

COVID-19 vaccination acceptance of healthcare workers in Singapore

Kian Wei Alvin Tan¹ MBBS, Limin Wijaya² MRCP(UK), Chee Tiong Lim³ PhD, Wee Hoe Gan¹ FRCP(Edin)

The Coronavirus disease 2019 (COVID-19) pandemic resulted in 511.0 million cases of confirmed SARS-CoV-2 infection and almost 6.2 million deaths globally as of end April 2022.¹ With the introduction of vaccines that are effective in reducing severe COVID-19 illnesses and deaths, Singapore had since pivoted from a COVID-19 elimination strategy to a COVID-19 resilient strategy, aiming to achieve near-normalcy while protecting lives and minimising the impact on the healthcare system and the economy.² An overall high vaccination rate was crucial in Singapore's 3-pronged strategy to Test, Trace and Vaccinate,^{3,4} so as to safely transition towards a COVID-19 vaccine-driven endemic state.

Singapore's national COVID-19 vaccination programme currently employs 2 mRNA vaccines—Pfizer-BioNTech/Comirnaty and Moderna COVID-19 vaccines—and 1 inactivated vaccine—Sinovac-CoronaVac—which are authorised for use under the nation's Pandemic Special Access Route.⁵ Vaccination rollout was implemented in phases, starting with healthcare and frontline workers who provide essential health services and face significant risk of being infected from their workplace exposure to at-risk patients. This was followed by the elderly and those with medical comorbidities, before extending to the rest of the population.⁶

Singapore's phased COVID-19 vaccination strategy, starting with healthcare workers, was rolled out from early January 2021. Singapore Health Services (SingHealth) is Singapore's largest public healthcare cluster, which comprises a network of acute hospitals, national specialty centres, community hospitals and polyclinics offering over 40 clinical specialties. A combined strength of 40,767 healthcare and administrative support staff, as well as service partners (in domains such as housekeeping, security and information technology) enabled the cluster to achieve an annual workload of more than 239,000 inpatient admissions, 285,000 inpatient and day surgeries, 412,000 emergency department attendances, 2.4 million

specialist outpatient attendances and 1.5 million primary care attendances.⁷

COVID-19 vaccination with the Pfizer-BioNTech/Comirnaty COVID-19 vaccine for SingHealth's staff population commenced on 8 January 2021. Over a 7-month period from January 2021 to July 2021, 38,244 (93.8%) of 40,767 staff and service partners were fully vaccinated with the 2-dose regime of the Pfizer-BioNTech/Comirnaty COVID-19 vaccine and 39,206 (96.2%) received at least 1 dose (Fig. 1). By November 2021, more than 99.5% of SingHealth's population are fully vaccinated.

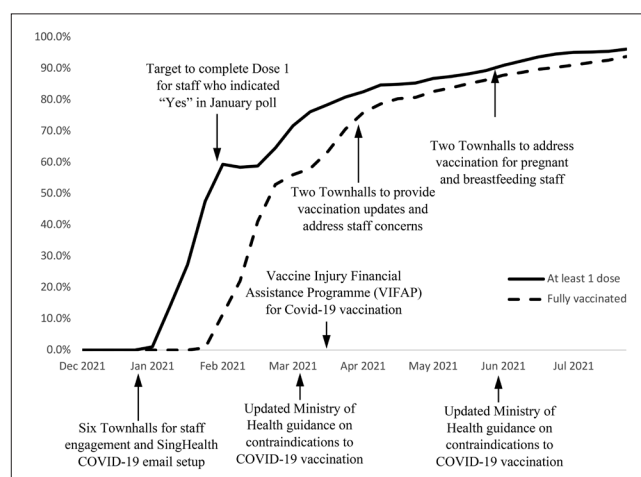


Fig 1. Timeline of the Singapore Health Services COVID-19 vaccination programme.

The principles of the World Health Organization (WHO) Tailoring Immunization Programmes (TIP)⁸ have been instructive to achieve the high vaccination rate in SingHealth's healthcare workforce. The conventional approach to planning and implementation of a mass vaccination programme is one that is centred around logistics, cold chain and access optimisation. The TIP further draws from health behavioural change theories, emphasising social and behavioural insights behind vaccination acceptance and participation, and are

¹ Department of Occupational and Environmental Medicine, Singapore General Hospital, Singapore

² Department of Infectious Diseases, Singapore General Hospital, Singapore

³ Group Chief Operating Officer Office, Singapore Health Services, Singapore

Correspondence: Dr Wee Hoe Gan, Department of Occupational and Environmental Medicine, Singapore General Hospital, 10 Hospital Blvd, Singapore 168582. Email: gan.wee.hoe@singhealth.com.sg

essential to shape relevant interventions to achieve a high vaccination uptake.

Incorporating the principles of TIP in SingHealth's COVID-19 vaccination programme had helped planners understand the perspectives of staff and the factors affecting the decision to proceed with vaccination. Regular polling of all SingHealth staff was conducted across a 4-month period, and staff responses were collated anonymously (Table 1). The results provided a sensing of the ground sentiments across the 4 vocational groups in SingHealth, and over time, reflected positive shifts towards vaccination acceptance with maturation of the vaccination programme.

Qualitative interviews and surveys were also conducted to delve deeper into the factors associated with vaccine hesitancy. The COM-B model, arising from the WHO TIP, is a behavioural theory that identifies 3 key determinants: Capability (C), Opportunity (O) and Motivation (M), which influence the behaviour (B) of vaccine hesitancy.⁸ Table 2 shows a list of some of the commonly cited reasons for the vaccine hesitancy among SingHealth staff.

Interventions and vaccination efforts were targeted at these 3 determinants to address gaps in the vaccination programme and improve the vaccination take-up rate.

First, capability refers to an individual's internal factors such as knowledge and awareness of the COVID-19 vaccines; the risks, benefits and contraindications of COVID-19 vaccines; and the individual's own fitness for vaccination. During the start of the SingHealth vaccination roll-out, 6 cluster-wide townhalls chaired by the group's senior management and medical specialists were organised to equip staff with the necessary knowledge of the relatively new COVID-19 vaccines. Two subsequent tranches of townhalls were organised to provide updated information regarding the relaxation of the vaccination guidelines and to address specific concerns relating to allergies, pregnancy and breastfeeding.

One of the biggest concerns were the emerging reports of severe allergic reactions and anaphylaxis to the COVID-19 vaccines and the medical eligibility for receiving the vaccine. An Expert Committee on Allergy involving allergists from across SingHealth was hence

Table 1. COVID-19 vaccination acceptance across 4 vocational groups in SingHealth

		Dec 2020	Jan 2021	Feb 2021	Mar 2021
Medical staff	Yes	47.7%	55.2%	76.0%	83.2%
	No	12.8%	12.8%	10.3%	8.9%
	Undecided	39.5%	32.0%	13.7%	7.9%
	Total number	2782	2782	2769	2758
Nursing staff	Yes	39.9%	43.7%	65.4%	75.6%
	No	23.0%	23.3%	19.5%	16.5%
	Undecided	37.1%	33.0%	15.1%	7.9%
	Total number	11840	11840	11774	11703
Administrative and ancillary staff	Yes	39.3%	42.6%	63.0%	73.5%
	No	21.3%	21.5%	18.6%	15.6%
	Undecided	39.4%	35.9%	18.4%	10.9%
	Total number	11172	11172	11442	11345
Allied health professionals and research staff	Yes	37.4%	42.7%	64.9%	74.5%
	No	19.7%	20.0%	16.0%	12.7%
	Undecided	42.9%	37.1%	19.1%	12.8%
	Total number	6324	6324	6314	6343
All staff combined	Yes	42.8%	46.4%	66.3%	76.1%
	No	20.0%	20.8%	17.6%	14.5%
	Undecided	37.2%	32.8%	16.1%	9.4%
	Total number	32118	32118	32299	32149

Table 2. Commonly cited reasons for vaccine hesitancy among SingHealth staff (December 2020–March 2021)

COM-B Model	Reasons for hesitancy in receiving Pfizer-BioNTech/Comirnaty COVID-19 vaccine
Capability	• Pre-existing medical conditions that may not be suitable for COVID-19 vaccination • Currently undergoing family planning, pregnancy or breastfeeding, of which there are unknown risks to the pregnancy and the foetus
Opportunity	• Lack of real-world safety data and long-term effects of the vaccine • Inadequate real-world data on the effectiveness of the Pfizer-BioNTech/Comirnaty COVID-19 vaccine
Motivation	• Fears of side effects of the vaccine • Concerns with the mRNA technology used to develop the Pfizer-BioNTech/Comirnaty COVID-19 vaccine

set up to harmonise the medical assessment protocols for suitability to receive the mRNA vaccine. SingHealth staff who had a history of allergies or allergic reaction to the first dose of the COVID-19 vaccines were seen either on the same day or given a fast-track appointment for clinical evaluation on the suitability to receive the vaccine.

Second, opportunity refers to external factors such as access, availability and convenience of COVID-19 vaccination-related services and information. Electronic direct mail, memos with bite-size information snippets and Frequently Asked Questions about the COVID-19 vaccines were regularly disseminated to SingHealth staff via emails and the Intranet as part of the communications strategy to educate with accurate and updated information relating to the COVID-19 vaccines. An “open door” policy was adopted within SingHealth with a dedicated COVID-19 vaccination email for staff to send in queries relating to COVID-19 vaccination, which would be answered in a timely manner. Staff could also get in touch directly with Infectious Diseases and Occupational Medicine specialists for informal consultations regarding their medical conditions and medical concerns. SingHealth also availed its Staff Clinics and polyclinics across the Cluster for walk-in medical consult service for staff who developed side effects from the COVID-19 vaccines. Based on SingHealth’s vaccination adverse events reporting, the commonest side effects were dermatological, followed by respiratory and cardiovascular symptoms (Table 3). This is in contrast to the vaccination-related presentations in another healthcare institution in Singapore, where cardiovascular symptoms such as giddiness, palpitations and chest discomfort accounted for the majority of cases.⁹

To create an enabling environment for easy access and convenience to the vaccination services, dedicated vaccination centres were set up in almost all SingHealth institutions for staff to receive the COVID-19 vaccination at their workplaces without having to take time off to travel to a community vaccination centre. For example, the Singapore General Hospital had a daily capacity

to vaccinate more than 600 staff to accelerate the staff vaccination uptake from the outset. A dedicated appointment booking system was developed with Integrated Health Information Systems for staff to book vaccination appointments at their preferred time slots via the SingHealth Intranet portal.

Third, motivation refers to the confidence and trust in the COVID-19 vaccines. It was important to build trust in the COVID-19 vaccines before an opinion had been formed against it. SingHealth institutions’ senior management and heads of departments served as role models who led by example by receiving the COVID-19 vaccinations first. Recognising that adverse events post-vaccination might lead to loss in confidence, these events were monitored via reaction monitoring reports by the SingHealth Duke-NUS Institute for Patient Safety & Quality, which also looks for trends in adverse reactions observed among staff. In addition, Neurology and Cardiology specialist panels were convened to review and adjudicate all suspected cases of post-vaccination adverse events, so as to minimise speculation and incorrect attribution of the adverse events to the COVID-19 vaccines. There was also a strong emphasis on the social benefits of receiving the COVID-19 vaccines, in which social norms in favour of receiving the COVID-19 vaccination were publicised and made more salient on electronic direct mails and the SingHealth Intranet. Vaccinated staff received special identification stickers on their name tags to indicate their COVID-19 vaccination status and were no longer required to log their daily temperature on the staff surveillance system.

Over the 7-month period from January to July 2021, vaccination continued to remain voluntary with no additional workplace penalties or discrimination against non-vaccinated staff. Instead, a personalised approach was adopted in which vaccinated supervisors took on the role as advocates and engaged individual staff who might still be hesitant, to understand the potential concerns that could be addressed.

Table 3. Comparison of vaccination adverse events between 2 healthcare entities

System/Symptoms	SingHealth staff number (%) N=1044	Lim et al. ⁹ National University Hospital staff number (%) N=196
Dermatological	585 (56.0) - Rash, itch, hives, mucosal swelling	46 (23.5) - Rash, itch
Respiratory	142 (13.6) - Throat discomfort, sensation of breathlessness, wheeze, cough	13 (6.6) - Throat discomfort: 9 (4.6) - Sensation of breathlessness: 4 (2.0)
Cardiovascular	97 (9.3) - Giddiness, palpitations, tachycardia, hypotension	93 (47.4) - Giddiness: 64 (32.7) - Palpitations/chest discomfort: 29 (14.8)
Neurological	71 (6.8) - Headache	30 (15.3) - Numbness over injection arm: 16 (8.2) - Headache: 11 (5.6) - Blurred vision: 3 (1.5)
Musculoskeletal	53 (5.1) - Myalgia, arthralgia	-
Gastrointestinal	44 (4.2) - Nausea/vomiting/diarrhoea/abdominal pain	11 (5.6) - Nausea/vomiting/reflux
Anaphylaxis	10 (0.96)	-
Others	42 (4.0) - Lethargy/malaise: 41 (3.9) - Otalgia: 1 (0.1)	3 (1.5)

⁹ Lim SM, Chan HC, Santosa A, et al. Safety and side effect profile of Pfizer-BioNTech COVID-19 vaccination among healthcare workers: A tertiary hospital experience in Singapore. *Ann Acad Med Singap* 2021;50:703-11.

There were 2 key takeaways from the SingHealth COVID-19 vaccination experience. First, it was important to recognise that the provision of knowledge and information does not necessarily translate to positive change in vaccination behaviour, especially in the current era of an overabundance of misinformation. Healthcare workers with a higher level of health literacy than the general population tended to trust information in line with what they already believed in. They would be more discerning and critical of new information presented, and additional efforts were required in ensuring a robust narrative detailing quality evidence-based research to address biases and concerns behind their vaccine hesitancy. Second, clear and transparent communication helped to build trust and credibility in the overall approach to the vaccination programme. This included the disclosure of any uncertainty or gaps in knowledge and data, potential limitations, and known risks of the COVID-19 vaccines, even if they may result in some degree of vaccine hesitancy. Such disclosure must be addressed upfront so as not to create a sense of uncertainty and delusion, which can manifest into distrust. Being transparent helped with building trust

in the overall vaccination programme and increased the persuasive effect in the long term.

The SingHealth experience demonstrated how behavioural science can be applied in the planning and rollout of a COVID-19 vaccination programme. Vaccination behaviour continues to be a complex issue that must be addressed given the ever-changing COVID-19 pandemic and will be an integral component to help achieve high vaccination rates.

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