

Variations in management strategies for stable coronary artery disease in the Asia-Pacific region: Insights from a multinational survey

Lucky Cuenza^{*1,2} MD, Satoshi Honda^{*3} MD, Khi Yung Fong^{*4} MRCSI, Mitsuaki Sawano^{5,6} MD, F Aaysha Cader⁷ MD, Purich Surunchupakorn⁸ MD, Wishnu Aditya Widodo⁹ MD, Mayank Dalakoti^{10,11} MD, Jeehoon Kang¹² MD, Misato Chimura¹³ MD, Mohammed Al-Omary¹⁴ PhD, Zhen-Vin Lee¹⁵ MD, Novi Yanti Sari¹⁶ MD, Thanawat Suesat¹⁷ MD, Tanveer Ahmad¹⁸ MD, Jose Donato Magno¹⁹ MD, Chen Ting Tan²⁰ MD, Badai Bhatara Tiksnadi²¹ MD, Uditha Hewarathna²² MD, Faisal Habib²³ MD, Derek Pok Him Lee²⁴ MBChB, Jonathan Yap^{25,26} MD

ABSTRACT

Introduction: Randomised controlled trials (RCTs) have informed guideline recommendations for the management of stable coronary artery disease (CAD). However, the real-world impact of contemporary guidelines and trials on practising physicians in the Asia-Pacific region remains uncertain. We aimed to evaluate the knowledge, attitudes and practices among cardiovascular physicians in the region regarding stable CAD management.

Method: An anonymised cross-sectional electronic survey was administered to cardiovascular practitioners from the Asia Pacific, assessing 3 domains: 1) baseline knowledge on recent trials and society guideline, 2) attitudes towards stable CAD, and 3) case scenarios reflecting management preferences. Correlations among knowledge, attitudes and practice scores were assessed

between physicians from developed and developing countries using Pearson correlation.

Results: Overall, 713 respondents from 21 countries completed the survey. The mean knowledge score was 2.90 ± 1.18 (out of 4), with 37.3% of respondents answering all questions correctly, while 74.6% noted that guidelines have significant impact on their practice. Despite guidelines recommending optimal medical therapy, majority chose revascularisation (range 53.4–90.6%) as the preferred strategy for the case scenarios. Practitioners from developed regions had higher knowledge scores and lower attitude scores compared to developing regions, while practice scores were similar in both groups. Weakly positive correlations were noted between knowledge, attitude and practice scores.

Conclusion: Variations exist in knowledge and attitudes towards guideline recommendations and correspondingly

The Annals is an open access journal, allowing non-commercial use under CC BY-NC-SA 4.0.

* Joint first authors

¹ Philippine Heart Center, Quezon City, Philippines

² St. Luke's Medical Center, Bonifacio Global City, Taguig, Philippines

³ Department of Cardiovascular Medicine, National Cerebral and Cardiovascular Center, Osaka, Japan

⁴ Yong Loo Lin School of Medicine, National University of Singapore, Singapore

⁵ Yale New Haven Hospital Center for Outcomes Research and Evaluation, New Haven, Connecticut, US

⁶ Department of Cardiology, Keio University School of Medicine, Tokyo, Japan

⁷ Kettering General Hospital, UK

⁸ Central Chest Institute of Thailand, Thailand

⁹ Jakarta Heart Center, Jakarta, Indonesia

¹⁰ Department of Cardiology, National University Heart Centre, Singapore

¹¹ Cardiovascular Metabolic Translational Research Programme, National University of Singapore, Singapore

¹² Seoul National University Hospital, South Korea

¹³ Osaka University Graduate School of Medicine, Osaka, Japan

¹⁴ John Hunter Hospital The University of Newcastle, Australia

¹⁵ KPJ Damansara Specialist Hospital 2, Kuala Lumpur, Malaysia

¹⁶ Mohammed Hoesin General Hospital, Indonesia

¹⁷ Khon Kaen Hospital, Thailand

¹⁸ United Hospital Limited, Dhaka, Bangladesh

¹⁹ University of the Philippines–Philippine General Hospital, Philippines

²⁰ Sarawak Heart Centre, Malaysia

²¹ Department of Cardiology and Vascular Medicine, Universitas Padjadjaran, Bandung, Indonesia

²² Teaching Hospital Ratnapura, Sri Lanka

²³ Haji Adam Malik General Hospital University of Sumatera Utara, Indonesia

²⁴ Department of Medicine, Queen Elizabeth Hospital, Hong Kong

²⁵ Department of Cardiology, National Heart Centre Singapore, Singapore

²⁶ Duke-NUS Medical School, Singapore

Correspondence: Dr Derek Pok Him Lee, Division of Cardiology, Queen Elizabeth Hospital, 30 Gascoigne Rd, Yau Ma Tei, Kowloon, Hong Kong.

Email: derekph@gmail.com

Accepted: 3 March 2025

Published Online First: 22 May 2025

actual clinical practice in the Asia Pacific, with most practitioners choosing an upfront invasive strategy for the treatment of stable CAD. These differences reflect real-world disparities in guideline interpretation and clinical adoption..

Keywords: Asia Pacific, cardiologists, coronary artery disease, coronary intervention, survey

CLINICAL IMPACT

What is New

- There is limited data in the Asia Pacific regarding how the results of studies and guidelines impact physicians' management preferences for stable coronary artery disease.
- While respondents showed favourable perceptions towards trials and guidelines, the majority of practitioners preferred revascularisation over optimal medical therapy in answering the hypothetical case scenarios, regardless of trial results and guideline recommendations.

Clinical Implications

- Further studies are required to assess factors associated with these variations and discrepancies to facilitate translation of evidence into real-world clinical practice.

INTRODUCTION

Ischaemic heart disease remains the leading cause of morbidity and mortality worldwide, and Asia being the most populous region in the world has shown an increasing prevalence of coronary artery disease (CAD) and related mortality compared to Western countries; 58% of cardiovascular deaths worldwide occurred in Asia in 2019 and 47% was due to ischaemic heart disease.¹ While advancements in management of CAD have progressively improved outcomes, the definitive management of patients with stable CAD can be a subject of debate, particularly with regard to options for revascularisation compared to optimal medical therapy (OMT). Results from landmark trials such as ISCHEMIA and COURAGE,^{2,3} which showed that revascularisation did not significantly reduce the incidence of death and myocardial infarction when compared to medical therapy, have helped inform guideline recommendations to aid physicians in the management of stable CAD.^{4,5} However, the real-world impact of these results and recommendations on clinical practice

has not been fully elucidated. Data is scarce on what factors influence physicians' decisions to recommend revascularisation over OMT, and vice versa. In Asia in particular, differences in prevalences of stable CAD across countries, varied implementation rates of OMT as well as updates on revascularisation decisions after the latest trials and guidelines represent unmet needs that exist between guideline recommendations and actual clinical application.⁶ The present study aimed to assess the knowledge, attitudes and practices of cardiologists towards managing stable CAD in the region.

METHOD

This study was conducted through an online electronic cross-sectional survey of cardiovascular practitioners in the Asia-Pacific region. Our target population consisted of a broad inclusion of cardiac practitioners (i.e. both interventional and non-interventional cardiologists, cardiac surgeons as well as trainees/cardiology fellows), meant to capture wider perspectives and increase representativeness. Only active cardiac practitioners with direct patient care practising in the Asia-Pacific region were included to maintain focus on the intended demographic. A waiver of ethics approval was obtained and granted by the Singhealth Centralised Institutional Review Board as the target respondents were anonymous and participation in the survey was voluntary.

An anonymised electronic survey (see Supplementary Material) was designed by an expert panel of experienced cardiologists based on a similar concept used in previous studies.^{7,8} The questionnaire was initially pilot-tested with 20 expert cardiologists to test for validity and reliability, ensuring proper wording of questions, appropriateness of content, clarity and sequence as well as establishing how the data will be sought from the respondents. Questions were carefully crafted using clear and unambiguous language with neutral wording to ensure more accurate and unbiased responses. The first section of the survey collected basic demographic information about the respondent. The second section consisted of 4 questions that assessed knowledge, notably on the COURAGE and ISCHEMIA trials, as well as the 2021 American College of Cardiology (ACC) and American Heart Association (AHA) guidelines on coronary revascularisation,⁹ with participants answering "yes", "no", or "unsure". For the knowledge section, 1 point was ascribed to each correct answer for a maximum of 4 points, and attaining 3–4 points was deemed as a high knowledge score. The third section assessed attitudes and perceptions towards the COURAGE and ISCHEMIA trials as well as contemporary guidelines available at the time the survey was

conducted. For the first 6 questions of the attitudes section, a response of “strongly agree” or “agree” was given a score of 1, and responses of “neutral”, “disagree” or “strongly disagree” were given a score of 0. An average attitude score was then calculated for each respondent. Additionally, on a 5-point Likert scale, clinicians assessed how 19 variables influence the choice of OMT versus [vs] revascularisation. The Likert-type responses were grouped into 3 categories either favouring OMT, favouring revascularisation, or neutral for ease of analysis. For the fourth section, we showed hypothetical case scenarios to understand practice patterns towards revascularisation vs OMT. The ideal and correct response to all 5 case scenarios based on current guidelines would be to offer OMT; 1 point was ascribed to each correct answer for a maximum of 5 points. The Japanese version of the questionnaire only had 3 case scenarios (i.e. they did not answer for cases 1D and 1E) due to technical issues that resulted in the last 2 scenarios not being displayed online. The average score from the respective case scenarios were calculated for each individual participant.

Selection of respondents from participating countries was guided by ascertainment of geographical diversity (i.e. efforts to ensure a mix of developed and developing countries with varying healthcare systems), stratification (i.e. participants were classified based on their country’s development status (developed vs developing) according to United Nations classifications,¹⁰ allowing for comparative analysis and voluntary participation (ensuring ethical standards were upheld). The final version of the questionnaire, which was available in both English and Japanese, was disseminated through professional networks shared within professional groups and associations as well as social media and messaging applications (i.e. Facebook, Viber and WhatsApp groups) to participants from member regions of the Asian Pacific Society of Cardiology from August 2022 to January 2023.

Statistical analysis

Categorical variables were expressed as number values and percentages. Continuous variables were analysed with 2 samples expressed as mean and standard deviation (SD) as appropriate. The relationships between knowledge, attitude and practice scores were explored via calculations of the Pearson correlation coefficient in bivariate analysis. Two subgroup comparisons were performed using the gathered data: 1) developed versus developing countries; and 2) knowledge score (0–2 vs 3–4 correct questions from section 2 of the survey. Two-way comparisons were performed using Student’s t-test for parametric data, Mann-Whitney U test for nonparametric data and chi-squared test for categorical data. All statistical analyses were

performed in RStudio using R-4.3.0 (Posit, Boston, MA, US), with a *P* value of <0.05 used to denote significance.

RESULTS

Study population

In total, 713 unique respondents from 21 countries completed the survey. The majority of participants (61.5%) were ≤50 years old, and 11.2% were female. The highest proportion of respondents came from Japan (66.9%), followed by the Philippines (10.4%) (Table 1). Developed countries accounted for 76.2% of the respondents. Interventional cardiologists comprised 32.7% of respondents, and the duration of practice was >10 years in 74.8% of respondents. The majority practised in an urban setting (66%), and the respondents were well distributed between government, private and rural institutions (Table 2).

Table 1. Survey respondents (n=713).

Countries	Respondents	%
Japan	477	66.90%
Philippines	74	10.38%
Indonesia	32	4.49%
Hong Kong	24	3.37%
Singapore	21	2.95%
Vietnam	14	1.96%
Malaysia	10	1.40%
Thailand	10	1.40%
Nepal	9	1.26%
United Arab Emirates	9	1.26%
Taiwan	7	0.98%
Australia	6	0.84%
Sri Lanka	6	0.84%
South Korea	5	0.70%
Bangladesh	2	0.28%
Oman	2	0.28%
Egypt	1	0.14%
Jordan	1	0.14%
Mongolia	1	0.14%
Myanmar	1	0.14%
Saudi Arabia	1	0.14%

Table 2. Demographics of the study population (n=713).

	All (n=713)	Developed (n=543)	Developing (n=170)	P value
Country, no. (%)		543 (76.2)	170 (23.8)	<0.001
Gender, no. (%)				
Male	633 (88.8)	509 (93.7)	124 (72.9)	
Age, no. (%)				<0.001
21–30	18 (2.5)	13 (2.4)	5 (2.9)	
31–40	212 (29.7)	110 (20.3)	102 (60.0)	
41–50	209 (29.3)	173 (31.9)	36 (21.2)	
51–60	173 (24.3)	160 (29.5)	13 (7.6)	
Above 60	101 (14.2)	87 (16.0)	14 (8.2)	
Primary specialty				<0.001
Cardiology, non-interventional cardiology	385 (54.0)	308 (56.7)	77 (45.3)	
Fellow/trainee	54 (7.6)	19 (3.5)	35 (20.6)	
Interventional cardiology	233 (32.7)	181 (33.3)	52 (30.6)	
Others	41 (5.8)	35 (6.4)	6 (3.5)	
Duration of practice				<0.001
<5 years	91 (12.8)	15 (2.8)	76 (44.7)	
5–10 years	89 (12.5)	39 (7.2)	50 (29.4)	
11–20 years	183 (25.7)	169 (31.1)	14 (8.2)	
21–30 years	211 (29.6)	192 (35.4)	19 (11.2)	
>30 years	139 (19.5)	128 (23.6)	11 (6.5)	
Type of practice				<0.001
Government, academic	179 (25.1)	115 (21.2)	64 (37.6)	
Government, non-academic	104 (14.6)	81 (14.9)	23 (13.5)	
Private	269 (37.7)	187 (34.4)	82 (48.2)	
Rural	161 (22.6)	160 (29.5)	1 (0.6)	
Area of practice				
Rural	239 (33.5)	221 (40.7)	45 (26.5)	0.001
Urban	474 (66.5)	447 (82.3)	127 (74.7)	0.038

P values in bold denote significance.

Knowledge scores

The mean knowledge score was 2.90 ± 1.18 . Knowledge scores were higher in developed countries compared to developing countries (3.01 ± 1.13 vs 2.55 ± 1.28 , $P < 0.001$). Overall, 37.3% of respondents answered all questions correctly, and 51.3% had high

knowledge scores (3–4 points). The question with the highest number of incorrect answers was related to the ACC/AHA guidelines on revascularisation in patients with stable CAD and significant triple vessel disease without left main disease, with only 46.6% answering correctly (Table 3).

Table 3. Overall survey results stratified by developing vs developed countries and by knowledge scores.

Knowledge						
	Total (n=713)	Developed (n=543)	Developing (n=170)	P value	Knowledge score 0-2 (n=194)	Knowledge score 3-4 (n=519) P value
All knowledge questions correct, no. (%)	266 (37.3)	221 (40.7)	45 (26.5)	0.001	0 (0.0)	266 (51.3) <0.001
Q1	574 (80.5)	447 (82.3)	127 (74.7)	0.038	69 (35.6)	505 (97.3) <0.001
Q2	572 (80.2)	449 (82.7)	123 (72.4)	0.004	72 (37.1)	500 (96.3) <0.001
Q3	332 (46.6)	265 (48.8)	67 (39.4)	0.040	21 (10.8)	311 (59.9) <0.001
Q4	588 (82.5)	472 (86.9)	116 (68.2)	<0.001	81 (41.8)	507 (97.7) <0.001
Mean knowledge score, no. (%)	2.90 (1.18)	3.01 (1.13)	2.55 (1.28)	<0.001	1.25 (0.87)	3.51 (0.50) <0.001
By score						
0	54 (7.6)	37 (6.8)	17 (10.0)		54 (27.8)	0 (0.0)
1	37 (5.2)	16 (2.9)	21 (12.4)		37 (19.1)	0 (0.0)
2	103 (14.4)	74 (13.6)	29 (17.1)		103 (53.1)	0 (0.0)
3	253 (35.5)	195 (35.9)	58 (34.1)		0 (0.0)	253 (48.7)
4	266 (37.3)	221 (40.7)	45 (26.5)		0 (0.0)	266 (51.3)
Attitudes/perceptions						
	Total (n=713)	Developed (n=543)	Developing (n=170)	P value	Knowledge score 0-2 (n=194)	Knowledge score 3-4 (n=519) P value
Average A/P score, no. (%)	0.71 (0.34)	0.67 (0.35)	0.81 (0.31)	<0.001	0.70 (0.35)	0.71 (0.34) 0.637
Individual questions: no. of respondents with score = 1 (strongly agree/agree)						
I find the results of the COURAGE trial informative.	460 (64.5)	328 (60.4)	132 (77.6)	<0.001	121 (62.4)	339 (65.3) 0.520
The COURAGE trial has impacted my management of patients with stable CAD.	443 (62.1)	307 (56.5)	136 (80.0)	<0.001	120 (61.9)	323 (62.2) 0.995
I find the results of the ISCHEMIA trial informative.	523 (73.4)	383 (70.5)	140 (82.4)	0.003	139 (71.6)	384 (74.0) 0.594
The ISCHEMIA trial has impacted my management of patients with stable CAD.	504 (70.7)	370 (68.1)	134 (78.8)	0.01	134 (69.1)	370 (71.3) 0.626

Table 3. Overall survey results stratified by developing vs developed countries and by knowledge scores. (Cont'd)

Attitudes/perceptions							
	Total (n=713)	Developed (n=543)	Developing (n=170)	P value	Knowledge score 0-2 (n=194)	Knowledge score 3-4 (n=519)	P value
I find the recommendations of the guidelines informative.	561 (78.7)	415 (76.4)	146 (85.9)	0.012	153 (78.9)	408 (78.6)	>0.99
The guidelines have impacted my management of patients with stable CAD.	532 (74.6)	390 (71.8)	142 (83.5)	0.003	144 (74.2)	388 (74.8)	0.961
Variables influencing therapeutic decision (medical therapy/neutral/revascularisation)							
	Total (n=713)	Developed (n=543)	Developing (n=170)	P value	Knowledge score 0-2 (n=194)	Knowledge score 3-4 (n=519)	P value
Symptomatic, (%)	4.5/7.2/88.4	3.9/8.1/88	6.5/4.1/89.4	0.088	2.6/5.7/91.8	5.2/7.7/87.1	0.189
Asymptomatic, (%)	59.5/30/10.5	53.6/34.4/12	78.2/15.9/5.9	<0.001	50.5/36.1/13.4	62.8/27.7/9.4	0.011
Age <65, (%)	10.8/28.9/60.3	8.8/29.5/61.7	17.1/27.1/55.9	0.011	8.2/25.3/66.5	11.8/30.3/58	0.105
Age 65-80, (%)	20.2/38/41.8	16.4/37.9/45.7	32.4/38.2/29.4	<0.001	19.6/32.5/47.9	20.4/40.1/39.5	0.100
Age >80, (%)	51.8/30.7/17.5	49/32/19	60.6/26.5/12.9	0.025	44.3/28.9/26.8	54.5/31.4/14.1	<0.001
Presence of diabetes	10.2/22/67.7	9.9/24.9/65.2	11.2/12.9/75.9	0.005	9.3/19.1/71.6	10.6/23.1/66.3	0.388
Presence of multiple comorbidities	24.3/28.3/47.4	24.1/30.8/45.1	24.7/20.6/54.7	0.027	16.5/25.3/58.2	27.2/29.5/43.4	0.001
LVEF <35%	7.9/15/77.1	4.8/16/79.2	17.6/11.8/70.6	<0.001	12.4/20.1/67.5	6.2/13.1/80.7	0.001
LVEF 35-50%	4.6/18.2/77.1	3.7/20.3/76.1	7.6/11.8/80.6	0.007	4.6/19.6/75.8	4.6/17.7/77.6	0.847
LVEF >50%	21/42.6/36.3	18.4/46.4/35.2	29.4/30.6/40	<0.001	15.5/33/51.5	23.1/46.2/30.6	<0.001
LM disease	1.7/4.2/94.1	0.4/4.4/95.2	5.9/3.5/90.6	<0.001	2.6/8.2/89.2	1.3/2.7/96	0.002
Triple vessel disease	2.8/7.4/89.8	1.7/7.4/91	6.5/7.6/85.9	0.004	3.1/7.7/89.2	2.7/7.3/90	0.941
pLAD disease	3.4/6.5/90.2	2.2/6.6/91.2	7.1/5.9/87.1	0.009	3.1/8.8/88.1	3.5/5.6/90.9	0.303
mLAD disease	14.6/26.5/58.9	12.2/28.7/59.1	22.4/19.4/58.2	0.001	12.4/22.7/64.9	15.4/27.9/56.6	0.134
Single vessel disease not involving LAD	36.5/35.9/27.6	35.4/37.8/26.9	40/30/30	0.184	30.9/34/35.1	38.5/36.6/24.9	0.020
Double vessel disease not involving LAD	21.7/30.2/48.1	19.2/31.5/49.4	30/25.9/44.1	0.011	16.5/24.2/59.3	23.7/32.4/43.9	0.001

Table 3. Overall survey results stratified by developing vs developed countries and by knowledge scores. (Cont'd)

Variables influencing therapeutic decision (medical therapy/neutral/revascularisation)						
	Total (n=713)	Developed (n=543)	Developing (n=170)	P value	Knowledge score 0-2 (n=194)	Knowledge score 3-4 (n=519) P value
Mild ischaemia on stress test	43.6/30.7/25.7	39.4/33.9/26.7	57.1/20.6/22.4	<0.001	36.6/32/31.4	46.2/30.3/23.5 0.037
Moderate ischaemia on stress test	14.6/20.1/65.4	11.2/20.3/68.5	25.3/19.4/55.3	<0.001	10.8/18/71.1	16/20.8/63.2 0.106
Severe ischaemia on stress test	2.4/7/90.6	1.3/6.8/91.9	5.9/7.6/86.5	0.002	2.1/7.7/90.2	2.5/6.7/90.8 0.853
Practices/offering medical therapy ("correct" option) for the case below						
	Total (n=713)	Developed (n=543)	Developing (n=170)	P value	Knowledge score 0-2 (n=194)	Knowledge score 3-4 (n=519) P value
Case 1a	67 (9.4)	52 (9.6)	15 (8.8)	0.886	15 (7.7)	52 (10.0) 0.431
Case 1b	332 (46.6)	231 (42.5)	101 (59.4)	<0.001	82 (42.3)	250 (48.2) 0.186
Case 1c	177 (24.8)	133 (24.5)	44 (25.9)	0.792	35 (18.0)	142 (27.4) 0.014
Case 1d*	25 (10.1)	8 (10.3)	17 (10.0)	>0.99	5 (5.7)	20 (12.4) 0.148
Case 1e*	62 (25.0)	16 (20.5)	46 (27.1)	0.343	14 (16.1)	48 (29.8) 0.026
Average case scenario score	0.25 (0.29)	0.25 (0.30)	0.26 (0.24)	0.619	0.20 (0.25)	0.27 (0.30) 0.006

CAD: coronary artery disease; LAD: left anterior descending; LM disease: left main coronary artery disease; LVEF: left ventricular ejection fraction; mLAD: mid left anterior descending artery disease;
pLAD disease: proximal left anterior descending coronary artery disease
* Excluding 465 participants from Japan.
P values in bold denote significance.

Attitude scores

For the attitudes section, the majority of respondents found the guideline recommendations informative (78.7%) and felt that the guidelines impacted their clinical practice (74.6%). The average attitude score was 0.71 ± 0.34 and was lower in developed countries compared to developing (0.67 ± 0.35 vs 0.81 ± 0.31 , $P < 0.001$). Compared to developing countries, a lower percentage of respondents from developed countries noted that both COURAGE (56.5% vs 80.0%, $P < 0.001$) and ISCHEMIA trials (68.1% vs 78.8%, $P = 0.01$) impacted their management of patients with stable CAD. There were no differences in attitude scores when stratified by higher vs lower knowledge scores ($P = 0.637$) (Table 3).

For the variables influencing therapeutic decision-making in section 3 of the survey, the majority of respondents favoured the performance of coronary revascularisation compared to OMT for symptomatic patients (88.4% vs 4.5%), age < 65 (60.3% vs 10.8%), presence of diabetes (67.7% vs 10.2%) and multiple comorbidities (47.4% vs 24.3%). In addition, LVEF $< 50\%$, left main disease, triple vessel disease, proximal left anterior descending (LAD), mid-LAD, and patients with moderate and severe ischaemia on the stress test all showed a trend favouring revascularisation, and this appears consistent whether the respondent is from a developing or developed country (all P values < 0.05). When stratified based on knowledge scores, respondents with higher knowledge scores tended to favour OMT over revascularisation in the setting of asymptomatic status (62.8% vs 9.4%), age > 80 years (54.5% vs 14.1%), single vessel disease not involving the LAD (38.5% vs 24.9%) and mild ischaemia on stress testing (46.2% vs 23.5%, all P values < 0.05) (Table 3).

Practice scores

For the practice domain, the correct answer based on guideline recommendations for all clinical scenarios was OMT. The average practice score was 0.25 ± 0.29 , indicating that respondents on the whole favoured revascularisation for most scenarios. The distribution of the responses to the case scenarios of stable

with double vessel disease (89.9%). Notably, only 25% selected OMT for the fifth scenario of an asymptomatic patient with an abnormal treadmill test and proximal LAD stenosis. There were no significant differences in practice scores between developed and developing countries ($P = 0.619$) (Table 3). Overall, while OMT should technically be the correct answer to all the mentioned cases based on guidelines, the majority of respondents chose revascularisation as the preferred option.

Correlations between scores

The results of the correlation analysis are shown in Table 4. For the overall cohort, there was a weakly positive correlation between knowledge and practice scores ($r = 0.12$, $P = 0.001$) and attitude and practice scores ($r = 0.13$, $P < 0.001$). There was a positive correlation between knowledge and attitude scores ($r = 0.109$, $P = 0.016$), knowledge and practice scores ($r = 0.096$, $P = 0.025$), and attitude and practice scores ($r = 0.14$, $P = 0.001$), respectively, in developed countries; while in developing countries, the positive correlation was only noted between knowledge and practice scores ($r = 0.23$, $P = 0.003$). In those with higher knowledge scores, there was a positive but weak correlation between attitude and practice scores ($r = 0.18$, $P < 0.001$) but this was not seen in those with low knowledge scores.

DISCUSSION

This multinational survey of cardiovascular practitioners from the Asia-Pacific region reveals several important observations regarding the management of stable CAD. First, knowledge scores were in general favourable, with the majority of respondents scoring 3 or 4 points. Developed countries appear to have higher knowledge scores than developing countries. Second, the majority of respondents felt guideline recommendations were informative and impacted their management. Lower attitude scores were observed in developed compared to developing countries. Third, practice scores were overall low, indicating a preference for revascularisation over OMT in scenarios where guidelines do not recommend revascularisation. Practice scores were higher in respondents with high knowledge scores than those with low knowledge scores. Fourth, significant but only weakly positive correlations were seen between knowledge and practice as well as attitude and practice scores.

While overall knowledge scores were generally good, developed countries appear to have higher knowledge scores than developing countries. This may be due to differences in resource availability as well as feasibility to comply to guideline recommendations.

Fig.1. Responses to case scenarios.

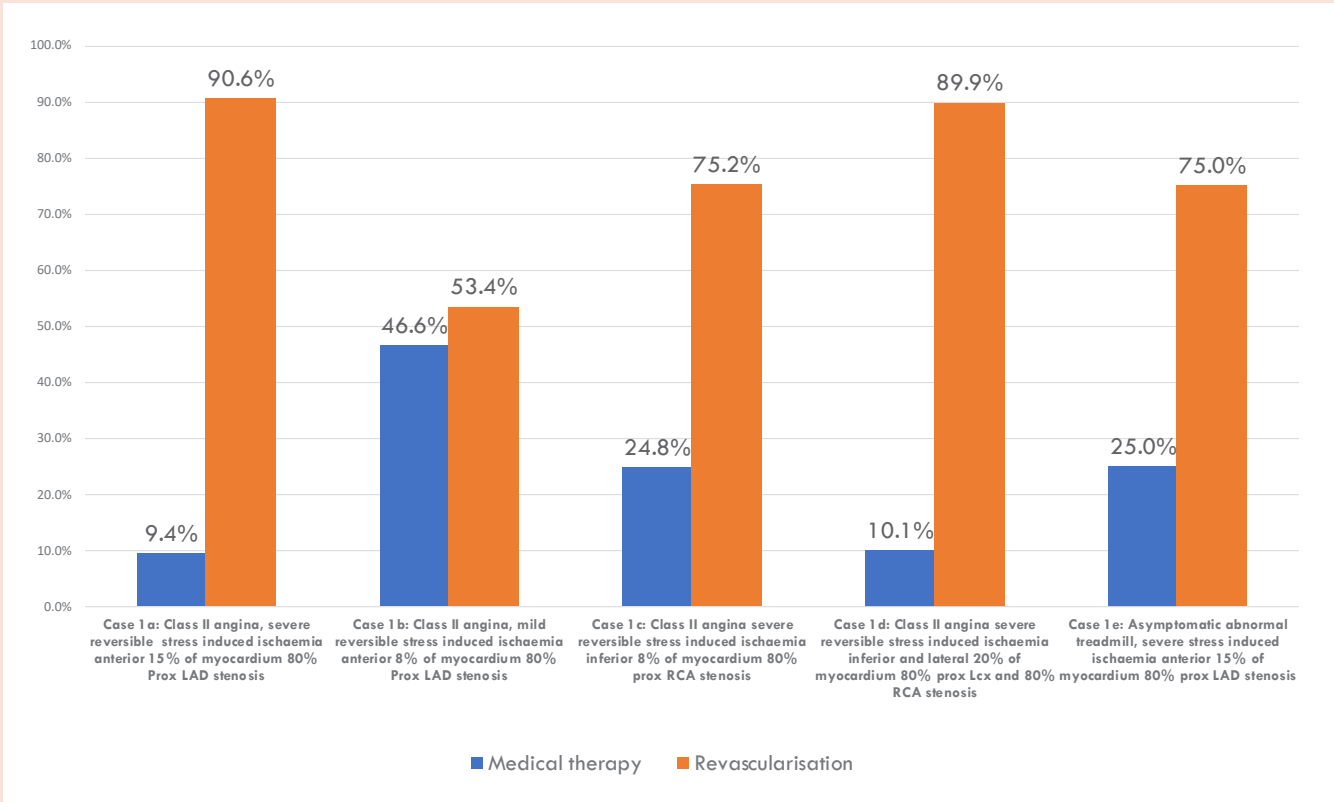


Table 4. Correlation between knowledge, attitude and practice scores.

Variable	t-statistic	Degrees of freedom	P value	Correlation coefficient	95% confidence interval
Knowledge score vs attitude score					
Overall	0.702	711	0.483	0.026	-0.047 to 0.10
Developing countries	-1.14	168	0.255	-0.088	-0.24 to 0.064
Developed countries	2.41	541	0.016	0.109	0.019–0.19
Knowledge score vs practice score					
Overall	3.21	711	0.001	0.12	0.046–0.19
Developing countries	3.04	168	0.003	0.23	0.080–0.37
Developed countries	2.25	541	0.025	0.096	0.012–0.18
Attitude score vs practice score					
Overall	3.47	711	<0.001	0.13	0.056–0.20
Developing countries	1.17	168	0.243	0.090	-0.061 to 0.24
Developed countries	3.20	541	0.001	0.14	0.053–0.22
Knowledge score 3–4	4.08	517	<0.001	0.18	0.092–0.26
Knowledge score 0–2	-0.28	192	0.781	-0.020	-0.16 to 0.12

Developed countries typically have more robust healthcare systems with better infrastructure, including advanced medical technologies and access to comprehensive medical education. Cardiologists from developed countries often benefit from structured training programmes and continuing medical education opportunities.¹¹ Developing countries also face unique challenges with regard to length and variability of training, education and research output inequity, especially in comparison with developed nations.¹² These socioeconomic disparities can influence healthcare delivery and education. Finally, it has been shown that availability and applicability of guidelines can differ between high-income and low-income nations, and applying the best evidence is often not feasible in the latter and may diverge from guideline recommendations in actual practice.¹³

The vast majority from both groups noted that the information provided by the guidelines was informative and impacted their practice. It has been shown that the knowledge and attitudes of healthcare providers may play a role in the usage of clinical practice guidelines.¹⁴ A study assessing attitudes and behaviours towards clinical guidelines showed that 77% of surveyed clinicians have a welcoming attitude towards guidelines, and clinicians' decisions to use them were based on the perceived value of the guideline.¹⁵ The variables that influenced the decision to revascularise among respondents appears congruent with the 2018 European Society of Cardiology/European Association of Cardio-Thoracic Surgery (ESC/EACTS) guidelines on myocardial revascularisation¹⁶ which are mostly Class I recommendations focused on the extent of CAD (either anatomical or functional) or symptomatology. These characteristics are frequently assessed by practitioners in the real world and influence their decision making.

For the clinical case scenarios, we aimed to understand what decisions clinicians would make in real-world practice. The majority of respondents chose revascularisation despite guidelines and RCTs indicating OMT as the correct answer and firstline treatment for these scenarios. On average, approximately only around a quarter of the respondents chose OMT, suggesting a discrepancy between current guidelines and actual clinical practice. Despite good knowledge and generally positive attitude scores, practice scores overall were poor. There was only a weakly positive correlation between knowledge and practice scores as well as attitude and practice scores. While it is expected that good knowledge forms the basis of a good foundation for better attitudes and practices, the weakly positive correlations suggest that factors beyond these behavioural aspects such

as demographics and socioeconomic status also exert influence in the clinician's decision-making.¹⁷ Cardiologists who answered a survey about ESC guidelines for heart failure showed that while awareness of the guidelines was high and respondents found the guidelines relevant to their treatment choices, only around 25% of the responses in clinical case scenarios were in agreement with the guidelines.¹⁸ A study by Karbach et al.¹⁹ that assessed primary care physicians' knowledge and compliance with guidelines also showed that adequacy of physician's knowledge does not in itself always lead to better guideline implementation.

It is difficult to ascertain how the trials and guidelines for stable CAD management influence real-world practice, but some data suggest it has had minimal impact. Despite the results of COURAGE, there was little to no significant change in OMT prescription patterns noted by Borden et al.²⁰ while Inohara et al. compared 2 national registries and even noted an increase in volume of PCIs in the US by 15.8% and in Japan by 36%, respectively, after publication of COURAGE.²¹ The ORBITA²² trial showed PCI having no significant improvement in exercise capacity or angina frequency compared to sham procedure, and generated considerable debate and controversy regarding the symptom benefits of PCI.²³ Despite these results, data from the UK showed no impact on elective PCI rates for stable angina, and interventionists did not alter their practice before and after publication of both COURAGE and ORBITA.²⁴ While the results of ISCHEMIA encouraged calls for a paradigm shift as reflected in the guidelines on the contemporary management of stable ischaemic heart disease,²⁵ it is acknowledged that due to unique characteristics of these types of patients in the Asia-Pacific region as well as heterogenous approaches, differences in resources along with low number of patients from the region in pivotal studies, international guidelines cannot be routinely applied in Asia Pacific countries.²⁶

The physician's decision-making process for the treatment of stable CAD is complex and cannot be simply explained by quantitative factors or trial results alone. While it can be assumed that fee for service healthcare systems may create financial incentivisation to perform procedures, there is evidence which shows that even cardiologists in capitated settings still prefer revascularisation, indicating that factors other than payment play a role in the decision to perform invasive management.²⁷ Many practitioners may also feel that the results of trials like ISCHEMIA and COURAGE represent a homogeneous population that is not fully applicable to real-world patients.²⁸ Analysis of an Italian registry which assessed a real-world, large-scale evaluation of the applicability

of ISCHEMIA showed that 84.7% did not fulfil ISCHEMIA criteria, and that only 3.8% were “ISCHEMIA like”.²⁹ Findings from trials represent a small fraction of patients routinely encountered in clinical practice, thus requiring a more nuanced approach with equipoise.³⁰ The way the benefits of revascularisation are perceived by the physician and presented to the patient may also affect management preferences,³¹ such as the “open artery hypothesis” (i.e. the notion that an open artery is better than a stenosed artery).³² Lastly, psychological and emotional factors play a role in decisions that prevail over evidence from clinical trials and cultural bias towards the use of technology compared to more conservative measures.³³

Results from our survey among cardiovascular practitioners in the Asia Pacific suggest that while the knowledge and attitudes to guidelines and trials regarding stable CAD are positive, there is discordance between cardiologists’ clinical knowledge and beliefs about the benefits of revascularisation for stable CAD and how they apply evidence into practice. This suggests that these clinical practice guidelines may have limited effect on changing physician behaviour.³⁴ There is high awareness regarding guidelines and recommendations but there is data that suggest that large-scale dissemination of guidelines may not contribute to improvement in practice,³⁵ and physicians may continue to ignore the results of studies that may be in conflict with their own clinical practice beliefs and practise selective-based medicine.³⁶ Attempts to address and resolve these differences of translating results from research studies to practice are complex and challenging³⁷ and beyond the scope of this paper but may involve improvement in the characteristics of future studies that methodologically reconcile randomised and pragmatic designs while assessing endpoints to make them more comparable to real world data found in registries.³⁸ The review by Van Spall et al. also provides some guidance to overcome suboptimal uptake of evidence-based cardiovascular therapies after trial results by improving implementation science and execution, which includes engagement of broad stakeholders (i.e. patients, clinicians and decision-makers) in trial advisory boards as well as integrating trial execution with the healthcare system while evaluating and addressing barriers and facilitators to deployment of the intervention.³⁹ These measures may allow adoption of guidelines and trial results for better implementation of research findings into clinical practice and ultimately better patient care.

Limitations of this study exist. The results may not be fully generalisable and representative. A large percentage of survey respondents were from one

country (Japan), and the majority of respondents are from developed countries, which may possibly lead to an underrepresentation of practitioners most notably from other developing countries. Any regional differences and inferential tests noted at this stage are exploratory in nature and will need to be further studied. Moreover, being limited to the Asia-Pacific region, this survey cannot account for knowledge, attitudes and practices in other regions such as Europe and the Americas. Due to the anonymous nature of the survey and mass sent dissemination via social media channels, we were not able to account for non-responders to ascertain the actual response rates. Despite our best efforts to design and administer the survey, we cannot totally remove nonresponse bias, which may also affect the generalisability of our results. Lastly, most of the knowledge that the respondents based their responses were from data up to 2022. The latest guidelines on chronic coronary syndromes published by the ESC not only reflect changes in nomenclature but also provide updated recommendations on the role of revascularisation on a variety of clinical scenarios while emphasising the role of guideline directed medical therapy.⁴⁰ It is uncertain how clinician interpretation of the evidence in these guidelines will affect clinical practice moving forward. Nevertheless, the results of this study contribute to a better understanding of physicians’ attitudes and practices related to the management of stable CAD in the Asia-Pacific region, of which data are currently lacking at present. In addition, how these results translate into practical measures to bridge the gaps between trial results and guidelines with that of clinical practice will be the work of future research.

CONCLUSION

In the management of stable CAD, variations exist in knowledge and attitudes towards guideline recommendations and correspondingly actual clinical practice in the Asia-Pacific. These differences reflect real-world disparities in relation to guideline interpretation and subsequent adoption.

Supplementary material: Appendix S1. Survey questions and Appendix S2. Case scenarios/practice

Acknowledgment

The authors would like to thank Sayoko Watanabe and the Asian Pacific Society of Cardiology for their assistance and support in the conduct of this study.

Ethics statement

A waiver of ethics approval was obtained and granted by the SingHealth Centralised Institutional Review Board (2022/2356).

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.

REFERENCES

- Zhao D. Epidemiological Features of Cardiovascular Disease in Asia. *JACC Asia* 2021;1:1-13.
- Boden WE, O'Rourke RA, Teo KK, et al. Optimal medical therapy with or without PCI for stable coronary disease. *N Engl J Med* 2007;356:1503-16.
- Maron DJ, Hochman JS, Reynolds HR, et al. Initial Invasive or Conservative Strategy for Stable Coronary Disease. *N Engl J Med* 2020;382:1395-1407.
- Virani SS, Newby LK, Arnold SV, et al. 2023 AHA/ACC/ACCP/ASPC/NLA/PCNA Guideline for the Management of Patients With Chronic Coronary Disease: A Report of the American Heart Association/American College of Cardiology Joint Committee on Clinical Practice Guidelines. *Circulation* 2023;148:e9-e119. Erratum in: *Circulation* 2023;148:e148. Erratum in: *Circulation* 2023;148:e186.
- Lawton JS, Tamis-Holland JE, Bangalore S, et al. 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Circulation* 2022;145:e18-e114.
- Kohsaka S, Ejiri K, Takagi H, et al. Diagnostic and Therapeutic Strategies for Stable Coronary Artery Disease Following the ISCHEMIA Trial. *JACC Asia* 2023;3:15-30.
- Vaidya A, Aryal UR, Krettek A. Cardiovascular health knowledge, attitude and practice/behaviour in an urbanising community of Nepal: a population-based cross-sectional study from Jhaukhel-Duwakot Health Demographic Surveillance Site. *BMJ Open* 2013;3:e002976.
- Yap J, Lee VJ, Yau TY, et al. Knowledge, attitudes and practices towards pandemic influenza among cases, close contacts, and healthcare workers in tropical Singapore: a cross-sectional survey. *BMC Public Health* 2010;10:442.
- Lawton JS, Tamis-Holland JE, Bangalore S, et al. 2021 ACC/AHA/SCAI Guideline for Coronary Artery Revascularization: Executive Summary: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Circulation* 2022;145:e4-17.
- United Nations. Country classification. https://www.un.org/en/development/desa/policy/wesp/wesp_current/2014wesp_country_classification.pdf.
- Celletti F, Buch E, Samb B. Medical education in developing countries. In Kieran Walsh (ED), *Oxford Textbook of Medical Education*, Oxford Textbook (Oxford Academic, 2013).
- Qureshi NQ, Mufarrih SH, Bloomfield GS, et al. Disparities in Cardiovascular Research Output and Disease Outcomes among High-, Middle- and Low-Income Countries - An Analysis of Global Cardiovascular Publications over the Last Decade (2008-2017). *Glob Heart* 2021;16:4.
- van Dijk WB, Schuit E, van der Graaf R, et al. Applicability of European Society of Cardiology guidelines according to gross national income. *Eur Heart J* 2023;44:598-607.
- Naumann M, Scharfenberg SR, Seleznova Y, et al. Factors influencing adherence to clinical practice guidelines in patients with suspected chronic coronary syndrome: a qualitative interview study in the ambulatory care sector in Germany. *BMC Health Serv Res* 2023;23:655.
- Mansfield CD. Attitudes and behaviors towards clinical guidelines: the clinicians' perspective. *Qual Health Care* 1995;4:250-5.
- Neumann FJ, Sousa-Uva M, Ahlsson A, et al. 2018 ESC/EACTS Guidelines on myocardial revascularization. *Eur Heart J* 2019;40:87-165. Erratum in: *Eur Heart J* 2019;40:3096.
- Shen T, Teo TY, Yap JJ, et al. Gender Differences in Knowledge, Attitudes and Practices towards Cardiovascular Disease and its Treatment among Asian Patients. *Ann Acad Med Singap* 2017;46:20-8.
- Erhardt L, Komajda M, Hobbs FD, et al. Cardiologists' awareness and perceptions of guidelines for chronic heart failure. The ADDRESS your Heart survey. *Eur J Heart Fail* 2008;10:1020-5.
- Karbach U, Schubert I, Hagemeister J, et al. Physicians' knowledge of and compliance with guidelines: an exploratory study in cardiovascular diseases. *Dtsch Arztebl Int* 2011;108:61-9.
- Borden WB, Redberg RF, Mushlin AI, et al. Patterns and intensity of medical therapy in patients undergoing percutaneous coronary intervention. *JAMA* 2011;305:1882-9. Erratum in: *JAMA* 2011;305:2418.
- Inohara T, Kohsaka S, Spertus JA, et al. Comparative trends in percutaneous coronary intervention in Japan and the United States, 2013 to 2017. *J Am Coll Cardiol* 2020;76:1328-40.
- Al-Lamee R, Thompson D, Dehbi HM, et al. Percutaneous coronary intervention in stable angina (ORBITA): a double-blind, randomised controlled trial. *Lancet* 2018;391:31-40. Erratum in: *Lancet* 2018;391:30.
- Bhatt DL, Gersh BJ, Steg PG, et al. Rediscovering the Orbit of Percutaneous Coronary Intervention After ORBITA. *Circulation* 2018;137:2427-9.
- Rashid M, Stevens C, Wijeyesundera HC, et al. Rates of Elective Percutaneous Coronary Intervention in England and Wales: Impact of COURAGE and ORBITA Trials. *J Am Heart Assoc* 2022;11:e025426. Erratum in: *J Am Heart Assoc* 2022;11:e020843.
- Jafary FH, Jafary AH. Ischemia Trial: Does the Cardiology Community Need to Pivot or Continue Current Practices? *Curr Cardiol Rep* 2022;24:1059-68.
- Tan JWC, Chew DP, Brieger D, et al. 2020 Asian Pacific Society of Cardiology Consensus Recommendations on Antithrombotic Management for High-risk Chronic Coronary Syndrome. *Eur Cardiol* 2021;16:e26.
- Lin GA, Dudley RA, Redberg RF. Cardiologists' Use of Percutaneous Coronary Interventions for Stable Coronary Artery Disease. *Arch Intern Med* 2007;167:1604-9.
- Oude Rengerink K, Kalkman S, Collier S, et al. Series: pragmatic trials and real world evidence: paper 3. Patient selection challenges and consequences. *J Clin Epidemiol* 2017;89:173-80.
- De Luca L, Uguccioni M, Meessen J, et al. External applicability of the ISCHEMIA trial: an analysis of a prospective, nationwide registry of patients with stable coronary artery disease. *EuroIntervention* 2020;16:e966-73.
- Stone GW, Hochman JS, Williams DO, et al. Medical Therapy With Versus Without Revascularization in Stable Patients With Moderate and Severe Ischemia: The Case for Community Equipoise. *J Am Coll Cardiol* 2016;67:81-99.
- Goff SL, Mazor KM, Ting HH, et al. How Cardiologists Present the Benefits of Percutaneous Coronary Interventions to Patients With Stable Angina: A Qualitative Analysis. *JAMA Intern Med* 2014;174:1614-21.

32. Kim CB, Braunwald E. Potential benefits of late reperfusion of infarcted myocardium. The open artery hypothesis. *Circulation* 1993;88:2426-36.
33. Lin GA, Dudley RA, Redberg RF. Why physicians favor use of percutaneous coronary intervention to medical therapy: a focus group study. *J Gen Intern Med* 2008;23:1458-63.
34. Cabana MD, Rand CS, Powe NR, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA* 1999;282:1458-65.
35. Beaulieu MD, Brophy J, Jacques A, et al. Physicians' attitudes to the pharmacological treatment of patients with stable angina pectoris. *QJM*. 2005;98:41-51.
36. Mearns BM. Coronary artery disease. Stents should not precede optimal medical therapy in stable CAD. *Nat Rev Cardiol* 2012;9:256.
37. Boden WE, Bhatt DL. Translating the findings of ISCHEMIA into clinical practice: a challenging START. *EuroIntervention* 2020;16:e953-6.
38. Marquis-Gravel G, Moliterno DJ, Francis DP, et al. Improving the Design of Future PCI Trials for Stable Coronary Artery Disease: JACC State-of-the-Art Review. *J Am Coll Cardiol* 2020;76:435-50.
39. Van Spall H, Desveaux L, Finch T, et al. A Guide to Implementation Science for Phase 3 Clinical Trialists: Designing Trials for Evidence Uptake. *JACC* 2024;84:2063-72.
40. Vrints C, Andreotti F, Koskinas KC, et al. 2024 ESC Guidelines for the management of chronic coronary syndromes. *Eur Heart J* 2024;45:3415-537.