A nationwide survey on awareness and knowledge about Bronchial Provocation Test amongst doctors in Malaysia

Khai Lip Ng, MRCP[1], Nai-Chien Huan, MRCP[1], Fatimah Azmah Mohammad, MRCP, Nur Husna Mohd Aminudin, MMED[1], Fatimah A'tirah Mohammad, PhD[2], Jamalul Azizi Abdul Rahaman, MMED[1]

[1]Department of pulmonology, Serdang Hospital, Selangor, Malaysia, [2]Faculty of resource science and technology, Universiti Malaysia Sarawak (UNIMAS), Kota Samarahan, Sarawak, Malaysia, [3]Department of medicine, Universiti Putra Malaysia (UPM), Selangor, Malaysia

ABSTRACT

Background: Bronchial provocation test (BPT) is widely used internationally not only to evaluate bronchial responsiveness in conditions especially asthma, but is also utilized as a marker of control, severity and prognosis for asthma. However, the uptake of BPT in certain countries including Malaysia remains low. We aimed to explore this lack of knowledge by assessing the current level of awareness and knowledge on BPT amongst doctors in Malaysia.

Materials and Methods: A nationwide web-based questionnaire targeting doctors was sent through social media (Facebook, WhatsApp and Telegram) and Malaysian Medical Association (MMA) mailing lists between 1 October 2020 – 5 February 2021.

Results: In all 415 survey responses were analysed from doctors of various grades namely medical officers to consultants. A total of 404 (97.35%) encountered patients with asthma in their daily practice. According to specialty: 169 (40.72%) were from primary care, 121 (29.16%) internal medicine, 50 (12.05%) pulmonary medicine and 75 (18.07%) others. Only 163 (39.28%) were aware of BPT as a tool to diagnose asthma. 232 (55.90%) and 124 (29.88%) regarded BPT as an important test and felt confident to refer patients for BPT respectively. Of those participants who were not confident to refer: 35.17% were unsure of BPT indications, 33.21% were unsure of centres providing BPT, 8.17% cited logistic reasons, 6.04% were concerned of possible BPT side effects. 387 (93.25%) wanted more training in BPT. The median BPT knowledge score was 20% (1 out of 5). Awareness and knowledge were affected by specialty but not by: region of practice, gender, age and grade from logistic regression analysis.

Conclusion: Various national level programs and targeted local interventions are much needed to increase the awareness, knowledge and uptake of BPT in Malaysia.

KEYWORDS:
bronchial provocation test, knowledge, awareness, questionnaire, survey, bronchial asthma

INTRODUCTION

Asthma is a common but potentially serious medical condition characterised by chronic airway inflammation. Typical symptoms include wheezing, shortness of breath, cough and/or chest tightness that varies in both intensity and over time.[1] The diagnosis of asthma requires a history of suggestive symptoms together with clear demonstration of variable expiratory airflow limitation.[1-3] Diagnosing asthma in daily clinical settings can be challenging as various conditions such as gastroesophageal reflux, chronic obstructive pulmonary disease and anxiety disorders can present with asthma-like symptoms.[1] Attempts to obtain a confident diagnosis of asthma from a single time-constrained doctor-patient encounter can be complicated as asthma is often episodic, variable and follows a relapsing remitting course.[4] This has led to a common practice of empirical asthma treatment in Malaysia and certain countries abroad. Studies have clearly shown that many patients with asthma are poorly investigated in the community setting.[5-7]

Bronchial provocation test (BPT) is widely used internationally to evaluate for the presence of airway hyper-responsiveness (AHR) in conditions especially (but not limited to) asthma, but also as a marker of disease control,[8] severity[9,10] and prognosis[11] for asthma. BPT is commonly used to confirm the diagnosis of asthma among patients presenting with asthma-like symptoms with normal or near normal volume of air at the end of the first second of force expiration (FEV1).[12] However, the uptake of BPT in some countries including Malaysia remains low. In Malaysia, BPT was first available back in July 2008 but to date, only very few specialized centres (Serdang Hospital, Selangor; Queen Elizabeth Hospital, Sabah; Sarawak General Hospital, Sarawak) are offering the test.[12] The primary aim of this study was therefore to evaluate the level of awareness and knowledge of BPT amongst doctors in Malaysia.

MATERIALS AND METHODS

Study design

We conducted a nationwide, cross sectional, self-administered web-based questionnaire among medical doctors in Malaysia. The questionnaire was generated by using Google Forms and consisted of a total of 23 questions that were subdivided into 2 parts: part A with 18 questions and part B

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Corresponding Author: Ng Khai Lip
Email: khailip08@yahoo.com

with 5 questions (see Appendix). All questions were written in English. Part A questions included gender, grade of doctor (medical officer, general practitioner, family medicine specialist, physician, consultant), specialty (primary care, internal medicine, pulmonary medicine, others), age range, region of practice as well as current and previous working experience in pulmonary medicine. Malaysian identity card number were requested to identify any potential duplicate responses. Respondents were asked about the frequency they encountered patients with asthma in daily practice, awareness of BPT to aid in diagnosis of asthma, perceived importance of BPT, confidence in referring patients for BPT, frequency of referral for BPT in daily practices, reason(s) for never / rarely referring patients for BPT, perceived sufficient training in BPT, perceived need for further training in BPT and perception on whether BPT should be made more available in Malaysia. The final question of part A asked broadly for any additional thoughts or comments. Part B included 5 short questions to assess the level of knowledge regarding BPT. Respondents were required to select the most appropriate answer for each question. The first question explored regarding the safe FEV1 threshold for BPT. The second question asked about agents that can be used for BPT. The third question assessed respondents' knowledge on indications of BPT while the final 2 questions required respondents to interpret BPT results.

To the best of our knowledge, there are no existing validated questionnaires on the topic of BPT. We therefore deployed the following steps for the design and development of our study questionnaire: (1) literature review on BPT by researchers, (2) conduct interviews with focus groups (doctors from Malaysia of various grades and specialty to identify how they conceptualized and describe the topic of interest), (3) development of online questionnaire in concordance with latest evidence guidelines on BPT, (4) review and validation by content experts (panel of expert respiratory and internal medicine physicians), and finally (5) conduct pilot testing.

The web-based questionnaire was sent to medical doctors nationwide through social media (Facebook, WhatsApp, and Telegram) as well as Malaysian Medical Association (MMA) mailing lists between 1st October 2020 to 5th February 2021. Inclusion criteria were fully registered doctors of any grade from both government and private sectors within Malaysia. Incomplete responses, duplicate responses, doctors working outside of Malaysia and non-doctors (medical students, allied health members) were excluded. The questionnaire was not specifically targeted towards any particular specialty. We did not restrict access or sharing of questionnaire in order to facilitate dissemination. Respondents were able to invite other participants by sharing the online questionnaire link.
This study was conducted in accordance with the latest amended Declaration of Helsinki. The study protocol was approved by the Medical Research and Ethics Committee, Ministry of Health, Malaysia (approval number: NMRR-20-2420-56805 Investigator initiated research (IIR)).

Statistical analyses
Numerical data are reported as mean and standard deviation (SD) if they follow normal distribution. Non-normally distributed data are expressed as median and interquartile range (IQR). Categorical data are stated as frequencies and percentages. Binary logistic regression analysis was used to assess if region of practice, specialty and / or grade of doctor were predictive of awareness of BPT, perceived importance of BPT, confidence to refer for BPT and knowledge on BPT. Statistical analyses were done using IBM SPSS Statistics for Windows Version 16 (IBM Corp., Armonk, NY, USA).

RESULTS

During the study period, a total of 423 responses were recorded. We excluded 4 duplicate responses, 2 incomplete responses and further removed 2 respondents who did not meet the inclusion criteria (1 medical student and 1 doctor not practicing within Malaysia). Figure 1 illustrates included and excluded respondents in a flowchart.

Respondent demographics
Of the 415 responses that were analysed, 231 (55.66%) were from females. Most respondents identified themselves as medical officers: 195 (46.99%) out of 415. Other grades in order of descending frequency were physicians (15.90%), family medicine specialists (14.22%), general practitioners (13.73%) and consultants (9.16%). In terms of specialty, the largest response rate was from primary care doctors (169 or 40.72%), followed by 121 (29.16%) from internal medicine, 50 (12.05%) from pulmonary medicine and 75 (18.07%) others. According to age, most respondents (54.94%) belong to age 30 – 39-year-old sub group. Considering region in Malaysia, 346 (83.37%) respondents were from Peninsular Malaysia while 69 (16.63%) were from East Malaysia (Sabah, Sarawak and Labuan). The summary of respondent demographics who were included for analysis is shown in table I.

Quantitative results
Most respondents (97.35%) encountered patients with asthma in their daily practice. Only 163 (39.28%) reported good awareness (understand the test; can demonstrate/explain the test) of BPT to diagnose asthma. 232 (55.90%) and 124 (29.88%) regarded BPT as an important test and felt confident to refer patients for BPT respectively. Of those who were not confident to refer, 35.17% were unsure of BPT indications, 33.21% were unsure of centers providing BPT, 8.17% cited logistic reasons, 6.04% were concerned of possible BPT side effects. Only 30 (7.23%) felt that they received sufficient training in BPT while nearly all participants, 387 (93.25%), wanted more training in BPT. Additionally, the majority, 327 (78.80%) agreed that BPT should be made more available in the country. Table II gives the summary of results.

The median score for the 5 questions on BPT knowledge assessment was 20% (IQR 0 – 40%): one out of 5 questions answered correctly. In all 106 (25.54%) correctly named the safe FEV1 threshold for BPT. Only 79 (19.04%) participants knew all the agents that can be used for BPT. Indications of BPT was correctly answered by 81 (19.52%). The final 2 questions (question 4 and question 5) on reporting BPT results were correctly answered by 108 (26.02%) and 136

Table I: Demographics of participants who returned responses to our survey

		N	%
Gender	Male	184	44.34
	Female	231	55.66
Grade	Medical officer	195	46.99
	General practitioner	57	13.73
	Family medicine specialist	59	14.22
	Physician	66	15.90
	Consultant	38	9.16
Specialty	Pulmonary medicine	50	12.05
	Internal medicine	121	29.16
	Primary care	169	40.72
	Others	75	18.07
Age	20-29	59	14.22
	30-39	228	54.94
	40-49	58	13.98
	50-59	39	9.40
	>60	31	7.47
Region	Perlis	4	0.96
	Kedah	8	1.93
	Penang	29	6.99
	Perak	57	13.73
	Selangor	101	24.34
	Putrajaya	5	1.20
	Kuala Lumpur	47	11.33
	Negeri Sembilan	22	5.30
	Melaka	20	4.82
	Johor	30	7.23
	Pahang	7	1.69
	Kelantan	12	2.89
	Terengganu	4	0.96
	Sarawak	21	5.06
	Labuan	9	2.17
	Sabah	39	9.40

(32.77%) respondents respectively. Importantly, 252 (60.72%) and 245 (59.04%) answered "not sure" for questions 4 and 5 respectively. Refer to table III for results of knowledge assessment on BPT. Logistic regression analysis revealed that participants' awareness of BPT, perceived importance of BPT, confidence to refer for BPT and knowledge on BPT were affected by specialty but not by: region of practice, gender, age and grade (Table IV). Respondents from pulmonary medicine demonstrated better awareness and knowledge scores on BPT compared to other specialties (Figures 2 and 3).

Qualitative results

A recurrent theme in the responses was that the respondents did not feel they had received enough exposure or experience to identify patients eligible and suitable to be referred for BPT:

"Many of my older patients are already on empirical treatment for suspected bronchial asthma when they present to my clinic. I am not sure about the indications, sensitivity and specificity of BPT for my patients."

"Not much is advertised about the test."

"I have not heard of the test despite managing patients with asthma in my daily practice!"

Besides, many respondents appreciated the importance of BPT and frequently suggested more educational sessions to promote the test:

"Would definitely like to learn about the test if educational sessions / training modules were offered."

"Not many are aware of the test! Please provide online courses for primary care doctors for better exposure and knowledge regarding BPT."

Furthermore, some respondents went on further by suggesting that merely blaming inadequate training and poor advertising of BPT were overly simplistic. It was repeatedly suggested that better and easier access to BPT may have a positive impact on the uptake of BPT in Malaysia:

"If BPT services are only available in major cities (Kuala Lumpur) then its uptake will remain low despite with increasing awareness. NOT many patients will go all the way to Kuala Lumpur for this test!"

"Making BPT more easily available for doctors and patients is the FIRST step to increase its acceptability and uptake."

DISCUSSION

An estimated 300 million individuals globally are living with asthma, making it one of the most common chronic diseases worldwide.[1] However, despite being a common condition, diagnosing asthma can be tricky and challenging. This has led to a common practice of empirical treatment of asthma with inhaled medications in Malaysia and many other countries abroad.[5-7] An early study reported that up to 34% of patients treated as asthma based on symptoms alone actually did not have asthma.[13] Empirical pharmacological

Table II: Quantitative Results of Survey Responses and Knowledge Assessment of BPT

Quantitative results of survey responses		
	N	**%**
Encounter patients with asthma in daily practice		
Yes	404	97.35
No	11	2.65
Aware of BPT to diagnose asthma		
No	126	30.36
Only heard of name	126	30.36
Understands test	135	32.53
Can demonstrate/explain test	28	6.75
Perceived importance of BPT		
No	2	0.48
Neutral	181	43.61
Important	232	55.90
Confidence in referring patients for BPT		
No	163	39.28
Neutral	128	30.84
Confident	124	29.88
Frequency of referral for BPT in daily practice		
Never	312	75.18
Rarely	56	13.49
Sometimes	38	9.16
Frequent	9	2.17
Reason for never/rarely referral for BPT		
Total reasons given by responders	563	
Unsure of indications	198	35.17
Concerns of side effects	34	6.04
Unsure of centres providing service	187	33.21
Long waiting list	8	1.42
Logistic issues	46	8.17
Never encountered patients requiring BPT	90	15.99
Perceived sufficient training		
Yes	30	7.23
No	385	92.77
Perceived need for further training		
Yes	387	93.25
No	28	6.75
Perception on whether BPT should be made more available		
No	3	0.72
Neutral	85	20.48
Yes	327	78.80
Results of knowledge assessment on BPT		
	N	**% (correct answer)**
Question 1: Safe FEV1 threshold for BPT	106	25.54
Question 2: Agents that can be used for BPT	79	19.04
Question 3: Correct indications of BPT	81	19.52
Question 4: Interpreting BPT test results	108	26.02
Question 5: Interpreting BPT test results	136	32.77
	Median	**IQR**
Knowledge score	20%(1/5)	0-40

treatment of all patients with suspected asthma will inadvertently lead to delay in attaining competing differential diagnoses such as gastroesophageal reflux disease, allergic rhinitis and chronic obstructive pulmonary disease in some. In addition, inhaled medications for asthma are not without adverse effects. For example, inhaled corticosteroids can affect the hypothalamic-pituitary-adrenal axis, bone growth and density and is linked to increased risk of oral candidiasis and pneumonia.[14,15,16] Empirical treatment of asthma without proper investigation should therefore be discouraged.

The initial recommended test for asthma is spirometry coupled with bronchodilator response (BDR) testing where improvement of more than 12% and 200mL in FEV1 post BDR testing is diagnostic.[1,2] A recent study reported that in subjects with self-reported physician diagnosis of asthma, absence of BDR had a negative predictive value of only 57% to exclude asthma.[17] Hence, among patients with negative BDR testing results, a further confirmatory BPT is widely used internationally for measurement of AHR.[17] Studies have shown that a negative BPT result is highly reliable for ruling out asthma.[18,19,20] Moreover, apart from diagnosing asthma, BPT can be utilised as a marker of disease control,[8], severity[9,10]

Table III: Logistic regression analysis for awareness, perceived importance, confidence to refer and knowledge on BPT

		Wald	Freedom	p-value
Awareness of BPT (understand test and can demonstrate test)	Region	20.268	15	0.162
	Grade	**17.092**	**4**	**0.002**
	Gender	2.037	1	0.153
	Specialty	**30.586**	**3**	**0.000**
	Age	8.11	4	0.088
Perceived importance of BPT (very and somewhat important)	Region	24.229	15	0.061
	Grade	1.244	4	0.871
	Gender	1.231	1	0.267
	Specialty	**17.88**	**3**	**0.000**
	Age	3.85	4	0.427
Confidence to refer for BPT (very and somewhat confident)	Region	13.316	15	0.578
	Grade	0.794	4	0.939
	Gender	0.583	1	0.445
	Specialty	**33.774**	**3**	**0.000**
	Age	5.612	4	0.230
Knowledge on BPT (score of at least 4 out of 5 or 80%)	Region	6.406	15	0.972
	Grade	6.379	4	0.173
	Gender	0.83	1	0.362
	Specialty	**57.046**	**3**	**0.000**
	Age	0.295	4	0.990

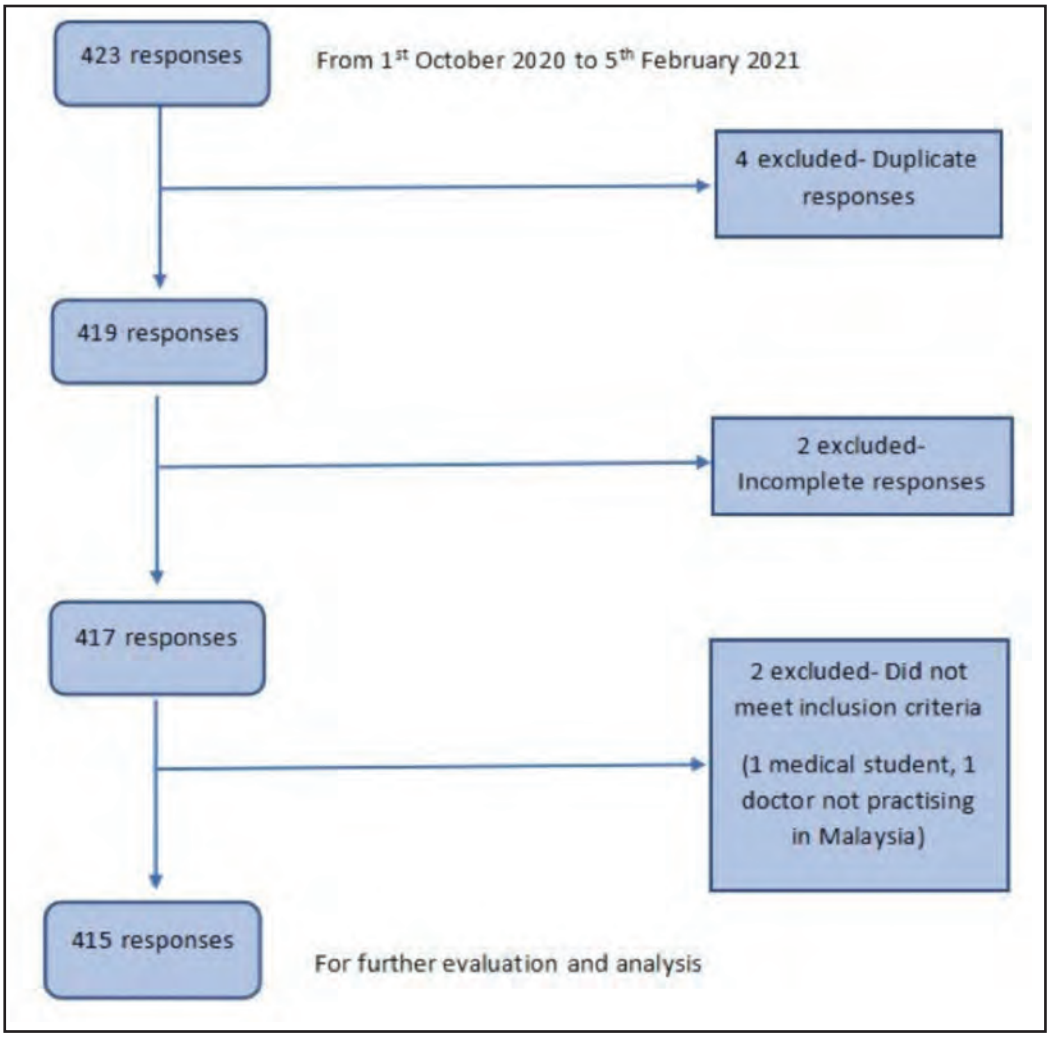

Fig. 1: Flowchart of Respondents of BPT Questionnaire.

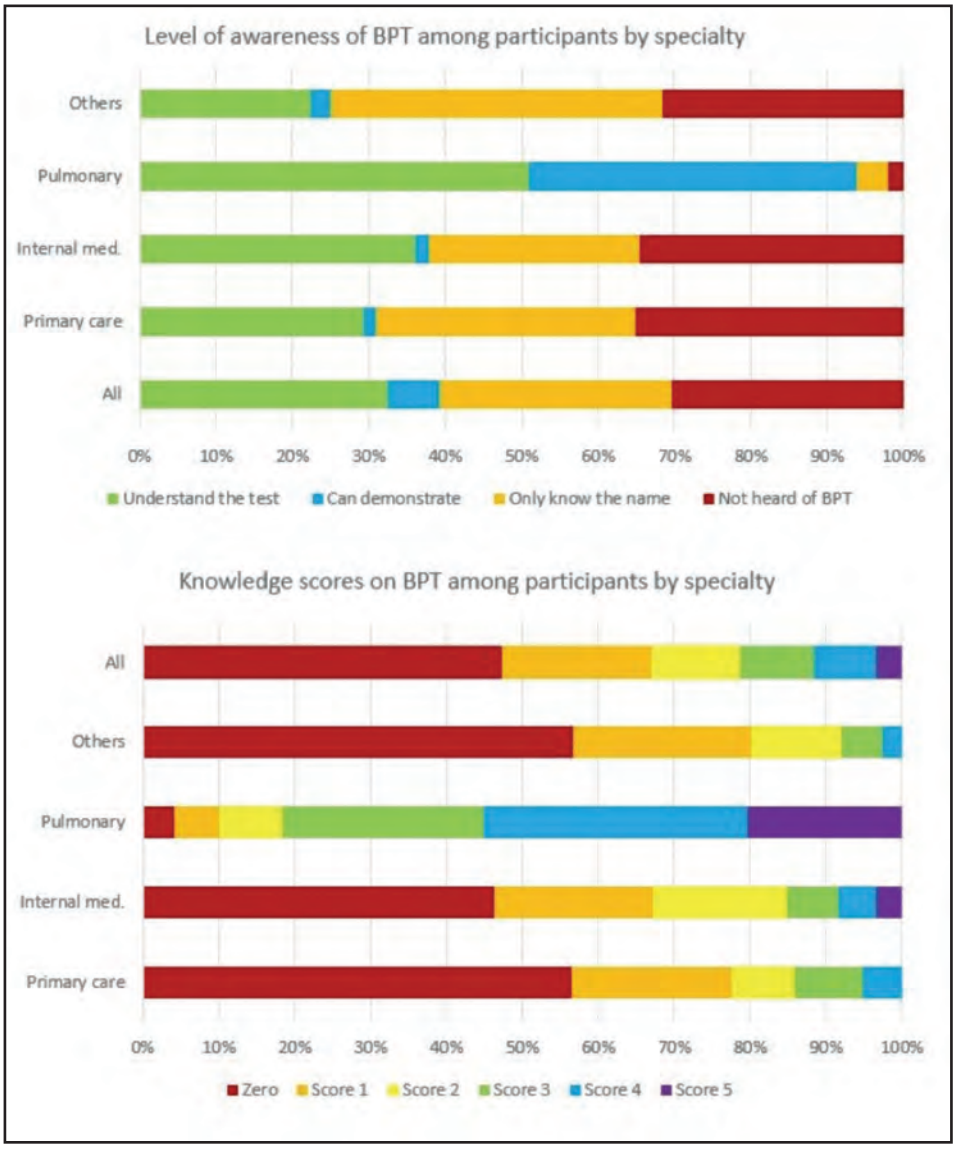

Fig. 2: Level of Awareness and Knowledge Score on BPT Among Participants by Specialty.

and prognosis[11] for asthma. The role of BPT in detecting exercise induced bronchoconstriction which occurs in up to 90% percent of patients with asthma is clearly stated in the latest Malaysian clinical practice guidelines on management of asthma in adults which was published back in 2017.[21] All three centres in Malaysia utilise methacholine,[12] a derivative of acetylcholine that stimulates muscarinic M3 receptors on bronchial smooth muscles for BPT.[18] In Malaysia, BPT services have been available since July 2008.[12] Nevertheless, to date, the uptake of BPT in Malaysia remains poor. We attempt to explore this phenomenon by unveiling the level of awareness, confidence, knowledge and perspectives of doctors practicing within Malaysia regarding the role of BPT in diagnosing asthma.

Our respondents comprised of doctors of all grades from all states of Malaysia. Most identified themselves as primary care doctors (40.72%), followed by internal medicine doctors (29.16%). According to regions in Malaysia, 83.37% participants were from Peninsular Malaysia with the remaining 16.63% from East Malaysia (Sabah, Labuan, Sarawak). Such location dispersal is consistent with the national distribution of doctors where approximately 80% and 20% of Malaysian doctors reside in Peninsular Malaysia and East Malaysia respectively.[22] Besides, a vast majority of doctors who participated in this survey (97.35%) encountered patients with asthma in their daily clinical practice. Accordingly, questionnaire respondents were regarded as suitable participants in this study.

Within our study sample, a significant proportion of doctors did not demonstrate good awareness and knowledge of BPT to diagnose asthma. We accept a knowledge score of at least 60% (at least 3 out of 5 questions answered correctly) as an indicator of sound knowledge regarding BPT. Nevertheless, the median knowledge score was only 20% (1 out of 5 questions answered correctly), suggesting significant deficiencies in understanding the basic principles of BPT

itself, let alone interpretation of BPT results. This corroborates with the qualitative results where many respondents confessed that they barely knew about BPT despite managing patients with asthma in daily practice. We further performed logistic regression analysis to assess if respondents' awareness and knowledge were influenced by variables including specialty, region of practice, gender, age and grade. As expected, doctors working in pulmonary medicine department had better awareness and knowledge on BPT. Senior and high ranked doctors (consultants), interestingly, did not score better in both knowledge and awareness compared to their younger counterparts, suggesting that poor BPT knowledge and awareness may be a widespread problem. We hypothesize that in Malaysia, BPT remains an 'exclusive' test that is only well known among the pulmonary medicine fraternity. This information could potentially be utilised to determine and guide strategies to promote the usage of BPT.

When considering various national level programs and targeted local interventions to increase awareness and knowledge on BPT among doctors in Malaysia, we suggest structuring educational and training programs at various levels. Firstly, doctors working in pulmonary medicine departments play vital roles in promoting awareness and education regarding BPT. Training in undergraduate, internship and primary care should all emphasize on the importance to avoid empirical pharmacological treatment of asthma and to introduce BPT as a potential confirmatory test for asthma. Targeted local interventions such as webinars, workshops and podcasts are among ways to allow dissemination of knowledge and awareness regarding BPT. Pamphlets and brochures should be made available for both doctors and patients in outpatient clinics and in wards to encourage and facilitate referrals for BPT when indicated. Concurrently, postgraduate training should focus on medical, primary care and respiratory consultants or specialists to ensure that they are able to maintain good knowledge and skills on BPT and thus able to contribute in promoting awareness and training of junior colleagues. We hope that detailed analysis of effects of local interventions to promote BPT could inform planning and shaping of national level programs, policies and resource allocation of BPT in Malaysia in the near future.

We accept that there is a limitation in the size of the study sample and, therefore, increasing generalisability and applicability of findings may have been found with a larger sample size. As of August 2020, there are 71041 medical doctors working in both the public and private sectors in Malaysia.[19] Our study thus represents 0.6% of potentially available respondents. Besides, selection and participation bias might occur in online based questionnaire studies. Doctors more engaged in care of patients with respiratory conditions such as asthma may have been more likely to participate in the questionnaire. Nevertheless, no incentives were given to survey participants that would have caused conflicts of interest. Survey participation was fully voluntary and was not deliberately targeted towards doctors with previous knowledge or working experience in respiratory medicine. Besides, we relied heavily on the Malaysian Medical Association (MMA) mailing lists for distribution of questionnaires. MMA has a wide network that linked all Malaysian doctors regardless of specialty and grade. Other than that, we did not collect data on location of both undergraduate and/or postgraduate training, which may have affected the study results as well.

CONCLUSION

Our questionnaire survey highlighted significant gaps in level of awareness and knowledge of BPT among doctors in Malaysia. Various national level programs and targeted local interventions are much needed to increase the update of BPT in Malaysia. We hope that data from this study could be used to inform for the purposes of planning and resource allocation of BPT in Malaysia.

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