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Establishing quality standards for white light upper gastrointestinal endoscopy in Singapore: Consensus statements from the Gastroenterological Society of Singapore

A core group of experts developed 20 consensus statements to improve upper gastrointestinal endoscopy practice. (See full article, p. 766)

Illustration by Maria De-Castro

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Different faces of atrial septal aneurysm

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Quality in gastroscopy: Consensus statements from the Gastroenterological Society of Singapore

Sabrina Xin Zi Quek^{1,2} MMed, Calvin J Koh^{1,2,3} FRCP

The upper gastrointestinal (UGI) endoscope is often the first scope that a novice endoscopist handles and learns to use. However, being able to navigate the UGI tract safely with proper technique to minimise complications, such as bleeding and perforation, is not equivalent to performing a complete high-quality examination of the UGI tract. A truly complete examination is one that not only avoids procedural complications but also enables careful mucosal visualisation, accurate detection of subtle pathology and ultimately helps to lower post-endoscopic upper gastrointestinal cancer (PEUGIC) rates.

Although numerous guidelines from endoscopic societies around the world have sought to define quality in upper endoscopy, it remains essential to contextualise these recommendations within the local clinical practice setting. The risk profiles for UGI malignancies, the endoscopic case mix and the workflow nuances—beginning even before the patient steps into the endoscopy suite and extending through post-procedure reporting and follow-up—can differ markedly between countries. Establishing Singapore consensus standards ensures that quality indicators remain both relevant and actionable within the country's healthcare context. In this issue of the *Annals*, Yim et al. provide clear, evidence-informed, practice-oriented and Singapore-adapted standards that set the foundation for quality benchmarking and continuous improvement across institutions.¹

Yim et al. divided the statements into pre-requisites, pre-, intra- and post-procedure components, with the statements targeted to (1) ensure the safety, completeness and quality of the procedure; (2) ensure adequate documentation; and (3) promote competence, accountability and a mechanism for quality auditing so that improvements can be made over time.

In terms of competence to independently perform a UGI endoscopy, in Singapore, a minimum of 200 UGI endoscopies have to be performed for accreditation. The authors acknowledge that while this threshold defines basic competency, the volume required to maintain proficiency may vary between

novice and experienced endoscopists, depending on individual case exposure and complexity. Hence, they opted against recommending a fixed number. In terms of sedation, Yim et al. also advocated for endoscopy units to adopt internationally recognised sedation guidelines, with the sedationist—who is often the endoscopist—having proper training and/or accreditation to administer moderate sedation. This is particularly relevant in the Singapore context, where moderate sedation remains the standard in most diagnostic oesophago-gastro-duodenoscopy. Adequate training not only ensures patient safety but also optimises procedural comfort and completion rates, forming a key component of the overall quality framework.

Ensuring the safety of a UGI endoscopy begins from the first point of patient–physician contact prior to listing for the procedure. The pre-procedure statements emphasise that all endoscopies should be appropriately indicated and clearly documented. Informed consent must be obtained and documented and pre-procedure assessment of fitness, including relevant medical history, physical examination and evaluation of sedation-related risks, should be performed by the endoscopist or a medical professional deemed competent to explain the procedure, its benefits and potential risks. In Singapore, this responsibility may be delegated under appropriate supervision. Safety is further reinforced through the use of a team pause or time-out, supported by a documented safety checklist verifying patient identity, procedure details, allergies and key comorbidities. In the Singapore context, it is important to emphasise that this is truly a team-based process, with endoscopy nurses playing a critical role in patient safety. They often initiate the time-out, and lead checklist verification of patient and procedural details and excised specimens—tasks that may not fall under the endoscopist's direct remit but nonetheless contribute significantly to procedural safety, efficiency and the avoidance of preventable errors. During the procedure, the patient needs to be monitored at regular intervals with documentation of all medications administered

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and any adverse events encountered. Following the procedure, patients should be monitored until recovery criteria are met, with clear documentation of discharge status and post-procedure instructions and a means to monitor for post-procedure and delayed complications.

A high-quality examination must not miss subtle lesions, and should help make the diagnosis and determine how to manage the patient. In Singapore, gastric and oesophageal cancers are the 7th and 19th most common cancers, and the 6th and 13th² leading causes of cancer mortality, respectively. A key prognostic factor of survival is the stage at which the cancer is diagnosed, with some early-stage lesions amenable to endoscopic resection. Hence, improving the diagnostic accuracy and lesion detection rates in routine diagnostic endoscopy can have a direct impact on national cancer outcomes. The statements reflect the need for adequate time for careful examination using high-definition video endoscopy. Emphasis was placed on ensuring appropriate time allocation based on the indication and complexity of the case, with a recommended minimum inspection time of 7 minutes with adequate visualisation, thorough mucosal evaluation and optimised lesion detection. Strong focus was also placed on the photo documentation of 10 standard anatomical landmarks, providing objective evidence of completeness and facilitating audit of endoscopic quality. Beyond these procedural aspects, documentation remains a cornerstone of quality. Comprehensive and accurate reporting, including lesion description and use of standardised terminology and classification, is crucial not only for clinical care continuity but also for institutional quality monitoring and training feedback.

The following points were not directly addressed by the authors in this consensus but merit further discussion and form the basis for future clinical research. First, while Yim et al. rightly highlighted the importance of establishing a system to monitor delayed complications and adverse events as a means to drive continual quality improvement, one could further argue that the systematic monitoring of PEUGIC rates³ is equally essential. Such monitoring serves as a national quality benchmark, ensuring that optimal care is delivered to patients and critical feedback is provided to help identify gaps and improve the detection rates over time.

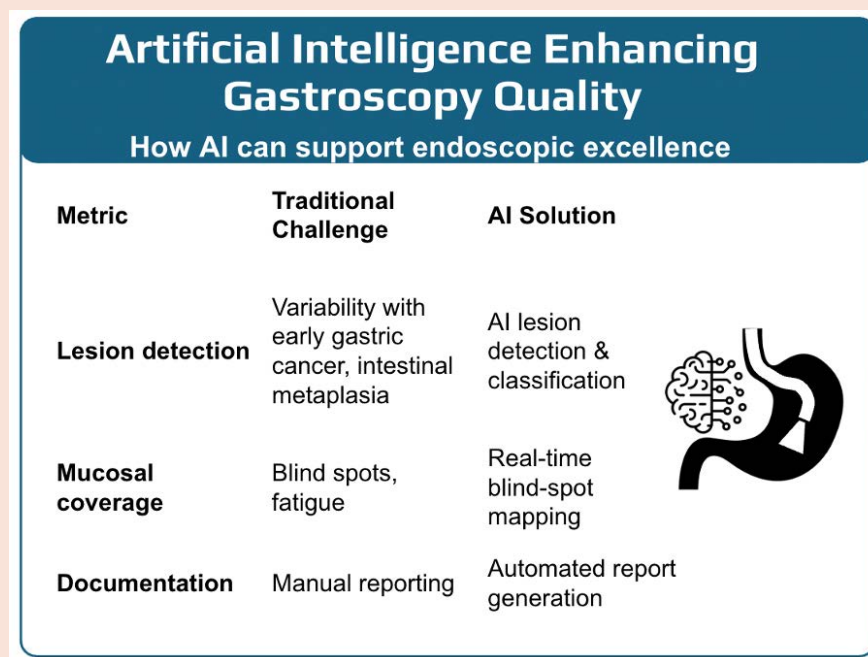
Second, although the risks of aspiration and the need for adequate fasting were briefly mentioned in the discussion of Statement 4, this issue warrants further attention in light of the increasing number of patients receiving glucagon-like peptide-1 receptor agonists. These agents are known to delay gastric

emptying and may increase aspiration risk during sedation and UGI endoscopy. Similarly, as the use of sodium-glucose cotransporter-2 inhibitors becomes more prevalent, their potential impact on endoscopic safety—particularly the risk of euglycaemic ketoacidosis associated with prolonged fasting—also deserves consideration. While further studies are needed to clarify these effects, endoscopy societies in Singapore should consider following the lead of the American Society for Gastrointestinal Endoscopy⁴ in issuing guidance on the peri-endoscopic management of patients taking these medications.

Finally, as the focus of these guidelines was that of white light endoscopy, the use of image-enhanced endoscopy and artificial intelligence (AI)-assisted endoscopy was not discussed in depth. However, these technologies are rapidly advancing and becoming integral to modern diagnostic endoscopy. As AI tools move from research into clinical practice, the establishment of clear, evidence-based guidance is critical to ensure safe, equitable and effective adoption. The Japan Gastroenterological Endoscopy Society⁵ recently released a position statement comprising 9 key recommendations addressing quality assurance, cost-effectiveness, safety, medico-legal responsibility and preparatory training for AI in endoscopy. This structured approach underscores the need for governance and multidisciplinary oversight as Singapore integrates AI into endoscopic workflows. Similarly, findings from a regional survey of Asian endoscopists⁶ revealed both optimism and caution toward AI adoption, with concerns centred on accountability, reimbursement and standardisation across healthcare systems. These insights highlight the importance of developing regionally relevant frameworks that balance innovation with practicality (Fig. 1). Moving forward, national societies such as the Gastroenterological Society of Singapore are well-positioned to contextualise international guidance and lead the development of consensus recommendations on AI-assisted endoscopy tailored to the Singapore and wider Asia-Pacific context.

The publication of this consensus document may serve to instil a shared culture of quality and accountability in upper endoscopy practice across Singapore. The 20 statements not only serve as a framework for auditing endoscopy centres but also as a baseline upon which future enhanced imaging, AI integration and advanced training standards can be built. By embracing these standards and embedding them into daily workflow, endoscopists can collectively raise the bar for diagnostic excellence, patient safety and clinical outcomes in UGI endoscopy.

Fig. 1. Artificial intelligence (AI) enhancing gastroscopy quality.



Ethics statement

Not applicable, as no study participants are involved.

Declaration

The authors declare there are no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript.

Keywords: artificial intelligence, endoscopy, gastroenterology, gastroscopy, quality indicators

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High-risk human papillomavirus genotype prevalence in Singapore cervical samples: Implications for clinical management

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ABSTRACT

Introduction: Human papillomavirus (HPV) causes over 95% of cervical cancers. The American Society for Colposcopy and Cervical Pathology (ASCCP) guidelines support a risk-based approach using the most informative test, which may include high-risk (HR) or extended genotyping. Most laboratories perform partial genotyping. This study reports findings from the comprehensive genotyping of all 14 HR HPV genotypes in cervical samples from the Singapore population.

Methods: A total of 2497 cervical specimens collected in ThinPrep PreservCyt vials underwent full HPV genotyping using real-time polymerase chain reaction TOCE technology (Seegene Inc, Seoul, South Korea). Among these, 327 (13.1%) tested positive for HPV. Cytology results were available for 275 (84.1%) of these HPV-positive cases. The authors examined genotype prevalence and cytology correlations, and compared follow-up management under the Society for Colposcopy & Cervical Pathology of Singapore (SCCPS) guidelines versus ASCCP 2019 guidelines.

Results: HPV52 and 58 were the most prevalent genotypes, accounting for 32.2% of all detected HPV genotypes. Co-infections were seen in 20.2% of samples. Among 31 (9.5%) HPV16/18 cases, most had normal cytology, though some showed atypical or low-grade changes. Under the ASCCP guidelines for primary screening, 16.8% of cases could defer to repeat HPV testing in 1 year instead of immediate cytology triage under SCCPS. In co-testing, ASCCP-guided management reduced colposcopy referrals by 7.4% since these cases would only require repeat HPV testing in 1 year.

Conclusion: Comprehensive HPV genotyping enhances risk stratification and enables more efficient patient management. Compared to SCCPS, the ASCCP guidelines reduce unnecessary procedures while preserving safety, supporting broader adoption of full genotyping and risk-based triage in cervical screening programmes in Singapore.

Keywords: cancer, epidemiology, high-risk HPV genotyping, infectious diseases, obstetrics and gynaecology, oncology

CLINICAL IMPACT

What is New

- Using the Seegene assay, 55 cases (16.8%; 55/327) were found to be positive for HPV59/56/66. These are genotypes often missed by partial genotyping methods.
- All were negative for the other 11 high-risk genotypes, making them eligible for deferred testing under the American Society for Colposcopy and Cervical Pathology (ASCCP) guidelines.

Clinical Implications

- Comprehensive genotyping improves risk stratification.
- Applying the ASCCP co-testing guidelines results in a 7.4% reduction in unnecessary colposcopy referrals, supporting safer and more cost-effective cervical screening in Singapore.

INTRODUCTION

The human papillomavirus (HPV) is a primary aetiological agent responsible for more than 95% of cervical diseases and cancers globally, presenting a significant public health concern. HPV comprises numerous genotypes, among which 14 are classified as high-risk (HR) due to their strong association with the progression of cervical cancer. The American Society for Colposcopy and Cervical Pathology (ASCCP) 2019 guidelines, also known as the Enduring Guidelines, use a risk-based approach to manage abnormal cervical screening results. Recognising the specific HR HPV genotype present in patients is critical, as the Enduring Guidelines recommend a stratified risk-based clinical management approach tailored to individual HPV genotype risks.

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The World Health Organization has set an ambitious global mission to eliminate cervical cancer, defined by the 90-70-90 targets by 2030: 90% of girls fully vaccinated with the HPV vaccine by age 15; 70% of women screened using high-performance tests, which refer to HPV-based testing rather than cytology, by age 35 and again by age 45; and 90% of women identified with cervical disease receiving appropriate treatment.¹

Despite these guidelines and objectives, most laboratories in Singapore currently perform only partial HPV genotyping, typically limited to identifying a subset of HPV genotypes. This substantially restricts the clinical utility of these results, potentially undermining effective patient management. Limited genotyping prevents healthcare providers from making fully informed decisions based on comprehensive genotype-specific risk assessment.

To address this clinical gap, this study aims to implement comprehensive genotyping for all 14 HR HPV genotypes in cervical swab samples collected in Singapore from October 2024 to June 2025. The primary objectives are to determine the prevalence and distribution of individual HPV types, investigate co-infection patterns and evaluate the relative significance of HR HPV genotypes HPV16 and 18 compared to other HR genotypes within the Singapore population. Moreover, cytology results are correlated with genotypic data where available, providing further clinical insights. An additional objective is to compare the differences in clinical management recommendations between primary HPV screening and co-testing strategies outlined in the Society for Colposcopy & Cervical Pathology of Singapore (SCCPS) and the ASCCP 2019 Risk-Based Management Consensus guidelines.^{2,3}

METHODS

Cervical specimens (n=2497) were collected in ThinPrep PreservCyt collection vials and submitted to iGene Laboratory, Singapore for routine HR HPV deoxyribonucleic acid (DNA) polymerase chain reaction (PCR) screening. These samples were collected from primary care clinics and specialist Obstetrics and Gynaecology centres across Singapore. Of the 2497 cervical samples analysed, nationality data were available for 1720 cases. Among these, 1015 (59%) were from Singaporean citizens. Of the Singaporean cases with age data available, 56 (5.5%) were aged below 30 years, while 954 (94.5%) were aged 30 and above. Percentages reported are based on cases with available demographic data. Prior to nucleic acid extraction, samples underwent standardised pre-treatment by transferring 1 mL of the ThinPrep sample into a Hologic Aptima Specimen

Transfer tube, followed by gentle inversion 3–5 times. Nucleic acid extraction was performed using the MagMAX Viral/Pathogen Nucleic Acid Isolation Kit (Thermo Fisher Scientific, Waltham, MA, US) on the KingFisher Flex Purification System (Thermo Fisher Scientific, Waltham, MA, US), according to the manufacturer's instructions and internal standard operating procedures.

HPV genotyping was performed using the Seegene Allplex HPV HR Detection assay (Seegene Inc, Seoul, South Korea), which employs multiplex real-time PCR incorporating Tagging Oligonucleotide Cleavage and Extension (TOCE) technology. This platform detects and distinguishes 14 HR HPV genotypes (HPV16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68) in a single reaction tube. TOCE technology leverages target-specific tagging oligonucleotides and signal generation control through a single melting curve per target, offering precise and reliable genotyping with high sensitivity and specificity. PCR amplification was carried out on the CFX96 Dx System (Bio-Rad Laboratories, Hercules, CA, US), using CFX Manager Dx Software version 3.1 (Bio-Rad Laboratories, Hercules, CA, US). Genotyping analysis was performed using Seegene Viewer software (Seegene Inc, Seoul, South Korea), which, along with the Seegene Allplex HPV HR Detection assay, is approved by the Health Sciences Authority for clinical use in Singapore.

For samples with available cytology, Papanicolaou test (Pap smear) test results were retrieved and categorised according to the Bethesda System for Reporting Cervical Cytology.⁴ These were compared to the corresponding HPV genotypes to evaluate co-infection profiles and genotype-cytology correlations.

In addition to the descriptive analysis of genotype prevalence and co-infection patterns, all HPV-positive cases with or without cytology were reviewed to assess clinical management recommendations based on both the SCCPS and ASCCP guidelines.^{2,3} Each sample was stratified according to HPV genotype and cytology status. Appropriate management actions (e.g. colposcopy, cytology triage or repeat HPV testing) were determined under both guideline frameworks. Concordance and discrepancies in management pathways were documented to assess the impact of guideline selection on clinical outcomes and resource utilisation.

Descriptive statistics were used to summarise HPV genotype prevalence, co-infection rates and cytology results. Proportions were compared using Fisher's Exact test. A *P* value of <0.05 was considered statistically significant. Statistical analyses were performed using GraphPad Prism version 5.0 (GraphPad Software, San Diego, CA, US).

RESULTS

Of the total 2497 specimens received, 327 tested positive for HPV DNA using real-time PCR, yielding a positivity rate of 13.1% (95% confidence interval 11.8–14.5).⁵

HPV genotype prevalence

Among the 14 HR HPV genotypes where 401 HPV genotypes were detected, HPV52 (20.7%, n=83) and HPV58 (11.5%, n=46) were the most prevalent in the study cohort. There were 4 cases (1.2%, n=4) with co-infections involving both HPV52 and 58. In total, 125 cases (38.2%; 125/327) had HPV52/58 and were significantly more prevalent compared to HPV16/18 (9.5%; 31/327) among HPV-positive samples ($P<0.0001$, Fisher's Exact test). These findings highlight the dominant presence of non-HPV16/18 genotypes, in particular HPV52 and 58 in the Singapore population, consistent with regional trends in Southeast Asia.^{6,7}

HPV co-infection distribution

Most samples (79.8%, n=261) tested positive for a single genotype, while 59 cases (18.0%) showed co-infection with 2 genotypes, and 7 (2.1%) had 3 or more. While most cases involved a single HR HPV type, the presence of multiple infections may impact persistence and disease progression.⁸

Comparison with cytology results

Among the 327 HPV-positive cases, 275 had concurrent liquid-based cytology (Pap smear) performed, enabling co-testing analysis. Among these, 196 (71.3%) showed normal cytology (negative for intraepithelial

lesion or malignancy [NILM]); 33 (12.0%) demonstrated atypical squamous cells of undetermined significance (ASC-US); 35 (12.%) showed low-grade squamous intraepithelial lesions (LSIL); 3 (1.1%) had atypical squamous cells, cannot exclude high-grade squamous intraepithelial lesions (HSIL) (ASC-H); 1 (0.4%) showed dysplasia/cervical dysplasia (CIN 1–2); and 4 (1.5%) had HSIL (Table 1).

Cytology results in HPV16/18-positive cases

Among the 327 HPV-positive cases, 31 (9.5%) tested positive for HPV genotype 16/18. In accordance with SCCPS and ASCCP guidelines, these individuals would be directly referred for colposcopy regardless of cytology results due to the high oncogenic risk associated with these genotypes. These cases were compared with available cytology results (n=24): 17 (70.8%) had NILM, 1 (4.2%) demonstrated ASC-US, 2 (8.3%) showed LSIL, 2 (8.3%) had ASC-H and 2 (8.3%) had LSIL with ASC-H (Table 2). No HSIL or CIN2+ cases were observed in this group. Nonetheless, due to the consistently high oncogenic potential of HPV16 and 18, current ASCCP and SCCPS guidelines recommend immediate colposcopy referral for individuals testing positive for these genotypes, regardless of cytology status. This approach ensures that early high-grade lesions are not missed, even in the presence of cytological findings that may appear benign or equivocal.

Cytology results in non-HPV16/18-positive cases

For the 251 cases positive only for non-HPV16/18 genotypes where cytology results are available, 179 (71.3%) had NILM. The remaining cytological findings

Table 1. Number of HPV positive cases (n=327) with available cytology results (n=275).

Cytology group	Description	No. of samples	Percentage (%)
HSIL	High-grade squamous intraepithelial lesion	4	1.5
Dysplasia/CIN 1–2	Moderate abnormal changes, possibly cervical intraepithelial neoplasia 2	1	0.4
LSIL, ASC-H	Mixed low- and possibly high-grade findings	3	1.1
ASC-H	Atypical squamous cells, cannot exclude HSIL	3	1.1
LSIL	Low-grade squamous intraepithelial lesion	35	12.7
ASC-US	Atypical squamous cells of undetermined significance	33	12.0
NILM	Negative for intraepithelial lesion or malignancy—normal cytology	196	71.3
Total		275	

Note: The table includes cytology results for 275 out of 327 HPV-positive cases. Cytology results are classified according to the Bethesda system. Percentages are based on total cases with available cytology.

Table 2. Comparison of cytology results between HPV16/18 and non-HPV16/18 genotypes.

Cytology group	HPV16/18 (n=24)	Non-HPV16/18 (n=251)	P value (Fisher's Exact) ^a	Total (n=275)	HPV 16/18 (%)	Non-HPV 16/18 (%)
NILM	17	179	1.0000	196	70.8	71.3
ASC-US	1	32	0.3291	33	4.2	12.7
LSIL	2	33	0.7498	35	5.7	13.1
ASC-H	2	1	0.0208 ^b	3	8.3	0.4
LSIL with ASC-H	2	1	0.0208 ^b	3	8.3	0.4
Dysplasia / CIN 1–2	0	1	1.0000	1	0.0	0.4
HSIL	0	4	1.0000	4	0.0	1.6

ASC-H: atypical squamous cells, cannot exclude HSIL; ASC-US: atypical squamous cells of undetermined significance; HSIL: high-grade squamous intraepithelial lesion; LSIL: low-grade squamous intraepithelial lesion; NILM: negative for intraepithelial lesion or malignancy

^a P values calculated using Fisher's Exact test (GraphPad Prism version 5.0 [GraphPad Software, San Diego, CA, US]).

^b Statistically significant differences observed for ASC-H and LSIL with ASC-H groups but based on small numbers.

included ASC-US (12.7%, n=32), LSIL (13.1%, n=33), ASC-H (0.4%, n=1), mixed findings of LSIL with ASC-H (0.4%, n=1), dysplasia/CIN 1–2 (0.4%, n=1) and HSIL (1.6%, n=4) (Table 2). In total, among the HPV16/18-positive cases with cytology, 6 (25.0%; 6/24) had abnormal results, compared to 72 (28.7%; 72/251) in non-HPV16/18 cases ($P=1.0000$, Fisher's Exact test), indicating no statistically significant difference. These findings highlight the importance of full HPV genotyping in identifying women at elevated risk for CIN2+, while also helping to avoid unnecessary immediate interventions.

Importantly, 55 cases (16.8%; 55/327) that tested positive for HPV59/56/66 and negative for HPV16/18 would qualify for deferred repeat testing in 1 year under the ASCCP guidelines. Of these cases, 48 (87.3%) had available cytology results and none had high-grade findings (Table 3). This highlights the value of extended genotyping to identify low-risk profiles and avoid unnecessary referrals, ensuring that healthcare resources are focused on individuals at genuinely elevated risk.

DISCUSSION

Regional genotype patterns and clinical implications of co-infection

The findings confirm the high prevalence of non-HPV16/18 HR genotypes in the Singapore population, particularly HPV52 and 58. Together, they accounted for 32.2% of all HR HPV genotypes (Fig. 1). Such findings are consistent with previous epidemiological studies in East and Southeast Asia, where HPV52 and 58 are reported as the most common non-vaccine types.^{7,8} Their oncogenic potential and frequent presence among HPV-positive cases further reinforce the need to incorporate them into screening and vaccine considerations.

Furthermore, this study revealed a notable proportion of co-infections where 20.2% of HPV-positive samples harboured 2 or more genotypes (Fig. 2). Although the clinical significance of co-infections remains debated, some evidence suggests a higher likelihood of persistent infection or pro-

Table 3. Number of HPV59/56/66 cases (non-HPV16/18) with available cytology results (n=48).

Cytology group	Description	No. of samples	Percentage (%)
LSIL	Low-grade squamous intraepithelial lesion	7	14.6
ASC-US	Atypical squamous cells of undetermined significance	9	18.8
NILM	Negative for intraepithelial lesion or malignancy—normal cytology	32	66.7
Total		48	

Note: The table includes 48 cases positive for HPV59/56/66, excluding any cases with HPV16/18. Cytology results are classified according to the Bethesda system.

Fig. 1. Distribution of high-risk HPV genotypes among 327 HPV-positive cases, showing HPV52 and 58 as the most prevalent types in the study cohort.

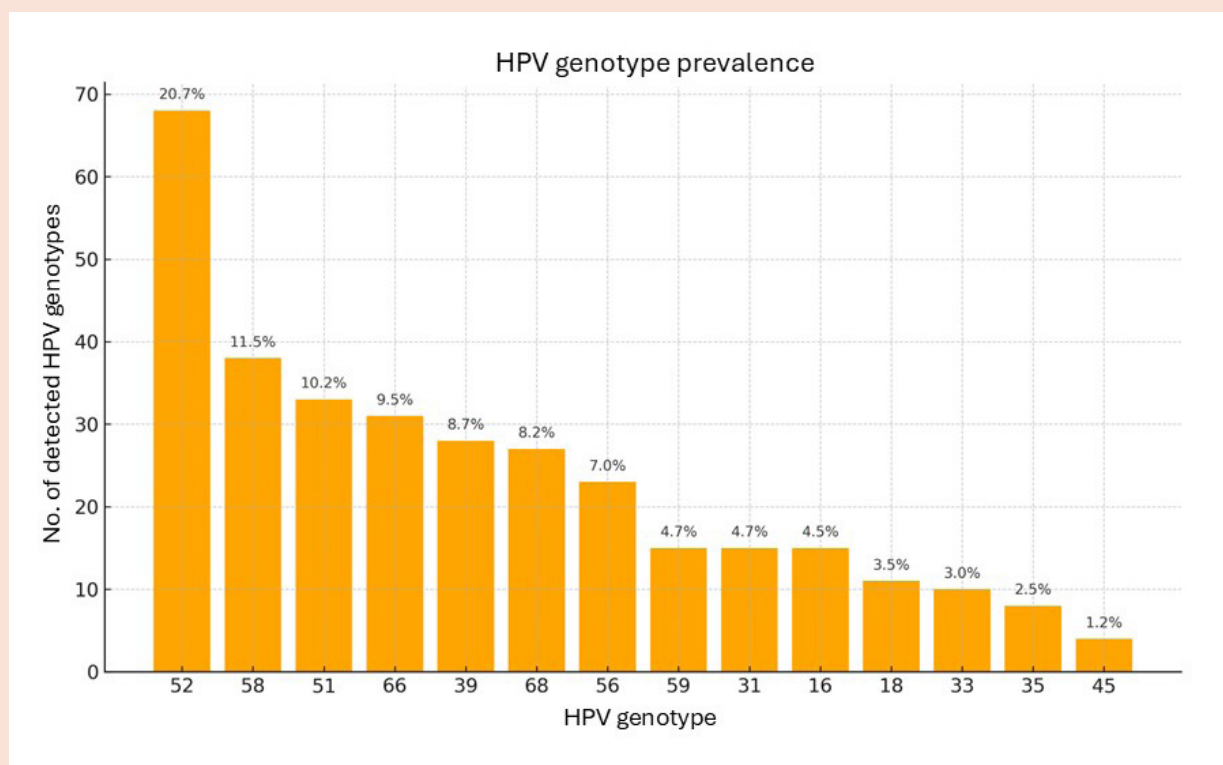
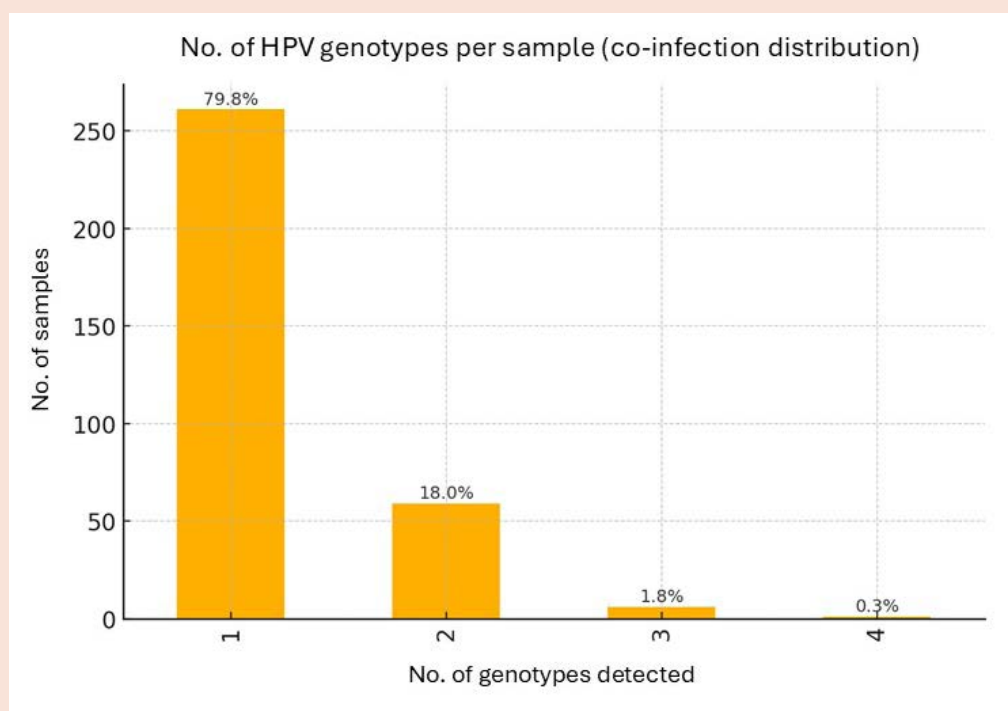


Fig. 2. Co-infection distribution showing the number of HPV genotypes detected per sample. Most cases (79.8%) had a single genotype, while 20.2% showed multiple infections.



gression to high-grade lesions in the presence of multiple HPV types.⁹

Triage and management stratification

The remaining 296 (90.5%) HPV-positive cases tested positive for 1 or more of the other 12 HR genotypes (i.e. excluding HPV16 and 18). In accordance with SCCPS guidelines for primary screening, these cases were subjected to cytology triage. Those with negative cytology (NILM) would be scheduled for repeat HPV testing in 1 year, while individuals with abnormal cytology ($\geq$ ASC-US) would be referred for colposcopy. This stratification allowed a direct comparison of the SCCPS's recommendations with international benchmarks, such as the 2019 ASCCP guidelines for HPV primary screening (without co-testing).

When comparing follow-up management strategies for primary HPV screening between the SCCPS and ASCCP guidelines, a significant difference in downstream procedures was observed. Under SCCPS, all 296 non-HPV16/18 positive cases would be directed to immediate cytology triage following a positive HPV test. In contrast, the ASCCP guidelines adopt a more risk-stratified approach, whereby only 241 of these cases (73.7%) (positive for non-HPV16/18 genotypes, such as HPV31, 33, 35, 39, 45, 51, 52, 58, or 68) would undergo cytology triage, while the remaining 55 cases (16.8%) could defer management and undergo repeat HPV testing after 1 year (Fig. 3).

This highlights the potential of ASCCP's framework to reduce unnecessary cytological evaluations, thereby conserving clinical resources and reducing patient anxiety, without compromising the safety of screening outcomes.

When analysing clinical management outcomes for cases undergoing HPV/cytology co-testing, notable differences were observed between SCCPS and ASCCP guidelines. Colposcopy referrals decreased from 36.5% (103/282) under SCCPS to 29.1% (80/275) under ASCCP, representing a 7.4% reduction. Although this difference did not reach statistical significance ($P=0.0711$, Fisher's Exact test), the observed trend suggests a meaningful potential to ease the burden on specialist services and reduce patient exposure to unnecessary invasive procedures. In addition, a greater proportion of cases—70.9% ($n=195$)—would be managed with repeat HPV testing in 1 year under ASCCP, compared to 63.5% ($n=179$) under SCCPS (Fig. 4). This 7.4% increase in deferred follow-up highlights the utility of ASCCP's risk-based approach, which prioritises long-term monitoring for lower-risk cases while preserving clinical vigilance for HR scenarios. These findings suggest that the adoption of ASCCP guidelines may support more efficient resource allocation and reduce patient anxiety, without compromising clinical safety. However, it is important to note that the ASCCP risk-based management framework was developed using

Fig. 3. Comparison of clinical management categories under SCCPS and ASCCP for primary HPV screening. ASCCP guidelines allowed 55 cases to defer to repeat testing, while SCCPS directed all to follow-up cytology or immediate colposcopy.

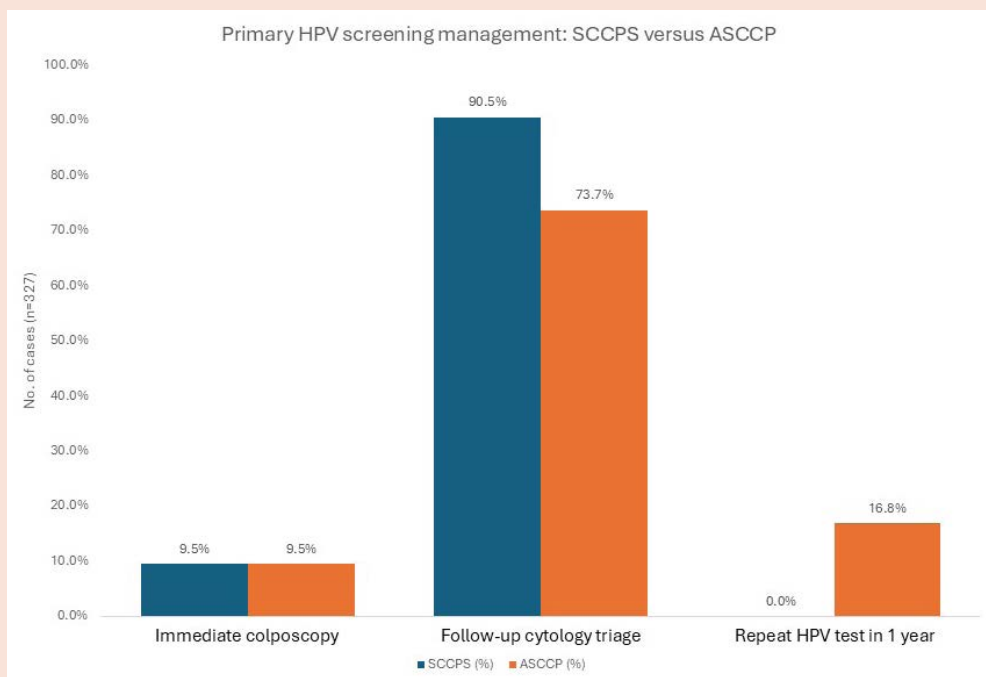
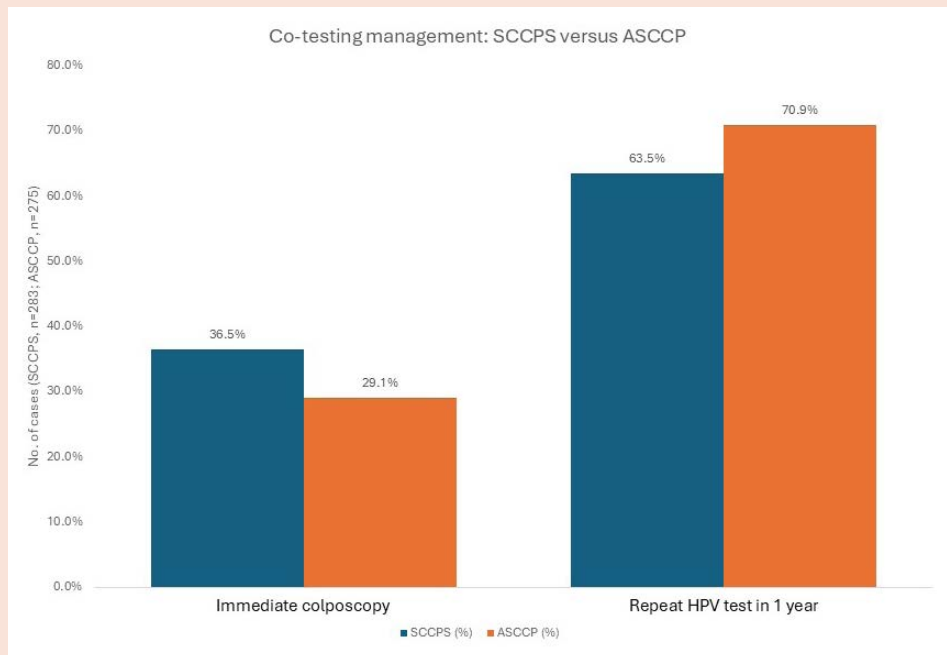


Fig. 4. Comparison of SCCPS and ASCCP co-testing management recommendations. ASCCP resulted in fewer colposcopy referrals ($n=80$) and more cases managed with repeat HPV testing ($n=195$) compared to SCCPS ($n=103$ and $n=179$, respectively).



longitudinal datasets from specific US Food and Drug Administration-approved platforms such as BD Onclarity HPV assay and Cobas 4800 HPV test. For instance, BD Onclarity groups certain genotypes together (e.g. HPV33 and 58, HPV56/59/66), limiting precise genotype-specific risk assessment. In contrast, the Seegene Allplex HPV HR Detection assay used in this study provides full individual genotyping of all 14 HR types, which may offer a more refined understanding of genotype-associated risk. Nonetheless, the Seegene assay has not yet been incorporated into the datasets that informed the ASCCP risk models. Large-scale prospective studies are therefore needed to establish genotype-specific risk estimates applicable to this platform and to evaluate its utility within an ASCCP-aligned management framework.

In this study, all cases testing positive for HPV16/18 ($n=31$) would be referred for immediate colposcopy under both SCCPS and ASCCP guidelines due to their high oncogenic potential. However, when examining the approach for non-HPV16/18 genotypes, key differences between the guidelines emerge. Under SCCPS guidelines, all 296 (100.0%) non-HPV16/18 cases require follow-up cytology triage. In contrast, the ASCCP guidelines adopt a more risk-based strategy where only 241 (73.7%) of these cases would undergo cytology triage, while 55 cases (16.8%) could safely defer to a repeat HPV test in 1 year (Fig. 3). This more tailored approach reduces unnecessary cytology tests

and supports resource optimisation without compromising patient safety.

There are several limitations in this study. First, the number of samples with paired cytology results was relatively small ($n=275$), which may limit the strength of genotype-cytology correlations. Second, the clinical indications for testing and patients' medical histories were not available. It was assumed that all samples were submitted for routine cervical cancer screening, although this could not be independently verified. Third, while the findings highlight the genotype distribution in a screened population, the absence of biopsy-confirmed CIN2+ or cancer data limits the interpretation of genotype-specific oncogenic risk. Prospective studies with histological endpoints are necessary to evaluate clinical outcomes more definitely.

CONCLUSION

Although individual-level clinical data were unavailable, partial demographic information suggests that the cohort reflects the Singapore screening population. Nationality data were available for over 68% of cases, with the majority being Singaporean residents. Nevertheless, this study demonstrates the value of comprehensive HR HPV genotyping in cervical screening, especially in the Singapore population where non-HPV16/18 genotypes such as HPV52 and 58 are highly prevalent. Comprehensive HPV genotyping combined with cytology improves risk

stratification and enables more targeted management. Risk-based frameworks such as SCCPS and ASCCP help avoid overtreatment, enhance clinical outcomes and conserve resources by identifying cases suitable for conservative follow-up instead of immediate colposcopy.

Ethics statement

This study utilised strictly de-identified data that was anonymised prior to collection and analysis by the research team. In accordance with the National Healthcare Group Domain Specific Review Board policy, this study is classified as Review Not Required and defined as non-human subject research.

Declaration

The authors declare there are no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript. All authors have no conflicts of interest to declare. This research received no specific grant from any funding agency. The authors used ChatGPT (OpenAI, San Francisco, CA, US) to refine language, check grammar and improve clarity during manuscript preparation. The authors take full responsibility for the content generation and interpretation of the manuscript.

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Establishing quality standards for white light upper gastrointestinal endoscopy in Singapore: Consensus statements from the Gastroenterological Society of Singapore

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ABSTRACT

Introduction: Oesophago-gastro-duodenoscopy (OGD) is the gold standard for evaluating upper gastrointestinal (UGI) symptoms. However, the quality of endoscopic examinations varies widely. This paper, initiated by the Gastroenterological Society of Singapore (GESS), aims to standardise best practices and enhance OGD procedure quality in Singapore.

Methods: A core group of 6 experienced gastroenterologists conducted a comprehensive literature review, referencing established international guidelines. They developed preliminary statements, which underwent 2 rounds of formal voting by a broader group of consultant-level gastroenterologists. Statements were reviewed, modified and re-evaluated using the Delphi process, and assigned levels of evidence and recommendation using the US Preventive Services Task Force model. The threshold for acceptance of statements was agreed to be 80% or higher.

Results: Twenty consensus statements were finalised, covering pre-requisite, pre-procedure, intra-procedure and post-procedure quality indicators.

Conclusion: The GESS consensus statements provide recommendations for institutions in Singapore to establish quality standards for white light UGI endoscopy, facilitating high-quality, safe and accurate endoscopic care.

Keywords: consensus guideline, endoscopy practice standard, Gastroenterological Society of Singapore, oesophago-gastro-duodenoscopy, upper gastrointestinal symptoms

CLINICAL IMPACT

What is New

- This consensus provides a unified set of quality standards for performing white light upper gastrointestinal (UGI) endoscopy in Singapore, guiding institutions to establish standardised best practices for OGD, ensuring high quality, safe and accurate endoscopic care.
- It can also reduce variability in practice and can potentially improve clinical outcomes.

Clinical Implications

- The consensus may serve as a benchmark for auditing and continuous quality improvement in endoscopy services across Singapore, potentially aiding future healthcare policies and research directions.

mucosa, facilitates tissue sampling and allows for therapeutic interventions when necessary.¹

Advances in technology over the past few decades have improved endoscopic image resolution significantly, resulting in high-resolution white light endoscopy.² Enhanced endoscopic imaging has led to better detection and characterisation of gastric lesions, as well as improved accuracy in delineating margins prior to resection.³ As the capabilities of advanced endoscopy continue to grow, enhancing the quality of routine endoscopic procedures is a crucial step in achieving high-quality, safe, accurate, patient-centred and accessible endoscopic care.

Although technical skills can be acquired through repetitive learning and proctorship,^{1,4,5} the actual execution of a high-quality examination varies

INTRODUCTION

Oesophago-gastro-duodenoscopy (OGD) is the gold standard for examining upper gastrointestinal (UGI) symptoms. It enables direct visualisation of the

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significantly. Thus, this study aims to standardise best practices across the field and enhance the overall quality of OGD procedures in Singapore.

METHODS

The Gastroenterological Society of Singapore (GESS) initiated the formation of a core group comprising 6 experienced gastroenterologists from public and private practice in Singapore. The core group nominated senior gastroenterologists and experienced peers as part of the voting panel. Voters were encouraged to discuss and seek input from their colleagues in this area prior to voting, and this included additional input from non-voting gastroenterologists, surgeons, nurses and pathologists in relevant aspects. The population, intervention, comparator, outcome (PICO) framework was used to create focused clinical questions that are relevant to quality in upper GI endoscopy practice. A computerised literature search was performed using PubMed, Embase and the Cochrane Library up to 2025 to identify relevant research papers, conference abstracts and existing guidelines. Searches were limited to articles published in English and focused on terms with “quality in endoscopy,” “quality in OGD” and “quality in EGD.” Bibliographies and references were also reviewed.

Relevant guidelines were identified and filtered for relevance, particularly the following key publications: American Society for Gastrointestinal Endoscopy (ASGE)’s *Quality Indicators for GI Endoscopic Procedures* (2015),⁶ *Quality Indicators for Upper GI Endoscopy* (2025),⁷ British Society of Gastroenterology and Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland (BSG/AUGIS)’s *Position Statement: Quality Standards in Upper Gastrointestinal Endoscopy* (2017),¹ and European Society of Gastrointestinal Endoscopy (ESGE)’s *Performance Measures for Upper Gastrointestinal Endoscopy* (2016).⁸ Based on these documents, 20 preliminary statements were developed.

These 20 statements underwent 2 rounds of formal voting. The voting process was conducted via email, involving a broader group of endoscopists of at least consultant level, practicing in both public healthcare institutions and private hospitals across Singapore. A total of 27 voters and 30 voters responded in the first and second rounds, respectively.

Voters assigned rated each statement using a 5-point scale (a = accept completely, b = accept with some reservation, c = accept with major reservation, d = reject with reservation, e = reject completely), with ≥80% agreement (either a or b votes) required for inclusion. Each statement was assigned a relevant level of evidence and recommendation, following the model established by the US Preventive Services Task Force (USPSTF) (Table 1).⁹ The authors

collectively agreed that it was easier to adopt the USPSTF framework during the grading of recommendations, as one of the key references was aligned to a similar framework applied to the PICO-derived statements that are pertinent to the Singapore setting. If consensus was not achieved, statements were reviewed, modified and re-evaluated using the Delphi process, until there was sufficient agreement to either include or discard the statement. In cases where a strong recommendation has been made despite weak evidence, this has been arrived at via expert consensus based on a pragmatic approach, when it is very certain that benefits outweigh risks and by referencing international guidelines (Fig. 1).

RESULTS

The final 20 consensus statements are summarised in Table 2, each accompanied by its classification of recommendation, quality of evidence, and proportion of the voting agreement. The statements are divided into the following categories: (1) pre-requisite, (2) pre-procedure, (3) intra-procedure and (4) post-procedure quality indicators.

DISCUSSION

Pre-requisite

Statement 1: Only an endoscopist with appropriate training and the relevant competency should independently perform OGD.

Level of agreement: 100%

Quality of evidence: III

Classification of recommendation: A

Competency is defined as the essential level of skill, knowledge and experience required to perform a task or procedure safely and proficiently.¹⁰ This standard is typically set by authoritative bodies, such as the ASGE, BSG/AUGIS, ESGE, American College of Gastroenterology, the American Board of Surgery, and the Society of American Gastrointestinal and Endoscopic Surgeons. Consequently, the criteria for competency may differ based on specialty, indication, procedure and geographic location. Most institutions now adopt these competency definitions as the basis for their local credentialing standards.

In Singapore, the Gastroenterology Residency Advisory Committee has determined the following criteria for gastroenterologists to be able to perform OGD independently: (1) perform at least 200 OGD procedures and (2) complete his/her gastroenterology senior residency training with adequate number of satisfactory directly observed procedures for OGD during residency and be recognised as a gastroenterology specialist by the Specialists Accreditation Board.

Table 1. Quality of evidence, classification of recommendation and voting on recommendation.

I	Evidence obtained from at least 1 properly randomised controlled trial.
II-1	Evidence obtained from well-designed controlled trials without randomisation.
II-2	Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than 1 centre or research group.
II-3	Evidence obtained from comparison between times or places with or without intervention. Dramatic results in uncontrolled experiments could also be included in this category.
III	Opinion of respected authorities, based on clinical experience, descriptive studies or report of expert committees.
Classification of recommendation	
A	There is good evidence to support the recommendation.
B	There is fair evidence to support the recommendation.
C	There is poor evidence to support the recommendation, but recommendations may be made on other grounds.
D	There is fair evidence to refute the recommendation.
E	There is good evidence to refute the recommendation.

Adapted from Berg AO, Allan JD. Introducing the third US Preventive Services Task Force. *Am J Prev Med* 2001;20:3-4.

While not a universal standard, the BSG/AUGIS guidance recommended an annual minimum of 100 upper GI endoscopies per operator based on weak evidence. The authors perceived that the minimum OGD numbers needed to maintain proficiency varies between an experienced and a budding endoscopist. As such this may not translate to a meaningful benchmark in the Singapore setting, and hence no definite recommendation was made for minimum OGD numbers per year to maintain high-quality examination.

Pre-procedure

Statement 2: All upper gastrointestinal endoscopies performed should have an appropriate indication that should be documented.

Level of agreement: 100%

Quality of evidence: II

Classification of recommendation: A

Studies have demonstrated that conducting OGD and colonoscopy for appropriate indications significantly increases the probability of clinically relevant diagnoses.^{11,12}

The aim of this quality indicator is to minimise the number of procedures without appropriate indications. The appropriate indications for UGI endoscopy are listed in Table 3, adapted from various clinical guidelines.¹³⁻¹⁸

Statement 3: Informed consent should be obtained and fully documented by the procedurist or a medical professional who is deemed by the

procedurist to have adequate knowledge to fully explain the procedure.

Level of agreement: 100%

Quality of evidence: III

Classification of recommendation: A

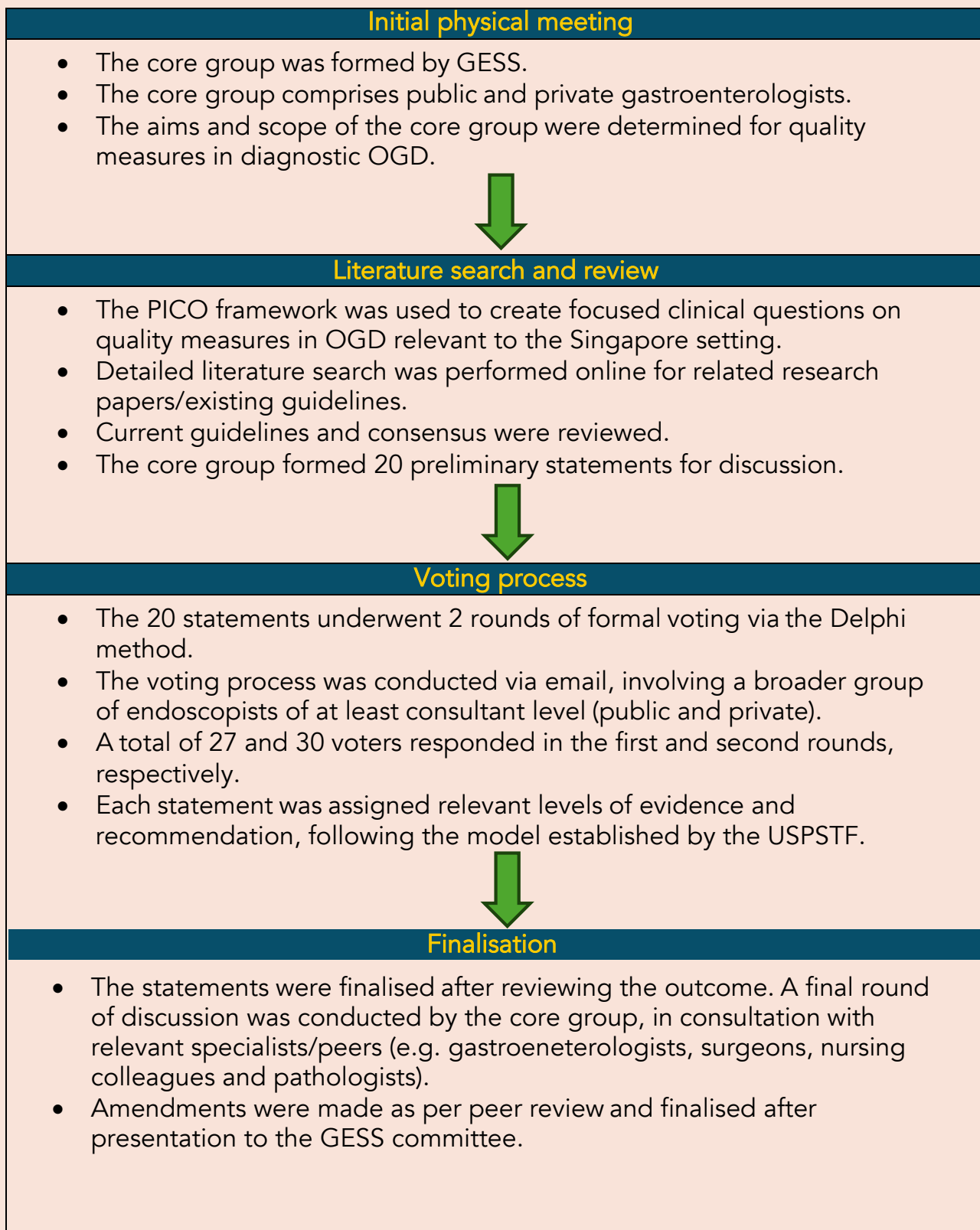
Informed consent is essential to respect patient autonomy, provide relevant information for decision-making and allows the opportunity for questions, which enhances understanding and confidence in the healthcare team.^{6,7} Notably, risk assessment is included as part of obtaining informed consent.

The ASGE guidelines on informed consent in endoscopy recommend the endoscopist to obtain consent personally. Under limited resources, a trained medical professional with adequate knowledge to explain the endoscopic procedure may obtain consent.⁷ For more complex procedures, it is recommended that the procedurist or relevant healthcare team involved in the procedure counsel and obtain informed consent whenever possible.

Consent may be supplemented by anatomic diagrams, brochures and videos and by information provided by nurses and other assistants. A consent form designed specifically for a particular procedure that contains all the essential elements of consent may facilitate a full discussion with the patient.^{1,6,7,19}

Taking consent from patients with diminished mental capacity must take into account the patients' residual or fluctuating cognitive ability. If patients can demonstrably understand, retain and use information and explanations to make clear and consistent decisions and communicate them in a coherent

Fig. 1. Flow chart of the statement development process.



GESS: Gastroenterological Society of Singapore; OGD: oesophago-gastro-duodenoscopy; PICO: population, intervention, comparator, outcome; USPSTF: United States Preventive Services Task Force

Table 2. Summary of consensus statements.

Statement	Classification of recommendation	Quality of evidence	Level of agreement
Pre-requisite			
1. Only an endoscopist with appropriate training and the relevant competency should independently perform OGD.	A	III	100%
Pre-procedure			
2. All upper gastrointestinal endoscopies performed should have an appropriate indication that should be documented.	A	II	100%
3. Informed consent should be ideally obtained and fully documented by the procedurist or a medical professional who is deemed by the procedurist to have adequate knowledge to fully explain the procedure.	A	III	100%
4. Patients should be assessed for fitness to undergo a diagnostic OGD.	B	III	93.3%
5. Team pause or time out is to be conducted and documented. A safety checklist should be completed before starting an OGD.	A	III	100%
6. An appropriate time slot should be allocated depending on procedure indications and patient characteristics.	B	II	93.3%
Intra-procedure			
7. Normal endoscopic examination should include a minimal of 10 photos consisting of the following anatomical landmarks: upper oesophagus and lower oesophagus, GE junction, fundus, corpus/body, incisura, antrum, pylorus, D1 and D2.	C	III	93.3%
8. Standardised terminology is encouraged for relevant findings and documentation (e.g. Los Angeles classification for erosive esophagitis, Prague classification for Barrett's oesophagus, Forrest classification for bleeding ulcers).	A	III	96.7%
9. In patients who have not undergone evaluation of <i>Helicobacter pylori</i> status before, this should be screened during gastroscopy by performing rapid urease test or histology.	A	III	93.3%
10. In patients who have clinically relevant gastric cancer risks, at least 2 biopsies from the antrum and 2 biopsies from the corpus should be taken for histology to exclude intestinal metaplasia.	C	III	80%
11. Patients should be monitored during sedation at an appropriate time interval, with the relevant information documented.	A	III	100%
12. The doses and routes of administration of all medications used, including reversal agents, during the procedure are to be documented.	A	III	100%
13. All endoscopies should be performed with high-definition video endoscopy systems, with the ability to capture images and take biopsies.	A	II-3	96.6%
14. All endoscopy units should have an internationally accepted guideline and policy on sedation.	B	III	96.7%
15. Adequate mucosal visualisation should be achieved by a combination of adequate air insufflation, flushing and aspiration and the use of mucosal cleansing techniques.	A	III	100%
16. A malignant-looking lesion should be described and photo documented, with biopsies taken for histology.	A	II-2	86.7%
Post-procedure			
17. All endoscopy units should have pre-determined discharge criteria and should provide patients with post-discharge instructions.	A	III	100%
18. Follow-up management plan should be specified.	A	III	96.7%
19. All adverse events related to the procedure should be documented.	A	III	100%
20. All endoscopy units should have a system to monitor for post-procedure and late adverse events occurrence.	C	III	90%

GE: gastroesophageal; OGD: oesophago-gastro-duodenoscopy

Table 3. OGD indications (not exhaustive).

1.	Upper abdominal symptoms that persist despite an appropriate trial of therapy
2.	Upper abdominal symptoms associated with other symptoms or signs suggesting serious organic disease (e.g. anorexia and weight loss) or in patients aged >45 years. Age cut-off varies in different geographical regions. ¹⁷
3.	Dysphagia or odynophagia
4.	Oesophageal reflux symptoms that are persistent or recurrent despite appropriate therapy
5.	Persistent vomiting of unknown cause
6.	Other diseases in which the presence of upper gastrointestinal pathology might modify other planned management. Examples include patients who have a history of ulcer or gastrointestinal bleeding who are scheduled for organ transplantation, long-term anticoagulation, or chronic nonsteroidal anti-inflammatory drug therapy for arthritis and those with cancer of the head and neck
7.	Familial adenomatous polyposis syndromes
8.	For confirmation and specific histologic diagnosis of radiologically demonstrated lesions: • Suspected neoplastic lesion; • Gastric or oesophageal ulcer; • Upper tract stricture or obstruction
9.	Gastrointestinal bleeding • In patients with active or recent bleeding • For presumed chronic blood loss and for iron deficiency anaemia when the clinical situation suggests an upper gastrointestinal source or when colonoscopy result is negative
10.	When sampling of tissue or fluid is indicated
11.	In patients with suspected portal hypertension to document or treat oesophageal varices
12.	To assess acute injury after caustic ingestion
13.	Treatment of bleeding lesions, such as ulcers, tumours, vascular abnormalities (e.g. electrocoagulation, heater probe, laser photocoagulation or injection therapy)
14.	Banding or sclerotherapy of varices
15.	Removal of foreign bodies
16.	Removal of selected polypoid lesions
17.	Placement of feeding or drainage tubes
18.	Dilation of stenotic lesions
19.	Management of achalasia (e.g. botulinum toxin, balloon dilation, peroral endoscopic myotomy)
20.	Palliative treatment of stenosing neoplasms (e.g. laser, multipolar electrocoagulation, stent placement)
21.	Endoscopic therapy for intestinal metaplasia (e.g. dysplasia in BO)
22.	Intraoperative evaluation of anatomic reconstructions typical of modern foregut surgery (e.g. evaluation of anastomotic leak and patency, fundoplication formation, pouch configuration during bariatric surgery)
23.	Management of operative adverse events (e.g. dilation of anastomotic strictures, stenting of anastomotic disruption, fistula or leak in selected circumstances)
24.	Surveillance for malignancy in patients with premalignant conditions (i.e. gastric intestinal metaplasia, BO)

BO: Barrett's oesophagus; OGD: oesophago-gastro-duodenoscopy

manner, the physician must obtain consent from the patients themselves. If patients have such diminished mental capacity that they cannot give consent, one must obtain consent from persons with the legal authority to make such medical decisions for them unless such persons are not contactable within reasonable time depending on the urgency of the situation. Otherwise, one must proceed according to the best judgement of patients' best interests.¹⁹

In emergency situations, a physician may proceed with treatment without consent when patients are not capable of giving consent and where he/she deems treatment is necessary in patients' best interests.¹⁹

Despite it being standard practice that consent for minors is taken from parents or legal guardians, the physician must consider the opinions of minors who are able to understand and decide for themselves.¹⁹

One must respect patients' right to refuse consent for tests, treatments or procedures, except when it is evident that their judgement is impaired or their mental capacity is so diminished that they cannot make choices about their own care.¹⁹

Some patients, such as those with dementia, psychiatric or neurological disorders, may show fluctuating mental capacity. The fact that a person is able to retain the information relevant to a decision, albeit for a short period only, does not prevent him from being regarded as lacking capacity. Decision-making capacity should be assessed at the particular time when consent is to be taken. If capacity is assessed to be present at the time of consent, such consent is valid.¹⁹ For details on consent in medical practice and various circumstances in the Singapore context, please refer to the Singapore Medical Council (SMC)'s *Ethical Code and Ethical Guidelines 2016 Edition*²⁰ and Ministry of Health's *Workgroup to Review the Taking of Informed Consent and SMC Disciplinary Process 2019*.

Statement 4: Patients should be assessed for fitness to undergo a diagnostic OGD.

Level of agreement: 93.3%

Quality of evidence: III

Classification of recommendation: B

Patients should undergo a pre-procedure assessment, including a health history and physical examination, which should be documented by either the procedurist or a medical professional who is deemed competent by the procedurist. In the context of an open-access OGD, the procedurist is expected to obtain a brief history and perform relevant physical examination before the procedure whenever possible.

The history should focus on procedure indications and conditions affecting performance and safety,

particularly sedation-related issues such as organ abnormalities, prior sedation/adverse events, medication allergies, current medications and substance use.^{6,7} Should changes to antiplatelet or anticoagulant therapy be indicated, these should be documented and communicated to the patient.¹

The timing and nature of patients' last oral intake should also be recorded. Although data on fasting and aspiration risk are limited, generally, patients are required to stop oral intake for at least 6 hours before endoscopy. The American Society of Anesthesiologists guidelines recommend ceasing clear liquids for 2 hours, milk for 6 hours, light meals for 6 hours and fatty meals for 8 hours before sedation. Patients with gastroparesis or achalasia may need longer fasting. Essential medications, including bowel preparation, can be taken before procedures.²¹

Statement 5: Team pause or time out is to be conducted and documented. A safety checklist should be completed before starting an OGD.

Level of agreement: 100%

Quality of evidence: III

Classification of recommendation: A

Before administering sedation or inserting the endoscope, the endoscopy team pauses to confirm the patient's identity and procedure type, as well as to go through a safety checklist, which should be recorded.^{1,6,7}

While there is no standardised endoscopy safety checklist, the BSG/AUGIS recommends verifying the following:¹ (1) patient identifiers (name/hospital number/date of birth), (2) drug allergies, (3) medications/conditions that may preclude any interventions (anticoagulants), (4) significant comorbidities, (5) patient understanding of proposed test and (6) completed consent form.

The checklist should ensure, at minimum, correct patient, procedure, procedurist and drug allergy. This process confirms the correct patient and procedure, allows reassessment of relevant data, and informs the team of the planned procedure and any potential deviations requiring special equipment.^{6,7}

Statement 6: An appropriate time slot should be allocated depending on procedure indications and patient characteristics.

Level of agreement: 93.3%

Quality of evidence: II

Classification of recommendation: B

The authors acknowledge that the duration of an OGD varies based on the indication, pathology and patient factors. For instance, certain clinical indications, such as the surveillance of premalignant conditions,

necessitate thorough inspection and may require advanced imaging, thus extending the procedure time.²² The BSG/AUGIS recommends a slot of a minimum of 20 minutes for standard diagnostic endoscopy, increasing as appropriate for surveillance or high-risk conditions.¹

The authors recommend the mouth in-out time to be at least 7 minutes, in line with the ESGE and BSG guidelines.^{1,8} A retrospective observational study in Singapore reported that endoscopists who took more than 7 minutes on average for an OGD had a three-fold increase in the diagnosis of gastric cancer and dysplasia compared to those who completed the procedure in less than 7 minutes.²² Other studies have also shown that a longer endoscopy time is associated with increased detection of neoplastic lesions and high-grade dysplasia, compared with shorter endoscopy time.^{23,24} A minimum inspection time of 7 minutes was also associated with the detection of Barrett's oesophagus (BO).²³

Intra-procedure

Statement 7: Normal endoscopic examination should include a minimum of 10 photos consisting of the following anatomical landmarks: proximal/mid oesophagus, distal oesophagus, oesophagogastric junction, gastric cardia/fundus, gastric body (forward), gastric body (retroflexed), incisura, gastric antrum/pylorus, duodenal bulb (D1) and duodenum second portion (D2).

Level of agreement: 93.3%

Quality of evidence: III

Classification of recommendation: C

Photo documentation of important anatomic landmarks (Fig. 2) and pathology is widely recommended.^{1,6,7} It enhances patient understanding, facilitates physician consultations, allows precise comparisons during repeat procedures, and serves as a legal record. While there is no direct evidence supporting its benefits, photo documentation intuitively promotes thorough mucosal inspection and cleansing, ensuring complete examinations.^{1,6,7,8}

All societies endorse good and adequate photo documentation. The ESGE recommends a minimum of 10 photos in a normal UGI examination. The authors agree that this standard should be adopted in Singapore. These standard anatomical landmarks include proximal/mid oesophagus (15–30 cm from incisors), distal oesophagus (distal to 30 cm from incisors), squamocolumnar junction and diaphragm indentation, cardia and fundus (retroflexed view), gastric body (forward view) and gastric body (retroflexed view), incisura (partial retroflexed view), gastric antrum/pylorus, duodenal bulb and second

part of duodenum.^{1,7,8} The emphasis on photo documentation during OGD is also supported by another study in the Singapore context.²⁵ This excludes surgically altered anatomy. The Asian consensus on standards of diagnostic upper endoscopy for neoplasia suggests systematic endoscopic mapping of the entire oesophagus and stomach to enhance the detection rate of superficial UGI neoplasms, and recommends taking at least 20–22 images, based on cited studies.^{26–29}

Statement 8: Standardised terminology is encouraged for relevant findings and documentation (e.g. Los Angeles classification for erosive oesophagitis, Prague classification for Barrett's oesophagus, Forrest classification for bleeding ulcers).

Level of agreement: 96.7%

Quality of evidence: III

Classification of recommendation: A

The use of standardised terminology is in line with recommendations from established guidelines.^{1,6,7} The Minimal Standard Terminology was created by the World Endoscopy Organization to facilitate this standardisation of gastrointestinal endoscopy terminology.³⁰

Statement 9: In patients who have not undergone evaluation of *Helicobacter pylori* status before, this should be screened during gastroscopy by performing rapid urease test or histology.

Level of agreement: 93.3%

Quality of evidence: III

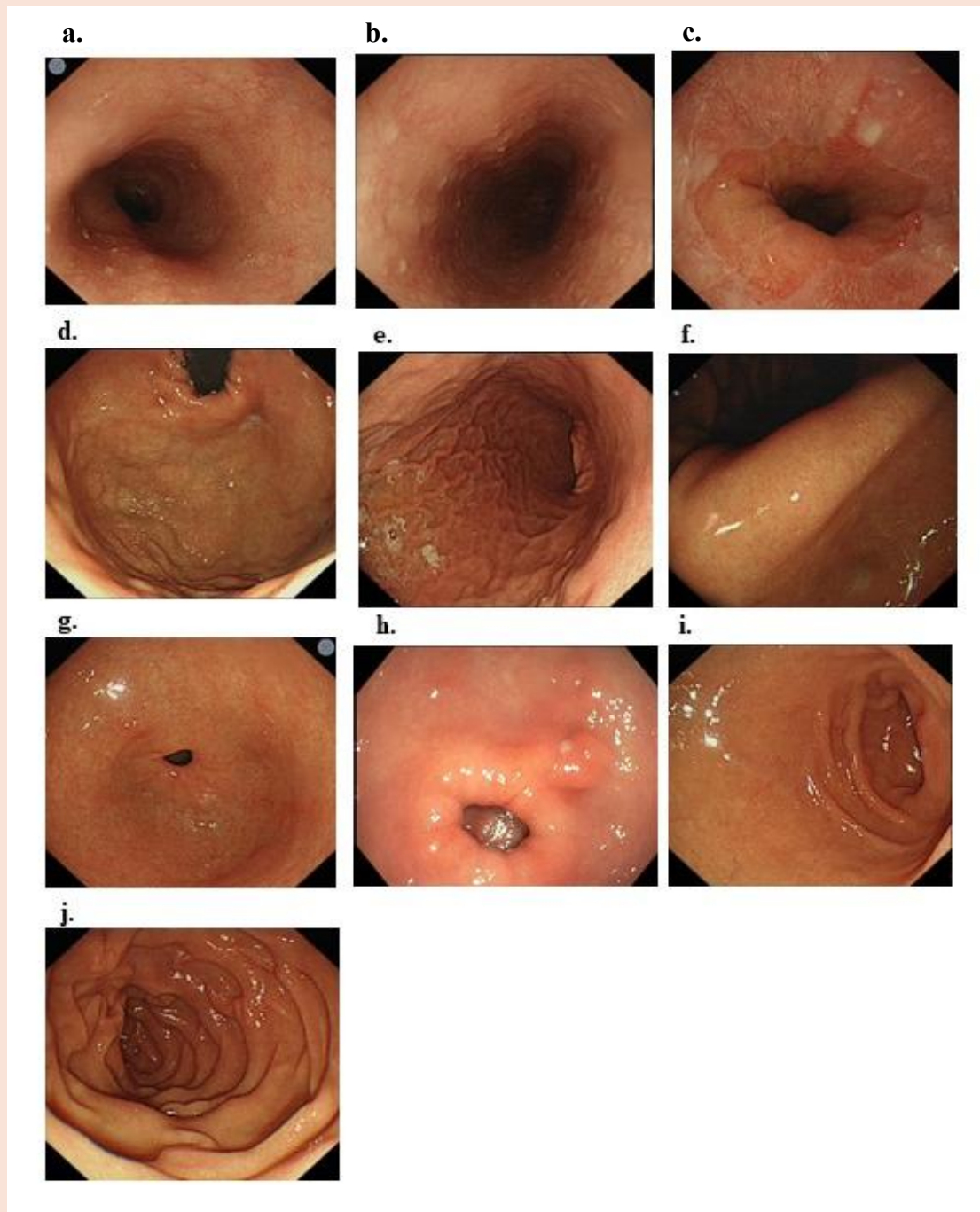
Classification of recommendation: A

Various studies have shown that the elimination of *H. pylori* reduces risk of cancer.^{31,32} A systematic review and meta-analysis linked the eradication of *H. pylori* infection with a reduced incidence of gastric cancer. The benefits of eradication vary with baseline gastric cancer incidence but apply to all levels of baseline risk.³²

Moreover, a prospective, double-blind randomised trial found that patients with early gastric cancer who received *H. pylori* treatment had lower rates of metachronous gastric cancer (hazard ratio 0.50; 95% confidence interval (CI) 0.26–0.94; $P=0.03$), and more improvement from baseline in the grade of gastric corpus atrophy than patients who received placebo ($P<0.001$).³³

Statement 10: In patients who have clinically relevant gastric cancer risks, at least 2 biopsies from the antrum and 2 biopsies from the corpus should be taken for histology to exclude intestinal metaplasia.

Fig. 2. Sample photo documentation of anatomical landmarks.



(A) proximal/mid oesophagus; (B) distal oesophagus; (C) gastro-oesophageal junction; (D) fundus; (E) body; (F) incisura; (G) antrum; (H) pylorus; (I) duodenal bulb; (J) duodenum second portion

Level of agreement: 80%

Quality of evidence: III

Classification of recommendation: C

This recommendation is consistent with the ESGE 2016, BSG 2017 and ASGE 2025 guidelines.^{1,6,7} This statement excludes the utilisation of imaging-enhanced endoscopy (IEE) techniques (e.g. narrow

band imaging, Fujinon intelligence chromoendoscopy [Fujinon Corporation, Japan], linked colour imaging, blue light imaging, i-scan and optical enhancement).

The BSG guidelines on the diagnosis and management of patients at risk of gastric adenocarcinoma recommend that patients with image-enhanced features of chronic atrophic gastritis should undergo biopsies for confirmation, targeting mucosal sites

within Sydney protocol areas where enhanced imaging reveals gastric intestinal metaplasia. A baseline endoscopy with biopsies is advised for individuals aged 50 years and older with laboratory evidence of pernicious anaemia, defined by vitamin B12 deficiency and positive gastric parietal cell or intrinsic factor antibodies. Since gastric adenocarcinoma affects the corpus in pernicious anaemia, biopsies should be taken from the greater and lesser curves.³⁴

Statement 11: Patients should be monitored during sedation at an appropriate time interval, with the relevant information documented.

Level of agreement: 100%

Quality of evidence: III

Classification of recommendation: A

Cardiopulmonary unplanned events (CUE) related to conscious sedation constitute a major proportion of GI endoscopy-associated complications. A retrospective review of a US national database found that the rates of CUE with OGD, colonoscopy, endoscopic retrograde cholangiopancreatography (ERCP) and endoscopic ultrasound were 0.6%, 1.1%, 2.1%, and 0.9%, respectively.³⁵

As numerous studies have documented sedation-related cardiopulmonary complications, it is good clinical practice to monitor patients appropriately during sedation. The authors recommend continuous pulse oximetry and continuous heart rate monitoring with blood pressure every 5 minutes.³⁵

Statement 12: The doses and routes of administration of all medications used, including reversal agents, during the procedure are to be documented.

Level of agreement: 100%

Quality of evidence: III

Classification of recommendation: A

Endoscopy units should adhere to pre-existing safe sedation guidelines to ensure sedation is given, factoring a patient's age, comorbidities, allergy status, together with appropriate monitoring.¹ Any instance requiring the use of naloxone, flumazenil or ventilation due to oversedation should be documented and investigated.^{1,7,8}

Statement 13: All endoscopies should be performed with high-definition video endoscopy systems, with the ability to capture images and take biopsies.

Level of agreement: 96.6%

Quality of evidence: II-3

Classification of recommendation: A

The BSG/AUGIS recommends that all diagnostic OGDs should use high-definition endoscopes and

include equipment for clear mucosal views and histological sample acquisition.¹

In a retrospective cohort study of patients with non-dysplastic BO undergoing routine surveillance, high definition was superior to standard definition white light endoscopy in targeted detection of all dysplastic lesions (odds ratio [OR] 3.27, 95% CI 1.27–8.40) as well as overall dysplasia detected on both random and target biopsies (OR 2.36, 95% CI 1.50–3.72).²

Statement 14: All endoscopy units should have an internationally accepted guideline and policy on sedation.

Level of agreement: 96.7%

Quality of evidence: III

Classification of recommendation: B

All endoscopy units are strongly encouraged to adopt an internationally accepted guideline and policy on sedation, which may be adapted to the Singapore context. Notably, 2 Singapore consensus guidelines have been recently published by the Academy of Medicine, Singapore, adapting international standards.^{36,37} These are the *Guidelines on Safe Sedation Practice for Non-Anaesthesiologists in Medical & Dental Clinics, Stand-Alone Ambulatory Surgical Centres, and Stand-Alone Endoscopy Suites in Singapore*³⁶ and the *Clinical Guideline on the Use of Sedation by Non-Anaesthesiologists During Gastrointestinal Endoscopy in the Hospital Setting*.³⁷ Only medical practitioners who are qualified by education, training and/or accreditation as per institutional policies and procedures to administer moderate sedation shall administer the sedation or supervise a registered nurse to administer the sedation. The sedationist must have adequate and specific training in safe administration of sedation, monitoring of patients under sedation, management of complications arising from sedation and proper documentation of sedation.³⁶ All staff involved in sedation including the procedurist shall be trained and shall maintain currency in Basic Cardiac Life Support.³⁶ The authors fully endorse these guidelines.

Statement 15: Adequate mucosal visualisation should be achieved by a combination of adequate air insufflation, flushing and aspiration and the use of mucosal cleansing techniques.

Level of agreement: 100%

Quality of evidence: III

Classification of recommendation: A

Clear mucosal views can be achieved by aspirating debris and flushing water through the endoscope's accessory channel. Adding mucolytic and defoaming agents like simethicone, N-acetylcysteine, or pronase disperses bubbles and mucus.¹

A systematic review and meta-analysis found that regular use of premedication with mucolytic agents prior to routine OGD is associated with improved total mucosal visibility score, with a mean difference of -2.69 in total mucosal visibility score between pooled mucolytic agents and control.³⁸

Statement 16: A malignant-looking lesion should be described and photo documented, with biopsies taken for histology.

Level of agreement: 86.7%

Quality of evidence: II-2

Classification of recommendation: A

Evidence on the optimal number of biopsies is limited. A prospective trial by Graham et al. found that 7 biopsy specimens yielded the correct diagnosis in all patients.³⁹ A subsequent study by Lai et al. found that 6 biopsy specimens likely yield a 100% diagnosis in oesophageal carcinoma cases.⁴⁰

The standard practice is to obtain at least 6 biopsies of the lesion. This number is appropriate for diagnosing malignancy promptly and aligns with biopsy protocols for other gastrointestinal pathologies. Additional tissue may be needed for further tests, such as HER2, to guide treatment options.¹

However, fewer biopsies may be taken in certain circumstances, such as patients on anticoagulants or with bleeding disorders, or based on lesion characteristics, such as a small lesion or high bleeding risk. Notably, for early malignancy amenable to endoscopic resection, multiple biopsies may induce fibrosis, rendering endoscopic resection more difficult.^{40,41} Thus, in early-stage lesions, fewer biopsies may be appropriate.^{40,41}

Post-procedure

Statement 17: All endoscopy units should have pre-determined discharge criteria and should provide patients with post-discharge instructions.

Level of agreement: 100%

Quality of evidence: III

Classification of recommendation: A

All endoscopy units should have a written policy outlining the criteria patients must meet before discharge. These will include, but not limited to, completed procedure documentation, documented post-procedure monitoring chart, post-procedure instructions given to patients (including advice to contact endoscopy centre or to go the emergency department if unwell), follow-up appointment with physicians if any. Documentation confirming that patients have met these criteria should be completed.^{6,7}

Statement 18: Follow-up management plan should be specified.

Level of agreement: 96.7%

Quality of evidence: III

Classification of recommendation: A

Follow-up medical appointments will be required for all patients. If biopsy samples have been obtained, the management plan for the patient and notification of this plan to the referring physician should be documented.^{6,7}

Statement 19: All adverse events related to the procedure should be documented.

Level of agreement: 100%

Quality of evidence: III

Classification of recommendation: A

OGD typically carries a low risk of adverse events, in the range of 1 in 200 to 1 in 10,000, and mortality rates ranging from none to 1 in 2000.⁴² Periprocedural adverse events vary from mild, such as transient hypoxemia or self-limited bleeding, to serious, such as cardiopulmonary arrest, perforation and infection.⁴²

Documenting adverse events facilitates early recognition and prompt intervention, thereby minimising associated morbidity and mortality. Additionally, it enables a thorough review process, which serves to educate endoscopists, reduces the risk of future adverse events, and enhances the overall quality of endoscopy procedures.

Statement 20: All endoscopy units should have a system to monitor for post-procedure and late adverse events occurrence.

Level of agreement: 90%

Quality of evidence: III

Classification of recommendation: C

While the majority agreed with this statement, some reservations were expressed. There is concern about the fragmentation of healthcare systems, where adverse events might not be effectively captured if patients seek follow-up care between private centres and public institutions after procedures like polypectomy. Additionally, the implementation of such a monitoring system may not be cost-effective, given the low risk of delayed complications for most patients. Some believe that monitoring should be left to the procedurist's discretion, based on the specifics of the procedure. For example, for more complex endoscopic procedures like ERCP, a monitoring system, such as physician-directed telephone calls, could help guide a significant number of patients to appropriate follow-up care for their medical concerns.

CONCLUSION

This study presents recommendations by evidence-based consensus that can be used for OGD. It is acknowledged that practice may vary according to patient needs, resource availability and limitations of the institution of practice. Endoscopy units may adapt these recommendations to define appropriate quality indicators, which can then be measured and reported if required. These recommendations are not meant to restrict or govern OGD in upper GI practice for endoscopists, but it is anticipated that implementing the above recommendations will enhance the quality of OGD, optimise patient outcomes and reduce healthcare burden in Singapore.

Supplementary material

Annex S1. World Endoscopy Organization Minimal Standard Terminology (WEO MST 3.0).

Ethics statement

Not applicable, as no patient information or medical data were assessed at all during this study.

Declaration

The GESS has received an unrestricted educational grant from Olympus to organise meetings for the development of this consensus manuscript. The authors declare there are no conflicts of interest and no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript.

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Community care at scale: Singapore's Active Ageing Centres 2.0 as a model for healthy ageing

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ABSTRACT

Introduction: Singapore's Active Ageing Centres (AACs) are central to the national strategy to enable older adults to age in place through preventive, community-based services. Under the Healthier SG and Age Well SG reforms, AACs are being transformed from targeted social support points for vulnerable seniors into population-wide health-social hubs, with a goal of reaching 80% of seniors by 2025.

Methods: This policy commentary draws on national policy documents, programme reports and practitioner insights to examine the evolution and implementation of AAC 2.0, and to identify emerging opportunities and system-level challenges.

Results: We highlight governance shifts, regional coordination mechanisms and health-social integration strategies. Innovations such as thematic centres, peer-led programmes and extended operating hours aim to engage diverse senior populations. Key challenges include centralised policy design, limited community voice, workforce constraints and fragmented coordination. Promising pilots, such as integrated wellness hubs, are underway but require greater alignment, relationship-building and local adaptation to scale.

Conclusion: We propose strategies to strengthen community partnerships, invest in trust-based engagement and embed robust evaluation frameworks informed by implementation science. Singapore's experience offers actionable insights for health systems seeking to design scalable, community-rooted models for healthy ageing that integrate social and healthcare services.

Keywords: Active Ageing Centres, community-based care, health policy, integrated health and social care, population health, public health

CLINICAL IMPACT

What is New

- Singapore's Active Ageing Centres (AACs) are transitioning from social care nodes to integrated health-social hubs under Healthier SG and Age Well SG.
- AAC 2.0 introduces thematic centres, peer-led programmes and extended hours to better engage diverse senior populations.
- Building trust, community partnerships and implementation science are key enablers of successful scale-up.

Clinical Implications

- Scalable, community-based ageing models must balance standardisation with ground-level adaptability and relational trust.
- Multisector collaboration, decentralised planning and robust evaluation frameworks are critical for integrated, person-centred care.
- Lessons from Singapore's AAC 2.0 may inform global efforts to build sustainable healthy ageing systems in rapidly ageing societies.

INTRODUCTION

Populations are rapidly ageing, with 1 in 6 people projected to be 60 years or older by 2030 worldwide.¹ This has profound implications for health systems already strained by chronic diseases and escalating costs.² To address these pressures, countries must

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urgently transition from reactive, hospital-centric models to proactive, preventive, community-based approaches.^{3,4} In line with the World Health Organization (WHO)'s vision for healthy ageing, countries must strengthen community systems that enable older adults to live healthily, independently and meaningfully within their communities.⁵ This demographic transition calls for a fundamental and anticipatory reimagining of how health systems engage older adults by shifting from hospital-based responses after illness and complications set in, to community-rooted and preventive approaches.

Active Ageing Centre (AAC) models

Community-based AACs have emerged globally as a key strategy to support the well-being, independence and social inclusion of older adults. A 2020 review found that similar models exist in countries such as Australia (Day Clubs), Bahrain (Day Care Centres), Canada (Senior Centres, Adult Day Services), Czech Republic (Senior Centres) and Israel (Day Centres), and these have achieved commendable results in terms of enabling the elderly to age well in place.⁶ These centres typically serve 4 main purposes: to provide social and preventive services, support seniors' continued independence, meet health and daily living needs, and offer respite to caregivers. Consequently, older adults are more socially connected, are more engaged in structured daily activities that give them a sense of purpose after retirement or bereavement, receive and participate in preventive care, and therefore have better physical and mental health.⁷⁻¹³

In Singapore, the earliest model—Senior Activity Centres (SACs)—was introduced to address social isolation, frailty and gaps in community-based eldercare among low-income seniors.¹⁴ These centres offered basic daily activities such as group exercises and board games, alongside befriending services, wellness check-ins and referrals to other services when needed. SACs also played an informal role in monitoring at-risk seniors to support ageing-in-place. Typically small in capacity and co-located within public rental housing blocks, these centres received input-based funding by the Ministry of Social and Family Development, and were operated by voluntary welfare organisations or social service agencies.¹⁴ The SAC model laid the foundation for more comprehensive, population-based approaches to community ageing services in Singapore.

Singapore's national response to an ageing population: Healthier SG and Age Well SG

As of 2023, approximately 19% of Singapore's population is aged 65 and above, and the country is on track to become a super-aged society by 2030.¹⁵ These demographic shifts have contributed to

increasing chronic disease prevalence, more complex patient profiles and greater demands on both health and social care systems.¹⁶ In response, Singapore has adopted 2 complementary national strategies: Healthier SG and Age Well SG.

Healthier SG, launched in 2023, is a major health reform initiative that anchors residents with a primary care provider and strengthens partnerships between healthcare and community actors to deliver preventive, person-centred care.¹⁷ Singapore's healthcare landscape was reorganised geographically into 3 healthcare clusters, which now serve as Regional Health Managers under Healthier SG, each accountable for the health outcomes of their assigned populations.¹⁷ These clusters oversee acute hospitals, community hospitals and polyclinics, and work closely with private healthcare providers and Community Care Organisations (CCOs) within their geographical boundaries.¹⁸ Funded on a per capita basis, healthcare clusters are incentivised to promote preventive care, appropriate care delivery and integration across the care continuum.¹⁹ CCOs deliver much of the community-based social care in this model.²⁰ Strengthening these linkages between health and social as well as hospital, primary care and community assets is essential to realise the full potential of Healthier SG's person-centred, preventive approach. Under Healthier SG, AACs support seniors in following up on their health plans through an ABC + 2S framework: Active ageing (A) programmes promote wellness and learning; Befriending and buddying (B) reduce social isolation; information and referral to Care services (C) links seniors to needed services; and Social connector for social and lifestyle interventions and community Screening (2S) facilitates early identification and follow-up for health and social risks.²¹ In Singapore, seniors are generally defined as individuals aged 60 years and above, in alignment with national ageing policies and eligibility criteria for programmes such as the AACs and public transport concessions.²²⁻²⁴ Entry into AACs is age-based, reflecting Singapore's universal approach to community ageing services. This expansion aligns with WHO's model of healthy ageing,⁴ where AACs enhance seniors' intrinsic capacity through targeted physical and cognitive health interventions, while supporting functional ability by creating an enabling environment.

The Age Well SG initiative was also launched in 2023, with fresh government funding of SGD800 million.²⁵ This initiative aims to expand the number of AACs from 119 in 2023 to 220 by 2025, with the goal of reaching 80% of Singapore's senior population,^{26,27} beyond low-income groups. As of April 2025, Singapore's AAC network has expanded to 223 centres, enabling 8 in 10 seniors to access a centre near their home.²⁸ The average daily attendance has also more than doubled, from 17 seniors in 2021 to 42 in

2023.²⁷ However, comprehensive data on population penetration and utilisation rates remain limited. Central is also the transformation of AACs into accessible, one-stop community hubs for health promotion, social engagement and care navigation.^{27,29} Singapore's AAC model has evolved over the past decade—from the original SACs, which primarily served low-income seniors in rental housing, to a population-wide AAC 2.0 model. AACs are thus expected to go beyond their original scope of services, to deliver a structured and evidence-based range of activities that span 5 key domains: social engagement, physical health, cognitive stimulation, lifelong learning and volunteerism.²⁶ This reflects a strategic shift from targeted social welfare to an integrated, preventive health-social approach that empowers all seniors to age meaningfully in the community.

Age Well SG reflects the government's recognition that ageing is a multidimensional issue requiring a multi-sectoral, whole-of-government response. Jointly led by Singapore's Ministry of Health (MOH), Ministry of National Development and Ministry of Transport, Age Well SG implements coordinated reforms across housing, transport, active ageing and care services to enable seniors to age confidently within their communities.^{21,25} Funding is now managed by the Agency for Integrated Care (AIC) rather than the Ministry of Social and Family Development through a mix of output and outcome-based targets with a small quantum allocated for ground-up pilot innovation.^{25,30} AAC services are delivered by a range of CCOs.²⁵ The Health Promotion Board, a statutory board under MOH, now supplements AAC programming with national wellness campaigns and resources.²⁵ Healthcare clusters, as Regional Health Managers under Healthier SG, also play a new, critical role in supporting AACs to integrate community social services into regional preventive health strategies. This transition of governance structures underpins a national understanding of the influence of social determinants on health. Concurrent efforts are also underway to enhance and fund the information technology infrastructure supporting AACs, to enable better client tracking, streamline health-social referrals, and improve data management and sharing between stakeholders.^{31,32}

Beyond AACs, Age Well SG also encompasses broader interventions to build age-friendly neighbourhoods and communities. These include the development of Community Care Apartments and assisted living facilities to provide integrated housing-care options, senior-friendly home retrofitting through the Enhancement for Active Seniors 2.0 programme, and estate-level upgrades under the Neighbourhood Renewal Programme and Estate Upgrading Programme.²⁵ Urban planning initiatives such as wayfinding projects and Singapore's Silver Zones

(residential areas with high senior populations that feature reduced road speed limits, etc.) also aim to create safer, more accessible environments for seniors in public spaces.²⁵

This commentary examines the early adaptation and implementation of AACs in light of recent policy reforms, explores the challenges and opportunities in strengthening community-based health-social models, and offers lessons for health and social system leaders seeking to scale integrated ageing strategies.

Challenges in implementation and opportunities to future-proof AAC 2.0

While AAC 2.0 holds strong promise as a scalable, community-based model for healthy ageing, its implementation presents several real-world challenges that must be addressed to ensure long-term sustainability and impact.

(A) The scale, frequency and speed of change needs ecosystem support

A key challenge is the increasing complexity of care models that strain the operational capacity of AACs. With the shift of care from healthcare institutions to the community setting, the responsibilities placed on AACs have been growing and are becoming increasingly complex. With Healthier SG, AACs are expected to deliver ABC + 2S, support residents in following up with their Healthier SG health plans and improve communications with primary care providers. A few months later, with the launch of Age Well SG, AACs were required to provide a suite of programmes across 5 standardised domains. This is especially challenging as many CCOs are manpower-lean organisations and may not have the ability to make frequent adjustments to their care models. As voiced by some AACs, frequent change has contributed to staff morale issues and operational misalignment. Another facet of change is the new roles and relationships between MOH, AIC, Health Promotion Board (HPB), healthcare clusters and AACs in Healthier SG and Age Well SG. These stakeholders must now align on shared system goals and delivery approaches.

A more participatory approach is needed, one that meaningfully involves AAC providers and ground staff in shaping service standards and performance frameworks, allows adaptation to local contexts, incorporates qualitative metrics to reflect care quality and community relevance, and moderates the pace of change. Such strategies are essential for keeping the model grounded, person-centred and sustainable. Existing platforms that bring stakeholders together include annual community partner appreciation events hosted by healthcare clusters, as well as AIC-led engagements on quality assurance and operational

standards. However, more can be done at both formal and informal platforms across various levels of cooperation to build the trust required to sustain such changes. For example, the Healthy, Empowered, Active Living (HEAL) Labs approach by the SingHealth healthcare cluster (a group of healthcare institutions in Singapore) exemplifies this ethos by embedding researchers in the community, engaging service providers as co-creators of locally grounded, culturally resonant interventions.³³ The Community Ageing in Place programme in eastern Singapore is one application of the HEAL Labs approach where SingHealth, AACs and government agencies come together to support older adults to age in place with interventions in the 3 pillars of built environment, health-social integration and technology.³⁴

(B) Care should integrate around the person

With the many stakeholders brought together under Healthier SG and Age Well SG, there is potential for care to be fragmented, with overlaps or gaps. Fragmented implementation where providers execute initiatives in isolation risks deepening systemic inequities in service quality and reach. This can manifest in heterogeneous referral pathways, limited visibility of services and unclear coordination roles. In parallel, MOH and AIC are also working with AACs and other stakeholders to streamline the care journey for seniors and provide more coordinated care. Within each geographical region, providers will come together to form an Integrated Community Care Provider to oversee care coordination for seniors in that region. However, it remains to be seen whether CCOs can perform this role effectively, as it will be contingent not only on capability, but also on relationships across the ecosystem. Pilot initiatives such as the Integrated Senior Health and Wellness Hubs aim to bring together stakeholders to co-create and align roles and expectations, so as to develop common referral and share care protocols between community nurses under the healthcare clusters and AAC partners. Underpinning these efforts is a trust and relationship-building process. These could be scaled up, although the current process is labour-intensive and time-consuming. Evidence from collaborative learning health systems suggests that trust and coordination can be deliberately strengthened through structured mechanisms.³⁵ Key strategies include establishing shared goals and transparent performance dashboards to promote accountability, developing enabling infrastructure such as shared data platforms and liaison roles to support daily coordination, and institutionalising cross-organisational learning forums for joint evaluation and problem-solving. Fostering reciprocity and distributed leadership where partners co-create resources and share recognition, can further build

psychological safety and sustain collaboration over time. These approaches, reflected in Singapore models such as the Integrated Senior Health and Wellness Hubs, offer feasible pathways to enhance collaboration for integrated community care. Finally, there are opportunities for HPB to play a bigger role in AAC programming. Currently, HPB programmes are hosted in AACs and may draw in participants to join other AAC activities. These include Health and Active Programme for the Young-Old,³⁶ which focuses on physical activity and healthy lifestyle habits, and Seniors Taking Extra Active Steps Daily (STEADY) Lah,³⁷ which emphasises fall prevention and balance training for older adults. Looking ahead, there could be potential for HPB to support evidence-based programme development and implementation resources for AACs to test evaluated innovative programmes that can enhance residents' well-being.

(C) Enrolment targets must leverage new strategies

While AACs are operated by non-government agencies, a substantial amount of funds for AACs originate from MOH, with AIC acting as a fund administrator to disburse funding to service providers. Tagged to AIC funding is the need to adhere to certain quality standards and policies that originate from both AIC and MOH, as well as pay-for-performance targets related to enrolment of seniors. Unlike the earlier SAC model, which focused on lower-income seniors, AAC 2.0 seeks to engage 80% of Singapore's senior population by 2025. Accordingly, the number of AACs have been scaled up. To mitigate the pressure placed on AACs, MOH has focused on building new AACs in areas where there is no existing service coverage. Additionally, the targets have been set as a proportion of the population within the AACs assigned catchment area.

Three key approaches have also been trialled to engage and enrol this new demographic, and these have allowed most AACs to hit their enrolment targets. First, some AACs have pivoted to new models to reach populations who do not traditionally attend AAC activities, particularly younger seniors, men, ethnic minorities and those residing in private housing, who may find conventional activities like arts and crafts or group exercises unappealing. CCOs such as Montfort Care have introduced thematic AACs offering interest-based programmes such as carpentry, theatre, podcasting and digital media.³⁸ Other CCOs like Brahm Centre complement these offerings with evidence-based mindfulness programmes that equip seniors with practical techniques for stress reduction and enhanced mental well-being.³⁹ These models appeal to niche but underserved populations, complementing traditional AAC models that cater to the wider population. AACs generally adopt a "no

wrong door” policy, allowing seniors to participate in programmes even if they reside outside the centre’s designated catchment area. This flexibility enables older adults to join centres offering activities that better match their interests or needs, reinforcing the inclusivity of the AAC network and its role as a community-wide, rather than geographically bounded platform for active ageing. The thematic AAC model also seeks to empower seniors as peer leaders and contributors within their communities, fostering ownership and social participation. This could serve to keep seniors engaged and participating in the AAC activities more frequently and for a longer time. Second, AACs empower seniors to take on active roles within the centres. For instance, able-bodied seniors are enlisted to assist with daily operations and provide peer support to more frail or socially isolated individuals. This extends out of the centre and into the neighbourhood. Several centres have implemented micro-job schemes that offer nominal compensation to seniors for ad hoc tasks, such as event support and outreach activities.⁴⁰ These initiatives not only help alleviate manpower constraints but also promote a sense of ownership, purpose and dignity among participating seniors, thereby contributing to the long-term sustainability of AAC operations. Finally, recognising the needs of working seniors, some AACs have introduced extended opening hours to improve accessibility for seniors.^{41,42} Together, these efforts reflect the utility of tailored, inclusive ground-up strategies to strengthen engagement and sustain participation across diverse senior population, which need to be evaluated to inform future scaling efforts.

(D) More evidence generation is needed to evaluate the impact of social determinants on health

Finally, the shift of governance and roles means that community development and capacity building in the social sector need to translate to better health and well-being among older adults. Robust evaluation rubrics must be embedded from the outset to assess the implementation fidelity, effectiveness and scalability of both the new AAC model, and novel strategies such as thematic programmes are needed.

To date, there is limited good quality, real-world evidence for models on health and social integration in community-based active ageing models. There is a need for such evaluations to inform future community health policies and iterations of the AAC model. Implementation science offers insights into the facilitators and barriers at the various system levels and throughout the designing, implementation and process phases, and should be systematically captured through quantitative and qualitative methods.⁴³ Both the health and social outcomes of seniors as well as studying the relationship between these metrics

would inform stakeholders on how to continue synergising efforts. Data availability and interoperability are key, so stakeholders can take evidence-based approaches to programme development and improvement. AIC has rolled out a list of approved management systems for AACs to enable limited bidirectional flow of information between healthcare clusters and AACs to support this. However, for information to flow, trust must be built first to avoid the alternative outcome of an unutilised platform. Gaps remain between stakeholders in terms of what data should be collected, how the data will be used and whether there is competency to interpret the data to guide programmatic improvement.

Co-creation approaches such as One Care Plan, a piloted technology-driven solution that integrates information across entities is progressively being rolled out across all healthcare settings, which may provide a useful foundation to align stakeholders.⁴⁴ Additionally, more can be done to integrate and make accessible HPB’s and MOH’s national level health, social and demographic data so stakeholders can evaluate and better develop services to meet the needs of residents. These insights should be shared through regular cross-learning platforms between agencies, healthcare clusters, researchers and AACs. This will enable a data-driven, iterative approach to the design, implementation and evaluation cycle, ensuring that the most effective programmes are continuously implemented and scaled to meet the evolving needs of seniors.

CONCLUSION

Lessons for the region

Singapore’s AAC 2.0 represents an ambitious, whole-of-government and whole-of-society approach to healthy ageing. While implementation challenges remain, this evolving model offers valuable insights for countries seeking to address similar challenges. Embedding community ageing services within national health strategies through strong governance, integrated care, inclusive engagement and rigorous evaluation can support seniors in ageing with dignity, purpose and support. As countries navigate demographic transitions, Singapore’s experience presents a compelling blueprint for designing community-rooted and prevention-focused systems to deliver healthy ageing at scale.

Ethics statement

Not applicable as no study participants are involved.

Declaration

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Health Research Grant (PHRGTC-7-0001). The authors declare there are no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript. The authors used ChatGPT (OpenAI, San Francisco, CA, US) during the preparation of this manuscript for grammar checking and language editing. The authors reviewed and verified the content and take full responsibility for the final version.

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Different faces of atrial septal aneurysm

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ABSTRACT

Atrial septal aneurysm (ASA) is a well-recognised abnormality on the echocardiogram; it is a mobile, localised saccular deformity of the atrial septum and is defined as excursion of the septal tissue of greater than 10 mm from the plane of the atrial septum into either atrium or a combined excursion of 15 mm. Several reports suggest possible links with atrial arrhythmias, increased prevalence of cryptogenic stroke and other embolic events. The authors discussed 3 atypical presentations of ASA that they encountered. Clinicians should be cognisant of these atypical appearances of ASA.

Keywords: atrial septal aneurysm, cardiac mass, cardiology, congenital heart disease, cryptogenic stroke, echocardiography

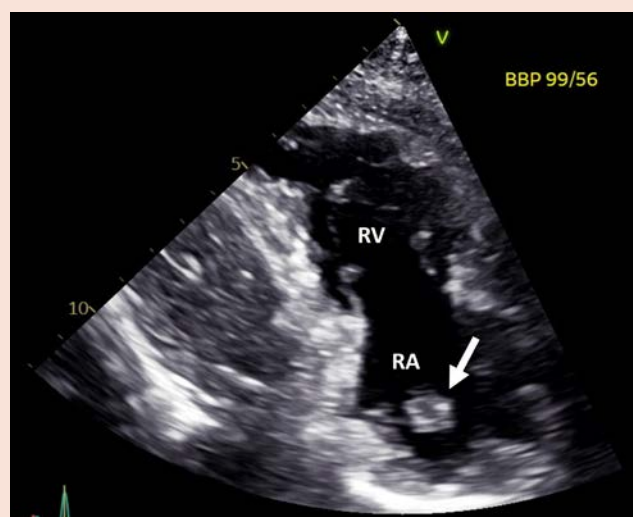
Atrial septal aneurysm (ASA) is a well-recognised abnormality on the echocardiogram with a prevalence rate of 2–3%. It is a mobile, localised saccular deformity of the atrial septum and is defined as excursion of the septal tissue of greater than 10 mm from the plane of the atrial septum into either atrium or a combined excursion of 15 mm.¹ ASA may be isolated or associated with another anomaly such as patent foramen ovale, atrial septal defect and mitral valve prolapse. Clinical significance of ASA remains unclear but several reports suggest possible link with atrial arrhythmias, increased prevalence of cryptogenic stroke and other embolic events.²

Olivares-Reyes et al. echocardiographically classified ASA based on the direction and pattern of its movement into 5 types: 1R (bulging into the right atrium only), 2L (bulging into the left atrium only), 3RL (predominantly bulging into the right atrium with lesser excursion into the left), 4LR (predominantly bulging into the left atrium with lesser excursion into the right) and 5 (bidirectional movement with equidistant excursion towards both atria during the cardiorespiratory cycle).³ Type 5 is most prone to

under-recognition or misdiagnosis due to its symmetrical and subtle motion on echocardiography.

ASA may masquerade itself as a pseudomass on transthoracic echocardiogram (TTE) as depicted in Fig. 1, Supplementary Video S1 and Video S2. Transesophageal echocardiogram (TEE) bi-caval view demonstrates the absence of right atrial mass and confirmed the presence of ASA. No inter-atrial shunt is revealed on colour flow imaging (Fig. 2A, Video S3). Three-dimensional reconstruction en face view of the ASA from the left atrium is shown in Fig. 2B (also from Video S4).

Fig. 1. Right ventricular inflow view showing a 0.9 x 1.4 cm well circumscribed mass in the RA (white arrow).



RA: right atrium, RV: right ventricle

Pseudomasses in the right atrium due to normal variants of benign structures such as the Eustachian/Thebesian valve, Chiari network and crista terminalis are commonly seen in clinical practice. Due to the elevation plane and the mobility of ASA, ASA may masquerade as a pseudomass, not just in the right atrium, but possibly in the left atrium as well. Previous

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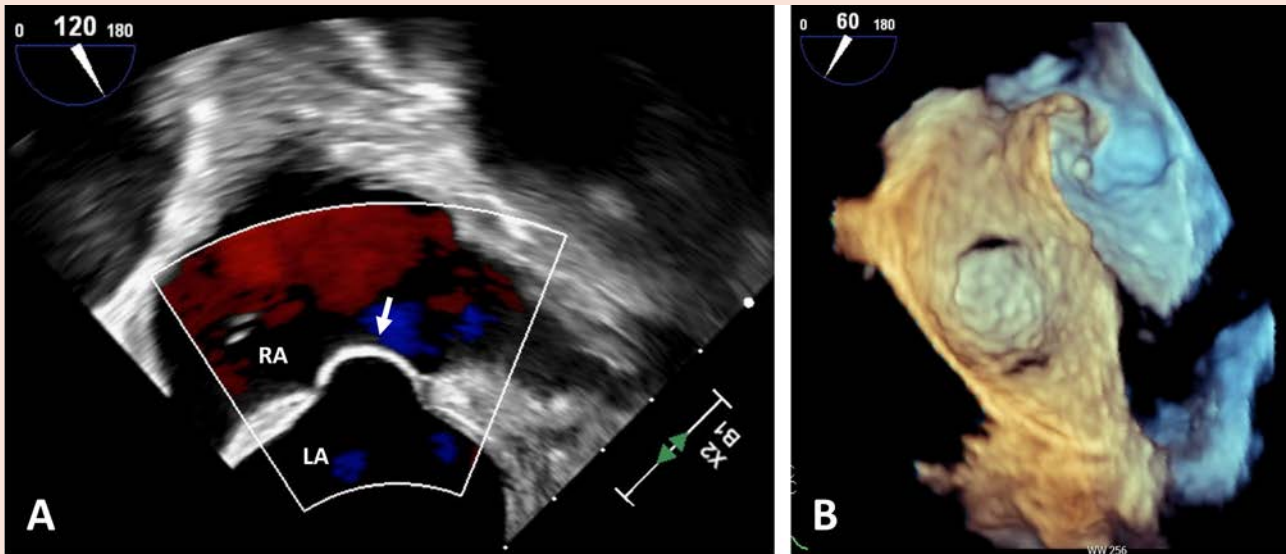
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Fig. 2. (A) TEE bi-caval view showing the ASA (white arrow); (B) Three-dimensional TEE view of the atrial septum from LA.



ASA: atrial septal aneurysm; LA: left atrium; RA: right atrium; TEE: transesophageal echocardiogram

reports have described similar presentation of ASA as a mass in the right atrium.^{4,5,6}

In addition to this atypical presentation, the authors have encountered 2 other atypical appearances of ASA—ASA may also present as a semi-circular structure in the right atrium in the right ventricular inflow view (Videos S5–6). The appearance of this structure resembles a winking eye. This is termed as an atypical appearance of the ASA as the winking sign. It can also manifest as a mobile linear echo in the LA suggestive of a “dissection flap” (Videos S7–8).

ASA has reported links with atrial arrhythmias, increased prevalence of cryptogenic stroke and other embolic events. Misdiagnosis of ASA can be minimised through a systematic echocardiographic approach. When a suspicious interatrial structure is visualised on TTE, acquiring multiple imaging planes—including subcostal, apical 4-chamber and right ventricular inflow views or orthogonal biplane imaging (X-plane)—can help clarify its attachment and motion pattern. The use of contrast echocardiography or agitated saline injection is particularly valuable in delineating the borders of the atrial septum and confirming the presence or absence of an interatrial shunt. In cases where TTE images are inconclusive, TEE provides superior spatial resolution and remains the gold standard for diagnosis, although it should be reserved as a last resort given its invasive nature.

Clinicians should be cognisant of these atypical appearances of ASA and employ an appropriate diagnostic strategy to avoid both misdiagnosis and unnecessary additional imaging.

Supplementary materials

Video S1. Transthoracic echocardiogram in the right ventricular inflow view showing a 0.9 x 1.4 cm well-circumscribed circular mass in the right atrium.

Video S2. Continuous acquisition of a number of cardiac cycles with the transducer rotating from basal parasternal short axis view to the right ventricular inflow view, showing that the “mass” is in fact an atrial septal aneurysm (ASA).

Video S3. Transesophageal echocardiogram bi-caval view of the atrial septum with the transducer at 120° showing the atrial septal aneurysm.

Video S4. Three-dimensional transesophageal echocardiogram view of the atrial septum from the left atrium.

Video S5. Transthoracic echocardiogram in the right ventricular inflow view showing a semi-circular structure in the right atrium (reproduced with permission from Yeo TC, Poh KK. Case-based comprehensive cardiology. Singapore: Springer Nature; to be published).

Video S6. Transthoracic echocardiogram in the apical 4-chamber view showing a large atrial septal aneurysm bulging into the right atrium (reproduced with permission from Yeo TC, Poh KK. Case-based comprehensive cardiology. Singapore: Springer Nature; to be published).

Video S7. Transthoracic echocardiogram in the parasternal long axis view showing a mobile linear echo suggestive of a “dissection flap” in the left atrium

(reproduced with permission from Yeo TC, Poh KK. Case-based comprehensive cardiology. Singapore: Springer Nature; to be published).

Video S8. Transthoracic echocardiogram in the parasternal short axis view showing an atrial septal aneurysm bulging into the left atrium (Reproduced with permission from Yeo TC, Poh KK. Case-based comprehensive cardiology. Singapore: Springer Nature; to be published).

Ethics statement

Not applicable as de-identified and anonymised data were used.

Declaration

The authors declare there are no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript.

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Ribavirin for paediatric patients with severe respiratory syncytial virus disease: A retrospective clinical audit

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Dear Editor,

Respiratory syncytial virus (RSV) is a single-stranded ribonucleic acid (RNA) virus of the *Paramyxoviridae* family and is one of the most common causes of lower respiratory tract infections in young children.¹ Presently, treatment of RSV infection has been limited to supportive management. Ribavirin is a guanosine analogue that has been described to have broad antiviral activity against some RNA and deoxyribonucleic acid (DNA) viruses² and has been approved since the 1980s for treatment of RSV infection in children.³ However, there remains a lack of strong evidence regarding the use of systemic ribavirin in immunocompetent paediatric patients.⁴ Currently, only a small number of paediatric studies are available demonstrating its efficacy in patients with severe disease or immunocompromised individuals⁵ and there are concerns of potential toxicity in exposed healthcare personnel.⁶ The American Academy of Pediatrics recommends against its routine use in the treatment of RSV.⁷

The authors aimed to perform an audit summarising the clinical course, and short-term outcomes of children younger than 17 years with severe RSV infection in a Singapore hospital, in particular focusing on patients who received systemic ribavirin including their clinical outcomes and any adverse effects experienced from ribavirin.

In this retrospective clinical audit of 240 children hospitalised at KK Women's and Children's Hospital (KKH) between 1 January 2018 and 31 August 2023 with severe RSV disease, data related to clinical course, patient demographics and information on ribavirin use including adverse effects were collected in February 2024. Severe RSV disease was defined as laboratory-confirmed RSV infection on nasopharyngeal swabs that were run on 1 of 3 test kits (Seeplex RV15 ACE [Seegene Inc, Seoul, South Korea], BioFire FilmArray RespPanel [BioFire Diagnostics, LLC, Utah, US] or Immunofluorescence testing), and

requiring high dependency (HD) or intensive care unit (ICU) care. Within KKH, patients in HD may receive up to supplemental oxygen or continuous positive airway pressure support. Any escalation of therapy to bi-level non-invasive respiratory support, invasive mechanical ventilation or circulatory support will require admission to ICU.

Among 240 children with severe RSV infection, 192 (80%) were admitted to HD and 48 (20%) were admitted to ICU. They had a median age of 7 months (interquartile range [IQR] 2–15.5). The most common comorbidity among patients with severe RSV infection was a background of prematurity with 33 patients (13.8%) born at 24–36 weeks' gestation, of whom 6 patients (2.5%) had a diagnosis of chronic lung disease of prematurity. The most common respiratory comorbidity was recurrent wheeze or asthma ($n=22$, 9.2%). There was no mortality from severe RSV infection during the study period. There was a decrease in the number of severe RSV cases during the COVID-19 pandemic in 2020–2021, which was particularly marked over Singapore's "circuit-breaker" period (April to June 2020) where there were strict social restrictions⁸ and no cases of severe RSV were detected in KKH.

In total, 7 (2.9%) immunocompetent patients with severe RSV received systemic ribavirin and all required ICU admission (Table 1). The decision for ribavirin administration for these 7 patients was made based on the treating physician's decision. Decisions were influenced by the presence of significant risk factors: 5 patients had major non-immunocompromised medical comorbidities, 6 patients required mechanical ventilation due to severe clinical disease, and 4 patients presented with both of these factors. Their median age was 2 months (IQR 1–8). Of patients who received ribavirin, 5 had comorbidities: 3 patients were born between 32–34 weeks' gestation and 2 had complex cyanotic heart disease. The overall median length of stay (LOS) was 15 days (IQR 9–25) and median ICU LOS was 8 days (IQR 6–11). Of these, 3 patients

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Table 1. Summary of demographic, ribavirin use and clinical outcome of patients receiving ribavirin between 1 January 2018 and 31 August 2023.

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Demographics							
Age (months)	2	0 (11 days)	3	1	36	1	8
Sex	Male	Male	Female	Female	Female	Male	Male
Ethnicity	Chinese	Malay	Malay	Chinese	Malay	Chinese	Chinese
Risk factors							
Comorbidities	Preterm 32 weeks ^a	Preterm 34 weeks ^a	None	None	AVSD/PA ^b asplenia	Preterm 33 weeks ^a	Tetralogy of Fallot, PA ^c
Day of illness (cough) at presentation	2	2	4	3	2	2	2
Ribavirin							
Day of illness when ribavirin was administered	4	3	5	4	3	3	3
Dose of ribavirin (mg/kg)	15	20	15	25	15	15 (IV) 24 (PO)	30
Route of ribavirin	IV	PO	IV	PO	IV	IV and PO	PO
Duration of ribavirin	10	10	7	10	7	10	10
Maximum medical care required							
Ventilatory support	Conventional					HFOV	Non-invasive
Inotropic support	None	None	None	None	Inotrope	None	None
Days of ICU stay	9	7	6	11	8	20	6
Days of hospital stay	19	36	9	15	9	25	14
Outcome and follow-up							
Outcome	Survived to discharge						
Follow-up duration ^d	2 years 5 months	3 years 11 months	4 months	1 year 1 month	10 months	Did not attend	5 months

AVSD/PA: atrioventricular septal defect with pulmonary atresia; HFOV: high frequency oscillatory ventilation; ICU: intensive care unit; IV: intravenous; PA: pulmonary atresia; PO: per os ("by mouth")

^a All 3 ex-premature infants who received ribavirin did not have chronic lung disease or significant respiratory sequelae as a result of their prematurity.

^b Complete atrioventricular septal defect with pulmonary atresia and major aortopulmonary collateral arteries, cyanotic baseline saturations of 78–80%.

^c Tetralogy of Fallot with pulmonary atresia, had undergone right ventricle-to-pulmonary artery shunt creation, cyanotic baseline saturations of 80–82%.

^d This represents the duration from discharge until last follow-up or time of data collection for the audit in February 2024 if follow-up was ongoing.

received intravenous ribavirin, 3 received oral ribavirin and 1 received both intravenous and oral ribavirin. The dosage used was between 20–30 mg/kg/day for oral ribavirin and 15 mg/kg/day for intravenous ribavirin. None of the infants developed haemolytic anaemia or electrolyte abnormalities from ribavirin. All 7 patients survived to discharge, and 1 patient was subsequently diagnosed with asthma requiring inhaled corticosteroid therapy on outpatient follow-up

4 months after the admission for RSV requiring ribavirin treatment.

Of the 7 patients who were treated with systemic ribavirin over the period of this audit, a Wilcoxon rank-sum test indicated no statistically significant differences in median age ($P=0.114$) or presence of co-infection with other respiratory viruses ($P=0.10$) between patients who were not given ribavirin and those who were given ribavirin. However, individuals

who received ribavirin were more likely to have had other comorbid medical conditions ($P=0.045$) and a longer median duration of ICU ($P=0.00$) and hospital stay ($P=0.00$).

In this audit, the authors described no acute adverse effects of ribavirin with good tolerability among 7 severe RSV-infected children. This is similar to the side effect profile described in existing literature⁹ with few significant adverse effects reported. One systematic review published in 2022 of studies in adults and a small paediatric population, demonstrated insufficient evidence to support its use in lung transplant recipients and healthy infants.⁹ Reported side effects described from other studies include bronchospasm, shortness of breath, chest pain, skin rash and conjunctivitis⁴ which were not present in the patients included in this study. Due to the small cohort of children started on ribavirin in this study, the authors were unable to draw any further conclusions regarding its efficacy in use in paediatric patients. In addition, the follow-up period was limited, as patients who had been admitted in 2023 would only have been followed up for 1 year at the time of this clinical audit. Further prospective studies are required to establish the efficacy and safety of ribavirin use in immunocompetent paediatric patients.

Ethics statement

This study was performed as a clinical practice improvement audit.

Declaration

The authors declare there are no affiliations with or involvement in any organisation or entity with any

financial interest in the subject matter or materials discussed in this manuscript. All authors have no conflicts of interest to declare.

Keywords: *infectious diseases, paediatric medicine, paediatrics, respiratory infection, respiratory syncytial virus*

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Patient-identified barriers to elective dialysis initiation in Singapore: A cross-sectional study

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Dear Editor,

Unplanned dialysis, defined as the initiation of dialysis without a definitive vascular or peritoneal access, remains a significant challenge in the management of end-stage kidney disease (ESKD). Compared to planned dialysis, it is associated with increased mortality, higher healthcare costs, reduced quality of life and productivity.¹ A Canadian study reported potential cost savings up to CAD 16.1 million dollars annually with a 50% reduction in unplanned dialysis initiation.² In Singapore, planned initiation of haemodialysis (HD) stands at a dismal 15%,³ with the authors' institution, the National University Hospital (NUH), Singapore fairing only slightly better, at 30%. These findings highlight the urgent need for strategies to promote uptake of elective dialysis initiation.

In a US 2013 and Australian 2016 study, limited health literacy was reported in 10–50% of patients with chronic kidney disease (CKD),⁴ with knowledge gaps about CKD persisting despite 1 year of standard outpatient nephrology care, highlighting the inadequacies in pre-dialysis education.⁵ A previous study from Singapore by Griva et al. reported various psychosocial factors such as lack of symptoms, fear of dialysis, work-related concerns, burden to loved ones, disruptions to one's lifestyle, risks of access creation, hope for alternative treatment options, and social influences as some of the main patient-related barriers to dialysis initiation.⁶ Studying these patient-related factors is key to streamlining dialysis-related education and counselling. Addressing them may lead to reduced rates of unplanned dialysis initiation and improved overall patient outcomes.

We identified 53 patients with ESKD aged at least 21 years who underwent unplanned HD initiation between June 2019 and May 2020 at NUH, of which 33 consented to the study and completed survey questionnaires from June 2020 to December 2021. The 17-item questionnaire was developed based on

available literature and divided into 3 sections: the first section assessed patients' demographics and socio-economic status; the second section identified factors leading to their initial decision against elective dialysis initiation and the subsequent impact of dialysis on their lifestyles; the final section focused on identifying additional information and resources that may have facilitated an earlier decision about elective dialysis start. Surveys were conducted in English or Mandarin by the authors.

We examined the socioeconomic determinants of timely dialysis initiation. Financial concerns played a key role in dialysis decision-making, with 94% of patients citing cost concerns as a deterrent to dialysis initiation. Post-initiation, 75% of patients perceived increased financial strain, consistent with prior studies.⁶ In this study's cohort, 75% had a per capita monthly household income below SGD 2800. In Singapore, dialysis is heavily subsidised, with per capita income of less than SGD 2800 being provided 20–75% of government subsidies.⁷ Despite the government support, the perceived financial burden of dialysis remains high. This perceived lack of financial support was similarly illustrated in a 2020 Singapore study by Hwang et al.⁸ and suggests a gap in patients' understanding and accessibility to financial resources, emphasising the need for improved communication between healthcare providers, administrators and patients. Further-more, 75% of patients received education up to secondary school level or lower. Lower socioeconomic status and education levels have previously been reported to correlate with a higher likelihood of unplanned dialysis initiation and poor survival outcomes in patients with ESKD.⁹ These findings underscore the need for targeted strategies to mitigate disparities in dialysis preparedness among the socially disadvantaged.

Physician recommendations and worsening symptoms associated with CKD progression were key factors influencing dialysis initiation in this study.

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This is consistent with previous literature showing that patients referred early to a nephrologist are more likely to receive definitive vascular access.¹⁰ The caveat, however, is that interpersonal trust is established through repeated interactions,^{10,11} and although healthcare providers are deemed to be key influencers in decision-making, the impact of recommendations varies in accordance to the level of trust established with patients and their families.¹² Early nephrology referrals provide opportunities to build the trust between physicians and patients.

In this study's cohort, only 16% of participants involved their family members in the initial decision-making process for dialysis initiation, but 34% eventually started dialysis after shared discussions with their families. There were 40% of patients who reported that family and social support played a role in their decision to initiate dialysis. Good family support facilitates adjustment to the significant lifestyle changes that are required post-dialysis. These findings underscore the need for early involvement of patients' families and caregivers in this complex decision-making process. Besides family, peer influence plays an important part in pre-dialysis education.⁶ Many participants felt that first-hand experiences, such as listening to testimonials from dialysis patients, in-person viewing of the dialysis centre, or observation of an actual patient undergoing dialysis, would have helped them make an earlier decision regarding dialysis initiation. Previous studies have also shown that peer influences are as important as input from healthcare providers,⁶ with some patients valuing peer stories more than physicians' recommendations when selecting a dialysis modality.¹²

Other significant barriers to dialysis initiation included concerns about a lower quality of life (81%), difficulties with travel (72%), fear of dialysis dependence (69%) and fear of surgery for access creation (69%). Despite these initial concerns, 88% of patients did not regret initiating dialysis, suggesting that most patients felt that the challenges associated with undergoing dialysis were reasonable trade-offs for a longer life expectancy. In this cohort, only 65% of patients recalled ever receiving counselling by a renal coordinator, of which almost 40% felt the resources provided were inadequate for a comprehensive understanding of dialysis. These findings are similar to previous studies where patients reported a suboptimal understanding of dialysis and access issues despite attending 2 or more counselling sessions by a renal coordinator.⁶ This suggests that the timing and reinforcement of pre-dialysis education are crucial for adequate retention of knowledge about dialysis modalities over time.

A summary of various barriers perceived by patients and potential solutions is presented in Table 1.

This study has several limitations including its single-centre design, small sample size and potential recall bias as the questionnaires were conducted after the initiation of dialysis. The questionnaire used in our study has not been validated. However, there is currently no validated tool available to identify barriers to unplanned dialysis initiation.

Our study found that perceived barriers to elective dialysis initiation remain consistent with those identified in previous Singapore studies published in 2019 and 2020. The novelty of this study lies in its direct engagement with patients, identifying aspects in care that could have been optimised to aid their decision-making process and capturing their suggestions on how to improve uptake of elective dialysis. We propose the following targeted strategies, partially based on the responses from the study participants. Renal counselling should be individualised, and repeated sessions should be arranged where necessary, to increase patients' health literacy about dialysis.⁷ Counselling should include information about lifestyle and dietary changes post-dialysis initiation and setting realistic expectations regarding symptom improvement. Additionally, we advocate for the inclusion of dialysis centre visits as part of renal counselling or the use of videos to demonstrate the dialysis process. Since physician recommendations and family support are known to influence patients' acceptance of elective dialysis, we propose a multidisciplinary counselling approach that includes the renal coordinator, nephrologist, patient and family members in a joint session to support informed decision-making.

Ethics statement

Ethics approval was obtained from National Healthcare Group Domain Specific Review Board (DSRB 2020/00554-SRF0001).

Declaration

The authors declare there are no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript.

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Keywords: dialysis, elective dialysis initiation, end-stage kidney disease, nephrology, renal counselling

Table 1. Barriers to elective dialysis initiation and proposed strategies to increase uptake of elective dialysis initiation.

Thematic domains	Perceived barriers	Illustrative quotes from patients	Proposed targeted solutions
Financial	Dialysis would pose a significant financial burden	"I have had a loss of income as I am now unable to spend many hours working." "My expenses have increased." "I have to arrange for ambulance transport to my dialysis center which causes financial strain." "I have cut down on outings to cut my spendings."	Initiate early financial counselling, involving medical social workers Evaluation of eligibility for voluntary welfare organisation subsidies prior to dialysis initiation
Knowledge gaps and fears	Dietary modifications and restrictions post-dialysis initiation	"I will be unable to eat food that I like or drink beverages that I want in the amount I want."	Structured, individualised and repetitive education programme
	Fear of undergoing surgery for access creation	"(I wish I was told) what alterations to meals would be required after commencing on dialysis."	Pre-dialysis counselling to include aspects on lifestyle changes, dietary changes and symptom improvement
	Lack of knowledge about the dialysis process	"I fear blood, needles, pain and poor cosmesis."	Use of videos to demonstrate the dialysis process
		"I worry about the lethargy post-dialysis and about pain and discomfort during dialysis." "I wish I knew about the duration of each dialysis session and the amount of time commitment it would require." "I did not expect that dialysis involved so much usage of needles. I am fearful of needles and I wish I was pre-empted about this." "Fear of dialysis is a major factor influencing decision not for dialysis initially hence it is important for patients to hear about first-hand dialysis experience from current patients undergoing dialysis to help allay their fears. I feel that dialysis counsellors themselves have not undergone dialysis before and hence do not fully understand what dialysis entails and hence are not adequately equipped to counsel patients on dialysis." "Having a video clip to show patients what dialysis is like will help to decrease the fear and encourage people to initiate dialysis."	Visits to dialysis centre Testimonials from existing dialysis patients
Family and social support	Misconception that making decisions about dialysis initiation does not require family involvement	"(Post-dialysis initiation), I feel that my family support has increased and my family is more tight-knitted now."	Active involvement of family members and caregivers in pre-dialysis counselling sessions
	Lack of adequate social and emotional support	"I have reduced self-confidence." "My mother and sister were on dialysis and they had poor health, I do not want to turn out like them." "I am scared that dialysis will kill me as I have had 2 friends who underwent dialysis and passed away."	Peer support groups and psychosocial counselling

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Genetic counselling and testing for inherited glomerular kidney diseases: A single-centre experience

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Dear Editor,

The World Health Organization (WHO) has projected kidney diseases to become the fifth leading cause of mortality by the year 2040.¹ Singapore is no exception; it currently ranks fifth and second among countries with the highest incident and prevalent kidney failure rates, respectively.² As genetic causes contribute to 10–30% of chronic kidney disease (CKD), early detection can allow prompt institution of disease-modifying treatment, avert an arduous and expensive diagnostic odyssey, avoid potentially futile treatment (e.g. use of immunosuppressants in genetic podocytopathies) and guide surveillance for extra-renal manifestations (e.g. sensorineural hearing loss in Alport syndrome).³ A genetic diagnosis in the proband (i.e. first person identified within a family to receive genetic counselling or testing) can also facilitate cascade testing in family members for earlier diagnosis and interventions.

Historically, patients with suspected monogenic kidney diseases at the Singapore General Hospital (SGH) were referred to the genetics service in a physically distant children's hospital or the adult genetics service within the institution because there was no genetic kidney disease service (GKS) within its adult nephrology unit. Since March 2023, a nephrologist-led GKS was implemented in the nephrology unit as part of a nationwide genomics clinical implementation effort. The implementation team comprised 6 nephrologists with genetics interest (termed "genetic nephrologists") and 2 coordinators. This implementation team was part of the Renal Alliance for Precision Diagnosis in Singapore (RAPIDS), a multidisciplinary

and multi-institutional team of nephrologists, geneticists, genetic counsellors, bioinformaticians, coordinators and laboratory scientists.⁴ Genetic nephrologists received training, supervision and feedback to increase genetic knowledge and skills in the RAPIDS multidisciplinary collaboration.⁴ Patients with suspected monogenic glomerular disease were identified and referred by nephrologists in the department and from other hospitals. As Alport syndrome is the most common monogenic glomerular disease, and has high phenotypic variability and incomplete penetrance,⁶ the authors initiated a collaboration with the Ocular Genetics Service at the Singapore National Eye Centre (SNEC) to identify and refer patients who had classical ophthalmological features of monogenic kidney conditions (e.g. fleck retinopathy in Alport syndrome). Fig. 1 summarises the patient journey. Specific barriers at the centre were established with facilitators, and implementation strategies were adapted in an iterative process that considered feedback from the implementation team, referring nephrologists and patients by using the PRISM process model (Supplementary Table S1).⁵ The authors described the intervention (Supplementary Table S2), implementation study method (Supplementary Table S3–S5) and outcomes of adoption, utility and intent to sustain the service (Supplementary Table S6) according to the Standards for Reporting Implementation Studies (StaRI) checklist (Supplementary Table S7).

In total, 201 eligible patients were referred to the GKS. Twenty-eight of 35 nephrologists (80.0%) and 4 of 20 nephrology trainees (20.0%) from SGH referred 186 patients, while 5 nephrologists from other

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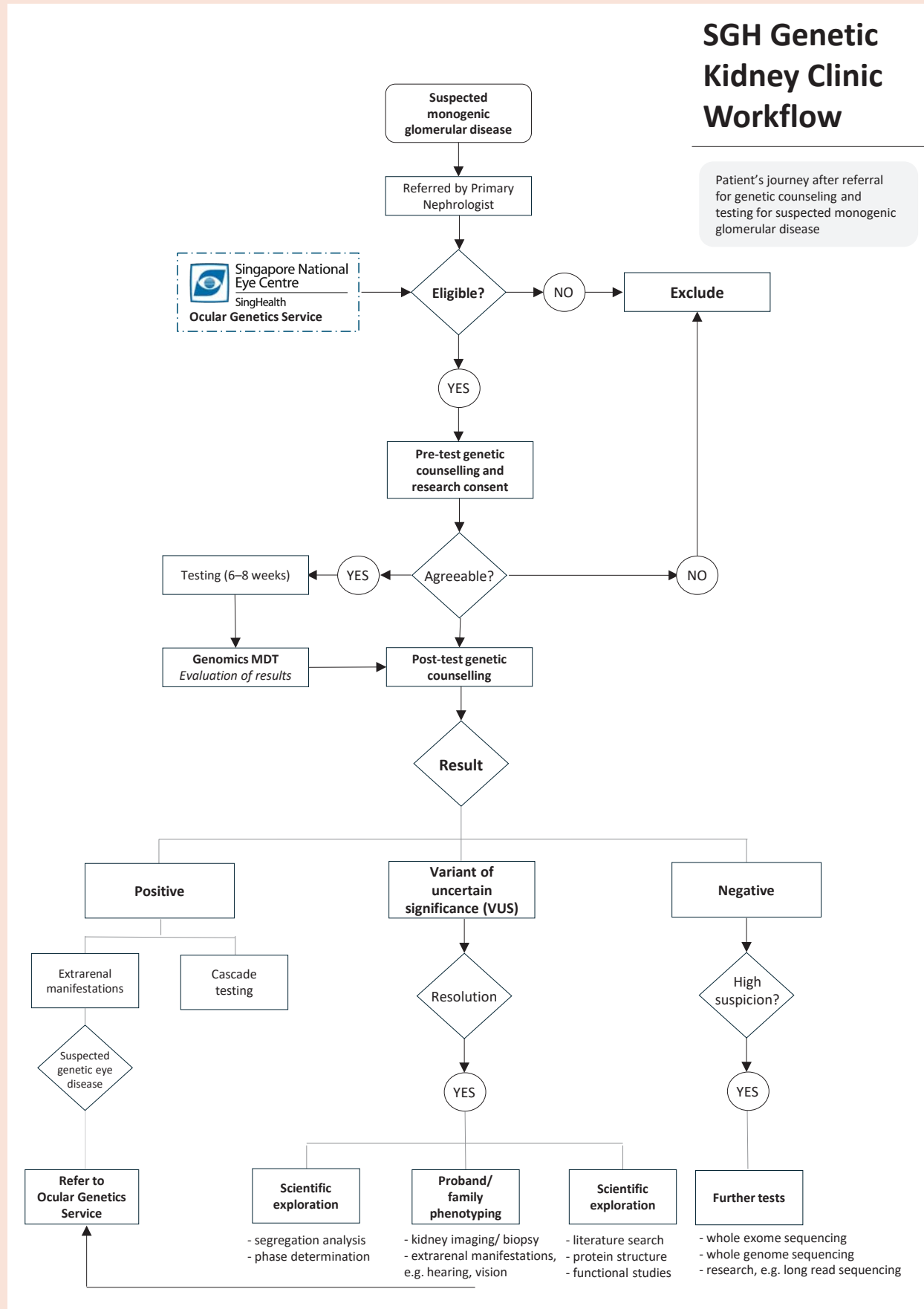
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Fig. 1. Patient journey.



institutions (2 public hospitals and 1 private hospital) referred 15 patients. Among 201 patients referred to the GKS, 109 (54.2%) consented to receive pre-test genetic counselling. Six patients declined testing and 2 withdrew consent after testing. Supplementary Table S8 shows the characteristics of the 101 patients who underwent genetic testing. The median age was 43 years (interquartile range 34.0–55.0) and 82.1% were Chinese. Most had a family history of kidney disease (75.2%). The most common indications for genetic testing were persistent albuminuria (60.4%), isolated haematuria (19.8%) and CKD Stage G3–G5 of unknown aetiology (19.8%).

The clinical genetics lab initially found that 13 patients (12.9%) had pathogenic variants that explained their kidney condition. The monthly genomic board variant curation meetings also determined that 18 (17.8%) patients had variants of uncertain significance (VUS) suspicious for pathogenicity. VUS resolution efforts undertaken included segregation analysis, family phenotyping, research tests such as functional studies and further genetic analysis (e.g. 10 patients [9.9%] had additional whole exome sequencing (WES). Subsequently, 8 additional patients (7.9%) had genetic diagnoses so that a total of 21 patients (20.8%) had genetic diagnoses. The most common genetic diagnosis was Alport syndrome (17/21 patients, or 81.0%). Supplementary Table S9 details the pathogenic variants and VUS of high pathogenic suspicion detected in the study cohort.

The initial diagnostic yield was considerably low, at 12.9%. This may be because only adult patients with glomerular disease phenotypes were recruited, while higher yield is associated with younger age and cystic kidney phenotypes.⁷ This may also reflect the paucity of genomic data from Asian populations.⁸ However, with the VUS resolution efforts carried out by the multidisciplinary RAPIDS collaboration, the authors were able to clinch genetic diagnoses for additional patients, and increased the yield to 20.8%. This has implications on medical management, cascade testing and family planning for the patients. Future analyses from the adult and paediatric centres participating in RAPIDS will provide more information on the clinical utility of genetic testing for monogenic kidney diseases.

Supplementary Table S10 shows that most nephrologists who responded to the survey were aware of the GKS and supported the service. Thus, many patients with suspected monogenic glomerular diseases were referred for genetic testing within the first 21 months of the GKS implementation (Supplementary Fig. S1), especially from the genetic nephrologists (Supplementary Figs. S2 and S3). However, only half of the patients agreed to receive pre-test

genetic counselling. Concerns regarding the adverse impact of a genetic diagnosis on insurability might have reduced the uptake of genetic counselling.⁹ At present, there is no legislation in Singapore to prevent genetic discrimination against employability and insurability. In addition, while genetic testing was fully covered by research funding in the study, the authors foresee that cost will be a barrier to future as there is no government subsidy nor insurance cover for genetic testing for kidney diseases in Singapore.⁹ In June 2025, Singapore's Ministry of Health (MOH) launched the national Familial Hypercholesterolaemia (FH) genetic testing programme where testing will be subsidised for eligible Singapore citizens and Permanent Residents, who can also utilise their MediSave (i.e. Singapore's national medical savings scheme) to offset the cost.¹⁰ MOH also disallowed life insurers from using genetic results from the FH programme for insurance underwriting.¹⁰ Similar healthcare policy and financing changes can encourage uptake of genetic testing for monogenic kidney diseases in the GKS.

In summary, implementing the GKS is feasible. While there continue to be barriers to the uptake of genetic testing, ongoing efforts to address them will improve adoption and access to genetic testing.

Supplementary Materials

Supplementary Table S1. Barriers and facilitators described according to the Practical, Robust Implementation and Sustainability Model (PRISM) domains with corresponding implementation strategies according to the Expert Recommendations for Implementing Change (ERIC) taxonomy.

Supplementary Table S2. Intervention and implementation strategies according to the Template for Intervention Description and Replication (TIDieR).

Supplementary Table S3. Implementation of study methodology.

Supplementary Table S4. Inclusion and exclusion criteria for probands and types of genetic tests.

Supplementary Table S5. List of genes tested for suspected inherited glomerular kidney disease.

Supplementary Table S6. Implementation outcomes of adoption, utility and intent to maintain the service.

Supplementary Table S7. Standards for Reporting Implementation Studies (StaRI) checklist.

Supplementary Table S8. Characteristics of patients who underwent genetic testing.

Supplementary Table S9. Genes detected with pathogenic/likely pathogenic variants and variants of uncertain significance (VUS) of high pathogenic suspicion.

Supplementary Table S10. The Normalization of Complex Interventions – Measure Development (NoMAD) survey responses at 12 months after implementation of the genetic kidney disease service.

Supplementary Figure S1. Number of referrals for genetic counselling and testing per quarter.

Supplementary Figure S2. Box plots of referrals per nephrologist from genetic nephrologist compared with non-genetic nephrologists.

Supplementary Figure S3. Box plots of referrals per nephrologist from genetic versus non-genetic nephrologists per quarter.

Ethics statement

All participants provided written informed consent for participation in the study, which included data collection and genetic testing. The study was conducted in accordance with the Declaration of Helsinki and approved by the National Healthcare Group's Domain Specific Review Board (2022/00108).

Declaration

The authors declare there are no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript. All authors have no conflicts of interest to declare.

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Keywords: genetics, genomics, glomerular disease, implementation, nephrology

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Healthier SG awareness and enrolment among persons with chronic disease

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Dear Editor,

Singapore introduced Healthier SG (HSG) in July 2023, shifting healthcare from curative to preventive care by preventing chronic diseases in healthy individuals and slowing deterioration in those with existing conditions.¹ It encourages residents to enrol with a clinic, consult a family doctor and develop a personalised health plan.^{2,3} Pre-enrolment was open to individuals aged ≥ 40 years with chronic conditions in May 2023.⁴ Later, enrolment was open to individuals aged ≥ 60 years in July 2023 and expanded to individuals aged 40–59 years from November 2023.⁵

A household survey was conducted among community dwellers with chronic disease to explore patient characteristics associated with HSG awareness and enrolment.

Data collection occurred between September and November 2023 (National University of Singapore Institutional Review Board 2023-190). This study used a sampling frame of 3000 addresses of Singapore citizens or permanent residents (PRs) aged ≥ 45 years, acquired from the Singapore Department of Statistics using a proportionate stratified design by dwelling type. Study invitation letters in English, Mandarin and Malay were mailed at least 2 weeks before the addresses were visited by interviewers. The eligibility criteria included: (1) community-dwelling Singapore citizens or PRs; (2) aged ≥ 45 years; (3) diagnosed with ≥ 1 of these chronic conditions: diabetes, hypertension, hyperlipidaemia, musculoskeletal conditions, respiratory conditions, heart failure or other heart conditions, chronic kidney disease, depression or anxiety, stroke, fatty liver or hepatitis B cirrhosis, Parkinson's disease or epilepsy; (4) speaks English, Mandarin or Malay; and (5) agreed to be re-contacted for future related studies. In addition, individuals aged ≥ 65 years were screened for cognitive impairment using the Abbreviated Mental Test.

The questionnaire, initially developed in English, was translated into Mandarin and Malay, covering 6 self-reported sections: (1) demographics, (2) disease management and patient-reported experience, (3) healthcare utilisation, (4) patient-reported outcomes, (5) health characteristics and (6) HSG-related questions. As HSG enrolment was not open for some individuals aged < 60 years at the time of the survey, tailored questions were used to assess HSG awareness and enrolment status. Those aged ≥ 60 years were asked if they had enrolled, while those aged < 60 years were asked if they would enrol when the enrolment is open for them. Enrolment status was categorised as (1) already enrolled, (2) planning to enrol, (3) unsure about enrolment and (4) planning not to enrol. Participants who responded "I don't know what Healthier SG is" were categorised as being unaware of HSG while all others were categorised as aware.

Separate logistic regression models were employed to identify characteristics associated with HSG awareness and enrolment status, using stepwise backward elimination method. HSG awareness was used as the dependent variable (0=aware; 1=unaware) to assess the participant characteristics associated with HSG unawareness. Patient characteristics associated with enrolment status (0=enrolled or planned to enrol; 1=uncertain about enrolment or planned not to enrol) were examined among those who were aware. Characteristics investigated included variables related to demographics, chronic disease management, health characteristics, 1-year health services utilisation and lifestyle.

A total of 1503 participants were surveyed. Most participants were ≥ 60 years old (70.3%) and Chinese (67.8%), followed by Malays (15.0%), Indians (13.6%) and Others (3.6%). More than half (55.7%) had > 1 chronic condition, with hypertension (60.4%), hyperlipidaemia (58.8%) and diabetes (34.6%) being

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most prevalent. Of the 1503 participants, 985 (65.5%) were aware of HSG. Of these, 44.3% had enrolled in HSG, while 39.8% planned to enrol; the remaining were either unsure about enrolment (10.5%) or planned not to enrol (5.5%).

Among individuals who were aware of HSG, Malays (odds ratio [OR] 1.56), those without a regular doctor (OR 1.71), those hospitalised for a total of more than 7 days in the past year (OR 1.82), those who did not visit a primary care provider in the past year (OR 2.61) and individuals reporting anxiety or depression (OR 1.46) were more likely to be unsure about or planning not to enrol in HSG (Table 1). Among them, not having a regular doctor and 1-year primary care visit were identified as the most significant factors in the multivariable regression analysis. Participants cited the following reasons for enrolment hesitancy: preference to retain doctor selection flexibility, lack of interest or motivation, uncertainty about enrolment process or clinic choice, preferred physician or clinic is not an HSG clinic, difficulty in using the enrolment app, insufficient information, discouragement from family or existing doctors, reliance on specialist clinics and perceived low need for primary care, busy with other commitments, physical limitations, negative perceptions of HSG, already have a regular doctor and perceived low needs to enrol. Individuals who were unaware of HSG were more likely to be Malays (OR 1.98) or Indians (OR 1.63), PRs (OR 1.79); those without formal education (OR 3.44); housewives (OR 1.40) or widow/widowers (OR 1.86); occupants of 1- to 4-room public housing flat (OR 1.75); individuals of lower socioeconomic status (card holders of Community Health Assist Scheme [CHAS] Blue or Orange) (OR 1.55); current or ex-smokers (OR 1.83); those who were hospitalised at least once in the past year (OR 1.38); or had a total length of inpatient stay of 7 days or more in the past year (OR 2.13); those who never visited a primary care provider (OR 1.65); and those who reported problems in mobility (OR 1.77), self-care (OR 2.13) or usual activities (OR 1.93) (Table 2). Among these, ethnicity, citizenship status, education, widowhood, socioeconomic status, smoking status, length of inpatient stays in the past year, and problems with usual activities were identified as the most significant factors in the multivariable regression analysis.

The study suggests that individuals who are more vulnerable or less health-conscious were unaware of HSG, probably due to slower penetration of HSG promotion into this group. Hopefully, the multi-method HSG campaigns in the past years have significantly improved its awareness, which is key to HSG enrolment.

The combined HSG enrolment and planning-to-enrol rate among individuals who were aware of HSG

Table 1. Characteristics of individuals who were aware of HSG but were unsure about enrolling or planned not to enrol in Healthier SG.

Participant characteristics	Univariate analysis		Multivariate analysis	
	OR	P value	OR	P value
(A) Demographics				
Age				
Below 60 years old	1.00		-	
60 years old and above	0.78	0.175	-	-
Sex				
Male	1.00		-	
Female	0.77	0.136	-	-
Ethnicity				
Chinese	1.00		-	
Malay	1.56	0.071	-	-
Indian	1.15	0.602	-	-
Others	0.92	0.861	-	-
Citizenship status				
Singapore citizens	1.00		-	
Singapore permanent resident	1.11	0.782	-	-
Lived in Singapore most of the time in the past 5 years				
Yes	1.00		-	
No	0.81	0.782	-	-
Education				
Has formal education	1.00		-	
No formal education	0.91	0.699	-	-
Work status				
Employed, unemployed, retired or full-time student	1.00		-	
Housewife	1.24	0.397	-	-
Marital status				
Single, married, divorced or separated	1.00		-	
Widowed	1.01	0.977	-	-
Children				
No children	1.00		-	
Have children	0.85	0.478	-	-

Table 1. Characteristics of individuals who were aware of HSG but were unsure about enrolling or planned not to enrol in Healthier SG. (Cont'd)

Participant characteristics	Univariate analysis		Multivariate analysis	
	OR	P value	OR	P value
Housing				
5-room public housing flat, private condominium or flat, or bungalow or semi-detached house	1.00		-	
1-, 2-, 3-, 4-room public housing flat	1.03	0.889	-	-
Socioeconomic status				
Higher socioeconomic status	1.00		-	
Lower socioeconomic status	1.00	0.980	-	-
(B) Disease management				
Regular doctor				
Have a regular doctor	1.00		1.00	
No regular doctor	1.71	0.005	1.55	0.023
Health plan				
No health plan	1.00		-	
Have a health plan	1.01	0.966	-	-
(C) Healthcare utilisation				
One-year hospitalisation				
Never hospitalised in the past year	1.00		-	
Hospitalised at least once in the past year	0.95	0.829	-	-
Total no. of nights spent in the hospital in the past year				
0–7 days	1.00		-	
More than 7 days	1.82	0.097	-	-
1-year emergency visit				
Never visited the emergency department in the past year	1.00		-	
Visited the emergency department at least once in the past year	0.74	0.333	-	-
Total no. of emergency visit in the past year	1.03	0.847	-	-

Table 1. Characteristics of individuals who were aware of HSG but were unsure about enrolling or planned not to enrol in Healthier SG. (Cont'd)

Participant characteristics	Univariate analysis		Multivariate analysis	
	OR	P value	OR	P value
1-year primary care visit				
Visited a primary care provider at least once in the past year	1.00		1.00	
Have not visited a primary care provider in the past year	2.61	<0.001	2.38	0.001
(D) Health characteristics				
EQ-5D mobility dimension				
No problem	1.00		-	
Have problem	0.99	0.947	-	-
EQ-5D self-care dimension				
No problem	1.00		-	
Have problem	1.08	0.827	-	-
EQ-5D usual activities dimension				
No problem	1.00		-	
Have problem	0.89	0.673	-	-
EQ-5D pain/discomfort dimension				
No problem	1.00		-	
Have problem	0.88	0.459	-	-
EQ-5D anxiety/depression dimension				
No problem	1.00		-	
Have problem	1.46	0.085	-	-
EQ VAS score	1.00	0.937	-	-
BMI category				
Underweight (<18.5 kg/m ²)	1.00		-	
Low cardiovascular disease risk (18.5–22.9 kg/m ²)	2.27	0.186	-	-
Moderate cardiovascular disease risk (23.0–27.4 kg/m ²)	2.21	0.200	-	-
High or very high cardiovascular disease risk (≥27.5 kg/m ²)	2.16	0.221	-	-

Table 1. Characteristics of individuals who were aware of HSG but were unsure about enrolling or planned not to enrol in Healthier SG. (Cont'd)

Participant characteristics	Univariate analysis		Multivariate analysis	
	OR	P value	OR	P value
(E) Lifestyle				
Smoking status				
Never smoker	1.00		-	
Current or ex-smoker	1.36	0.175	-	-
Alcohol consumption behaviour in the past month				
Non-drinker	1.00		-	
Drinker who did not engage in binge drinking	1.20	0.488	-	-
Binge drinker	1.25	0.731	-	-

BMI: body mass index; EQ VAS: EQ visual analogue scale;
OR: odds ratio

Table 2. Characteristics of individuals who were unaware of Healthier SG. (Cont'd)

Participant characteristics	Univariate analysis		Multivariate analysis	
	OR	P value	OR	P value
Lived in Singapore most of the time in the past 5 years				
Yes	1.00		-	
No	0.50	0.225	-	-
Education				
Has formal education	1.00		1.00	
No formal education	3.44	<0.001	3.38	<0.001
Work status				
Employed, unemployed, retired or full-time student	1.00		-	
Housewife	1.40	0.026	-	-
Marital status				
Single, married, divorced or separated	1.00		1.00	
Widowed	1.86	<0.001	1.56	0.017
Children				
No children	1.00		-	
Have children	1.16	0.345	-	-
Housing				
5-room public housing flat, private condominium or flat, or bungalow or semi-detached house	1.00		-	
1-, 2-, 3-, 4-room public housing flat	1.75	<0.001	-	-
Socioeconomic status				
Higher socioeconomic status	1.00		1.00	
Lower socioeconomic status	1.55	<0.001	1.40	0.008
(B) Disease management				
Regular doctor				
Have a regular doctor	1.00		-	
No regular doctor	1.06	0.649	-	-
Health plan				
Have a health plan	1.00		-	
No health plan	1.10	0.400	-	-

Table 2. Characteristics of individuals who were unaware of Healthier SG.

Participant characteristics	Univariate analysis		Multivariate analysis	
	OR	P value	OR	P value
(A) Demographics				
Age				
45–59 years old	1.00		-	
60 years old and above	0.93	0.557	-	-
Sex				
Male	1.00		-	
Female	1.04	0.744	-	-
Ethnicity				
Chinese	1.00		1.00	
Malay	1.98	<0.001	1.80	<0.001
Indian	1.63	0.002	1.48	0.022
Others	1.14	0.651	0.97	0.934
Citizenship status				
Singapore citizen	1.00		1.00	
Singapore permanent resident	1.79	0.005	3.39	<0.001

Table 2. Characteristics of individuals who were unaware of Healthier SG. (Cont'd)

Participant characteristics	Univariate analysis		Multivariate analysis	
	OR	P value	OR	P value
(C) Healthcare utilisation				
1-year hospitalisation				
Never hospitalised in the past year	1.00		-	
Hospitalised at least once in the past year	1.38	0.018	-	-
Total no. of nights spent in the hospital in the past year				
0–7 days	1.00		1.00	
More than 7 days	2.13	<0.001	1.70	0.030
One-year emergency visit				
Never visited the emergency department in the past year	1.00		-	
Visited the emergency department at least once in the past year	0.96	0.800	-	-
Total no. of emergency visit in the past year	0.98	0.877	-	-
1-year primary care visit				
Visited a primary care provider at least once in the past year	1.00		-	
Never visited a primary care provider in the past year	1.65	0.003	-	-
(D) Health characteristics				
EQ-5D mobility dimension				
No problem	1.00		-	
Have problem	1.77	<0.001	-	-
EQ-5D self-care dimension				
No problem	1.00		-	
Have problem	2.13	<0.001	-	-
EQ-5D usual activities dimension				
No problem	1.00		1.00	
Have problem	1.93	<0.001	1.46	0.018
EQ-5D pain/discomfort dimension				
No problem	1.00		-	
Have problem	1.16	0.176	-	-

Table 2. Characteristics of individuals who were unaware of Healthier SG. (Cont'd)

Participant characteristics	Univariate analysis		Multivariate analysis	
	OR	P value	OR	P value
EQ-5D anxiety/depression dimension				
No problem	1.00		-	
Have problem	1.13	0.377	-	-
EQ VAS score	0.99	0.015	-	-
BMI category				
Underweight (<18.5 kg/m ²)	1.00		-	
Low cardiovascular disease risk (18.5–22.9 kg/m ²)	0.84	0.564	-	-
Moderate cardiovascular disease risk (23.0–27.4 kg/m ²)	0.89	0.681	-	-
High or very high cardiovascular disease risk (≥27.5 kg/m ²)	1.04	0.884	-	-
(E) Lifestyle				
Smoking status				
Never smoker	1.00		1.00	
Current or ex-smoker	1.83	<0.001	1.88	<0.001
Alcohol consumption behaviour in the past month				
Non-drinker	1.00		-	
Drinker who did not engage in binge drinking	0.89	0.514	-	-
Binge drinker	1.18	0.689	-	-

BMI: body mass index; EQ VAS: EQ visual analogue scale;
OR: odds ratio

in the sample (84.1%) was similar to the high proportion (85.5%) of willingness to enrol in HSG among older adults observed in a Singapore study conducted a year before HSG's launch.⁶ However, 1 and a half years after the launch of HSG, only half of the eligible population had enrolled,⁷ which was only slightly higher than the enrolment rate of 44.3% among individuals who were aware of HSG in this study. The small increase in enrolment rate could be due to low willingness to enrol among eligible residents who were aware of or invited to HSG at a later time. For example, younger residents without chronic conditions, who were invited to enrol after the survey, may not feel the urgency to do so. Another possibility,

which is more worrying, is that some residents with chronic conditions did not enrol due to other undetected reasons, though they were aware of HSG and would express willingness when inquired.

Improving HSG uptake is key to HSG's success since it adopts an opt-in method. This study suggests that awareness per se is not sufficient, and targeted interventions are needed to improve for HSG enrolment.

Ethics statement

This study was approved by the National University of Singapore Institutional Review Board (2023-190).

Declaration

This study was funded by the MOE Academic Research Fund (AcRF). The authors declare there are no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript. All authors have no conflict of interest to declare.

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Keywords: *family medicine, health inequalities, Healthier SG, population health, public health*

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MRI landscape in Southeast Asia

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Dear Editor,

Magnetic resonance imaging (MRI) is used in the diagnosis, monitoring of disease progression and treatment planning,¹ especially of non-communicable diseases that account for 62% of all deaths in Southeast Asia (SEA).² However, the density of MRI scanners in SEA (1.1 per million population) is much lower compared to other regions.³ This study aims to describe the general state of MRI services in Southeast Asian countries in order to better understand the landscape, challenges and areas of need.

An online survey was conducted and disseminated via email to staff in radiology departments in countries across SEA in January 2023, through international and local radiological organisations. The results were collated over a 3-month period. The survey covered basic MRI scanner information, availability and accessibility, level of MRI scanning services, challenges faced in providing MRI services and a wish list for MRI services (Table 1). Hospitals in lower-middle-income countries (LMIC) were evaluated and compared to hospitals in upper-middle-income countries (UMIC) and high-income countries (HIC). The average of quantitative answers and majority consensus on categorical answers were taken for respondent hospitals with multiple responses. Quantitative variables are represented by median and range, while categorical variables are represented by percentages.

The survey gathered 77 responses from 57 hospitals located in 8 countries across SEA. Of these, 26 responses were from 21 hospitals in LMIC (i.e. Indonesia, the Philippines, Vietnam, Myanmar and Laos), while 51 responses were from 36 hospitals in UMIC and HIC (i.e. Malaysia, Thailand and Singapore) (Fig. 1).

The mean radiologist-to-bed ratio was 1:62.1, and the mean radiographer-to-bed ratio was 1:26.9 among respondent hospitals in SEA. The median (range) number of radiographers in respondent hospitals in UMIC and HIC was almost twice the median number in radiographers seen in LMIC (20 [3–80] versus [vs] 34.3 [2–200]; *P*=0.009). No significant difference was observed between LMIC respondent hospitals

Table 1. Key topics covered in the survey.

Key topics	Description
Basic hospital information	Type of hospital Type of patients served Radiology staff strength
MRI scanner information	Number and type of MRI scanners Average daily MRI scans per scanner Wait time Utilisation
Level of MRI scanning services	Scanning of patients under special conditions Use of contrast agents Basic and advanced protocols
MRI scan pricing	Price range Patient's mode of payment
Barriers and needs	Challenges faced in MRI service provision Wishlist for MRI services

MRI: magnetic resonance imaging

and UMIC and HIC respondent hospitals for the number of radiologists (14 [2–70] vs 11 [1.5–60]; *P*=0.310).

Most of the respondent hospitals in SEA (65.3%) had only 1 MRI available (median [range], 1 [0–10]), which were mostly of 1.5 Tesla strength. A greater percentage of respondent hospitals in UMIC and HIC had 3T MRI available, compared to LMIC. The median (range) percentage of utilisation observed was 90% (10–150%), where 9.5% of respondent hospitals had less than 50% of utilisation which were mainly of smaller size (bed number ≤500).

Patients' mode of payment for MRI scans among respondent hospitals was mostly either fully (40.4%) or partially (40.4%) government-funded. Notably, out-of-pocket payments (8.5%) were from LMIC respondent hospitals.

In terms of case complexity, respondent hospitals in SEA provided scanning services for patients with pacemakers and cochlear implants (45.8%), under sedation (89.4%) and under general anaesthesia (66.0%). The percentage of respondent hospitals

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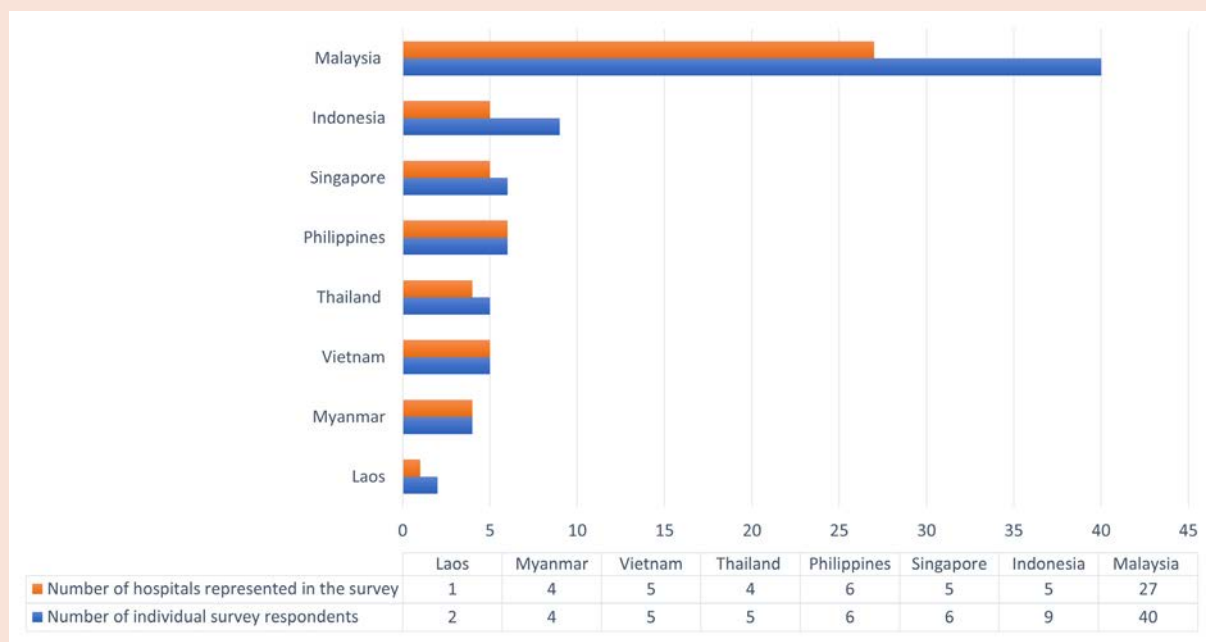
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Fig. 1. Distribution of respondents and their hospitals among Southeast Asian countries.



providing scanning services for patients with pace-makers and cochlear implants in LMIC was approximately a quarter ($P=0.002$), and for those under general anaesthesia ($P<0.001$) was less than half, compared to UMIC and HIC.

Most respondent hospitals in SEA have highlighted the current state of insufficient resources and increasing demand for MRI services in the challenges and wish list section of the survey. Almost all respondent hospitals have stated the lack of MRI equipment and the need for more MRI systems and provision of advanced MRI protocols. As a result, the need to train the radiology workforce that includes radiologists, radiographers and medical physicists was mentioned, including the expertise for using advanced MRI protocols. Despite the demand for more MRI services, the lack of government funding and long wait times were highlighted. Some respondent hospitals had indicated the need for MRI system infrastructure upgrade. There have also been delays with repair and purchase of parts for the MRI system due to little vendor support and red tape with the procurement process.

Shortage of adequately trained radiology staff in SEA could be addressed through improving training and education among Southeast Asian countries, by collaborating to provide unified region wide strategies. Imaging Southeast Asia (iSEA), for example, is a regional network aiming to facilitate training and education by coordinating with local societies among Southeast Asian countries.⁴ These efforts could extend to an integrated regional teleradiology across

SEA, boosted by artificial intelligence capabilities in workflow, could provide high-end image interpretation services to underserved areas, and could aid in training radiologists by exposing them to a variety of cases.⁵

MRI scanner availability in SEA, especially in LMIC, could be improved by introducing mobile MRI programmes using low-field portable MRI scanners as they are suitable for less urbanised areas as a point-of-care tool, especially in areas that do not have the funds, infrastructure and expertise to operate a higher field MRI system.⁶ Additionally, the donation of MRI scanners implemented through structured frameworks, similar to initiatives such as RAD-AID donating imaging equipment to hospitals after performing a Radiology Readiness Assessment,⁷ would be another approach to increase MRI scanner availability. Given that investment in imaging, especially in LMIC, has been a problem due to inadequate resources and investment plans to procure imaging equipment and more importantly, imaging has not been given priority in healthcare planning.³ The governments of countries in SEA should invest in MRI services due to the vast potential of economic benefits along with health benefits from scaling up MRI services.⁵ In May 2025, the 78th World Health Assembly adopted a milestone resolution “Strengthen medical imaging capacity”, recognising that medical imaging is vital for the diagnosis and treatment of diseases, acknowledging the global disparities in access to medical imaging, and urging member states to promote and develop strategies to improve

medical imaging capacity.⁸ The Lancet Oncology Commission on Medical Imaging and Nuclear Medicine has determined that a scale-up of MRI alone would increase the 5-year net survival among patients with selected cancer types by 1% in SEA and there would be a return of USD209 for every USD1 invested in the scale-up of imaging in Asia.^{5,9}

It is evident that the MRI services and resources present in Southeast Asian countries are insufficient in fulfilling patient needs, especially in LMIC. Hence, necessary actions should be taken to address unmet patient needs.

Ethics statement

Not applicable. The study did not involve patients. The survey was conducted among hospital professionals.

Declaration

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