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Singapore's Accreditation Council for Graduate Medical Education-International (ACGME-I) Otorhinolaryngology residency programme: Otorhinolaryngology Training Exam (OTE) scores as a predictor of performance at the Otorhinolaryngology final exit MCQ (Multiple-Choice-Question) examinations

Clarisse Chu¹, Rehena Sultana², Neville Wei Yang Teo¹ & Abhilash Balakrishnan¹

¹Department of Otorhinolaryngology – Head and Neck Surgery, Singapore General Hospital, Singapore; ²Centre for Quantitative Medicine, Duke-NUS Medical School, Singapore

Abstract

Introduction: The ACGME-I Singapore Otorhinolaryngology residency programme started in 2011. Our first Exit MCQ Examinations were held at the start of the fifth year of residency, in 2015. Its questions are developed by the American Boards and modified by Singapore's regulatory bodies to ensure relevance to local clinical practice. In contrast, Otorhinolaryngology residents in both Singapore and the USA take the same Otorhinolaryngology Training Examination (OTE) annually. Otorhinolaryngology residents in Singapore sit for the OTE in their first to fourth years of the five-year residency programme. Multiple specialities have described a positive association between in-training examination and final board MCQ examination pass rates. Our study aims to demonstrate that OTE scores may serve as predictors of performance in our local Exit MCQ Examination.

Methods: A retrospective review was performed of all 24 Otorhinolaryngology residents who entered and took the Exit MCQ Examination at a single institution's residency programme between 2016 to 2023.

Results: 75% (18/24) passed the Exit MCQ Examination in their first sitting. Univariate logistic regression analyses showed lower OTE stanines in the fourth year of residency was significantly associated with failing the Exit MCQ Examination. Youden's index showed attaining an OTE stanine <4 in the fourth year of residency training was most associated with failing the Exit MCQ Examination.

Conclusion: OTE scores may be a better predictor of Exit MCQ performance in the fourth year of residency. Optimal OTE score targets for each year of residency were established.

Keywords: Health Profession Education, Board Examinations, Assessments, Otorhinolaryngology, Residency, ACGME

Practice Highlights

- The OTE serves as an important goalpost for resident learning as they work towards specialist accreditation.
- Our findings will facilitate the identification of residents at risk of performing poorly in the final Exit MCQ Examination, such that remediation measures can be instituted early.

I. INTRODUCTION

Medical education is important for doctors in training throughout their years in residency and beyond. A key tenet of medical education is the use of regular examinations and assessments. They serve multiple functions such as evaluating the retention of medical knowledge, the clinical competencies, and tracking of residents' progress. Multiple specialties such as Anaesthesia, General Surgery, and Internal Medicine have established a positive correlation between in-training examination performance and pass rates amongst their residents in the final board examinations (McDonald et al., 2020; Patzkowski et al., 2023; Stain et al., 2021).

The Accreditation Council for Graduate Medical Education – International (ACGME-I) Singapore Otorhinolaryngology residency programme was started in 2011 to provide a comprehensive and holistic training programme for prospective Otorhinolaryngologists in

Singapore. Our first Exit Multiple-Choice-Question (MCQ) examinations were held at the start of the fifth year of residency, in 2015 (Ministry of Health Singapore, 2023).

There are two summative assessments in Singapore's five-year Otorhinolaryngology residency programme, namely the Master of Medicine (Otorhinolaryngology) (MMed(ORL)) Examination and the Exit Examinations (Figure 1). Residents usually take the MMed(ORL) Examination in their second year. This is set by the Division of Graduate Medical Studies (DGMS), part of the National University of Singapore. It currently comprises an Objective Structured Clinical Examination (OSCE) and Oral Examination (Division of Graduate Medical Studies, Yong Loo Lin School of Medicine, 2024). Residents have to pass the MMed(ORL) Examination by the fourth year of residency in order to sit for the Exit Examinations.

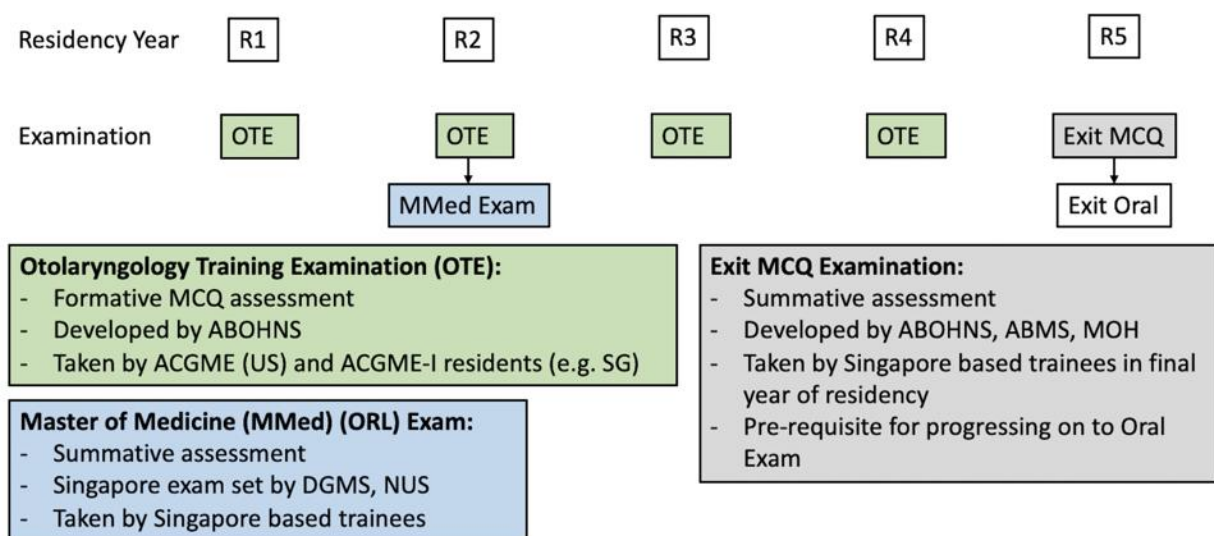


Figure 1. Background of Assessments in Singapore's Otorhinolaryngology Residency Programme (ABOHNS: American Board of Otorhinolaryngology – Head and Neck Surgery; ACGME: Accreditation Council for Graduate Medical Education; DGMS: Division of Graduate Medical Studies; NUS: National University of Singapore; ABMS: American Board of Medical Specialties; MOH: Ministry of Health)

The Exit MCQ Examination is the first of the two-part Exit Examination comprising both the MCQ and Oral Examinations. Residents take the Exit MCQ Examination at the start of the fifth year of residency. Candidates are required to pass the MCQ in order to be eligible for the Oral Examination at the end of the same year of residency. It is colloquially known as the Exit Examination because it is a regulatory requirement

before a resident can complete (and therefore “exit”) specialist training and subsequently obtain specialist accreditation in Singapore. The Exit MCQ Examination is developed by the American Board of Otorhinolaryngology – Head and Neck Surgery (ABOHNS), ACGME-I and Ministry of Health (MOH) Singapore. Its questions are based on the established blueprint used by the three regulatory bodies, and

modified to ensure relevance to local clinical practice (ACGME International, 2024).

On the other hand, Otorhinolaryngology residents in the United States of America (USA) take the Board Examinations developed by ABOHNS following completion of specialty training in an ACGME accredited residency programme (Cantrell & Goldstein, 1999; Miller, 2007).

The Otorhinolaryngology Training Examination (OTE) is an MCQ assessment developed by the ABOHNS. It is a formative assessment, and is conducted on an annual basis, to assess Otorhinolaryngology residents' clinical knowledge. Unlike the Exit MCQ Examination, residents in both Singapore and the USA take the same OTE with the same set of questions. Otorhinolaryngology residents in Singapore sit for the OTE in their first to fourth years, while those in the USA sit for the OTE in their second to fifth years of the five-year residency programme (Puscas, 2019).

Our study aims to demonstrate a similar relationship amongst Otorhinolaryngology residents in Singapore's largest healthcare cluster, that OTE scores can be used to predict performance in our local Exit MCQ Examination. This enables medical educators to identify residents who are at risk of failing the Exit MCQ Examination and institute remediation programmes early.

II. METHODS

A retrospective review was performed of the examination results of all 24 Otorhinolaryngology residents from our healthcare cluster who entered and took the Exit MCQ Examination between 2016 and 2023. Approval from the SingHealth Institutional Review Board (IRB) was obtained for a waiver of informed consent (IRB reference number 2024-3953). All data was de-identified to ensure anonymity.

Each individual resident's performance in the OTEs from year one to four of residency and the subsequent Exit MCQ Examination was included in the analysis. The profile and educational background of the individual residents were also obtained. These include their age, gender, primary medical education and the numbers of years spent as a practising medical doctor.

The OTE performance across the first to fourth years of residency is reported in terms of stanines, where raw test scores are converted to a 9-point standard scale across a bell curved distribution of all residents across the same residency training year. An OTE stanine of 9 is the highest, while a stanine of 1 was the lowest – i.e., best and poorest performance respectively. The results of the Exit MCQ Examination are binary, either pass or fail.

Frequencies (proportions) were used to summarise variables. The effects of various factors on Exit MCQ Examination performance was evaluated using logistic regression analyses and association from logistic regression analyses were expressed as odds ratio with 95% confidence interval (CI). Receiver operating characteristic (ROC) curves were also calculated to predict the OTE stanines most associated with a pass result in the Exit MCQ Examination. SPSS for Windows version 25 was used in the analyses.

III. RESULTS

Between 2016 to 2023, 24 Otorhinolaryngology residents in our healthcare cluster entered and took the Exit MCQ Examination. 45.8% (11/24) were male and 54.2% (13/24) were female. 95.8% (23/24) underwent their undergraduate medical training in Singapore, while 4.2% (1/24) studied overseas. The mean post-graduate year at exits was 8.7 ± 2.3 years. 75% (18/24) passed the Exit MCQ Examination in their first sitting (Table 1).

Residents' Characteristics	N=24
Final Exit MCQ Performance (first sitting); N(%)	
Passed	18 (75%)
Failed	6 (25%)
Gender; N(%)	
Male	11 (45.8%)
Female	13 (54.2%)
Medical School; N(%)	
Singapore	23 (95.8%)
Non-Singapore	1 (4.2%)
Post-Graduate Year at time of Exits; mean $\pm$ SD	8.7 $\pm$ 2.3

Table 1. Summary Table of Residents' Characteristics

Univariate analyses demonstrated lower OTE stanines in the second (OR 0.44, 95% CI 0.20-0.97, $p < 0.05$) and fourth (OR 0.35, 95% CI 0.13-0.99, $p < 0.05$) years of residency were significantly associated with failing the Exit MCQ Examination. There was no significant association between OTE stanines and Exit MCQ Examination performance in the first (OR 0.09, 95% CI 0.008-1.13, $p = 0.06$) and third (OR 0.68, 95% CI 0.35-1.32, $p = 0.25$) years of residency. There was no significant association between gender (Fisher's exact test $p = 1.00$), medical school (Fisher's exact test $p = 0.25$) and Exit MCQ Examination performance.

Receiver Operating Characteristic (ROC) curve analysis was used to evaluate the predictive power of OTE stanine scores in identifying residents who would pass the Exit MCQ Examination. For each potential stanine cut-off in Years 1–4, we calculated the sensitivity (true positive rate) and specificity (true negative rate) for predicting a pass outcome. The ROC curve plots these values, and the Area Under the Curve (AUC) quantifies discriminatory ability. To determine the most effective cut-off for each year, we applied the Youden Index ($J = \text{sensitivity} + \text{specificity} - 1$). The stanine cut-off with the highest Youden Index was selected as the optimal threshold, balancing the risk of false positives and false negatives. For example, in Year 4, a stanine cut-off of ≥ 4 yielded the highest Youden Index ($J = 0.67$), meaning this threshold had the best combined sensitivity and specificity for predicting Exit MCQ success. Similarly, in Year 2, a stanine cut-off of ≥ 3 yielded the highest Youden Index ($J = 0.50$). In Year 1, a stanine cut-off of ≥ 2 yielded the highest Youden Index ($J = 0.72$). Residents scoring below this threshold may benefit from targeted remediation. In Year 3, no stanine cut-off could not be established, as the maximum Youden Index observed was low ($J = 0.30$).

Additionally, we noted that all residents who obtained OTE stanines > 4 in both their second or fourth years of residency passed the Exit MCQ Examination on their first attempt.

IV. DISCUSSION

The OTE is recommended by the ABOHNS as a practice test for residents prior to sitting for primary certification (American Board Examinations) to be qualified as board-certified. Our study aimed to refine the utility of the OTE by assessing whether there were predictive values to stanine levels in Singapore residents sitting for the MCQ component of the specialist Exit Examinations. In this respect, our study demonstrated a positive correlation between OTE stanines and Exit MCQ

Examination performance. However, this only applied to the OTE stanines in the second and fourth years of residency and not the other years. Given that the OTE is a formative assessment with no penalty for suboptimal performance, low scores may not correlate with residents' academic knowledge.

It is worthwhile to note that in the second year of residency, residents sit for the MMed(ORL) Examination, which is a summative assessment, about one month after the OTE examination. Similarly, Year-4 residents sitting for the OTE have to sit for the Exit MCQ Examination, which determines eligibility for taking the Exit Oral Examination, in about six months' time. As the OTE is conducted relatively closer to these high-stakes examinations, residents would be undertaking more extensive preparation, and hence their OTE stanines would be more reflective of their academic performance.

Additionally, using Youden's index, we identified OTE score targets which residents can aim to meet at each year of residency. For each stanine, the sensitivity and specificity for failing the Exit MCQ Examination were determined. The stanine with the highest sensitivity and specificity was deemed the cut off. Our analysis showed that residents should aim to achieve OTE stanines of ≥ 3 in their second year and ≥ 4 in their fourth year of residency to reduce their risk of failing the Exit MCQ Examination. Faculty can then work with residents to develop individualised learning plans to achieve these concrete academic goals.

Our study had a small sample size ($n = 24$), drawn from a single healthcare cluster in Singapore. This limited sample size reduces the effect size of our analysis. Despite this limitation, our results provide a preliminary insight into OTE scores as predictors of performance in our local Exit MCQ Examination. In the future, we aim to expand it to the two other healthcare clusters in Singapore for a larger pool of candidates, for increased statistical power and to determine the broader applicability of our conclusions.

V. CONCLUSION

Continuous assessment tools, such as the OTE, serve as key milestones and reference points for residents to take stock of their own academic performance as they work towards specialist accreditation. Our findings will facilitate the identification of residents at risk of performing poorly in the final Exit MCQ Examination, such that remediation measures can be instituted early.

Notes on Contributors

Clarisse Chu reviewed the literature, performed data analysis and wrote the manuscript.

Rehena Ganguly designed the study, performed data analysis and developed the manuscript.

Neville Wei Yang Teo advised design of the study and gave critical feedback to the writing of the manuscript.

Abhilash Balakrishnan reviewed the literature, advised design of the study and gave critical feedback to the writing of the manuscript.

All authors have read and approved the final manuscript.

Ethical Approval

Approval from the SingHealth Institutional Review Board (IRB) was obtained for waiver of informed consent (IRB reference number 2024-3953).

Data Availability

The data relevant to the study is not publicly available, so as to protect our residents' confidentiality. Although there are no specific descriptors about each resident, the small number of residents per year could lead to the examination results being narrowed down to specific residents.

Our Graduate Medical Office does not share survey results with programmes if there are fewer than 4 respondents each year. Similarly, we would not share the information as there are multiple years where the residents taking the OTE are less than 4 in their year of graduation.

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Declaration of Interest

There are no financial, consultant, institutional and other relationships that might lead to bias or a conflict of interest.

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*A/Prof Abhilash Balakrishnan
31 Third Hospital Ave
Singapore General Hospital
Singapore 168753
Email: balakrishnan@singhealth.com.sg