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Ageing with Vitality

Stop the Story
before it begins

"I NEVER IMAGINED THAT THERE'S MORE TO **SHINGLES** THAN **RASHES AND PAIN.**^"

Lionel L,
Diagnosed with shingles at age 56

Lionel suffered from shingles when he was 56 years old. The pain, he says, was "not something I have experienced before" and yet he never imagined that "there was more to shingles other than rashes and pain.^"

This is because he also discovered that, in rare cases, shingles can increase a heart attack risk by 59% and stroke by 35%[1*].

So if you're 50 years old and above, and have had chickenpox, you are at risk of getting shingles[2]. Learn how to protect yourself. Speak to your doctor about shingles prevention.

Find out more about Lionel's story here.

THE PAIN[3] ONLY TELLS HALF THE STORY.

LEARN MORE AT **WWW.STOPSHINGLES.COM**

^ All statements are based on patient's testimony. [1] Kim MC;Journal of the American College of Cardiology;2017;20;295-296. * Studies have shown that shingles may increase the risk of heart attack by 59% (n = 46,426, Myocardial Infarction HR 1.59 (95% CI:1.27 – 2.01), p Value <0.001) and stroke by 35% (n = 46,426, stroke HR 1.35 (95% CI: 1.18-1.54) , p Value <0.001).
[2] World Health Organization. (2025, March 24). Shingles (herpes zoster). WHO. [3] CDC;2024;1-4; Shingles Symptoms and Complications.

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Ageing with Vitality

Dr Chiang Shu Hui Grace

SFP2025; 51(4)

Singapore is a rapidly ageing society. Statistics from the National Population and Talent Division, Strategy Group Prime Minister's Office revealed that the proportion of Singaporeans aged 20-64 years has decreased from 64.8 percent in 2014 to 60.4 percent in 2024. Conversely, the proportion of older adults (aged 65 and above) has increased from 12.4 percent in 2014 to 19.9 percent in 2024. It is estimated that, by 2030, 24.1 percent of Singaporeans will be aged 65 and above.[1]

The risk and impact of respiratory syncytial virus (RSV) and herpes zoster increases with age; this is associated with declining immune function.[2] The incidence of herpes zoster increases sharply after 50 years old: it is estimated to be between 8.45 for those aged 50-59, and 10.46 for those greater than 60 years of age.[3] Herpes zoster complications include postherpetic neuralgia – which increases with age – stroke, facial paralysis, and keratitis.[4] While herpes zoster is rarely lethal, it can cause significant morbidity and societal cost. In the United States, herpes zoster results in $2.6 billion in direct medical costs annually.[4] Similarly, RSV is a significant cause of morbidity and mortality amongst the elderly, infants, immunocompromised adults, and adults with chronic cardiopulmonary disease.[5] Globally, RSV causes an estimated 3.6 million RSV-associated hospitalisations and approximatively 100,000 RSV-attributable deaths annually in children aged five years and younger worldwide.[6] While the global estimates of RSV disease amongst adults is unknown, in the United States, RSV causes 160,000 hospitalisations and 10,000 deaths annually amongst adults 65 years and above.[7] Both herpes zoster and RSV pose a significant global health burden that is expected to increase as the population ages.

In Singapore, vaccinations against both RSV and herpes zoster are available. Herpes zoster vaccination has been found to be more than 90 percent effective in preventing shingles and postherpetic neuralgia across age groups, with protection lasting at least 7-10 years.[8] Likewise, a meta-analysis evaluating the efficacy of RSV vaccination showed that RSV vaccines could reduce the risk of RSV-related lower respiratory tract disease (LRTD) by 78.3 percent and RSV-related severe LRTD by 86.5 percent.[9] Since September 2025, the Ministry of Health, Singapore has extended subsidies and MediSave usage for the shingles vaccine, Shingrix, for eligible Singaporeans and Permanent Residents. Individuals aged 60 years and above and immunocompromised adults aged 18-59 years old are eligible for mean-tested subsidies of up to 75 percent.[10] However, there is currently no government subsidy for the RSV vaccine in Singapore.

Both RSV and herpes zoster are vaccine-preventable diseases and vaccination should be encouraged amongst eligible populations to reduce the burden of such diseases, especially given Singapore's ageing population.

This issue will provide an update for family physicians on RSV and herpes zoster.

In Unit 1, Dr Asok Kurup offers a concise overview of the threats of herpes zoster and RSV, and the importance of vaccination.

In Unit 2, Adj A/Prof See Kay Choong elaborates on why primary care providers should advocate for RSV vaccination.

In Unit 3, Dr Goh Tze Chien Kelvin discusses the impact of herpes zoster and role that vaccination can play in preventing the disease.

In this issue, A/Prof Goh Lee Gan has selected 10 current readings on topics related to RSV and herpes zoster. These readings include articles on burden of disease and importance of vaccination.

This issue also includes two original papers and one PRISM article. The first original paper by Drs Luo Yang, Joshua Lee, Adrian Tan, and Ms Jennifer Tan highlights the role and application of point-of-care ultrasound in community and home care settings. The second original paper by Ms Vernice Vee et al is a mixed-methods study looking at the challenges faced by primary care physicians in private practice on the backdrop of Healthier SG. Finally, the PRISM article by Dr Han Weiyao discusses a case of elderly patient with Alzheimer's disease and how family physicians can help transition patients to community care by re-evaluating the diagnosis and managing caregiver concerns.

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Distance Learning Course on "Ageing with Vitality"

- Unit 1: Bridging the Risk Gaps on the Viral Threats of Shingles and RSV
- Unit 2: Respiratory Syncytial Virus Vaccination in Adults: A Brief Update for Primary Care Providers
- Unit 3: Preventing Shingles: The Overlooked Burden of Herpes Zoster and Its Impact

Unit No. 1

BRIDGING THE RISK GAPS ON THE VIRAL THREATS OF SHINGLES AND RSV

Dr Asok Kurup

ABSTRACT

Singapore's rapidly ageing population faces a growing threat from vaccine-preventable diseases (VPDs) such as respiratory syncytial virus (RSV) and herpes zoster (HZ), and this is driven by age-related decline in immunity (ARDI) and high rates of chronic comorbidities. Despite the success of Singapore's childhood immunisation programmes, adult immunisation rate remains poor. Emerging evidence highlights the long-term health and economic consequences of VPDs in older adults, underscoring the urgent need for proactive prevention. Adjuvanted vaccines, including novel RSV and HZ vaccines, have shown potential in enhancing immune responses, mitigating the effects of ARDI, extending protection duration, and restoring cellular immunity in older adults to levels observed in younger populations. With the availability of such vaccines and potential future government subsidies, adult immunisation should be integrated into routine care. Effective patient counselling and a standardised vaccination checklist can help to improve uptake and reduce the burden of VPDs in Singapore's ageing society.

Keywords: RSV, Shingles, Age-related decline in immunity, Adjuvants, Older adults

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INTRODUCTION

Singapore is one of the most rapidly ageing societies in Asia. Today, almost 1 in 2 (42.8 percent) adults in Singapore are 50 years or older and this proportion is only projected to increase significantly by 2035.[1] An increased risk and presence of comorbidities accompany advancing ages. In addition to this, a direct association between ageing and increased susceptibility to viruses has been established, and this has been in part, attributed to age-related decline in immunity (ARDI), resulting in reduced quality and quantity of immune cells.[2] This progressive decline in immune function increases the susceptibility to infections such as respiratory syncytial virus (RSV) and increases the risk of more severe complications of RSV, as has been observed for influenza and other non-respiratory infections such as herpes zoster (HZ).[2,3] To combat ARDI, adjuvant technology can be used in combination with a vaccine antigen to elicit a more robust immune response than with the antigen alone, leading to longer-lasting immunity.[4]

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There is a growing body of evidence demonstrating the long-term consequences of RSV and HZ infections. Severe outcomes such as increased risk of cardiovascular events, long-term morbidity, hospitalisation, and mortality beyond acute infection have been observed across multiple studies.[5-8] These infections, alongside influenza, pneumococcal, and COVID-19, contribute to a significant and growing burden among older adults. In view of our ageing population, there is a significant proportion of Singaporeans vulnerable to vaccine-preventable diseases (VPD). Adult immunisation must therefore be incorporated into our everyday counselling of patients to encompass holistic care for our older adults. Despite the success of childhood immunisation schemes, adult immunisation programmes in Singapore remain underutilised, which is important to address in order to ensure comprehensive public health protection across all age groups.

WHO IS AT RISK OF VPD

Beyond age, VPDs disproportionately affect adults with underlying chronic medical conditions.[9] There is a vicious cycle at play here, whereby the presence of comorbidities/ risk factors augment the risk of contracting VPDs and vice versa, with VPDs potentially exacerbating underlying medical conditions beyond acute infection.[10-14] The following risk factors or conditions outlined by the Centres for Disease Control and Prevention (CDC) define some of the population at higher risk of severe VPD outcomes (Note: list may not be exhaustive)[15-17]:

1. Older adults

Chronic cardiovascular disease, chronic lung or respiratory disease, diabetes mellitus, severe obesity, end stage renal disease/dialysis dependence, chronic haematologic conditions, chronic liver disease, neurological or neuromuscular conditions, residence in a nursing home, moderate or severe immunocompromise, HIV, and other chronic medical conditions on risk factors that a provider determines would increase risk of severe disease due to viral infections (e.g., frailty)

2. Immunocompromised individuals

3. Socioeconomic disadvantage groups

THE SILENT THREAT OF RSV

A recent publication by Wee et al (2025) reported for the first time the severity of RSV infection and its associated factors amongst hospitalised adults from 2021 to 2023

in Singapore, compared to influenza and COVID-19.[5] Data from this study indicated that factors such as older age, immunocompromised status, and/or presence of comorbidities were independently associated with RSV disease severity.[5] 28-day mortality was five times higher and intensive care unit (ICU) admission was two times higher than patients hospitalised for RSV compared to adults hospitalised for influenza.[5]

Beyond the short-term impact of RSV observed in hospitalised older adults, it has been shown that approximately one-third of RSV patients experienced a decline in functional status at six months post-discharge, losing their previous independence before infection.[18] Another study showed that up to 24.5 percent of RSV patients required professional home care and up to 26.6 percent required re-admission within three months post-discharge.[19] A cumulative mortality rate of 25.8 percent has also been observed within one year of admission for RSV.[20]

Comorbidities such as diabetes, chronic pulmonary disease, and cardiac conditions are common in older adults,[21] and the combination of older age and certain underlying comorbidities may increase the risk of severe outcomes of infection.[3,7,22] Wee et al (2025) reported that adults with diabetes mellitus had greater odds of 28-day mortality in RSV hospitalisations.[5] Separately, it has also been demonstrated that one in 10 patients hospitalised for RSV had a concurrent cardiovascular event. In particular, individuals with preexisting cardiac conditions had higher odds of a concurrent acute cardiac event during RSV hospitalisation.[6] The odds of cardiac events were also significantly higher in RSV compared to COVID-19 hospitalisations.[6] Similar to influenza, RSV infection has also been shown to lead to cardiac complications such as heart failure, arrhythmia, and acute coronary and cerebrovascular events.[19,23-25]

There are currently no specific treatments for RSV in adults.[26] However, since May 2023, vaccines have become available to protect adults from the outcomes of RSV infection.[27-29] An adjuvanted vaccine, Arexvy, has been developed to overcome ARDI by augmenting the older adult's immune response to RSV vaccination.[27] The RSV AS01-adjuvanted versus non-adjuvanted RSV fusion protein (RSVPreF3) vaccine formulations has shown to induce broader neutralising antibody responses against diverse RSV strains in preclinical models and clinical studies, indicating the potential for broader protection against circulating and future RSV strains.[30] In addition, AS01-adjuvanted recombinant subunit prefusion RSVPreF3 antigen formulations induced significantly higher levels of cellular immune response versus the nonadjuvanted formulation and restored RSVPreF3 CD4+ T-cell levels in older adults to similar levels as found in young adults aged 18-40 years.[31] In view of the growing elderly Singaporean population and the availability of novel RSV vaccines, it is crucial that our older adults are protected from the short- and long-term consequences of RSV, along with other respiratory illnesses such as influenza and COVID-19.[5]

THE SILENT THREAT OF HERPES ZOSTER: BEYOND THE RASH

Systematic reviews have reported that the lifetime risk of having HZ is approximately 1 in 3 in the general population, with the risk increasing sharply from the age of 50 years old.[32,33] With age-related decline in immunity and/or immunocompromising conditions, the decline in cellular immunity is also associated with an increased risk of HZ.[34]

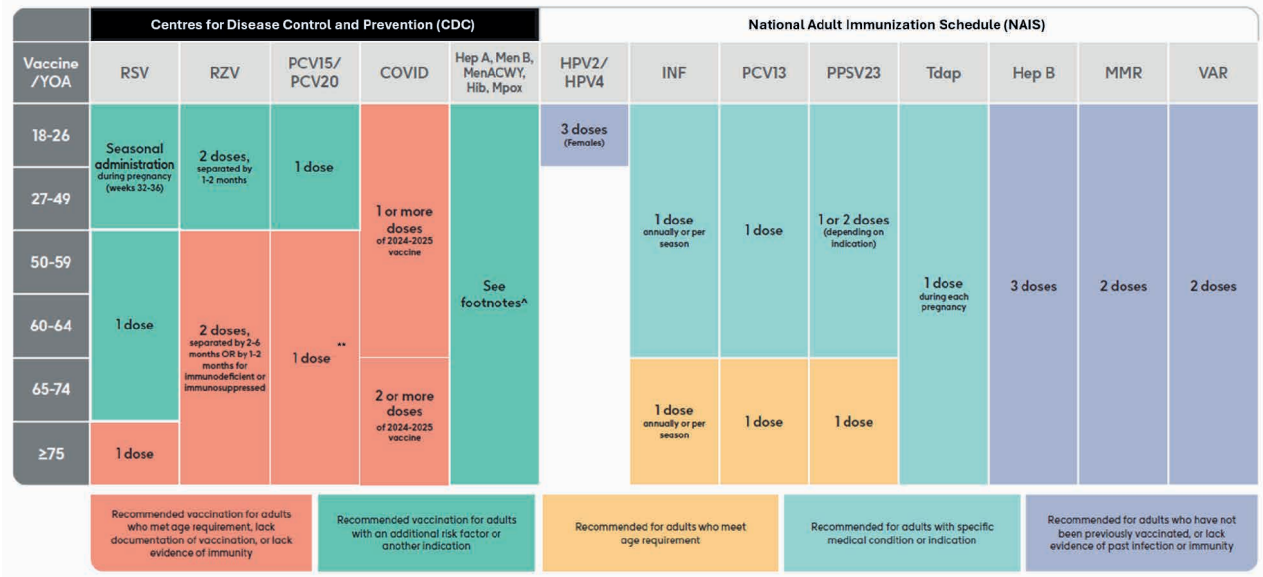
The risk of HZ and PHN is further augmented among patients with chronic medical conditions as outlined in above and ageing. With Singapore's high prevalence of chronic diseases such as diabetes, cardiovascular disease, and chronic kidney disease, a significant proportion of Singaporeans might suffer worsened disease outcomes if infected with HZ.[9,35-37] Studies have shown that patients with diabetes have a 27 percent increase in the risk of diabetes-related hospitalisation.[35] In those with cardiovascular diseases, there is a 19 percent increase in the risk of MI in the first year following HZ infection.[38] Beyond this, it has also been demonstrated that patients with chronic kidney disease have a 36 percent increase in risk of end-stage renal disease progression post shingles infection.[36]

Taking into consideration the risk of HZ among adults 50 years and above, all eligible Singaporeans should be offered vaccination. In Singapore, there is only one locally approved HZ vaccine, Shingrix, an adjuvanted recombinant zoster vaccine. Shingrix provides long-lasting protection with a two-dose regimen, maintaining high efficacy levels of 87.7 percent over 11 years. To date, no booster is required due to evidence demonstrating sustained vaccine efficacy up to 11 years post-vaccination.[39]

ADULT VACCINATION AS PART OF HOLISTIC CARE

In Singapore, the National Adult Immunisation Schedule (NAIS) offers a list of vaccines subsidised by the government, providing valuable support for adult immunisation. However, incorporating the latest recommendations from global health authorities such as the CDC can further enhance the programme. By considering international adult vaccination recommendations, we can ensure a more comprehensive approach to preventive care, particularly benefiting the elderly, individuals with chronic conditions, and those with immunocompromised states. This holistic approach supports the well-being of at-risk groups and strengthens overall public health. **Figure 1** combines the latest adult vaccination recommendations from CDC and the NAIS.

Figure 1. Adult vaccination recommendations from CDC and NAIS*†[40-45]



*NAIS is for vaccines subsidised in Singapore only. RZV and PCV20 will be under NAIS effective 1 September 2025. GSK RSVPreF3 OA is indicated for active immunisation for the prevention of LRTD caused by RSV in adults 50 through 59 YOA who are at increased risk for RSV disease. These vaccines are not repeated in the CDC-recommended vaccines section of the table. The CDC-recommended vaccines include vaccines not recommended by NAIS. CDC recommendation as of 16 April 2025.

†For a more comprehensive list of vaccine and dosing schedule, special situations, contraindications and precautions, etc., please refer to CDC schedule and Society of Infectious Diseases (Singapore) handbook.

**Based on shared clinical decision-making, adults ≥65 YOA have the option to get PCV20 if they have received both PCV13 (but not PCV15 or PCV20) at any age and PPSV23 at or ≥65 YOA.

^Hep A: 2, 3, or 4 doses depending on vaccine; MenACWY: 1 or 2 doses depending on indication; MenB: 2 or 3 doses depending on vaccine and indication; Hib: 1 vaccines or 3 doses depending on indication. Please refer to CDC schedule for detailed information.

Hep B = hepatitis B
Hib = Haemophilus Influenzae type B
HPV = human papillomavirus
Mpox = monkeypox
INF = influenza
MenACWY = meningococcal ACWY
MenB = Meningococcal B
MMR = Measles-Mumps-Rubella
PCV = pneumococcal conjugate vaccine
PPSV = pneumococcal polysaccharide vaccine
RSV = respiratory syncytial virus
RZV = recombinant zoster virus
Tdap = Tetanus-Diphtheria-Pertussis
VAR = varicella
YOA = years of age

Beyond CDC and NAIS, professional medical societies such as the American Diabetes Association, American College of Rheumatology, Global Initiative for Asthma, and Global Initiative for Chronic Obstructive Lung Disease have also recommended several vaccinations for patients with certain underlying conditions. The consistent recommendation for adult vaccination across societies reinforces the importance of embedding vaccination as standard of care for all patients aged 50 years and older.

To help promote vaccination counselling as part of daily practice, a vaccination checklist may be useful as a quick reference tool to assist in identifying immunisations that might be due or missing during routine consultations (refer to **Table I**). Especially for high-risk adults, this checklist promotes a proactive, regular approach to the monitoring of immunisation status. Additionally, if widely implemented, it minimises lost opportunities by standardising care across the different specialties and clinics (such as general care, pharmacies, and hospitals).

This checklist will not only support healthcare providers but also empower patients to take charge of their preventive health by serving as a personal health record. Incorporating it into yearly health evaluations or reviews of chronic illnesses can potentially improve the nation's vaccination rates, reduce the local burden of VPDs, and facilitate effective communication between patients and healthcare professionals. Immunisation rates may be further augmented by considering co-administration of vaccines to ensure that at-risk populations are protected in a timely manner.

Table I: Routine vaccine checklist for adults

Vaccine	NAIS/CHAS Coverage/ Subsidised	Recommended Age Group/ Dose	Completed?	Uptodate
Influenza	≥65 years ≥18 years with specific medical condition or indication	All Adult Age Group – Yearly or per season Seasonal availability	☐	
Pneumococcal*	≥65 years ≥18 years with specific medical condition or indication	≥50 years ≥18 years with specific medical condition or indication	☐	
COVID-19	All Adult Age Group	All Adult Age Group – Yearly or per season Seasonal availability	☐	
Herpes Zoster*	≥60 years Immunocompromised ≥18 years	≥50 years/2 doses (0, 2-6 m) Immunocompromised ≥18 years/2 doses (0, 1-2 m)	☐	
Respiratory Syncytial Virus (RSV)	N/A	≥75 years 50-74 years at increased risk	☐	
Tetanus, reduced diphtheria, and acellular pertussis (Tdap)	During each pregnancy	During each pregnancy/ 1 dose Every 10 years/1 booster dose	☐	

***Note:** Herpes Zoster Vaccine and Pneumococcal 20-valent conjugate vaccine will be subsidised by the Singapore government from 1 September 2025.

In addition to evidence-based guidelines, patient counselling plays a critical practical role in promoting vaccine uptake; **Table II** provides strategies that may help facilitate conversations with vaccine-hesitant individuals based on barriers commonly faced by local physicians.

Table II: Proposed strategies to navigate conversations with patients

Barrier	Patient Perception	Assessment	Proposed Strategies
Pain/Fear of Injection/ Needle Phobia/Anxiety	"Injections are painful." "I'm scared of needles."	Gauge if fear is psychological or from past negative experience.	Reassure patients that vaccine needles are small, and vaccination is quick. Offer vaccinations in a calming environment.
Perceived Inconvenience	"I don't have time."	Understand the patient's daily schedule, mobility, work hours, and ability to access clinics.	Offer co-administration with other vaccines or during existing appointments. Provide reminders (SMS, WhatsApp). Reinforce benefits of prevention vs time lost to illness.
Cost Concerns	"It's too expensive."	Explore financial status and awareness of subsidy schemes.	Educate about vaccine subsidy options, MediSave usage, and long-term cost savings. Compare vaccine cost vs cost of hospitalisation for VPDs.

Lack of Knowledge	"I'm not sure if I need this."	Check literacy level, awareness of VPDs and prior health education.	Provide simple visuals or infographics. Use analogies (e.g., vaccines as insurance). Schedule time for Q&A. Engage family caregivers.
Low Perceived Risk	"I'm healthy."	Assess understanding of adult immunity and risk factors (e.g., age, comorbidities).	Share statistics about adult disease burden. Personalise with case examples of patients affected. Highlight ARDI and risk factors that are applicable to them.
Misinformation	"Vaccines cause disease."	Ask about sources of belief (e.g., online forums, friends/ family).	Provide evidence-based information. Reassure using safety data available. Debunk misinformation respectfully. Direct to credible resources (CDC, WHO, MOH).
Fear of Side Effects	"I'll get sick from the vaccine."	Assess knowledge of side effects.	Explain that normal vaccine response (pain, fatigue, etc.) and side effects are mild and transient. Reassure about close monitoring and adverse event reporting systems.
Belief that Vaccines Are Only for Kids	"Vaccines are for children only, not adults."	Assess knowledge of adult vaccine recommendations.	Educate on ARDI. Explain risk factors like ageing, chronic disease, and lifestyle.

CONCLUSION

Given the rising prevalence and consequences of RSV and HZ in older adults, it is imperative that all healthcare professionals play an active role in protecting our population against VPDs. Redefining preventive care is of utmost importance, especially with the recent availability of novel vaccines such as pneumococcal 20-valent conjugate vaccine, adjuvanted recombinant zoster vaccine, and RSV vaccines. Together, we can replicate the success of our childhood immunisation programme for Singaporean adults.

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LEARNING POINTS

- **Adult immunisation should mirror the success of childhood immunisation programmes and integrated into daily practice.**
- **Older adults are at increased risk of vaccine-preventable diseases and associated long-term outcomes, but with advancements in vaccine technology, adjuvants can help to combat ARDI to elicit robust immune response similar to levels observed in younger adults.**
- **Co-administration strategies should be adopted as it will accelerate vaccine coverage.**
- **HCPs should continue to advocate for preventive health through vaccination, recognising that patient hesitancy is common, but consistent, evidence-based engagement can lead to increased acceptance over time.**

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Unit No. 2

RESPIRATORY SYNCYTIAL VIRUS VACCINATION IN ADULTS: A BRIEF UPDATE FOR PRIMARY CARE PROVIDERS

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ABSTRACT

Respiratory syncytial virus (RSV) is a highly transmissible pathogen that poses a significant risk to older adults and individuals with chronic medical conditions. Two RSV vaccines, Arexvy® and Abrysvo®, are currently approved in Singapore. They are recommended for adults aged 75 years and older, as well as adults aged 60 years and above who have underlying risk factors such as cardiovascular disease, chronic lung disease, chronic kidney disease, diabetes mellitus, immunosuppression, frailty, or residence in long-term care facilities. Arexvy® is also indicated for adults aged 50 to 59 years with similar risk profiles in Singapore. Clinical trials have demonstrated approximately 80 percent efficacy in preventing lower respiratory tract infections in the first year following vaccination. This protection gradually declines to 70 percent at two years and 60 percent at three years. Mild local and systemic side effects are common, while serious adverse events remain rare. Guillain-Barré syndrome has been reported infrequently, with no confirmed causal relationship to the vaccine. Primary care providers play a critical role in improving vaccine uptake by educating patients, addressing concerns, and offering vaccination during routine visits. Year-round vaccination and co-administration with other adult vaccines, such as those for influenza, shingles, and COVID-19, are effective strategies to enhance coverage and protect high-risk populations.

Keywords: Immunisation Programmes; Guillain-Barre Syndrome; Preventive Health Services; Primary Healthcare; Vaccines, Subunit

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INTRODUCTION

Respiratory syncytial virus (RSV) is a pathogenic, single-stranded RNA virus and a leading cause of severe lower respiratory tract infections, particularly in infants and older adults.[1] Recent studies employing mathematical modelling estimate the basic reproductive number (R_0) of RSV to be approximately 3.0, highlighting its high transmissibility.[2] An R_0 of three indicates that, on average, each infected individual can transmit the virus to three others in a fully susceptible population, enabling rapid spread in the absence of preventive measures such as vaccination or social distancing.

Natural immunity is short-lived, and re-infection can occur as soon as two months after a prior infection.[3] Treatment is primarily supportive, and specific antiviral therapies are lacking. To reduce the burden of disease, preventive strategies include general measures such as hand hygiene and limiting transmission, as well as targeted approaches like monoclonal antibodies and vaccination.

Monoclonal antibody therapy provides immunoprophylaxis; however, its use is currently restricted to infants. Vaccination is available for infants through maternal immunisation and transplacental antibody transfer (passive immunisation), and for adults through direct vaccination. However, direct vaccination in children is not yet available due to the formation of non-neutralising antibodies that paradoxically leads to enhanced respiratory disease, a known immunological complication.

Primary care providers play a vital role in preventive healthcare and are well-positioned to lead adult vaccination efforts. This brief update summarises the current literature and key guidelines on RSV vaccination in adults, with a focus on its relevance to primary care practice in Singapore. Specifically, it addresses the following areas: recommendations from major medical organisations, vaccine efficacy and effectiveness, potential side effects, and strategies to enhance vaccine uptake.

RESPIRATORY SYNCYTIAL VIRUS VACCINATION RECOMMENDATIONS FOR ADULTS

RSV vaccines target the pre-fusion conformation of the RSV F protein. Although there are two major antigenic subtypes, known as RSV-A and RSV-B, the differences in their pre-fusion F proteins are small. As a result, targeting the pre-fusion F protein of one subtype can provide cross-protection against the other. Two RSV vaccines are currently available in Singapore. Both vaccines are administered as a single 0.5 ml intramuscular dose following reconstitution:

1. Abrysvo® (Pfizer Pte Ltd.) – an unadjuvanted bivalent protein subunit vaccine targeting both RSV-A and RSV-B pre-fusion F proteins

2. Arexvy® (GSK Pte Ltd.) – an adjuvanted monovalent protein subunit vaccine targeting the RSV-A pre-fusion F protein

According to the US Centers for Disease Control and Prevention (CDC), both vaccines are recommended for the active immunisation of adults aged 75 years and older, as

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well as adults aged 60 years and older who are at increased risk of severe RSV disease,[4] in alignment with vaccine indications in Singapore. In addition, in Singapore, Arexvy® is also indicated for adults aged 50 to 59 years who are at increased risk of RSV disease.[5]

Risk factors for RSV disease include chronic medical conditions such as cardiovascular disease, chronic lung diseases (including chronic obstructive pulmonary disease and asthma), and chronic kidney disease. Immunocompromised individuals – such as those undergoing cancer treatment, living with the human immunodeficiency virus, or receiving immunosuppressive therapy (e.g., organ transplant recipients) – are also at increased risk. Additional risk factors include frailty (a complex clinical syndrome involving reduced physiological reserves and a lowered ability to cope with physical or psychological stressors)[6] and long-term residence in nursing homes. Condition-specific guidelines also support RSV vaccination, including the Global Initiative for Asthma (GINA 2025), the Global Initiative for Chronic Obstructive Lung Disease (GOLD 2025), and the American Diabetes Association (ADA 2023) reports.

All data presented in this brief update will be based on studies involving these two protein subunit vaccines. Although an mRNA-based vaccine targeting the RSV-A pre-fusion F protein (mResvia®, Moderna Inc.) is available in other countries (e.g., the United States and European Union), it is not currently available in Singapore.

RESPIRATORY SYNCYTIAL VIRUS VACCINATION FOR ADULTS: EFFICACY AND EFFECTIVENESS

The primary clinically meaningful outcomes of vaccination include the prevention of infection and the reduction of severe complications from breakthrough infections, such as respiratory failure, hospitalisation, intensive care admission, and death. Investigators in well-controlled randomised trials can measure the extent to which vaccines prevent these outcomes, yielding a percentage known as vaccine efficacy. However, the controlled conditions of such trials may not fully reflect real-world settings and might overestimate the vaccine's protective effect. Therefore, it is also important to evaluate vaccine performance in certain open-label randomised trials or real-world observational studies, which provide a measure known as vaccine effectiveness. When efficacy and effectiveness are similar, clinicians and patients can be more confident that the benefits observed in controlled trials are applicable to routine clinical practice.

Clinical trials have demonstrated that RSV vaccination provides high efficacy – approximately 80 percent – in preventing lower respiratory tract infections within the first year after vaccination.[7] Real-world observational studies have reported similar levels of effectiveness in healthy older adults and in individuals with comorbid conditions, including chronic cardiovascular and respiratory diseases.[8,9] For comparison, the annual influenza vaccine showed an effectiveness of 30-60 percent.[10]

In immunocompromised individuals, vaccine effectiveness is expected to be lower, especially in those with severe immunosuppression.[9,11] Although clinical outcome data are not yet available for severely immunocompromised populations, such as organ transplant recipients receiving immunosuppressive therapy, immunogenicity studies suggest that vaccines containing adjuvants might produce higher antibody levels compared to unadjuvanted formulations.[12] It is still unknown whether alternative dosing strategies, such as multiple priming doses, could further enhance the immune response in these patients.

Long-term data on the adjuvanted RSV vaccine in older adults indicate that it maintains efficacy against severe lower respiratory tract disease for up to three years. However, cumulative protection wanes over time, declining to approximately 70 percent at two years[13] and 60 percent at three years.[14] Current evidence suggests that re-vaccination within this three-year period does not enhance efficacy, and the optimal timing for booster doses remains uncertain. Additionally, long-term data for the unadjuvanted RSV vaccine suggest a comparable level of protection over a two-year period,[15] although further evidence is needed to confirm its durability beyond that time period.

RESPIRATORY SYNCYTIAL VIRUS VACCINATION FOR ADULTS: SIDE EFFECTS

The benefits of RSV vaccination outweigh its known risks. Mild local adverse effects are common, with up to 60 percent of vaccine recipients experiencing pain at the injection site. Mild systemic side effects – such as fatigue, headache, and myalgia – occur in up to 30 percent of individuals.[16] Fortunately, severe adverse events remain exceedingly rare.

Neuroinflammatory disorders, primarily Guillain-Barré syndrome, have been reported within 42 days of RSV vaccination, occurring at a rate of fewer than 10 cases per million doses administered.[17] In comparison, the incidence associated with the influenza vaccine is approximately one case per million doses. While a causal link to RSV vaccination has not been definitively established, the US CDC has updated the prescribing information for Abrysvo® and Arexvy® to include a warning about a potential increased risk of Guillain-Barré syndrome within this time frame. This potential risk should be weighed alongside the risk of Guillain-Barré syndrome following RSV infection itself.[18]

STRATEGIES TO IMPROVE VACCINE UPTAKE

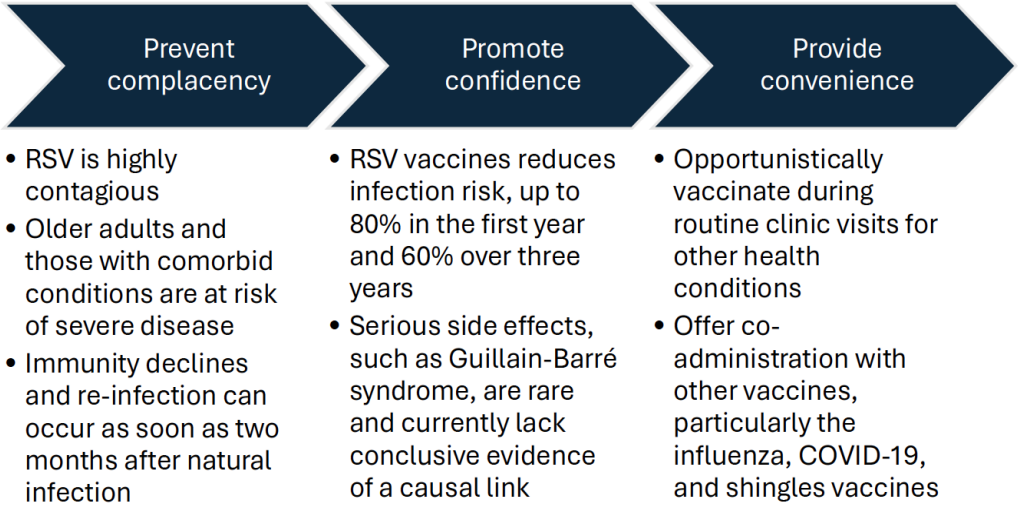
To improve vaccine uptake, the World Health Organisation's Strategic Advisory Group of Experts on Immunisation (SAGE) recommends focusing on three key domains: complacency, confidence, and convenience, commonly referred to as the 3C model (refer to **Figure 1**).[19]

To address complacency, primary care providers should inform individuals about their risk of severe RSV infection.

This includes not only acute complications such as respiratory failure and acute heart failure, but also long-term outcomes like functional decline and loss of independence. To build confidence in vaccination, providers should engage in open and balanced conversations about the benefits and potential risks. As for COVID-19 vaccination, these discussions can be supported by various patient decision aids, including printed materials or digital tools such as web-based applications and mobile chatbots.[20]

Primary care providers can enhance convenience by offering RSV vaccination during routine healthcare visits and by co-administering it with other recommended vaccines. Although RSV infections display seasonal patterns worldwide, these patterns vary considerably within and between regions, making it difficult to predict peak periods accurately.[21] As a result, in Singapore, primary care providers can administer RSV vaccination year-round to individuals who meet the eligibility criteria. Co-administration with other vaccines, such as those for influenza,[22] shingles (ClinicalTrials.gov ID NCT05966090), and COVID-19,[23] has been shown to be safe and effective. To minimise local side effects when multiple vaccines are given at the same visit, each vaccine should be administered at a different anatomical site (e.g., deltoid region of the upper right and left arms).

Figure 1. A stepwise approach to adult respiratory syncytial virus (RSV) vaccination for primary care providers



CONCLUSION

RSV is a common yet potentially severe respiratory pathogen in older adults and those with comorbidities. The availability of two effective vaccines, Abrysvo® and Arexvy®, offers a promising opportunity to reduce the burden of disease in these populations. Clinical and real-world evidence supports their use, demonstrating robust protection against lower respiratory tract infections and favourable safety profiles. Although rare, the potential for neuroinflammatory events such as Guillain-Barré syndrome necessitates continued surveillance and informed clinical decision-making.

Primary care providers are well-positioned to lead adult RSV vaccination efforts. By addressing patient complacency, building confidence in vaccine safety and efficacy, and enhancing access and convenience, they can play a pivotal role in improving vaccine uptake. Routine health visits provide valuable opportunities for patient education, risk assessment, and co-administration with other vaccines. As RSV vaccination becomes integrated into adult immunisation programmes, ongoing research and real-world data will be essential in refining booster strategies and optimising long-term protection.

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LEARNING POINTS

- **RSV is a significant cause of severe respiratory illness in older adults and high-risk populations, with an estimated basic reproductive number (R_0) of three, indicating high transmissibility.**
- **Two protein-based RSV vaccines, Arexvy® and Abrysvo®, are approved for adults aged 60 years and above in Singapore, with Arexvy® also indicated for at-risk individuals aged 50-59 years.**
- **Vaccine efficacy is high in the first year (around 80 percent) and remains moderately protective for up to three years, although booster schedules and longterm durability are still being studied.**
- **Mild local and systemic side effects are common, while serious adverse events like Guillain-Barré syndrome are rare and not causally established, prompting precautionary labelling rather than strict warnings.**
- **Primary care providers are essential in improving RSV vaccine uptake by educating patients, addressing vaccine hesitancy, and integrating RSV vaccination into routine care, including co-administration with other adult vaccines.**

Unit No. 3

PREVENTING SHINGLES: THE OVERLOOKED BURDEN OF HERPES ZOSTER AND ITS IMPACT

Dr Goh Tze Chien Kelvin

ABSTRACT

Herpes zoster is a viral infection that occurs as a result of reactivation of the dormant varicella zoster virus. Herpes zoster carries a high healthcare burden, especially in older adults aged 50 years and older and those who are immunocompromised due to underlying medical conditions or immunosuppressive therapy. Without vaccination, an approximate 27.0 percent, 4.5 percent, and 3.6 percent of adults aged 50 years and older in Singapore could develop herpes zoster, post-herpetic neuralgia (PHN), and other complications, respectively. Well known complications of herpes zoster are the painful, blistering rash and PHN; however, the lesser-known effect of herpes zoster is its association with cardiovascular implications, including stroke and myocardial infarction. Herpes zoster is a vaccine-preventable disease. Recombinant Varicella Zoster Vaccine is an effective vaccine.

Key words: Herpes Zoster, Shingles, Comorbidities, Complications

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INTRODUCTION

Herpes zoster (HZ), more widely known as shingles, is caused by the reactivation of the dormant varicella-zoster virus (VZV) in cranial nerve ganglia and dorsal root ganglia along the entire neuroaxis.[1] HZ mainly affects older adults aged 50 years and above, people with comorbidities, people with autoimmune diseases, and people with immunocompromised conditions (IC).[2] It is estimated that approximately 27.0 percent, 4.5 percent, and 3.6 percent of adults aged 50 years and older in Singapore could develop herpes zoster, post-herpetic neuralgia, and other complications, respectively, without vaccination.[3] The National Centre for Infectious Diseases (NCID) estimates that 30,000 people develop shingles annually in Singapore.[4] Despite the prevalence of HZ, vaccine uptake remains poor in Singapore likely due to the high cost. HZ not only causes a painful vesicular rash; its complications can be severe and debilitating. In 2024, *The Straits Times* correspondent Salma Khalik described her shingles experience: "For almost two weeks, I endured excruciating pain that no medicine could alleviate."[5] The natural course of HZ after the acute infection may follow with chronic complications such as post-herpetic neuralgia (PHN) and herpes zoster ophthalmicus (HZO), and cardiovascular events including stroke and myocardial infarction (MI).1,[6-9] The risk of developing post-HZ chronic complications is high with approximately 10 percent of patients aged 50 years and older having experienced at least one non-PHN complication.[10]

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BURDEN OF DISEASE

Epidemiology

The global incidence of HZ and PHN increases with age, showing an exponential rise from the age of 50 years. In Singapore, the incidence of HZ is expected to rise due to our rapidly ageing population. By 2030, 1 in 4 Singaporeans will be aged 65 years or older, up from 1 in 10 in 2010.[11] This increased susceptibility is greatly attributed to immunosenescence, the age-related decline in immunity.[12]

In Singapore, varicella (chickenpox) vaccine was introduced in 2020 under the National Children Immunisation Schedule (NAIS).[11] Studies have shown that the seroprevalence of varicella zoster among Singaporeans aged above 25 years old is high, at 88 percent between 1998 and 2010.[12] In parliament on 22 November 2023, MP Mr Muralli Pillai asked the Minister of Health for action regarding the fact that 90 percent of Singaporeans above 50 years of age are infected with the Varicella Zoster Virus and 1 in 3 would be expected to develop HZ in their lifetime.[15] Most of these would have been wild-type varicella strains rather than the OKA varicella strain from varicella vaccination.

Complications and Impact

HZ is sometimes regarded as a simple latent viral reactivation disease; however, most overlook its potential long-term implications. The most common complication is Post-Herpetic Neuralgia (PHN). The US CDC defines PHN as pain persisting for 90 days or more after the onset of the herpes zoster rash. This is a chronic neuropathic painful condition occurring in the same dermatomal distribution as the previous episode of herpes zoster. The pain is typically characterised by burning, stabbing, or electric shock-like pain, often accompanied by allodynia or hyper algesia. This can occur in as many as 30 percent of older people with HZ.[10] PHN has been demonstrated to persist up to years even after the rash has resolved, which can result in a poor quality of life, impacting social, psychological, physical, and functional aspects.[16]

Another common and severe complication is HZO (Herpes Zoster Ophthalmicus). HZO results from the reactivation of latent varicella-zoster virus residing in the trigeminal ganglion. Upon reactivation, the virus travels

along the ophthalmic branch, leading to development of a vesicular rash in the ophthalmic branch dermatome of the trigeminal nerve. HZO is associated with numerous complications, including keratitis, cornea scarring, uveitis, and glaucoma.[12,17] Not limited to PHN and HZO, less common complications of HZ include facial nerve palsy (Ramsey Hunt syndrome), VZV encephalitis, transverse myelitis, VZV retinitis, cerebral arteritis, and post-herpetic pruritus.[1,17,18]

Emerging evidence indicates a direct relationship between HZ and acute cardiovascular (CV) events such as MI and stroke.[7] Postulated mechanisms underlying this association include hypothesis of vasculitis, systemic inflammation, and autonomic dysfunction that are amplified by VZV reactivation.[19-22] VZV vasculitis may induce inflammation, thrombosis, and vascular remodelling, while autonomic dysfunction may worsen immunological status, sympathetic tone, and blood pressure. These combined effects can contribute to vasculopathy, potentially leading to stroke or MI.[19-21] The first week and month after an episode of HZ is when the relative risk of stroke and MI is highest, and this increased risk may persist for up to a year. The risk of stroke two weeks post-HZ is 1.80 times (1.42-2.29) and decreases to 1.27 times (1.15-1.40) at one year. The risk of MI/ACS within three months of HZ is 1.31 times (1.02-1.70) and decreases to 1.19 times (1.01-1.41) at one year (refer to **Figures I** and **II**).[7,23-28] Beyond CV complications, studies suggest that HZ may impact diabetes control,[29] accelerate chronic kidney disease (CKD) progression, and increase the risk of end stage renal disease.[30]

LINK TO IMMUNE AGEING, COMORBIDITIES, AND IMMUNOCOMPROMISED CONDITIONS

Immune Ageing and Immunosenescence

For young adults, VZV can maintain its latency as cell-mediated immunity (CMI) prevents the reactivation of VZV. However, a decline in CMI due to immunosenescence can lead to reactivation of latent VZV,[2,31] Due to this dependency on CMI, individuals with weakened immunity are more susceptible to developing HZ. Although HZ can also affect individuals at a younger age, this is less frequent and usually associated with less-severe disease.[32]

Effect on Chronic Disease and Immunosuppressive Therapy

In addition to immunoscenescence among older adults, there is an increased risk of HZ among people with comorbid chronic conditions such as respiratory, cardiovascular, metabolic, and autoimmune disease among others.[1,33-36] Beyond the effects of acute infection with HZ, long-term effects include the exacerbation of their underlying chronic conditions, disrupting otherwise stable management of their comorbidities.[29,30,37]

Many patients with rheumatoid arthritis, systemic lupus erythematosus, and other autoimmune diseases are frequently on oral prednisolone, anti-TNF monoclonal antibodies, Interleukin 6 inhibitors, and Janus Kinase Inhibitors. These populations have a higher incidence of HZ as well as an increased risk of complications.[38] In these populations, VZV reactivation can cause visceral organ involvement, multi-dermatomal involvement, and disseminated zoster.[38] The risk factors for HZ are summarised in **Table I**.[33,39,40]

Figure I: Risk of stroke by time since HZ; meta-analysis of data from 15 studies (1986-2020; n=1,276,021 HZ cases/N=11,119,984; all ages) (Figure adapted from Lu P et al, 2023)[27]

Risk of stroke/TIA by time since HZ; meta-analysis of data from 15 studies (1986–2020; n=1,276,021 HZ cases/N=11,119,984; all ages)

Time after HZ, days	Enrolled studies[2]	aRR* of stroke, including TIA, following HZ vs no HZ (95% CI)
≤14	3	**1.80** (1.42–2.29)
≤30	5	**1.61** (1.43–1.81)
≤90	5	**1.45** (1.33–1.58)
≤180	5	**1.32** (1.25–1.39)
≤365	9	**1.27** (1.15–1.40)
>365	6	1.19 (0.90–1.59)

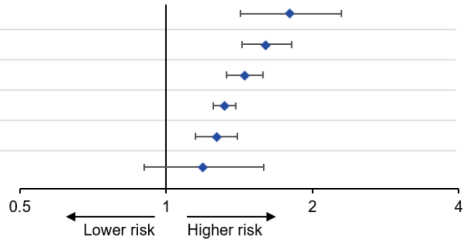

Figure II: Risk of MI or ACS by time since HZ; meta-analysis including 4 studies (1986–2010; UK, USA and Taiwan; n=188,447 HZ cases/N=731,303; all ages) Figure adapted from (27)

Risk of MI or ACS by time since HZ; meta-analysis including four studies (1986–2010; n=188,447 HZ cases/N=731,303; all ages)

Time after HZ	Enrolled studies	Pooled OR for MI/ACS following HZ vs no HZ (95% CI)	
		Fixed effects model	Random effects model
Up to 3 months	2	**1.31** (1.02–1.70)	1.34 (0.98–1.82)
Up to 1 year	2	**1.19** (1.01–1.41)	**1.19** (1.01–1.41)
>1 year	4	**1.12** (1.08–1.16)	**1.12** (1.08–1.16)

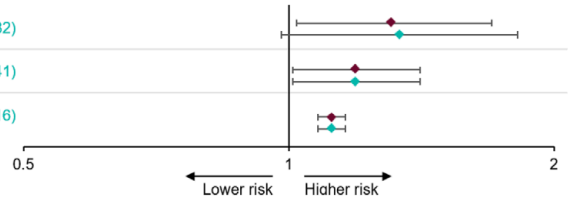

Table I: Risk factors for HZ

Risk Category	Factor
Non modifiable	Age (Older adults)
	Sex (female)
	Family history
Immunosuppression	HIV/AIDS
	Malignancies
	Allogenic/autologous stem cell transplant
Co-morbidities	Systemic lupus erythematosus
	Rheumatoid arthritis
	Psoriasis
	Psoriatic arthritis
	Multiple sclerosis
	Chronic obstructive pulmonary disease
	Cardiovascular conditions
	Inflammatory bowel disorder
	Chronic renal disease
	Asthma
	Diabetes
Immunosuppressive therapy or medications	Chemotherapy
	Radiotherapy
	Chronic use of corticosteroids
	Immunosuppressants (biologics, non-biologics, Janus Kinase inhibitors, biologic-immune modulators)

ANTIVIRALS AND VACCINATION

Antiviral drugs including acyclovir, valacyclovir, and famciclovir can be used to treat acute HZ (refer to **Table II**). For optimal treatment, these medications must be started within 72 hours of rash onset. Although antiviral treatments can effectively lower neuronal inflammation and reduce symptoms and PHN severity and duration, they remain limited in the prevention of complications like PHN.[12,41] Taking this limitation into consideration, proactive prevention should be taken instead of reactive management of HZ. HZ is a vaccine-preventable disease. In Singapore, the Society of Infectious Disease recommends the recombinant zoster vaccine (RZV), Shingrix, for adults aged 50 years and older and for those over 19 years old who are at increased risk due to immunodeficiency or immunosuppression.[42] In clinical studies (refer to **Figure III**), RZV demonstrated 97.2 percent overall vaccine efficacy and 91.2 percent protection against PHN in immunocompetent adults aged 50 years old and above. Even in older adults above 70, the vaccine efficacy was 91.3 percent with 88.8 percent protection against PHN.[43] There is currently no recommendation for booster with evidence indicating that vaccine efficacy is sustained at 87.7 percent up to 11 years post-vaccination.[44] Common side effects include injection site pain, myalgia, fatigue, and injection site redness (refer to **Table III**).[47] Main serious adverse reactions were similar in RZV and placebo group. Recent studies have also shown that HZ vaccination is associated with lower risk of major adverse cardiovascular events, including stroke and coronary artery disease.[45,46]

Timely vaccination is crucial as postponing immunisation can lead to preventable morbidity and burden our already strained medical system.

Table II: Antivirals for HZ

Medication	Dosage	Route	Duration
Acyclovir	800 mg every 4 hours, 5 times daily	Oral	7-10 days
Acyclovir	10 mg/kg every 8 hours	Intravenous (IV)	7 days
Valacyclovir	1 gram 3 times daily	Oral	7 days
Famciclovir	500 mg every 8 hours	Oral	7 days

Figure III: Efficacy of RZV against HZ (VEHZ) and HZ-related Complications

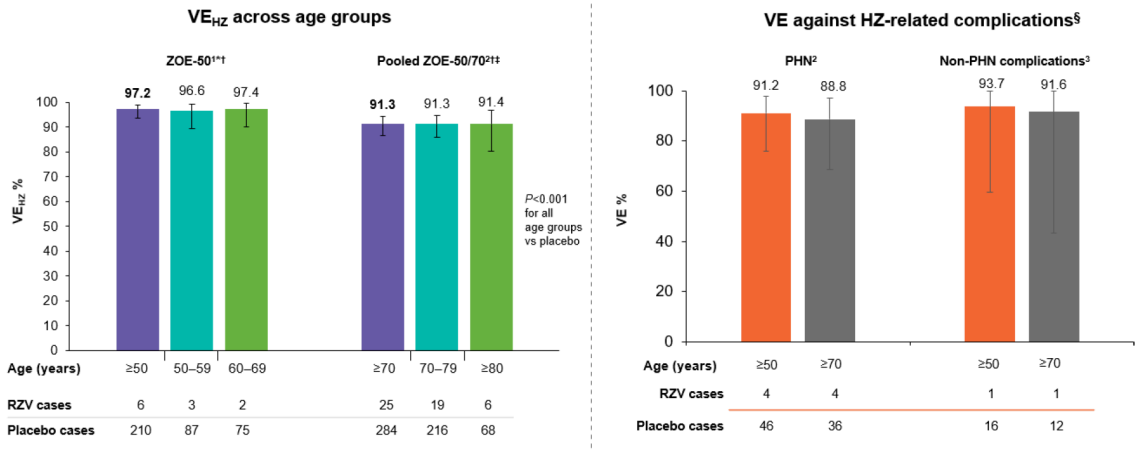

Table III: Vaccine Adverse Reactions compared to placebo

Pooled analysis from ZOE-50 and ZOE-70		
Adverse Reaction	**RZV (%)**	**Placebo (%)**
Pain	~68	~7
Redness	~28	~1.5
Swelling	~18	~1.0
Myalgia	~34	~6
Fatigue	~32	~9
Headache	~26	~8
Shivering	~16	~3
Fever	~13	~2.5
Gastro-intestinal symptoms	~11	~4

NAIS AND OTHER RECOMMENDATIONS

Perceived affordability may contribute to the resistance to HZ vaccine uptake. Increasing availability through public health initiatives and making funding alternatives clearer might improve this. From September 2025 (refer to **Figure IV**), all Singaporeans and Permanent Residents aged 60 years and above, and immunocompromised adults aged 18 to 59 years, can get subsidies of up to 75 percent at CHAS GP clinics, polyclinics, and MOH-funded long-term care institutions (refer to **Figure III**). After subsidies, Singaporeans can expect to pay around $75 to $300 per course of RVZ vaccine (two doses) and permanent residences can expect to pay $450 per course. From 2026, MediSave can be utilised to pay for RZV across the abovementioned settings.[47] This will remove out-of-pocket payments for some patients and reduce financial barriers to vaccination.

Figure IV: Summary of RHZV recommendations to be included in the NAIS

Annex A

Summary of RHZV recommendations to be included in the NAIS
(From September 2025)

Vaccine	Recommendations	Additional information
Recombinant herpes zoster vaccine (RHZV)	RHZV is recommended for persons aged 18 years or older who are at increased risk of developing shingles and associated complications, as follows: • All persons aged 60 years or older; • Persons aged 18 years or older with immunocompromising conditions	• Two doses are recommended at an interval of 2-6 months. • For persons with immunocompromising conditions, the interval can be shorter at 1-2 months if earlier protection is desired. • For persons aged 60 years or older, all persons are recommended for RHZV regardless of medical condition. • For persons aged 18-59 years, only those with immunocompromised conditions are recommended for RHZV. • Detailed information on examples of immunocompromised conditions will be provided in another circular prior to the implementation date.

Table IV summarises the recommendations for the recombinant herpes zoster vaccine under the National Adult Immunisation Schedule Singapore, The Handbook of Adult Vaccinations by Society of Infectious Disease Singapore, US Advisory Committee on Immunisation Practices, and Joint Committee on Vaccination and Immunisation UK.

Table IV: Summary of Recommendations

Issuing Body	Recommendations
Singapore National Adult Immunisation Schedule – 2025	• Adults aged 60 or older • Aged 18 or older with immunocompromising conditions
Handbook of Adult Vaccination 2023 (Society of Infectious Disease Singapore)	• Adults aged 50 years or older • Adults 19 years of age or older at increased risk of herpes zoster due to immunodeficiency or immunosuppression caused by known disease or therapy
US Advisory Committee on Immunisation Practices (ACIP), CDC 2023	• Adults aged 50 and above • For immunocompromised adults aged 19 and above
Joint Committee on Vaccination and Immunisation (JCVI) UK 2023	• National programme for adults aged 60 to 79 years • Immunosuppressed adults aged 50 years or older

CONCLUSION

Herpes zoster is a preventable disease. There is a growing body of evidence supporting the risk of stroke, MI, and other long-term complications. The RVZ vaccine is safe and effective. Patients above 60 years of age or above 18 with significant immunocompromising conditions should be inoculated.

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LEARNING POINTS

- **Early Diagnosis of Herpes Zoster and early treatment with 72 hours of rash is key.**
- **Herpes zoster can lead to serious complications like PHN, HZO, stroke, and MI.**
- **Older adults above 50 years old are at risk of shingles and its complications.**
- **Vaccination with recombinant zoster vaccine is safe and effective even for immunocompromised and elderly patients.**

ASSESSMENT OF 15 MCQS

FPSC NO : 128
MCQS ON AGEING WITH VITALITY
SUBMISSION DEADLINE: 2 September 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. In whom should we consider RSV vaccination with *Arexvy*?

A. All adults aged 18 years and above
B. All adults aged 60 years and above, and adults aged 50-59 years at increased risk of severe RSV outcomes
C. All adults aged 60 years and above
D. All adults aged 50 years and above
E. All adults aged 50 years nd above, and adults aged 18 years and above at increased risk of severe RSV outcomes

2. How would you counsel a patient who is a candidate for RSV vaccination but is worried about GBS?

A. There is no risk of GBS with RSV vaccination
B. The risk of GBS with RSV vaccination was only observed in patients older than 75 years of age
C. Although data suggest a rare risk of GBS after RSV vaccination, the risk of severe complications from RSV is substantially higher
D. RSV vaccination is recommended for all adults regardless of age or risk assessment
E. The risk of GBS with RSV vaccination was only observed in patients older than 85 years of age

3. CDC recommends co-administration of RSV vaccine with:

A. Acceptable with other adult vaccines
B. Recommended with seasonal flu vaccine only
C. Not recommended with COVID-19 vaccine
D. Not recommended with other adult vaccines
E. Not recommended with pneumococcal vaccine

4. What is the recommended age to start shingles vaccination with recombinant zoster vaccine (*Shingrix*)?

A. 40 years
B. 50 years
C. 55 years
D. 60 years
E. 65 years

5. What is the main reason adults aged >50 years should consider shingles vaccination, even if they feel healthy?

A. They are required by law to be vaccinated
B. Shingles only affects older adults with chronic conditions
C. The risk of shingles increases with age regardless of health status
D. Vaccination prevents all viral infections
E. Shingles is only dangerous for immunocompromised people

6. Which of the following groups is currently not indicated for RSV vaccination in Singapore?

A. Adults aged 50-59 years with heart failure
B. Adults aged 60-74 years living in nursing homes
C. Adults aged 60-74 years with chronic obstructive pulmonary disease
D. Adults aged 75 years and older
E. Healthy adults aged 50-59 years

7. Which of the following best describes the mechanism of action of currently approved RSV vaccines?

A. Activation of cytotoxic T-cell responses via viral vector delivery
B. Induction of immunity against the post-fusion F protein
C. Induction of immunity against the pre-fusion F protein
D. Inhibition of RNA polymerase activity
E. Neutralisation of RSV G protein via monoclonal antibody infusion

8. What is the approximate efficacy of RSV vaccines in preventing lower respiratory tract infections within the first year post-vaccination?

A. 30%
B. 50%
C. 60%
D. 80%
E. 95%

9. Which of the following strategies is not part of the World Health Organisation's 3C model to improve vaccine uptake?

A. Addressing complacency through education
B. Enhancing convenience via routine co-administration
C. Improving confidence with shared decision-making
D. Integrating vaccination into routine primary care visits
E. Reducing cost through vaccine subsidies

10. Which statement regarding Guillain-Barré syndrome (GBS) and RSV vaccination is correct?

A. GBS has been causally linked to RSV vaccination in large-scale trials
B. GBS is a common side effect of RSV vaccination
C. GBS occurs at a rate of fewer than 10 cases per million RSV vaccine doses
D. GBS risk prompted a black box warning by the US CDC
E. The incidence of GBS is higher following influenza vaccination than RSV vaccination

11. Postherpetic Neuralgia (PHN) is the most common complication of herpes zoster (shingles), characterised by persistent neuropathic pain lasting more than X days after the onset of the shingles rash. What is X?

A. 30 days
B. 60 days
C. 90 days
D. 120 days
E. 150 days

12. Which statement regarding antiviral and post-herpetic neuralgia (PHN) is correct?

A. Acyclovir prevents PHN
B. Valaciclovir prevents PHN
C. Antivirals do not reduce severity of PHN
D. Antivirals do not prevent PHN
E. Antivirals increase incidence of PHN

13. Which statement regarding Recombinant Zoster Vaccine (RZV) is false?

A. It is a live vaccine
B. It has an adjuvant system
C. Two doses are needed
D. Under NAIS it is recommended for adults >60 years of age
E. It is indicated for adults >50 years of age

14. NAIS recommends Recombinant Zoster vaccine (RZV) to prevent shingles in all patients aged X years old and above. What is X?

A. 40
B. 50
C. 60
D. 70
E. 80

15. Which of the following statements are true about herpes zoster?

I. Patients have an increased risk of ACS and AMI post-infection

II. Patients have an increased risk of TIA/ CVA post-infection

III. Post-herpetic neuralgia is the commonest complication

A. I and II
B. I and III
C. II and III
D. All of the above
E. None of the above

FPSC 125 "The Extended Consultation" Answers to 30 MCQs					
1.	B	11.	D	21.	A
2.	A	12.	B	22.	B
3.	C	13.	C	23.	C
4.	B	14.	A	24.	E
5.	E	15.	A	25.	A
6.	C	16.	D	26.	E
7.	D	17.	B	27.	A
8.	C	18.	C	28.	C
9.	A	19.	D	29.	A
10.	E	20.	A	30.	C

FPSC 126 "Chronic Disease Management 2025" Answers to 30 MCQs					
1.	D	11.	C	21.	D
2.	B	12.	B	22.	A
3.	A	13.	E	23.	E
4.	E	14.	D	24.	A
5.	C	15.	E	25.	C
6.	B	16.	E	26.	B
7.	D	17.	E	27.	A
8.	A	18.	B	28.	E
9.	C	19.	A	29.	D
10.	A	20.	D	30.	C

FPSC 127 "Muscles Matter: Uncovering The Role of Muscles in Health and Disease" Answers to 15 MCQs					
1.	B	6.	D	11.	E
2.	E	7.	A	12.	D
3.	D	8.	C	13.	C
4.	C	9.	A	14.	A
5.	C	10.	B	15.	B

READINGS

A SELECTION OF TEN READINGS ON TOPICS RELATED TO
AGEING WITH VITALITY

https://doi.org/10.33591/sfp.51.3.ur

A SELECTION OF TEN READINGS ON TOPICS RELATED TO 2025 FAMILY PRACTICE SKILLS COURSE: AGEING WITH VITALITY

FPSC128 – SATURDAY, 28 JUN 2025 2.00pm-5.30pm
All are available as free full text

Selection of readings made by A/Prof Goh Lee Gan

READING 1 – HERPES ZOSTER VACCINATION KNOWLEDGE, ATTITUDES, AND PRACTICES IN PRIMARY CARE PROVIDERS IN USA

Stempniewicz N,[1] Davenport E,[2] Wang J,[2] Sweeney C.[3] Herpes zoster vaccination: Primary care provider knowledge, attitudes, and practices. Hum Vaccin Immunother. 2025 Dec;21(1):2488093. PMID: 40249278.

doi: 10.1080/21645515.2025.2488093; PMID: 40249278. Free full text.

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ABSTRACT

Primary care providers (PCPs) play a key role in vaccine recommendations and uptake, but limited information exists about PCP knowledge, attitudes, and practices regarding herpes zoster (HZ) vaccination. Clinical trials have shown that recombinant zoster vaccine (RZV) significantly reduces the risk of developing HZ. Hence, RZV is recommended by the US Advisory Committee on Immunization Practices (ACIP) for adults aged ≥50 years and immunocompromised adults aged ≥19 years. However, RZV uptake varies across age groups, and is lower for adults aged 50-59 compared to those aged ≥60 years.

Using a cross-sectional web-based survey, this study described provider knowledge of HZ risk factors, ACIP recommendations, attitudes toward HZ vaccination, and HZ vaccination practices/barriers.

Among 301 licensed PCPs in the US, knowledge of HZ risk factors was high, but only 29 percent were fully aware of the ACIP recommendations. PCPs indicated that HZ vaccination was important for patients aged 50-59, 60-69, and ≥70 years, with importance increasing with advancing age. During a typical week, an average of 44 percent (standard deviation = 32%) of PCPs reported initiating a conversation about HZ vaccination among adults aged 50-59 years. Key perceived barriers to recommending HZ vaccines to adults were contraindications and insufficient time to assess risk factors, while perceived HZ vaccine administration challenges included patients' out-of-pocket costs and lack of motivation.

Results suggest that PCPs may benefit from updated information about ACIP recommendations, while both patients and providers may benefit from streamlining the vaccination process and educational efforts focused on addressing perceived barriers.

READING 2 – EXCESS RESPIRATORY HOSPITALISATIONS ASSOCIATED WITH INFLUENZA, RESPIRATORY SYNCYTIAL VIRUS, AND SARS-COV-2 IN SINGAPORE FROM 2015 TO 2023

Qi CH,[1] Lim R,[1] Pung R.[1,2] Excess Respiratory Hospitalisations Associated with Influenza, Respiratory Syncytial Virus, and SARS-CoV-2 in Singapore from 2015 to 2023. Influenza Other Respir Viruses. 2025 Apr;19(4):e70098. PMID: 40196916.

doi: 10.1111/irv.70098; PMID: 40196916. Free full text.

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ABSTRACT

BACKGROUND: The patterns of circulation and burden of influenza and respiratory syncytial virus (RSV) in Singapore are affected by the COVID-19 pandemic containment measures. These patterns in relation to SARS-CoV-2 in a post-pandemic era are unclear.

METHODS: Using data from 2015 to 2023, we estimated excess influenza-, RSV-, and SARS-CoV-2-associated hospitalisation in Singapore, adjusted for rhinovirus/enterovirus activity in generalised additive models. The data include pneumonia and influenza (P&I) hospitalisation from a national inpatient database and a community-wide acute respiratory infection (ARI) sentinel surveillance programme, stratified by age groups.

RESULTS: Across all age groups, the proportion of hospitalisation associated with influenza, SARS-CoV-2, and RSV was 13.2 percent (95% CI 5.0%-21.6%), 19.3 percent (95% CI 13.8%-25.0%), and 4.0 percent (95% CI 0.9%-12.1%) in 2023, respectively. From 2019 to 2023, all-age influenza-associated hospitalisation declined from 264.4 per 100,000 person-years (95% CI 214.2-313.2) to 203.7 per 100,000 person-years (95% CI 76.8-333.6). In contrast, all-age RSV-associated hospitalisation after the pandemic was 62.2 per 100,000 person-years (95% CI 13.8-186.9), similar to pre-pandemic observations. Peak seasonal influenza occurred 3-8 weeks later as compared with the time of pre-pandemic peak influenza activity.

CONCLUSION: The overall burden of influenza has declined after the COVID-19 pandemic and its burden is comparable with SARS-CoV-2. Furthermore, shifts in the timing of peak influenza activity suggest a potential need to review the timing of vaccine recommendations in Singapore.

READING 3 – PUBLIC HEALTH IMPACT OF HERPES ZOSTER VACCINATION ON OLDER ADULTS IN SINGAPORE: A MODELLING STUDY

Oh H,[1] Tan C,[2] Williams C,[3] Giannelos N,[4] Ng C.[5] Public health impact of herpes zoster vaccination on older adults in Singapore: a modelling study. Hum Vaccin Immunother. 2024 Dec 31;20(1):2348839.

doi: 10.1080/21645515.2024.2348839. PMID: 38804600. Free full text.

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ABSTRACT

In Singapore, population ageing and rising life expectancy are increasing herpes zoster (HZ) burden, which may be reduced by vaccination.

The present study modelled the public health impact of HZ vaccination in Singapore using the ZOster ecoNomic Analysis (ZONA) model, adapted with Singapore-specific key model inputs where available. Base case analysis was conducted in adults ≥50 years of age (YOA), exploring three vaccination strategies (no vaccination, recombinant zoster vaccine [RZV], zoster vaccine live [ZVL]) under mass vaccination setting (30% coverage). Scenario and sensitivity analyses were performed.

Out of 1.51 million adults in 2021 (base case population), 406,513 (27.0%) cases of HZ, 68,264 (4.5%) cases of post-herpetic neuralgia (PHN), and 54,949 (3.6%) cases of other complications were projected without vaccination. RZV was estimated to avoid 73,129 cases of HZ, 11,094 cases of PHN, and 9,205 cases of other complications over the subjects' remaining lifetime; ZVL would avoid 17,565 cases of HZ, 2,781 cases of PHN, and 1,834 cases of other complications. The number needed to vaccinate to prevent one case of HZ/PHN was lower for RZV (7/41) than ZVL (26/163). Among all five age-stratified cohorts (50-59/60-64/65-69/70-79/≥80 YOA), RZV (versus no vaccination/ZVL) avoided the largest number of cases in the youngest cohort, 50-59 YOA. Results were robust under scenario and sensitivity analyses.

Mass vaccination with RZV is expected to greatly reduce the public health burden of HZ among Singapore individuals ≥50 YOA. Findings support value assessment and decision-making regarding public health vaccination strategies for HZ prevention in Singapore.

READING 4 – OF RESPIRATORY SYNCYTIAL VERSUS SARS-COV-2 OMICRON 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: A total of 12,811 hospitalised adults were included (RSV: N=1,332; influenza: N=3,999; COVID-19: N=7,480). Amongst RSV hospitalisations, 5.4 percent (72/1,332) died within 28 days; 3.8 percent (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.

READING 5 – CARDIAC EVENTS IN ADULTS HOSPITALISED FOR RESPIRATORY SYNCYTIAL VIRUS VS COVID-19 OR INFLUENZA

Wee LE,[1-4] Ho RWL,[1] Tan KB,[1,2,5,6,8,9] Lim JT,[1,5] Lye DCB,[1,5,7,8] Chiew CJ.[1,6] Cardiac Events in Adults Hospitalised for Respiratory Syncytial Virus vs COVID-19 or Influenza. JAMA Netw Open. 2025 May 1;8(5):e2511764. PMID: 40402498.

doi:10.1001/jamanetworkopen.2025.11764. PMID: 40402498. Free full text.

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ABSTRACT

INTRODUCTION: Respiratory viral infections (RVIs) are associated with elevated cardiovascular risk; however, less is known about cardiac complications after hospitalisation for respiratory syncytial virus (RSV) vs other vaccine-preventable RVIs (COVID-19 or influenza).

OBJECTIVE: To compare the risk of acute cardiovascular complications in adults hospitalised for RSV vs COVID-19 or influenza.

DESIGN, SETTING, AND PARTICIPANTS: This population-based cross-sectional study, conducted before the RSV vaccination rollout in Singapore, assessed all adults hospitalised for RSV or influenza (1 January 2017 to 30 June 2024) and all adult hospitalised for COVID-19 during Omicron XBB/JN.1 transmission (1 January 2023 to 30 June 2024).

EXPOSURE: Hospitalisation for RSV, influenza (vaccinated or unvaccinated), or COVID-19 (boosted [≥3 vaccine doses] or unboosted [<3 vaccine doses]).

MAIN OUTCOMES AND MEASURES: Cardiovascular events during RSV, influenza, or COVID-19 hospitalisation, defined as any cardiac, cerebrovascular, or thrombotic event, occurring from admission until discharge or death. Odds of any cardiovascular event (RSV vs COVID-19 or RSV vs influenza) and severe RVI (intensive care unit admission) with or without an acute cardiovascular event were estimated using multivariate logistic regression, adjusted for sociodemographic and clinical characteristics.

READING 6 – HERPES ZOSTER INCIDENCE AND BURDEN IN OLDER CHINESE IN HUNNAN: A SYSTEMATIC REVIEW AND META-ANALYSIS

Zheng B,[1] Geng Y,[1] Li Q,[1] Cao W,[1] Yin D,[2] Yin M,[3] Ning Y,[4,5] Petersen JD.[6-9] Herpes zoster incidence and burden in older Chinese: a systematic review and meta-analysis. BMC Public Health. 2025 Apr 22;25(1):1494. PMID: 40264149.

doi: 10.1186/s12889-025-22703-6. PMID: 40264149. Free full text.

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ABSTRACT

BACKGROUND: Previous studies have documented variations in herpes zoster (HZ) incidence across regions and periods. We aimed to synthesise data on HZ incidence, complications, and associated healthcare costs (inpatient and outpatient) in the Chinese population aged 50 years and older over the last two decades.

METHODS: We searched studies published in English between 1 January 2000 and 31 March 2023 in PubMed, Cochrane Library, Embase, EBSCO, OVID, and Web of Science, supplemented by Chinese databases CNKI, Wan Fang, CQVIP, and Yiigle. Main search terms included "Herpes Zoster", "Herpesvirus 3, Human", "Neuralgia Postherpetic", "incidence", "morbidity", "epidemiology", "complication", "healthcare cost", "expenditure", "economic", and "burden". The Agency for Healthcare Research and Quality tool and Newcastle-Ottawa Scale were used for quality assessment.

RESULTS: Of 6,958 studies, 19 (73,044,981 total population) were included for analysis (1,107,682 HZ cases, mean age 63.03±8.30 years, 47.10% male). The pooled annual HZ incidence from 13 studies (two with high quality, 11 with medium quality) from 2000 to 2020 was 6.28 per 1,000 PYs (95%CI: 5.42, 7.15), with a significant increasing trend over the period (meta-regression coefficient: 0.0031, 95%CI: 0.0027, 0.0036), and more pronounced among females and those with advancing age. Neuralgia system disorders were the most frequently reported complications, followed by ear and eye diseases. Furthermore, HZ-associated inpatient costs showed a 4.4-fold dramatic increases, rising from 3,260 RMB in 2010-2012 to 14,303 RMB per patient in 2017-2018, while outpatient costs increased from 336 RMB to 1,329 RMB.

CONCLUSIONS: Despite the medium overall quality of the studies, our findings highlight an urgent need for effective public health strategies including vaccines aimed at reducing HZ incidence and associated healthcare costs in China.

READING 7 – THE EPIDEMIOLOGY OF RESPIRATORY SYNCYTIAL VIRUS AND THE IMPACT OF COVID-19 PANDEMIC IN A RETROSPECTIVE EVALUATION

Zheng B,[1] Geng Y,[1] Li Q,[1] Cao W,[1] Yin D,[2] Yin M,[3] Ning Y,[4,5] Petersen JD.[6-9] Herpes zoster incidence and burden in older Chinese: a systematic review and meta-analysis. BMC Public Health. 2025 Apr 22;25(1):1494. PMID: 40264149.

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ABSTRACT

INTRODUCTION: Respiratory syncytial virus (RSV) is the main aetiological agent in paediatric lower respiratory tract infections. The limited availability of therapeutic options for severe clinical cases associated with RSV infection makes prophylactic interventions a priority for containment. The aim of the current study was to evaluate the epidemiology of RSV in the Piedmont population and the consequences of containment measures applied during the pandemic on viral circulation in the immediate and medium-term post-pandemic phase.

METHODS: This study considered all biological samples analysed for RSV at the City of Health and Science of Turin collected from 1 January 2016 to 31 December 2023. Evaluation of the positivity rates of samples was performed and differences between paediatric and adult population swabs (nasopharyngeal, pharyngeal, nasal aspirates) and bronchoalveolar samples were reported.

RESULTS: This study analysed 14,085 samples and highlighted a trend in Piedmont RSV infections characterised by a higher paediatric population involvement of 82 percent compared to the adult population at 17 percent. A higher number of URT infections (95%) compared to LRT infections (4.6%) was also identified. This study shows a peak in RSV cases from November to April between 2016 and 2020. Our data show no RSV positivity during the 2020/2021 winter season, a result most likely due to the influence of containment measures implemented during the COVID-19 pandemic.

CONCLUSIONS: Our study provided an epidemiological panorama of RSV and its high prevalence in paediatrics and adults. Paediatrics had a higher prevalence, while adults presented a delayed trend of about one month compared to paediatrics. The effectiveness of infection control measures applied during the SARS-CoV-2 pandemic to limit viral infections were proved. Future studies may further investigate the impact of the SARS pandemic on RSV epidemiology considering patients at a higher risk of severe symptoms.

READING 8 – A SYSTEMATIC LITERATURE REVIEW OF EPIDEMIOLOGY AND BURDEN OF HERPES ZOSTER IN ASIA PACIFIC COUNTRIES

Chen J,[1] Ke Y,[1] Ong CR,[1] Shantakumar S,[1] Abrahamson PE,[2] Parikh R.[3] A systematic literature review of the epidemiology and burden of herpes zoster in selected locales in Asia Pacific. Hum Vaccin Immunother. 2024 Dec 31;20(1):2344983. PMID: 38767209.

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ABSTRACT
Herpes zoster (HZ) is a painful rash that typically affects older adults. This is of concern in Asia-Pacific given its ageing population. As HZ epidemiology and burden are evolving, this systematic literature review aimed to update the current understanding of HZ burden and associated costs for selected Asia-Pacific locales.

MEDLINE and Embase were searched for English articles of HZ studies conducted in Australia, China, Hong Kong, Japan, Korea, New Zealand, Singapore, and Taiwan. Eligible outcomes included HZ incidence and prevalence, occurrence of HZ-related complications, healthcare resource utilisation, costs, and HZ-associated quality of life outcomes. This paper focused on HZ data in the general adult population (N = 90 articles).

Substantial HZ-related disease and economic burden were observed in these locales, consistent with global trends.

These findings reinforce the increasing burden of HZ and need for preventive strategies, which may include raising awareness and encouraging timely vaccination.

READING 9 – KNOWLEDGE, ATTITUDE, AND PRACTICE TOWARDS HERPES ZOSTER (HZ) AND HZ VACCINATION IN ASIA PACIFIC COUNTRIES

Chen J,[1] Shantakumar S,[1] Si J,[2] Gowindah R,[2] Parikh R,[3] Chan F,[4] Chan M,[5] Choi WS,[6] Huang E,[7] Huang KC,[8] Huang LM,[9] Kim H,[10] Leong CK,[11] Leong HN,[12] Seo Y,[13] Williams C,[14] Wong AT.[15] Knowledge, attitude, and practice toward herpes zoster (HZ) and HZ vaccination: Concept elicitation findings from a multi-country study in the Asia Pacific. Hum Vaccin Immunother. 2024 Dec 31;20(1):2317446. PMID: 38436584.

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ABSTRACT

Herpes zoster (HZ) is a prevalent disease characterised by a painful rash. A multi-country study was conducted to elicit public and physician knowledge, attitude, and practice (KAP) towards HZ disease and vaccination for the assessment of local factors influencing HZ vaccine perceptions in four Asian-Pacific countries/territories.

One-to-one qualitative interviews were conducted in 2022, among the public (people aged ≥50 years, adults with parents aged ≥50 years, zoster vaccine live-vaccinated individuals aged ≥50 years in Republic of Korea, and HZ patients; n=78) and physicians (general practitioners and specialists; n=24). Themes surrounding KAP toward HZ and HZ vaccination were summarised using a thematic analysis.

A substantial knowledge gap related to HZ was observed among the public, including its causes, long-term impacts, and the at-risk population. There was a low perceived risk of HZ and low general awareness of HZ vaccine availability, although country/territory-specific differences existed. Fear of HZ-associated pain contributed toward vaccination intent among HZ patients and adults with parents aged ≥50 years. HZ-naïve adults who were encouraged to receive the vaccine by others were not motivated to do so due to optimism bias. Physicians were perceived to be a reliable source of information. However, physicians did not always proactively discuss HZ vaccination due to time constraints and a perceived need to prioritise other vaccinations including influenza and pneumococcal vaccines.

Initiatives are needed to improve public awareness of HZ and its complications, in terms of overall impact on individuals and society, and highlight the important role of physicians in recommending vaccination.

READING 10 – A SYSTEMATIC REVIEW AND META-ANALYSIS OF HERPES ZOSTER RISK IN ADULTS WITH IMMUNOCOMPROMISED CONDITIONS AND AUTOIMMUNE DISEASES IN ASIA-PACIFIC

Chen J,[1] Shantakumar S,[1] Ho CY,[2,3] Tu YK,[2,3] Lin YC,[3,4] Hsia Y,[3,5] Lin YC.[3,6] A systematic review and meta-analysis of herpes zoster risk in adults with immunocompromised conditions and autoimmune diseases in Asia-Pacific. Hum Vaccin Immunother. 2025 Dec;21(1):2496048. PMID: 40299930.

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ABSTRACT

Asia-Pacific (APAC) faces an increasing burden of herpes zoster (HZ) over time. The risk of HZ and its complications are increased in immunocompromised (IC) patients and those with autoimmune diseases (AID).

Our study aimed to synthesise evidence on the epidemiological burden of HZ and its complications among the general adult population and patients with IC/AID conditions in APAC. Following a systematic literature review, we performed meta-analyses for outcomes where ≥3 studies met the inclusion criteria.

Of the 271 articles identified, 75 were included for meta-analysis. We found a high burden of HZ and its complications (i.e., postherpetic neuralgia, HZ ophthalmicus), particularly among individuals with IC/AID conditions in APAC. Patients with IC/AID conditions had significantly increased HZ risk and a higher proportion of HZ recurrence than the general adult population.

These findings may inform clinical practice and public health decisions regarding HZ prevention, including HZ vaccination strategies, among the IC/AID population in APAC.

PRISM

- Functional Decline in a Patient with Alzheimer's Disease with Behavioural and Psychological Symptoms of Dementia: Re-evaluating the Diagnosis and Managing Caregiver Concerns

FUNCTIONAL DECLINE IN A PATIENT WITH ALZHEIMER'S DISEASE WITH BEHAVIOURAL AND PSYCHOLOGICAL SYMPTOMS OF DEMENTIA: RE-EVALUATING THE DIAGNOSIS AND MANAGING CAREGIVER CONCERNS

Dr Han Weiyao

ABSTRACT

Madam C, an 81-year-old lady, with a history of Alzheimer's disease (AD) with behavioural and psychological symptoms of dementia (BPSD) was admitted to the community hospital (CH) for rehabilitation following functional decline from newly diagnosed drug-induced parkinsonism (DIP). The concurrent issues of worsening function and ongoing behavioural issues contributed to significant caregiver stress. This case illustrates how family physicians help transition patients to community care: by re-evaluating diagnosis and managing caregiver concerns.

Keywords: Geriatrics, Dementia

SFP2025; 51(4): 39-43

INTRODUCTION

Family physicians (FPs) often interact with patients who present with undifferentiated symptoms. Our generalist perspective to patient care allows us to adopt a biopsychosocial approach to identify hidden agenda and make a comprehensive diagnosis of the patient's problems.[1]

Whilst providing care for a patient with dementia, it is also important to provide care for their caregiver. Caregiver burden increases with dementia severity and the presence of BPSD.[2] FPs are well placed to provide personal, comprehensive, and coordinated care to patients with dementia and their caregivers.

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CASE STUDY

Madam C is an 81-year-old Chinese female who was admitted to a tertiary hospital for functional decline with parkinsonism features after recent discharge from post-subarachnoid haemorrhage rehabilitation.

During her tertiary hospital admission, she was diagnosed with:

1. Functional decline secondary to DIP

- Causative agent: risperidone (medication ceased)
- Function:
    - Sit-to-stand and basic ADL: 2-person maximum assistance
    - Ambulation: unable to ambulate with assistance

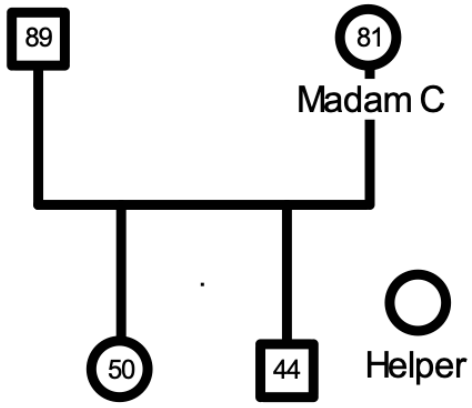
2. Mixed delirium, background of AD with BPSD

- Precipitated by left knee osteoarthritis flare, psychotropic medication use, hospital environment
- CT brain: no acute abnormalities, old lacunar infarcts present
- Withheld fluvoxamine 50 mg ON due to drowsiness
- Reduced Epilim Chrono to 300 mg ON (previously 300 mg BD)
- Started quetiapine 12.5 mg BD due to BPSD

3. Vitamin D insufficiency

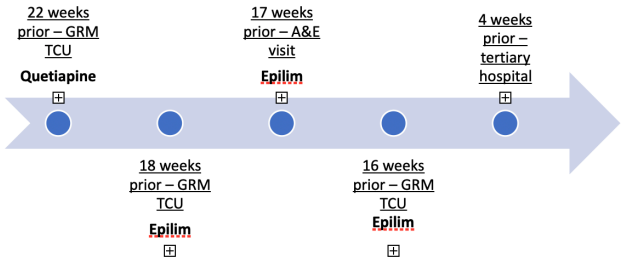
Madam C was transferred to the CH for rehabilitation. Upon admission to CH, Madam C did not have joint pain nor did she report any hallucinations. On examination, supine BP was 131/68 mmHg without postural hypotension. Her BMI was 21.4kg/m^2. Neurological examination revealed bradykinesia, cogwheeling, and rigidity in both upper limbs. Power was 4 in all limbs. Hypomimia was present. There were no cerebellar signs or resting tremor. Visual acuity was 6/9 bilaterally. There was no vertical gaze palsy. Madam C required 2-person maximum assistance for bed mobility and sit-to-stand and was unable to ambulate. Madam C was alert during the assessment and did not display inattention. Mini Mental State Examination score was 16/30.

Background



Prior to the recent admissions, Madam C was pre-morbidly ADL independent and community ambulant with a walking stick. Her BPSD manifested as persecutory delusions and physical assaults towards her son. Her BPSD medications were changed over the course of six months (illustrated in **Figure 1**).

Figure 1: Timeline of change of BPSD medications



Madam C lives with her son and a newly hired helper in a 5-room HDB flat. There are no ramps or grab bars in the flat. Madam C is a retired teacher and lives off her pension. Her son was previously a freelance photographer but has not worked since the pandemic. Madam C's daughter lives overseas and supports the family financially.

Background Medical History

1. AD with BPSD

- AD diagnosed three years prior – on follow-up with a geriatrician
- Previously taking donepezil – stopped due to nightmares
- BPSD started six months prior

2. Recurrent falls (nine falls in past year) attributed to poor safety awareness from AD

- Complicated by recent subarachnoid haemorrhage
- No history of fragility fracture

Medication List (upon arrival to CH)

PO Epilim Chrono 300 mg ON
PO quetiapine 12.5 mg BD
PO colecalciferol 1,000 units OM
PO calcium carbonate 1.25 g OM
PO paracetamol 1 g TDS PRN
Topical ketoprofen plaster 1 patch BD PRN

Caregiver's Revelation

Madam C's son conveyed his concerns about Madam C's deterioration in function from premorbid. He was concerned the parkinsonism was not improving despite cessation of the causative medication. He was experiencing caregiver stress due to her underlying BPSD and was worried that the recent change in medications could lead to worsening of BPSD. He was also concerned that she would not regain function thus adding to caregiver burden. He wanted to return to work but was worried that the helper would not be able to handle Madam C alone.

Gaining Insight: What Are the Issues?

1. Is the functional decline solely due to DIP?
2. How do we balance managing patient's underlying BPSD and her son's concerns and expectations of BPSD management?
3. How can we manage her son's caregiver stress whilst supporting the patient to return home safely with adequate resources?

STUDY THE MANAGEMENT: HOW DO WE APPLY THIS IN OUR CLINICAL PRACTICE?

1. Is the functional decline solely due to DIP?

Functional decline in older adults with dementia is often multifactorial, involving an intricate interplay of neurological, pharmacological, and systemic factors. Diagnosing the exact cause requires a comprehensive evaluation to differentiate between reversible conditions and underlying neurodegenerative processes.

Role of DIP

DIP is an adverse effect of dopamine receptor-blocking agents, particularly antipsychotics, which are frequently used to manage BPSD. DIP manifests with parkinsonian features such as bradykinesia, rigidity, and tremors, which resemble idiopathic Parkinson's disease (PD) but are often symmetrical and associated with less pronounced resting tremor.[3]

Risperidone, an antipsychotic used in Madam C's treatment, is well-documented to have a higher propensity for causing DIP compared to other second-generation antipsychotics.[4] Its strong D2 receptor binding affinity and slower dissociation

contribute to this risk. An epidemiological study comparing antipsychotics found that quetiapine and clozapine had the lowest rates of DIP, making them preferable for elderly patients prone to motor side effects.[5] The decision to switch Madam C from risperidone to quetiapine aligns with this evidence-based understanding.

DIP typically resolves within weeks to months of discontinuing the offending drug, but in up to 20 percent of older adults, symptoms persist beyond this timeframe, suggesting an unmasking of pre-existing subclinical neurodegeneration, such as PD or dementia with Lewy bodies (DLB).[6]

Differentiating DIP from Neurodegenerative Parkinsonism

Distinguishing DIP from idiopathic PD or other neurodegenerative parkinsonian syndromes is challenging but critical for tailoring treatment. Clinical clues include:

- History of symptoms: DIP is defined as the presence of parkinsonism without a history of parkinsonism before the use of the offending drug and onset of parkinsonian symptoms during use of the drug.[7] If parkinsonism symptoms predate the use of the drug, PD is the more likely diagnosis.
- Symmetry of symptoms: DIP typically presents with bilateral and symmetric motor features, while PD often begins unilaterally.
- Resting tremor and response to levodopa: PD is more likely to include resting tremor and a robust response to levodopa, whereas DIP shows less pronounced tremor and inconsistent levodopa responsiveness.[3]
- Non-motor symptoms: Non-motor symptoms, such as REM sleep behaviour disorder, hyposmia, and autonomic dysfunction, are more specific to PD and less common in DIP.[8]

Advanced imaging techniques, such as dopamine transporter (DaT) scans, can help differentiate DIP from neurodegenerative parkinsonism. DaT scans typically show preserved striatal dopamine uptake in DIP but reduced uptake in PD and DLB.[3] While not performed in Madam C's case due to limited availability, such tests could have clarified her diagnosis.

Contributors to Madam C's Functional Decline

1. **Underlying idiopathic PD:** Upon further history-taking, Madam C had been having left upper limb tremors for the past year and was noted to be "shuffling" her feet. These symptoms preceded quetiapine and risperidone use.
2. **Hospital-associated deconditioning:** Prolonged hospitalisation following her subarachnoid haemorrhage likely exacerbated physical and cognitive impairment. Evidence shows that older adults lose up to 5 percent of muscle mass per day during bed rest, significantly impairing mobility and function.[9]

Recognising the multifactorial nature of Madam C's functional decline, her management was individualised to address each potential contributor. The initiation of levodopa therapy, based on the suspicion of idiopathic PD, led to significant improvements in rigidity and ambulation. Levodopa, as a dopamine precursor, is the gold standard treatment for PD, with studies confirming its efficacy in improving motor symptoms.[10]

This therapeutic response, combined with structured rehabilitation, underscores the importance of iterative reassessment in complex cases. Functional improvement, to 2-person moderate assistance for basic ADLs, sit-to-stand, and ambulation with walking frame, was achieved despite the challenges of overlapping diagnoses, reaffirming the need for a multidisciplinary approach to care.

2. How do we balance managing patient's underlying BPSD and her son's concerns and expectations of BPSD management?

BPSD, affecting over 90 percent of individuals with dementia during their disease course, are a major cause of caregiver distress and institutionalisation.[11] Madam C's well-controlled BPSD during her initial rehabilitation period demonstrated the effectiveness of low-dose quetiapine combined with non-pharmacological measures and caregiver education.

However, her BPSD temporarily worsened during an episode of hyperactive delirium, triggered by a urinary tract infection. Delirium, particularly in dementia patients, is a common consequence of infections. Non-pharmacological strategies such as reorientation, use of music, and daytime cognitive activities have been shown to reduce the severity and duration of delirium episodes without the risks associated with pharmacological treatments.[12]

Madam C's son, concerned about the potential recurrence of BPSD at home, requested medication adjustments. While pharmacological management is sometimes necessary, it is essential to weigh the risks of polypharmacy and side effects, particularly in dementia patients. The morning dose of Epilim chrono was restarted in consultation with her geriatrician. Madam C's symptoms stabilised, illustrating the value of collaborative, evidence-based decision-making in managing BPSD.

3. How can we manage her son's caregiver stress whilst supporting the patient in returning safely home with adequate resources?

Caregiver burden is a critical consideration in dementia care, particularly when managing complex cases involving both functional decline and BPSD. Studies consistently demonstrate that caregiver burden increases with the severity of dementia and is strongly associated with reduced quality of life for both patients and caregivers.[2] Madam C's

son's stress revolved around providing care for his mother. His initial Zarit Burden Interview (ZBI) showed moderate to severe burden.

In this case, the multidisciplinary team addressed caregiver stress by implementing a comprehensive discharge plan, including:

- **Caregiver Training:** Evidence shows skill-building interventions, such as hands-on training for managing BPSD and ADLs, significantly improve caregiver competence and reduce stress.[13]
- **Environmental Modifications:** The installation of grab bars and ramps, facilitated through the HDB EASE programme, has been shown to enhance home safety and prevent falls, critical for patients with impaired mobility.[14]
- **Community Resources:** Referring caregivers to online platforms such as DementiaHub.SG and support groups provides ongoing education and emotional support, which are essential for sustained caregiving.
- **Respite and Daycare Services:** Enrolment in dementia daycare programmes provides structured patient activities while allowing caregivers to work or rest, a strategy linked to reduced caregiver burden and improved mental health outcomes.[13]

The tailored plan successfully reduced Madam C's son's caregiver burden, as evidenced by his improved ZBI at discharge. This underscores the importance of an interdisciplinary approach in addressing the needs of both patients and their caregivers.

CONCLUSION

This case highlights the role of the FP as a medical expert and collaborator in re-evaluating and managing the biological interplay of functional decline from anti-psychotic use in a patient with advanced dementia with BPSD. The most appropriate psychotropic agents at the lowest possible dose were used, in collaboration with the inputs of the interdisciplinary team and the geriatrician. It also highlights how an FP bridged communications with the patient's son, enabling a smooth transition with safety netting for the patient as she transitioned into the community.

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LEARNING POINTS

- **Importance of re-evaluating diagnosis: Continuous re-assessment of patients with dementia is crucial, as new symptoms may point to additional diagnoses, which can significantly influence management.**
- **Balancing symptom control and caregiver concerns: Effective communication with caregivers is essential for managing expectations and addressing concerns, especially when balancing the control of BPSD with the patient's overall health and function.**
- **Multidisciplinary approach to caregiver burden: A tailored, team-based approach that includes practical training, resource provision, and emotional support is essential for reducing caregiver burden and facilitating safe patient discharge.**

Original Paper

- The Role of POCUS in Community and Home Care
- Challenges Faced by Private Practice General Practitioners & Family Physicians in Light of Healthier SG: A Mixed-Methods Survey

THE ROLE OF POCUS IN COMMUNITY AND HOME CARE

Dr Luo Yang, Ms Tan Hui Juan Jennifer, Dr Lee Shaowen Joshua, Dr Tan Kok Heng Adrian

ABSTRACT

Due to its portability and accessibility, point-of-care ultrasound (POCUS) has significant potential for application in community and home care settings. We conducted a literature review on the use of POCUS in these settings, highlighting its role in screening, diagnosis, therapeutic monitoring, and assistance with bedside procedures. Key applications include assessing fluid status, monitoring cardiac failure, confirming nasogastric tube placement, and facilitating paracentesis in patients with ascites.

Keywords: POCUS, community, home care

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INTRODUCTION

Point-of-care ultrasound (POCUS) enables real-time imaging directly at the patient's bedside. Unlike other imaging methods, such as X-rays and CT scans, POCUS is cost-effective, portable, and free from ionising radiation.[1] With the increasing emphasis on healthcare delivery in community and home settings,[2] POCUS has significant potential to improve access for patients facing mobility challenges or barriers to hospital-based imaging. In this article, we review the current literature on the use of POCUS in the community, with a particular focus on its application in home care environments.

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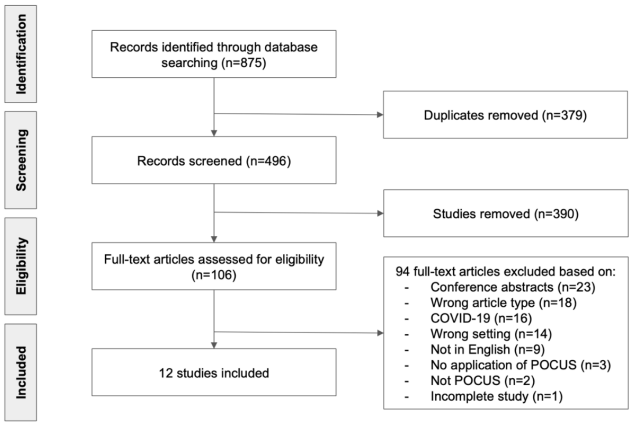
LITERATURE SEARCH

A comprehensive search was conducted in April 2024 across the Cochrane Library, CINAHL, Embase, Medline, PubMed, and Web of Science databases, using controlled vocabulary and free-text terms related to POCUS and community care (refer to **Table I**). The search, performed by a senior librarian, yielded 875 articles. After removing duplicates, 496 articles were screened by two authors (JHJT, JSL), with disputes resolved by a third author (AKHT). Inclusion criteria encompassed using POCUS at home or in a home care setting, and its application for diagnosis, monitoring, follow-up, procedures, or condition management. Exclusion criteria included its use in obstetric populations, individuals under 16 years of age, educational purposes, and resuscitation settings. Following this, seven studies and five case series or reports were included in this review (refer to **Figure 1**).

Table I: Search Strategy

#1: ("point of care systems"[MeSH:NoExp]) AND ("ultrasonography"[MeSH Terms])
#2: ("point of care"[Title/Abstract] OR point-of-care[Title/Abstract] OR wireless[Title/Abstract] OR bedside[Title/Abstract] OR "hand held"[Title/Abstract] OR hand-held[Title/Abstract] OR portable[Title/Abstract]) AND (ultrasound*[Title/Abstract] OR ultrasonography[Title/Abstract])
#3: POCUS[Title/Abstract]
#4: #1 OR #2 OR #3
#5: ((((((("residential facilities"[MeSH:NoExp]) OR ("assisted living facilities"[MeSH:NoExp])) OR ("homes for the aged"[MeSH:NoExp])) OR ("hospices"[MeSH:NoExp])) OR ("home care services"[MeSH:NoExp])) OR ("home care services, hospital based"[MeSH:NoExp])) OR ("home nursing"[MeSH:NoExp])
#6: home[Title/Abstract] OR homes[Title/Abstract] OR hospice[Title/Abstract] OR hospices[Title/Abstract]
#7: #5 OR #6
#8: #4 AND #7

Figure 1: Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) flow chart



THE USE OF POCUS IN COMMUNITY CARE

POCUS serves multiple roles in community settings, offering versatile applications such as screening for various conditions, diagnostic support, therapeutic monitoring, and assistance with interventional procedures. The literature highlights its use by specialists (e.g., gastroenterologists and geriatricians), primary care physicians, and community nurses. These applications are summarised in **Table II**.

Table II:

Author	Country	N	Setting	Role of POCUS	Conditions	Operator
Arpaia (2011)	Italy	221	Home care Institutions	Screening	Deep vein thrombosis	Angiologist
Arya (2022)	Canada	89	Clinic Home care Institutions Hospital	Diagnostic, Procedural	Diagnosis: ascites, pleural effusion, pneumonia, pneumothorax, heart failure, bowel obstruction Procedures: paracentesis, thoracentesis	Palliative care physician
Bonnel (2019)*	United States	16	Home care	Monitoring	Intravascular status, dyspnoea/hypoxia, acute retention of urine	Geriatrician
Landers (2014)	New Zealand	32	Community	Diagnostic, Procedural	Diagnostic: ascites Procedural: paracentesis	Palliative care physician
Liao (2020)	Taiwan	132	Home care, institution	Screening, Diagnostic	Intra-abdominal organs, peritoneal cavity, pleural space	Gastroenterologist
Mak (2020)	Hong Kong	68	Community	Procedural	NGT placement confirmation	Nurses
Mariani (2009)*	United States	2	Home care	Diagnostic, Procedural	Diagnostic: ascites Procedural: paracentesis	Emergency physician
Matsumoto (2020)*	Japan	1	Home care	Monitoring	Constipation	Nurses (Palliative)
Ota (2020)*	United States	33	Home care	Procedural	Procedural: paracentesis	Primary care physician
Santos (2019)*	--	1	Home care	Diagnostic	Heart failure	Primary care physician
Tromp (2023)	Tunisia	94	Home care	Screening	Heart failure	Nurses
Zisis (2023)	Australia	122	Home care	Monitoring	Heart failure	Nurses

A TOOL FOR SCREENING AND DIAGNOSIS

POCUS demonstrates significant potential in the diagnosis and screening of various conditions. In a study by Arpaia, POCUS was used to screen for deep vein thrombosis (DVT) in immobilised patients through bilateral lower limb compression ultrasonography, identifying an 18 percent prevalence (95% CI 13-24%) of asymptomatic proximal DVT in this population.[3]

More recently, Tromp explored the use of AI-augmented POCUS by community nurses for heart failure screening.[4] Measurements of left ventricular ejection fraction and left atrial volume index were performed in home care patients. The study compared the sensitivity of POCUS-detected heart failure with N-terminal pro-B-type natriuretic peptide (NT-proBNP) serum testing, benchmarking both against clinic-based transthoracic echocardiography. AI-POCUS demonstrated a high sensitivity of 92 percent (95% CI 62-99) for heart failure detection, compared to 87 percent (95% CI 60-98) for NT-proBNP.

Other notable applications of POCUS reported in the literature include its use in screening and diagnosing intra-abdominal pathologies involving the hepatobiliary system, kidneys, and spleen, as described by Liao.[5] Several articles also highlighted its value in identifying ascites and pleural effusions, particularly in palliative care settings.[6-9]

SUPPORTING CLINICAL DECISIONS

Bonnel reported a case series on the use of POCUS in home care by trained geriatricians.[10] In the article, POCUS was used to assess fluid or hydration status, evaluate the causes of shortness of breath, and determine bladder volume in cases of urinary retention. The application of POCUS-facilitated clinical decision-making, including diuretic titration and trials to discontinue catheters.

Similarly, Zisis investigated the role of POCUS among a cohort of nurses in Australia for triaging heart failure patients who might require escalated care.[11] By detecting B-lines on lung ultrasound, POCUS provided an estimate of fluid status, aiding in medication titration decisions and identifying patients who needed more frequent monitoring.

In a case report, Matsumoto discussed the use of POCUS in the assessment and management of constipation in a palliative care patient.[12] POCUS was instrumental in identifying the level of fecal obstruction, enabling targeted interventions to alleviate symptoms.

ASSISTING BEDSIDE PROCEDURES

In addition to assessing ascites, POCUS can assist in performing paracentesis for symptom relief. Ota described a case series in which a trained primary care physician used POCUS guidance to perform home-based paracentesis, effectively alleviating ascitic symptoms in palliative care patients.[9]

Mak conducted a study on the use of POCUS by community nurses for assessing nasogastric tube (NGT) placement.[13] This method was compared to the pH test or X-ray. NGT placement was directly visualised using POCUS, achieving a high sensitivity of 92.45 percent (95% CI 83.20-97.40%). If visualisation was not possible, air was introduced through the NGT to create a "fogging" effect, confirming placement with a sensitivity of 95.45 percent (95% CI 87.29-99.05%). Both methods demonstrated a high specificity of 100 percent.

DISCUSSIONS

POCUS offers significant advantages for home care patients to improve clinical outcomes. Its portability allows for seamless integration into home visits, enabling healthcare providers to perform real-time assessments and address clinical questions promptly. For patients with limited mobility, POCUS eliminates the need for immediate hospital visits, serving as an effective triaging tool and helping to reduce unnecessary hospital visits.

With POCUS guidance, clinicians can perform targeted therapeutic interventions with enhanced precision and safety. Besides the placement of drainage catheters, POCUS helps with the visualisation of target sites for the delivery of therapeutic agents. Some applications include nerve block procedures for pain control in palliative patients and delivery of botulinum toxins to reduce salivary flow in drooling for patients with end-stage neuromuscular diseases described in one literature.[14]

While POCUS holds significant promise in community practice, it is important to acknowledge the challenges associated with its use to ensure its appropriate application. One primary consideration is the operator dependency inherent in ultrasound imaging. Adequate training and proficiency are essential for effective use. Healthcare institutions offering POCUS in home care should implement structured training programmes and conduct regular competency assessments for operators.

As POCUS can serve as a valuable screening tool, careful consideration must be given to interpreting its findings and determining the appropriate next steps. Overdiagnosis may lead to unnecessary evaluations and interventions, potentially causing patient anxiety. To mitigate this, clinicians should use POCUS with clearly defined clinical questions in mind, considering the overall clinical picture and the patient's goals of care.

To further enhance its usability, especially for less-experienced users, the integration of artificial intelligence (AI) can play a crucial role in assisting with result interpretation, calculating clinical measurements, reducing variability, and improving diagnostic accuracy. One study demonstrated the use of AI-integrated POCUS to calculate left ventricular ejection fraction, allowing nurses to perform accurate assessments after completing a single-day training programme.[4] While other applications of AI in POCUS have been reported in

inpatient settings, further research is essential to validate AI-generated results before large-scale implementation.[15]

CONCLUSION

POCUS is a powerful tool with numerous potential applications in community and home care settings. Current literature highlights only a fraction of its capabilities, with many applications still underexplored. There is considerable potential for future research to expand the use of POCUS in home care, as well as to develop training programmes for its application and integrate AI to enhance diagnostic support.

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CHALLENGES FACED BY PRIVATE PRACTICE GENERAL PRACTITIONERS & FAMILY PHYSICIANS IN LIGHT OF HEALTHIER SG: A MIXED-METHODS SURVEY

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ABSTRACT

Introduction: Singapore's rising non-communicable diseases is expected to show an increase in multimorbid patients. We used mixed methods to gather potential challenges that private GPs/FPs might face. Methods: Five GPs were interviewed to formulate a quantitative survey. The survey was verified for face and content validity before dissemination between 3 January to 12 February 2023, to GPs in Singapore. Results: 47 complete responses were analysed. The top three DI sources were Google [63.8% (n=30)], Pharmaceutical companies [51.1% (n=24)], and MIMS [42.6% (n=20)]. Approximately 23.4 percent (n=11) deemed their current source of DI insufficient. Over 70 percent indicated that it was of "high importance" of raising public health literacy across all age groups. The largest gap identified for NEHR was "incomplete medical and medication history". We polled for willingness-to-pay for six collaborative services. Over 60 percent were willing to subscribe to at least one service, with 27.7 percent willing to subscribe to all services. The majority were willing to pay SGD50-99 per month per service. Over 70 percent saw benefit for interim follow-up with patients whose medication was changed. Conclusion: The challenges identified could present as opportunities for allied health, pharmacy, and nursing in the wake of Healthier SG.

Keywords: Family Medicine; Healthcare Team; Interprofessional Collaboration; Population Health; Primary Care

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INTRODUCTION

In Singapore, there is a rapidly ageing population and rising prevalence of non-communicable diseases (NCDs), which has led to growing numbers of multi-morbid patients. This has resulted in greater emphasis placed on the primary care setting to manage these patients and drive population health.[1] Primary care in Singapore is mainly provided in two settings; by general practitioner (GP) clinics in the private sector and government polyclinics in the public sector.[2] Private GPs range from solo practices to group practices and cover approximately 80 percent of the primary care demand.[3] In order to tackle the healthcare needs of Singapore, Healthier SG (HSG) was launched in 2022 by the Ministry of Health (MOH) to highlight and drive patients towards preventive health.

The Healthier SG white paper has mentioned several key features of the initiative.[4] One such key feature is to encourage Singapore residents to enrol with a GP or Family Physician (FP) of their choice. This might potentially increase patient loads in the primary care sector and there is thus a need to deliver stronger primary care services. Another feature of Healthier SG mentions the advantages of leveraging on the strengths of other Healthcare Professionals (HCPs) to deliver stronger primary care.

In order to develop a strong multidisciplinary care team (MDCT) to serve the multimorbid population in the community, there is an urgent need to understand the challenges faced by current GPs/FPs in their current daily practice. This understanding may be used to build a team of HCP, or MDCT, with relevant strengths to best serve the population. However, a knowledge gap exists due to the lack of literature in Singapore. Therefore, our study aims to address the gap by exploring the challenges faced by private practice GPs/FPs in their daily practice in Singapore and prioritise areas of possible collaboration with HCP from other healthcare disciplines.

METHODOLOGY

Study Design and Subjects

This mixed method study consisted of informal conversations and a cross-sectional survey. The survey questions were crafted based on informal conversations with five GPs/FPs held in September 2022. The informal conversations were centred around the GPs'/FPs' current needs and demands in the primary care setting.

Ultimately, a total of seven questions were finalised and agreed upon by the authors. The questions consisted of mainly multiple choice and multi-response questions (i.e., select more than one applicable answer). Open-ended questions were available for the respondents to answer on a voluntary basis. The survey questions are attached in **Appendix 1**.

Supplementary Appendix 1

Background

The Healthier SG strategy was launched by the government in 2022 to resume the drive towards population health post-pandemic. The main focus of the strategy is to manage population health and shift towards preventive health in the primary care setting. With respect to a specific component under Healthier SG – "One Family Doctor and One Health Plan for Everyone", each citizen will enrol with one General Practitioner (GP) or family physician who will follow up with them regularly to not only manage their chronic illnesses, but also discuss health goals and meet their other healthcare needs. This aims at reducing the healthcare cost burden when preventive health is adopted as the main health management strategy.

With higher uptake of health screening programmes under Healthier SG, we foresee a sharp rise in newly diagnosed hypertensive, hyperlipidaemic, and diabetic subjects requiring treatment in the GP community and primary care network. At the other end of the spectrum, hospitals are barely coping with the current patient load and may wish to right site the patients into primary care setups. This would translate to more post-discharge transitional care patients and more multiple comorbidity patients that GPs will care for.

Hence, the goal of the survey is to determine the challenges that GPs face in their daily practice and prioritise areas where GPs could benefit from complementary collaborative services in which clinically trained pharmacists can provide, towards a common goal of Healthier SG.

Finalised Survey Questions:

Question 1 & 2 are related.

1. **What is your drug dosing/drug interaction source? Choose all that apply**
    a. Pharmaceutical Companies (e.g., reps, inserts)
    b. Google
    c. MIMS
    d. Up to Date/Lexicomp
    e. National Drug Formulary
    f. Others
2. **In relation to Question 1, do you feel that the resources that you are currently using are sufficient for your daily practice?**
    a. Sufficient
        i. Why?
    b. Insufficient
        i. Why not?

Questions 3 & 4 are related.

3. **How important do you think raising health literacy is for the following age groups? (1: very high importance; 2: high importance; 3: moderate importance; 4: low importance; 5: very low importance)**
    a. <40
        i. Scale of 1 to 5
    b. 41-50
        i. Scale of 1 to 5
    c. 51-64
        i. Scale of 1 to 5
    d. ≥65
        i. Scale of 1 to 5
4. **With regards to the age group, what areas of health literacy could be improved on? (grid)**
    a. Knowledge of management of their chronic conditions (goals of therapy, complications, importance of adherence to management strategies/medications)
    b. How to spot health/medicine misinformation
    c. Proper use of medication devices (inhalers, injectables etc)
    d. Self-monitoring of health status (e.g., body weight, fluid, blood pressure, glucose levels, adverse drug reactions)
    e. Lifestyle modifications (e.g., smoking cessation, exercise, nutrition & diet)

Example: Tick those that apply.

Age Group	Knowledge of management of their chronic conditions	How to spot health misinformation	Proper use of medication devices
<40			
41-50			
51-64			
≥65			

5. What are the current gaps of care with regards to National Electronic Health Record/Electronic Medical Record (NEHR/EMR) systems? Select all that apply.

a. Lack of care plans

b. Rationale as to why medications were prescribed

c. Downtime/IT challenges, e.g., incompatibility with GP in-house system/Standard Operating Procedure (SOP)

d. Incomplete medical/medication history by other GPs and private practitioners

e. Others: _____

6. Assuming the following services are made available to you, please indicate how valuable these subscribed services are to you <u>per month</u>. (grid)

a. Call in to ask about drug information (e.g., drug dosing, drug interactions, pregnancy & lactation enquiries, etc)*;

b. Quarterly updated drug and customised references (e.g., Dosing adjustments for organ dysfunction, pregnancy & lactation, paediatric dosing)*;

c. Medication reconciliation (during transitions of care; updated patient medication list);

d. Medication optimisation (optimisation of doses, choice of therapy);

e. Patient education on health prevention (e.g., lifestyle modifications)

f. Patient education on medication use (e.g., counselling, administration, storage)

g. If you choose **"I do not want to subscribe to these services"** for any of the above options, please share why. _____

*Note that an individual UptoDate subscription is SGD76/month.

Example: Tick those that apply. Can only select one per row.

Services	>SGD 200	SGD 150-200	SGD 100-149	SGD 50-99	I do not want to subscribe to this service
a					
b					
c					
d					

7. For a patient who is prescribed a new chronic medication or has an updated dose for their chronic medications, do you think it will be beneficial to have an interim follow-up before your next appointment with them?

a. Yes

i. Why?

b. No

i. Why?

Demographics Questions:

- How many years of experience do you have as a General Practitioner/Family Physician?
  - o <5
  - o 6 to 10
  - o 11 to 15
  - o 16 to 20
  - o >20
- Where is your place of practice?
  - o Solo practice
  - o Small chain practice (1 to 5 clinics)
  - o Medium chain practice (6 to 10 clinics)
  - o Large chain practice (>10 clinics)
- Do you manage profit and loss of your clinic/chain?
  - o Yes
  - o No
- Are you an accredited Family Physician?
  - o Yes
  - o No

- Encounter with Interprofessional Education (IPE)/ Interprofessional Collaborative Practice (IPCP) in education/training/practice.
    - Have you worked in a multidisciplinary team or collaborated with other healthcare professionals before? (e.g., pharmacists, allied healthcare professionals)
        - Yes
        - If yes, which one(s)?
        - No
- Regarding your highest level of qualification, were you trained locally or overseas?
    - Local University
    - Foreign University
    - Which country?
- Which demographics of patients do you mainly see? / What is your clinic's patient profile?
    - ____ % chronic
    - _____ % acute
    - _____ % preventive health (e.g., screening, vaccinations)
- Where is your clinic located in Singapore? Please specify the area (e.g., Toa Payoh)
    - _____

The anonymised online quantitative survey was then administered to GPs/FPs in private practice in Singapore from January 2023 to February 2023. The survey was reviewed and approved by the National University of Singapore Departmental Ethics Review Committee (PHA-DERC-38).

Survey Recruitment

The survey was hosted on Qualtrics and disseminated via Singapore Medical Association (SMA), GP groups, solo GPs and social media (LinkedIn, Instagram, and Facebook), and communication platforms (WhatsApp and Telegram) through authors' close contacts. Participation was voluntary. As no personal identifiers were to be recorded, submission of the survey form was taken as consent to participation.

Sample Size

Typically, the target sample size is determined by one question corresponding to five respondents. Since the quantitative survey included seven questions, the minimum sample size was 35 respondents.

Survey

The survey included demographic data such as years of practice, chain size, GP's participation in management of profit and loss of the clinic, Family Physician accreditation, past experience in MDCT, location of university education, and their clinic's patient profile. The survey questions were with regard to the GP's difficulties faced in sources of drug information (DI), interprofessional collaboration (IPC), and their opinions about patient health literacy and financial issues. Hence, these questions will help us to determine the challenges that GPs face in their daily practice and areas where GPs could benefit from complementary services which AHCPs could provide. The survey questions were sent out to three GPs prior to dissemination for face and content validation.

Statistical Analyses

All statistical analyses were performed using SPSS Statistics software version 28; a p-value of less than 0.05 was considered statistically significant.

Pearson's chi-square test, Fisher's exact test, or independent sample t-test were used to assess for associations with the demographic variables. Multivariable analysis with logistic regression was performed using variables with p-values of <0.1.

RESULTS

Survey Demographics

Out of 63 responses received, a total of 47 complete responses were analysed.

Table I. Demographics of GPs/FPs

Demographic Variables (Total n=47)	Count (%)
Years of Practice	
<5	3 (6.4%)
6 to 10	7 (14.9%)
11 to 15	4 (8.5%)
16 to 20	5 (10.6%)
>20	28 (59.6%)
Chain Size	
Solo practice	20 (42.6%)
Small chain practice (1 to 5 clinics)	16 (34.0%)
Medium chain practice (6 to 10 clinics)	4 (8.5%)
Large chain practice (>10 clinics)	7 (14.9%)

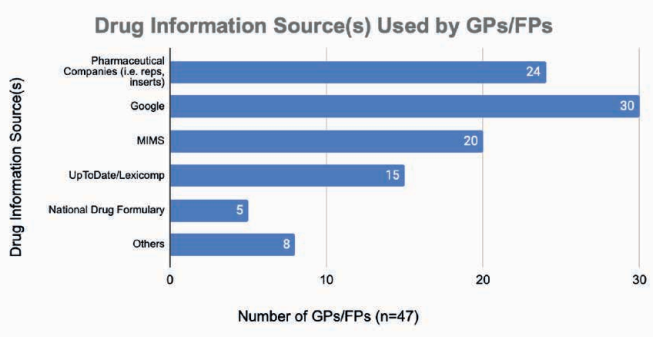
Managing Profit & Loss in Clinic	
Yes	23 (48.9%)
No	24 (51.1%)
Family Physician Accreditation	
Yes	37 (78.7%)
No	10 (21.3%)
Past Experience in MDCT	
Yes	18 (38.3%)
No	29 (61.7%)
Location of University Education	
Local (Singapore)	43 (91.5%)
Foreign	4 (8.5%)
Percentage of Patient Profile Seen in Clinic ***As it is a free text question, some responses did not add up to 100%**	**Mean (S.D)**
Acute	54.7 (18.9)
Chronic	30.4 (16.9)
Preventive	20 (15.3)

Survey Results

Drug Information (DI) Source(s) Used by GPs/FPs in Daily Practice

The top three DI sources used by respondents were Google [30 (63.8 percent)], Pharmaceutical Companies [24 (51.1 percent)], and MIMS [20 (42.6 percent)] (refer to **Figure 1a**). There was no significant difference between the selected DI source(s) and demographic variables. "Other" listed options include Medscape, British National Formulary, and Electronic Medicines Compendium.

Figure 1. DI Source(s) Used by GPs/FPs in their Daily Practice.



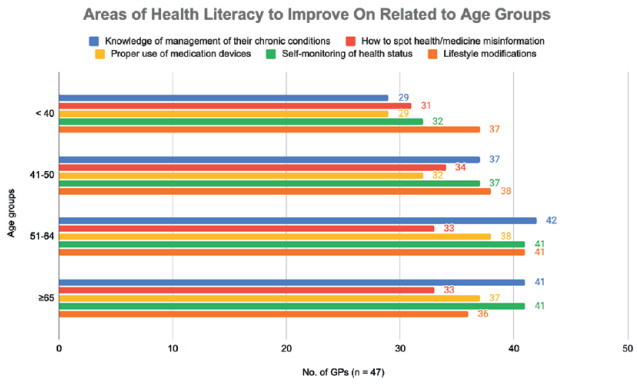
Sufficiency of Selected DI Source(s) for GPs'/FPs' Daily Practice

The majority [36 (76.6 percent)] of respondents thought that the current selection of Drug Information (DI) sources were sufficient for their daily practice. However, 11 (23.4 percent) deemed their current source of DI to be insufficient. Among the respondents who expressed sufficiency for their DI sources, some reasons cited include familiarity with the drug use, accessibility of drug information and continuing education programmes, and uncomplicated patient profiles (e.g., minor ailments, simple chronic diseases). On the other hand, respondents who indicated insufficiency generally felt that there is a barrier in retrieving information from the DI sources and some resources are not applicable to local practice.

Health Literacy – Importance & Areas to Improve On

At least 70 percent of the respondents opine that there is high importance in raising health literacy in patients regardless of their age groups. For patients aged below 40 years, lifestyle modifications (n=37) was ranked as the highest area of health literacy to improve on. For patients aged 41 to 50 years, "lifestyle modifications" (n=38) was ranked the highest, while "knowledge of management of their chronic conditions" and "self-monitoring of health status" (n=37) was closely ranked second. For patients aged 51 to 64 years, "knowledge of management of their chronic conditions" (n=42) was the most important area whereas "lifestyle modifications" and "self monitoring of health status were both closely ranked second" (n=41). For patients aged 65 years and above, "knowledge of management of their chronic conditions" (n=41) and "self-monitoring of health status" (n=41) were both ranked as the most important. Overall, subgroup analyses against the demographics of the GPs/FPs were not statistically significant.

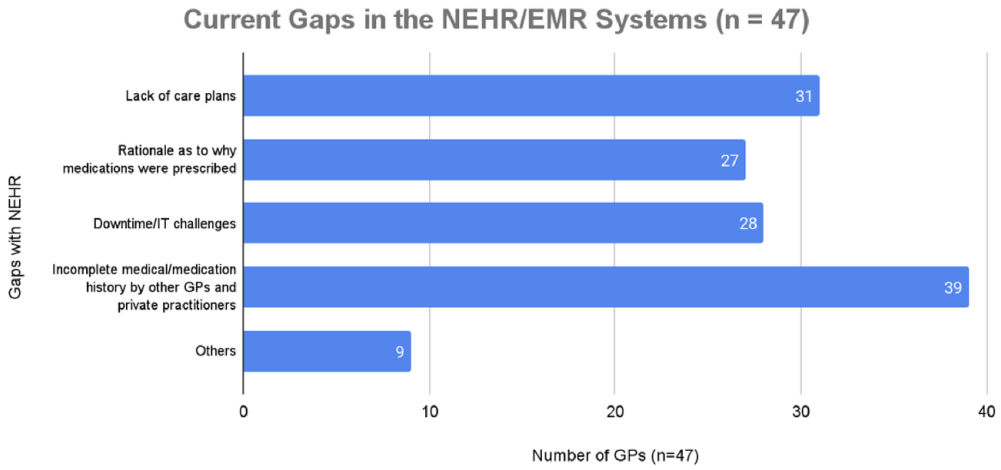
Figure 2: GPs/FPs' opinion on the areas of health literacy to improve on related to age groups



Gaps of Care with Regards to NEHR/EMR Systems

At least 50 percent of respondents agree that all areas listed are current gaps in the National Electronic Health Record (NEHR) and Electronic Medical Record (EMR) systems. A resounding majority of respondents [39 (83.0 percent)] think that "incomplete medical and medication history" is the largest gap.

Figure 3: GPs'/FPs' opinion on the current gaps of care with regard to NEHR and EMR systems



GPs/FPs' Interest in Subscribing to Services

In the survey, six services (refer to **Figure 4b**) were listed and the GP/FPs were asked to select the cost for which they are willing to pay for each service per month. They were also allowed to select that they did not wish to subscribe to the service.

Among the six listed services, 30 (63.8 percent) of the respondents were willing to subscribe to one or more of the services and 13 (27.7 percent) indicated interest in all six services (refer to **Figure 4a**) while 17 (36.2 percent) of them were unwilling to subscribe to any of the services. Overall, there was a similar level of interest among the services (refer to **Figure 4b**). For each service, the majority of the respondents were willing to pay SGD50-99/month per service. Respondents who were not willing to subscribe to any of the services cited reasons such as cost of the services, being able to carry out the services themselves, availability of resources, limitations of the services listed, and not seeing the need for the service.

Figure 4a. Services that GPs/FPs are willing to subscribe to

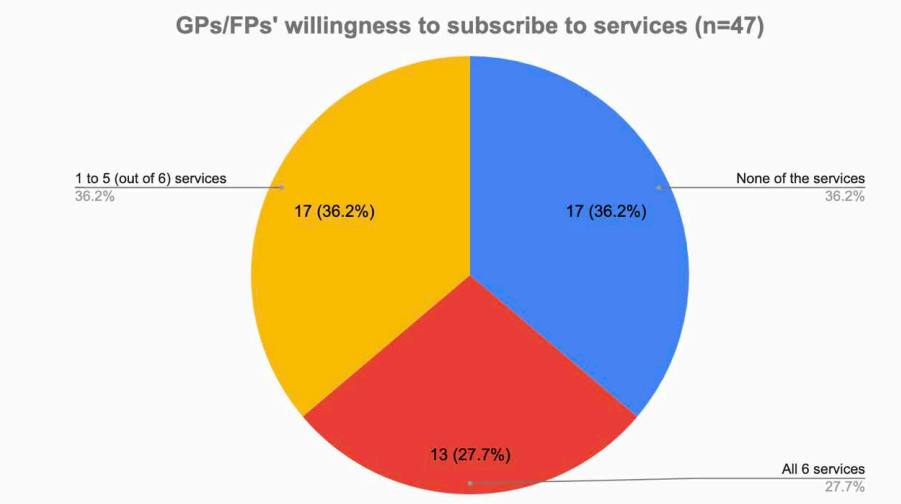
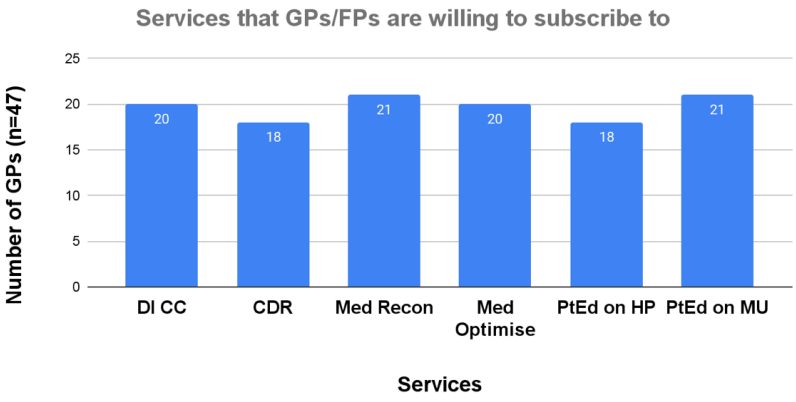


Figure 4b. Services that GPs/FPs are willing to subscribe to



Key

DI CC = Drug Information Call Centre

CDR = Customised Drug Reference

Med Recon = Medication Reconciliation

Med Optimise = Medication Optimisation

PtEd on HP = Patient Education on Health Prevention

PtEd on MU = Patient Education on Medication Use

GPs/FPs' Opinion on Whether There Is Benefit for Interim Follow-Up with Patients

Seventy-two percent (n=33) of the respondents agree that there is a benefit to interim follow-up with their patients after prescribing them a new chronic medication or adjusting their chronic medication doses. Reasons for benefits to interim follow-up include being able to monitor side effects, efficacy compliance, drug safety, and easy dose titration. Some respondents agreed that there are benefits, but still expressed some concerns about the practicality and logistics required. Meanwhile, reasons for no benefit were lack of time, cost issues, GPs/FPs taking measures for follow-up with their patients, patients being unreceptive, and concerns as to who would conduct the follow-up.

DISCUSSION

Our survey is the first quantitative study that has revealed some important insights on the challenges faced by GPs/FPs and their interest in subscribing to collaborative services. The four key challenges found were with regards to drug information (DI), health literacy, NEHR/EMR systems and interim follow-up. These findings can help to kickstart conversations among policymakers on the future transformation of primary care.

First, although most GP/FPs agree that there is a benefit to interim follow-up with their patients, the respondents also shed light on the barriers that hinder this. From the results, there is a need to look deeper to find suitable personnel to step up and perform the interim follow-up. Additionally, enablers and barriers should be identified in order for the suitable personnel to take on this role. A systematic review and thematic synthesis by Damarell et al[5] called out policies that frame care delivery systems, for interfering with patient's consultation with their GP. These policies induce "short clinical interactions and disease-focused care".

However, patients are becoming more multimorbid and need more time for interaction with their GP. If care for multimorbid patients in the community can be delivered through MDCTs, interim follow-up by HCPs of other disciplines can benefit patients through increased interaction with a trusted HCP. For example, the systematic review by Martínez-González et al[6] concluded positive impacts of "physician-nurse task shifting" when nurses followed disease-specific protocols in managing chronic diseases, in primary care. It also found that nurses were better in managing secondary prevention of heart disease and dyspepsia, and at reducing cardiovascular risk in diabetic patients. The systematic review, however, was limited by the studies being small-sized, having varied follow-up episodes and were at risk of biases.

In another systematic review and meta-analysis, the included studies looked at pharmacists integrated into general practice clinics that deliver multi-pronged interventions plus follow-up of patients, instead of studies that narrowed on single-interventions/outcomes by pharmacists.[7] These pharmacists performing generalistic roles not only improved management of chronic diseases such as cardiovascular disease and diabetes, but also enhanced the standard and fitness of prescriptions when there was interprofessional communication with the primary care physician. There was better medication adherence and alleviation of drug-related issues, and the indicators of quality of care reflected improvements.

Second, GPs/FPs believe that health literacy should be improved across all adult age groups. The top three areas of health literacy identified that required improvement were lifestyle modifications for ages <40 to 64 years, knowledge of management of their chronic conditions for ages 51 to >65 years, and self-monitoring of health status for ages 51 to >65 years. As mentioned in other studies,[8,9] one way HCPs in MDCTs can help to raise health literacy is by using personalised patient education. Future studies could be designed to find out what knowledge gaps are required to be filled.

Third, the largest gap identified in the NEHR and EMR systems was incomplete information. Incomplete information includes "lack of care plans", "rationale as to why medications were prescribed", and "incomplete medical/medication history by other GPs and private practitioners". As there is a lack of reconciliation of information related to medications, radiology, and medical history, work needs to be done to reconcile information. National IT systems need to be constantly upgraded, and proper reconciliation of history is required. HCPs can reconcile the patients' history and develop a care plan for patients to ensure safe and seamless transitions between care settings. A systematic review and meta-analysis revealed that pharmacy-led medication reconciliation programmes during transitions of care have led to a reduction in medication discrepancies, which in turn lead to safe patient transition.[10] Meanwhile, a randomised trial by Gabbard et al[11] showed that nurse-led integrated healthcare professional-facing electronic health record (EHR) resulted in increased advanced care planning (ACP) documentation. The increased ACP documentation was beneficial in primary care settings such that patients were provided with their desired end-of-life care and undesired care was minimised.

Lastly, about a fifth of GP/FPs expressed insufficiency of their drug information source(s). However, insufficient reason was provided, thus the type of information from the selected DI source(s) that was deemed insufficient was unable to be ascertained. Therefore, further studies are required to find out about the specific areas of insufficiency and the types of support that the GP/FPs need.

Apart from the challenges faced by GP/FPs, another key finding from the survey was that at least two-thirds of respondents were willing to subscribe to services. Similarly in systematic reviews, attitudes of medical practitioners towards interprofessional collaboration with nurses[12,13] and pharmacists[5] were mostly positive and have shown efficacy[14] in managing patients in primary care. For

example, GPs were keen to work with pharmacists for medication reviews,[5] and GP-pharmacist collaboration was effective.[7,15] Moreover, MDCTs in the primary care setting to manage complex chronic conditions have been shown to be effective and facilitate patients' self-management of their own health.[16-18] MOH's Healthier SG White Paper detailed out the different roles of members of the team-based care approach in delivering a "Stronger Primary Care". Members include a Doctor, a Nurse, a Care Coordinator, as well as a Pharmacist and Allied Health Professionals.

LIMITATIONS & FUTURE RESEARCH

In future studies, this study can be scaled up to garner more responses from GP/FPs in this period of Healthier SG implementation. The study team acknowledges that 47 responses could appear to be non-generalisable. However, this is comparable with another study that obtained 31 responses from GPs.[19] The small sample size could be due to concurrent surveys being disseminated to the GP/FPs at the time of data collection. In an attempt to increase the reach of our survey, the survey was disseminated via various social media platforms, the Singapore Medical Association (SMA), and the authors' close professional contacts. Hence, we are satisfied with the sample size.

Some potential mechanisms to expand outreach in the future include using paid surveyors to visit the GP clinics to administer the survey and collaborating with Primary Care Networks (PCN) or the College of Family Physicians (CFPS). Additionally, incentives can be given to complete surveys. The larger outreach can be aimed at validating our findings. Nevertheless, our results still offer meaningful insights and can serve as a basis for further analysis.

CONCLUSION

This study identified challenges faced by GP/FPs in their daily practice. This could present opportunities for Allied Health, Pharmacy, and Nursing to strengthen primary care in light of Healthier SG. Our findings are a start in suggesting what further insights are required to fulfil the unmet needs for the different healthcare disciplines. Future market research is needed prior to the introduction of services between GP/FPs and HCPs of different disciplines.

DISCLOSURE

There are no affiliations or financial involvement with any commercial organisation with a direct financial interest in the subject or materials discussed in the manuscript. The authors declare that they have no conflict of interest in relation to this article.

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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).

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

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The author(s) will suggest ways to apply the new knowledge in clinical practice or to highlight the limitations of its applications, if any.

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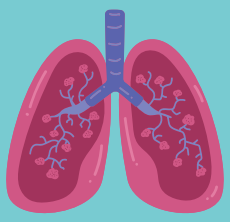
There is currently no treatment for **RSV**[3].

Make RSV prevention a priority

ICU = Intensive Care Unit
*From 2021-2023. N=1332
†From 2021-2023. N(ICU Admissions/Hospitalizations) = 51/1332
‡From 2021-2023. N(28-Day Mortality/Hospitalizations)=72/1332

1. Branche AR;Clin Infect Dis;2022;74:1004-1011
2. CDC. Respiratory Syncytial Virus Infection (RSV) RSV in older Adults. Available at: https://www.cdc.gov/rsv/older-adults/index.html. Last Accessed: May 2025
3. Wee LE;Lancet Reg Health West Pac. 2025;55;1-12



COPD EARLY DIAGNOSIS PROGRAMME

Key Challenges

LIMITED ACCESS to spirometry test and **LOW** diagnosis of COPD

AS A CONSEQUENCE

Majority of patients referred to tertiary hospitals in **LATE STAGE**

PERFORMED BY TRAINED NURSES EQUIPPED WITH OFFICE SPIROMETERS

SPIROMETRY PROGRAMME

To offer spirometry service at the clinic to help with COPD early diagnosis

Clinic Visit Schedule

2 visits per month at every clinic

4 hours per visit

AT LEAST **4 PATIENTS** PER VISIT*

*Eligibility Criteria:

1. Individuals aged over 40 years
2. Current or past history of smoking
3. Clinical indicators suggestive of obstructive respiratory symptoms

What does the spirometry test involve?

- ✓ Pre- and post- bronchodilator assessments
- ✓ Patients are to bring their **OWN** bronchodilator or have one prescribed by their doctor

Results can be used as supporting documentation for CHAS subsidies

NOTE

Test results are forwarded directly to the attending physician.

GSK will NOT have access to any personal patient data

Abbreviation: CHAS, Community Health Assist Scheme; **COPD,** chronic obstructive pulmonary disease.
Footnote: This program is strictly non-promotional and is conducted under the medical department, with no association with any promotional campaigns or products.

FOR MORE INFORMATION, KINDLY CONTACT:

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