College of Family Physicians Singapore

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## Covid-19 and Respiratory Virus Vaccination Strategies for Family Physicians (2025 Update)

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# Contents


**EDITORIAL**

**3**

COVID-19 and Respiratory Virus Vaccination Strategies for Family Physicians (2025 Update)
*Dr Chiang Shu Hui Grace*

---

**Distance Learning Course on "COVID-19 And Respiratory Virus Vaccination Strategies For Family Physicians (2025 Update)"**

**5**

Unit 1: Vaccine-Preventable Respiratory Diseases: A Case for Ongoing Vigilance in Primary Care
*Dr Wee Liang En Ian*

**12**

Unit 2: mRNA Vaccines: Safety, Efficacy, Future Applications, and Addressing Misconceptions
*Dr Leong Hoe Nam*

**15**

Unit 3: Confidence Through Connection: Supporting Confident Vaccine Choices in Primary Care
*Dr Tan Kian Wee Kenneth, Dr Gabriel Yee*

**23**

Assessment of 15 MCQs

---

**READINGS**

**25**

A Selection of Ten Current Readings on "COVID-19 and Respiratory Virus Vaccination Strategies for Family Physicians (2025 Update)"

---

**CASE ARTICLE**

**36**

Reactive Thrombocytosis in a Patient Undergoing Treatment for Vitamin B12 Deficiency
*Dr Shao Wen Tang Wymann, Dr Fang Yu Pang, Dr Farhad Fakhrudin Vasanwala*

---

**38**

Guidelines and Information for Authors



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# COVID-19 and Respiratory Virus Vaccination Strategies for Family Physicians

Dr Chiang Shu Hui Grace

**SFP2025; 51(6)**

Influenza, pneumococcal, and COVID-19 vaccinations have been made easily accessible in Singapore to reduce the incidence of respiratory infections caused by these pathogens. COVID-19 vaccination is free under the National Vaccination Programme for all eligible residents, while influenza and pneumococcal vaccinations are fully subsidised for HealthierSG-enrolled Singaporeans who are 65 years and above or who have certain medical conditions.

These efforts to increase the uptake of influenza and pneumococcal vaccinations have been successful. The uptake of pneumococcal vaccination among residents aged 65 and above increased from 22 percent in 2020 to 61 percent in 2024, while the uptake for influenza vaccination in the same age group also increased from 18 percent to 42 percent over the same period.[1]

By 2024, 88.7 percent of Singaporean residents have also received the full regimen of Covid-19 vaccinations.[2] However, a study done in Singapore found that there were relatively high rates of hesitancy for the booster dose among those already vaccinated. Over 30 percent of study participants reported being booster-hesitant, with 4.7 percent reporting that they would refuse the booster vaccine, despite completing the primary COVID-19 vaccine series.[3]

Vaccine hesitancy is complex. The reasons for vaccine hesitancy are varied and multifactorial. These factors include cultural norms, historical context, socioeconomic limitations, and personal experience. Targeted interventions that acknowledge and respond to diverse concerns about efficacy and safety and distrust of institutions and government are necessary to address vaccine hesitancy.[4]

Healthcare providers play an integral role in tackling barriers to vaccine acceptance and vaccine advocacy. Research has shown that there is a strong link between trust in the physician and vaccination rates.[5] Notably, primary care providers have been found to play an influential role in vaccination efforts[6] as most patients view their primary care providers as trusted messengers.[7]

This issue will provide an update for family physicians on effective vaccination strategies for COVID-19 and respiratory viruses.

In Unit 1, Dr Ian Wee offers a compelling case for primary care physicians to be remain vigilant and familiar with vaccine preventable respiratory diseases.

In Unit 2, Dr Leong Hoe Nam provides a comprehensive overview on the safety, efficacy, and future applications of mRNA vaccines. He also provides evidence to address misconceptions regarding mRNA vaccines.

In Unit 3, Drs Kenneth Tan and Gabriel Yee provide evidence for the use and integration of evidence-based communication strategies in vaccination counselling.

In this issue, A/Prof Goh Lee Gan has selected 10 current readings on topics related to Covid-19 and respiratory virus vaccination strategies. These readings include articles on burden of disease and the importance of vaccination.

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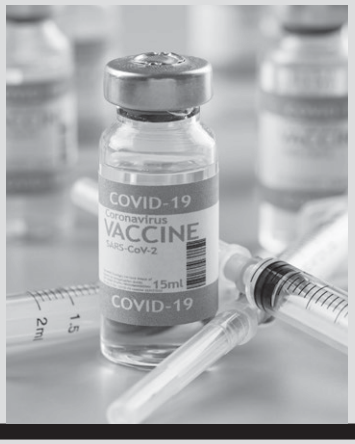


# Distance Learning Course on "COVID-19 And Respiratory Virus Vaccination Strategies For Family Physicians (2025 Update)"

- Unit 1: Vaccine-Preventable Respiratory Diseases: A Case for Ongoing Vigilance in Primary Care
- Unit 2: mRNA Vaccines: Safety, Efficacy, Future Applications, and Addressing Misconceptions
- Unit 3: Confidence Through Connection: Supporting Confident Vaccine Choices in Primary Care

Unit No. 1

# VACCINE-PREVENTABLE RESPIRATORY DISEASES: A CASE FOR ONGOING VIGILANCE IN PRIMARY CARE

Dr Wee Liang En Ian

## ABSTRACT

**Pneumonia is the second-most-common cause-of-death in Singapore; vaccination therefore comprises a significant part of Singapore's strategy to improve population health, and is embedded into primary care at the national level through Healthier SG. Tropical heat and humidity in Singapore predisposes to year-round transmission of respiratory-viral-infection (RVIs), including COVID-19, influenza, and respiratory-syncytial virus (RSV). The list of vaccine-preventable respiratory infections has expanded beyond influenza and pneumococcal vaccination in recent years to include COVID-19 and RSV; however, vaccine-hesitancy is a major obstacle to vaccination uptake and prevention of respiratory infections. Familiarity with the various vaccine-preventable respiratory diseases is essential for the primary care physician.**

**Key words: RSV, COVID-19, pneumococcal, vaccination**

**SFP2025; 51(6): 5-11**

## INTRODUCTION

Pneumonia is the second-most-common cause of death in Singapore; tropical heat and humidity in Singapore predisposes to year-round transmission of respiratory-viral-infection (RVIs).[1] Following the COVID-19 pandemic, significant rebound in transmission of endemic respiratory infections, such as influenza, respiratory-syncytial-virus (RSV) and pneumococcal disease[1,2] has been observed in Singapore.[1,2] Locally, mortality rates of ~5 percent were observed for hospitalisations attributed to various vaccine-preventable-respiratory-infections (VPRIs) amongst older Singaporeans (refer to **Figure 1**).

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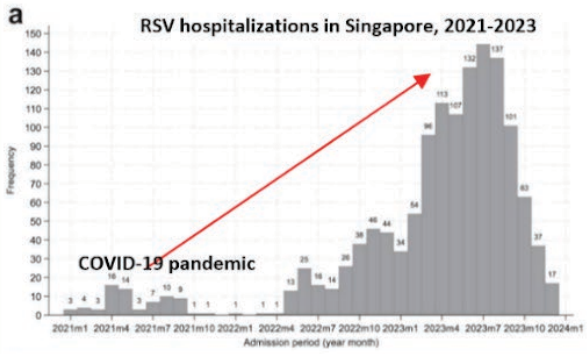
Vaccination against VPRIs, such as influenza/COVID-19/respiratory-syncytial-virus [RSV]/pneumococcal disease, have been shown to confer effective protection against hospitalisations and mortality in clinical trials[3] and other cohort studies.[4-6] However, despite incorporation of vaccination against VPRIs into Singapore's national adult immunisation schedule (NAIS), and the availability of subsidised vaccination at the primary care level, gaps still exist in uptake.

For instance, both influenza and pneumococcal vaccination (23-valent pneumococcal-polysaccharide-vaccine [PPSV-23], and the 13-valent pneumococcal-conjugate-vaccine [PCV-13]) are included in the NAIS and subsidised for older adults (aged ≥65 years) and adults with comorbidities; with the rollout of the Healthier SG (HSG) initiative in Singapore from July 2023 onwards, eligible HSG-enrolled Singaporean citizens are entitled to receive fully-subsidised ($0) vaccinations under the NAIS at their enrolled HSG clinic.[7] These efforts have translated into increases in influenza/pneumococcal vaccination uptake over the years, but room still remains for improvement. Prior to the COVID-19 pandemic, only 32.4 percent of older Singaporean adults received yearly influenza vaccination,[8] a figure substantially below the OECD average of 55 percent influenza vaccination coverage rates for older adults in 2021,[9] and below the World Health Organisation recommendation for 75 percent influenza vaccination coverage amongst older adults aged ≥65 years.[10]

Similarly, while COVID-19 vaccination is also freely available in primary care, differences in vaccination uptake across socioeconomic strata persist into the post-pandemic era,[11] and uptake of updated COVID-19 boosters has significantly dropped post-pandemic, with <5 percent having received an updated COVID-19 booster.[6]

The list of VPRIs has expanded beyond influenza and pneumococcal vaccination in recent years to include COVID-19 and RSV, but vaccine hesitancy remains an issue. Multiple reasons for vaccine hesitancy likely exist in the Singaporean context, including patient/physician factors, and healthcare system gaps. Local studies identified that having a regular family physician was associated with uptake of pneumococcal vaccination,[12] and point-of-care informational interventions carried out by primary care physicians significantly increased influenza/pneumococcal vaccination uptake.[13] This update aims to provide information on the significance of various VPRIs (beyond influenza) in the local context, so that primary care physicians can act as effective advocates for vaccination, particularly amongst at-risk groups. Specifically, we will examine the evidence supporting COVID-19, RSV and pneumococcal vaccination.

**Figure 1: Trend in a)RSV; b)influenza hospitalisations amongst adult Singaporeans nationally, 2021-2023.**




| Sociodemographic and clinical characteristics | Respiratory-syncytial-virus (RSV) hospitalisations,[a] N (%) | COVID-19 hospitalisations, boosted ≥1 year prior with ancestral mRNA vaccines,[b] N (%) | COVID-19 hospitalisations, boosted <1 year prior with updated mRNA vaccines,[b] N (%) | COVID-19 hospitalisations, unboosted,[b,c] N (%) | Influenza hospitalisations,[c] N (%) | Total hospitalisations, N (%) |
|---|---|---|---|---|---|---|
| **Clinical outcomes and healthcare utilisation** | | | | | | |
| 28-day mortality | 72 (5.4) | 281 (5.0) | 44 (4.5) | 82 (9.7) | 36 (0.9) | 515 (4.0) |
| Intensive-care-unit (ICU) admission | 51 (3.8) | 163 (2.9) | 23 (2.3) | 34 (4.0) | 69 (1.7) | 340 (2.7) |
| **Total cost of hospitalisation, US$ (median, IQR)**[i] | 2497.8 (1448.3–4673.9) | 3421.7 (1554.3–5990.3) | 3414.6 (1577.9–5972.6) | 3889.1 (1883.2–7270.3) | 2187.8 (1353.7–4215.1) | 2821.0 (1461.6–5442.3) |

Wee LE, et al. Severity of respiratory syncytial virus versus SARS-CoV-2 Omicron and influenza infection amongst hospitalized Singaporean adults: a national cohort study. Lancet Reg Health West Pac. 2025 Feb 20;55:101494. doi: 10.1016/j.lanwpc.2025.101494.

## COVID-19

While the threat of COVID-19 has receded in the public imagination during endemicity, COVID-19 still accounts for a substantial proportion of hospitalisations attributable to acute-respiratory-infection amongst adult Singaporeans. In a modelling study that estimated excess influenza-, RSV-, and SARS-CoV-2-associated hospitalisation in Singapore from 2015–2023, 19.3 percent of hospitalisations for acute-respiratory-infection were attributed to COVID-19.[1] Periodic surges in SARS-CoV-2 transmission are attributed to emergence of new circulating variants; as with other endemic respiratory diseases, periodic COVID-19 waves are expected throughout the year. Studies in other populations during endemicity found that COVID-19 imposed a greater disease burden than influenza, reflecting as higher hospital admission, mortality rates, and more severe illness.[14] During Omicron, mortality amongst adult COVID-19 hospitalisations in Singapore was estimated at 5.0 percent, with 2.9 percent requiring ICU admission.[2]

Comparative severity:

- In Singaporean adults, Omicron COVID-19 was more severe compared to influenza (4.5–9.7 percent 28-day mortality in COVID-19 hospitalisations, versus 0.9 percent 28-day mortality in influenza hospitalisations).[2]

At-risk populations:

- Older adults and individuals with pre-existing comorbidities remain at risk.
- During Omicron, significantly higher risk of infection, hospitalisation, and severe COVID-19 was observed among Singaporean adult patients with asthma and chronic-obstructive-pulmonary-disease (COPD).
- Singaporean adult asthmatics had a 31 percent higher risk of severe COVID-19 versus non-asthmatic population-based controls, while individuals with COPD had a 36 percent higher risk of severe COVID-19, versus controls.[15]
- Singaporean adults with pre-existing heart conditions, including ischaemic heart disease and heart failure, had significantly higher risk of COVID-19 hospitalisation during the Omicron period.[16]
- Individuals with heart failure had a 77 percent higher risk of COVID-19 hospitalisation, while individuals with ischaemic heart disease had a 21 percent higher risk, versus matched controls.[16]

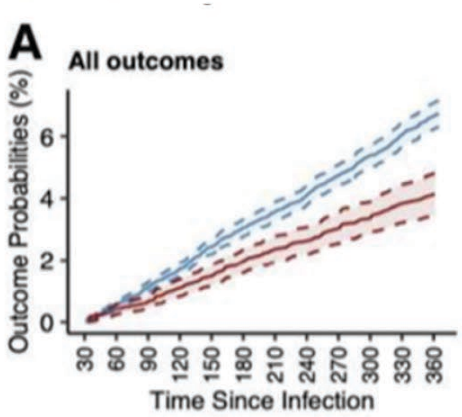
Impact of vaccination:

- Boosted COVID-19 hospitalisations were less severe than unboosted COVID-19 hospitalisations (unboosted: 9.7 percent 28-day mortality; boosted: 4.5–5.0 percent 28-day mortality).[2]
- Updated vaccine formulations confer greater protection against severe COVID-19 compared to ancestral vaccine doses.
- During a JN.1 wave in Singapore, recent receipt of updated boosters conferred protection against SARS-CoV-2 infection and emergency-department (ED) visits/hospitalisations, in both previously infected and uninfected individuals.[6]
- Compared with individuals last boosted ≥1 year earlier with ancestral monovalent vaccines, receipt of an updated XBB.1.5 booster 8–120 days earlier was associated with 40–50 percent lower risk of JN.1

infection, COVID-19-associated ED visits, and COVID-19 hospitalisations (refer to **Figure 2**).[6]

- Updated COVID-19 vaccine doses were also protective against long-term sequelae post-COVID-19 ("long-COVID-19") in the Singaporean population.[17]
- A 40 percent decrease in risk of any post-acute sequelae was observed amongst adult Singaporeans who received prior bivalent COVID-19 boosters, versus those boosted with ancestral COVID-19 vaccines (refer to **Figure 2**).[17]

**Figure 2: Comparative vaccine-effectiveness of ancestral versus bivalent COVID-19 vaccines against post-acute and acute infection outcomes in a pandemic**




B

| mRNA Vaccination Status | aHR (95% CI SARS-CoV-2 Infection |
|---|---|
| Boosted; ≥1 y since last dose[c] | 1.00 (Reference) |
| Boosted, with last dose a bivalent booster; 8–120 d since last dose | 0.77 (.66–.91) |
| Boosted, with last dose a bivalent booster; 121–365 d since last dose | 0.92 (.88–.95) |
| Boosted, with last dose an XBB 1.5 booster; 8–120 d since last dose | 0.59 (.52–.66) |

**A:** Vaccine-effectiveness of ancestral versus bivalent COVID-19 vaccines against any post-acute sequelae at 31-365 days post-SARS-CoV-2 infection, comparing outcome probabilities of any post-acute sequelae in individuals boosted with ancestral versus bivalent COVID-19 vaccines. Red line: bivalent vaccines; blue line: ancestral vaccines; dotted lines: 95% CIs.

**B:** Vaccine-effectiveness of ancestral versus bivalent COVID-19 vaccines against acute SARS-COV-2 infection; computed using Cox-regression, with adjusted-hazards-ratios (aHR) and 95% CIs

Wee et al. Bivalent Boosters and Risk of Postacute Sequelae Following Vaccine-Breakthrough SARS-CoV-2 Omicron Infection: A Cohort Study. Clin Infect Dis. 2025 Mar 17;80(3):520-528.
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Vaccination recommendations:

- Singaporeans aged six months and above are eligible for COVID-19 vaccination. The persons recommended for COVID-19 vaccination in 2024/2025 are:
  1. Individuals aged 60 years and above
  2. Medically vulnerable individuals aged six months and above
  3. Residents of aged care facilities

Persons living or working with medically vulnerable individuals are also encouraged to consider receiving the vaccine.

## RESPIRATORY SYNCYTIAL VIRUS

Often confused with the common cold, respiratory syncytial virus (RSV) can in fact cause serious disease. Previously, awareness of RSV was low due to a lack of testing; however, in tropical Singapore, RSV is most common at the extremes of age,[19] and year-round RSV transmission occurs given the heat and humidity. In a modelling study that estimated excess influenza-, RSV-, and SARS-CoV-2-associated hospitalisation in Singapore from 2015–2023, 4.0 percent of hospitalisations for acute-respiratory-infection were attributed to RSV.[1] Mortality amongst adult RSV hospitalisations in Singapore was estimated at 5.4 percent, with 3.8 percent requiring ICU admission.[2] RSV hospitalisations account for significant morbidity and costs; a systematic review across Asian countries found that the direct inpatient medical costs attributable to a RSV hospitalisation ranged from US$126–$2,448 in low-middle-income countries (LMICs) to US$838–$3,402 in high-income countries.[20]

Comparative severity:

- In Singaporean adults, higher odds of 28-day mortality/intensive-care-unit admission and higher healthcare utilisation were observed in RSV hospitalisations versus influenza (5.4 percent 28-day mortality in RSV hospitalisations, versus 0.9 percent 28-day mortality in influenza hospitalisations).[2]
- RSV was less severe than unboosted COVID-19, with lower odds of 28-day mortality and healthcare utilisation. However, higher odds of intensive-care-unit admission were observed in RSV hospitalisations, versus COVID-19 hospitalisations boosted <1 year prior with updated vaccines.[2]
- Beyond respiratory complications, emerging evidence suggests that RSV is also linked to cardiac events.
- In a large cohort of hospitalised US veterans, nearly one-quarter of hospitalised adults with RSV infection experienced an acute cardiac event (most frequently heart failure).[21]
- In a cohort of almost 33,000 adult Singaporeans hospitalised for RSV, COVID-19, or influenza, slightly more than one in 10 RSV hospitalisations had an acute cardiovascular event; the odds of a cardiac event were significantly higher than patients hospitalised for COVID-19, as well as for patients with vaccine-breakthrough influenza hospitalisations.[22]
- Long-term sequelae may also occur following RSV hospitalisation.[23]

- Within a cohort of 83,000 adults hospitalised for RSV, COVID-19, or influenza, increased risk of long-term cardiovascular and neurological complications was observed up to 300 days post-hospitalisation.[23]

At-risk populations:

- Older age (≥70 years) and diabetes mellitus were associated with greater odds of 28-day mortality amongst Singaporean adults hospitalised for RSV.[2]

Impact of vaccination:

- Vaccines targeting RSV have recently become available for adult populations.
- Two RSV vaccines are currently licensed for use: an AS01-adjuvanted vaccine targeting the RSV fusion F surface glycoprotein of an RSV-A strain (Arexvy), and an unadjuvanted bivalent RSV prefusion F (RSVpreF) vaccine (Abrysvo).
- In clinical trials, vaccine effectiveness of the AS01-adjuvanted vaccine against RSV-related lower respiratory tract disease was 82.6 percent,[24] while vaccine effectiveness of the unadjuvanted bivalent vaccine against RSV-related lower respiratory tract disease was 85.7 percent.[25]
- Emerging data supports real-world effectiveness of RSV vaccination. In a real-world analysis following administration of the RSV vaccine amongst Scottish adults aged 75–79 years, a 62.1 percent reduction in RSV-related hospitalisations was observed amongst the eligible age group, compared with predictions.[26]
- In a real-world analysis of vaccine-effectiveness for the RSVpreF vaccine amongst members of a large US healthcare system aged 60 years and above, vaccine-effectiveness against RSV-related lower respiratory tract disease was estimated at 90 percent.[27]
- A single dose of RSV vaccine prevented RSV-associated hospitalisation across two RSV seasons, although effectiveness was lower in patients with immunocompromising conditions and cardiovascular disease.[28]
- However, the optimal timing for RSV re-vaccination remains unknown, given variations in RSV seasonality.

Vaccine safety:

- Real-world surveillance data supports overall safety of RSV vaccination.
- In a large electronic health record study of more than 4 million vaccinated adults, RSV vaccination was shown to be safe overall, with no excess risk of immune thrombocytopenic purpura (ITP).[29]
- A statistically significant signal for increased risk of Guilain-Barré syndrome (GBS) was observed amongst patients who received the RSVPreF vaccine, though it must be emphasised that this risk was extremely rare (estimated excess of GBS cases: 5.2 per 1,000,000 vaccinations).[29]

Vaccination recommendations:

- In Singapore, RSV vaccines, though not part of the NAIS, are currently licensed for use in the following groups of individuals:
- Adults 60 years of age and older to prevent RSV disease
- Adults 18 through 59 years of age who are at increased risk for RSV disease (e.g., those with chronic heart or lung disease, weakened immune system)
- Pregnant women at 32 through 36 weeks gestational age to protect their infants from birth through six months of age against RSV disease

## PNEUMOCOCCAL VACCINATION

*Streptococcus pneumoniae* remains a major respiratory pathogen and significant cause of pneumonia globally.[30] Two types of pneumococcal vaccines, polysaccharide and conjugate vaccines, are available for prevention of pneumococcal disease in older adults and individuals with comorbidities.[30] Multiple population-based studies have demonstrated real-world effectiveness of the 23-valent pneumococcal-polysaccharide-vaccine (PPSV-23),[31-35] and the 13-valent pneumococcal-conjugate-vaccine (PCV-13),[36-39] respectively, in mitigating risk of pneumococcal-related-disease and hospitalisations for pneumonia in older adults. National surveillance data from 2019–2022 indicated that 44.4–52.3 percent of invasive-pneumococcal-disease cases in adult Singaporeans involved serotypes covered by PCV-13, while 55.5–70.3 percent of cases were covered by PPSV-23, with type 3 the predominant serotype in all years except 2021.[40,41]

At-risk populations:

- Older age and presence of comorbidities were identified as risk factors for invasive pneumococcal disease amongst adult Singaporeans.[42]

Impact of vaccination:

- In a real-world population-wide study of PPSV-23 vaccine effectiveness conducted amongst older Danish adults from 2020-2023, vaccine effectiveness of PPSV-23 was estimated at 32 percent.[35]
- In a much larger population-based study of US Veterans-Health-Administration (VHA) enrollees, sequential PCV-13/PPSV-23 vaccination was associated with lower risk of invasive pneumococcal disease, highlighting the additional benefit of combined pneumococcal vaccination.[43]

Vaccination recommendations:

- In Singapore, the pneumococcal conjugate PCV-20 vaccine was included on the subsidised vaccine list starting September 2025, Singapore being the first country in Asia to get PCV-20.
- PCV-20 covers seven more bacterial serotypes compared to PCV-13.
- Under the NAIS, PCV-20 is recommended for all adults aged 65 years and above, as well as adults aged 18 to 64 years who are at increased risk of developing severe pneumococcal disease. Healthier SG Singaporean enrolees will be fully subsidised for PCV20 at their enrolled clinic.
- Detailed recommendations on pneumococcal vaccines are available in the NAIS (refer to **Figure 3**).

**Figure 3: NAIS recommendations for pneumococcal vaccines**

**Detailed NAIS recommendations on pneumococcal vaccines:**
**1. All persons aged 65 years or older**

| Prior vaccines | Option A: PCV20 recommendations | Option B: PCV13 and/or PPSV23 recommendations |
|---|---|---|
| None | **PCV20** | **PCV13;** followed by **PPSV23** (interval: ≥1 year*) |
| Received **PPSV23** only (at any age) | **PCV20** (interval: ≥1 year from PPSV23) | ***<<If previous PPSV23 was ≥65 years>>*** **PCV13** (interval: ≥1 year from PPSV23) |
| | | ***<<If previous PPSV23 was <65 years>>*** **PCV13** (interval: ≥1 year from PPSV23); **followed by PPSV23** (interval: ≥1 year) |
| Received **PCV13** only (at any age) | **PCV20** (interval: ≥1 year from PCV13) | **PPSV23** (interval: ≥1 year from PCV13*) |
| Received **PCV13** (any time) and **PPSV23** (at <65 years) | **PCV20** (interval: ≥5 years†) | **PPSV23** (intervals: see footnote§) |
| Received **PCV13** (any time) and **PPSV23** (at ≥65 years) or Received **PCV20** (any time) | **No vaccines recommended** Have already completed vaccination series | **No vaccines recommended** Have already completed vaccination series |

** For persons with an immunocompromising condition, cochlear implant or CSF leak, a minimum interval of 8 weeks can be considered*
*† Interval of at least 5 years from any of the most recent dose of PCV13 or PPSV23*
*§ Intervals of at least 5 years from PPSV23 and at least 1 year from PCV13, whichever is later*

## CONCLUSION

Vaccine-preventable respiratory infections remain a year-round problem in Singapore, where a humid tropical climate predisposes to year-round, rather than seasonal, transmission of respiratory viral infections. A large proportion of patients hospitalised with pneumonia in a tropical setting have evidence of a respiratory viral infection on systematic testing. The list of vaccine-preventable respiratory infections has expanded beyond influenza and pneumococcal vaccination in recent years to include COVID-19 and RSV; however, vaccine-hesitancy is a major obstacle to vaccination uptake and prevention of respiratory infections. Physician recommendations are important in educating patients regarding key benefits arising from vaccination against respiratory infections.

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**LEARNING POINTS**

- **Pneumonia is the second-most-common cause-of-death in Singapore; the list of vaccine-preventable respiratory infections has expanded beyond influenza and pneumococcal vaccination in recent years to include COVID-19 and RSV.**
- **During COVID-19 endemicity, keeping up-to-date with vaccination improves protection against acute and longer-term sequelae of COVID-19.**
- **RSV vaccinations are now available for older adults and individuals at increased risk for RSV disease; with real-world evidence of benefit.**
- **The pneumococcal conjugate PCV-20 vaccine was included on the subsidised vaccine list from September 2025 onwards; multiple real-world studies support effectiveness of pneumococcal conjugate vaccines in protecting against severe disease.**

Unit No. 2

# mRNA VACCINES: SAFETY, EFFICACY, FUTURE APPLICATIONS, AND ADDRESSING MISCONCEPTIONS

Dr Leong Hoe Nam

## ABSTRACT

**Messenger RNA (mRNA) vaccines have transformed vaccinology, achieving unprecedented success during the COVID-19 pandemic. This review synthesises evidence on their safety, efficacy, and potential applications beyond infectious diseases, while addressing common misconceptions. Over 13 billion doses administered globally to date demonstrates a robust safety profile, with rare serious adverse events. Effectiveness against severe COVID-19 has been demonstrated with real-world evidence, with significant reductions in hospitalisations and mortality. Future applications include vaccines for infectious diseases and personalised therapies, with promising clinical trials underway. Misconceptions, such as DNA alteration and infertility, are debunked using peer-reviewed data. This article underscores mRNA vaccines' transformative potential and the critical role of physicians in combating misinformation to promote public health.**

**Keywords: Messenger RNA vaccines, COVID-19 vaccines, Vaccine safety, Vaccine hesitancy, Public health communication, Personalised therapeutics**

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## INTRODUCTION

The advent of mRNA vaccines marks a pivotal advancement in medical science, driven by decades of research and accelerated by the urgent need to address the COVID-19 pandemic. Pioneered by scientists like Katalin Karikó and Drew Weissman, who were awarded the 2023 Nobel Prize for their work on lipid nanoparticles, mRNA technology enables rapid, precise, and adaptable vaccine development.[1] Unlike traditional vaccines, which use inactivated or live-attenuated pathogens, mRNA vaccines deliver synthetic mRNA to instruct cells to produce pathogen-specific proteins, eliciting robust immune responses without infectious agents.[2] By 2025, over 13 billion doses have been administered globally, primarily for COVID-19, with emerging applications in other diseases.[3] This article reviews the safety profile, clinical benefits, and future potential of mRNA vaccines, while systematically addressing misconceptions that fuel vaccine hesitancy. Through evidence-based insights, we aim to equip medical professionals with the knowledge to advocate for this transformative technology.

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## SAFETY PROFILE OF mRNA VACCINES

The safety of mRNA vaccines has been rigorously evaluated through clinical trials, real-world studies, and continuous global surveillance. Since their introduction in 2020, mRNA vaccines have been administered to billions. In Singapore, the rates of serious adverse events after the third mRNA COVID-19 dose was reported at <0.001 percent.[4] Common side effects, including injection-site soreness, fatigue, and low-grade fever, are transient, typically resolving within 1–3 days.[5] These effects reflect the immune system's activation and are consistent with other vaccines.

Severe adverse events, such as myocarditis and anaphylaxis, are rare but warrant attention due to their clinical significance. Myocarditis, primarily observed in young males after the second dose, occurs at an incidence of 1–2 per 100,000 doses, with most cases being mild and resolving with rest or minimal intervention.[6,7] In contrast, COVID-19 infection poses a significantly higher risk of myocarditis, with rates of 2.8 per 1,000 infections.[7] This stark difference underscores the protective benefit of vaccination. Anaphylaxis, another rare event, occurs at a rate of 0.55 to 0.67 per 100,000 administered doses of mRNA COVID-19 vaccines and can be mitigated with timely medical intervention.[8] Screening for allergies and post-vaccination observation further mitigate this risk.

A critical aspect of mRNA vaccine safety is the transient nature of the mRNA itself. After translation into proteins, mRNA degrades within 24–48 hours.[9] This rapid degradation eliminates concerns about long-term persistence or genomic integration, as mRNA operates exclusively in the cytoplasm and does not enter the nucleus.[1,10,11] Long-term safety data, now spanning over five years, confirm no significant adverse effects, with ongoing monitoring through systems like the Vaccine Adverse Event Reporting System (VAERS) and V-safe.[5] A 2025 study by the Center for Infectious Disease Research and Policy (CIDRAP) found no safety issues with the latest mRNA vaccine formulations, reinforcing their reliability.[12]

mRNA vaccines are also safe in special populations, such as pregnant women. Recent evaluation by the CDC in 2025 found no increased risk of poorer maternal, pregnancy, or infant outcomes from analyses taken from the COVID-19 Vaccine Pregnancy Registry and the Vaccine Safety Datalink.[13] Similarly, fertility studies, such as Wesselink et al,[13] found no difference in conception rates between vaccinated and unvaccinated individuals, debunking

infertility concerns.[14] Regulatory oversight by the FDA, European Medicines Agency (EMA), and World Health Organization (WHO) ensures rigorous testing and post-market surveillance, establishing mRNA vaccines as among the safest in vaccinology.[15]

## CLINICAL BENEFITS OF mRNA VACCINES

The clinical efficacy of mRNA vaccines has been a cornerstone of their success. Clinical trials for mRNA-COVID-19 vaccines demonstrated over 90 percent efficacy against severe COVID-19 outcomes, including hospitalisation and death.[10] Real-world data further validate these findings, with an estimated 80 percent reduction in hospitalisations and 20 million lives saved globally.[15,16] The vaccines induce robust humoral and cellular immunity, producing high levels of neutralising antibodies and T-cell responses that persist with booster doses.[17,18] This immunogenicity is particularly valuable in immunocompromised patients, where adjusted dosing regimens enhance protection.[17]

The adaptability of mRNA vaccines is a key advantage. The platform allows rapid modification to target emerging variants, as demonstrated by Omicron-specific variant vaccines developed within months.[19] This flexibility contrasts with traditional vaccines, which require years to develop due to reliance on cultured pathogens.[20] By protecting vulnerable populations, such as the elderly and those with comorbidities, mRNA vaccines have alleviated strain on healthcare systems, facilitating economic and social recovery during the COVID-19 pandemic.[3] These benefits underscore the platform's transformative impact on global health.

## FUTURE APPLICATIONS OF MRNA TECHNOLOGY

The versatility of mRNA technology extends far beyond COVID-19, with a robust pipeline targeting infectious diseases, cancer, and rare disorders.[21] The platform's rapid design and scalability make it ideal for addressing emerging pandemics, such as potential H5N1 outbreaks.[22] It may be possible for mRNA technology to be used for universal vaccines (e.g., pan-coronavirus) or personalised therapies in the near future.

## DEBUNKING COMMON MYTHS

Misinformation has significantly contributed to vaccine hesitancy, necessitating evidence-based rebuttals to common myths. One pervasive myth is that mRNA vaccines alter DNA. This is scientifically implausible, as mRNA operates in the cytoplasm, degrades within 24–48 hours, and does not enter the nucleus where DNA resides.[1,10,11] Studies, including Pardi et al,[1] confirm no evidence of genomic integration, and regulatory agencies have reiterated this finding.[23] Concerns about long-term harm are equally unfounded. Over five years of data, including a 2025 CIDRAP study, show no significant long-term adverse effects, with global surveillance systems like VAERS and V-safe ensuring ongoing safety.[12]

The myth that mRNA vaccines cause infertility has been thoroughly debunked. Wesselink et al[13] found no difference in conception rates between vaccinated and unvaccinated individuals, and studies of over 500,000 pregnant women confirm no increased risk of miscarriage or fertility issues.[14] Claims that mRNA vaccines are "experimental" ignore over 30 years of research, starting in the 1990s, and the administration of over 13 billion doses safely.[3,24] The 2023 Nobel Prize for mRNA technology underscores its established scientific foundation.[1] Other misconceptions, such as vaccines causing widespread severe side effects, are contradicted by data showing adverse events are rare and manageable.[6-8] Addressing these myths with clear, evidence-based communication is essential for building public trust and encouraging vaccine uptake.

## CONCLUSION

mRNA vaccines have redefined vaccinology, offering an effective, tolerable, and versatile platform for combating infectious diseases and beyond. With a safety profile demonstrating rare adverse events (<0.01%), robust efficacy against severe COVID-19, and a promising platform for infectious diseases and therapeutics, mRNA technology is poised to transform medicine. By debunking myths with robust evidence, physicians can counter misinformation and promote vaccine confidence. Ongoing research and global initiatives to expand access will further amplify the impact of mRNA vaccines. Medical professionals are urged to be updated with the knowledge of the mRNA platform to better educate patients, and support continued innovation to realise the full potential of this revolutionary technology.

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**LEARNING POINTS**

- **Proven Safety: mRNA degrades in 24–48 hours with no DNA integration; serious adverse events are rare (<0.01 percent), far lower than disease risks (e.g., myocarditis from COVID-19 is 10–100 times higher).**
- **High Efficacy & Adaptability: >90 percent protection against severe COVID-19; platform enables rapid variant updates and strong antibody/T-cell responses, saving ~20 million lives globally.**
- **Future Potential: Versatile for infectious diseases (e.g., RSV, HIV trials), cancer immunotherapy (e.g., personalised melanoma vaccines), and rare disorders like cystic fibrosis.**
- **Myth Debunking: No evidence of infertility (studies show no conception impact) or long-term harm (5+ years of data); mRNA is established tech, not experimental, with 13B+ safe doses.**

Unit No. 3

# CONFIDENCE THROUGH CONNECTION: SUPPORTING CONFIDENT VACCINE CHOICES IN PRIMARY CARE

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## ABSTRACT

**Adult vaccine hesitancy presents a formidable barrier to addressing the escalating burden of vaccine-preventable diseases (VPDs) in an ageing population. Conveying the clinical urgency for adult immunisation to vulnerable populations often collides with a complex landscape of patient doubt, misinformation, and low-risk perception. Overcoming this challenge requires a fundamental shift from simple information provision to a relational, patient-centred approach designed to build trust and foster confidence. Clinicians may utilise a structured framework to examine the psychological drivers of hesitancy through the 5C model (Confidence, Complacency, Convenience, Calculation, Collective Responsibility). By using evidence-based communication strategies, including the presumptive recommendation, Motivational Interviewing (MI), the SHARE model for shared decision-making, and the Empathetic Refutational Interview for addressing misinformation. By integrating these techniques, we would be able to transform challenging vaccine discussions into opportunities to strengthen the patient-provider relationship and support confident, informed health decisions.**

**Keywords: Vaccine Hesitancy, Health Communication, Primary Care, Motivational Interviewing, Shared Decision-Making, Adult Immunisation, Patient-Centred Care**

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## INTRODUCTION

Singapore's childhood immunisation programme has been very successful, achieving high community vaccination uptake rates,[1] yet a significant but narrowing gap persists in adult preventive care, which is a core mission of Family Physicians (FPs) nationally.[2] In rapidly ageing societies, this gap represents a growing threat. Older adults face a dual vulnerability: they have a higher prevalence of chronic comorbidities, while facing an age-related decline in immunity (ARDI), which increases susceptibility to infections and increases their risk of severe complications.[3]

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However, the availability of effective vaccines[4] is only half the equation. The biological problem of waning immunity especially in the vulnerable middle-aged to elderly population has a profound and complex psychological counterpart: vaccine hesitancy.

Here, we narratively review the drivers leading to vaccine hesitancy and confidence, outline how FPs can participate in whole-of-society change management efforts to improve vaccine confidence, and provide communication and motivational interviewing strategies to tactically support these objectives at the individual FP level.

## THE CHALLENGE OF VACCINE HESITANCY

Vaccine hesitancy has been variably defined as a delay in acceptance or refusal of vaccination despite the availability of vaccination services[5]; a set of attitudes and beliefs associated with vaccine decision-making that precedes a decision to (not get) vaccinated.[6] Vaccine hesitancy exists on a spectrum, ranging from minor uncertainty or a desire for more information to a firm, belief-driven refusal.

Thus it may not be solely due to a knowledge deficit that can be addressed simply by presenting facts, but rather might be attitudinal, stemming from complex, context-specific psychological, social, emotional, and political phenomena.[6] The modern information ecosystem, saturated with misinformation and disinformation, further complicates the landscape, making it difficult for patients to distinguish credible health information from persuasive but false claims.

**Family Physicians play a pivotal role alongside specialists and the Government in tackling vaccine hesitancy by multimodal interventions including social media outreach.** At the individual level, Family Physicians are well placed—as per the seven CANMEDS roles[7]—to reach out to vaccine-hesitant patients as medical experts, scholars, and communicators. At the societal level, FPs are well placed to collaborate with other specialists, healthcare institutions, and the government, co-leading efforts in this area to influence public perception.

There is local[8] and international[9] evidence of the efficacy of FPs in improving vaccination uptake. For example, Ho et al noted[8] in a pragmatic cluster-randomised crossover trial across 22 general practices in Singapore in the pre-COVID era how a 3-month intervention with flyers and posters encouraging vaccination could modestly influence influenza and pneumococcal vaccination uptake, and with the 100 percent Healthier SG subsidies for these vaccinations for eligible patients, the impact is likely to be even greater in current times.

Despite the pervasive influence of online sources of health information, such as social media, among older adults,

information from doctors or healthcare institutions are perceived as trusted sources, as well as information from governmental organisations and institutions of higher learning.[10,11]

Specifically, in a cross sectional study[11] on data from the Singapore Life Panel (SLP) by Tan et al, a population representative monthly survey of Singaporeans aged 56–75 by SMU researchers, it was noted that 60–92 percent of those aged 56–74 years in Singapore receive somewhat trusted information from social media, family, and friends, specifically with 60 percent shown to "slightly trust" social media. A latent class analysis by the authors noted that a portion of respondents who placed broad trust in all sources of information, especially those with low trust in formal sources of information and high trust in informal sources, have higher odds of being vaccine-hesitant. Especially for this subgroup who place equal or greater weight on social media, family, and friends' recommendations, the authors proposed that they might fall through the cracks, and that it was necessary to develop interventions to tackle this significant subgroup. This was leveraged by Singapore's government, which tackled via a whole-of-government approach misinformation and ambivalence via multi-pronged interventions including social media accounts and videos and targeted use of legislation.[12]

Family Medicine defines itself by its primary, continuing, and patient-centred nature, building a trusted relationship longitudinally, which can be leveraged for fostering vaccine confidence.

There remains a gap of tailored knowledge and skills for Family Physicians at all levels to address vaccine hesitancy. As such, we review, describe, and expand the application of structured communication frameworks such as the 3Cs (of complacency, convenience, and convenience) that have hitherto been described in this journal by Prof See Kay Choong in 2024[13] and that FPs can use in fostering vaccine confidence.

## DECONSTRUCTING VACCINE HESITANCY

**Understanding and Tackling the Hesitancy Spectrum at the Individual and Societal Level**
Vaccine hesitancy and confidence are a continuum, the vast majority of hesitant individuals do not hold intractable, identity-defining beliefs. Instead, most individuals span a wide and varied middle ground of ambivalence, uncertainty, and legitimate questioning.

At the **patient level**, approaching patients as individuals whose unique concerns and perspective must be understood before they can be addressed, we are able to define the specific nature of the hesitation and tailor interventions and communication strategies.

For FP leaders, it is equally important to apply **societal level** change management techniques such as Kotter's Model[14] that provide a "how" to improve vaccine confidence after diagnosing "why" vaccine hesitancy is present with models such as WHO's Behavioural and Social Drivers of Vaccine Uptake.[15] With the "how" and "why" addressed, structured, people-centred strategies can be employed to address the core motivations of individuals, build a broad-based community of support, tackle misinformation, and proactively remove barriers to action. By generating measurable wins and sustaining acceleration, public health leaders can anchor a new health behaviour of smart trust and evidence-based vaccine confidence in public culture. **Table 1** provides tangible examples of how each of the eight steps of Kotter's Change Management techniques were applied in Singapore's COVID-19 Vaccination campaign that enabled it to urgently vaccinate a large proportion of her population,[16] at one time the highest in the world.

**Table 1: Kotter's 8 Steps of Change Management as applied to Singapore's COVID-19 Vaccine Campaign**

| Kotter's 8 Steps | Application in Singapore's COVID-19 Vaccine Campaign |
|---|---|
| 1. Create a Sense of Urgency | Public communications highlighted the high risk of severe outcomes, hospitalisation, and death, especially among older adults and the immunocompromised. The government also framed misinformation and falsehoods as a parallel threat to public health that required a unified response. |
| 2. Build a Guiding Coalition | A Multi-Ministry Taskforce (MTF) with key leaders from various sectors (Health, Finance, Trade and Industry, etc.) led the response. This was advised by an independent Expert Committee on COVID-19 Vaccination (EC-19V) to ensure all decisions were evidence-based. |
| 3. Form a Strategic Vision | The campaign was guided by a clear, unifying vision to become a "COVID-19-resilient nation", which was tied to the tangible goal of safely reopening the economy and returning to normalcy. |

| | |
|---|---|
| 4. Enlist a Volunteer Army | The government mobilised a wide network of "trusted messengers", including General Practitioners (GPs), community ambassadors, and social service organisations, to provide personalised information and address concerns at the local level. They also engaged local celebrities and artistes to create content in multiple languages to reach diverse audiences. |
| 5. Enable Action by Removing Barriers | Vaccination was made free for all Singapore citizens and residents to remove financial barriers. A vast network of community vaccination centres, polyclinics, and mobile vaccination teams was established to ensure convenient and widespread access for all, including homebound seniors. A unified IT system was also created for seamless booking and data synchronisation. |
| 6. Generate Short-Term Wins | The government used a "carrot-and-stick" approach, implementing vaccination-differentiated safe-management measures that provided vaccinated individuals with tangible, immediate benefits, such as eased restrictions on social gatherings and dining. These incentives were introduced after key vaccination milestones were met, reinforcing the value of the collective effort. |
| 7. Sustain Acceleration | As immunity waned and new variants emerged, the campaign transitioned to a continuous booster programme, demonstrating an ongoing effort to maintain a high level of protection. This involved progressively closing large, temporary vaccination centres and moving the responsibility for ongoing vaccination back to polyclinics and GP clinics, integrating the practice into routine healthcare. |
| 8. Institute Change in the Culture | The behaviours and lessons learnt were formally anchored into the national culture. The government created the "COVID-19 Resilience Medal" to publicly recognise and celebrate the contributions of individuals and teams. They also established a new, disease-agnostic "Pandemic Preparedness and Response Framework" to ensure the nation is ready for future public health challenges. |

The remainder of this article will focus on the individual level techniques for the practising FP to tackle vaccine hesitancy.

## THE 5C AND 7C FRAMEWORKS FOR VACCINATION READINESS

By actively listening, FPs can obtain the necessary information from patients to utilise the 5C model, a validated psychological framework that identifies five key drivers of vaccine hesitancy[17] to diagnose the root cause(s) of their reluctance.

The five drivers are:

- **Confidence:** This refers to the level of trust in the safety and efficacy of vaccines, the reliability and competence of the healthcare system and its professionals, and the motivations of the policymakers who decide on vaccine schedules. A patient expressing fear of side effects ("I'll get sick from the vaccine") or citing stories of adverse events is signalling a deficit in **Confidence**. This is perhaps the most intuitive driver of hesitancy and is often fuelled by misinformation.
- **Complacency:** This driver is characterised by a low perceived risk of contracting a VPD. When the threat of a disease seems distant or insignificant, the motivation to vaccinate is correspondingly low. A patient who states, "I'm healthy, I don't need it" is demonstrating **Complacency**. They do not necessarily distrust the vaccine; they simply do not believe the disease poses a personal threat, making vaccination seem superfluous. This is a common barrier in adults who have not personally witnessed the severe impact of vaccine-preventable diseases. GPs are well placed to provide the necessary information on the (mitigatable) consequences of vaccine-preventable diseases.
- **Convenience:** This dimension encompasses structural and practical barriers to vaccination. It includes factors like the physical availability of the vaccine, geographic accessibility, affordability, and the ease of scheduling an appointment. A patient concerned about cost ("It's too expensive") or time ("I don't have time") is facing a **Convenience** barrier. These are often the most straightforward barriers to address, yet they can be a significant deterrent if not acknowledged and resolved. GPs laboured round the clock to vaccinate patients during the COVID pandemic, enabling convenient vaccination for the populace especially the working class.
- **Calculation:** This refers to an individual's active and deliberate process of seeking information to weigh the perceived risks and benefits of vaccination. A patient who has done extensive online research and comes to the appointment with a list of detailed questions is engaged in **Calculation**. While this behaviour can be challenging, it also signals a high level of engagement with their health. The key for GPs is to ensure patients' calculations are based on accurate understanding of risk.

- **Collective Responsibility:** This dimension relates to the willingness to be vaccinated to protect others in the community, contributing to herd immunity. While a powerful motivator for some, an appeal to collective responsibility is often less effective for adult vaccines (which primarily offer direct protection) compared to childhood or pandemic vaccines. Nonetheless, understanding a patient's orientation towards this concept can inform the communication approach.

## EXPANSION TO THE 7C MODEL IN THE POST-PANDEMIC ERA

The global experience during the COVID-19 pandemic highlighted the need for a more comprehensive framework. The model was expanded to include two additional drivers, creating the **7C model of vaccination readiness**[18]:

- **Compliance (or Conformity):** This dimension captures the influence of mandates, rules, and social pressure. It was a particularly strong driver in Singapore, where Vaccination-Differentiated Safe Management Measures (VDS) linked vaccination status to access to public spaces like malls and restaurants, creating a powerful incentive for compliance. In the appropriate setting, individual clinicians can leverage on this particularly strong trait in Singapore for individual patients, pointing how the majority of other patients, friends, and family have undergone vaccination.
- **Conspiracy:** This refers to the belief that vaccines are part of a secret, harmful plot by powerful organisations. Such a mindset makes individuals distrust official health advice. Whilst the Singaporean government actively addressed this driver by promoting official information channels and using legislation such as POFMA to counter the spread of dangerous misinformation, **at the individual level**, clinicians can reflectively listen and **reflect back** the misinformation for the **patient's** consideration, **encouraging** them to **critically review**, and **evaluate** for themselves the correctness of this information.[19]

## USING THE 7C MODEL AS A CLINICAL TOOL

The clinician can use the **7C model** to perform a "psychosocial diagnosis" to plan their approach. The process involves two steps. First, the clinician must listen carefully to the patient's expressed barrier. This might be a direct statement like "I'm scared of needles", or a more complex belief like "Vaccines cause disease".

Second, the clinician maps this symptom to the underlying **7C driver**. For instance:

- **"It's too expensive"** is a symptom of a **Convenience** issue.
- **"I'm healthy and rarely get sick, so I don't need it"** is a symptom of **Complacency**.
- **"I've read that the new mRNA vaccines can alter your DNA"** is a symptom of low **Confidence** and flawed **Calculation**.

A clinician who only responds to the symptom might offer a simple, factual rebuttal (e.g., "Subsidies are available" or "That's a myth"). While not incorrect, this approach fails to address the root cause. In contrast, a clinician who has diagnosed the underlying driver can select a much more targeted and effective communication strategy.

For a patient driven by **Compliance**, the focus should be on validating their decision and making the process efficient, rather than debating the vaccine's merits. For a patient expressing **Conspiracy**-related beliefs, the goal is not to win a factual debate, but to maintain the therapeutic relationship, find common ground, and preserve trust for future encounters.

## COMMUNICATION STRATEGIES FOR BUILDING PATIENT CONFIDENCE

### The Power of the Presumptive Recommendation

For the majority of patients who are not hesitant, the most effective and efficient way to initiate a vaccine conversation is with a presumptive recommendation.[20] Frame vaccination as a routine and expected part of good clinical care, thereby normalising the behaviour. Instead of asking an open-ended question like "What are your thoughts on getting the shingles vaccine today?", make a clear, confident recommendation. "Let's do your shingles vaccine today to protect you".

The presumptive approach helps efficiently identify patients who are ready to accept vaccination. If the patient agrees, the clinician can proceed. However, if the patient expresses any hesitation, consider pivoting to a more patient-centred, exploratory approach like Motivational Interviewing. Failure to pivot is a common mistake that can shut down the conversation.

### Motivational Interviewing (MI) for the Ambivalent Patient

When a patient expresses ambivalence, the goal shifts from recommending to understanding. Motivational Interviewing (MI) is a collaborative conversational style for strengthening a person's own motivation and commitment to change.[17] It is ideally suited for vaccine conversations because it avoids the "righting reflex", the natural tendency for clinicians to correct what they perceive as wrong thinking, which often elicits patient defensiveness.

- **Core Philosophy (The "Spirit" of MI):** MI is guided by four principles:
    - **Partnership:** The clinician works collaboratively with the patient, who is viewed as the expert on their own life.

- **Acceptance:** The clinician respects the patient's autonomy, worth, and perspective, even if they disagree.
- **Compassion:** The clinician actively promotes the patient's welfare with empathy.
- **Evocation:** The clinician's primary task is to draw out the patient's own arguments for change, rather than imposing their own.

- **Core Skills (OARS):** These four skills are the practical application of the MI spirit.
  - **Open Questions:** Questions that cannot be answered with a simple "yes" or "no". They invite the patient to tell their story.
    - *Example:* "What have you heard about the RSV vaccine?" or "Help me understand your concerns about getting vaccinated today".
  - **Affirmations:** Statements that recognise the patient's strengths, efforts, or positive qualities. This builds rapport and self-efficacy.
    - *Example:* "I can see you've put a lot of thought into this, and I appreciate you sharing your concerns with me."
  - **Reflections:** The clinician makes a statement that reflects back the meaning of what the patient has said. This is the most powerful MI skill, as it shows the patient they are being heard and understood.
    - Patient: "I'm just not sure the risk of shingles is a big deal for me. I'm pretty healthy."
    - Clinician (Simple Reflection): "So you feel that because you're in good health, shingles isn't a major risk for you."
    - Clinician (Complex Reflection): "On the one hand, you feel healthy and the risk seems distant, but on the other, you're here today talking about it, so a part of you is considering it." This highlights the patient's own ambivalence.
  - **Summaries:** A collection of reflections that pull together the key elements of the conversation, often used to transition to the next step.
    - *Example:* "So, let me see if I have this right. You're worried about potential side effects you've read about online, but you also know your neighbour had a terrible case of shingles and you want to avoid that. Where does that leave us?"

MI is the ideal tool when the underlying 7C driver is **Complacency** or **Calculation**. It helps the patient explore their own reasons for and against vaccination, allowing them to resolve their ambivalence in favour of protecting their health.

### The SHARE Model for True Shared Decision-Making

While MI is designed to help a patient find their own motivation, shared decision-making is a collaborative process of weighing evidence and preferences together to make a choice. The SHARE model provides a five-step framework[21] for this process and is particularly useful when a patient is actively engaged in Calculation and wants to be a partner in the decision.

**The Five Steps of SHARE:**

1. **Seek** your patient's participation. Explicitly invite the patient to be part of the decision-making process.
   - *Example:* "There are a couple of ways we can approach protecting you from pneumococcal disease. I'd like to talk through the options with you and decide together what makes the most sense."
2. **Help** your patient explore and compare treatment options. Present the options clearly, using plain language and decision aids if available. Discuss the risks and benefits of each choice, including the option of not vaccinating.
   - *Example:* "We have two types of pneumococcal vaccines available. Vaccine A is one dose, while Vaccine B requires two doses but might offer broader protection for someone with your health condition. Let's look at what that means."
3. **Assess** your patient's values and preferences. Understand what matters most to the patient. Is it convenience? Maximum efficacy? Avoiding side effects?
   - *Example:* "Given these two options, what's most important to you right now? Is it getting it done in one visit, or are you more focused on the long-term protection?"
4. **Reach** a decision with your patient. Check for understanding and make a decision together.
   - *Example:* "It sounds like the single-dose option fits best with your priorities. Are you comfortable moving forward with that plan?"
5. **Evaluate** your patient's decision. Follow up to ensure the patient is comfortable with the plan and that it is implemented.

Follow this conversational algorithm: **Start Presumptive → If Hesitation, Assess Cause → If Ambivalence, Use MI → If Collaborative/Data-Seeking, Use SHARE** to navigate the majority of vaccine conversations in a way that is both efficient and tailored.

## NAVIGATING DIFFICULT CONVERSATIONS

One of the most challenging scenarios in a vaccine conversation is when a patient presents a piece of specific

misinformation. Countering misinformation is crucial to ensure patients make informed decisions based on factual information, and misinformation can be successfully debunked.[22,23] The Empathetic Refutational Interview[24] is a guided conversation that integrates psychological research with best clinical practices to correct false information while preserving the trusted relationship with the patient. It does so by refuting misconceptions within a supportive framework that shows empathy and understanding for the patient's underlying motivations.

**The Four-Step Method:**

**Step 1: Elicit Concerns**

- Invite the patient to share their thoughts, drawing from motivational interviewing techniques like active listening. This helps establish common ground and allows the healthcare professional (HCP) to understand the underlying motivation, or "attitude root", for the patient's concern.

**Step 2: Affirm**

- Express empathy by affirming the patient's concerns or the values behind them. The HCP can agree with the legitimate part of a patient's worry (e.g., that it's wise to be cautious about medications) without endorsing the specific misconception. This affirmation builds trust, shows the patient they are being heard, and increases their receptiveness to further information.

**Step 3: Offer a Tailored Refutation**

- After building rapport, the HCP refutes the misconception. This is more effective than simply stating facts. The refutation should be tailored not just to the false information but also to the patient's underlying motivation (attitude root) to avoid threatening their worldview. The goal is to replace the misconception with a believable and acceptable alternative for the patient.

**Step 4: Provide Factual Information**

- The interview concludes by providing additional, evidence-based facts that are known to be effective at increasing vaccine acceptance. This can include explaining the risks of the disease or the benefits of immunity.

## MAPPING COMMUNICATION STRATEGIES TO COMMON VACCINATION BARRIERS

To make these frameworks immediately applicable in a busy clinical setting, the following table serves as a practical, quick-reference guide. It synthesises the entire communication process, helping clinicians move swiftly from a patient's expressed concern (the symptom), to a diagnosis of the underlying psychological driver (the 5C model), and finally to the selection of the most appropriate evidence-based communication strategy and sample phrasing.

| Common Patient Barrier & Phrasing | Likely Primary 7C Driver(s) | Recommended Communication Strategy | Sample Phrasing & Clinical Pearls |
|---|---|---|---|
| **Pain/Fear of Injection**<br>"Injections are painful."<br>"I'm scared of needles." | Low Confidence (in a painless experience) | Simple Reassurance & Procedural Support | "I hear you. Many people feel that way. The needle is very small, and it will be over in just a few seconds. We can use a distraction technique, like coughing right as I give the injection, which can help a lot. How does that sound?" |
| **Perceived Inconvenience**<br>"I don't have time." | Convenience | Problem-Solving & Benefit Framing | "It's definitely a challenge to fit one more thing into a busy day. The good news is we can do it right now, and it will only take a minute. This one quick step can save you from being sick for weeks with something like RSV, which would be a much bigger disruption." |
| **Cost Concerns**<br>"It's too expensive." | Convenience | Education & Cost-Benefit Analysis | "That's a very practical concern. HealthierSG or Medisave might help cover some of the cost. When we compare that to the potential cost of hospitalisation or missed work from a serious illness, the vaccine is incredibly great value for your health." |
| **Lack of Knowledge**<br>"I'm not sure if I need this." | Calculation (early stage) | Education & Personalisation (using analogies) | "That's a great question. Your immune system is like a security force that gets a little slower as we age. This vaccine helps to train up that security force, preparing it to fight off a real shingles infection. For someone your age, that training is really important." |

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|---|---|---|---|
| **Low Perceived Risk**<br>"I'm healthy."<br>"Vaccines are for children only, not adults." | Complacency | Motivational Interviewing (MI) to Develop Discrepancy | "It's wonderful that you feel so healthy, and you've clearly taken great care of yourself. Help me understand what your health looks like for you in 10 years. How does staying active and independent fit into that picture? Sometimes, an illness like shingles can unexpectedly get in the way of those plans." |
| **Fear of Side Effects**<br>"I'll get sick from the vaccine." | Low Confidence | MI to Explore Fears & Normalise Response | "It's understandable to be worried about side effects. What specific things are you most concerned about? It's helpful to know that feeling a bit tired or having a sore arm is actually a sign that your immune system is learning and building protection. These feelings are mild and temporary, unlike the illness, which can be more severe." |
| **Misinformation**<br>"Vaccines cause disease." | Low Confidence & Flawed Calculation | Empathetic Refutational Interview (ERI) | **1. Elicit:** "Thanks for sharing that with me. There's a lot of conflicting information out there. Can you tell me a bit more about that?"<br>**2. Affirm:** "I can see why that would be worrying. It's smart to be cautious and want to be sure about safety. It's normal to wonder about that."<br>**3. Tailored Refutation:** "That's an important question. The great thing about this vaccine is that it's designed to be impossible to cause the disease because it only uses a small, inactive piece of the virus. It's like giving your immune system a photo of the intruder without ever letting them in the house."<br>**4. Provide Facts:** "So we can be confident that it's safe, and the benefit is that it is very effective at preventing a severe infection that could lead to hospitalisation." |

## CONCLUSION

The growing burden of adult vaccine-preventable diseases demands a renewed focus on prevention. The behavioural and social drivers of vaccine hesitancy can be diagnosed at the societal level, and change management strategies to tackle these have been outlined.

At the individual level, clinicians can effectively approach vaccine hesitancy by diagnosing the root causes of vaccine hesitancy with the 7Cs model and apply tailored, evidence-based communication. Strategies like Presumptive Recommendation, Motivational Interviewing, SHARES, and the Empathetic Refutational Interview (ERI) are key approaches to addressing vaccine hesitancy and helping healthcare professionals refute misconceptions while maintaining trust and rapport with patients. An empathetic response, such as affirming a patient's concerns, helps support a FP's refutation and subsequent information. Each conversation is a critical opportunity to strengthen the therapeutic alliance, and directly contributes to community-wide disease prevention.

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**LEARNING POINTS**

- **Effective vaccine conversations require a shift from simply providing facts to first understanding the root cause of a patient's hesitation. Use the 7C model to perform a "psychosocial diagnosis" and identify the driver behind a patient's reluctance.**
- **Use a tailored communication strategy based on the diagnosed driver of hesitancy. This involves using a presumptive recommendation for accepting patients, Motivational Interviewing (MI) for ambivalent patients, the SHARE model for collaborative patients engaged in calculation, and the Empathetic Refutational Interview (ERI) for those presenting specific misinformation.**
- **Avoid the "righting reflex" (the urge to immediately correct a patient), which can cause defensiveness and damage trust.**

## ASSESSMENT OF 15 MCQS

# FPSC NO : 130
# MCQS ON COVID-19 AND RESPIRATORY VIRUS VACCINATION STRATEGIES FOR FAMILY PHYSICIANS (2025 UPDATE)
## SUBMISSION DEADLINE: 23 DECEMBER 2025, 12 NOON

**INSTRUCTIONS**
- **To submit answers to the following multiple choice questions, you are required to log on to the College Online Portal (https://lms.wizlearn.com/cfps/)**
- **Please contact sfp@cfps.org.sg if you have not received an email on the new LMS account.**
- **Attempt ALL the following multiple-choice questions.**
- **There is only ONE correct answer for each question.**
- **The answers should be submitted to the College of Family Physicians Singapore via the College Online Portal before the submission deadline stated above.**
- **There will be NO further extension of the submission deadline**

**1. Which of the following groups are not recommended for COVID-19 vaccination in Singapore?**

A. Individuals aged 60 years and above
B. Medically vulnerable individuals aged six months and above
C. Residents of aged care facilities
D. Persons living or working with medically vulnerable individuals are also encouraged to consider receiving the vaccine
E. Children aged under six months

**2. Which of the following describes an RSV vaccine licensed for use in Singapore?**

A. Non-adjuvanted vaccine targeting RSV fusion F surface glycoprotein of RSV-A
B. Unadjuvanted vaccine targeting RSV prefusion F surface glycoprotein of RSV-A and RSV-B strains
C. Unadjuvanted vaccine targeting RSV prefusion F surface glycoprotein of RSV-A strain only
D. Unadjuvanted vaccine targeting RSV prefusion F surface glycoprotein of RSV-B strain only
E. Adjuvanted vaccine targeting RSV fusion F surface glycoprotein of RSV-A and RSV-B strains

**3. Which of the following describes a rare side effect that has been observed in association with some existing RSV vaccines (5.2 per 1,000,000 vaccinations)?**

A. Heart failure
B. Heart attack
C. Kidney failure
D. Stroke
E. Guillain-Barre Syndrome minimal, with less than 1 billion US dollars in productivity losses reported globally

**4. Which pneumococcal vaccine is currently not part of NAIS recommendations in Singapore?**

A. PCV-20
B. PCV-13
C. PPSV-23
D. PCV-15
E. All of the options listed above are part of NAIS recommendations

**5. An adult aged 66 years, without any previous pneumococcal vaccination or other comorbidities, shows up at your clinic asking about pneumococcal vaccination. What pneumococcal vaccine would you recommend?**

A. PCV-20 only
B. PCV-20 followed by PPSV-23 one year later
C. PCV-13, followed by PPSV-23 within two weeks
D. PPSV-23 only
E. No need for pneumococcal vaccination, as he does not have any comorbidities

**6. What is the typical duration that mRNA from vaccines remains in the human body before degradation?**

A. 1–2 weeks
B. 24–48 hours
C. 1–2 months
D. Permanently
E. 6–12 hours

**7. What is the approximate incidence rate of myocarditis associated with mRNA vaccines?**

A. 1–2 per 100,000
B. 10–20 per 100,000
C. 1–2 per 1,000
D. 100–200 per 100,000
E. No reported cases

**8. Which characteristic of the mRNA vaccine platform most directly enhances global pandemic preparedness and response?**

A. Requirement for large-scale cell culture of live pathogens prior to formulation
B. Capacity for rapid antigen redesign and manufacturing within weeks of sequence availability
C. Dependence on cold-chain storage throughout the entire distribution pathway
D. Necessity for adjuvant reformulation with each new viral strain
E. Ability to induce lifelong sterilising immunity after a single dose

**9. Why does mRNA from vaccines not alter human DNA?**

A. It is rapidly absorbed into the nucleus
B. It remains in the cytoplasm and degrades quickly
C. It integrates into the genome temporarily
D. It uses reverse transcriptase to modify DNA
E. It replaces damaged DNA sequences with corrected templates

**10. When a patient expresses concerns that mRNA vaccines "alter DNA", which communication strategy is most effective for healthcare professionals to counter misinformation and maintain trust?**

A. Reassure the patient by stating, "That claim is irrational; just trust the science"
B. Acknowledge the concern, provide evidence-based explanation that mRNA cannot integrate into the DNA, and direct the patient to reputable sources (e.g., CDC, WHO, peer-reviewed studies)
C. Emphasise that vaccination is recommended under government regulations, so there is no concern
D. Respond with an explanation on the mechanism of action and the lack of enzymes required for DNA integration
E. Provide the patient with official fact sheets that firmly refute conspiracy theories and end the discussion without further dialogue

**11. A 58-year-old patient coming for a routine check-up says, "I'm quite healthy and I don't really see the point in getting the pneumococcal vaccine. I feel like it's more for frail or elderly people." According to the 7C model described in the article, which psychological driver is this patient primarily exhibiting?**

A. Low Confidence
B. Convenience
C. Calculation
D. Complacency
E. Conspiracy

**12. A 66-year-old patient expresses hesitation about the shingles vaccine. When you begin to discuss it, you find they are ambivalent. They acknowledge a family member had a severe case of shingles but are also worried about potential side effects they've read about. According to the article, which communication style is most appropriate for this scenario?**

A. A presumptive recommendation to normalise the vaccine
B. The Empathetic Refutational Interview to debunk their side-effect concerns
C. Motivational Interviewing to help them explore their own reasons for and against vaccination
D. The SHARE model to collaboratively review all available vaccine brands
E. Focusing on a cost-benefit analysis to address convenience barriers

**13. During a consultation, a patient asserts, "I heard the new RSV vaccine wasn't tested properly and contains harmful toxins." When using the Empathetic Refutational Interview (ERI) framework, what is the crucial first step a clinician should take after hearing this statement?**

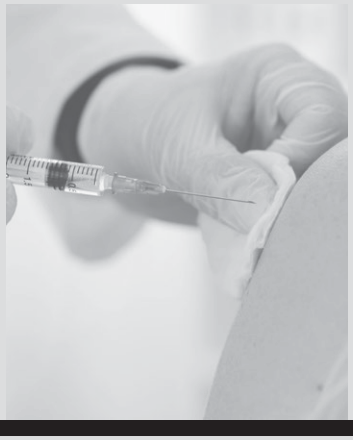
A. Immediately provide data from clinical trials to prove the vaccine is safe and effective
B. Ask the patient to identify the source of their information to assess its credibility
C. Express empathy and affirm the underlying value of their concern (e.g., "It's smart to be cautious and want to be sure about safety")
D. Elicit more concerns by asking an open-ended question like "What else have you heard about the vaccine?"
E. Explain the biological mechanism of the vaccine to show how it cannot be toxic

**14. A patient has done their own research on pneumococcal vaccination and comes to the appointment wanting to discuss the differences between the available vaccine types (e.g., PCV15, PCV20, PPSV23), their efficacy rates, and which one would be best for their specific health condition. They are highly engaged and want to be a partner in the decision. Which communication framework is most suitable?**

A. The SHARE model
B. The Presumptive Recommendation
C. Motivational Interviewing
D. The Empathetic Refutational Interview
E. The 7C model

**15. The "presumptive recommendation" (e.g., "Let's do your shingles vaccine today to protect you") is a highly effective opening strategy. However, its success depends on the clinician's ability to perform a crucial next step if the patient shows any hesitation. What is that crucial step?**

A. Repeating the recommendation with more authority to reinforce its importance
B. Immediately providing a pamphlet with factual information about the vaccine
C. Documenting the patient's refusal and agreeing to revisit it at the next appointment
D. Pivoting from recommending an exploratory, patient-centred approach like Motivational Interviewing
E. Asking a series of direct questions to challenge the patient's reasons for hesitating



# READINGS

A SELECTION OF TEN READINGS ON TOPICS RELATED TO
**COVID-19 AND RESPIRATORY VIRUS VACCINATION STRATEGIES FOR FAMILY PHYSICIANS (2025 UPDATE)**

# A SELECTION OF TEN READINGS ON TOPICS RELATED TO COVID-19 AND RESPIRATORY VIRUS VACCINATION STRATEGIES FOR FAMILY PHYSICIANS (2025 UPDATE)

**FPSC130 – SATURDAY, 18 OCT 2025: 2.00pm – 5.00pm**
**All are available as PMC free full text**

**Selection of readings made by A/Prof Goh Lee Gan**

## READING 1 – LONG-TERM MULTISYSTEMIC SEQUELAE—COVID-19 AND INFLUENZA COMPARED: RETROSPECTIVE COHORT STUDY

**Wee LE,[1] Ho RWL,[2] Lim JT,[3] Chiew CJ,[4] Lye DCB,[5] Tan KB.[6] Long-term multisystemic sequelae post-hospitalisation for Omicron COVID-19 vs influenza: A retrospective cohort study. Int J Infect Dis. 2025 Sep;158:107946. PMID: 40499677.**

**doi: 10.1016/j.ijid.2025.107946. PMID: 40499677. Free full text.**

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ABSTRACT

OBJECTIVES: To contrast long-term sequelae post-COVID-19 hospitalisations attributed to Omicron, vs seasonal influenza; stratified by vaccination.

METHODS: Retrospective population-based cohort study in Singapore, including all adult COVID-19 hospitalisations post-Omicron emergence (1 January 2022 – 3 September 2023), and historical influenza hospitalisations (1 January 2017 – 3 September 2023). Risks of post-acute diagnoses/symptoms 31–300 days post-COVID-19 hospitalisation, vs influenza, were estimated using overlap-weighted competing-risks-regression, with death as a competing risk.

RESULTS: 70,628 COVID-19 hospitalisations and 10,454 influenza hospitalisations were included. Lower overall risk of post-acute cardiac symptoms (adjusted-hazards-ratio, aHR=0.77 [95% CI=0.64-0.92]; P<0.001) was observed following any COVID-19 hospitalisation vs influenza. Similarly, lower risk of any post-acute cardiac diagnosis/symptoms (aHR=0.80 [95% CI=0.68-0.94]; P<0.001) was observed following unboosted COVID-19 hospitalisations vs unvaccinated influenza, and lower risk of other cardiac disorders (e.g., heart failure) was observed following boosted COVID-19 hospitalisations vs vaccinated influenza (aHR=0.58 [95% CI=0.39-0.86]; P<0.001). However, risks of post-acute cognitive impairment and fatigue/malaise were significantly higher post-COVID-19 vs influenza (cognition: aHR=1.34 [95% CI=1.08-1.68]; P<0.001; fatigue/malaise: aHR=1.75 [95% CI=1.23-2.50]; P<0.001) and when unboosted COVID-19 was compared against unvaccinated influenza (memory/cognition: aHR=1.67 [95% CI=1.27-2.19; P<0.001]; fatigue/malaise: aHR=1.77 [95% CI=1.18-2.64]; P<0.001).

CONCLUSION: Risks of cognitive impairment/fatigue were increased while risk of cardiac sequelae was significantly lower post-COVID-19 vs influenza in unboosted/unvaccinated individuals. Vaccination for COVID-19/influenza remains important during endemicity.

## READING 2 – RISK FACTORS FOR SEVERE COVID-19 OUTCOMES IN ASIA PACIFIC REGION: A LITERATURE REVIEW

**Thompson M,[1,#] Buttery AK,[1,#] Clarke C,[1] Oh SX,[2] Chan M,[3] Lee BH,[4] Iino T,[5] Wang YA.[6] Risk factors for severe COVID-19 outcomes in the Asia-Pacific region: a literature review. Front Public Health. 2025 Jun 9;13:1562179. PMID: 40612551.**

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ABSTRACT

This comprehensive synthesis of severe COVID-19 risk factors specific to the Asia-Pacific (APAC) region addresses gaps in previous global studies, which often overlook regional demographic, epidemiological, and healthcare system variations.

Three databases (PubMed, Ovid MedLine, Scopus) and two preprint platforms (BioRxiv, MedRxiv) were searched between 1 December 2019, and 31 March 2023. English-language publications from 11 APAC countries/regions (Australia, Hong Kong, Japan, Macau, New Zealand, Philippines, Singapore, South Korea, Taiwan, Thailand, and Vietnam) reporting conditions associated with severe COVID-19 outcomes in adults (aged ≥16 years) were included.

Of 295 publications screened, 123 met inclusion criteria, mostly from South Korea (n=68) and Japan (n=23). Common risk factors included older age, male sex, obesity, diabetes, heart failure, renal disease, and dementia. Less commonly, hypertension, chronic obstructive pulmonary disease, cardio-and cerebrovascular disease, immunocompromise, autoimmune disorders, and mental illness were reported.

To date, no prior region-specific synthesis of risk factors for severe COVID-19 outcomes across the APAC region has been identified. The findings support the development of tailored vaccination strategies and public health interventions at both national and regional levels, helping ensure high-risk populations are prioritised in ongoing COVID-19 prevention and management efforts.

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## READING 3 – SEVERITY OF RSV VERSUS SARS-COV-2 OMICRON INFECTION AND INFLUENZA INFECTION AMONGST HOSPITALISED SINGAPOREAN ADULTS: A NATIONAL COHORT STUDY

**Wee LE,[1-4] Ho RWL,[1] Tan KB,[1,2,5,6,12] Lim JT,[1,5] Young B,[1,5,7] Boon Lye DC,[1,5,7] Chiew CJ,[1,6] Yung CF,[2,5,11] Venkatachalam [1,3,4] Sim JXY,[3,4] Cheong HY,[8] Ng TY.[9,10] Severity of respiratory syncytial virus versus SARS-CoV-2 Omicron and influenza infection amongst hospitalised Singaporean adults: a national cohort study. Lancet Reg Health West Pac. 2025 Feb 20;55:101494. PMID: 40060306.**

**doi: 10.1016/j.lanwpc.2025.101494. PMID: 40060306. Free full text.**

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ABSTRACT

BACKGROUND: More data is required to contextualise respiratory-syncytial-virus (RSV) disease burden, versus other vaccine-preventable respiratory-viral-infections (RVIs) in older adults. We aimed to compare severity of RSV in hospitalised adults versus influenza/boosted COVID-19.

METHODS: Retrospective population-based cohort study, including all adult RSV hospitalisations (2021–2023) in Singapore. Disease severity (28-day mortality/intensive-care-unit [ICU] admission) and healthcare utilisation in RSV hospitalisations were compared with contemporaneous influenza hospitalisations and COVID-19 hospitalisations in 2023. Outcomes for COVID-19 were stratified by type/receipt of boosters. Comparative severity of RSV versus COVID-19/influenza was evaluated using multivariate logistic regression, adjusted for confounders. Generalised linear models were utilised to estimate excess length-of-stay/costs of RSV hospitalisation versus COVID-19/influenza as a rate-ratio.

FINDINGS: 12,811 hospitalised adults were included (RSV: N=1,332; influenza: N=3,999; COVID-19: N=7,480). Amongst RSV hospitalisations, 5.4% (72/1,332) died within 28 days; 3.8% (51/1,332) required ICU. Median length-of-stay (RSV) was 5.0 days (IQR=3.0-8.0). Older age/diabetes were associated with greater odds of 28-day mortality in RSV hospitalisations. Higher odds of 28-day mortality/ICU admission and higher healthcare utilisation was observed in RSV hospitalisations versus influenza. Conversely, RSV was less severe than unboosted COVID-19, with lower odds of 28-day mortality (adjusted-odds-ratio, aOR=0.56 [95% CI=0.40-0.79]) and rate-ratio for length-of-stay/costs significantly <1. However, higher odds of ICU (aOR=1.80 [95% CI=1.07-3.00]) were observed in RSV hospitalisations, versus COVID-19 hospitalisations boosted <1 year prior with updated vaccines.

INTERPRETATION: Hospitalisations attributed to RSV were more severe than influenza. RSV disease was less severe versus COVID-19 in unboosted patients but severity was not significantly different from COVID-19 in boosted individuals.

FUNDING: National Medical Research Council, Singapore.

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## READING 4 – PROTECTION AND WANING OF VACCINE-INDUCED, NATURAL, AND HYBRID IMMUNITY TO SARS-COV-2 IN HONG KONG

**Jiang J,[1] Yin G,[1] Lam KF,[1,2] Lau EHY,[3] Lin Y,[3] Cowling BJ.[3,4] Protection and waning of vaccine-induced, natural and hybrid immunity to SARS-CoV-2 in Hong Kong. Expert Rev Vaccines. 2025 Dec;24(1):252-260. PMID: 40137440.**

**doi: 10.1080/14760584.2025.2485252. PMID: 40137440. Free full text.**

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ABSTRACT

BACKGROUND: As the COVID-19 pandemic transitions into its fourth year, understanding the dynamics of immunity is critical for implementing effective public health measures. This study examines vaccine-induced, natural, and hybrid immunity to SARS-CoV-2 in Hong Kong, focusing on their protective effectiveness and waning characteristics against infection during the Omicron BA.1/2 dominant period.

RESEARCH DESIGN AND METHODS: We conducted a territory-wide retrospective cohort study using vaccination and infection records from the Hong Kong Department of Health. The analysis included over 6.5 million adults, applying the Andersen-Gill model to estimate protective effectiveness while addressing selection bias through inverse probability weighting.

RESULTS: Vaccine-induced immunity peaked one month after the first dose but waned rapidly, while boosters significantly prolonged protection. Infection-induced immunity showed higher initial effectiveness but declined faster than vaccine-induced immunity. Hybrid immunity provided the most durable protection. mRNA vaccines (Comirnaty) demonstrated greater effectiveness and slower waning compared to inactivated vaccines (CoronaVac).

CONCLUSIONS: Hybrid immunity represents the most effective strategy for sustained protection against SARS-CoV-2. Public health policies should emphasise booster campaigns and hybrid immunity pathways to enhance population-level immunity and guide future COVID-19 management in Hong Kong.

## READING 5 – PREFERENCES FOR NONPHARMACEUTICAL INTERVENTIONS DURING ENDEMIC PHASE OF COVID-19

**Wang Y,[1] Har CE,[1] Tan SHX,[1] Cheng HS,[1] Ang IYH.[1] Preferences for Nonpharmaceutical Interventions During the Endemic Phase of COVID-19: Discrete Choice Experiment. JMIR Public Health Surveill. 2025 Jun 4;11:e67725. PMID: 40470547.**

**doi: 10.2196/67725. PMID: 40470547. Free full text.**

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ABSTRACT

BACKGROUND: Nonpharmaceutical interventions (NPIs) are effective tools for pandemic containment but often impose significant socioeconomic consequences that intensify over time. Public support and compliance to NPIs are crucial to ensure their effectiveness.

OBJECTIVES: This study aimed to elicit preferences of a Singaporean population for the reintroduction of NPIs in response to the emergence of a new SARS-CoV-2 variant during the COVID-19 endemic phase.

METHODS: A web-based discrete choice experiment (DCE) was conducted. DCE attributes reflected key NPIs implemented in Singapore during the COVID-19 pandemic from 2020 to 2022, including mask wearing, dining restrictions, suspension of vocalisation activities and large-scale events, quarantine after international travel, and mandatory vaccine boosters. Participants were recruited from a demographically representative online panel. Statistical analysis was performed using a mixed-logit model and mixed-mixed multinomial logit model.

RESULTS: A total of 1,552 participants were included in the analysis. Overall preferences from the mixed-logit model showed that mask wearing was valued, both in public and indoors. Dining restrictions allowing groups of up to five people were preferred, but stricter dining restrictions allowing up to two people or no dining out were not favoured. Prohibiting large-scale events was not preferred. Participants accepted quarantine at home but opposed quarantine in government facilities. Two classes emerged from the mixed-mixed logit model: class 1 ("Prefer NPIs") and class 2 ("Prefer No NPIs"). While class 1 (39%) was only opposed to a complete prohibition on dining in at food and beverage establishments, no NPIs were preferred by class 2 (61%). Both classes were not opposed to mandatory mask wearing, dining restrictions allowing groups of up to five people, and mandatory vaccine boosters. Sex, age, education, employment status, the number of COVID-19 vaccine shots received, and risk attitude were associated with individuals' likelihood of belonging to a specific preference group.

CONCLUSIONS: Following the emergence of a new SARS-CoV-2 variant after a prolonged period of restrictions, less disruptive NPIs such as mask wearing indoors were valued by the public and should be swiftly reinstated. Adaptive strategies should be adopted for more contentious NPIs, such as strict dining restrictions and quarantine policies. Public preferences should be considered in the design and selection of NPIs for future pandemic containment strategies to enhance compliance and effectiveness.

## READING 6 – ESTIMATION OF TRAJECTORY OF COVID-19 VACCINES EFFECTIVENESS AGAINST INFECTION

**Jiang J,[1] Yin G,1 Lam KF,[2] Lau EHY,[3] Lin Y,[3] Cowling BJ.[4] Estimation of trajectory of COVID-19 vaccines effectiveness against infection. Vaccine. 2025 May 10;55:127067. PMID: 40158307.**

**doi: 10.1016/j.vaccine.2025.127067. PMID: 40158307. Free full text.**

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ABSTRACT

This large-scale cohort study conducted in Hong Kong examined the time-varying protective effects of various COVID-19 vaccines and dosing regimens against the Omicron BA.1/BA.2 variants.

An innovative pharmacokinetic/pharmacodynamic model was employed to estimate the trajectory of vaccine effectiveness over time.

Results indicated that the maximum protection for a single dose reached 0.120 for CoronaVac and 0.171 for Comirnaty. The peak protective effectiveness for the second and third doses were observed at 0.348 and 0.522, respectively. In a 4-dose regimen, CoronaVac demonstrated a maximum protective effectiveness of 0.548, stabilising at 0.487, while Comirnaty achieved a maximum effectiveness of 0.784, stabilising at 0.714 six months after the administration of the last dose. The vaccine effectiveness exhibited a rising and then declining pattern, peaking approximately 1-2 months post-vaccination. Understanding waning immunity is crucial for optimising vaccination strategies and policies as viral evolution continues. This real-world study captured changing dynamics that may differ from clinical trials with limited follow-up, providing essential evidence to guide the optimisation of vaccination efforts. Ongoing monitoring of vaccine effectiveness remains critical as the viral landscape evolves.

OBJECTIVES: This study aims to investigate the time-varying protective effects of various COVID-19 vaccines and dosing regimens against infections caused by the Omicron BA.1/BA.2 in Hong Kong.

METHODS: This territory-wide cohort study from Hong Kong combined vaccination records, confirmed COVID-19 cases, and census data from January 2022 to May 2022 to comprehensively analyse the time-varying protective effects of different COVID-19 vaccines and dosing regimens against Omicron BA.1 and BA.2 infections. A 4-parameter pharmacokinetic/pharmacodynamic model was used to estimate the trajectory of vaccine effectiveness over time.

RESULTS: Among 6.2 million adults, the maximum protective effectiveness for a single vaccine dose reached 0.120 for CoronaVac and 0.171 for Comirnaty. For the second and third doses, peak effectiveness was observed at 0.348 for CoronaVac and 0.522 for Comirnaty. Notably, a 4-dose regimen resulted in maximum protections of 0.548 for CoronaVac and 0.785 for Comirnaty, which stabilised at 0.487 and 0.714, respectively, six months following the last doses. The vaccine effectiveness exhibited a rising then declining pattern, peaking around 1–2 months post-vaccination, underscoring the importance of ongoing vaccination strategies.

CONCLUSIONS: Understanding the waning of vaccine protection over time is critical for informing optimal vaccination strategies, booster schedules, and public health policies. This real-world study can capture changing dynamics that might differ from clinical trials, which have more limited follow-up periods, and can provide crucial evidence to guide optimisation of vaccination strategies. Ongoing monitoring of vaccine effectiveness remains crucial as the viral evolution continues.

## READING 7 – OMICRON SARS-COV-2 OUTCOMES IN VACCINATED INDIVIDUALS WITH HEART FAILURE AND ISCHAEMIC HEART DISEASE

**Wee LE,[1-3,#] Loy EX,[1,#] Tan KB,[1,2,4,13,14] Lye DCB,[1,4,6,12] Hausenloy DJ,[2,6,10,11] Yap J,[2,9] Yeo KK,[2,9] Lim JT,[4,#] Chia YW,[4-6] Chan MYY,[6,7] Lim SL.[6-8] Omicron SARS-CoV-2 outcomes in vaccinated individuals with heart failure and ischaemic heart disease. Ann Acad Med Singap. 2025 Apr 30;54(5):270-282. PMID: 40471109.**

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ABSTRACT

INTRODUCTION: Outcomes after SARS-CoV-2 Omicron infection in patients with heart failure (HF) and ischaemic heart disease (IHD) remain poorly defined.

METHOD: In a highly vaccinated cohort of adult Singapore citizens and permanent residents, we used Cox proportional hazards models (adjusted for sociodemographic variables and comorbidities) to compare the risks of Omicron infection, COVID-19-related hospitalisation, and severe COVID-19 between individuals with HF or IHD and matched controls without these conditions.

RESULTS: From national databases, we identified 15,426 HF patients matched 1:~3 to 41,221 controls, and 110,442 IHD patients matched 1:~2 to 223,843 controls. Over 80% of HF and IHD patients had received at least three vaccine doses. During the Omicron-predominant period, both HF and IHD cohorts demonstrated higher adjusted risks of COVID-19 hospitalisation compared with matched controls (HF: adjusted hazard ratio [aHR] 1.77, 95% confidence interval [CI] 1.65–1.90; IHD: aHR 1.21, 95% CI 1.17–1.26). Among those with at least 1 HF-or IHD-related admission in the prior year, hospitalisation risk was further elevated (HF: aHR 1.27, 95% CI 1.13–1.42; IHD: aHR 1.11, 95% CI 1.01–1.23). Receipt of ≥3 vaccine doses was associated with substantially lower risk of severe COVID-19 versus only 2 doses (HF: aHR 0.35, 95% CI 0.28–0.43; IHD: aHR 0.27, 95% CI 0.23–0.32). A fourth dose conferred additional reductions in infection and adverse outcomes, though CIs for infection overlapped with those for three doses.

CONCLUSION: During Omicron predominance, HF and IHD patients experienced greater risk of COVID-19 hospitalisation and severe COVID-19 versus matched controls. Booster vaccinations attenuated these risks. Individuals with recent HF/IHD admissions should be prioritised for receipt of booster vaccine doses.

## READING 8 – DISCRIMINATION OF A SINGLE-ITEM SCALE TO MEASURE INTENTION TO HAVE A COVID-19 VACCINE

**Sim J,[1] Smith LE,[2] Amlôt R,[2,3] Rubin GJ,[3,4] Sevdalis N,[5] Sherman SM.[6] Discrimination of a single-item scale to measure intention to have a COVID-19 vaccine. PLoS One. 2025 May 5;20(5):e0322503. PMID: 40323983.**

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ABSTRACT

AIM: When developing public health measures in a pandemic, it is important to examine attitudes and beliefs relating to vaccination uptake. We report the discrimination of a single-item vaccination intention scale and derive cutpoints in terms of sensitivity (true positives) and specificity (true negatives) in relation to subsequent vaccination status.

SUBJECT AND METHODS: In a sample of UK adults (n=1,119) recruited through an online survey platform, vaccination intention was measured on a 0–10 numerical rating scale (0=very unlikely, 10=very likely) at the beginning of the UK COVID-19 vaccination rollout (January 2021), and self-reported vaccination status was gathered after vaccination had been offered to all adults (October 2021). Discrimination of the scale was measured by the area under the receiver operating characteristic (ROC) curve.

RESULTS: The responders reporting being vaccinated or unvaccinated were 1,034 (92.4%) and 85 (7.6%), respectively. The area under the ROC curve was 0.956 (95% CI.943, 0.967), indicating a high degree of discrimination. The combined value of sensitivity and specificity was greatest at a cutpoint of 8 on the scale (sensitivity=0.821, specificity=0.988). If, however, the individual values of sensitivity and specificity are required to be simultaneously optimised, this occurs at point 6 (sensitivity=0.886, specificity=0.871).

CONCLUSION: We recommend a 0–10 intention scale as a validated, practical measure of vaccination intention in public health practice, with a cutpoint of 8 on the scale as optimal, unless sensitivity and specificity are to be simultaneously optimised, when 6 is the optimal cutpoint.

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## READING 9 – COMPARATIVE ANALYSIS OF THE ROLE OF HEALTHCARE BELIEFS ON CHILDHOOD VACCINATION UPTAKE AMONG PARENTS IN MALAYSIA AND SINGAPORE DURING THE COVID-19 PANDEMIC

**Jiang J,[1] Yin G,1 Lam KF,[2] Lau EHY,[3] Lin Y,[3] Cowling BJ.[4] Estimation of trajectory of COVID-19 vaccines effectiveness against infection. Vaccine. 2025 May 10;55:127067. PMID: 40158307.**

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ABSTRACT

INTRODUCTION: The rollout of successful vaccination programmes during the COVID-19 pandemic has been impeded worldwide by high rates of vaccine hesitancy. We investigated vaccine hesitancy rates in Malaysia and Singapore, and explored whether these rates were associated with parents' health beliefs.

METHODS: A total of 226 Malaysian parents (MPs) and 635 Singaporean parents (SPs) participated in an online voluntary survey between November 2021 and August 2022.

RESULTS: MPs were younger and had more children compared to SPs. SPs were more likely to have received the COVID-19 vaccine than MPs, and less likely to delay vaccinations for their children. SPs displayed greater trust in information about vaccines, their children's doctors, and healthcare authorities than MPs. Despite the similarities in ethnography and geographic proximity, the prevalence of perceived parental vaccine hesitancy was higher in Malaysia than in Singapore; this was associated with differences in healthcare beliefs.

CONCLUSION: Beyond educational campaigns, strengthening community-based healthcare support, addressing misinformation, and fostering transparent communication from healthcare authorities may further enhance parental trust in vaccines.

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## READING 10 – IMMUNISATION HEALTH WORKFORCE CAPACITY BUILDING IN TWO SOUTHEAST ASIAN COUNTRIES (CAMBODIA AND LAO PDR)

**Saravanos G,[1,2] Chanlivong N,[1,3] Leask J,[1,3] Teo AKJ,[1,3,4] Jenkins K,[3,7] Sheel M,[3,7,15] Yam ELY,[4,5] Yi S,[4,6] Chou SC,[6] Chanthorn P,[6] Thy C,[6] Sayavong S,[7] Kirk M,[7] Gray D,[7] Danchin M,[8] Morgan C,[9-11] Macartney K,[12] Coghlan B,[13] Apostol M,[13] Arora D,[13] Smart T.[14] Immunisation health workforce capacity building in Southeast Asia: reflections from training programme implementation in Cambodia and Lao PDR. BMJ Glob Health. 2025 Feb 19;10(2):e018007. PMID: 39971585.**

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ABSTRACT

The Immunisation Agenda 2030 emphasises the need for a motivated, skilled, and knowledgeable workforce equipped to plan, manage, implement, and monitor immunisation programmes at all levels. The rapid introduction of COVID-19 vaccines during the pandemic highlighted the adaptability of the health workforce but also exposed gaps in professional development and learning. This practice paper describes the implementation of an immunisation training programme in the Kingdom of Cambodia and the Lao People's Democratic Republic. The programme was developed and delivered by the project team in partnership with local stakeholders and technical experts.

A country-centric approach ensured that training programmes met each country's needs, while input from technical experts ensured an evidence-based programme that aligned with international standards.

There were 445 training participants from professional groups across various levels and sectors of the health system. Training curricula included a range of differentiated training modules that aimed to build knowledge and skills to drive increased vaccine demand, improve service delivery, and optimise monitoring and evaluation of programmes. The Gavi Learning and Performance Management framework supported a structured reflection of programme strengths, limitations, and opportunities. Strengths were the country-centric and learner-centric approach and the high technical quality of the programme.

The pandemic context necessitated agility and adaptation to meet changing country needs and priorities; however, this introduced some limitations. Future training programmes should undertake an enhanced assessment of training needs, workforce, and digital capabilities, and learning and performance management systems, alongside the development of country-driven immunisation workforce training roadmaps to ensure optimal impact and sustainability.

## Case Article

- Reactive Thrombocytosis in a Patient Undergoing Treatment for Vitamin B12 Deficiency

# REACTIVE THROMBOCYTOSIS IN A PATIENT UNDERGOING TREATMENT FOR VITAMIN B12 DEFICIENCY

Dr Shao Wen Tang Wymann, Dr Fang Yu Pang, Dr Farhad Fakhrudin Vasanwala

## ABSTRACT

**This case reports describes the presentation and management of a middle-aged patient with significant and chronic nutritional deficiencies (Vitamin B12) contributed to by a history of schizoaffective disorder. The patient presents acutely with altered mental state secondary to sepsis and severe anaemia. Upon acute stabilisation and completion of replacement therapy, subsequent laboratory monitoring demonstrated significant levels of thrombocytosis requiring an urgent transfer back to the acute hospital for further evaluation and management. This case demonstrates the phenomena of reactive thrombocytosis post-Vitamin B12 replacement in the context of severe malnutrition and B12 deficiency.**

**Key words: Reactive thrombocytosis; Vitamin B12 deficiency; hypokalaemia; anaemia; Schizoaffective disorder**

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## CASE PRESENTATION AND MANAGEMENT OF CASE

Mr G, a 40-year-old Chinese male, was initially admitted to an acute hospital after being found unconscious with a GCS of 5 (E1V2M2), requiring intubation and admission to the intensive care unit (ICU). History taken by the paramedics from the family revealed that the patient had been anorexic and had not been eating for the two days prior. On examination, the patient was jaundiced, cachectic with a BMI of 12, and in a poor general condition. Pressure sores were noted over his left hip, while hematomas were also noted over his left temporal region, and left thigh. Preliminary investigations showed severe pancytopenia—with haemoglobin (Hb) levels at 1.7g/dL (Reference range 13.6–16.6 g/dL), and a platelet count of 36 x $10^9$/L (Reference range 150–360 x $10^9$/L). This was associated with low haptoglobin levels and raised unconjugated bilirubin suggestive of haemolytic anaemia. Peripheral blood film showed hypersegmented neutrophils while the Direct Coomb's test was negative. He was noted to have a severe vitamin B12 deficiency of 90 µmol/L (Reference range 145–569 µmol/L). A CT brain was done showing no signs of intracranial haemorrhage. The renal panel showed elevated creatinine levels suggestive of an acute kidney injury while the inflammatory markers, i.e., C-reactive protein (CRP) and ketone levels, were also noted to be raised. A chest X-ray concurrently showed signs suggestive of a right lower zone pneumonia. Mr G was given intravenous fluids and antibiotics for elevated creatinine levels and pneumonia respectively. For his malnutrition, he was started on a 1,800 kcal diet with 60 g of protein per day supplemented by oral Fresubin 2 cal/ml feeds.

Mr G had a past medical history of schizoaffective disorder with manic symptoms but had defaulted follow-ups and was not on treatment. He had also previously been worked-up for anaemia and thrombocytopenia six years ago attributed to poor oral intake with significantly low levels of vitamin B12 at 44 µmol/L (Reference range 145–569 µmol/L) and folate at 9.3 nmol/L (Reference range 8–40 nmol/L) resulting in ineffective erythropoiesis. Previous work-up for autoimmune, malignant, or congenital causes of bicytopenia were unremarkable (including G6PD enzyme levels, hepatitis serology, ANA, ENA, ANCA/anti-MPO/anti-PR3, anti-dsDNA, anti-intrinsic factor, and anti-parietal cell antibodies).

With regards to the patient's current presentation, his GCS drop was attributed to his severe anaemia as well as sepsis. The clinical impression for the underlying reason behind the patient's bicytopenia was a severe Vitamin B12 deficiency on a background of severe malnutrition. His malnourishment was in turn related to disorganised and anorexic behaviour from a relapse of his schizoaffective disorder. During resuscitation, he was given three pints of blood transfusion, and upon stabilisation of his condition, Mr G was started on a customised nutritional supplementation and feeding regime. He was also treated with subcutaneous mecobalamin and IV folate replacement, which brought about significant reticulocyte response. He received a regimen of regular intramuscular doses of cyanobalamin 1 mg weekly for three weeks followed by monthly injections and intravenous folinic acid 10 mg once daily for three days followed by a daily 5 mg dose of folic acid.

His Hb levels increased to 8.9 g/dL while his platelet levels increased to 323 x $10^3$ u/L. On stabilisation, the patient was transferred to a tertiary psychiatric hospital for further management of his schizoaffective disorder.

Blood tests repeated subsequently, however, demonstrated further increases in the patient's platelet levels, from 686 u/L and eventually up to 865 u/L over a course of three

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days. The patient was then placed on regular full blood count monitoring, with an early haematological referral arranged for his thrombocytosis. He was also reviewed regularly for thromboembolic complications such as any neurological deficits or cardiorespiratory symptoms. Later in the admission, the patient reported chest pain associated with up-trending troponin levels as well as ECG changes of tall T waves over the lateral leads.

The decision was made for the patient to be transferred back to the acute restructured hospital for further evaluation in view of concerns of thromboembolic risks and possible acute coronary syndrome. He was later referred for an urgent haematology consultation. As he was sent to another institution, the subsequent management of his clinical condition was not known due to restrictions in accessing patient data.

## DIAGNOSES/PROBLEMS IDENTIFIED

Vitamin B12 deficiency is a common condition associated with megaloblastic anaemia.[1] The effects of Vitamin B12 deficiency can be multiple and systemic. Haematological manifestations are related to bone marrow suppression and while reduced erythropoiesis commonly results in megaloblastic anaemia, pancytopenia may also occur affecting all cell lines. Neuropsychiatric manifestations may also occur, including symptoms of peripheral neuropathy, areflexia, diminished sense of proprioception, and spinal cord subacute combined degeneration (SACD).[2] While routine screening for Vitamin B12 levels are not recommended, screening may be appropriate for patients with significant risk factors.[2] Screening may be warranted in patients with one or more risk factors such as gastric or small intestine resections, inflammatory bowel disease, use of metformin for more than four months, use of proton pump inhibitors or histamine H2 blockers for more than 12 months, vegans or strict vegetarians, and adults older than 75 years.[2] Besides addressing reversible causes of its deficiency, replacement of Vitamin B12 can be achieved via oral supplementation or intramuscular injections in cases of severe deficiency or neurological symptoms.[3] Monitoring of response rate to therapy may include monitoring of reticulocyte response, haemoglobin concentration, improvement of hyper segmented neutrophils, and decrease in serum methylmalonic acid.[4]

Vitamin B12 replacement in the context of thrombocytopenia may result in reactive thrombocytosis or secondary thrombocytosis, which is also otherwise commonly caused by infection, inflammatory conditions, haemolysis, iron deficiency, malignancies, and even exercise. Vitamin B12, being essential in DNA synthesis, is involved in hematopoietic processes. Replacement of Vitamin B12 in the context of severe deficiency might result in a rebound effect following marrow recovery and megakaryocyte production. Inflammation and the release of cytokines may also stimulate and potentiate this process.[5] The management of reactive thrombocytosis involves addressing its underlying cause. While usually benign, patients at high-risk of thromboembolic complications or with platelet counts exceeding 1,000,000/μL may require anti-thrombotic therapy. In cases of thrombosis, plateletpheresis may also be considered.[5]

## CLINICAL PRACTICE POINTERS

This case demonstrates the phenomena of reactive thrombocytosis post-Vitamin B12 replacement in the context of severe malnutrition and B12 deficiency. This emphasises the need for routine follow-up and full blood count monitoring even after blood counts show an improving trend following replacement therapy. It is also important to evaluate patients for thromboembolic complications and to be mindful of clinical circumstances in which an urgent haematological consult may be necessary. While Vitamin B12 deficiency may contribute to bicytopenia, it is prudent to consider differentials of malignancies or myeloproliferative disorders should there be any relevant clinical red flags that might be unmasked following replacement therapy. As haematopoiesis accelerates post-replacement therapy, iron supplementation may also be necessary especially for patients with relevant risk factors for iron deficiency. As potassium is also utilised in this process, subsequent regular monitoring of the patient's renal panel in the initial phase of potassium replacement may be warranted to treat the hypokalaemia.[6]

In this patient's presentation, there is also a significant overlay of how manifestation of the patient's psychiatric condition has influenced his medical condition, which emphasises the importance of comanaging psychiatric conditions with the community care physicians. The chronicity and severity of the patient's malnutrition bring to attention a probable significant duration of untreated disorganised behaviour. It bears emphasis for community medical and mental health practitioners to be vigilant with regards to early signs of relapses and unusual behaviour that might influence medical outcomes.

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Tables should be submitted on a separate page. Label them in Roman-numeric sequence [I, II, III, etc] and ensure they are clear and with explanatory legends as required. Give each column a short or abbreviated heading. Place Table explanations in the footnotes, not in the heading. Explain in footnotes all non-standard abbreviations that are used in each Table.

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Summarise your main findings and its clinical implication, preferably in a single paragraph and no more than 3-4 sentences. Link the conclusions with the goals of the study but avoid unqualified statements and conclusions not adequately supported by the data. In particular, distinguish between clinical and statistical significance, and avoid making statements on economic benefits and costs unless the manuscript includes the appropriate economic data and analyses. Avoid claiming priority or alluding to work that has not been completed. State new hypotheses when warranted, but label them clearly.

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Include a minimum of three (3) Learning Points as a take-home message for readers.

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The Case Records of Family Medicine is a newly created series to encourage submissions from Family Medicine teaching programmes and for Family Medicine departments to submit cases of learning value to the *Singapore Family Physician*. Cases discussed during peer review learning and Family Medicine grand ward round teachings are just some examples of submissions that are suitable for this

series. Authors planning to submit their case studies to the Case Records of Family Medicine section should structure their article according to these headings:

**Title**
The title should define the key focus of the case study.

**Case Presentation**
The author(s) will provide a pertinent summary of the medical and/or psychosocial issue pertaining to the health or disease management of the case. It should cover the situation and relevant background of the case. Author(s) should conceal the identity of the subject and/or related or accompanying personnel; abbreviation should be used instead, if necessary.

**Diagnoses/Problems identified**
The assessment of the diagnoses/problems identified will constitute a problem list and will serve as a focus for the management of the case. If the case was a diagnostic dilemma, the author(s) should showcase the diagnostic challenges and their work in narrowing to the correct diagnosis and/or differential diagnoses.

**Management of the case**
This section covers the approach to the management of the case by the author(s).

**Literature review on latest evidence/guidelines (related to diagnosis and/or management)**

The author(s) should provide a literature review of current evidence/guidelines, if any, of the basis of the case's diagnosis/management, or to highlight the gaps of knowledge if such evidence is lacking.

The author(s) will provide a concise summary of the lessons learnt from this case study.

**Clinical Practice pointers (up to three (3))**
The author(s) will suggest ways to apply the new knowledge in clinical practice or to highlight the limitations of its applications, if any.

**RECOMMENDED FORMAT FOR PRISM (Patients' Revelations as Insightful Studies of their Management) SECTION**

Authors planning to submit their case studies to the PRISM section should structure their article according to these headings:

**Title**
The title should be framed into a question to define the key focus of the case study.

**Patient's revelation: What happened?**
The author(s) will provide a concise description of the setting in which the subject raised his/her medical or psychosocial issue pertaining to their health or disease management. It should cover the background, encounter, and interaction of patient with the healthcare professional (doctor, nurse, or allied healthcare professional).

Author(s) should conceal the identity of the subject and/or related or accompanying personnel: abbreviation should be used instead, if necessary.

**Gaining insight: What are the issues?**
The issue(s) raised by the patient should be framed into question(s). The question(s) will constitute a problem list and will serve as a focus for the management of this subject.

**Study the management: How do we apply in our clinical practice?**
This section covers the approach to the management of the subject by the author(s). The author(s) should provide a literature review of current evidence, if any, of the basis of the subject's management, or to highlight the gaps of knowledge if such evidence is lacking. The author(s) will suggest ways to apply the new knowledge in clinical practice or to highlight the limitations of its applications, if any.

**Conclusion**
The author(s) will provide a concise summary of the lessons learnt from this case study.

The article submitted to the PRISM section should be written by no more than three authors. Each article should not exceed 2,000 words. Photographs or charts may be included but should conform to the specific instructions for any other articles submitted to *The Singapore Family Physician*.

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**References: 1.** WHO, 2024. Coadministration of seasonal inactivated influenza and COVID-19 vaccines. Available at: https://www.who.int/publications/i/item/WHO-2019-nCoV-vaccines-SAGE_recommendation-coadministration-influenza-vaccines. Accessed February 2025. **2.** Spikevax LP.8.1 PFS & MDV Product Details search: Go to https://eservice.hsa.gov.sg/prism/common/enquirepublic/SearchDRBProduct.do?action=getProductDetails and type "Spikevax" under "Product name". Click onsearch results "SIN16835P" to access MDV PI and click on "SIN17128P" to access PFS PI. Accessed September 2025. **3.** Ministry of Health Singapore. (2024, February 29). Changes To Covid-19 Vaccination Precautions And Recommendations. https://isomer-user-content.by.gov.sg/7/4b12a09e-8650-46a9-8639-7a3ab4bf7a63/moh-cir-12-2024-changes-to-covid-19-vaccination-precautions-and-recommendations.pdf **4.** Bonanni P, *et al. Hum Vaccin Immunother*. 2023 Dec 31;19(1):2195786. doi: 10.1080/21645515.2023.2195786. Epub 2023 Apr 11. PMID: 37039318; PMCID: PMC10142308. **5.** Hanage WP & Schaffner W. Infect Dis Ther 2025;14(Suppl 1):5–37; Earle K, Williams S. Pneumonia (Nathan) 2016:8:9. doi: 10.1186/s41479-016-0008-8. **6.** MacNeil A. ACIP meeting materials. Current Epidemiology of COVID-19, June 25, 2025. https://www.cdc.gov/acip/downloads/slides-2025-06-25-26/02-MacNeil-COVID-508.pdf

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**Pre-Filled Syringes: indicated for individuals aged 12 years and older. Multi-Dose Vials: indicated for individuals aged 6 months and older.

**References: 1.** Adapted from: Fujita Y, *et al. Cureus* 2024;16:e66373. **2.** Spikevax LP.8.1 PFS & MDV Product Details search: Go to https://eservice.hsa.gov.sg/prism/common/enquirepublic/SearchDRBProduct.do?action=getProductDetails and type "Spikevax" under "Product name". Click on search results "SIN16835P" to access MDV PI and click on "SIN17128P" to access PFS PI. Accessed September 2025. **3.** European Medicines Agency. Available at: https://www.ema.europa.eu/en/news/etf-recommends-updating-covid-19-vaccines-target-new-lp81-variant. Accessed September 2025. **4.** https://www.cnbc.com/2021/07/03/how-moderna-made-its-mrna-covid-vaccine-so-quickly-noubar-afeyan.html. Accessed September 2025. **5.** Ministry of Health (2025, April 29). COVID-19 National Vaccination Programme. https://www.moh.gov.sg/seeking-healthcare/overview-of-diseases/covid-19-national-vaccination-programme.

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