"Do you reckon I should sit?": Is it possible to predict success in the ACEM fellowship examination?

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Abstract

Introduction: The ACEM (Australasian College for Emergency Medicine) fellowship examination is a high-stakes assessment occurring at the end of postgraduate training in emergency medicine. The objectives of this study were to identify factors that allow prediction of success or failure in the ACEM fellowship examination, information that may be useful to those involved in examination preparation.

Methods: From 2009–2012, six consecutive cohorts of Victorian ACEM trainees sat a practice written examination and completed surveys regarding examination preparation. Subsequent ACEM fellowship examination outcome was obtained by contacting trainees and using ACEM annual reports. Univariate analysis was undertaken to determine which factors would most reliably predict examination success. Each sitting of the practice examination was viewed separately.

Results: From the 150 examination candidates, we received responses on 111 occasions from a total of 80 trainees (several candidates sat the exam more than once). Pass/fail data was available for 72 datasets. The strongest positive predictors for examination success included the number of examination sections passed in the practice examination (OR 3.34, 95% CI 1.61–6.90), reading outside of the major international emergency medicine textbooks (OR 2.53, 95% CI 1.21–5.28) and a belief that attending a course was helpful for examination preparation (OR 1.70, 95% CI 1.06–2.73). Years since graduating from medical school (OR 0.79, 95% CI 0.69–0.91) was negatively associated with examination success.

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Conclusions: In this cohort of Victorian trainees, performance in a practice examination had one of the strongest associations with performance in the real ACEM fellowship examination. Practice examinations are a useful method to provide benchmarking and advice to candidates prior to the formal examination.

Keywords: emergency medicine; medical education; specialty boards; assessment.

Introduction

In Australasia, postgraduate medical training in emergency medicine is coordinated by the Australasian College for Emergency Medicine (ACEM). There are three major hurdles that must be completed during training: a primary examination in basic sciences, a research requirement and an exit fellowship examination.

In the period 1996–2003, the mean pass rate of 61% for the fellowship examination raised concerns about the adequacy of ACEM training (Cameron & O'Reilly, 2004). Factors possibly contributing to the low pass rate included trainee selection, training programme structure and the impact of the local director of emergency medicine training (DEMT), examination preparation, examination validity and examination reliability (Rogers, Leach, & Brookes, 2004). The view of some emergency medicine educators was that specific examination preparation, as opposed to general emergency medicine education, is vital to success in the fellowship examination (Rogers et al., 2004), which might raise questions about the validity of the ACEM examination.

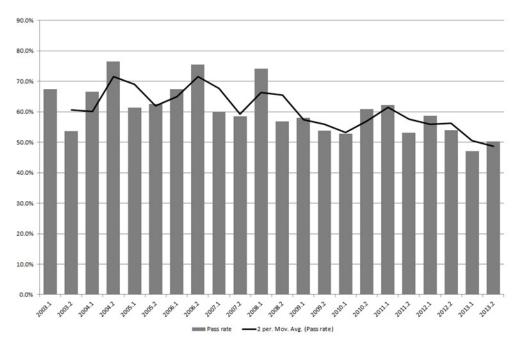


Figure 1. ACEM fellowship examination pass rates 2003–2013.

From 2004–2008, the pass rate improved slightly, then suffered a gradual decline over the subsequent years (Figure 1), with the pass rate between 47.0% and 62.2% from 2009 until 2013 (ACEM, 2004–2013). Nevertheless, in a 2009 survey, the fellowship examination was thought by most trainees to be fair (Craig, Braitberg, Nicolas, White, & Egerton-Warburton, 2010).

Although there are now more resources for examination preparation for trainees, including a specific textbook (Wilkes, Peirce, Foot, & Ting, 2009) and a number of web-based resources (see www.lifeinthefastlane.com) (ACEM, 2017; Australian Resuscitation Council, 2016), there are no formally endorsed ACEM examination preparation courses, and exam preparation programmes vary between hospitals and across Australasia. Gaining a better understanding of factors that contribute to examination success will help trainees and those supervising and advising them.

The ACEM Fellowship Examination is a twice-yearly exit examination comprising a written examination followed by a clinical examination around ten weeks later. At the time of this study, the written examination comprised three written papers (MCQs, visual aid questions and short answer questions), and there were three clinical examination components (long case, short cases and OSCEs). Only trainees passing at least two of the three written papers are invited to the clinical examination.

Since 2008, one of the authors (SC) has coordinated biannual practice written fellowship examinations for all eligible Victorian Emergency Medicine trainees. The practice examination is held approximately two months prior to the ACEM written examination. Between 2008 and 2013, there were over 300 participants in 12 practice examinations. Anecdotally, most training hospitals encouraged all trainees contemplating the ACEM fellowship examination to attend the practice examination. However, due to the large number of training hospitals in Victoria, and no requirement to register trainees at a particular stage of training, we do not have accurate information on the total number of trainees eligible to sit the fellowship examination during the study period.

Each practice examination question is marked by a single emergency physician, with about half being ACEM examiners. Markers provide written feedback on each marked paper as well as group feedback regarding their guidelines for answers, advice about exam preparation and advice about interpretation of practice examination scores given the approaching ACEM examination.

There is very little information to guide emergency medicine educators around what factors or approaches to exam preparation are more likely to result in examination success. This paper aims to identify predictors of success in the ACEM examination, using information from trainee performance in the practice examination and their self-reported examination preparation.

Methods

The study population was six consecutive cohorts of Victorian practice fellowship examination candidates from 2009 to 2012. Practice examination participants sat a written examination with the same format as the ACEM written examination and were

invited to participate in the study survey. Invitations to participate were sent on two occasions—an initial email was sent on the day of the practice exam and a reminder was sent 2 weeks later. The email contained background information to the study as well as a link to the survey. There was no incentive or disincentive for survey participation.

The survey was a voluntary, cross-sectional web-based survey generated using SurveyMonkey (www.surveymonkey.com), a proprietary online survey platform. The survey questionnaire consisted of questions regarding basic demographics, time spent preparing for the examination, courses attended, textbooks and journals used, access to emergency physicians and examiners for education, perceptions regarding exam preparation and advice received about sitting the upcoming ACEM examination. The survey was designed by two emergency physicians with experience in medical education (JB and SC) and was piloted on a cohort of practice examination candidates prior to the study period.

The survey was approved by the Southern Health Human Research Ethics Committee as low risk research and given ethical approval in accordance with the National Health and Medical Research Council's National Statement on Ethical Conduct in Human Research (NHMRC, 2007). Survey responses were downloaded onto a passwordprotected Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, WA, USA).

Subsequent ACEM fellowship examination outcome (pass/fail/deferred) was obtained by contacting consenting trainees by email and by using the ACEM annual report, which lists trainees who passed the fellowship examination. As the ACEM does not publish the names of trainees who fail, unless advised by the trainee, we were unable to determine whether a candidate who had not passed had elected not to sit the examination or had failed the examination. The "pass/fail" data set, therefore, comprised:

Pass = Pass in the subsequent ACEM fellowship exam (verified by ACEM report) or

Fail = Fail in the subsequent ACEM fellowship exam (verified by trainee communication)

Statistical analysis

Data were analysed using the Stata version 8.0 statistical package (Stata Corporation, College Station, TX, USA). Univariate analysis was undertaken to determine which factors were most reliable in predicting ACEM examination success. Predictor variables included scores from the relevant practice examination, demographic data and responses to survey questions exploring exam preparation.

In analysing the data, each candidate's sitting of the practice examination was viewed separately, with exam success being defined as the *result of the ACEM examination immediately following the practice examination*.

As some candidates sat the practice examination more than once, we conducted analysis by individual candidates' *first* attempt at the practice examination and their *final* attempt at the practice examination. If a candidate sat the practice examination once, then this attempt was considered in both the first attempt and final attempt datasets.

Data are presented as odds ratios with 95% confidence intervals. For continuous data, the odds ratio represents the change in odds of passing the examination for each numerical increase of the relevant variable. For categorical data, the odds ratio represents the change in odds of passing the examination for each increase of category (each category was assigned a numerical value for the purpose of analysis).

Results

One hundred and fifty candidates participated in the six practice examinations between December 2009 and June 2012. One hundred and eleven candidates responded to the survey from a total of 80 individual trainees, as some trainees participated in the practice exam more than once—one trainee sat 5 times, two sat 4 times, three sat 3 times, and 15 sat twice. The 20 trainees who sat more than once accounted for 31 survey responses.

ACEM examination pass/fail data was available for 72/111 survey respondents (65%), comprising 64 individual trainees. Six of these sat the practice examination twice. Fifty-eight of these 72 survey respondents had not previously sat the ACEM examination (81%). Demographic data is shown in Table 1.

	Pass/fail data available (n = 72)
Years since medical school	
<10	33
10–15 16–20	26
>20	4
Type of hospital	
Major referral Urban district	30
Regional/referral	38
Other	1
Previous attempts at the actual ACEM FE ⁺	
None	58
2	9 4
3	0
4	1
Location of work within last 12 months [†]	20
Emergency department (ED) only Mix of ED and non-ED work	29 42
Non-ED work only	1
Work patterns over last 12 months [±]	
Part-time only Nix of part time and full time work	22
Mix of part-time and full-time work Full-time work only	23

 Table 1

 Demographic Data From Survey Respondents

† Two people did not answer this question

‡ Three people did not answer this question

Table 2

Predictor variable Passed (n = 53) Failed (n = 19) Odds ratio (95% Cl)^{\dagger} P value[†] Overall practice exam score 14.8 (2.5) 11.5 (2.7) 1.67 (1.27-2.25) < 0.001 (marks out of 30) [‡] Practice exam sections passed (/3) [‡] 1.9 (0.9) 1.0 (0.8) 3.34 (1.61-6.90) < 0.01 Practice exam MCQ score 5.0 (1.3) 4.2 (1.1) 1.67 (1.05-2.66) 0.03 (marks out of 10) [‡] Practice exam VAQ score 4.7 (1.2) 3.5 (1.6) 1.97 (1.25-3.11) < 0.01 (marks out of 10)[‡] Practice exam SAQ score 5.2 (1.4) 3.8(1.1) 2.24 (1.36-3.67) < 0.01 (marks out of 10)[‡] Years since medical school (years) * 11.2 (3.2) 15.1 (4.8) 0.79 (0.69-0.91) < 0.01 How much have you read of any 0 (0-1) 2.53 (1.21-5.28) 0.01 1(0-2)other emergency textbooks? § (0 = not opened or a little, 1 = around 50%, 2 = most or all) 3(1-3)0.03 Perceptions of the importance 3(3-4)1.70 (1.06-2.73) of attending a course on fellowship preparation § (0 = not at all important, 1 = neutral, 2 = somewhat important, 3 = important, 4 = very important)

Significant Odds Ratios and Associations Between Predictor Variables and Fellowship Examination Outcome (Pass/Fail)

† Calculated using chi-squared test

‡ Mean (SD)

§Median (IQR)

A significant positive association was found between performance in the practice examination (overall practice exam score, number of practice exam sections passed and section scores) and success in the ACEM fellowship examination. A significant negative association was found between success in the ACEM fellowship examination and years since medical school graduation. Additional factors that showed positive association with passing the ACEM examination were self-reported extent of coverage of emergency medicine textbooks and the perception that attendance at a fellowship examination course was important. These results are shown in Table 2.

To account for candidates sitting the practice exam more than once, additional analyses explored the first time each individual candidate sat the practice examination (Table 3) and the last time each individual candidate sat the practice examination (Table 4). This showed consistent association of practice examination performance (overall practice exam score and number of practice exam sections passed and years since medical school graduation, self–reported coverage of emergency text books and ACEM examination success). Our results did not demonstrate any statistical association (positive or negative) between passing the ACEM examination and previous attempts at the ACEM examination, duration of study for the exam, working in a major referral hospital, full-time versus part-time work or access to ACEM examiners.

Table 3

Odds Ratios and Associations Between Predictor Variables and Fellowship Examination Outcome (Pass/Fail), Using Data From the First Time Each Candidate Sat the Practice Examination

Predictor variable	Passed (n = 42)	Failed (n = 12)	Odds ratio (95% CI) ⁺	P value [†]
Overall practice exam score (marks out of 30) [‡]	14.9 (2.6)	12.2 (1.9)	1.63 (1.16–2.28)	0.005
Practice exam sections passed (/3) [‡]	2 (0.9)	1.1 (0.7)	3.65 (1.45-9.21)	0.006
Practice exam SAQ score (marks out of 10) [‡]	5.2 (1.4)	3.8 (1.4)	1.98 (1.18–3.34)	0.01
Practice exam MCQ score (marks out of 10) [‡]	4.9 (1.3)	4.2 (1.2)	1.64 (0.94–2.89)	0.08
Practice exam VAQ score (marks out of 10) [‡]	4.8 (1.2)	4.2 (0.9)	1.58 (0.89–2.82)	0.12
Years since medical school (years) [±]	10.9 (3.0)	13.3 (4.5)	0.84 (0.7-0.99)	0.046
I was able to have practice questions marked by my DEMT/other FACEMs [§] (0 = strongly disagree, 1 = disagree, 2 = neutral, 3 = agree, 4 = strongly agree)	3 (3-4)	3 (1.5–3)	2.54 (1.08–5.96)	0.03
How much have you read of any other emergency textbooks? [§] (0 = not opened or a little, 1 = around 50%, 2 = most or all)	1 (0–2)	0 (0–1)	2.75 (1.08–7.00)	0.034
Perceptions of the importance of attending a course on fellowship preparation [§] (0 = not at all important, 1 = neutral, 2 = somewhat important, 3 = important, 4 = very important)	3 (3–4)	3 (1–3)	1.78 (1.02–3.10)	0.041

† Calculated using chi-squared test

‡ Mean (SD)

§ Median (IQR)

Table 4

Adds Ratios and Associations Between Predictor Variables and Fellowship Examination Outcome (Pass/Fail), Using Data From the Final Time Each Candidate Sat the Practice Examination

Predictor variable	Passed (n = 53)	Failed (n = 11)	Odds ratio (95% CI)†	P value [†]
Overall practice exam score (marks out of 30) [±]	14.8 (2.5)	11.4 (3.0)	1.66 (1.21–2.29)	0.002
Practice exam sections passed (/3) [‡]	1.9 (0.9)	0.9 (0.9)	3.51 (1.47-8.36)	0.005
Practice exam VAQ score (marks out of 10) [±]	4.7 (1.1)	3.5 (1.6)	1.93 (1.14–3.33)	0.017
Practice exam SAQ score (marks out of 10) [±]	5.2 (1.4)	3.5 (1.3)	2.48 (1.34–4.59)	0.004
Practice exam MCQ score (marks out of 10) [±]	5.0 (1.3)	4.3 (0.9)	1.63 (0.92–2.91)	0.09
Years since medical school (years) [‡]	11.2 (3.2)	14.1 (5.6)	0.84 (0.72-0.98)	0.032
How much have you read of any other emergency textbooks? [§] (0 = not opened or a little, 1 = around 50%, 2 = most or all)	1 (0–2)	0 (0–0)	4.03 (1.30–12.47)	0.016
Exam number (1 = May 2010, 2 = October 2010, 3 = May 2011, 4 = October 2011, 5 = May 2012, 6 = October 2012)	4 (2–5)	6 (5–6)	0.33 (0.13–0.82)	0.017
Self-reported studying time per week in the last 6 months (hours) [‡]	26.2 (8.8)	33.8 (12.7)	0.93 (9.87–0.99)	0.028

† Calculated using chi-squared test

‡ Mean (SD)

§ Median (IQR)

Discussion

It is difficult to predict individual trainee performance in the ACEM fellowship examination with any certainty. Our study has found ACEM fellowship examination success was associated with performance at a practice examination held 2 months prior to the ACEM examination. It is not unexpected that scores on a practice written examination might predict subsequent performance in a definitive examination within this time frame.

Practice or "mock" examinations may serve a number of purposes, including to demonstrate exam readiness, mark progress in exam preparation and identify trainees in need of remediation. In a survey of recently successful MRCP (UK) trainees, respondents considered practice with past and simulated papers absolutely essential for examination success (Salter & Smith, 1998). A number of studies of overseas specialty training programmes have shown a correlation between preceding academic performance (e.g., as a medical student, in licensing examinations, during in-training examinations or practice examinations) and subsequent success in certifying examinations (Brill-Edwards et al., 2001; Corneille, Willis, Stewart, & Dent, 2011; Frederick, Hafner, Schaefer, & Aldag, 2011; McClintock & Gravlee, 2010; Shellito, Osland, Helmer, & Chang, 2010).

In our study, performance in a practice examination held 2 months prior to the ACEM examination may serve as a marker of examination preparedness or "readiness to sit". From a practical standpoint, the timeframe may not allow for significant remediation prior to the upcoming ACEM examination; however, as the ACEM exit examination is held twice yearly, the ramifications for trainees deferring the examination by one sitting may be less than it would be for specialty training programmes with annual examinations.

Although counter-intuitive, we found no statistical difference between those passing or failing the ACEM examination and any of the following: previous attempts at the ACEM examination, duration of study for the exam, working in a major referral hospital, full-time versus part-time work or access to ACEM examiners. Common anecdotal practices of reducing working hours or moving to a major referral hospital to assist with examination preparation do not appear to be supported by our data.

More than half of the survey respondents reported 10 years or more since medical school graduation. We found that the odds of ACEM fellowship examination success decreased with increasing years since medical school graduation. It is difficult to draw conclusions from this without further information and analysis given the many factors and confounders that may contribute to an increased time between trainee medical school graduation and sitting the ACEM exit examination, including demographic, personal and professional factors. Trainee age, years since graduation, delay in exam sitting and gender have all been associated with a higher risk of postgraduate examination failure (Malangoni et al., 2012; Oyebode & Furlong, 2007; Pinheiro-Torres, Tang, & Dacre, 2013; Tyrer, Leung, Smalls, & Katona, 2002).

The association of examination success with trainee self-report of coverage of emergency medicine textbooks fits with the inherent notion that a standard of core medical knowledge is required for examination success. There was no association between exam success and attending a paid examination course or specific training programme for fellowship examination in the trainee's hospital/network, although these are commonly advocated as beneficial for exam preparation. Trainee *perception* that going to a course was important was associated with passing the ACEM examination.

The provision of resources for examination preparation for trainees, including marked practice examinations, varies from hospital to hospital, and ideally the benefit of this provision would be measurable in examination outcomes. A survey of trainees who had sat the UK Fellowship of the College of Emergency Medicine (FCEM) exit examination (with the majority passing) found that the most highly-valued resources by trainees for examination preparation overall were practice questions, private study, small-group study with peers and a yearly mock FCEM examination (Cooper, Rutherford, & Hamer, 2013). In a survey of New Zealand trainees after they had sat the Royal Australasian College of Physicians (RACP) written examination, 62% of trainees had used a study group, and of those who did, all rated its contribution to examination preparation as either important or very important (Perrin, Prasad, & Robinson, 2005). This study did not correlate survey findings with exam outcome. In some overseas settings, training programme providers can be disciplined with probation or lack of accreditation if their trainees do not have an acceptable first-attempt pass rate at residency examinations (Shellito et al., 2010).

Failure in a high-stakes examination can have a significant negative impact on trainees, with psychological, financial and professional repercussions. Reliable prediction of examination success may allow supervisors to provide informed advice to trainees, as well as to monitor the performance of their education programme. Being informed of a low likelihood of success may allow the candidate to reassess their progress towards reaching the required standard and to defer sitting until they are better prepared. Preventing an unsuccessful attempt at a specialty examination also allows the trainee to avoid the expense of examination fees and the negative psychological impact that may follow high-stakes examination failure.

There is a paucity of published studies in the Australasian context on issues around postgraduate examinations in specialty training programmes. Little is known about predictors of examination success, consequences of failure and issues relating to remediation. Caution must be exercised in comparing studies across specialty training programmes and countries due to significantly different training and examination processes, including timing of the examination and examination modality (e.g., written versus oral). It should be noted that demonstration of an association does not imply causation, and it may be very difficult to account for the various modifiable and non-modifiable factors that impact on postgraduate examination performance.

Limitations

Our study has a number of limitations. The practice examination, for which scores were correlated with ACEM examination outcome, was designed by FACEMs experienced in exam preparation and was modelled on the ACEM written examination; however, reliability and validity were not tested, and not all markers were ACEM examiners.

The survey questions relied on trainee self-report and recall. For survey nonresponders, we could not determine whether they had failed the subsequent sitting of the ACEM examination or had decided not to sit. Our primary outcome was ACEM fellowship examination success, which encompasses both a written and clinical examination, but we were not able to determine how performance in the practice written examination correlated with the ACEM written versus clinical examination, as these data were not available.

We surveyed a large cohort of fellowship examination candidates from Victoria, but our cohort did not include all Victorian trainees who sat the ACEM examination, and our data may not reflect outcomes for trainees across Australasia. While there are advantages to seeking the trainee perspective prior to an examination outcome, study of trainees' perceptions following the ACEM examination may also shed light.

The inclusion of survey responses from participants who sat more than once, and the non-response rate of 26% of the cohort will impact on our data. We have attempted to minimise this impact by performing additional analyses using the first and last practice examination sitting for each individual. Reassuringly, the major findings did not change—practice examination performance and years since medical school graduation were consistent predictors of ACEM examination success.

Our survey did not account for non-modifiable factors such as age, gender, international medical graduation and English as a second language, and it is apparent from overseas studies that the interplay of these factors on exam preparation and postgraduate examination outcome is complex.

Conclusions

Identification of postgraduate trainees who are likely to pass and those who may fail a high-stakes examination will facilitate remedial action and avoid the secondary impact of examination failure. Although difficult to predict with certainty, success at the ACEM fellowship examination is strongly associated with performance at a practice written examination with detailed feedback. These practice examinations provide an excellent opportunity to benchmark trainee progress and enable the provision of appropriate advice regarding trainee exam readiness.

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Competing interests

SC was previously a member of the ACEM Training and Assessment Review Working Group (TARWG) and is currently a member of the Trainee Research Panel. JB is an ACEM Senior Examiner and a member of the ACEM Examiner Committee. The research conducted and views expressed in this paper are those of the authors and do not reflect the views of the above mentioned groups.

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