Impact of a training program on the performance of graduating Canadian residents on a national urology exam: Results of the last 20 years

Naji J. Touma, MD, FRCS(C)1; Darren T. Beiko, MD, FRCS(C)1; Andrew E. MacNeily, MD, FRCS(C)2; Michael J. Leveridge, MD, FRCS(C)1

1Department of Urology, Queen’s University, Kingston, ON, Canada; 2Department of Urologic Sciences, University of British Columbia, Vancouver, BC, Canada

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Abstract

Introduction: Many factors impact the performance of graduating residents on certification exams. It is thought that most factors are related to the individual candidate’s ability, motivation, and work ethic. Less understood, however, is whether a training program has any impact on the preparation and performance of its graduates on certification exams. We present 20 years of results of a national preparatory exam that all graduating residents complete about three months before the Royal College of Physicians and Surgeons of Canada (RCPSC) qualifying urology exam. This exam, known colloquially as QUEST, aims to simulate the RCPSC exam with written and oral components. We aimed to analyze the impact of a training program on the performance of its residents.

Methods: A retrospective review of exam results from 1997–2016 was conducted. During that time, 495 candidates from all 12 Canadian urology training programs undertook the exam. The performance of graduating residents from each individual program was grouped together for any given year. The different programs were anonymized, as the aim of this study is to assess the impact of a training program and not to rate the different programs. Statistical analysis using one-way ANOVA was conducted.

Results: All training programs fall within one standard deviation of the mean for the written component, the oral component, and the overall score. The residents of four training programs had statistically better scores than the overall mean of the written component. The residents of three out of these four training programs also had statistically better scores than the overall mean of the oral component and the overall results of the exam.

Conclusions: Most Canadian training programs prepare their residents adequately for this simulated certification exam in urology. However, there are some training programs that consistently prepare graduating residents to outperform their peers.
determine the impact a training program on the performance of its residents.

**Methods**

Since 1997, the Department of Urology at Queen’s University has hosted a national preparatory exam that all Canadian graduating urology residents complete about three months before the RCPSC exam. The Queen’s Urology Examination Skills Training, known colloquially as QUEST, aims to simulate the RCPSC exam with a written and an oral component. The written component consists of short answer questions (SAQ) and the oral component is an objective structured clinical exam (OSCE) composed of eight stations. Given its content and proximity to the RCPSC exam, QUEST reflects the state of knowledge of soon-to-be graduates and constitutes a good assessment of the CanMEDS Medical Expert role.

Between 1997 and 2016, 495 graduating residents from all 12 Canadian urology training programs undertook the exam. The overall scores for the exam were determined by weighting the SAQ and OSCE marks equally. The results of the SAQ and OSCE components, as well as the overall scores, were then collated and grouped by residency training program. The training programs were then anonymized as the goal was not to rate the different training programs, but rather evaluate whether a particular training milieu impacts a trainee’s level of knowledge and examination skills.

**Statistical analysis**

The data was evaluated and determined to adequately fit a normal distribution and hence, suitable to carry out parametric analysis using the one-way ANOVA. A post-hoc analysis, using Tukey’s test, comparing the mean scores between the different programs was then carried out.

**Results**

Plots of the SAQ, OSCE, and overall scores were all determined to fit reasonable normal distributions. There was also a moderate correlation between SAQ and OSCE scores confirming the internal validity of the exam with a $R^2$ coefficient of 0.33 (Fig. 1).

The overall, SAQ, and OSCE marks were found to fit within one standard deviation from the respective means for all 12 training programs.

A one-way ANOVA was conducted examining the impact of a training program on the SAQ, OSCE, and overall scores. ANOVA showed a significant effect of training program on SAQ scores ($F[12,482]=5.488; p=0.000$) (Fig. 2), as well as for OSCE scores ($F[12,482]=8.319; p=0.000$) (Fig. 3) and overall scores ($F[12,482]=8.049; p=0.000$) (Table 1).

**Discussion**

Over 20 years, there was a moderate correlation between candidates’ SAQ scores and OSCE scores. This confirms that both parts of the exam reflect a candidate’s knowledge base. The data from the first five years of QUEST (1997–2001) has previously been shown to be a moderate predictor of performance on the RCPSC exam and the American Board of Urology part 1 exam.

Specialty accreditation of a urology training program by the RCPSC requires compliance with certain standards.
to achieve competence in graduating residents. From an academic perspective, programs offer didactic teaching sessions, grand rounds, and multidisciplinary rounds among the tools to ensure knowledge transfer. However, there is no standardized and uniform curriculum between programs. Academic teaching is considered complimentary to the resident’s effort to ensure preparedness. Indeed, 73% of Canadian chief urology residents report studying more than 25 hours a week in anticipation of the Royal College exam.2 Until this study, it was unclear whether a training program has a significant impact on a resident’s exam performance. It would appear that all programs prepare their residents adequately for exams, as the results for all programs fall within one standard deviation of the mean. However, the residents of a few select Canadian programs indeed outperform their peers on board exams.

There are many factors that can improve a program’s preparation of its own residents. For instance, a formalized curriculum has been shown to correlate with performance on United States Medical Licensing Examination (USMLE) scores and otolaryngology training examination scores.6,7 An educational program of weekly assigned reading, followed by weekly examinations prepared and administered by the program director results in improvements in the five-year pass rates on the American Board of Surgery (ABS) qualifying and certifying exams.8 It is, therefore, possible that the variability in the formal teaching between training programs could account for some of the discrepancy.

Another factor that affects board exam outcomes is the performance on in-training examinations. This has been shown across a broad spectrum of specialties.9-13 Monthly mock orals and simulated exams have been shown to improve outcomes on the ABS certifying exam.14,15 These exams give trainees real-time feedback about their progress and may allow for rehearsal and development of familiarity with high-stakes exams. It is, therefore, possible that training programs that institute frequent and rigorous exams during training may imbue their residents with a potential advantage.

In addition to curricular and in-training exams, some non-academic characteristics have also been shown to predict board exam performance. For instance, the number of on-call shifts in the six months prior to an exam has been shown to inversely impact performance.9 Some common attributes of high performing American general surgery programs include: rotating at a level 1 trauma centre, spending more time with simulation, and, offering numerous fellowship programs.16 Beyond board exam performance, the data is mixed about the impact of a training program on patient outcomes. For instance, an obstetrics training program was found to be a predictor of the maternal complication rates of its gradu-

![Graph](image_url)

**Fig. 3.** Performance of different programs on the objective structured clinical exam (OSCE) exam.

**Table 1. Overall marks on the exam by different training program**

| Training program | n  | Mean | Standard deviation | Standard error | 95% confidence interval for mean |
|------------------|----|------|--------------------|----------------|---------------------------------|
|                  |    |      |                    |                | Lower bound Upper bound         |
| A                | 20 | 80.8 | 7.4                | 1.7            | 77.3  84.2                      |
| B                | 45 | 78.4 | 5.4                | 0.8            | 76.8  80.0                      |
| C                | 20 | 78.4 | 5.1                | 1.1            | 76.0  80.8                      |
| D                | 67 | 76.9 | 6.4                | 0.8            | 75.4  78.5                      |
| E                | 37 | 75.5 | 6.0                | 1.0            | 73.5  77.5                      |
| F                | 52 | 72.8 | 6.4                | 0.9            | 71.1  74.6                      |
| G                | 30 | 72.2 | 7.9                | 1.4            | 69.2  75.1                      |
| H                | 38 | 71.7 | 7.3                | 1.2            | 69.3  74.1                      |
| I                | 44 | 73.0 | 5.5                | 0.8            | 71.3  74.6                      |
| J                | 30 | 71.7 | 7.7                | 1.4            | 68.9  74.6                      |
| K                | 29 | 72.3 | 6.7                | 1.2            | 69.8  74.8                      |
| L                | 72 | 71.3 | 7.1                | 0.8            | 69.6  73.0                      |
| Unaffiliated candidates | 11 | 69.3 | 8.1                | 2.4            | 63.8  74.7                      |
| Total            | 495| 74.1 | 7.2                | 0.3            | 73.5  74.8                      |
ates. Conversely, the surgical performance of bypass surgeons was not associated with graduation from any particular medical school, residency, or fellowship program. There are several limitations to our data that must be considered. Firstly, training programs change substantially over a 20-year period. Several program directors would have been at the helm. The turnover of faculty is likely to be substantial. This natural renewal in personnel would inevitably bring fresh perspectives and overhauls of academic curricula. Secondly, it could be that different residents tend to gravitate to programs that suit their skills, natural abilities, personalities, and career aspirations. For instance, a program’s reputation for research opportunities or clinical exposure may attract different residents with different abilities for studying or board exam performance. A prime example of a resident’s characteristics influencing a training program’s results would be the admission of international medical graduates (IMG). Over the years, some programs have had a policy of consistently welcoming IMGs and others not. Although not analyzed here, it has been shown that these residents tend to underperform on board exams.

This data should be interpreted with caution. It provides a snapshot of exam performance. A number of other qualities of competent graduating urologists are not measured here. Such qualities include surgical skills and clinical acumen that may have substantially more impact on real-world performance and patient outcomes. Other qualities that are not measured include the intrinsic roles of CanMEDS beyond the medical expert role. In addition, the performance of residents on the different topics examined is not analyzed, as the breakdown of the exam content does not exist over a 20-year period. However, this data is being collected prospectively and will be reported in the future to provide a more fulsome picture of the trainees’ performance.

Conclusion

Most Canadian training programs prepare their residents adequately for this simulated certification exam in urology. However, there are some training programs that consistently prepare graduating residents that outperform their peers. Further research to elucidate the qualities that make a training program successful in academically preparing its residents is needed.

Competing interests: Dr. Leveridge has served as an advisor for Astellas. The remaining authors report no competing personal or financial interest related to this work.

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Correspondence: Dr. Naji J. Touma, Department of Urology, Queen’s University, Kingston, ON, Canada; naji.touma@kingstonhsc.ca