Université Paris Cité

Actualités vaccinales

Panorama des vaccins en Phase 3

Odile Launay

Bordeaux, vendredi 17 juin 2022

Liens d'intérêt

- Recherches/essais cliniques : MSD, GSK bio, spmsd, Sanofi Pasteur, Janssen, Pfizer
- Advisory Boards : spmsd, Sanofi Pasteur, Janssen, Pfizer
- Cours, formations : Pfizer, MSD, Sanofi Pasteur
- Aides pour des recherches : MSD, GSK bio, spmsd, Sanofi Pasteur, Janssen, Pfizer

Plan

- Vaccins Covid et Monkeypox
- Vaccins pneumocoque
- Vaccins VRS et grippe
- Vaccins pneumo
- Vaccin CMV
- Vaccin Dengue
- Autres

Vaccins COVID-19

News & Analysis

Medical News & Perspectives

Challenges of Deciding Whether and How to Update COVID-19 Vaccines to Protect Against Variants

Rita Rubin, MA

- Quels vaccins en dose de rappel?
- Vaccins ‘adaptés aux variants’?
- Intérêt des ‘boost hétérologues’?
- Essais de phase 2/3 d’immunogénicité

Vaccins COVID-19

- Vaccins ‘adaptés’
- Bi valent D614/OMICRON (25microgramme de chaque) vs vaccin de 1ere génration

Overview Phase 2/3 (P205) study for mRNA-1273.214

All subject received mRNA-1273 primary series (100 µg) and mRNA-1273 booster (50 µg)

Trial	4th dose Booster	4th dose Dose	Subjects(n)	Comments
Phase 2/3 P205 *Only showing current arms*	**mRNA-1273**	50 µg	377	Enrolled February 21 to March 8
	.214 (32 Omicron mutations)	50 µg	437	Enrolled March 8 to March 23

mRNA-1273.214 also being evaluated in study in UK (P305) with ~1,500 participants per arm and mixed primary regimen

Vaccins COVID-19

- Vaccins ‘adaptés’ MODERNA
- Bi valent D614/OMICRON (25microgramme de chaque) vs vaccin de 1ere génération

Overview Phase 2/3 (P205) study for mRNA-1273.214

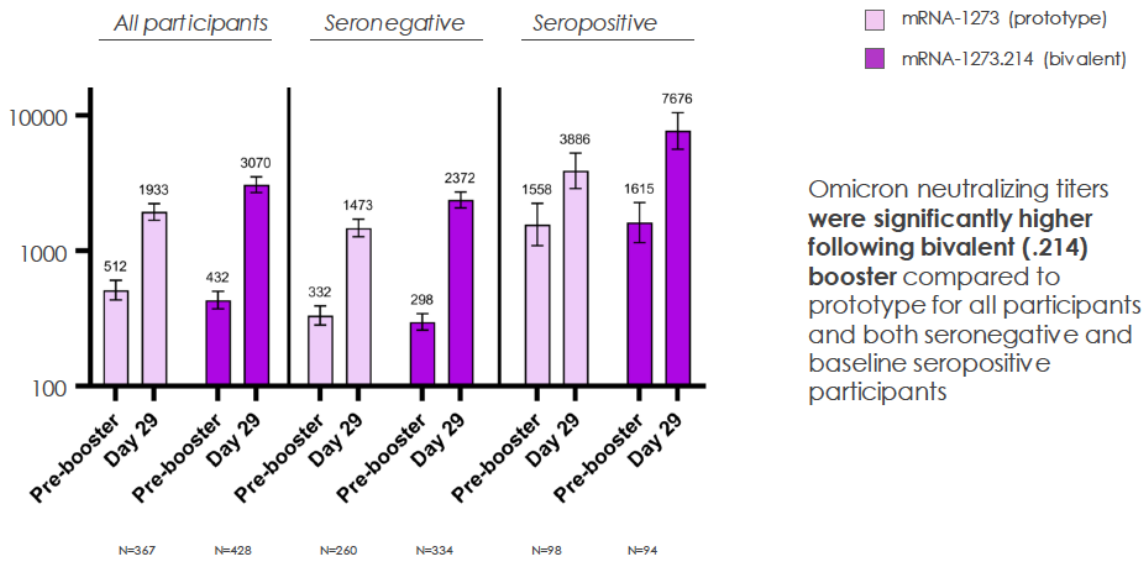
All subject received mRNA-1273 primary series (100 µg) and mRNA-1273 booster (50 µg)

	4th dose				
Trial	*Booster*	*Dose*	**Subjects(n)**	**Comments**	
Phase 2/3 P205 *Only showing current arms*	**mRNA-1273**	50 µg	377	Enrolled February 21 to March 8	*mRNA-1273.214 also being evaluated in study in UK (P305) with ~1,500 participants per arm and mixed primary regimen*
	.214 (32 Omicron mutations)	50 µg	437	Enrolled March 8 to March 23	

Vaccins COVID-19

- Vaccins ‘adaptés’ MODERNA
- Bi valent D614/OMICRON (25microgramme de chaque) vs vaccin de 1ere génération

Omicron neutralizing titers (PsVNT50)

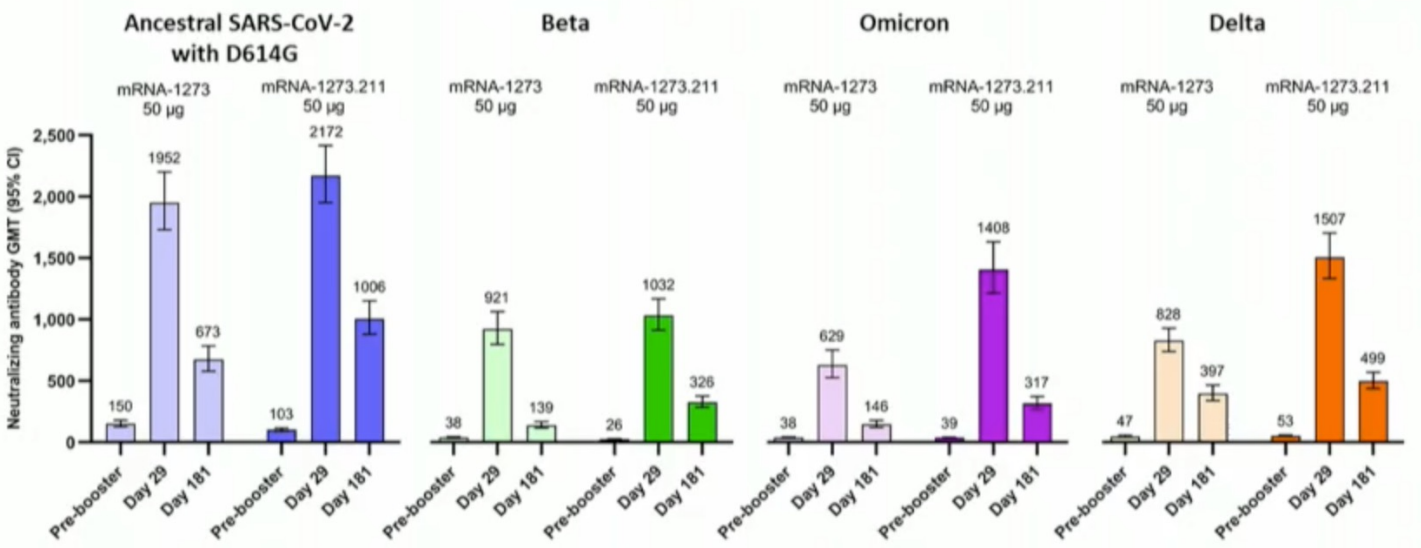


Omicron neutralizing titers **were significantly higher following bivalent (.214) booster** compared to prototype for all participants and both seronegative and baseline seropositive participants

Vaccins COVID-19

- Vaccins ‘adaptés’ MODERNA
- Bi valent D614/Beta (25microgramme de chaque)

Neutralizing antibody responses after the 50 µg mRNA-1273.211 booster dose were higher than the responses after the 50 µg mRNA-1273 booster dose against the ancestral SARS-CoV-2, Beta, Omicron, Delta (28 days) and the ancestral SARS-CoV-2, Beta and Omicron (180 days)



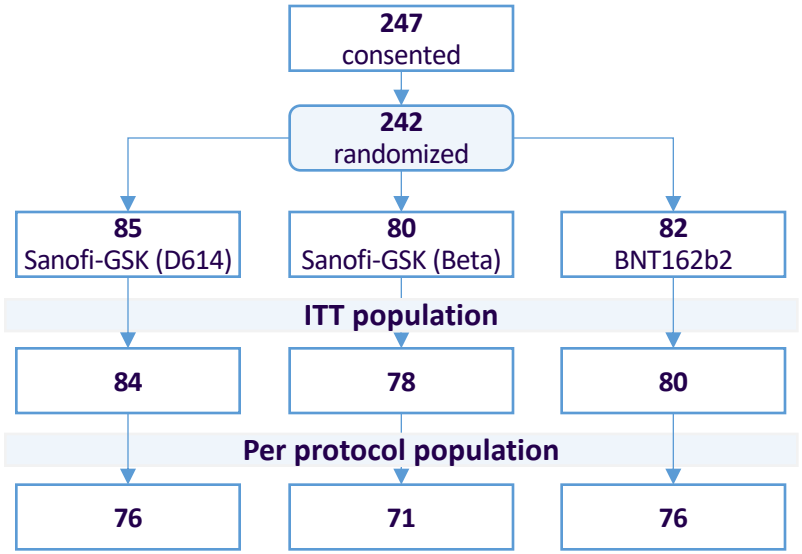
moderna

Spike-pseudotyped lentivirus neutralization assay ID_{50}^{7}

Vaccins COVID-19

- Boost hétérologue vaccin beta
- Essai APHP Coviboost

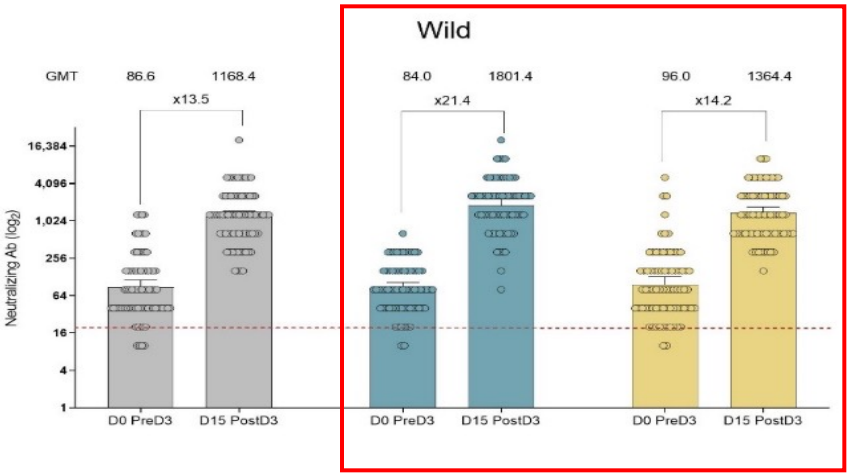
  - Promotion APHP
  - 11 centres participants
  - Première inclusion: 08/12/2021
  - Dernière inclusion: 14/01/2022
  - 247 inclus dont 67 dans l'étude ancillaire
  - Seulement 6 volontaires ont 65 ans ou plus

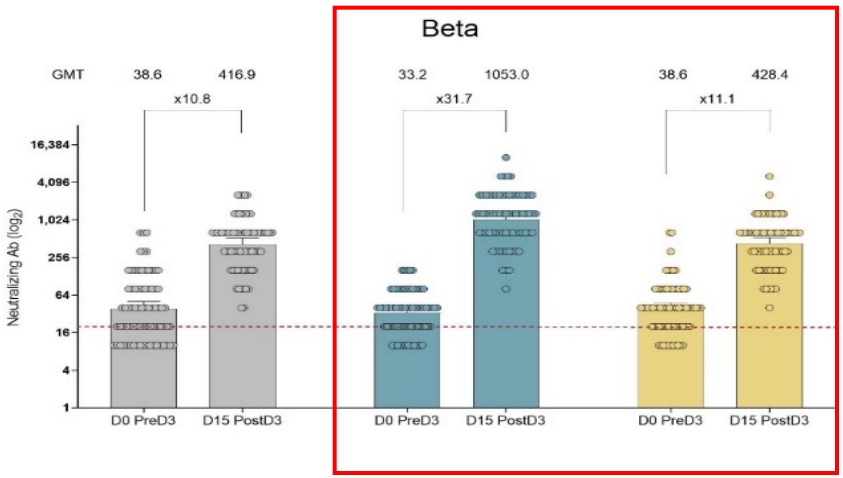


medRxiv preprint doi: https://doi.org/10.1101/2022.05.25.22274904; this version posted May 27, 2022

Vaccins COVID-19

- Boost hétérologue vaccin beta
- Titres en anticorps neutralisants plus élevés contre la souche orignale et les 3 variants testes (Beta, delta et Omicron BA1)

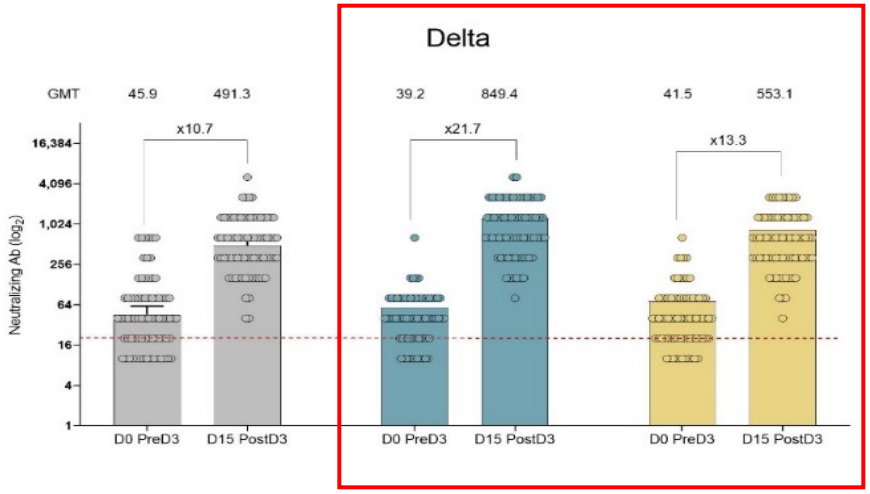


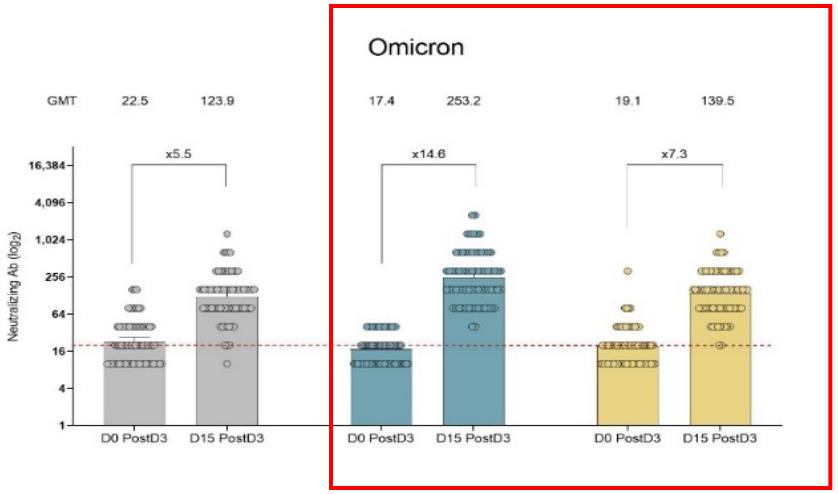


medRxiv preprint doi: https://doi.org/10.1101/2022.05.25.22274904; this version posted May 27, 2022

Vaccins COVID-19

- Boost hétérologue vaccin beta
- Titres en anticorps neutralisants plus élevés contre la souche orignale et les 3 variants testes (Beta, delta et Omicron BA1)

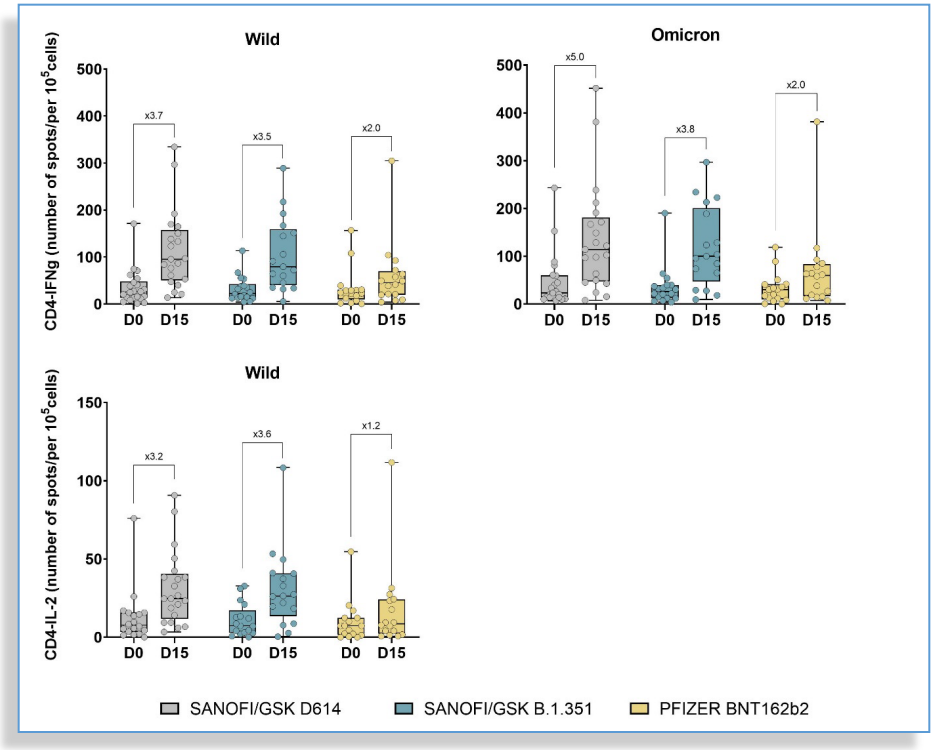




medRxiv preprint doi: https://doi.org/10.1101/2022.05.25.22274904; this version posted May 27, 2022

Vaccins COVID-19

- Boost hétérologue vaccin beta
- Plus forte réponse CD4: intérêt sur la persistance de la réponse (et de la protection)?



medRxiv preprint doi: https://doi.org/10.1101/2022.05.25.22274904; this version posted May 27, 2022

Vaccins Variole – Monkeypox virus

→ Vaccins variole de '3e génération' (Bavarian Nordic, Danemark)

→ **Vaccins vivants atténués non réplicatifs formulés à partir du virus vivant modifié de la vaccine Ankara (MVA)**

→ **Contre-indication à la vaccination** si hypersensibilité à l'un des composants du vaccin ou aux résidus présents à l'état de traces (protéines de poulet, benzonase, gentamicine et ciprofloxacine)

→ **Pas de contre-indication** pour les personnes immunodéprimées

Imvanex (Europe)

AMM 2013 : immunisation active contre la variole chez les adultes en circonstances exceptionnelles

Jynneos (USA)

AMM 2019 : prévention de la variole et du Monkeypox virus

Imvamune(Canada)

AMM 2013 : immunisation contre la variole

2020: extension d'AMM a la vaccination contre Monkeypox

Vaccins Variole 3è génération

The NEW ENGLAND JOURNAL of MEDICINE
ESTABLISHED IN 1812 NOVEMBER 14, 2019 VOL. 381 NO. 20

Phase 3 Efficacy Trial of Modified Vaccinia Ankara as a Vaccine against Smallpox

Phillip R. Pittman, M.D., Matthew Hahn, M.D., HeeChoon S. Lee, M.D., Craig Koca, M.D., Nathaly Samy, M.D.,

- Objectif: évaluer l'efficacité du vaccin MVA en prévention de la variole
- 440 militaires américains non préalablement vaccinés contre la variole
- Randomisés en 2 groupes:
  - MVA group: 2 doses de MVA à 4 semaines d'intervalle suivies d'une 1 dose du vaccin variole replicatif (ACAM2000) 4 semaines plus tard
  - ACAM2000 group: 1 dose du vaccin variole à J0
- Deux critères prinicpaux d'évaluation:
  - Immunogénicité : non infériorité (tires en anticorps neutralisants au pic)
  - Atténutation des signes cutanés post vaccination variole par le MVA

Table 1. Demographic Characteristics of the Participants (Full-Analysis Population).*

Characteristic	MVA Group (N=220)	ACAM2000-Only Group (N=213)	All Participants (N=433)
Age — yr	23.5±4.77	23.4±4.58	23.5±4.67
Sex — no. (%)			
Female	39 (17.7)	29 (13.6)	68 (15.7)
Male	181 (82.3)	184 (86.4)	365 (84.3)
Height — cm	174.00±9.169	173.87±9.140	173.93±9.144
Weight — kg	79.38±13.463	79.90±14.234	79.64±13.834
Body-mass index	26.12±3.297	26.30±3.292	26.21±3.291
Race or ethnic group — no. (%)†			
American Indian or Alaskan Native	8 (3.6)	6 (2.8)	14 (3.2)
Asian	14 (6.4)	12 (5.6)	26 (6.0)
Black	48 (21.8)	40 (18.8)	88 (20.3)
Native Hawaiian or other Pacific Islander	5 (2.3)	3 (1.4)	8 (1.8)
White	126 (57.3)	136 (63.8)	262 (60.5)
Other race	19 (8.6)	16 (7.5)	35 (8.1)
Hispanic or Latino	54 (24.5)	40 (18.8)	94 (21.7)
Not Hispanic or Latino	166 (75.5)	173 (81.2)	339 (78.3)

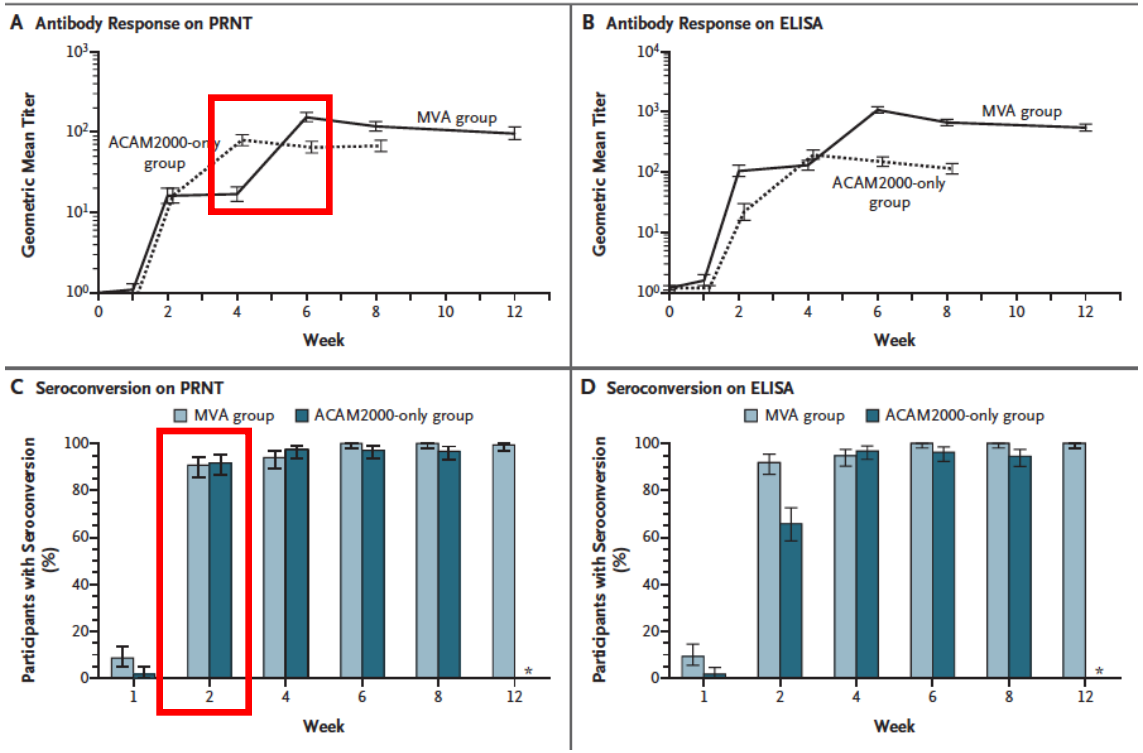
Vaccins Variole 3è génération

The NEW ENGLAND JOURNAL of MEDICINE
ESTABLISHED IN 1812 NOVEMBER 14, 2019 VOL. 381 NO. 20

Phase 3 Efficacy Trial of Modified Vaccinia Ankara as a Vaccine against Smallpox

Phillip R. Pittman, M.D., Matthew Hahn, M.D., HeeChoon S. Lee, M.D., Craig Koca, M.D., Nathaly Samy, M.D.,

- Immunogénicité
- Au pic:
  - titres en Ac neutralisants (variole) plus élevés dans le groupe MVA (153,5 vs 79,3)
  - Ratio des GMT 1,94 (IC95%: 1,56-2,40) : non infériorité
- A S2:
  - Seroconversion similaire dans les 2 groupes 91,8% et 90,8% respectivement



Vaccins Variole 3è génération

The NEW ENGLAND JOURNAL of MEDICINE
ESTABLISHED IN 1812 NOVEMBER 14, 2019 VOL. 381 NO. 20

Phase 3 Efficacy Trial of Modified Vaccinia Ankara as a Vaccine against Smallpox

Phillip R. Pittman, M.D., Matthew Hahn, M.D., HeeChoon S. Lee, M.D., Craig Koca, M.D., Nathaly Samy, M.D.,

- Efficacité
- Taille mediane des lésions (surface ou diametre)
- 0 dans le groupe MVA
- 76 mm2 dans le groupe ACAM2000
- Ration de 97,6% (IC 95%; 96,6-98,3)

Table 2. Assessment of Major Cutaneous Reactions after ACAM2000 Vaccination (Per-Protocol Population).*

Visit and Measurement	MVA Group (N=165)		ACAM2000-Only Group (N=161)		Area Attenuation Ratio or Diameter Attenuation Ratio (95% CI)†
	Median (95% CI)	Range	Median (95% CI)	Range	
Lesion area — mm²					
Days 6–8‡	0 (0–1)	0–96	37 (33–42)	0–133	95.2 (93.8–96.2)
Days 13–15	0 (0–0)	0–99	75 (69–85)	0–368	98.2 (97.7–98.4)
Maximum area‡	0 (0–2)	0–99	76 (70–87)	0–368	97.9 (96.6–98.3)
Lesion diameter — mm					
Days 6–8‡	0 (0–2)	0–12	8 (8–9)	0–16	80.0 (77.8–85.7)
Days 13–15	0 (0–0)	0–12	10 (10–11)	0–25	88.9 (87.5–90.0)
Maximum diameter‡	0 (0–2)	0–12	11 (10–11)	0–25	87.5 (83.3–88.9)

Vaccins Variole 3è génération

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 NOVEMBER 14, 2019 VOL. 381 NO. 20

Phase 3 Efficacy Trial of Modified Vaccinia Ankara as a Vaccine against Smallpox

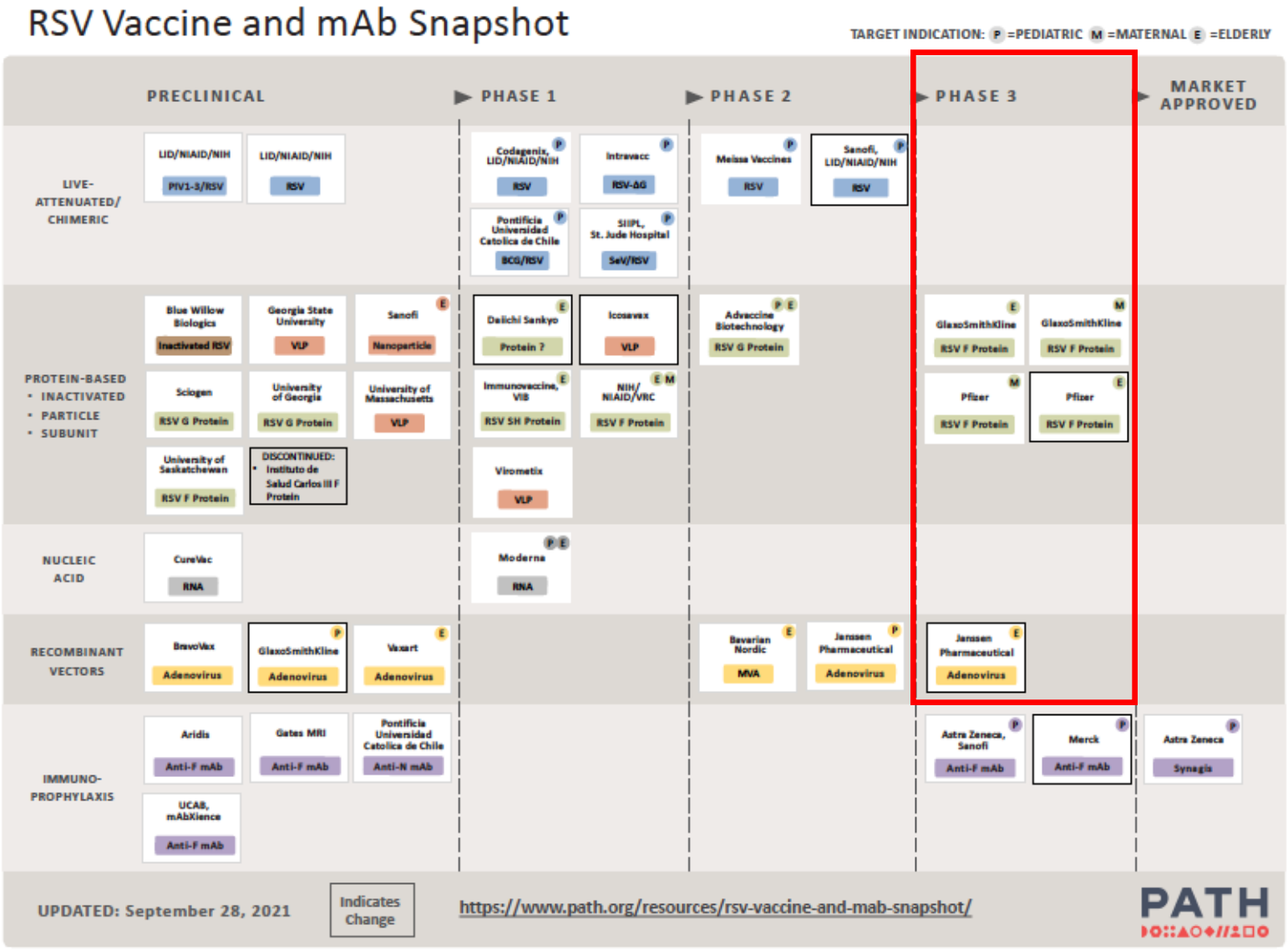
Phillip R. Pittman, M.D., Matthew Hahn, M.D., HeeChoon S. Lee, M.D., Craig Koca, M.D., Nathaly Samy, M.D.,

- Meilleure tolérance du vaccin MVA

Table 3. Pooled Solicited and Unsolicited Adverse Events during the Active Trial Phase in Each Vaccination Period (Full-Analysis Population).*

Event	MVA Group							ACAM2000-Only Group
	Period 1 MVA (N=220)	P Value†	Period 2 MVA (N=208)	P Value†	Periods 1 and 2 MVA (N=220)	Period 3 ACAM2000 (N=196)	P Value†	Period 1 (N=213)
	no. (%)		*no. (%)*		*no. (%)*			*no. (%)*
Documented adverse event	169 (76.8)	<0.001	135 (64.9)	<0.001	184 (83.6)	181 (92.3)	0.008	209 (98.1)
Nonserious adverse event within 29 days after vaccination	168 (76.4)	<0.001	135 (64.9)	<0.001	183 (83.2)	181 (92.3)	0.008	209 (98.1)
Serious adverse event‡	2 (0.9)	1.0	0	1.0	2 (0.9)	0	1.0	1 (0.5)
Adverse event of special interest	2 (0.9)	0.44	2 (1.0)	0.68	4 (1.8)	2 (1.0)	0.69	4 (1.9)
Related adverse event within 29 days after vaccination§	112 (50.9)	<0.001	76 (36.5)	<0.001	130 (59.1)	61 (31.1)	<0.001	158 (74.2)
Adverse event grade ≥3 within 29 days after vaccination	13 (5.9)	<0.001	4 (1.9)	<0.001	17 (7.7)	10 (5.1)	<0.001	64 (30.0)
Related adverse event grade ≥3§	3 (1.4)	<0.001	2 (1.0)	<0.001	5 (2.3)	3 (1.5)	<0.001	22 (10.3)
Related adverse event grade ≥3 within 29 days§	3 (1.4)	<0.001	2 (1.0)	<0.001	5 (2.3)	3 (1.5)	<0.001	22 (10.3)
Adverse event leading to withdrawal from trial	2 (0.9)	0.5	0	NA	2 (0.9)	0	NA	0
Adverse event leading to withdrawal from vaccination	2 (0.9)	0.5	0	NA	2 (0.9)	0	NA	0

Vaccin VRS


RSV Vaccine and mAb Snapshot
TARGET INDICATION: P =PEDIATRIC M =MATERNAL E =ELDERLY
PRECLINICAL
PHASE 1
PHASE 2
PHASE 3
MARKET APPROVED
LIVE-ATTENUATED/ CHIMERIC
LID/NIAID/NIH
PIV1-3/RSV
LID/NIAID/NIH
RSV
Codagenix, LID/NIAID/NIH
RSV
Intravacc
RSV-ΔG
Pontificia Universidad Catolica de Chile
BCG/RSV
SIIPL, St. Jude Hospital
SeV/RSV
Meissa Vaccines
RSV
Sanofi, LID/NIAID/NIH
RSV
PROTEIN-BASED
• INACTIVATED
• PARTICLE
• SUBUNIT
Blue Willow Biologics
Inactivated RSV
Georgia State University
VLP
Sanofi
Nanoparticle
Sciogen
RSV G Protein
University of Georgia
RSV G Protein
University of Massachusetts
VLP
University of Saskatchewan
RSV F Protein
DISCONTINUED:
• Instituto de Salud Carlos III F Protein
Daiichi Sankyo
Protein ?
Icosavax
VLP
Immunovaccine, VIB
RSV SH Protein
NIH/ NIAID/VRC
RSV F Protein
Viromatix
VLP
Advaccine Biotechnology
RSV G Protein
GlaxoSmithKline
RSV F Protein
GlaxoSmithKline
RSV F Protein
Pfizer
RSV F Protein
Pfizer
RSV F Protein
NUCLEIC ACID
CureVac
RNA
Moderna
RNA
RECOMBINANT VECTORS
BravoVax
Adenovirus
GlaxoSmithKline
Adenovirus
Vaxart
Adenovirus
Bavarian Nordic
MVA
Janssen Pharmaceutical
Adenovirus
Janssen Pharmaceutical
Adenovirus
IMMUNO-PROPHYLAXIS
Aridis
Anti-F mAb
Gates MRI
Anti-F mAb
Pontificia Universidad Catolica de Chile
Anti-N mAb
UCAB, mAbXience
Anti-F mAb
Astra Zeneca, Sanofi
Anti-F mAb
Merck
Anti-F mAb
Astra Zeneca
Synagis
UPDATED: September 28, 2021
Indicates Change
https://www.path.org/resources/rsv-vaccine-and-mab-snapshot/
PATH

Vaccin VRS

PRESS RELEASE

GSK

For media and investors only

Issued: 10 June 2022, London UK – LSE Announcement

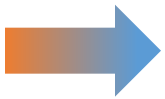
GSK announces positive pivotal phase III data for its respiratory syncytial virus (RSV) vaccine candidate for older adults

- Protéine recombinante (Prefusion RSV F glycoprotéine)
- Adjuvanté par AS01
- Essai de phase 3, randomisé, contre placebo,
- 25 000 participants de 60 ans et plus
- une dose de vaccin
- Analyse intermediaire
- Depot du dossier aux autorités réglementaires

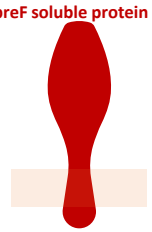
Vaccin VRS (2)

Single-injection vaccine regimen (mix)

The **RSV F protein stabilised in the preF conformation** is the preferred immunogen[1]



Ad26.RSV.preF protection against RSV was successfully demonstrated in a human challenge model[2]



The **humoral immune response improves** when **preF protein** is added to Ad26.RSV.preF[3] (previous regimen selection study)[4]

- Ad26.RSV.preF + RSV preF protein (combination regimen) is a **replication-incompetent Ad26 vector** that encodes the RSV F protein stabilised in its preF conformation[5]

Vaccin VRS (2)

CYPRESS: Essai de phase 2b: Ad26.RSV.preF + RSV preF protein was highly efficacious against RSV-mediated LRTD in adults ≥65 years

Vaccine efficacy was higher with increasing severity of the LRTD case definitions:

- Case definition 1: 80%
- Case definition 2: 75%
- Case definition 3: 70%

Ad26.RSV.preF + RSV preF protein elicited robust and durable humoral and cellular immune responses

The Phase 3 (EVERGREEN) study is currently ongoing (NCT04908683)

Vaccins pneumocoque

couverture sérotypique des vaccins actuels

Sérotypes	1	3	4	5	6A	6B	7F	9V	14	18C	19A	19F	23F	8	10A	11A	12F	15B	22F	33F	2	9N	17F	20
Vaccin polysaccharidique																								
PPSV23 (Merck)	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Vaccins conjugués																								
PCV13 (Pfizer)	●	●	●	●	●	●	●	●	●	●	●	●	●											
PCV15 (Merck)	●	●	●	●	●	●	●	●	●	●	●	●	●						●	●				
PCV20 (Pfizer)	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				

- Les sérotypes additionnels choisis pour leur contribution aux infections invasives de par le monde.[1-5]
- Certains associés à un fort taux de mortalité : 8, 10A, 11A, 15BC, 22F, 33F
- 4 ont une sensibilité diminuée aux antibiotiques : 11A,15B/C, 22F, 33F
- et/ou à des méningites : 10A, 15B/C, 22F, 33F

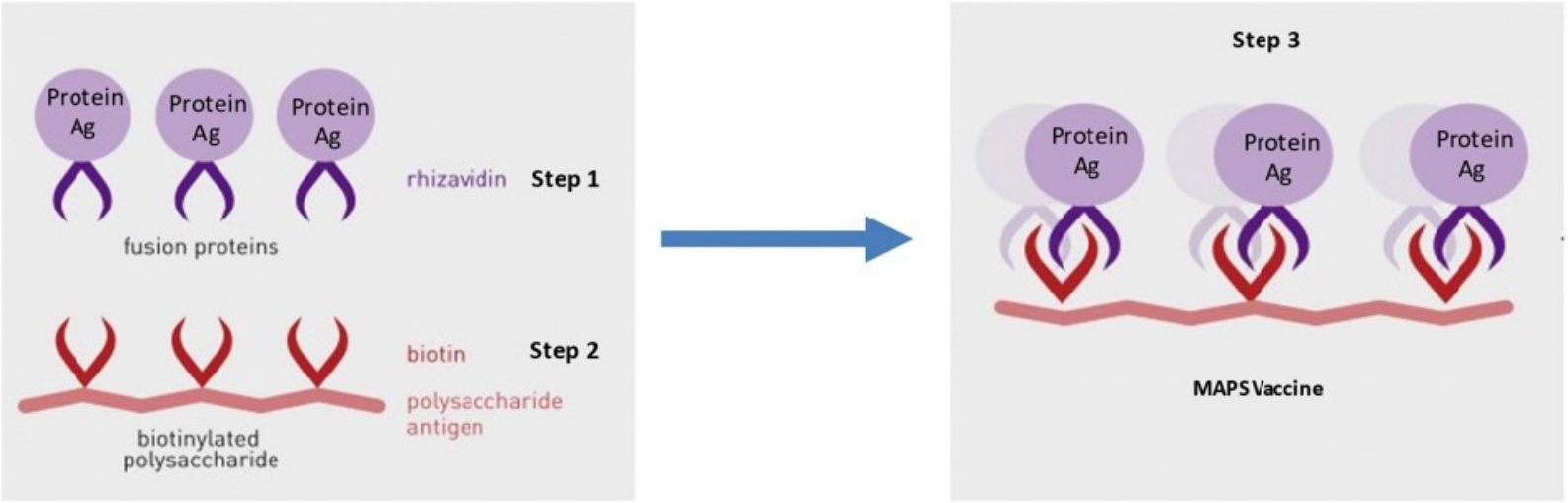
PCV13=13-valent pneumococcal conjugate vaccine; PCV15=15-valent pneumococcal conjugate vaccine PCV20=20-valent pneumococcal conjugate vaccine; PPSV23=23-valent pneumococcal polysaccharide vaccine.

Vaccins pneumocoque: développements en cours

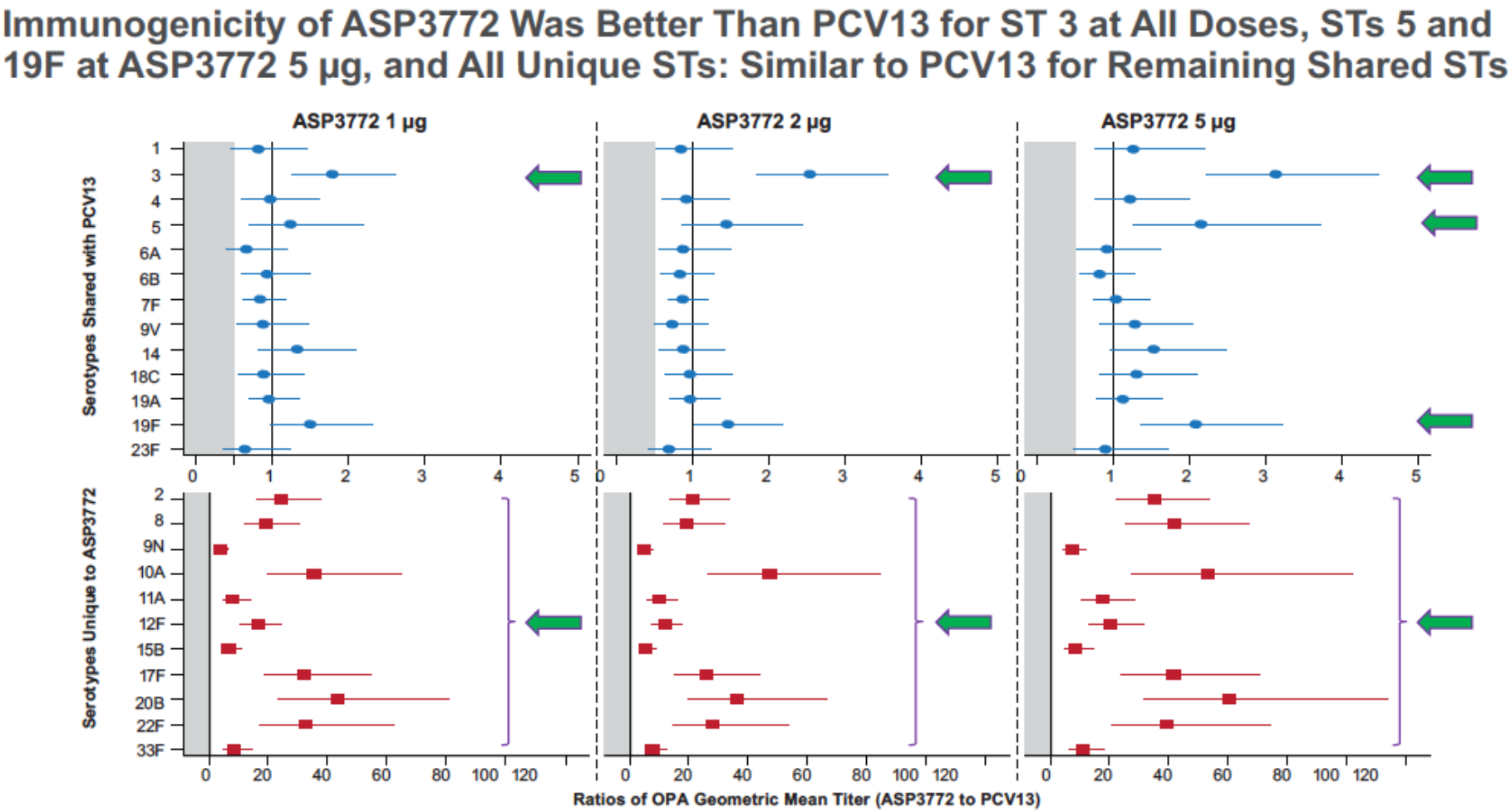
- Vaccin 21 valent: V116, essais de phase 3 en cours dans différentes populations
- ASP3772 : utilise la technologie MAPS

ASP3772 contains 24 PSs: 13 STs contained in PCV13 plus an additional 11 STs

– a unique carrier protein consisting of two pneumococcal protein fragments of genetically conserved *sp*1500 and *sp*0785 proteins, which have been shown to be important for pneumococcal virulence in vivo, immunity shown to be protective in vivo [1]



Vaccins pneumocoque: ASP3772

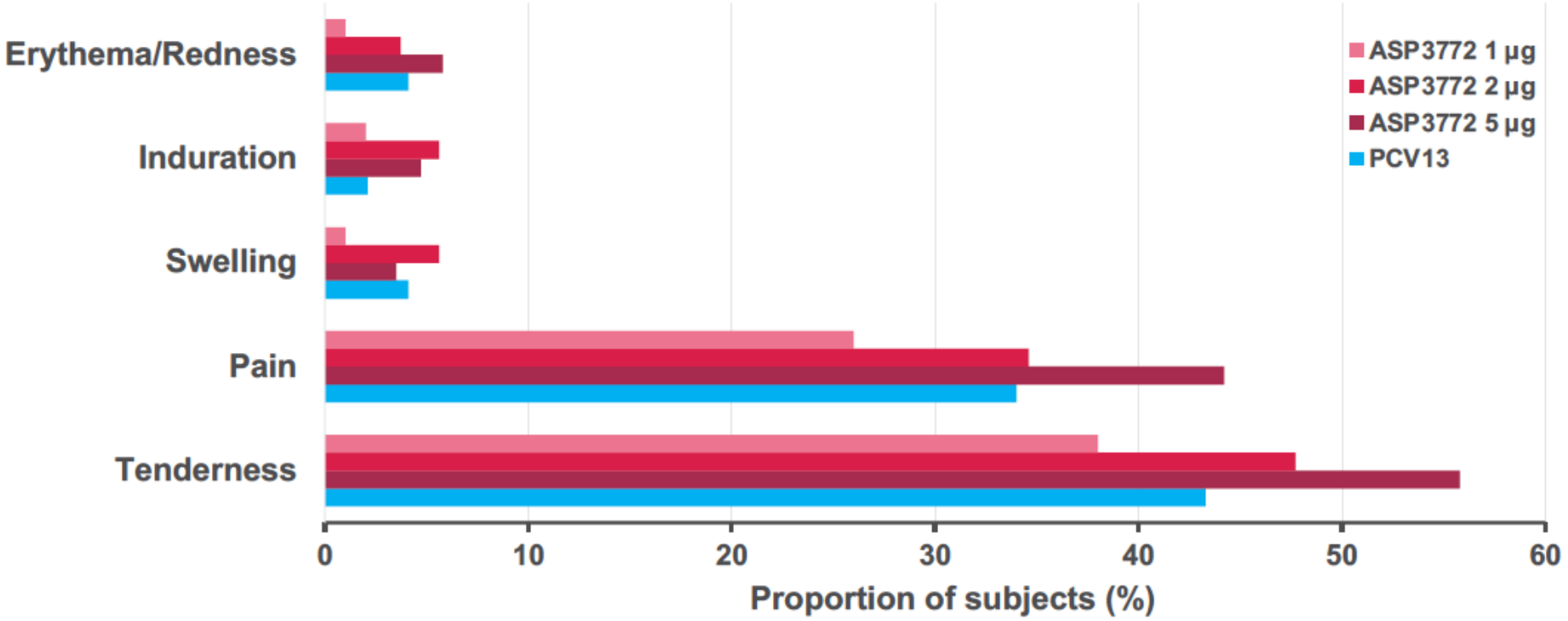


The point estimate is the ratio of the geometric means. Whiskers extend to the 95% confidence interval of the ratio. Gray area indicates ratio of 0.5 or below. Note different scales on ordinate axis.
Abbreviations: OPA, opsonophagocytic activity; PCV, pneumococcal conjugate vaccine.

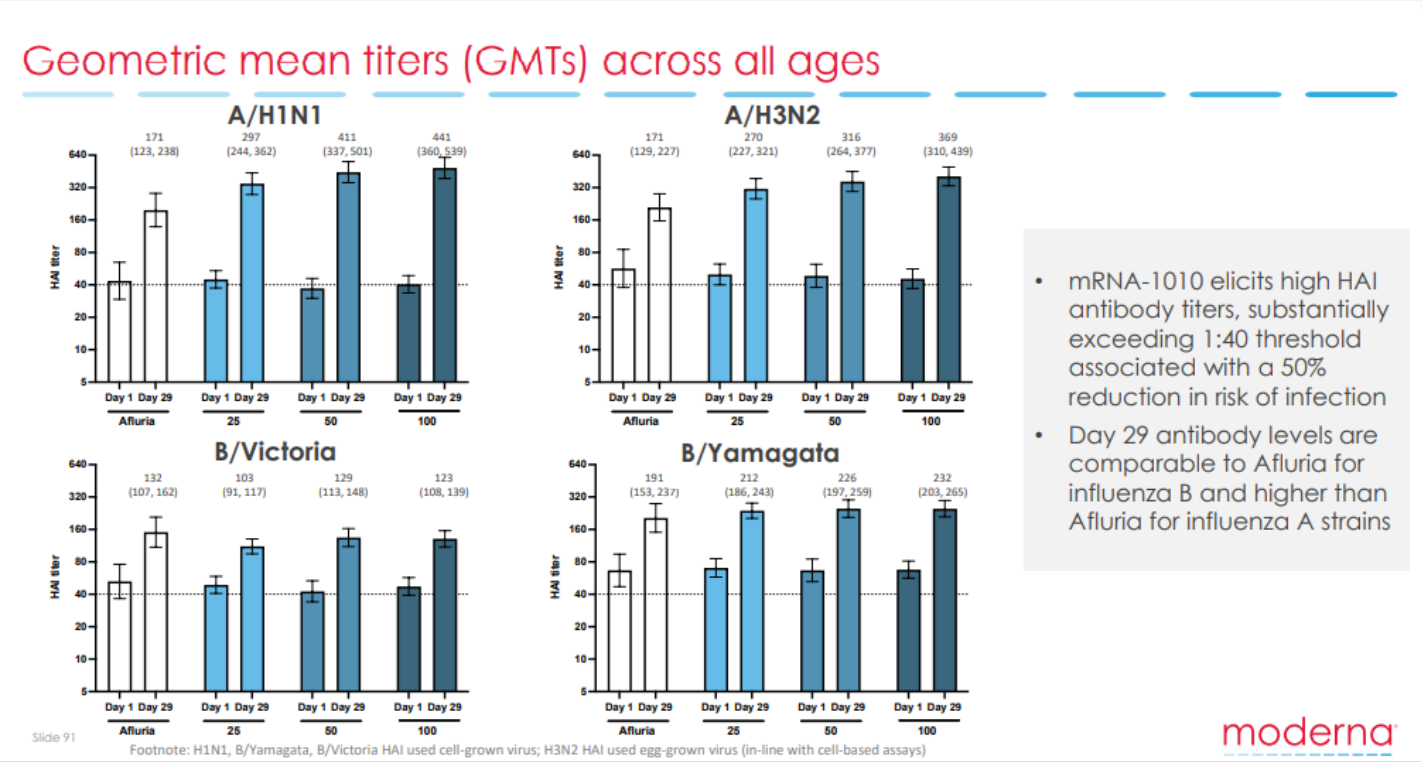
Green arrows point to significantly higher ratio

Vaccins pneumocoque: ASP3772

Frequently Reported Local Reactions Were Tenderness and Pain With No Clear Difference Across ASP3772 and PCV13 Cohorts



Vaccins grippe ARNm



Ref: : Moderna 3d Vaccines Day, March 24 2022

Phase 3 en cours de demarrage

Vaccin CMV

Table 3
CMV vaccines in development.

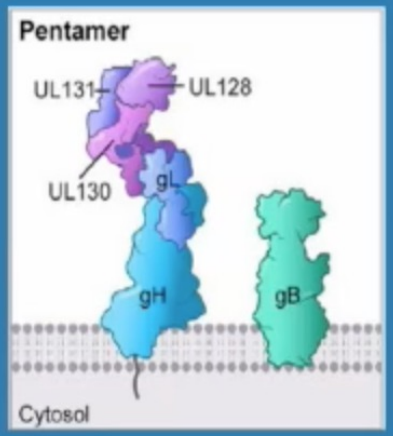
Type of vaccine	Developer	Ref. #
Attenuated strain (Towne)	Wistar Inst./Med Coll VA	[41]
Recombinants with wild virus (Towne-Toledo)	Medimmune	[44]
Replication-defective virus	Merck	[51]
Vectored:		
Canary Pox	Sanofi	[52]
MVA	City of Hope	[57]
Adeno	Queensland Inst.	[58]
LCMV	Hookipa	[55]
VSV	Yale	[59]
Recombinant gB glycoprotein with adjuvant	Sanofi Pasteur, GSK	[45–47]
Soluble Pentamers	Redbiotech, GSK, Humabs	[49]
DNA plasmids	Astellas, Inovio	[61,63]
Self-replicating RNA	Moderna	[54,62]
Peptides	City of Hope	[64]
Dense bodies	Vaccine Project Management (Germany) and Serum Inst. India	[61]
Virus-like particles	Variations Bio	[56]

Modified mRNA Vaccine

Composition: modified mRNA vaccine encoding CMV pentamer complex and glycoprotein antigens (gB)[a,b]

- **Phase 2**, randomized, observer-blind, placebo-controlled, dose-finding trial
- 3 doses in 180 healthy CMV-seronegative and 72 CMV-seropositive males and females, 18 to 40 years old
- Placebo vs mRNA (50 µg, 100 µg, 150 µg)

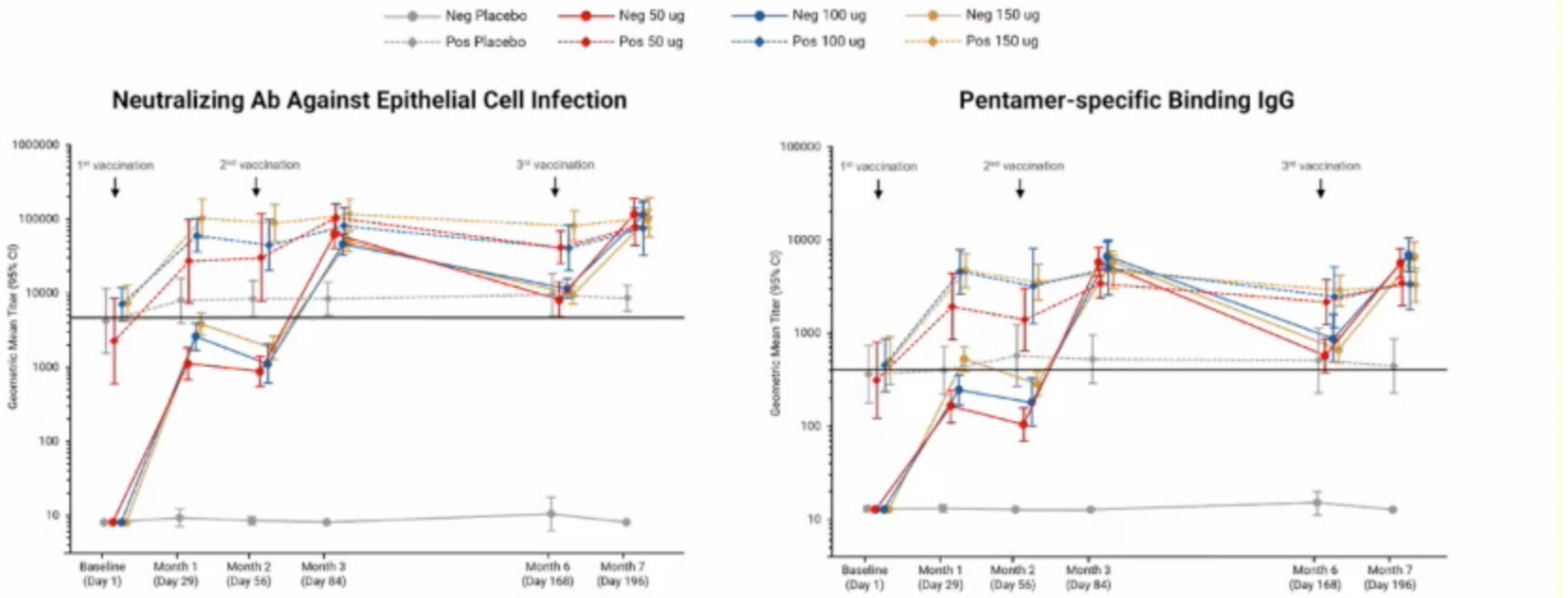
CMV vaccine (mRNA 1647)[a]



GMT, antibody geometric mean titre; LNP, lipid nanoparticle; nAb, neutralizing antibody.

a. Panther L. Presented at: Annual Conference on Vaccinology Research; April 20, 2021; Bethesda, Maryland; b. ClinicalTrials.gov. Accessed April 22, 2022. https://clinicaltrials.gov/ct2/show/NCT04232280.

Modified mRNA Vaccine: Immunogenicity



Immunogenicity: antibody response against pentamer

Seronegative: after 3rd dose, nAB GMT against epithelial cell infection × 20 baseline GMT in seropositives

Seropositive: after 3rd dose, nAB GMT against epithelial cell infection increased × 6.8-fold over baseline

Panther L. Presented at: Annual Conference on Vaccinology Research; April 20, 2021; Bethesda, Maryland.

Phase 3 en cours chez des femmes en âge d’avoir des enfants et exposées

Vaccin Dengue

APJAI Asian Pacific Journal of Allergy and Immunology

REVIEW ARTICLE

Dengue vaccine: Global development update

Eakachai Prompetchara,[1,2,3] Chutitorn Ketloy,[3,4] Stephen J. Thomas,[5] Kiat Ruxrungtham[4,6]

Table 1. Dengue vaccine candidates currently evaluate in clinical trials

Vaccine type	Vaccine name/Strategy	Developer	Clinical Trial Phase
Attenuated chimera	**CYD, Denvaxia®:** Yellow fever 17D vaccine virus backbone chimerized with prM and E proteins from DENV-1-4	Sanofi-Pasteur	Licensed, Post licensed evaluation is on-going
	TV003/TV005: Attenuated by deletion of 30 nucleotides from 3' UTR of DENV-1, DENV-3 DENV-4, and a chimeric DENV-2/DENV-4	US NIH	Phase III
	DENVax: Use attenuated DENV-2 PDK-53 as the backbone and replace with prM and E of other serotypes (DENV-2/-1, -2/-3, and -2/-4 chimeras)	US CDC/Inviragen/ Takeda	Phase III
Inactivated virus	**Purified formalin-inactivated virus (PIV)** formulated with adjuvants	WRAIR/GSK	Phase I
DNA vaccine	**Monovalent DENV-1** prME delivered by needle-free biojector **Tetravalent prM/E** formulated with Vaxfectin	US NMRC	Phase I
Subunit vaccine	**V180:** 80% of N-terminal E protein produced in insect cell formulated with ISOCOMATRIX and alhydrogel	Hawaii Biotech Inc. and Merck	Phase I
Heterologous prime/boost	**TLAV-prime/PIV-boost and *vice versa***	US Army Medical Research and Materiel Command	Phase I

Vaccins et antibioresistance

Table 2 Vaccine candidates in clinical development with the potential to prevent diseases caused by pathogens highlighted in this review

Vaccine	Composition	Latest trials
C. difficile		
PF-06425090 (Pfizer)[58]	Genetically/chemically inactivated *C. difficile* toxins A and B ClinicalTrials.gov identifier NCT03090191	Phase 3
ACAM-CDIFF (Sanofi)[86]	Formalin-inactivated wild-type toxoid (A and B) ClinicalTrials.gov identifier NCT01887912	Phase 3
VLA84 (Valneva)[87]	Recombinant fusion protein consisting of truncated toxin A and B ClinicalTrials.gov identifier NCT02316470	Phase 2
S. aureus		
SA4Ag (Pfizer)[88]	CP5/CP8-CRM_{197}, P-Y variant ClfA, MntC ClinicalTrials.gov identifier NCT02388165	Phase 2b
4C-Staph (GSK)[89]	Csa1A (Sur2), FhuD2, EsxA/EsxB, HlAH35L ClinicalTrials.gov identifier NCT01160172	Phase 1
Group B *Streptococcus*		
Trivalent GBS vaccine (GSK)[90]	Capsular epitopes of GBS serotypes Ia, Ib and III conjugated to CRM197 ClinicalTrials.gov identifier NCT02270944	Phase 2
Bivalent GBS protein vaccine (Minervax)[91]	N-terminal domains of the Rib and alpha C surface proteins	Phase 1
E. coli		
EcoXyn-4V (GlycoVaxyn)[92]	*E. coli* bioconjugate vaccine ClinicalTrials.gov identifier NCT02289794	Phase 1
FimH adhesin vax[93] (Sequoia)	Protein-based vaccine	Phase 1
JNJ63871860 (Janssen)[94]	*E. coli* bioconjugate vaccine	Phase 2

Merci pour votre attention

Safety and immunogenicity of PXVX0317, an aluminium hydroxide-adjuvanted chikungunya virus-like particle vaccine: a randomised, double-blind, parallel-group, phase 2 trial

Sean R Bennett, James M McCarty, Roshan Ramanathan, Jason Mendy, Jason S Richardson, Jonathan Smith, Jeff Alexander, Julie E Ledgerwood, Paul-André de Lame, Sarah Royalty Tredo, Kelly L Warfield, Lisa Bedell