WALVAX®
WALVAX BIOTECHNOLOGY CO., LTD.

Vaccine Innovations

Lessons learned in developing mRNA-based COVID-19 vaccines

Andrew Wong, MD, MBA
Director, Business Development, Walvax Biotech
General Manager, Wotai Biotech Co., Ltd., a Walvax subsidiary

December 9, 2022

Overview of Walvax

01 History | 21 Years in Business

Founded in 2001 with 13 subsidiaries

02 Market Value |$9.0 B

IPO in 2010

Market value US$9.16 B （as of today）

03 Global Sales | $531M

Products distributed in 18 countries

Worldwide sales: 2021 - US$531 million

1H2022 - US$348 million

04 Licensed Products | 9 Vaccines

Pneumococcal + Human papillomavirus+ Meningococcal vaccine series + mRNA COVID-19 vaccine

Product and Pipeline

With 9 licensed products, Walvax has world's 2nd approved PCV-13, 4th approved mRNA Covid-19 vaccine and 5th approved HPV vaccine.

4 Advanced Technology Platform

Polysaccharide / Conjugate vaccines

13-valent Pneumococcal Polysaccharide Conjugate Vaccine

23-valent Pneumococcal Polysaccharide Vaccine

Men ACYW135 Polysaccharide Vaccine

Men A/C Polysaccharide Vaccine

Men A/C Polysaccharide Conjugate Vaccine

Hib Conjugate Vaccine

DTaP

Group ACYW135 Meningococcal Polysaccharide Conjugate Vaccine
Phase III

Recombinant protein / VLP vaccines

Recombinant Human Papillomavirus Bivalent Types 16,18 Vaccine
(Supported by BMGF)

Recombinant 9-valent HPV Vaccine
Phase III
(Supported by BMGF)

Recombinant Subunit SARS-CoV-2 Vaccine
Phase II
(Supported by BMGF & CEPI)

Recombinant Subunit SARS-CoV-2 Vaccine (Variant)
Phase I

RNA vaccines

SARS-CoV-2 mRNA Vaccine

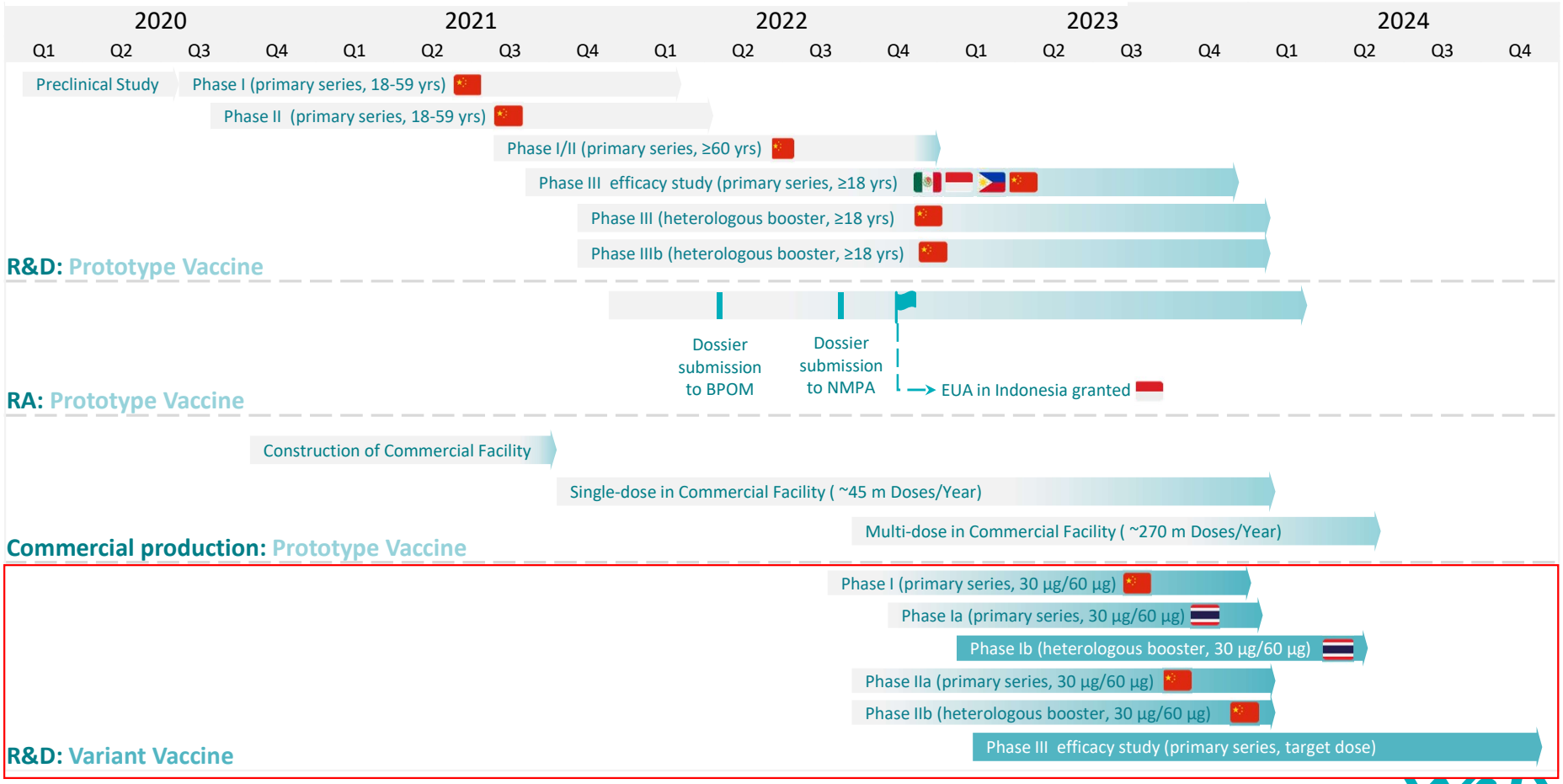
SARS-CoV-2 mRNA Vaccine (Variants)
Phase II

Adenovirus vector vaccines

Adenoviral Vector Based SARS-CoV-2 Vaccine
Phase II

Prototype | Variant

mRNA COVID-19 Vaccine Programs at Walvax



Prototype

Product Profile

18 years and older

Indicated Population

Primary Series (2-dose Regimen)

28 Days

Heterologous Booster

≥6 months

Inactivated COVID-19 Vaccine

Dosing Regimen

15 ug RBD mRNA per dose

Single pre-filled syringe (0.5 mL)

6-dose pre-filled syringe (90µg/0.45 mL)
+
Diluent, vial (2.55 mL 0.9% sodium chloride injection)

(single & multi-dose)

Presentation

2°C to 8°C

Stability data ≥ 12 months
Proposed shelf life of 12 months

Stability

WALVAX

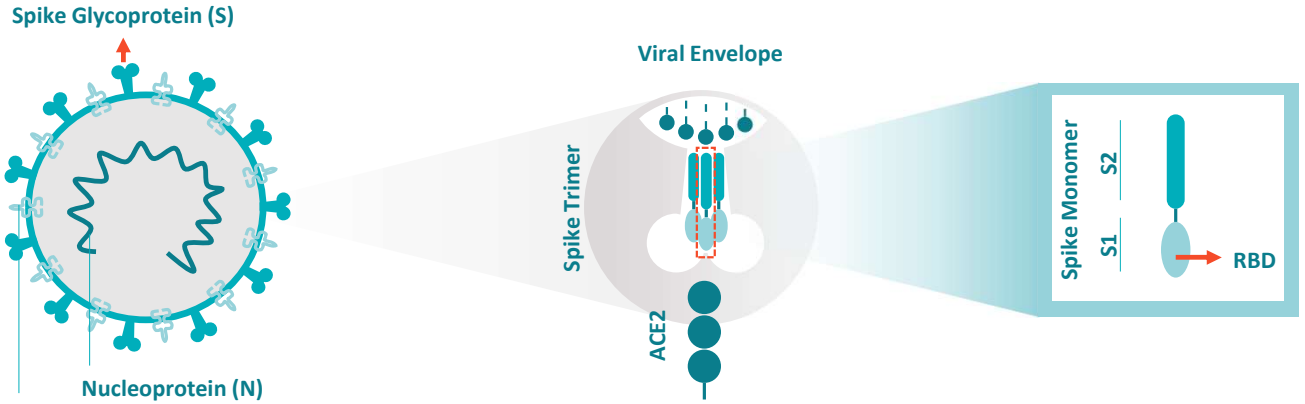
Prototype

Target Antigen Selection

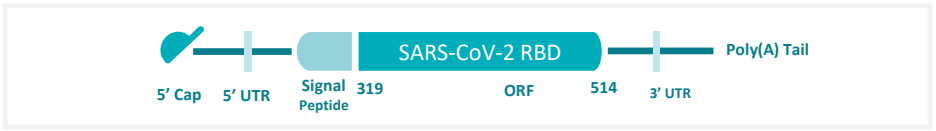
An ideal COVID-19 vaccine target would be expected to induce high titers of nAbs, reduce non-nAb production to minimize ADE potential [1]

AWcorna: RBD Encoded mRNA

A markedly lower binding to nAb ratio than a S-2P-based vaccine, indicating the RBD encoded mRNA vaccine has lower ADE potential [2]



- More efficient in neutralizing antibody induction
- Lower risk for ADE

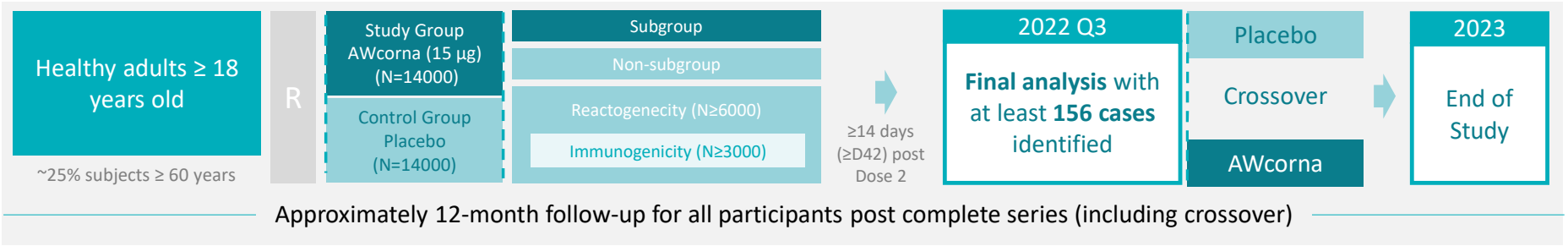


1. Dai, L., & Gao, G. F. (2020). Viral targets for vaccines against COVID-19. Nature Reviews Immunology, 1-10.
2. Walls, A. C., Fiala, B., Schäfer, A., Wrenn, S., Pham, M. N., Murphy, M., ... & King, N. P. (2020). Elicitation of potent neutralizing antibody responses by designed protein nanoparticle vaccines for SARS-CoV-2. Cell, 183(5), 1367-1382.

Prototype

Efficacy and Safety of AWcorna as 2-dose Primary Series: Study Design and Topline Results

ARCoV-005 (NCT04847102): A global, multi-center, randomized, double-blind, placebo-controlled, phase III clinical study to evaluate the protective efficacy, safety and immunogenicity of AWcorna in healthy population aged 18 years and older (N=28000)



- **Safety**: well tolerated with commonly reported symptoms of side effects such as fever, pain at injection site, fatigue, muscle pain (myalgia), headache, chills, swelling, and itching (pruritus).
- **Efficacy**: Phase III data showed the efficacy of AWcorna against symptomatic wild-type SARS-CoV-2 infection was **83.58%,** and the efficacy against the Omicron variant was **71.17%** in preventing moderate COVID-19 diseases.

BPOM Terbitkan EUA Vaksin Indovac dan Vaksin AWcorna

30 September 2022 11:34 WIB · Dilihat 521 Kali · Kerjasama dan Humas

SIARAN PERS

BPOM Terbitkan EUA Vaksin Indovac dan Vaksin AWcorna

Dari hasil uji klinik, efikasi Vaksin AWcorna terhadap *wild type* (virus COVID-19 yang belum bermutasi) sebesar 83,58%, sementara efikasi Vaksin AWcorna terhadap varian Omicron sebesar 71,17% dalam mencegah kasus COVID-19 sedang (moderate). Keamanan vaksin AWcorna secara umumdapat ditoleransi dengan baik dan efek samping yang dilaporkan berisifat ringan. Gejala efek samping yang paling sering dilaporkan adalah demam, nyeri pada tempat penyuntikan, kelelahan *(fatigue)*, nyeri otot (*myalgia*), sakit kepala, meriang *(chills)*, bengkak, dan rasa gatal (pruritus).

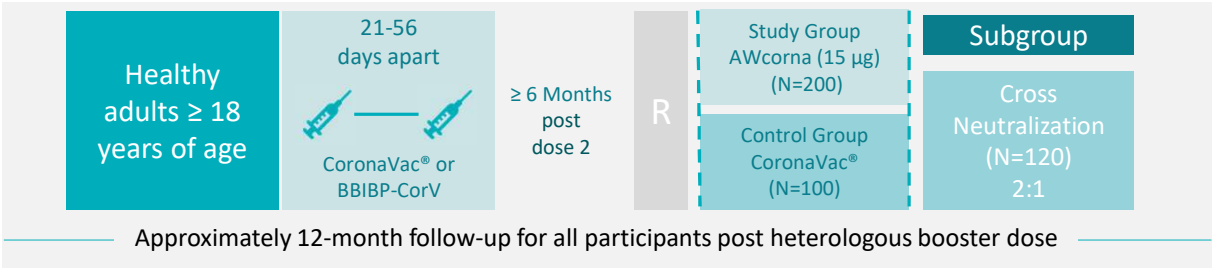
BADAN POM

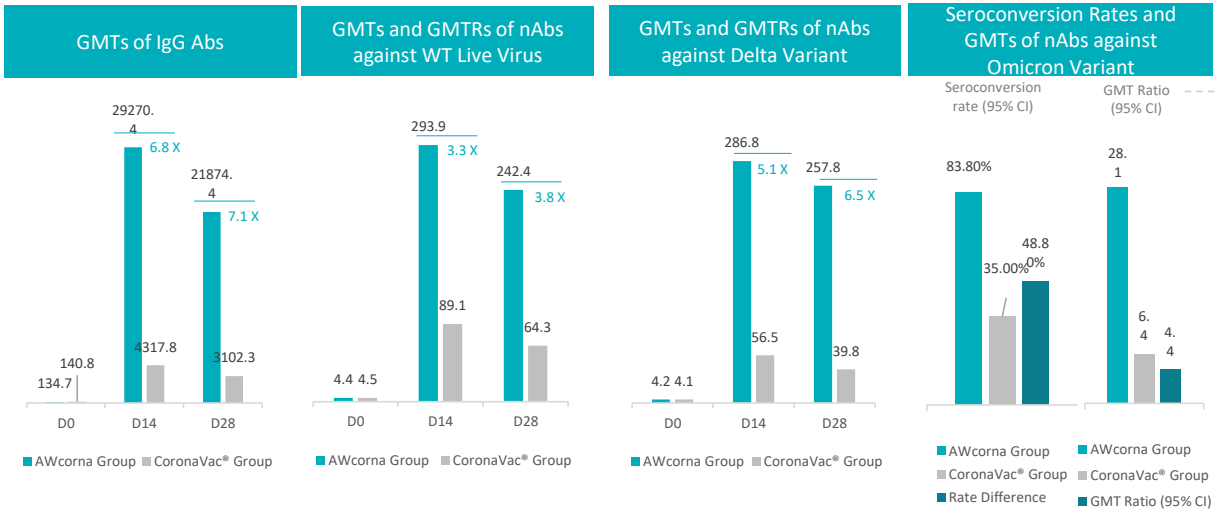
N: planned sample size

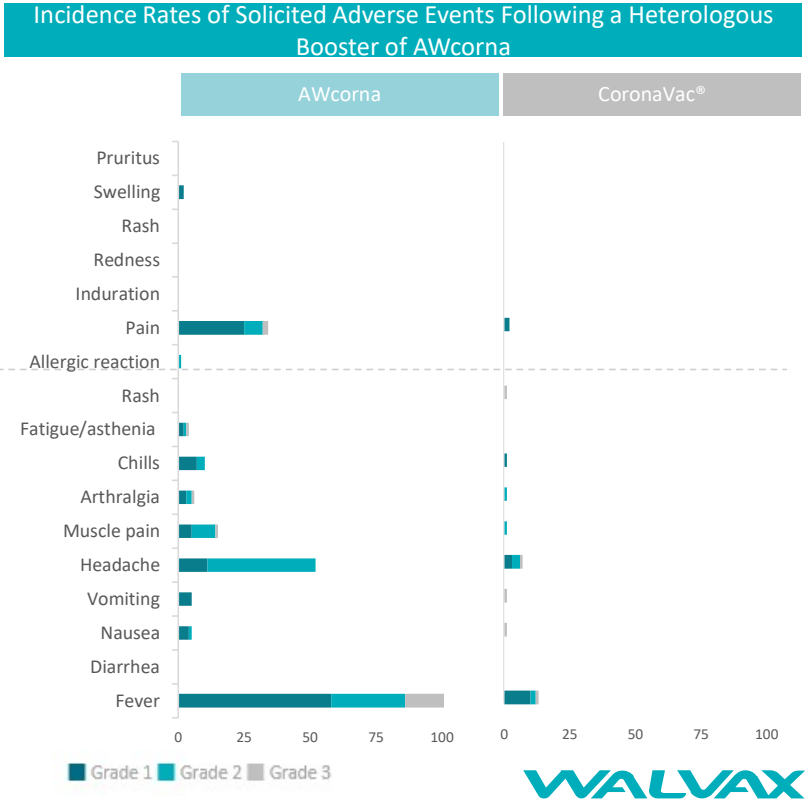
Prototype

Promising Immunogenicity and Well-performed Safety of AWcorna as a Heterologous Booster

AWcorna-007 (ChiCTR2100053701): A single-center, randomized, double-blind, positive-controlled clinical trial to evaluate the immunogenicity and safety of 1 heterologous booster dose of AWcorna in subjects aged 18 years and above who have completed the 2-dose primary series with CoronaVac® or BBIBP-CorV







WALVAX

Prototype

6 Papers Published

Variant

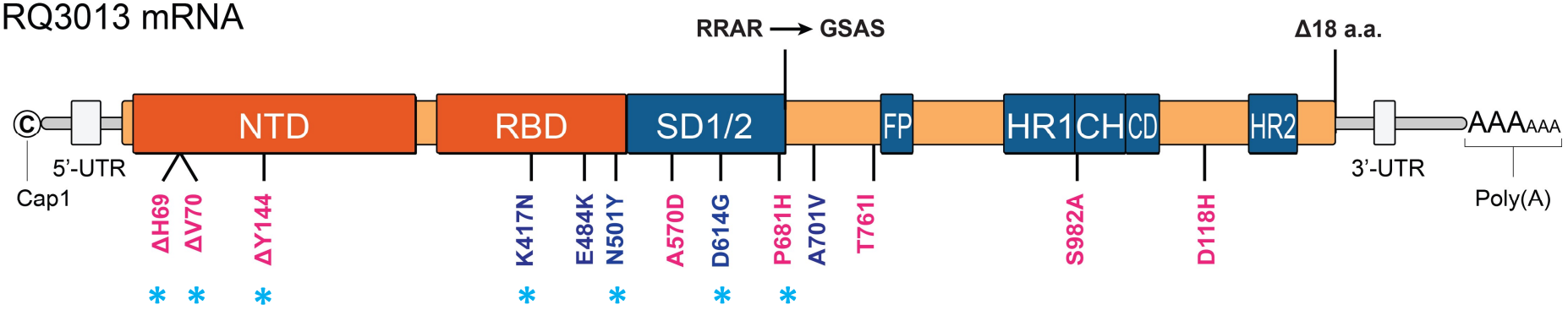
Target Product Profile

Generic Name	SARS-CoV-2 variant mRNA vaccine (Chimeric S protein vaccine)
Dosage Form	Injection
Administration Route	Intramuscular injection
Specification	Specification 1: 30 μg/0.15 mL/dose; Specification 2: 60 μg/0.3 mL/dose
Presentation	Preparation 1: 0.15 mL/vial; 0.15 mL for each single human dose, containing 30 μg mRNA Preparation 2: 0.3 mL/vial; 0.3 mL for each single human dose, containing 60 μg mRNA
Packaging	1 mL vial, single dose
Indication	Prevention of COVID-19 caused by the infection of SARS-CoV-2
Dosing Regimen	Intramuscular injection at Day 0 and Day 28
Target Population	Population aged 18 years and above
Storage Condition	Store between -50℃ to -15℃. Protect from light. The product can be stored for at least 24 months in frozen storage. After thawing at 2 ℃ to 8 ℃, the product can be stored up to 30 days in the refrigerator between 2 ℃ to 8 ℃ .

Variant

Antigen Design

RQ3013 mRNA



(sites contained in the Alpha variant; sites contained in the Beta variant; *sites contained in the Omicron variant)

- ✓ **Extensive coding region optimization:** The furin cleavage site and the terminal 18 amino acids are removed to stabilize the antigen conformation.
- ✓ **Variant chimeric antigen design:** A single–strand mRNA encodes a chimeric S protein antigen. A key immune escape related mutation site of Beta was introduced based on the full-length S protein of the Alpha mutant strain.
- ✓ **Strong broad-spectrum potential:** RQ3013 is expected to be widely cross-reactive to various VoCs in addition to Alpha and Beta variants based on the following considerations: Omicron is under the same lineage as the Alpha variant; The immune escape-related mutations contained in Omicron are the same as those in the Beta variant; RQ3013 is designed to contain 7 mutations as those contained in the Omicron variant.

Variant

Highlights of RQ3013

- **Advanced design**: novel S variant antigen; proprietary mRNA design
- **Ensured efficacy and safety**: excellent preclinical data; clinically proved delivery system; safety and immunogenicity assessed as compared to COMIRNATY® starting from phase 1
- **Reliable Product Quality**: state-of-the-art mRNA capping and purification; production scale of LNP formation
- **Affordable Vaccine**: self-supply of raw materials (enzymes, cap analogs, modified nucleotide and ionizable lipid)

Challenges and Opportunities for Vaccine Manufacturers

Challenges

- Reduced efficacy against infection caused by emerging or mutated strains
- Huge investment at early stage
- Shrinking target population for efficacy study as vaccination rate increases
- Emergency use authorization are becoming more stringent
- Packaging consumables like pre-filled syringe are in short supply
- Surging cost of shipment and raw materials
- Stocks and flow of massive vaccines challenge corporate supply chain management

Opportunities

- Strengthened international collaboration
- More accessible government subsidies and grants from international organizations
- Largely shortened development cycle for COVID-19 vaccines (12-24 months compared with 10-15 years for traditional pathway)
- Having boosted significant progress in innovative technology platforms (e.g., mRNA)
- Manufacturing capacity ramp-up and facility upgrade
- Raised social awareness of immunization and peer recognition

WALVAX

Andrew Wong
andrew.wong@walvax.com
en.walvax.com