

## Factors affecting PACES success rate–A Singapore experience

Wai Ching Lee <sup>1\*</sup>, Chong Yau Ong <sup>2†</sup>, Meyyur Aravamudan Veeraraghavan <sup>3</sup>,  
Desmond B Teo <sup>4</sup>, Vernon Min Sen Oh <sup>4</sup>

<sup>1</sup>Division of General Medicine, Sengkang General Hospital, Sengkang, SINGAPORE

<sup>2</sup>Newcastle University Medicine Malaysia, Johor, MALAYSIA

<sup>3</sup>Division of General Medicine, Woodlands Health Campus, SINGAPORE

<sup>4</sup>Division of Advanced Internal Medicine, Department of Medicine, National University Hospital, SINGAPORE

\*Corresponding Author: [deanna.lee.w.c@singhealth.com.sg](mailto:deanna.lee.w.c@singhealth.com.sg)

† These authors contributed equally to this article. Both authors are co-first authors.

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### ABSTRACT

**Introduction:** MRCP (UK) is intentionally renowned for its relevance as a summative assessment in internal medicine training. It is known that the passing rates for the clinical component of MRCP (PACES) examinations for non-UK trainees are lower. Studies involving UK candidates proposed that factors such as availability and quality of postgraduate medical education, candidate demographics, and candidate's preparation efforts for this examination may affect the prospect of success. However, these factors have not been studied in detail among non-UK candidates.

**Material and Methods:** To study these factors in non-UK candidates, we conducted an online survey of all doctors who took PACES examination from year 2009 to 2017 in a Singapore tertiary hospital to determine if these factors are similar in our population. A total of 107 respondents completed the survey. Pearson Chi-square, Fisher's exact, and Kruskal-Wallis H tests were used to determine the significance of these factors and their relationship with PACES examination success.

**Results:** Singapore medical graduates perform better than their counterparts who are from medical schools outside Singapore. Males performed equally well as their female counterparts in PACES.

**Conclusion:** It is suggested to look beyond conventional factors for other non-demographic contributors such as training, preparedness, and how organized is the candidate.

**Keywords:** academic training, clinical competence, clinical skills, internal medicine

## INTRODUCTION

The Federation of Royal Colleges of Physicians of the United Kingdom offers a membership diploma examination, the Membership of the Royal College of Physicians United Kingdom (MRCP (UK)), to all internal medicine trainees. This examination has three parts: two written knowledge-based assessments (KBAs) in a multiple-choice, best-of-five (BOF) format (parts 1 and 2 written), and a clinical skills component (part 2 clinical examination: The Practical Assessment of Clinical Examination Skills–PACES) [1]. MRCP (UK) has an international reputation where some countries recognize MRCP (UK) for the purposes of employment and recruitment at the level of specialist trainee and above [2,3]. MRCP (UK) showed high correlation with MRCP, supporting the validity of each [3]. Additionally, MRCP (UK) performance is a valid predictor of professionally important outcomes that is fitness to practice sanctions in UK doctors [4].

The postgraduate internal medicine training in Singapore transited to the residency program in 2010 [5]. The program introduced a structured and well-defined curriculum, regular formative assessments, allocated resources including program

directors and core faculties who supervise the training and education. The program is accredited by the Accreditation Council for Graduate Medical Education International (ACGME-I). Prior to progression to subspecialty training, trainees would need to pass the locally conjoint American Board Internal Medicine International (ABIM-I), a written examination, which consists of 400 multiple-choice questions, and MRCP (UK) during their training with the program [6].

MRCP (UK) clinical skills component (PACES) is a structured assessment that was first introduced in 2001. To pass PACES, candidates must attain a minimum standard in each of the seven clinical skills and a minimum total score of 130 out of 172 (75.5%) across the whole assessment. This examination is designed to set a benchmark in assessment of clinical skills, communication and knowledge relevant to the practice of Internal Medicine [7]. An analysis of MRCP (UK) examinations showed that PACES is an accurate assessment with smaller standard error of measurement compared to the written examinations [8].

The mean passing rate at first attempt for PACES from 2017 till 2019 for UK trainee was 59.96% whereas the non-UK trainee's rate was 37.13% [9]. Every ten years or so, PACES will undergo an assessment review and institute changes if

required. It is due to undergo some changes in the format in 2020 but was deferred because of the COVID-19 pandemic [10].

Several factors may affect the prospect of succeeding in this examination. One older study estimated about 87% of main effect variance was due to candidate differences, 12% due to differences in leniency-stringency of examiners, and 1% due to station differences [11]. Since then, various ways had been done to reduce the differences in the examiners. Gender, ethnic origin, country of undergraduate medical education, and candidate's preparatory efforts for this examination are among intrinsic factors affecting the success in PACES examination [12-14]. International medical graduates perform less well than UK graduates not only in PACES but on a number of postgraduate examinations in the UK [15-17].

Several studies had identified these factors amongst the UK candidates, but no study has been performed for non-UK candidates [12-17]. Hence, this study aims to provide insight towards the factors affecting the success in PACES examination among non-UK candidates from a tertiary teaching hospital in Singapore.

## MATERIAL AND METHODS

### Design, Setting and Participants

A cross-sectional study was conducted between 15 May 2017 to 30 June 2017. Doctors from a tertiary teaching hospital in Singapore (National University Hospital) who took PACES examination from year 2009 to 2017 were invited to complete a self-administered online questionnaire anonymously.

All doctors, including residents, non-trainee doctors and consultants, who underwent the PACES examination were surveyed. The doctors were invited to participate via electronic mail system and given three automated electronic mail reminders to complete the survey throughout the duration.

### Selection of Variables and Data Analysis

The variables collected in the survey were based on published findings which may influence and confound the candidate's performance at this examination. Among the known and hypothesized factors included were, as follows:

1. demographics (age, gender, ethnicity, nationality, first language, and marital status),
2. candidate's training background (country of first medical qualification, year of qualifying, and postgraduate medical training), and
3. preparatory efforts of candidates preparing to sit for the PACES examination (utilization of PACES courses) [7,12-14].

The questionnaire also asked the participants to self-evaluate the confidence in performance in the PACES examination. A pilot survey study was performed by three senior doctors to obtain feedback on the content and readability of the self-administered survey to ensure content validity. All concurred that they did not find any issues with understanding the questionnaire and found content relevant to research question and population undertaking the survey.

Statistical analysis was performed using statistical package of the social science (SPSS version 26, IBM Corporation). Pearson Chi-square, Fischer's exact test, and Kruskal-Wallis H

**Table 1.** Demographics and performance of respondents

| Variable                  | n (%)       |
|---------------------------|-------------|
| Age group                 | n=122       |
| 25 to 27                  | 44 (44.1%)  |
| 28 to 30                  | 41 (42.1%)  |
| 31 to 33                  | 11 (10.8%)  |
| Above 33                  | 2 (2.0%)    |
| Gender                    | n=98        |
| Male                      | 52 (53.1%)  |
| Female                    | 46 (46.9%)  |
| Marital status            | n=99        |
| Married                   | 52 (52.5%)  |
| Single                    | 47 (47.5%)  |
| Ethnicity                 | n=97        |
| Chinese                   | 77 (72.0%)  |
| Indian                    | 13 (12.1%)  |
| Burmese                   | 3 (2.8%)    |
| Malay                     | 1 (0.9%)    |
| Middle Eastern            | 1 (0.9%)    |
| Pakistani                 | 1 (0.9%)    |
| White                     | 1 (0.9%)    |
| Singapore graduate        | n=107       |
| Yes                       | 49 (45.8%)  |
| No                        | 58 (54.2%)  |
| Residency training        | n=106       |
| Yes                       | 93 (87.7%)  |
| No                        | 13 (12.3%)  |
| Previous attempt          | n=98        |
| Yes                       | 4 (4.1%)    |
| No                        | 94 (95.9%)  |
| English as first language | n=101       |
| Yes                       | 85 (84.2%)  |
| No                        | 16 (15.8%)  |
| Results                   | n=107       |
| Pass                      | 104 (97.2%) |
| Fail                      | 3 (2.8%)    |
| Score range               | n=107       |
| Below 130                 | 3 (2.8%)    |
| 130 to 140                | 13 (11.2%)  |
| 141 to 150                | 40 (37.4%)  |
| 151 to 160                | 35 (30.8%)  |
| 161 to 172                | 18 (17.8%)  |

tests were used to determine the association of the various factors to the success in the PACES examination.

### Ethical Approval

Ethics board approval was waived for this study because there was no patient involvement. A written explanation of the study was provided in the email with the attached link of the online questionnaire. The return of completed questionnaire was entirely voluntary and indicates implied consent. All responses and data published were made anonymous.

## RESULTS

Out of 127 online questionnaires sent, a total of 109 responses were received. After removal of two duplicate responses, a total of 107 responses from unique respondents were obtained, giving a response rate of 84.3%. Results are reported in descriptive data (number and percentage) and analytical data (p-value). Three participants had not passed the examination at the time of the study. Not all the participants answered all the items questioned. **Table 1** shows the demographics of the participants.

**Table 2.** Demographics & factors related to PACES success

| Variable                           | AC    | P  | NP | p    |
|------------------------------------|-------|----|----|------|
| Gender                             | n=107 |    |    |      |
| Male                               | 52    | 49 | 3  | 0.19 |
| Female                             | 46    | 46 | 0  |      |
| Did not specify                    | 9     | 9  | 0  |      |
| Marital status                     | n=99  |    |    |      |
| Married/legal partnership          | 52    | 51 | 1  | 0.50 |
| Single                             | 47    | 45 | 2  |      |
| Age                                | n=102 |    |    |      |
| 25 to 27                           | 45    | 45 | 0  | 0.45 |
| 28 to 30                           | 44    | 42 | 2  |      |
| 30 to 33                           | 11    | 11 | 0  |      |
| Above 33                           | 2     | 2  | 0  |      |
| English as first language          | n=101 |    |    |      |
| Yes                                | 85    | 83 | 2  | 0.40 |
| No                                 | 16    | 15 | 1  |      |
| Ethnicity                          | n=93  |    |    |      |
| Chinese                            | 78    | 75 | 3  | 0.75 |
| Indian                             | 12    | 12 | 0  |      |
| Others                             | 3     | 3  | 0  |      |
| Residency training                 | n=107 |    |    |      |
| Yes                                | 92    | 89 | 3  | 0.6  |
| No                                 | 15    | 15 | 0  |      |
| Residency year of first attempt    | n=77  |    |    |      |
| First                              | 8     | 8  | 0  | 0.08 |
| Second                             | 26    | 26 | 0  |      |
| Third                              | 38    | 37 | 1  |      |
| Fourth                             | 5     | 5  | 0  |      |
| Prior attempt                      | n=79  |    |    |      |
| Yes                                | 2     | 2  | 0  | 0.78 |
| No                                 | 77    | 74 | 3  |      |
| Exam center                        | n=105 |    |    |      |
| Singapore                          | 51    | 50 | 1  | 0.26 |
| London                             | 29    | 29 | 0  |      |
| Glasgow                            | 16    | 14 | 2  |      |
| Edinburgh                          | 3     | 3  | 0  |      |
| India                              | 4     | 4  | 0  |      |
| Others                             | 6     | 6  | 0  |      |
| UK preparatory course              | n=107 |    |    |      |
| None                               | 18    | 17 | 1  | 0.21 |
| PassPaces                          | 44    | 44 | 0  |      |
| Other preparatory courses          | 8     | 7  | 1  |      |
| PassPaces and other courses        | 37    | 36 | 1  |      |
| Singapore preparatory course       | n=106 |    |    |      |
| None                               | 36    | 36 | 0  | 0.32 |
| NUH preparatory course             | 44    | 42 | 2  |      |
| Other courses                      | 11    | 10 | 1  |      |
| NUH and other courses              | 15    | 15 | 0  |      |
| UK & Singapore preparatory course  | n=106 |    |    |      |
| None                               | 5     | 5  | 0  | 0.13 |
| Both UK & Singapore                | 56    | 55 | 1  |      |
| UK course only                     | 32    | 32 | 0  |      |
| Singapore course only              | 13    | 11 | 2  |      |
| Any preparatory course             | n=106 |    |    |      |
| Yes                                | 101   | 98 | 3  | 0.70 |
| None                               | 5     | 5  | 0  |      |
| Hospital worked                    | n=106 |    |    |      |
| National University Hospital (NUH) | 95    | 92 | 3  | 0.55 |
| Non-NUH                            | 11    | 11 | 0  |      |

Note. AC: All candidates; P: Passed; NP: Not passed; p: p-value

Most of the respondents were aged between 25 to 30 years, and there was no correlation between age and PACES success ( $p=0.45$ ). We also found no associations of gender, marital status, ethnicity, and having English as the respondent's first language with PACES examination success (**Table 2**).

**Table 3.** Selected factors with PACES score range

| Variable                      | n   | MR   | APS   |
|-------------------------------|-----|------|-------|
| Self-rated performance        | 96  |      | 0.012 |
| Struggle in all stations      | 3   | 16.2 |       |
| Well in communications        | 27  | 38.8 |       |
| Well in physical examinations | 10  | 49.8 |       |
| Well in all stations          | 56  | 54.7 | 0.03  |
| PACES before Part2 written    | 98  |      |       |
| Yes                           | 4   | 89.5 |       |
| No                            | 94  | 47.8 |       |
| Medical school                | 107 |      | 0.013 |
| Singapore                     | 49  | 61.8 |       |
| Non-Singapore                 | 58  | 47.4 |       |

Note. MR: Mean rank; APS: Asymptotic p sigma

**Table 4.** Comparison of undergraduate medical schools with cut off score at 151

| Variable       | n   | Score<150 | Score≥151 | p-value |
|----------------|-----|-----------|-----------|---------|
| Medical school | 107 |           |           | 0.005   |
| Singapore      | 49  | 18        | 31        |         |
| Non-Singapore  | 58  | 37        | 21        |         |
| Medical school | 107 |           |           | 0.032   |
| Singapore      | 49  | 18        | 31        |         |
| UK             | 20  | 13        | 7         |         |

The medical school where respondents graduated from was associated with higher PACES scores ( $p=0.013$ ) (**Table 3**).

However, when the PACES scores were divided into two groups (up to 150, and 151 to 172), graduates from Singapore medical school scored significantly better than those from medical schools outside Singapore ( $p=0.005$ ) (**Table 4**).

There was no difference in PACES success, between those who underwent residency training and those who did not ( $p=0.60$ ) (**Table 2**). Among the residents, taking the PACES examination early or late in their training had no effect on PACES success ( $p=0.08$ ). Majority of the residents (60.6%) passed the PACES in the second and third year of residency (**Table 2**). Most of the respondents (76.63%) reported having only worked at National University Hospital, Singapore (NUH). No difference was noted between respondents who had prior working experience in Singapore versus those outside the country ( $p=0.82$ ) (**Table 2**).

Among the 104 respondents who passed the PACES, only two (1.9%) had failed in their prior attempts. When comparing between those who sat for PACES before part 2 written test and those who took it after written test, those who sat for PACES had higher mean score rank ( $p=0.03$ ) (**Table 3**). Notably, the location of the examination center did not influence their PACES success ( $p=0.26$ ) (**Table 2**).

Prior participation in local or UK preparatory courses did not lead to higher success rates ( $p=0.70$ ) (**Table 2**). We found no difference between respondents' self-rated performance and their actual success in PACES ( $p=0.57$ ) (not shown in table). However, their self-rated performance did correlate significantly with the scores obtained in PACES ( $p=0.012$ ) (**Table 3**).

## DISCUSSION

The objective of this study is to investigate if there are any factors affecting success in PACES examination outside UK in a population group in Singapore.

Although there was no statistical significance between age and passing of PACES in our study, most respondents passed the PACES at age 25 to 30. This corresponded to about 24 to 48 months after graduation, as most of the residents joined the residency program within two years after graduation. This is in keeping with findings from international studies that the passing rates were highest among those who took PACES 25 to 36 months after graduation at which the age would be between 25 to 30 [12-14]. Other studies also showed that recent graduation is a predictor of performance in all three parts of the MRCP examination [13]. However, one study cautioned that candidates who entered PACES early were least likely to pass, which highlights the importance of developing knowledge and skills in a clinical setting before taking this component [14].

In our Singapore-based study, we also found that a gender difference for PACES success was absent, which contrasts with studies done in UK [7,18], in which both UK and international female medical graduates outperformed their male counterparts. For Singapore medical school admissions also, there is no detectable difference between men and women in terms of school grades, nor in how they perform in admission interviews and tests [19]. It has been reported in several studies that the whites outperformed the non-white candidates in PACES. However, in this study we found no performance difference among the ethnicity in Singapore.

Interestingly, despite the small size of four respondents who took PACES before the part 2 written examination, the four scored significantly higher mean scores than the majority who did PACES examination last. These findings could likely be due to the candidates having higher level of ambition, motivation, or cognitive skillsets [14]. Candidates who revised thoroughly, had a clear plan for progression, possessed ambition, and whose peers had already passed, were more likely to succeed in PACES [14]. Better-prepared candidates with proper organizational skills are more likely to pass the PACES [20]. Proper mental conditioning, organizational skills, confidence, reduction of examination anxiety improves chances of success [21].

Contrary to suggestion that participation in PACES preparatory courses would better equip a candidate and bring about higher passing rates [12], we found no difference between those who attended PACES course and those who did not. There were also no published studies to show preparatory courses help in passing PACES. Some Singapore teaching hospitals have initiated regular training to prepare their candidates for PACES. Committed and readily accessible tutors who have passed the examination were engaged in conducting regular structured pedagogical small group and simulated teachings on core PACES topics and conditions. Although a small, initial observational study on mentoring core medical trainees failed to show difference in PACES pass rates compared to non-mentored trainees, positive association was observed in the other training outcomes [22]. Also there is formal support for self-directed learning such availability of educational resources and protected time for examination preparation including priority of clinical posting selection and allowing consumption of training leave. Long-term commitment is shown to improve PACES results, as reported in one qualitative improvement initiative [23].

In our study, the respondent's self-rating of their PACES performance was strongly concordant with the score obtained. Most of the candidates who rated themselves as having performed well actually obtained high scores in PACES. This

finding is contrary to one study that found candidates poorly predicted their own success [14]. The accuracy of student's self-assessment often yields mixed results [24]. In this study, most of the respondents are residents in training and has been exposed to self-assessment and formative feedbacks leading to better insight and judgement in self-rating of their own performance.

With regards to undergraduate medical schools of the respondents, Singapore medical school graduates showed significant passing rates compared to colleagues graduating from medical schools outside Singapore. Additionally, when total score ranges and score cut-off at 151 were compared, Singapore medical school graduates fared better than candidates who graduated from medical schools outside of Singapore. Although this was not an eye-to-eye comparison, this finding could be an exception to the general demographic pattern reported by the Federation of Royal Colleges of Physicians of the United Kingdom, in which non-UK trainee's passing rate was only at 37.1%. One study in UK found candidates from different UK medical schools consistently perform differently in all three parts of the MRCP(UK) examination [13]. As for Singapore, it was ranked second after China by the Programme for International Student Assessment (PISA) in reading, mathematics, and science in 2018 [18]. From the PISA and similar comparative analyses, it is reasonable to infer that Singapore pre-university school system laid a foundation for Singapore medical school graduates to excel in formal examinations. Moreover, English is also the dominant language of education, the professions, business, and industry in Singapore.

Both in UK and Singapore, the completion of MRCP (UK) is a prerequisite to joining a higher specialty training; and is expected to be delivered by the trainee by the end of core medical training in UK and by the residents by the end of internal medicine junior residency in Singapore. Although the ACGME-I residency training model adopted from the USA in Singapore is different from that in UK, there are similarities such as annual review of competency progression (ARCP) and the use of mini-CEX in formative assessments [22,25]. Therefore, comparison between the training models using pass-fail outcome in PACES would be difficult.

### **Strengths of the Study**

To our knowledge, this study is the first outside UK to analyze demographic data and factors influencing success in the MRCP PACES examination. Respondents were recruited from doctors with varying job titles that encompassed candidates for PACES spanning over multiple different diets. This increases reliability and account for differences between the diets.

This information will be useful for postgraduate training directors to encourage and support their candidates who are preparing for the examination. Internationally, it would provide motivation for international medical graduates to aspire to succeed in PACES, and other international centers to allocate resources to postgraduate internal medicine training.

### **Limitations of the Study**

This study was done in a single tertiary, teaching hospital in Singapore, where sufficient resources were allocated to ensure training and education for the candidates. Hence our findings might not be generalizable to candidates from other non-teaching hospitals or training centers. Future study such

as survey among participants from other hospitals in Singapore would provide more generalizable inferences.

Another limitation was that the participation was voluntary. Although all the known candidates and colleagues were approached, selection bias is possible, wherein candidates who did not pass the examination might have declined participation making the number of failures very small. However, the average passing rate of this center for the past three years was consistently around 92% which is almost similar to the average population of this study.

Finally, the study relied on self-reported scores. While respondents generally tend to be honest in self-reporting, recall bias could have affected the accuracy of details because some candidates sat for the PACES several years prior to the study. This bias was reduced by asking the candidates to check in their actual scores published by the College of Physicians [14].

## CONCLUSION

This study is the first outside UK to demonstrate the differences between factors affecting PACES success, in this study performed in Singapore, success rate of PACES is not affected by gender and ethnicity factors; which prompts looking beyond conventional factors for other non-demographic contributors such as preparedness, and how organized is the candidate. Self-rated performance, attempting PACES before part 2 written tests, and undergraduate medical school were found to be favorable for PACES success, further suggesting the success contributors are intrinsic and modifiable- the training and preparedness for examination. Future mixed method or qualitative studies conducted with the candidates and program directors can delve deeper in the themes and other potential factors; particularly paying attention to the details on how the structured initiatives contributed to the performance of PACES candidates.

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**Ethical statement:** Ethical approval was exempted. No patients were involved, and submission of questionnaire was voluntary.

**Declaration of interest:** No conflict of interest is declared by authors.

**Data sharing statement:** Data supporting the findings and conclusions are available upon request from the corresponding authors.

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