The arrival of vaccines was viewed as a gamechanger,

an antidote to neutralise the threat of the virus.

COMBAT

HEALTHCARE WORKERS ON THE COVID-19 FRONTLINES SPENT LONG HOURS IN FULL PERSONAL PROTECTIVE GEAR, WHICH INCLUDED GLOVES, GOWNS, GOGGLES, HEAD COVERS AND SURGICAL MASKS.

PHOTO: NATIONAL UNIVERSITY HEALTH SYSTEM

CHAPTER 7

BEHIND THE JAB

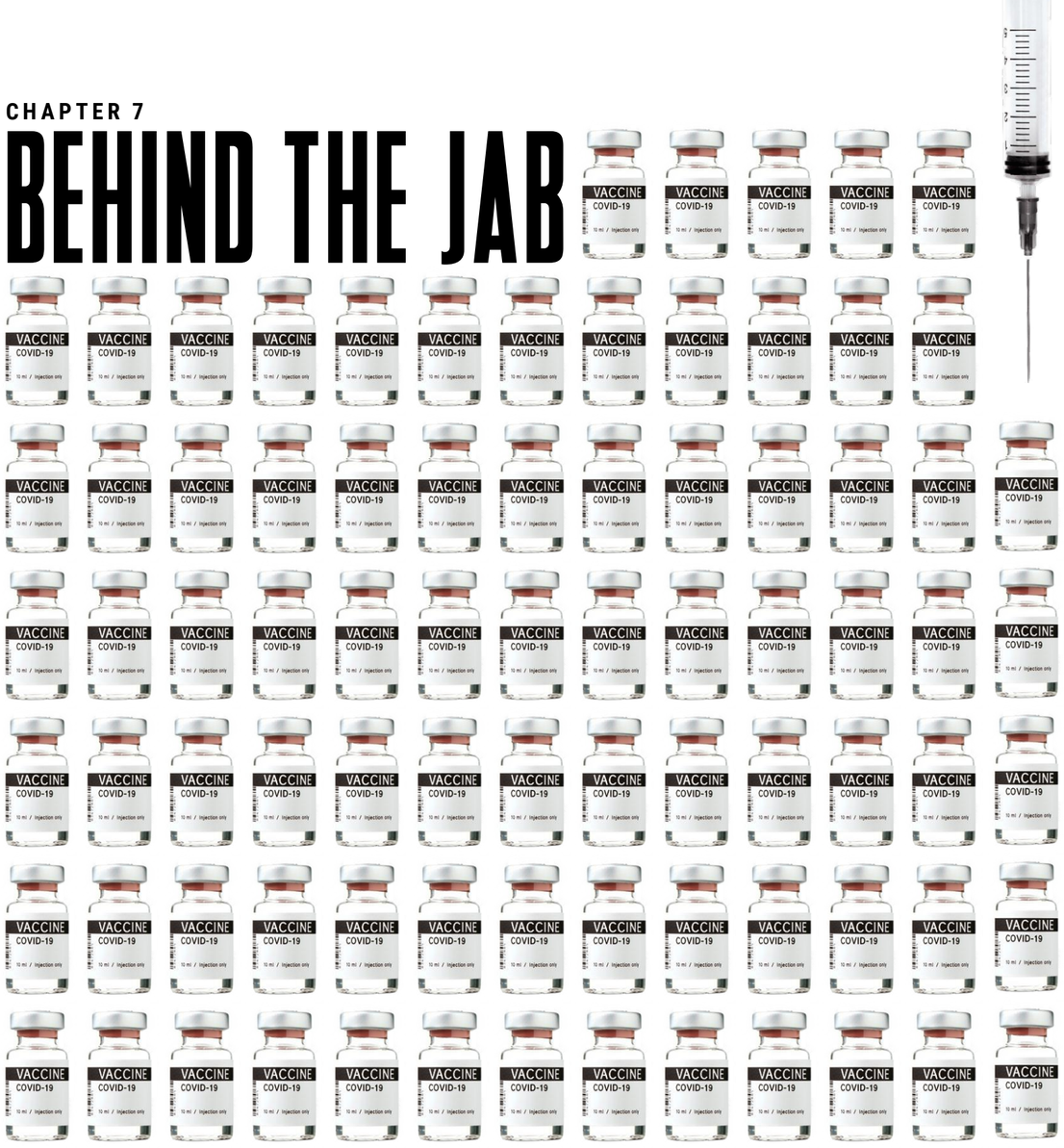


PHOTO: MINISTRY OF TRANSPORT

Then-Minister for Transport **Mr Ong Ye Kung** (second from left) is among the on-the-ground crew at Changi Airport receiving Singapore's first batch of Pfizer-BioNTech vaccines on Dec 21, 2020.

PHOTO: MINISTRY OF COMMUNICATIONS AND INFORMATION

THEN-Minister for Transport Mr Ong Ye Kung and Captain Sam Llewellyn shared a COVID-appropriate fist bump, flanked by First Officer Wilson Lee and Singapore Airlines CEO Goh Choon Phong, who were each giving a thumbs-up.

The reason for their joy was the boxes behind them, tightly bound by yellow packaging tape. In those boxes were precious cargo: the first batch of Pfizer-BioNTech COVID-19 vaccines. They were flown in by the national carrier from Brussels, Belgium, landing at Changi Airport on December 21, 2020 – making Singapore the first country in Asia to receive this vaccine.

Mr Ong later posted on Facebook that their safe and smooth arrival was a "historic cold chain moment". For one thing, the vaccines had to be packed and transported at very low temperatures throughout the delivery. But, more interestingly, the night they arrived in Singapore coincided with the Winter Solstice Festival, an occasion when the Chinese community gathers to eat *tang yuan* (glutinous rice balls) on what is believed to be the coldest day of winter.

While the tradition continues in tropical Singapore, the larger gatherings had to wait just a little longer. A week later, on December 28, Singapore officially started Phase 3 of its carefully calibrated

PHOTO: URBAN REDEVELOPMENT AUTHORITY

The façades of Fullerton Hotel Singapore and the Merlion at Marina Bay were lit up with artworks depicting the collective efforts of organisations and individuals who helped others in need during the pandemic on Dec 25, 2020 – a fitting precursor to Phase 3 of Singapore's reopening three days later.

reopening plan, six months after the nation exited from the circuit breaker in June 2020.

Many were looking forward to celebrating the new year with loved ones. Eight people were allowed to gather, an increase from five in Phase 2; live performances were slowly making a comeback; and the capacity for marriage solemnisations was increased.

The government's confidence to loosen restrictions was premised on one key reason: the arrival of the vaccines.

It was viewed as a game-changer, an antidote to neutralise the threat of the virus. But even as most people looked forward to gaining herd immunity with inoculation, not many realised the remarkable feat of securing the vaccines early.

A behind-the-scenes look at this journey reveals how medical experts and scientists from the Ministry of Health (MOH) and other agencies, together with officials from the Economic Development Board (EDB), joined hands to form a formidable force to secure the vaccines.

TEAM VACCINES

Several committees were set up to take three vital steps to get early access to the vaccines in 2020: identify potential vaccines in the market, negotiate for advance procurement, and assess their efficacy and safety.

None of these steps were simple or straightforward, and some steps happened concurrently in a bid to get the vaccines faster.

Mr Chan Yeng Kit, Permanent Secretary for Health at MOH, revealed that these tasks required more than just the Ministry's involvement. Much needed help came from the Head of Civil Service, Mr Leo Yip, who offered to chair a planning group to get the vaccines early – arguably one of the toughest tasks.

"I think he took pity on all of us because we had so many things to handle," said Mr Chan. As Mr Yip was the former Chairman of EDB, he had a vast network of connections, including the contacts of large pharmaceutical and biotechnology companies that have invested in Singapore.

"We have good relations with the companies, and we tried to get into the vaccine queue. So rather than waiting in line to secure supplies, we used the relationship route," he shared, adding that Singapore was prepared to take the risk and enter into advance procurement contracts.

STEERING SINGAPORE'S VACCINATION PROGRAMME

THERAPEUTICS AND VACCINES EXPERT PANEL, TxVax FORMED IN APR 2020	Comprised 18 members, including clinicians, scientists, public health experts and immunologists from both the public and private sectors	Their main task was to source for – and assess – promising vaccines to procure for use in Singapore.	
PLANNING GROUP TO SECURE ADVANCE ACCESS TO VACCINES FORMED IN LATE APR 2020	Chaired by Head of Civil Service Mr Leo Yip Its members included officers from the Economic Development Board (EDB) and MOH	They were tasked to make 'strategic bets' on promising vaccine candidates recommended by TxVax and sign non-disclosure agreements that would give Singapore early access to	confidential data on vaccine progress. These tasks were facilitated by leveraging EDB's strong relationships with pharmaceutical and biotechnology companies, like Pfizer, Moderna and BioNTech.
EXPERT COMMITTEE ON COVID-19 VACCINATION, EC19V FORMED ON OCT 5, 2020	Comprised 14 experts in infectious diseases, immunology and other relevant fields	Its main role was to advise the Singapore government on how to best deploy the vaccines safely across all age groups in Singapore after they arrive. EC19V	also worked closely with TxVax on various aspects of Singapore's vaccine strategy, including procurement and recommendations for vaccine selection and deployment.

"THE HISTORICAL BETTING AVERAGE OF GETTING THE RIGHT VACCINE WAS ONE IN 10... IN FACT, THERE WERE AS MANY AS 290 KNOWN COVID-19 VACCINE PROJECTS BY MID-2021."

– PROFESSOR BENJAMIN SEET, DEPUTY GROUP CHIEF EXECUTIVE OFFICER (EDUCATION & RESEARCH) AND MEDICAL LEAD AT THE NATIONAL HEALTHCARE GROUP

IDENTIFY:
GETTING A HEAD START ON VACCINES

The search for vaccines began almost 11 months before they arrived in December 2020. "The first conversation I had about vaccines was as early as February 2020," recalled Professor Tan Chorh Chuan, Chief Health Scientist at MOH.

He and other colleagues in the scientific community had been closely following the Coalition for Epidemic Preparedness Innovations (CEPI) – a foundation that funds early vaccine development – and tracking which vaccines they were putting their funds into.

When it became increasingly clear that a vaccine would be needed as part of Singapore's pandemic response, a committee to head the search for vaccines was set up in April 2020.

The Therapeutics and Vaccines Expert Panel, or TxVax, was chaired by Professor Benjamin Seet, Deputy Group Chief Executive Officer (Education & Research) of the National Healthcare Group. The committee comprised 18 clinicians, scientists, public health and industry experts.

Its job was not easy. "The historical betting average of getting the right vaccine was one in 10, and there were so many vaccine projects in development. In fact, there were as many as 290 known COVID-19 vaccine projects by mid-2021. We were in touch with more than 50 companies and academic groups around the world," Prof Seet recalled.

TxVax adopted a "portfolio approach", taking into account the efficacy and safety of candidates across different vaccine technology categories, while also making sure to diversify the sources of manufacturing and production in case of supply chain disruptions.

The list was eventually narrowed down to about 15 promising vaccine candidates. After conducting an extensive study, they submitted their recommendations to the planning group headed by Mr Yip. By June 2020, the first advance procurement agreement was signed with Moderna, and by September 2020, the second with Pfizer-BioNTech.

"SOME DECISIONS HAD TO BE TAKEN DURING THE EARLY PHASES OF CLINICAL TRIALS OF THE VACCINES, WHERE THERE WAS NO CERTAINTY OF THE FINAL OUTCOMES."

– MR LEO YIP, HEAD OF CIVIL SERVICE AND FORMER CHAIRMAN OF ECONOMIC DEVELOPMENT BOARD

NEGOTIATE:
MAKING ADVANCE PURCHASES

The multi-agency planning group, made up of largely EDB and MOH officers, had an equally tough task of deciding which vaccines should be purchased.

From the shortlist of vaccine candidates by TxVax, the planning group signed about 40 non-disclosure agreements, which gave them early access to unpublished data about the progress of the vaccines.

The consensus then was to diversify options. Given the variety of vaccine types, there needed to be a "balance between established options and fastest to the market", noted Ms Lisa Ooi, EDB's Vice President of Healthcare and Wellness Strategy, at a media Q&A on COVID-19 vaccines on December 21, 2020.

In the next few months, the planning group, together with TxVax, scrutinised the different data before deciding which vaccines to purchase. "We had to cut through the fog of war, because some decisions had to be taken during the early phases of clinical trials of the vaccines, where there was no certainty of the final outcomes," shared Mr Yip, at the same media interview.

Eventually, three strong contenders emerged: Moderna, Pfizer-BioNTech and Sinovac. The first two utilised a novel messenger ribonucleic acid (mRNA) technology, while Sinovac was an inactivated virus vaccine.

To ensure that Singapore would not be bypassed in the global vaccine market, the planning team also linked up with other countries to do group orders.

Professor Benjamin Ong, Chair of the Expert Committee on COVID-19 Vaccination (EC19V), explained the rationale for doing so: "We don't have the clout of bigger countries. We cannot expect a company to sell us four or five million doses at once."

Apart from scaling orders, Singapore also went one step further to ensure vaccine priority. As early as June 2020, the Government had signed advance purchase agreements with Moderna. By August, similar agreements were signed with Pfizer-BioNTech and Sinovac, in a bid to guarantee the country's access to these vaccines ahead of time without waiting for their clinical trials to be completed.

Over S$1 billion was set aside for vaccines, with down payments made even before TxVax found out that the two mRNA vaccines – Pfizer-BioNTech and Moderna – had an efficacy rate of over 90 per cent.

Naturally, this was a big, albeit calculated, risk: Singapore was making advance investments in vaccines that could very well fail. But the risk of not getting the vaccines was far deadlier.

As MOH negotiated the purchase, the Health Sciences Authority (HSA) was reviewing the scientific data when it became available as part of the regulatory process.

PHOTO: DIGITALVISION VIA GETTY IMAGES/TANG MING TUNG

EVALUATE:
SAFETY OF VACCINES

The speed at which policymakers moved to secure vaccines was far quicker than behind-the-scenes processes of evaluating the vaccines.

"That is the fundamental challenge of using science to inform policy," said Prof Tan. "In a pandemic, policymakers want to make decisions fast, but the process of science – evidence gathering and analysis – takes time."

To expedite the process of assessing vaccine candidates, HSA – the regulatory body in charge of approving vaccines for use in Singapore – began establishing the Pandemic Special Access Route (PSAR) as early as June 2020.

PSAR became a formalised mechanism for vaccine companies to submit "rolling submissions" to HSA, where data from product development and clinical trials could be sent over faster, as and when they became available, instead of waiting for one complete set of data.

Not every potential vaccine candidate passed HSA's stringent standards. Certain vaccines that were initially thought to be strong contenders did not get approved due to the risk of serious adverse reactions, such as severe bleeding and blood clots.

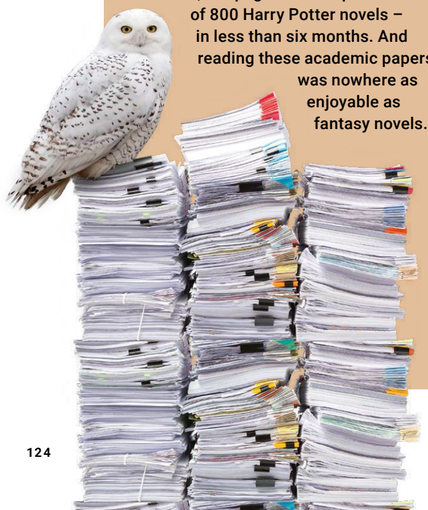
With everyone putting in their best effort to speed up the process of evaluating the vaccines, the top vaccines were finally approved in good time, and not without careful consideration. The next course of action: well-planned logistics to ensure the smooth and safe delivery of vaccines to Singapore.

READING "800 HARRY POTTER NOVELS" IN SIX MONTHS

EVEN AFTER TxVax had managed to successfully narrow down their list of 290 known COVID-19 vaccines to 15 promising vaccine candidates, the copious amount of documents to plough through was still formidable.

Associate Professor Chan Cheng Leng, Group Director of the Health Sciences Authority's (HSA) Health Products Regulation Group (HPRG), recalled that her team had received about 400 to 500 softcopy files for every brand of vaccine.

To illustrate the reams of reports to be scrutinised, she drew this analogy: imagine a Harry Potter book, which has about 500 pages. Her team of 24 regulators had to read a total of 400,000 pages – the equivalent of 800 Harry Potter novels – in less than six months. And reading these academic papers was nowhere as enjoyable as fantasy novels.



"My colleagues were working overtime and very long hours over the weekend to ensure that we were able to approve the first vaccine by December 14," she revealed. "Many of us lost sleep knowing the huge responsibility that we carried to safeguard our population."

Essentially, her team of dedicated professionals were looking for three main criteria in a vaccine: quality, safety and efficacy.

Evaluating the quality of a vaccine involves a step-by-step assessment of how manufacturers develop vaccines as well as their purity and potency. Most importantly, whether a company produces 10 or 1,000 batches, each has to be of consistently high quality.

As for the efficacy and safety of vaccines, companies must be able to provide ongoing data on both their non-clinical (animal) and clinical (human) trials.

For instance, studies conducted on mice give a good indication of the toxicity and potential immune response elicited by the vaccine. Clinical trials, on the other hand, demonstrate how the vaccine behaves in humans and whether it offers a good enough immune response.

HPRG also consulted experts from HSA's Medicines Advisory Committee, which consisted of senior doctors and pharmacists, before locking in the final decision.

To approve the first vaccine by Dec 2020, regulators from the Health Sciences Authority's Health Products Regulation Group raced against the clock to read through academic papers to determine the quality, safety and efficacy of each vaccine candidate, said Group Director **Associate Professor Chan Cheng Leng**.

LOGISTICS:
COLD CHAIN MOMENT

The "historic cold chain moment" that Mr Ong alluded to might have seemed like just a singular point in time, but it was evident that the events leading up to the first delivery of vaccines took the collective time, effort and discretion of many.

Now that the vaccines had finally been procured and received, the next hurdle to cross before they could make their way out into the population was the issue of storage. The delivery of vaccines is a complex task, and requires a carefully coordinated chain of events to transport and store in temperature-controlled environments.

Pfizer-BioNTech vaccines, for example, had to be stored at -70°C, while Moderna vaccines must be stored at -20°C. Both had a limited shelf life when stored at regular refrigerator temperatures.

MOH Permanent Secretary for Health Development, Mr Ng How Yue, explained how getting the logistics right was critical.

"None of our current vaccines needed to be stored at that temperature, so we had to work with private sector providers to bring in special fridges, and check with the Energy Market Authority to make sure that the place where we keep the fridges have triple redundancy of electricity. Otherwise, the vaccines would not have made it," he shared.

Other organisations also chipped in to help. For instance, local ground-handling company Singapore Airport Terminal Services (SATS) offered their cool dollies – wheelable refrigerated warehouses – to transport the vaccines from Changi Airport to their official storage location.

The vaccines continued to arrive steadily in batches, strengthening confidence that there would be "enough vaccines for everyone" by September 2021, Prime Minister Lee Hsien Loong assured Singaporeans in a nationwide televised address on December 14, 2020.

Now, it was time to convince Singaporeans to take their shots.

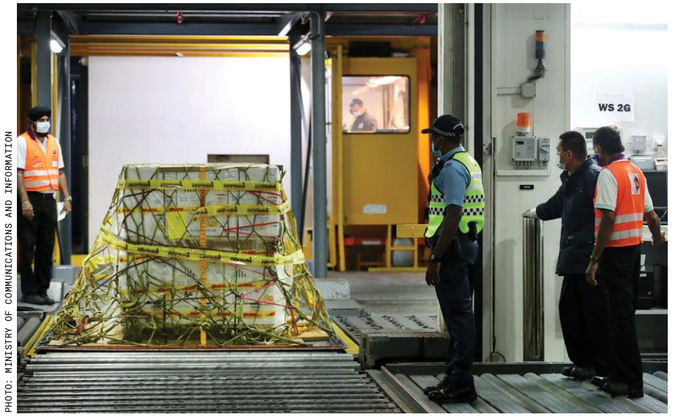


PHOTO: MINISTRY OF COMMUNICATIONS AND INFORMATION

After the arrival of the vaccines, transporting and storing them was the next crucial task. Singapore Airport Terminal Services (SATS) helped transport the vaccines in wheelable refrigerated warehouses to be stored in special, temperature-controlled fridges.