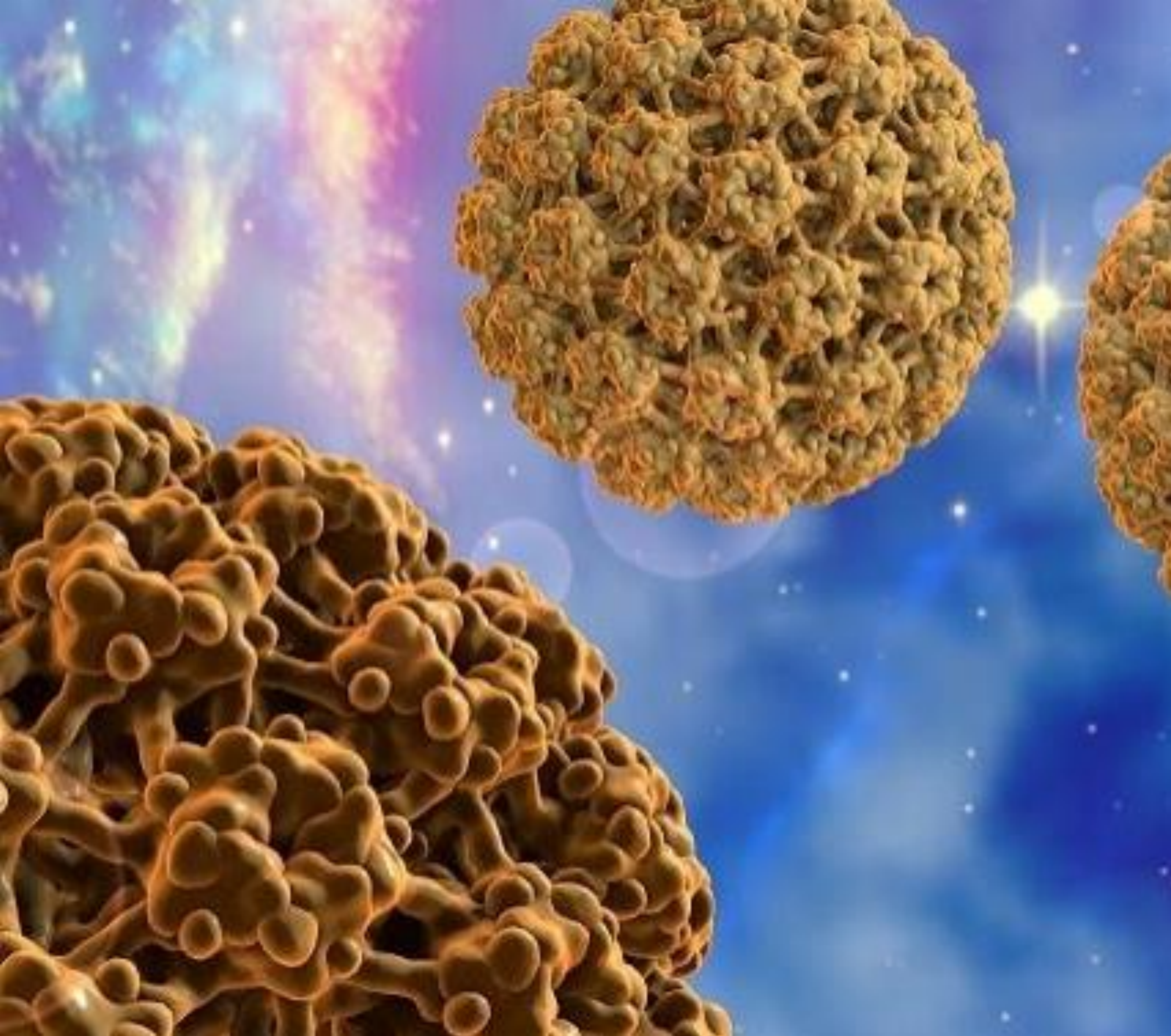
OBJECTIVES

- **Discuss how the HPV vaccine helps prevent cancer, and the benefits and challenges of HPV vaccination.**
- **Explain how different types of research can help us learn why some people with disabilities do not get vaccines.**
- **Describe how researchers can create programs that support informed vaccine choices..**

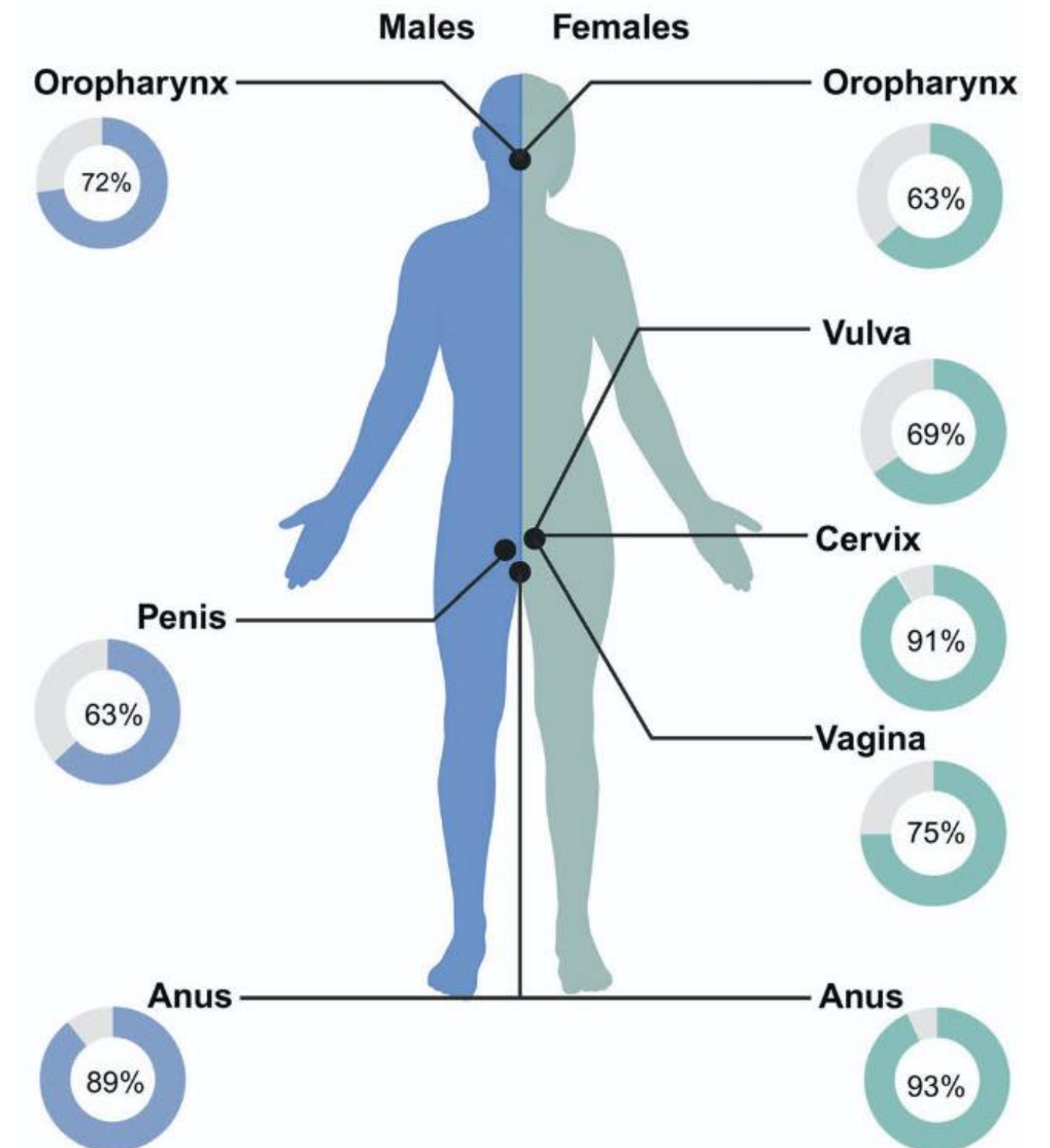
BACKGROUND

- It's a Virus
- Skin-to-skin contact
- Many HPV types can infect people, but 12 cause human cancers
- Vaccine prevention





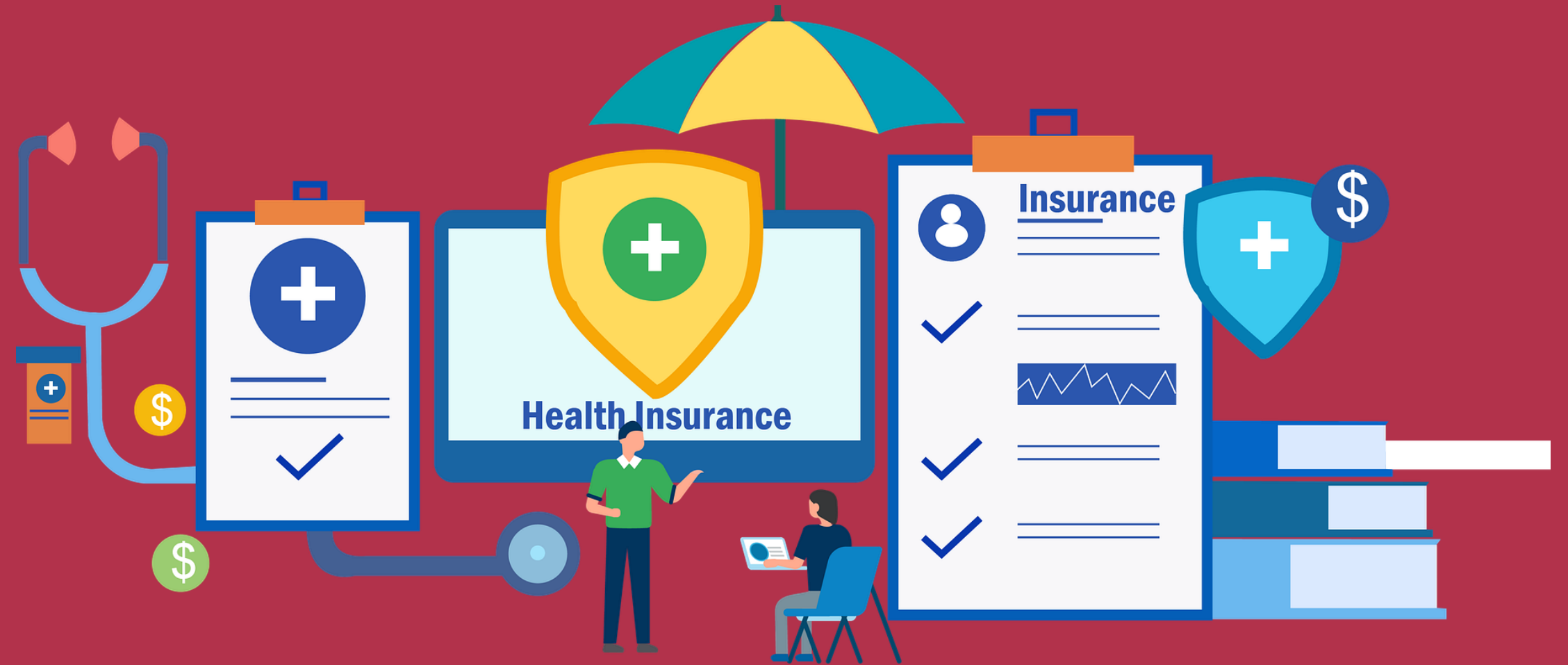
HPV CANCERS – LOCATIONS





STEP I: ARE YOUTH WITH DDs AT RISK UNDER-VACCINATION?

U.S. COMMERCIAL & PUBLICLY- FUNDED INSURANCE CLAIMS



9 TO 15 YEAR
OLDS
BORN 1999-2005



CHARACTERISTICS

Concept	Variables
Developmental Disabilities that were neurodevelopmental, cognitive, or physical, motor-related impairments diagnosed before age 22.	Autism Spectrum Disorder Cerebral Palsy Intellectual Disability Spina Bifida
Sociodemographic Characteristics at the individual or community level	Sex Age (year of birth) Household race/ethnicity, income, educational attainment
Pediatric Complex Chronic Conditions developed by Feudtner and colleagues	Congenital/Genetic, Malignancy, Metabolic, Cardiovascular, Respiratory, Renal, Neonatal, GI, Hematological/immunological, Technology Dependency, Transplant
Healthcare System	Number of provider visits,

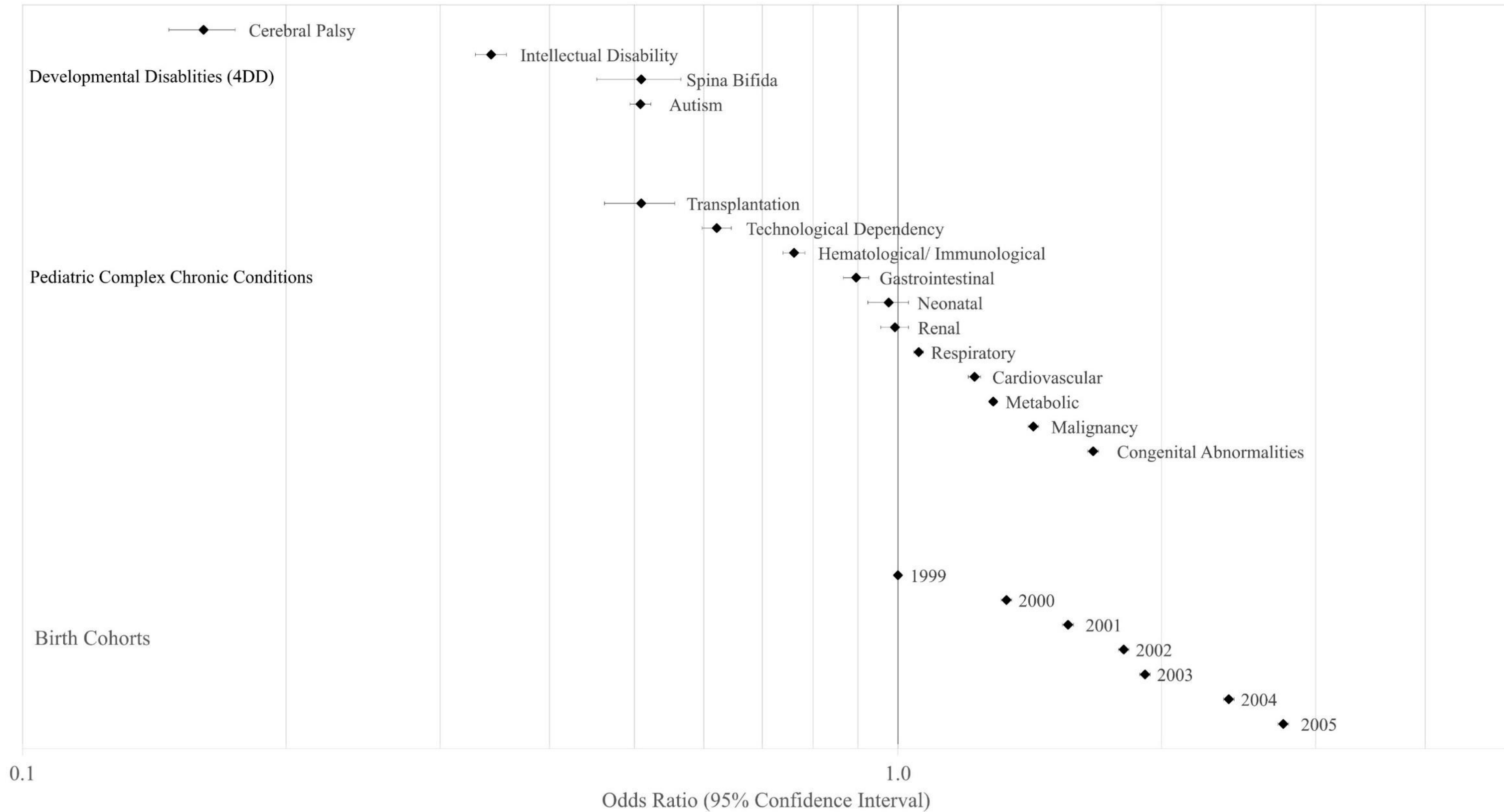
UP TO FIVE
YEARS OF
CONTINUOUS
HEALTHCARE
COVERAGE



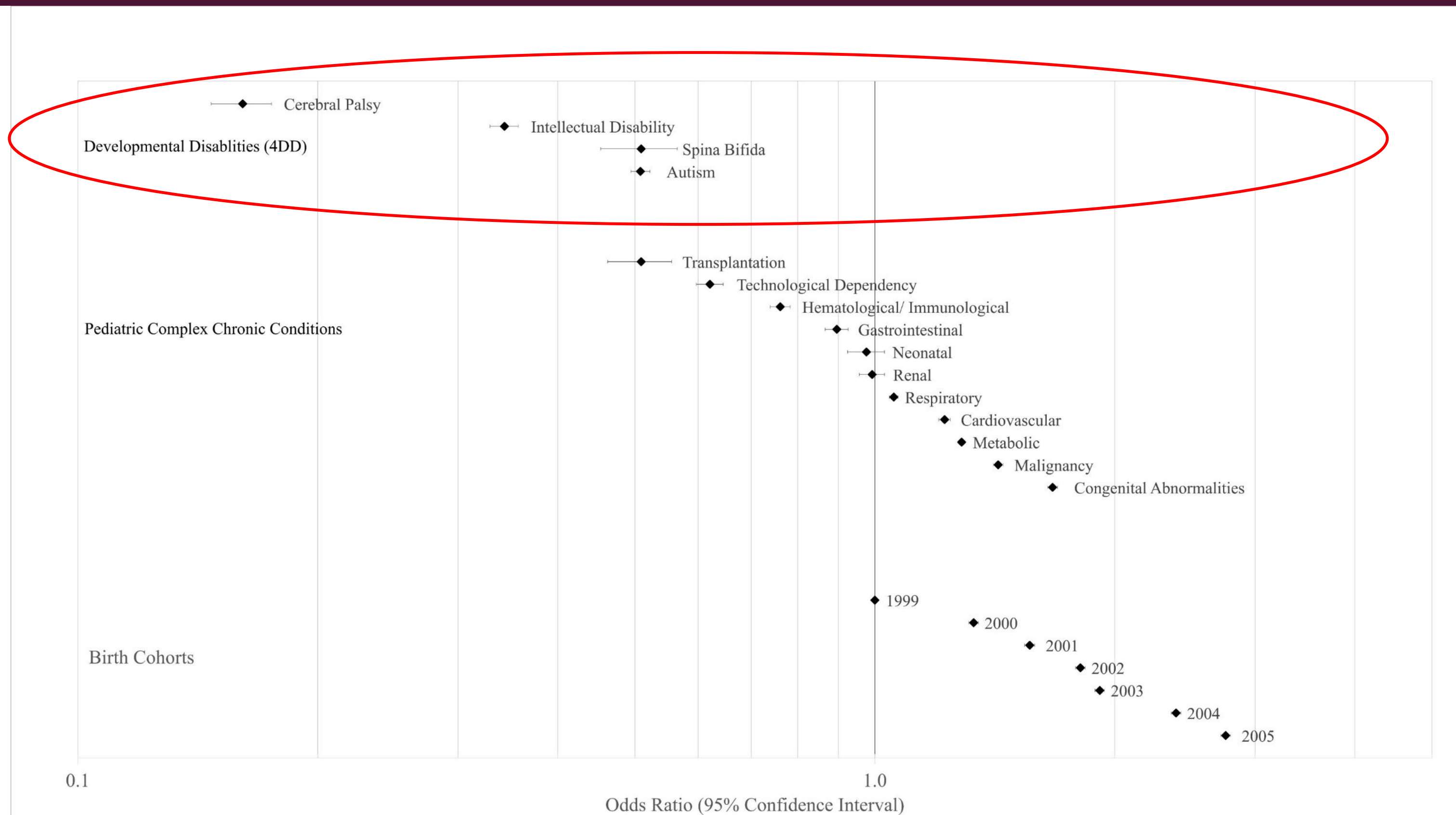


ASSOCIATIONS BETWEEN HPV VACCINATION INITIATION AND FOUR NEURODEVELOPMENTAL, COGNITIVE, AND PHYSICAL DEVELOPMENTAL DISABILITIES

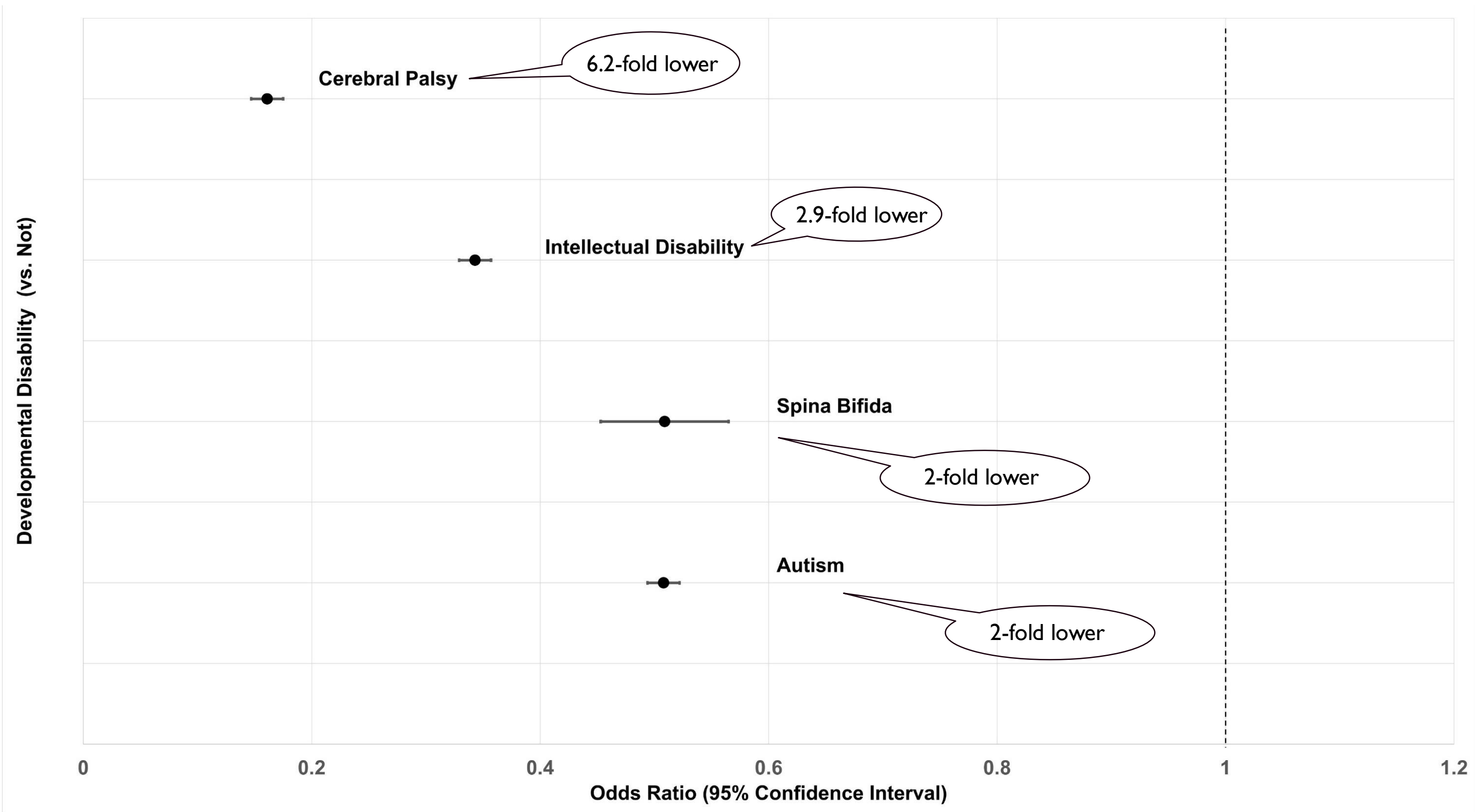
WE FOUND...



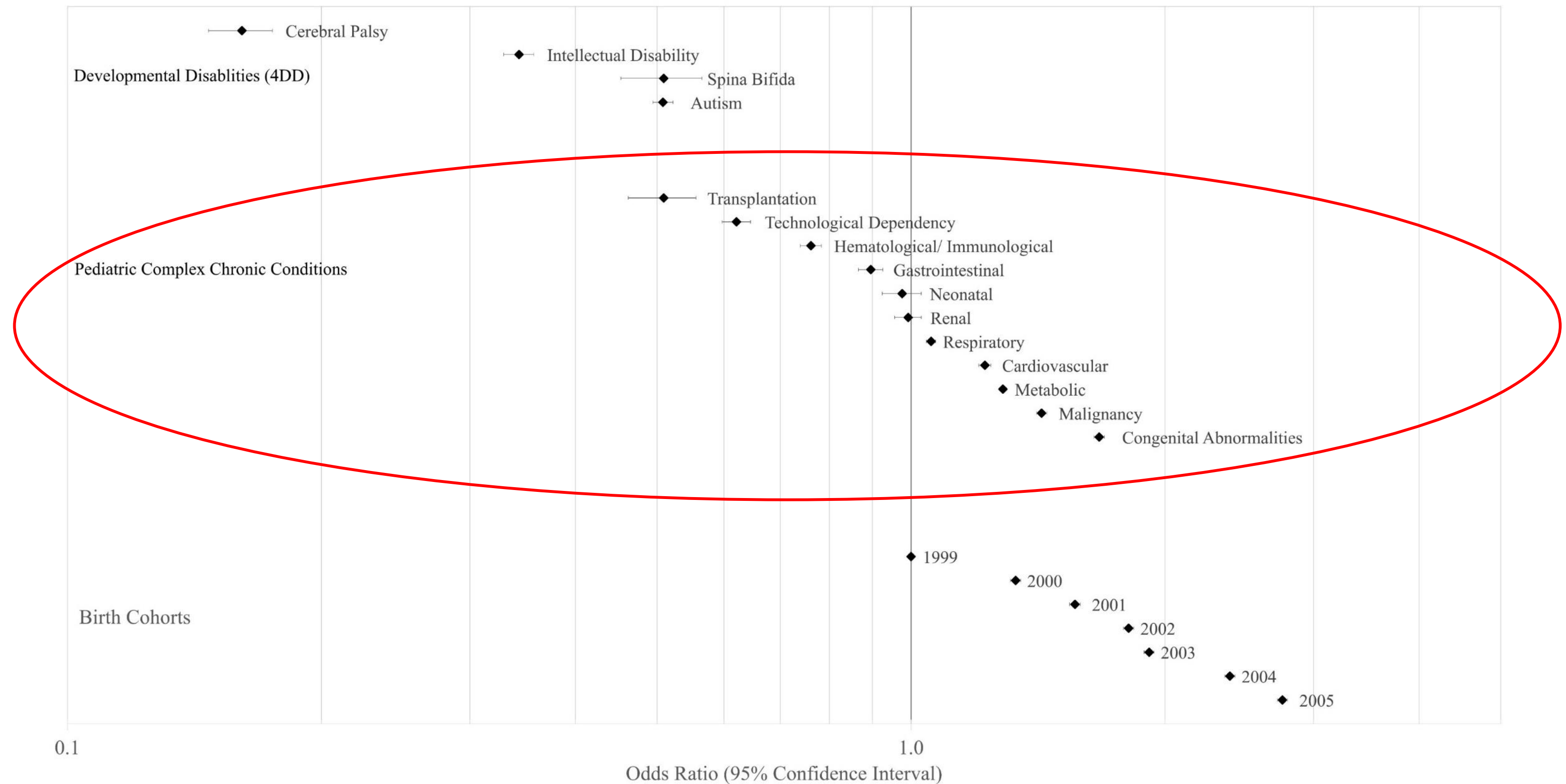
PATTERNS DIFFERED FOR YOUTH WITH DEVELOPMENTAL DISABILITIES



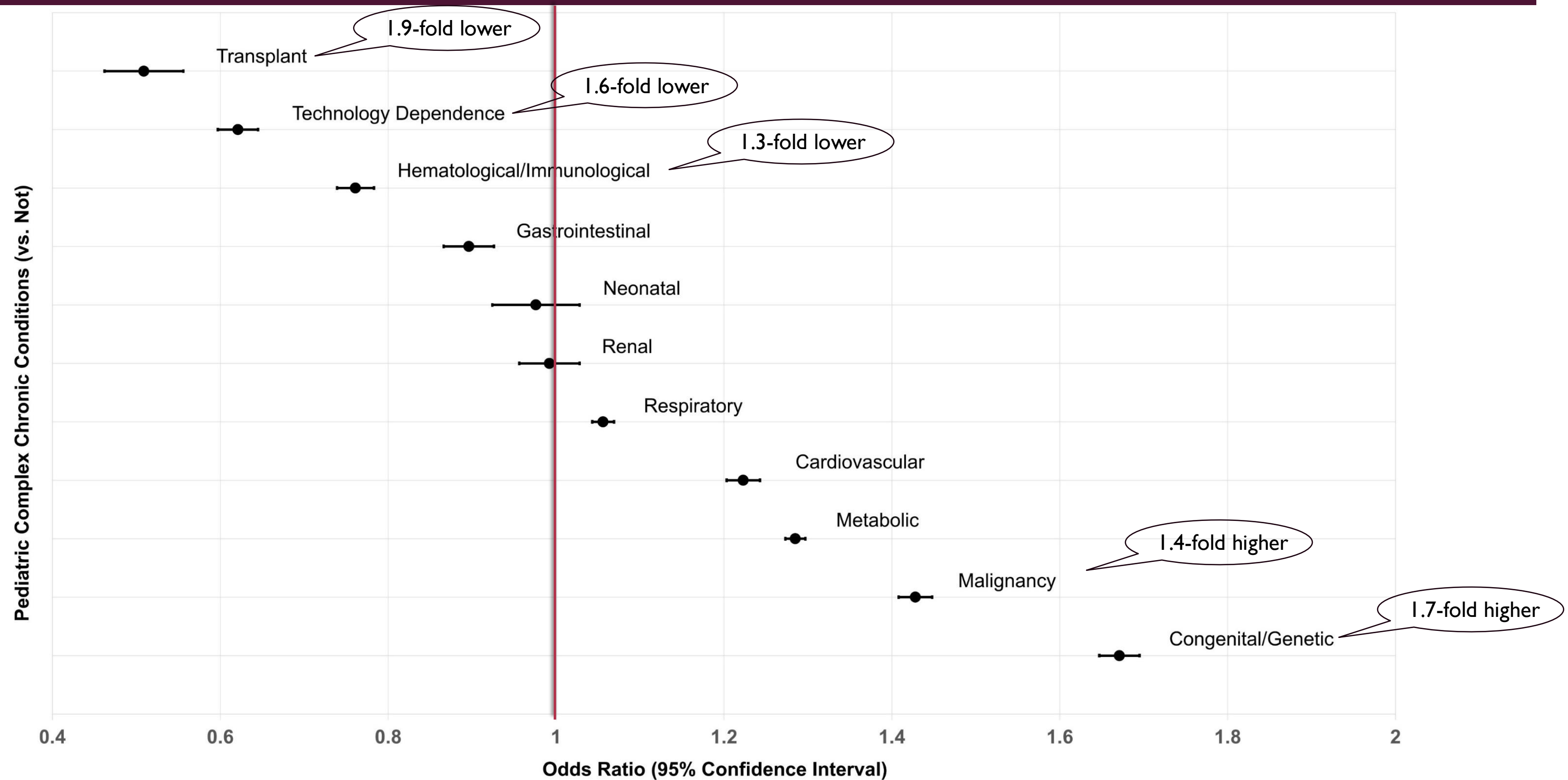
VACCINATION PATTERNS WERE LOWER FOR YOUTH WITH DEVELOPMENTAL DISABILITIES



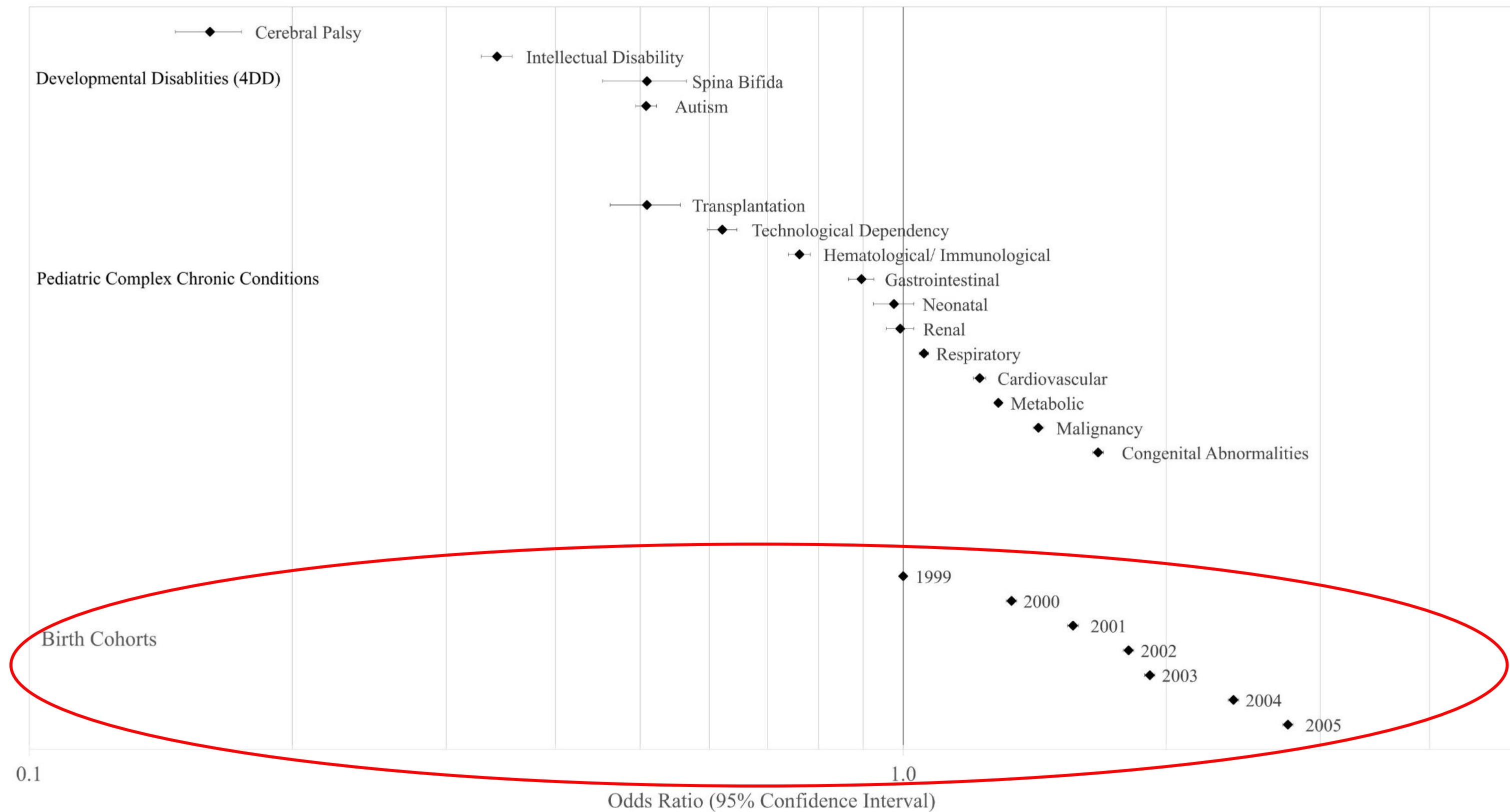
VACCINATION PATTERNS VARIED ACROSS CHRONIC HEALTH CONDITIONS.



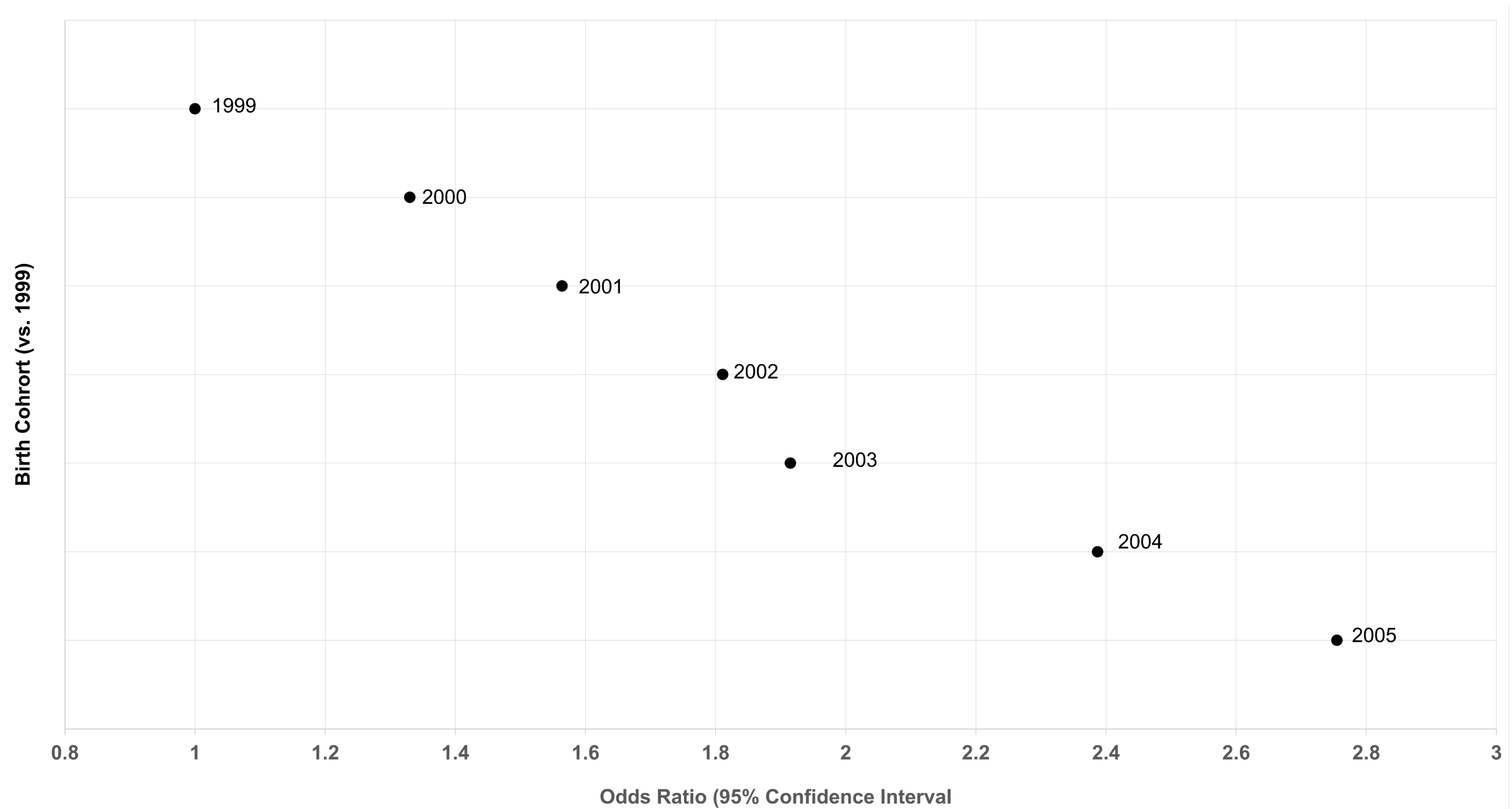
FOR CHRONIC HEALTH CONDITIONS



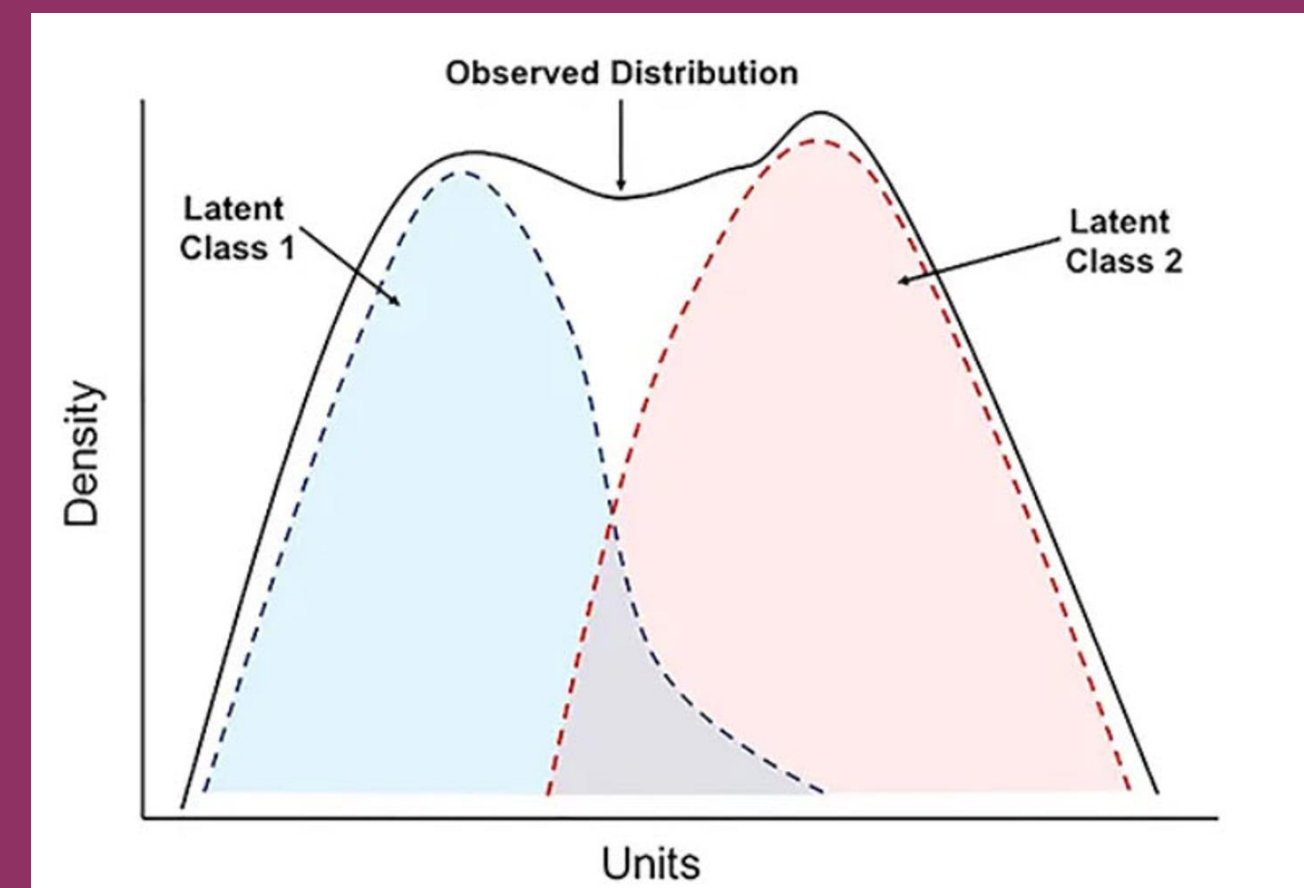
VACCINATION IMPROVED OVER TIME

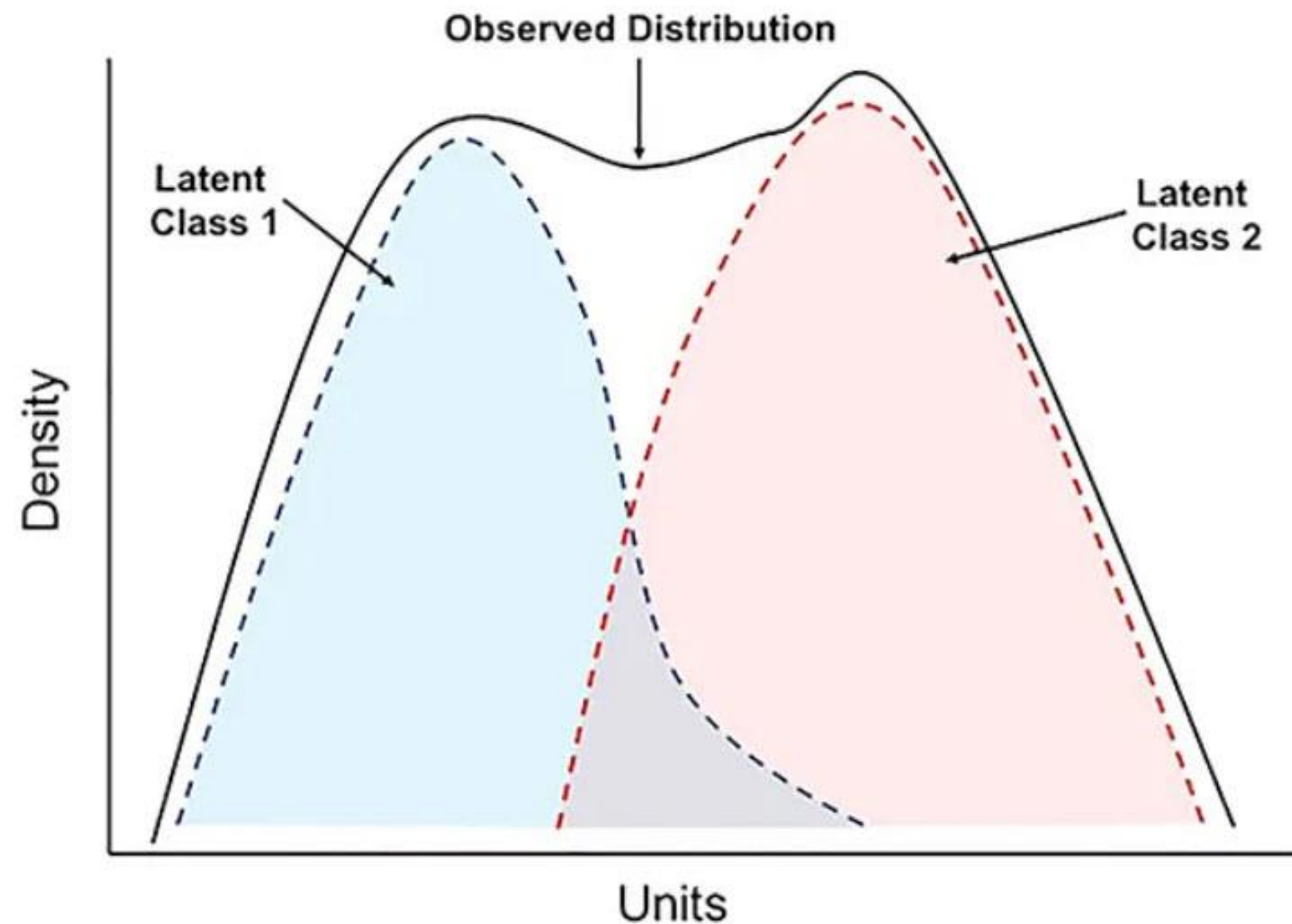


HPV VACCINATION: A CHOICE THAT IMPROVED OVER TIME



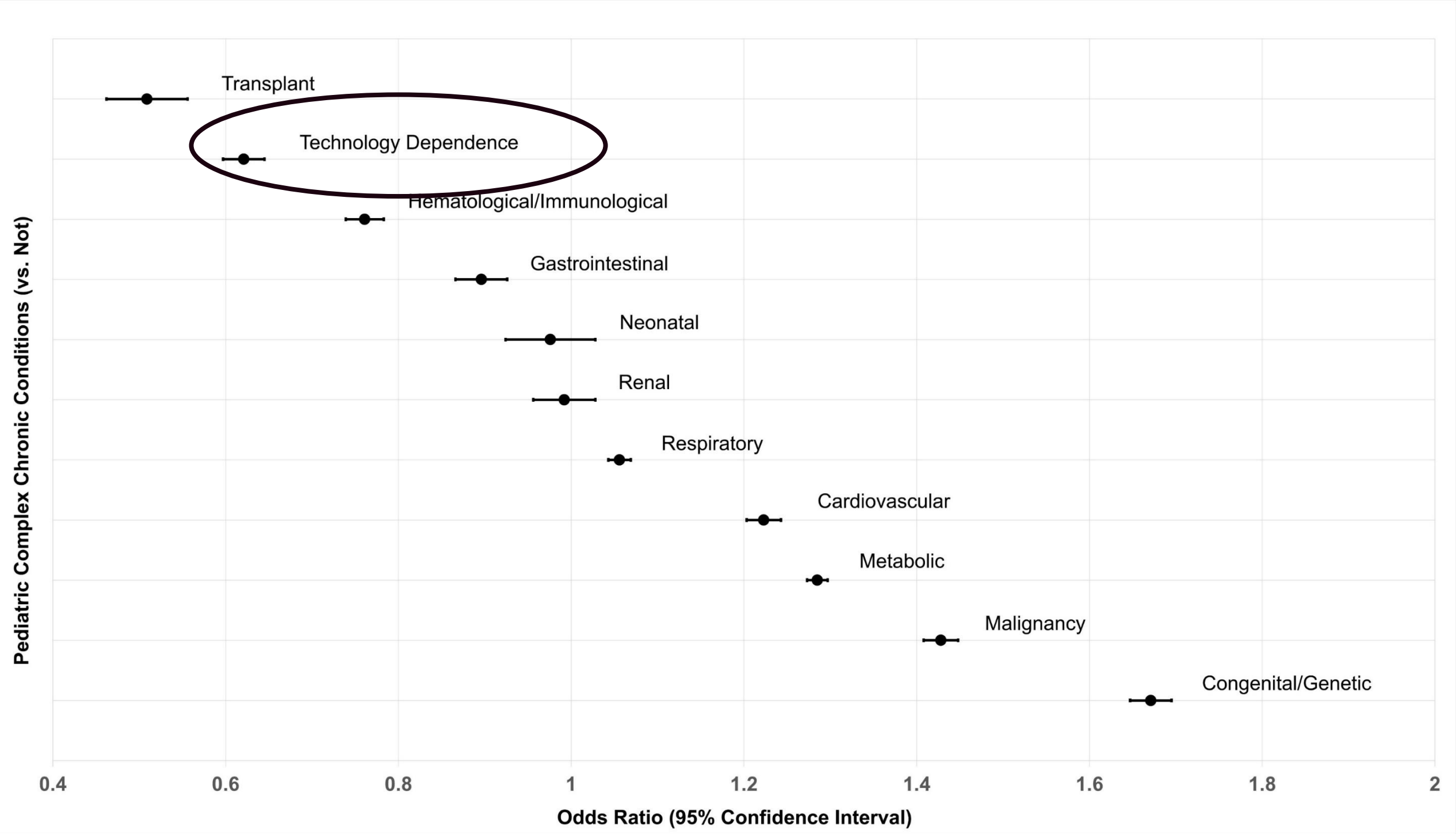
DIFFERENCES IN VACCINATION FOR CHILDREN WITH DD AND COMPLEX CHRONIC CONDITIONS





For the analysis, we:

- Included 16,937 9-15-year-olds with Technology Dependency.
- Used Latent Class Analysis (LCA) to identify smaller, unobserved groupings.
- From LCA, 9 models emerged.
- Fit statistics suggested two distinct clusters of co-occurring PCCCs and 4DDs ($E \approx I$), plus one class with no strong association to condition groups ($\rho \approx 0$).
- Bolck–Croon–Hagenaars (BCH) adjustment to evaluate HPV vaccination probability, following LCA analysis
- Estimated incidence of HPV vaccination for each group from the raw data.



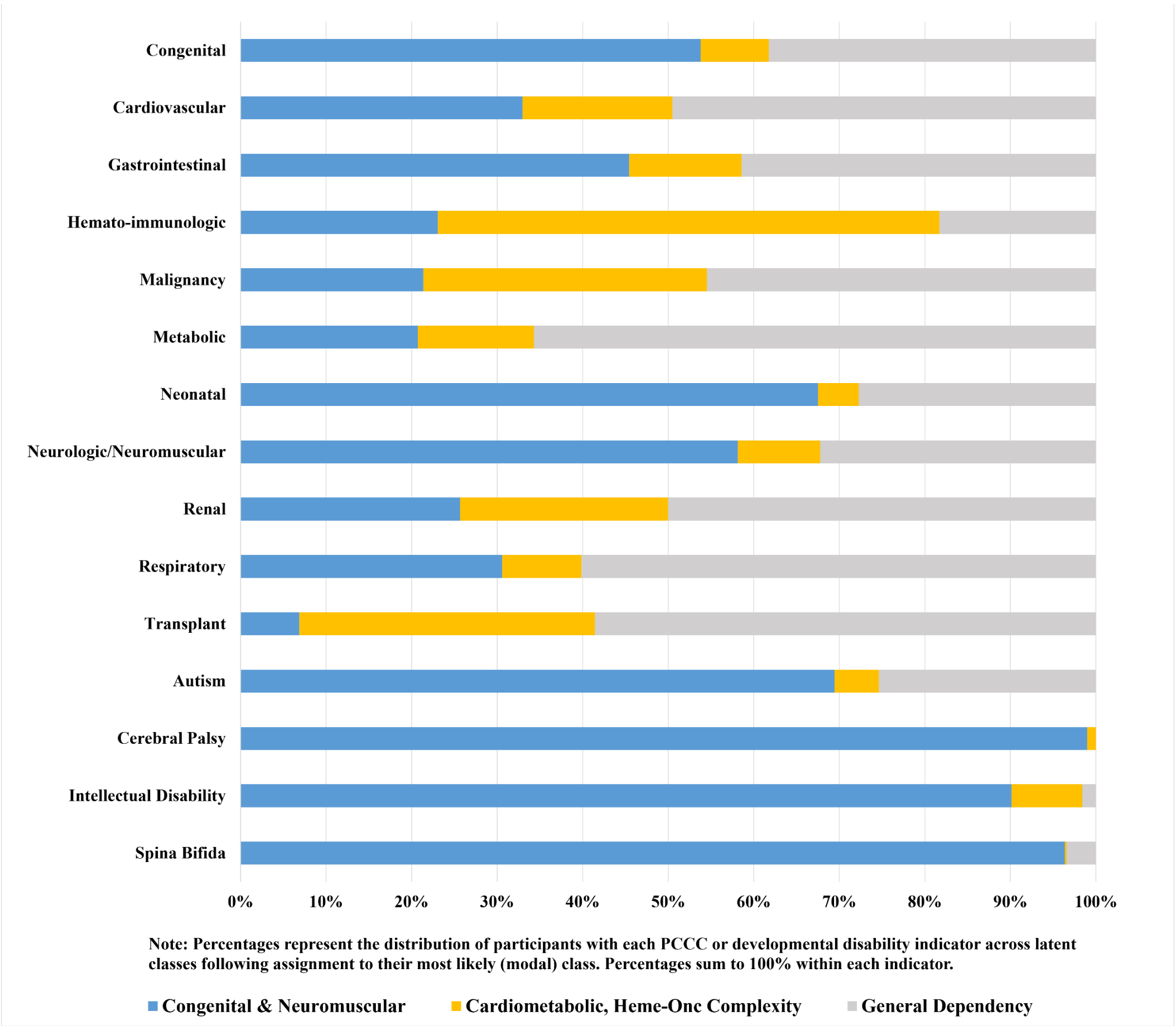
WERE CHILDREN WITH
THE LOWEST ODDS OF
VACCINATION *REALLY*
ONE GROUP?

THREE
DISABILITY
AND
CHRONIC
CONDITION
TYPES
IDENTIFIED BY
LATENT CLASS
ANALYSIS

	Class 1	Class 2	Class 3
	Congenital & Neurological- Neuromuscular	Cardiometabolic & Hematology- Oncology	General Dependency
	Youth with Technology Dependency Complex Chronic Conditions/Class (%)		
	22.10%	8.90%	69%
Characteristics			
Pediatric Complex Chronic Conditions			
Congenital/Genetic		0.29	
Cardiovascular			
Gastrointestinal			
Heme/Immunologic			
Malignancy			
Metabolic			
Neonatal			
Neurological-Neuromuscular			
Renal			
Respiratory			
Transplant			
Four <i>Index</i> Developmental Disabilities			
Autism			
Cerebral Palsy			
Intellectual Disability			
Spina Bifida	0.12		0

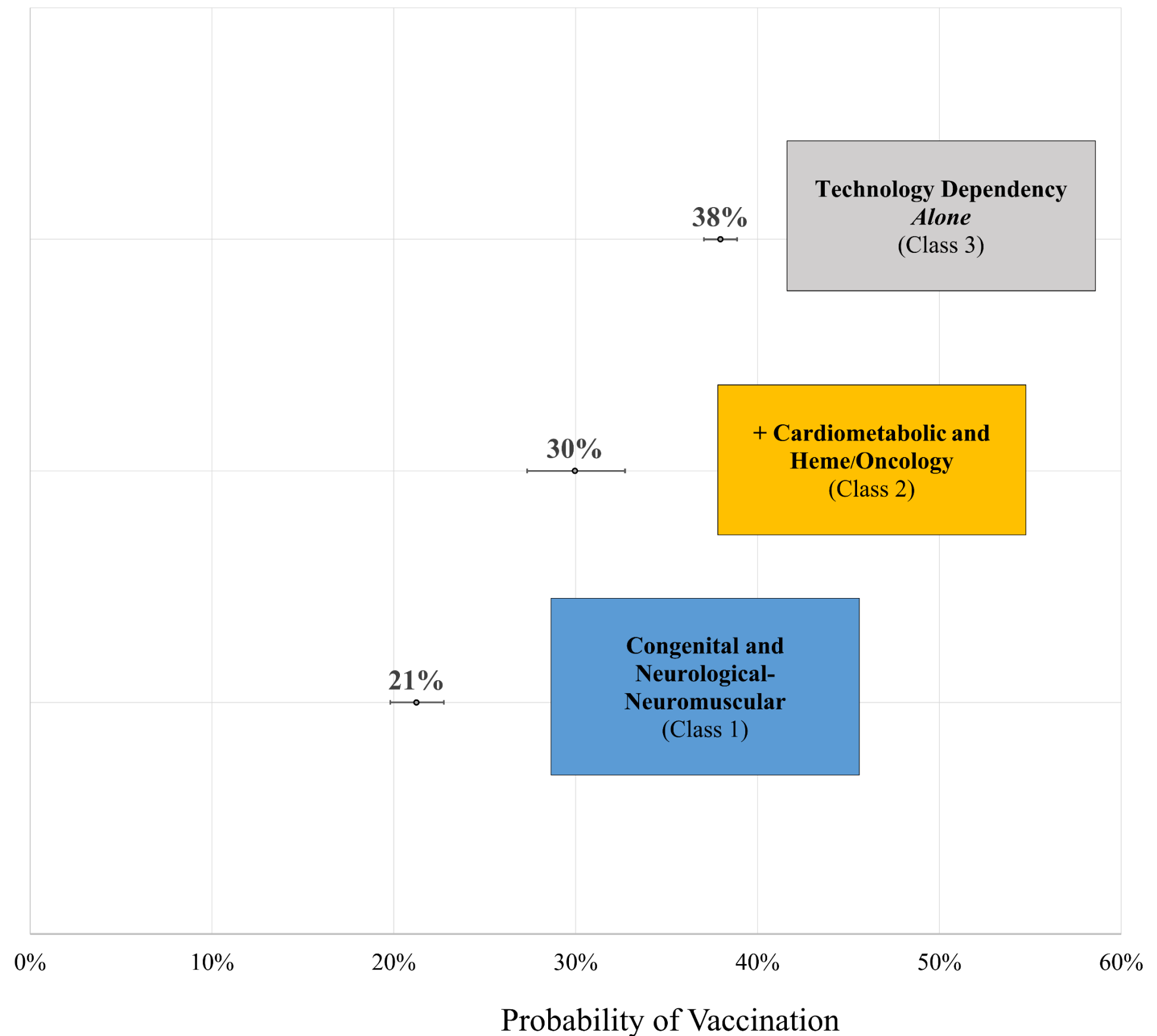
Conditional Probability of Assignment to the Latent Class	
$\geq 70\%$	
31%-69%	
$\leq 30\%$	

COMPLEX
CHRONIC
CONDITION
REPRESENTATION
BY LATENT CLASS

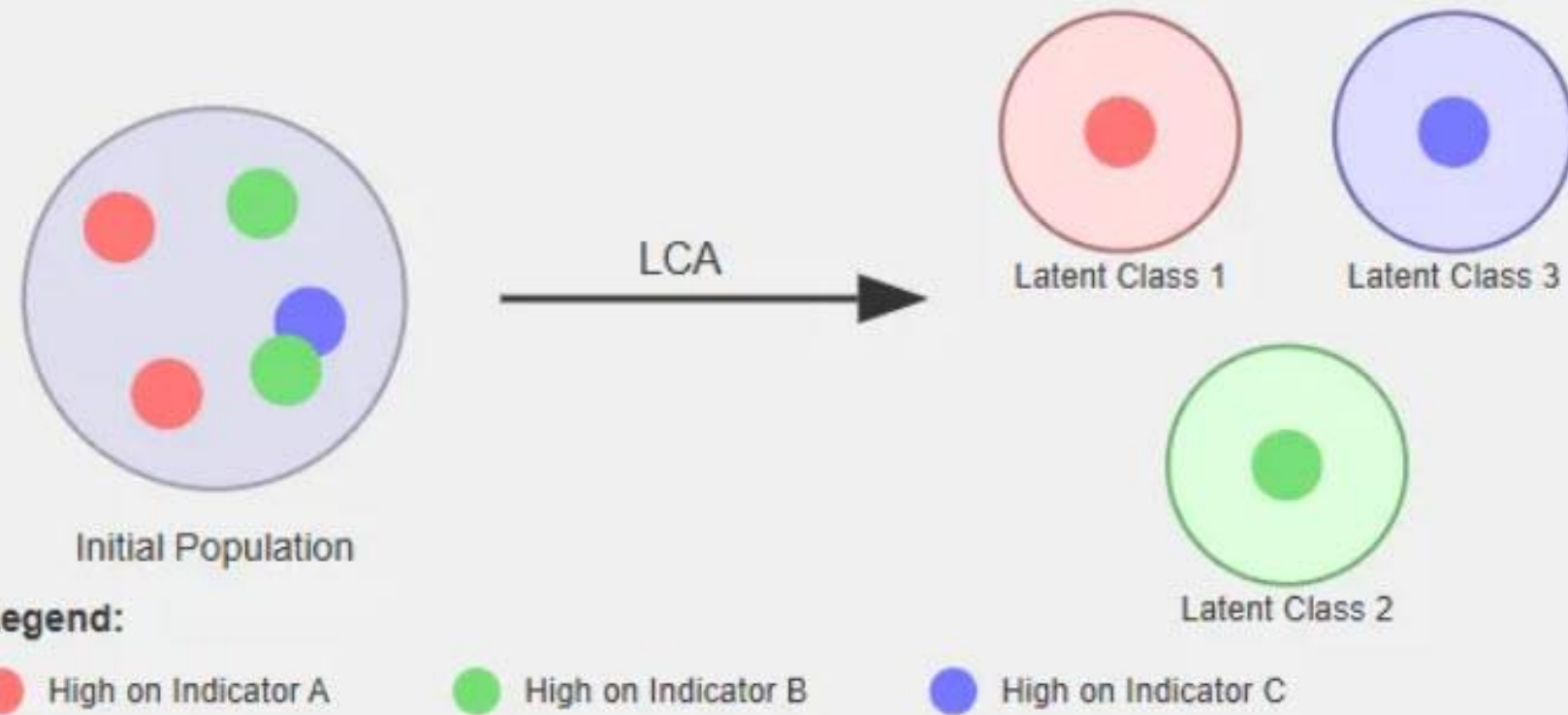


CHILDREN WITH
CONGENITAL,
NEUROLOGICAL, AND
NEUROMUSCULAR
CONDITIONS HAD
*LOWEST PROBABILITY OF
HPV VACCINATION*

HPV Vaccination Probability Varies Across Three Groups of 9-15 Year Olds
with Technology Dependent Complex Chronic Conditions

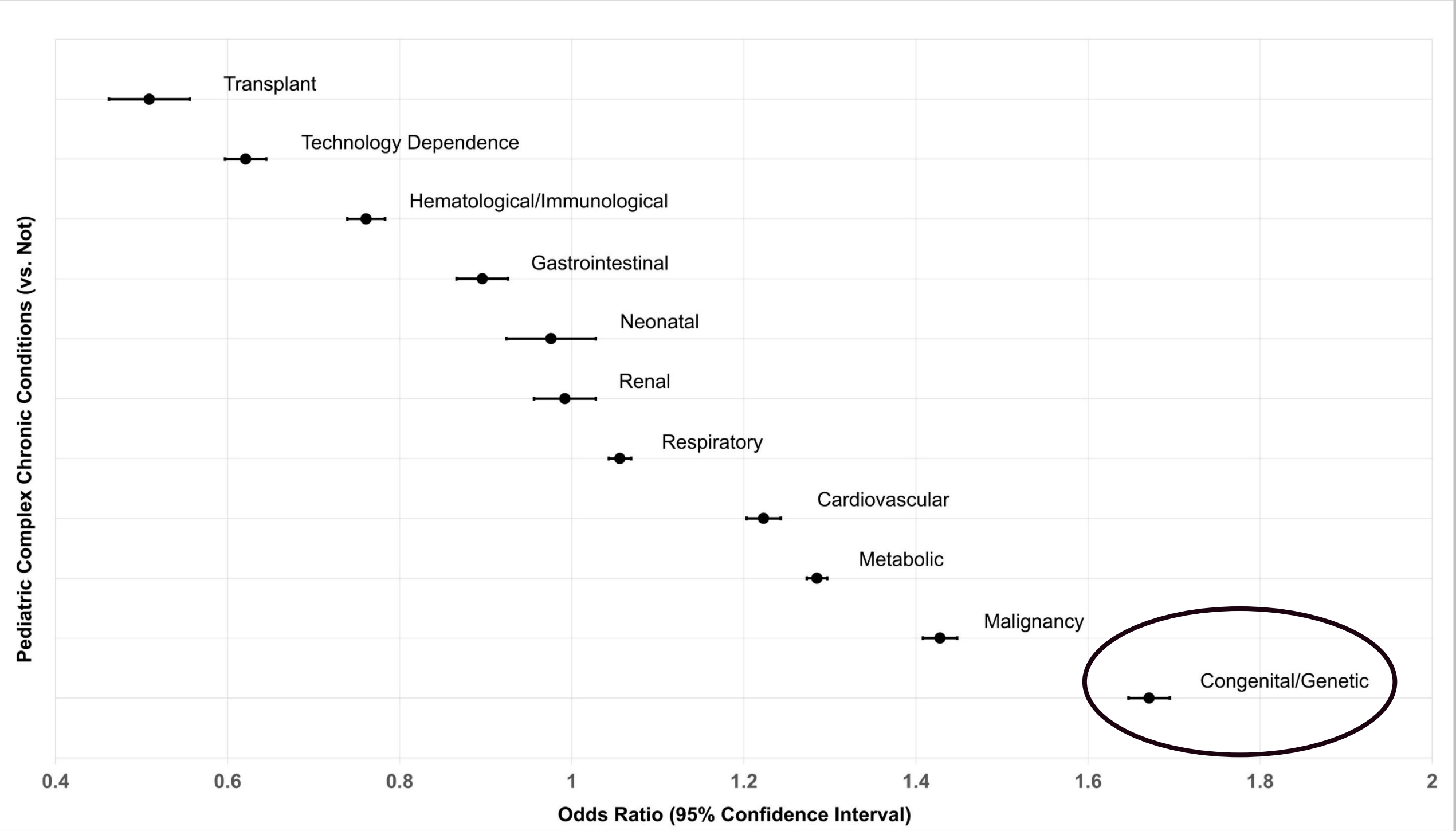


Latent Class Analysis (LCA) Illustration



For the analysis,

- 95,999 children with congenital/genetic PCCCs
- LCA identified six latent subgroups
- Five condition-specific clusters + one heterogeneous reference group
- BCH estimated class-specific HPV vaccination probability
- Vaccination incidence calculated within each subgroup



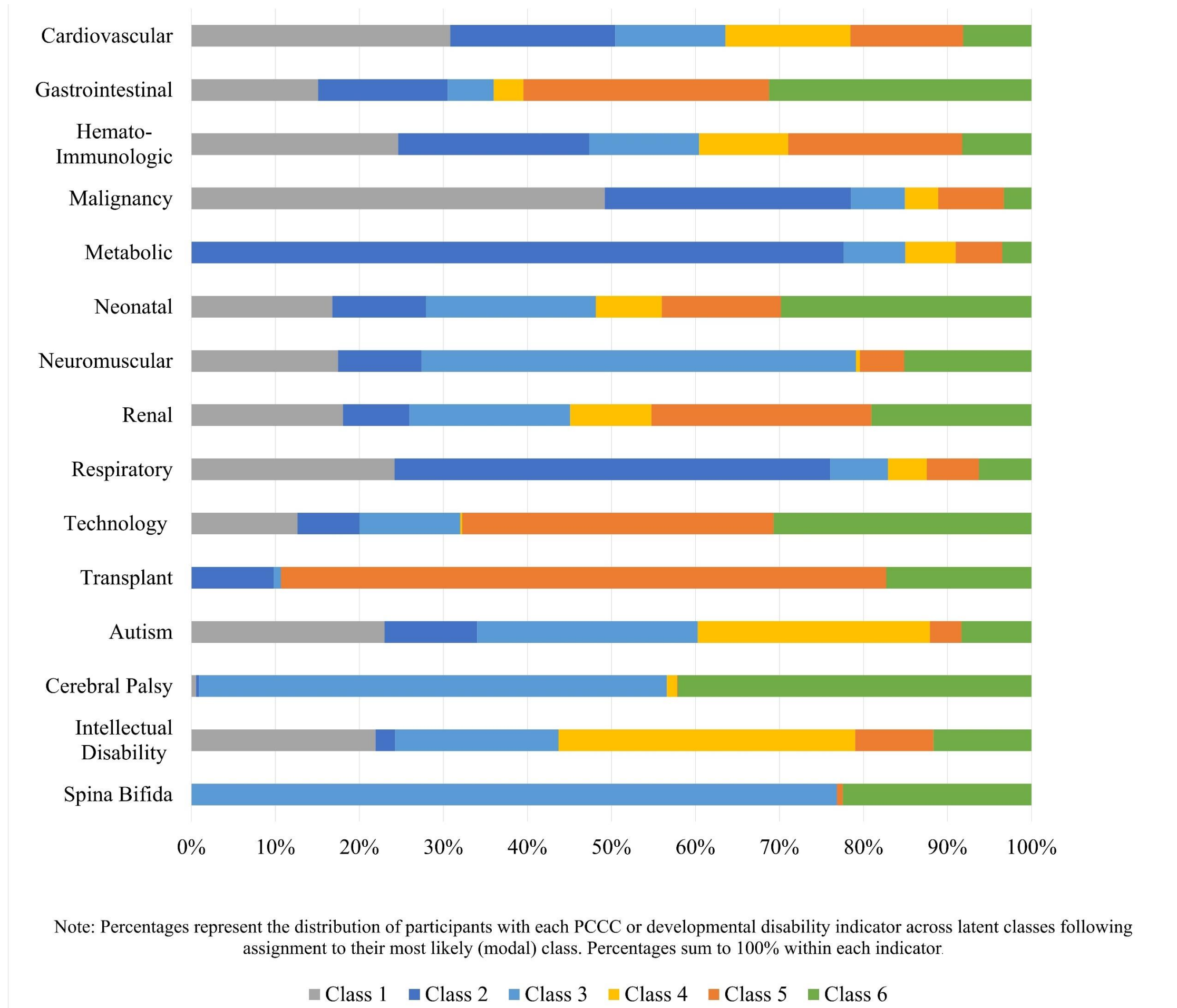
WERE CHILDREN WITH
THE HIGHEST ODDS OF
VACCINATION *REALLY*
ONE GROUP?

SIX DISABILITY
AND
CHRONIC
CONDITION
CLASSES
IDENTIFIED BY
LATENT CLASS
ANALYSIS

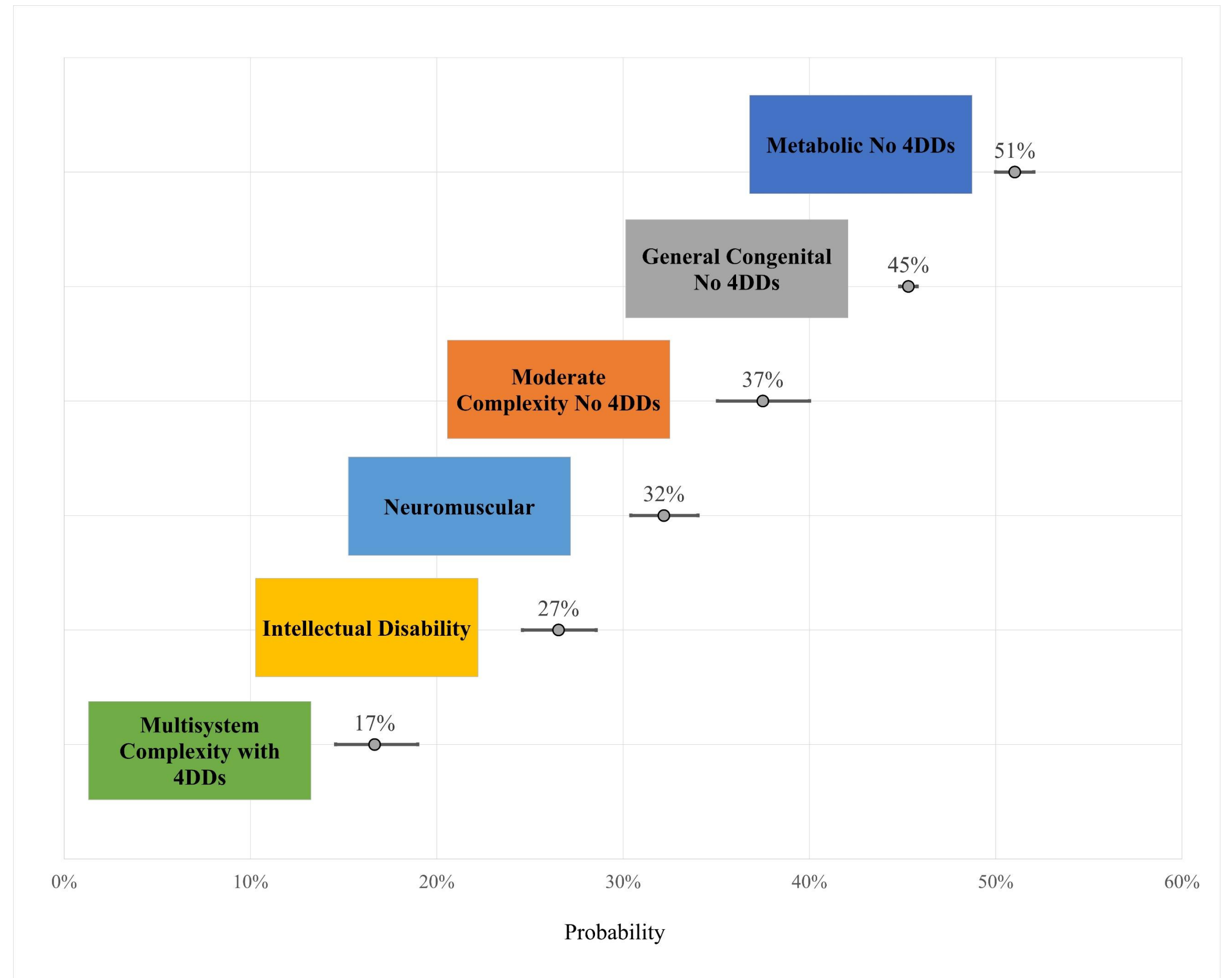
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6
	General Congenital Conditions without 4DDs	Metabolic Conditions Without 4DDs	Neurological- Neuromuscular	Intellectual Disability With Limited PCCCs	Moderate Complexity without 4DDs	Multisystem Complexity With 4DDs
	Youth with Congenital-Genetic Complex Chronic Conditions/Class (%)					
Characteristics	64%	20%	5%	7%	3%	2%
Pediatric Complex Chronic Conditions						
Cardiovascular						
Gastrointestinal						
Hematologic/Immunologic						
Malignancy						
Metabolic						
Neonatal						
Neuromuscular						
Renal						
Respiratory						
Technology Dependency						
Transplant						
Four Index Developmental Disabilities						
Autism						
Cerebral Palsy						
Intellectual Disability						
Spina Bifida						

Conditional Probability of Assignment to the Latent Class	
≥ 70%	
31%-69%	
≤ 30%	

COMPLEX CHRONIC CONDITION REPRESENTATION BY LATENT CLASS

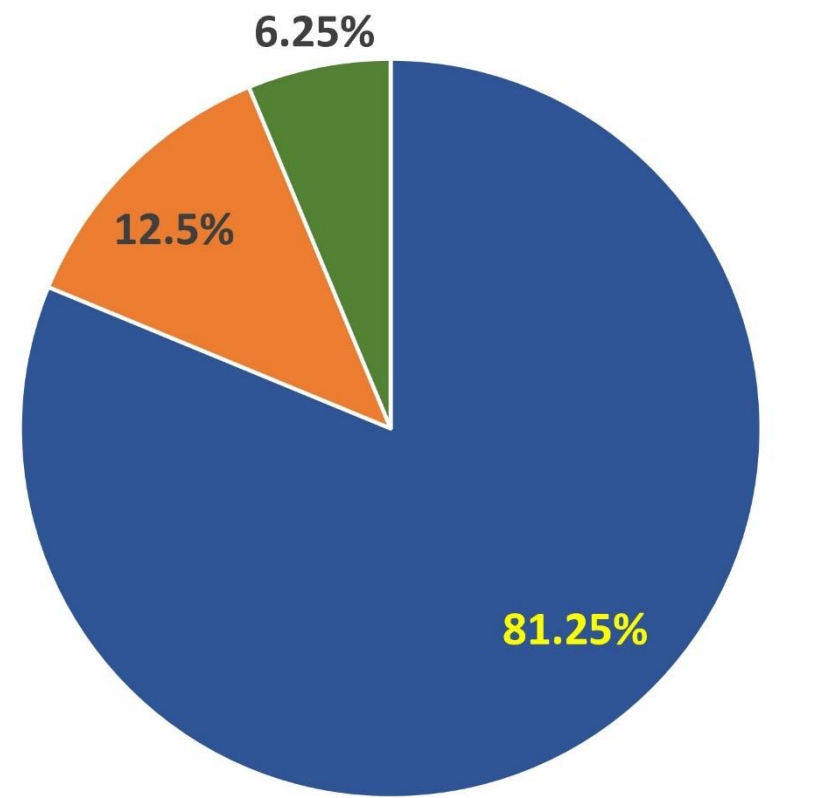


CHILDREN WITH
MULTISYSTEM
COMPLEXITY WITH
FOUR
DEVELOPMENTAL
DISABILITIES SHOW
THE *LOWEST*
PROBABILITY OF HPV
VACCINATION

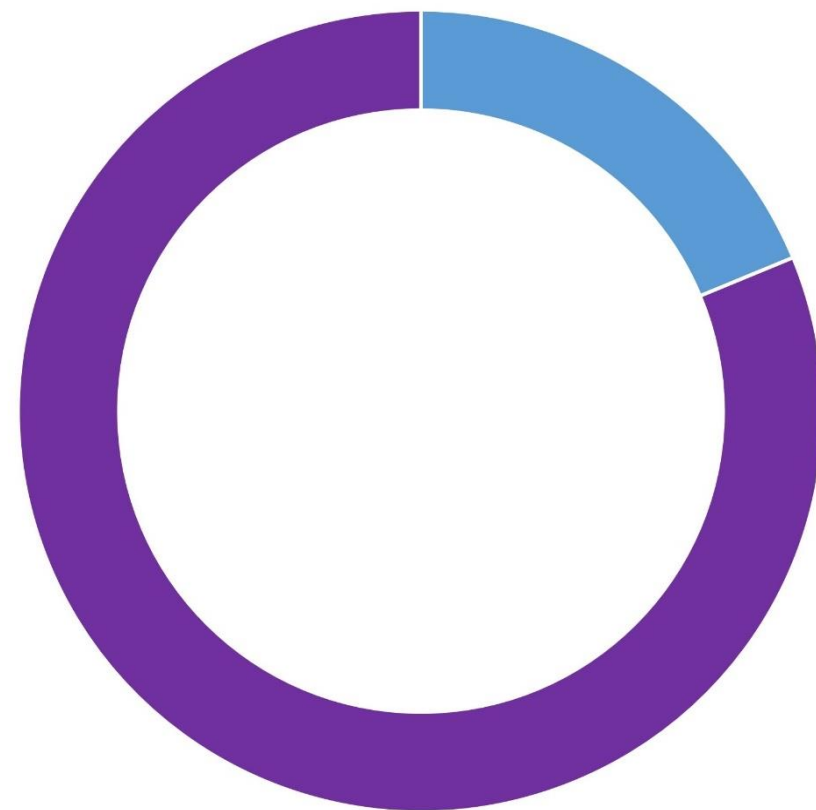




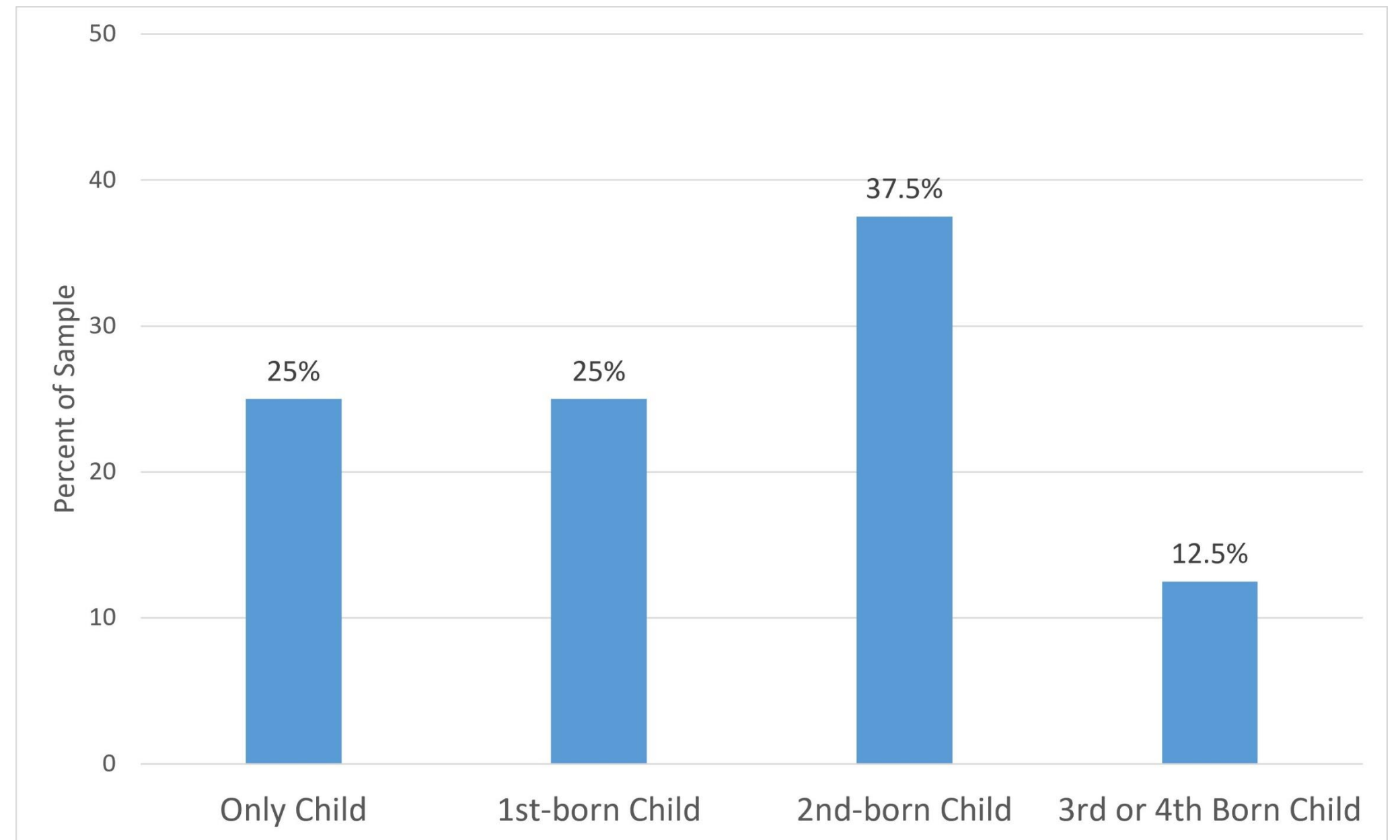
MATERNAL TRUST AND VACCINATION DECISIONS FOR INFANTS AND CHILDREN WITH DEVELOPMENTAL DISABILITIES



■ White ■ Asian ■ Black/White



■ Hispanic ■ Not Hispanic



Birth Order of Sample, 9-to-21 year-old youth with IDD

Table S2. Performance of basic ADL% and instrumental activities of daily living IADL%

Activities	Independent or Does on Own %	Does with Help %	Does Not Do at All %
Making his/her own bed ^a	LE 25%	26-50%	GT 50%
Doing household tasks ^a	26-50%	26-50%	GT 50%
Doing errands ^a	26-50%	26-50%	GT 50%
Doing home repairs ^a	26-50%	26-50%	GT 50%
Doing laundry, washing and drying ^a	26-50%	26-50%	GT 50%
Washing/bathing ^b	26-50%	26-50%	GT 50%
Grooming, brushing teeth/ hair ^b	26-50%	26-50%	GT 50%
Dressing and undressing ^b	26-50%	26-50%	GT 50%
Toileting ^b	LE 25%	26-50%	GT 50%
Preparing simple foods ^a	LE 25%	26-50%	GT 50%
Mixing and cooking simple foods ^a	26-50%	26-50%	GT 50%
Preparing complete meal ^a	26-50%	26-50%	GT 50%
Setting and clearing table ^a	26-50%	26-50%	GT 50%
Drinking from a cup ^b	LE 25%	26-50%	GT 50%
Eating from a plate ^b	LE 25%	26-50%	GT 50%
Washing dishes ^a	26-50%	26-50%	GT 50%
Banking and managing daily finances ^a	26-50%	26-50%	GT 50%

Legend

LE 25%	26-50%	GT 50%
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^a = Instrumental activity of daily living IADL%; ^b = activity of daily living ADL%

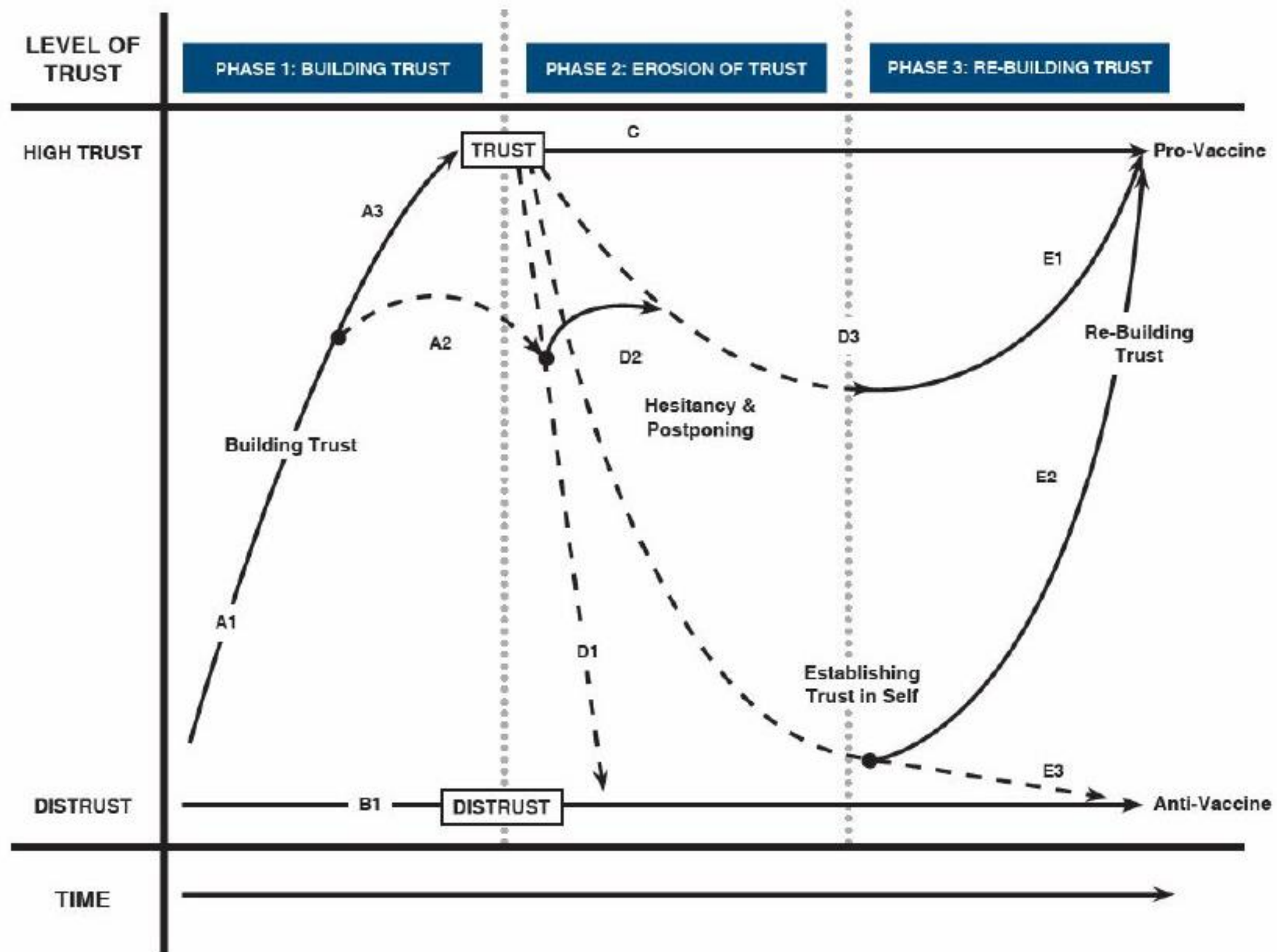


Scientific/Institutional Domain	Interpersonal Domain
Uncertainty	
Vulnerability	
Dependency	
Risk	



Vaccination decisions are changeable over time, depending on a mother's trust in

- **Public health system**
- **Healthcare providers, including physicians, nurses, and medical assistants**
- **Parental know-how**



FUTURE RESEARCH





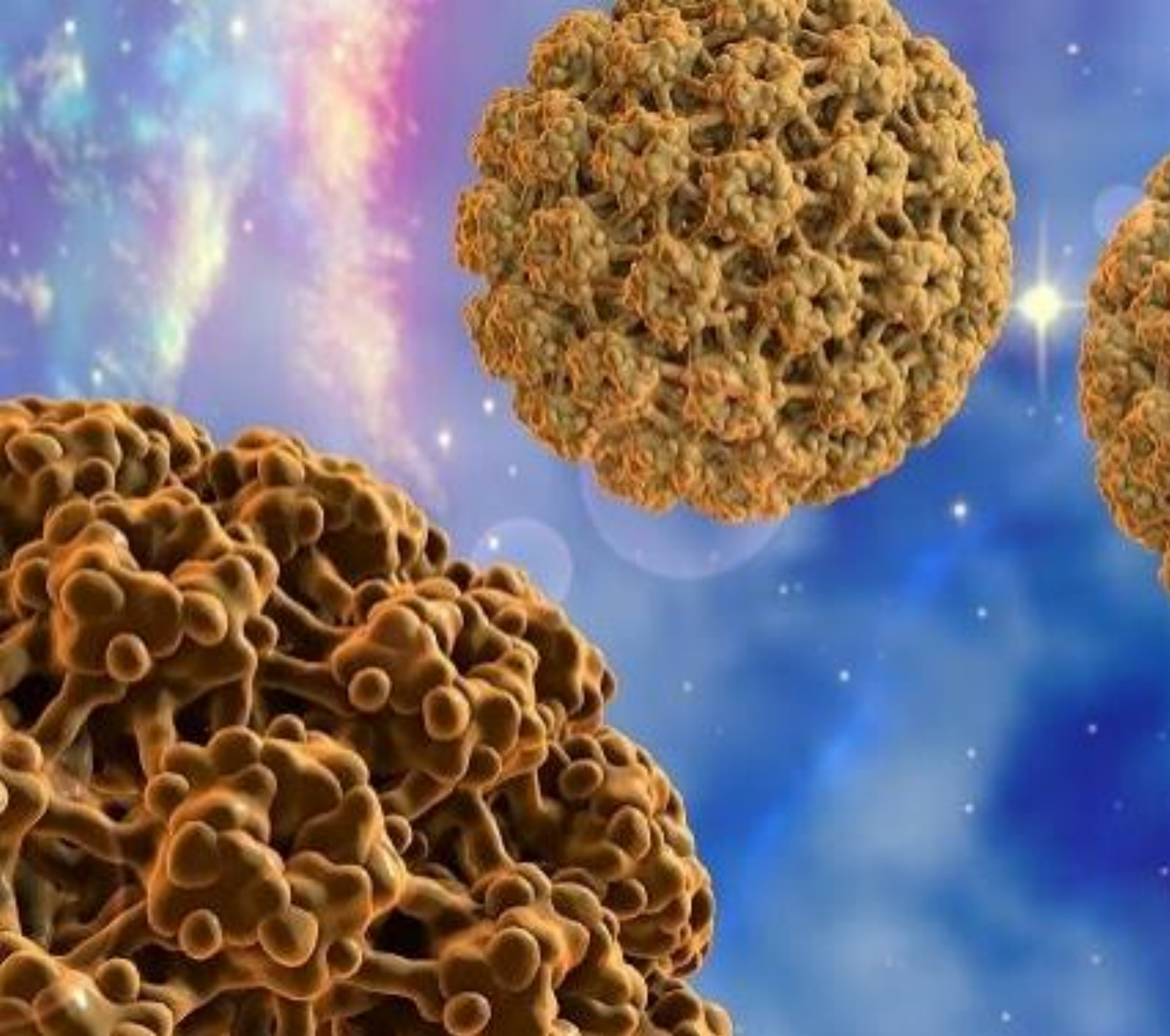
WE HAVE WORK TO DO:

- TO ENSURE THAT PEOPLE WITH DISABILITIES ARE FULLY INCLUDED IN AN ALL-OF-US APPROACH TO CANCER PREVENTION, INCLUDING HPV CANCERS.
- TO USE MIXED METHODS RESEARCH TO DEVELOP PRACTICAL SOLUTIONS TO REAL-WORLD PUBLIC HEALTH CHALLENGES.

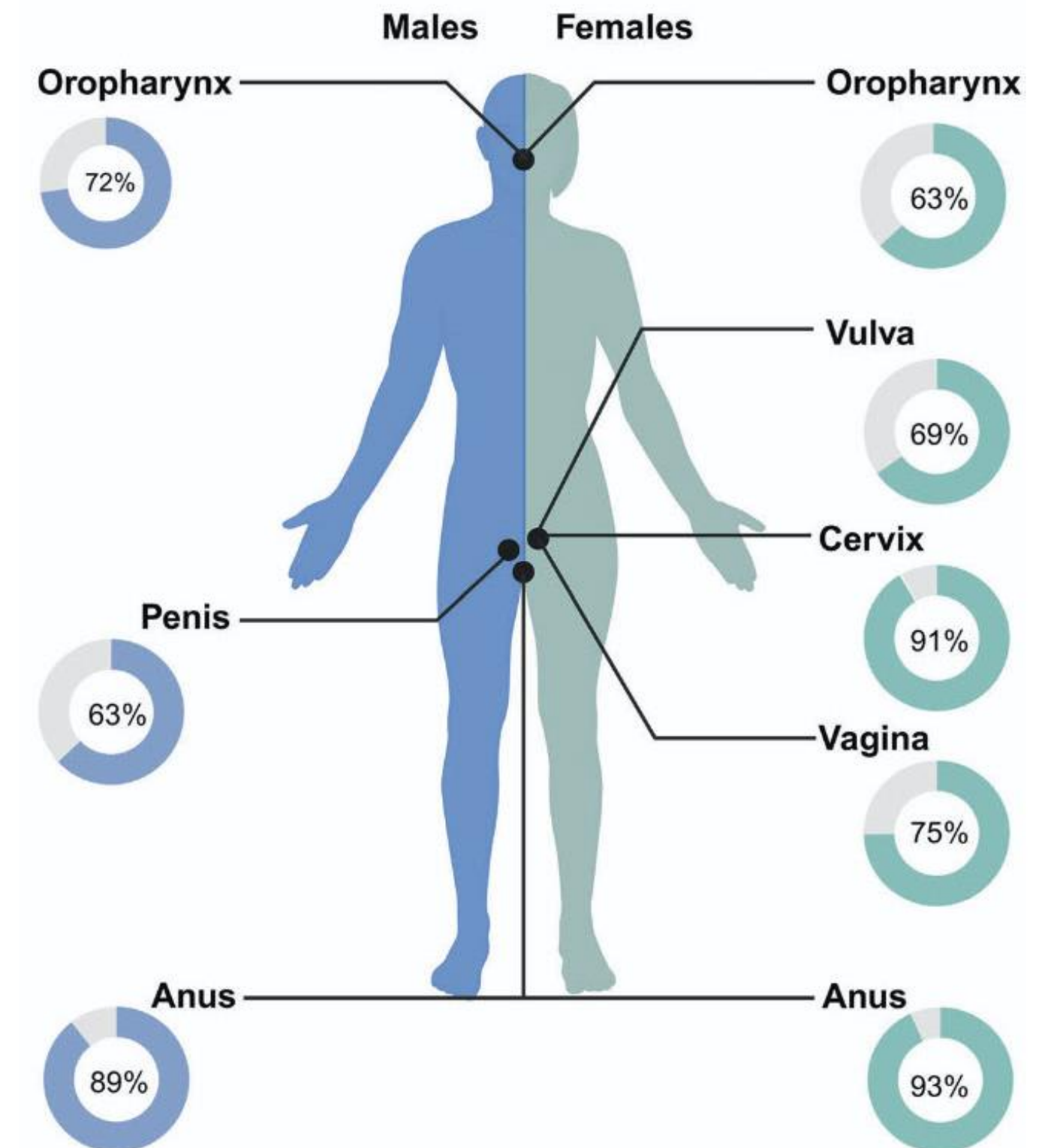
Q&A



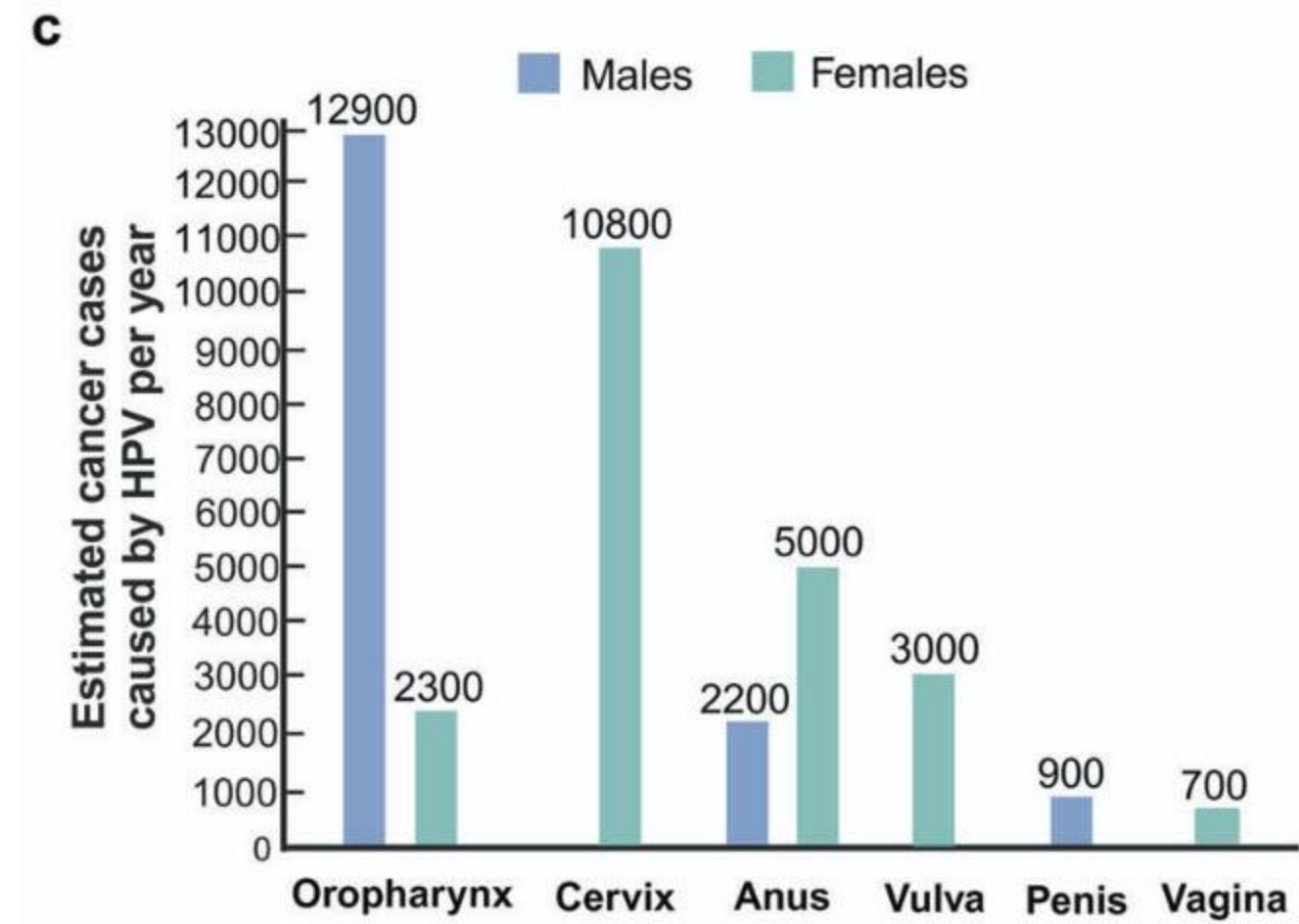
- EXTRA SLIDES FOLLOW



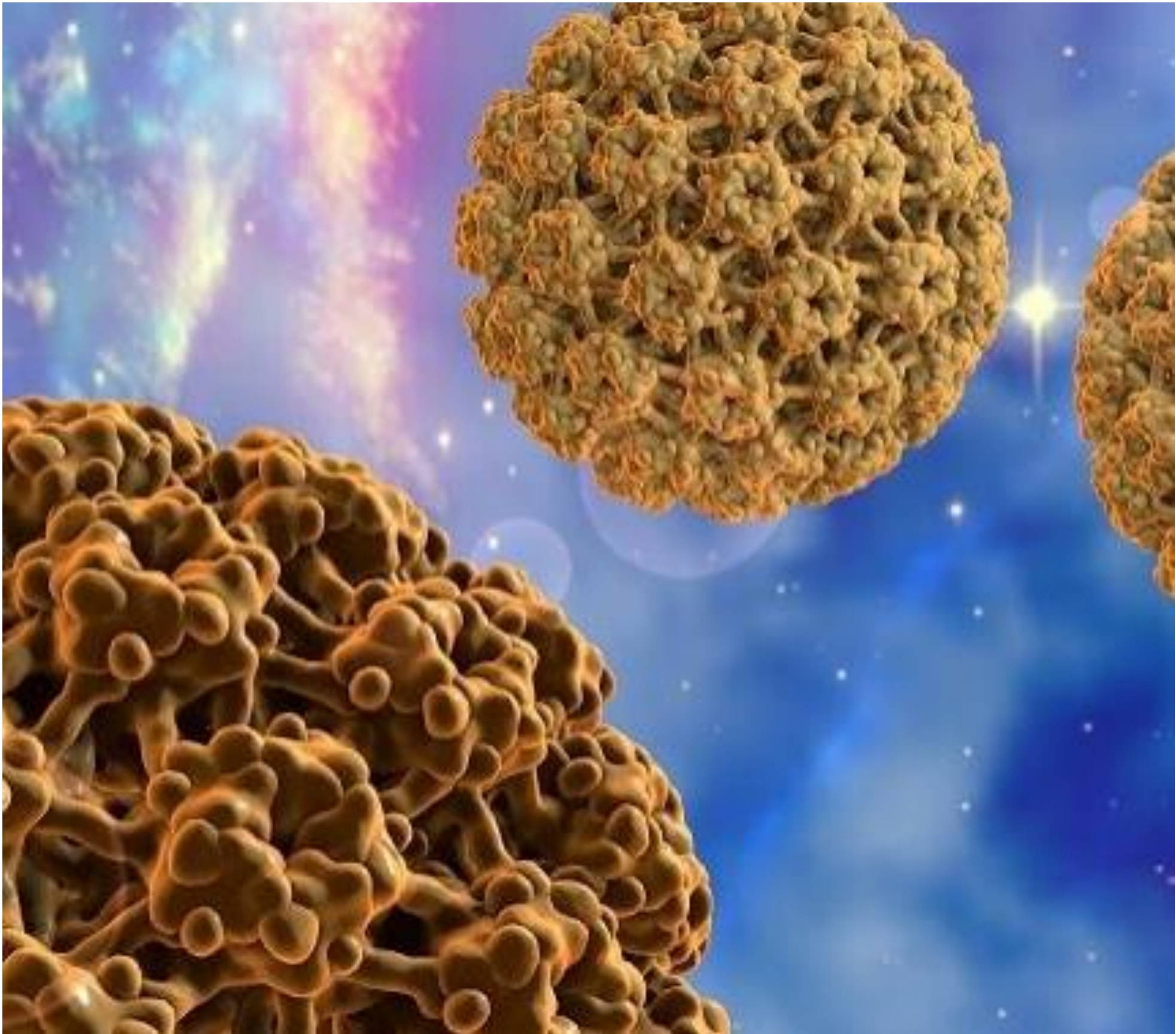
HPV CANCERS – LOCATIONS



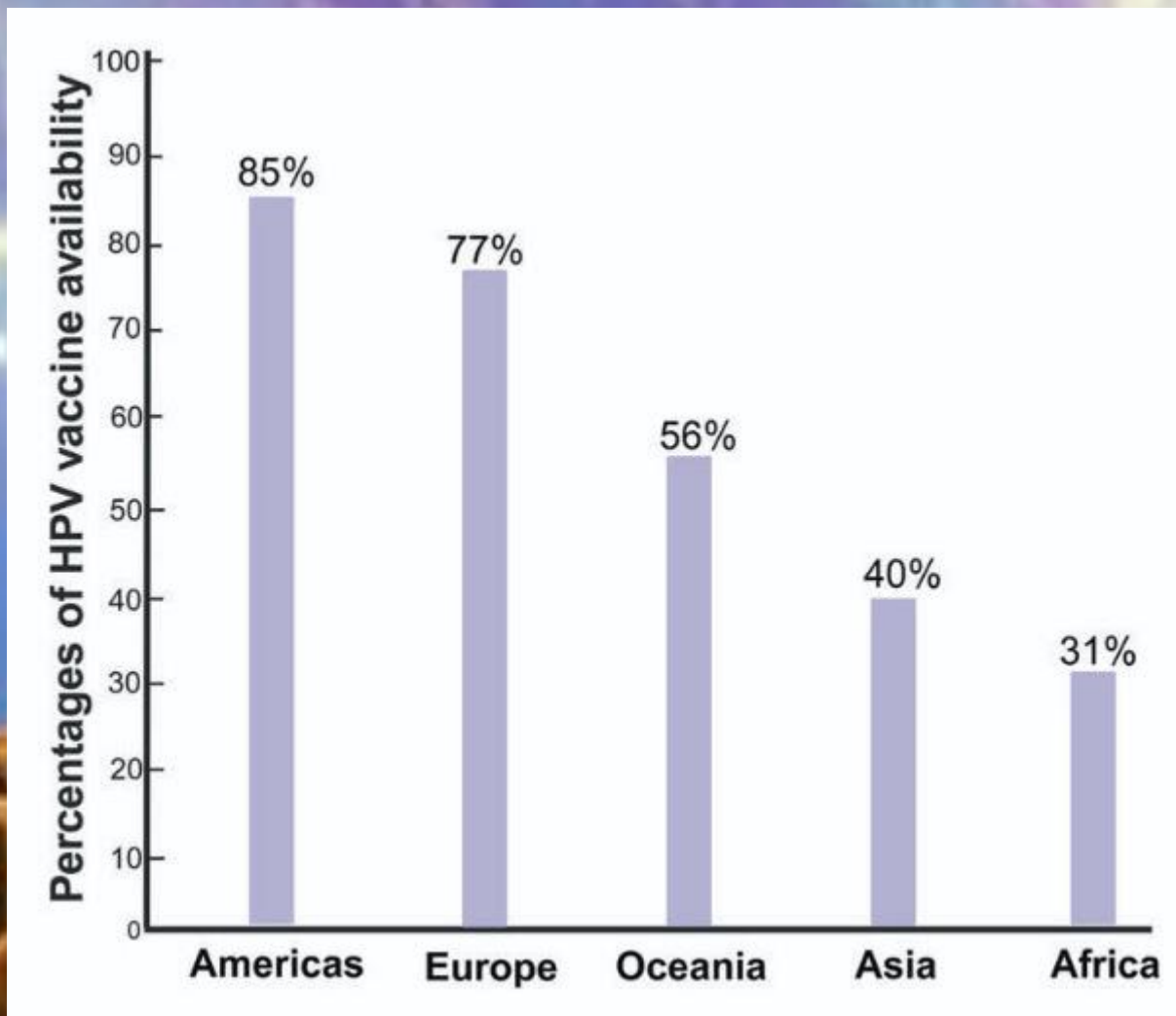
HPV CANCER CASES



Zhang et al., 2025. Signal Transduction and Targeted Therapy. 10(1):44.



HPV Vaccination Availability



Zhang et al., 2025. Signal Transduction and Targeted Therapy. 10(1):44.

VACCINATION SAFETY



- The HPV vaccine uses proteins that resemble the outer surface of **nine HPV types**, helping the immune system recognize and build protection against each one.
- HPV vaccines have a **strong safety record**.
- HPV vaccines are **highly effective at preventing infections caused by the nine HPV types included in the vaccine**.

EFFECTIVENESS



- In a long-term follow-up study of approximately **2,000 vaccinated females**, the vaccine was **more than 90% effective in preventing HPV-related precancers** over up to 10 years of follow-up.
- Many of the few precancer cases that occurred in long-term studies may be due to **HPV infections already present at the time of vaccination**.
- By **four years after vaccination**, no new cases of **high-grade cervical precancer (CIN2+)** were observed among vaccinated participants.
- Most effective cancer prevention is associated with vaccination before age 16 years.

VACCINE COMPONENTS



- The vaccine contains proteins that resemble the outer shell of HPV. This helps the immune system develop protection against the specific HPV types included in the vaccine.
- The vaccine is **not a live virus vaccine**.
- The vaccine **contains no viral DNA, RNA, or other components needed for a virus to grow or reproduce**.

■

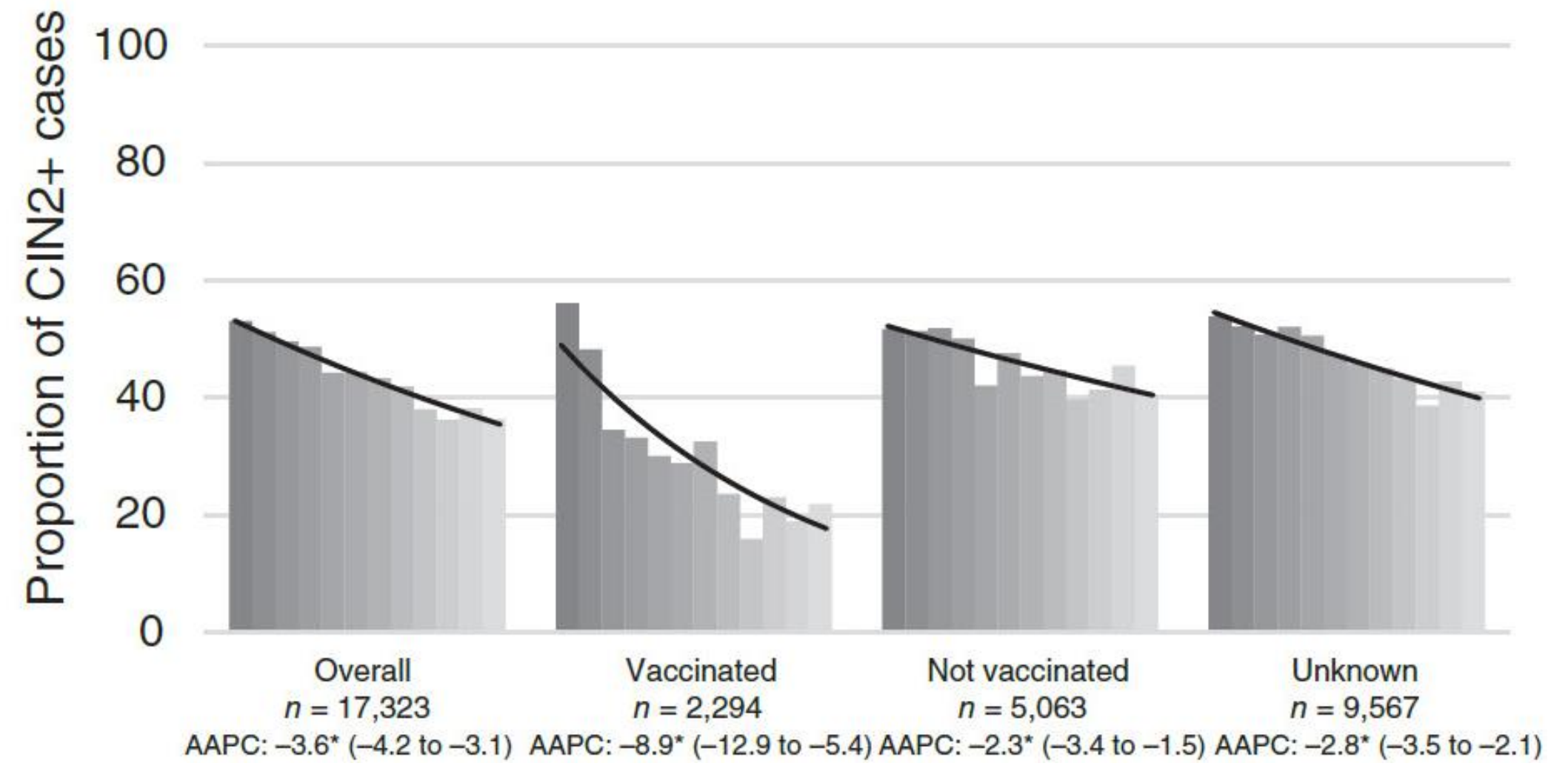
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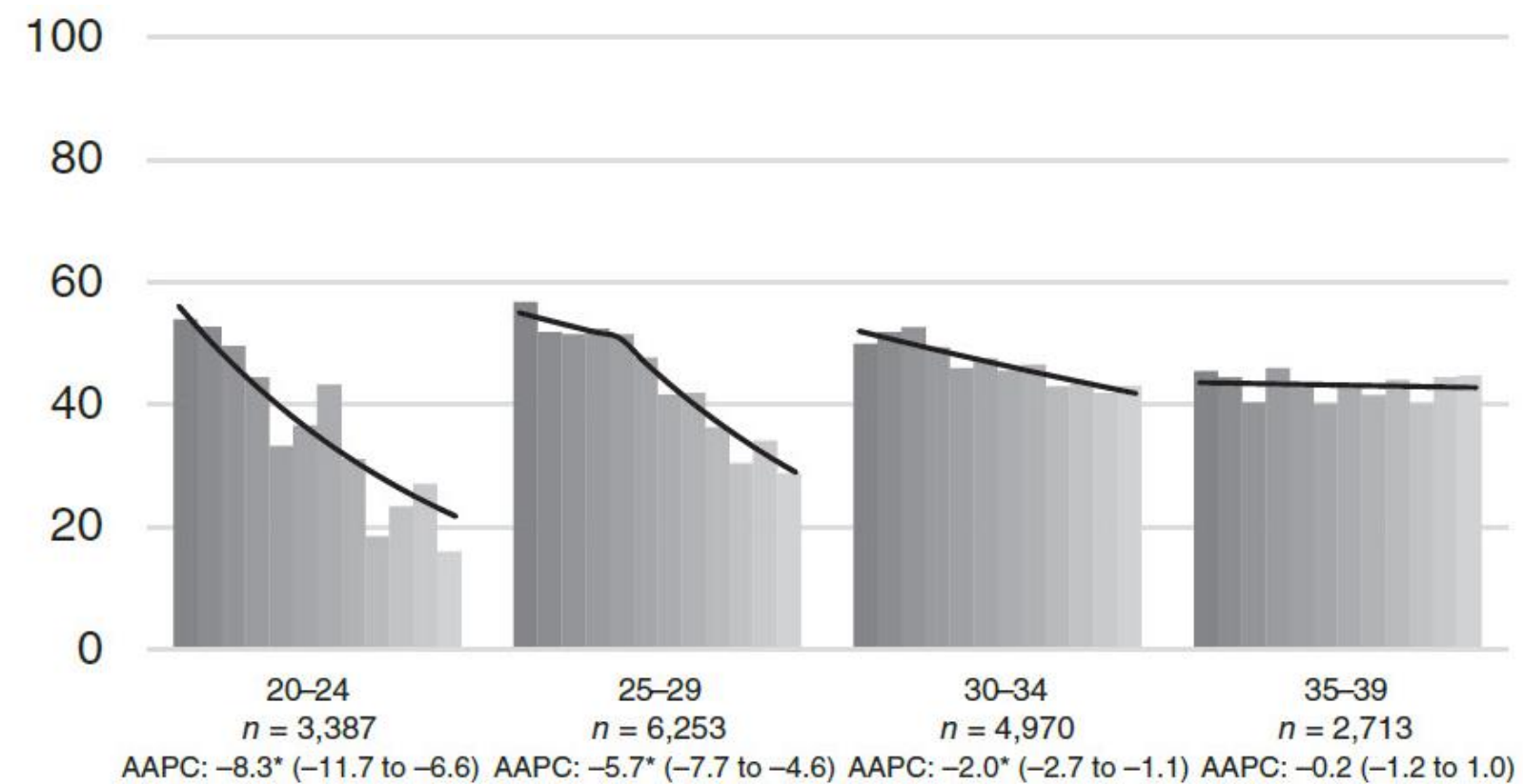
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Name	Type	Manufacturer	HPV genotypes covered	WHO prequalified (year)
Cervarix®	Bivalent	GlaxoSmithKline /UK	16, 18	Yes (2009)
Cecolin®	Bivalent	Xiamen Innovax/China	16, 18	Yes (2021)
Walrinvax®	Bivalent	Yuxi Zerun Biotechnology/China	16, 18	Yes (2022)
Gardasil®	Quadrivalent	Merck (MSD)/US	6, 11, 16, 18	Yes (2009)
Gardasil-9®	Nonavalent	Merck (MSD)/US	6, 11, 16, 18, 31, 33, 45, 52, 58	Yes (2018)
Cervavax®	Quadrivalent	Serum Institute of India	6, 11, 16, 18	No
Cecolin-9®	Nonavalent	Xiamen Innovax/China	6, 11, 16, 18, 31, 33, 45, 52, 58	No
11-valent	11-valent	China's National Vaccine and Serum Institute	6, 11, 16, 18, 31, 33, 45, 52, 58, 59, 68	No
SCT1000	14-valent	Sinocelltech Ltd./China	6, 11, 16, 18, 31, 33, 45, 52, 58, 35, 39, 51, 56, 59	No



-
-
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- While the reductions were greatest among the vaccinated, age mattered.
- Greatest reduction: 20-to-24-year-olds