A Procedural Skills OSCE for Internal Medicine Residents to Assess Multiple Competencies

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THESIS

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ACKNOWLEDGMENTS

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DP
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SUMMARY

BACKGROUND: Internists are required to perform a number of procedures that require mastery of technical and non-technical skills. Formal assessment of these skills is often lacking.

OBJECTIVE: To develop, implement, and gather validity evidence for a procedural objective structured clinical examination (PS-OSCE) for Internal Medicine (IM) residents, to assess their technical and non-technical skills when performing procedures.

PARTICIPANTS: Thirty-five IM residents from post-graduate years one to three.

METHODS: Residents participated in a five-station PS-OSCE combining task-specific models, standardized patients, and allied health professionals. Modern validity theory was used as a framework for gathering evidence for the validity of the scores. Formal blueprinting was performed and content experts were used to develop cases and the rating instruments. Examiners underwent a frame-of-reference training session to prepare them for their rater role. Reliability was calculated using a Generalizability analysis. Scores were compared by levels of training and experience and to a non-procedural OSCE (IM-OSCE).

RESULTS: The g-coefficient for the technical and non-technical scores was 0.69 and 0.56, respectively. To reach a reliability of 0.80, nine technical and sixteen non-technical stations would be needed. PGY-3 residents scored significantly higher than PGY-1 residents on the technical (73.5% vs 62.2%) and non-technical (83.2 vs 75.1%) component of the PS-OSCE (p < 0.05). Residents who had performed the procedures more frequently scored higher on the central line, lumbar puncture, and thoracentesis stations (p < 0.05). There was a moderate correlation (r = 0.47) between the IM-OSCE and the technical component of the PS-OSCE scores.

CONCLUSIONS: The PS-OSCE is a feasible and efficient method for assessing multiple competencies related to performing procedures and the validity evidence collected thus far supports its use for an in-training examination.
BACKGROUND

Graduates of Canadian Internal Medicine (IM) Residency programs are required to be proficient in performing a number of medical procedures, such as central line insertion and lumbar puncture (1). With no standardized and validated approach available to assess residents’ competence in performing procedures, most IM program directors continue to rely on informal assessment methods such as logbooks documenting the number of procedures done (2). As a result, IM residents, including recent graduates, do not feel adequately prepared to perform many procedures that they are expected to master (3-6).

One approach to this problem has been to apply a mastery approach to teaching procedural skills. Using this method, trainees are taught to perform procedures (usually on a mannequin) and their technical skills are then observed until a pre-determined level of competence has been achieved (7,8). However, completing a procedure requires mastery of both technical skills as well as several other CanMEDS roles (9). For example, when performing an endotracheal intubation, a physician must be able to obtain informed consent from the patient or their substitute decision maker (Communicator), work with a registered nurse and respiratory therapist to ensure adequate preparation and flow of the procedure (Collaborator), remain calm if a patient has an unanticipated deterioration in their clinical status (Professional), as well as perform the technical aspects of the procedure to properly place the tube (Medical Expert). Jefferies et al. showed that it is feasible to use an OSCE to assess multiple CanMEDS roles (10). However, a systematic review of the literature revealed that checklists for procedural skills tend to be focused almost exclusively on the technical aspects of the skills and infrequently address issues related to non-technical skills such as communication, collaboration, and professionalism (11).

The Integrated Procedural Performance Instrument (IPPI) (12) is another approach that has been used to teach and assess technical skills. The IPPI is a performance-based examination using a combination of standardized patients (SPs) and
mannequins, in which communication and professionalism skills are assessed along with technical ability. The IPPI has been shown to be feasible and to have acceptable psychometric characteristics when used to assess some of the procedures commonly performed by medical students (e.g., urinary catheterization or venepuncture) and surgical trainees (e.g., wound closure and cast application) (13,14). However, the IPPI has not been used to assess IM residents, nor has it been used to assess the collaborative skills that are often required when performing procedures.

Given the lack of standardized and validated means of assessing procedural skills in internal medicine, we developed and implemented a procedural skills objective structured clinical examination (PS-OSCE) for IM residents to assess both technical and non-technical competencies, including professionalism, communication, and collaboration. Modern validity theory was used as a framework to gather evidence for the validity of the scores from this examination (15-17). Using this framework, multiple sources of evidence to support or refute the validity of the construct in question are sought, namely procedural skills ability, in this case.
METHODS

Study Participants. The PS-OSCE was a mandatory activity for PGY-1 to PGY-3 residents in the University of Ottawa IM Residency Program. Ethics approval was given from the University of Illinois at Chicago (as part of DP's thesis requirements) and the University of Ottawa. Written consent to participate in the study was obtained from the residents.

Five sources of evidence will be presented to demonstrate evidence for the validity of scores from the PS-OSCE, namely: content, response process, internal structure, relations with other variables, and consequences.

Content Evidence. We developed a PS-OSCE with five 18-minute stations, each containing three elements: (1) the use of a task-specific model (i.e., for lumbar puncture, endotracheal intubation, central line insertion, thoracentesis, and knee joint aspiration), interaction with (2) an SP, and (3) an allied health professional (AHP), such as a registered nurse or respiratory therapist. The examination blueprint was based on the procedures required of Canadian IM graduates. In addition, four of the seven CanMEDs roles were represented, that is, the Professional, the Communicator, the Collaborator, and the Medical Expert (i.e., technical ability in this case) because these were judged to be most relevant for the proper execution of a procedure. The cases were written by the investigators (DP, CT, SH-M) who have experience with the development of OSCE cases at a local and national level. Each case was reviewed by content experts and then pilot-tested.

As an example, in the thoracentesis station, residents had to: obtain consent from an angry SP; collaborate with an actor portraying an inexperienced nurse who, while assisting with the procedure, accidentally contaminates the sterile field; perform the thoracentesis on a mannequin; and discuss the results of a post-procedure radiograph demonstrating a pneumothorax with the SP.
Candidates’ technical skills were assessed by physician examiners (PEs) using task-specific checklists. Checklists were developed by groups comprised of between 7 and 12 content experts to ensure that all important steps in performing each skill were included. An online survey was used to obtain consensus about checklist items. After five rounds, unanimous consensus was achieved on 82-100% of the checklist items for each case. For items in which unanimous consensus could not be reached (ranging between zero and four checklist items for each of the five cases), decisions to include the items were based on a majority rule. Final checklists were comprised of 16 to 24 items.

Non-technical skills were assessed by PEs using six 7-point rating scales. Two separate rating scales were developed for each of the three non-technical domains assessed (professionalism, collaboration, and communication skills). Each rating scale was developed to assess different non-technical skills and the descriptors referred to performance rather than norm-referenced anchors. The scales were pilot-tested first in a teaching session in which residents were observed performing procedures on mannequins while interacting with SPs and AHPs, and again in a pilot of the actual PS-OSCE cases with PGY-4 IM residents. Using an iterative process, the rating scales were then modified following review by clinicians with expertise in the area of assessment.

Response Process. Physician examiners underwent an in-depth, two-hour frame-of-reference training session to introduce them to the rating instruments, prepare them for their rater role, and ensure the accuracy of their ratings. Immediately preceding the exam, candidates and PEs participated in separate orientation sessions to ensure that all exam instructions were clear. The SPs and AHPs received training to ensure that the portrayal of their roles was accurate and consistent.

During the administration of the PS-OSCE, staff monitored data entry by reviewing the checklist and rating scale forms completed after the first and second rounds of candidates. Data entry was performed by experienced staff with quality control checks, including verification of selected cases by a second staff member.
**Internal Structure.** Exam difficulty was reported separately for the technical (checklist) and non-technical (rating scale) components of each station. Scores were calculated on each station by converting the respective score or rating into a percentage. Total scores for each measure were determined by averaging these scores on the five stations. Reliability of the PS-OSCE scores was assessed using a Generalizability analysis with people crossed with stations. G–String and UrGenova were used to generate variance components for this analysis (18,19). Corrected item total correlations were calculated for technical and non-technical score on each station.

**Relation to Other Variables.** Differences in performance, based on year of training and experience (i.e., the self-reported number of times a trainee had performed the procedure), were compared using univariate ANOVA.

The correlation between the PS-OSCE and a non-procedural Internal Medicine OSCE (IM-OSCE) was calculated using Pearson’s correlation coefficient.

**Consequences.** Participants received a written summary of their scores for each station, and the results were forwarded to the IM residency program director. Residents were surveyed after the PS-OSCE to determine the acceptability of the exam.

This was a formative examination and, for the purposes of this paper, standard setting procedures will not be discussed.
RESULTS

Forty-one IM residents took the examination and 35 of these consented to participate in the study (n = 15 PGY-1, n = 10 PGY-2, n = 10 PGY-3). The six non-participants were distributed evenly between the first two years of training. Using five tracks and two consecutive administrations, all participants were assessed in one evening.

Exam Difficulty. The mean checklist score for the technical component of the exam was lower than the non-technical component (66.6% (SD = 11.0) vs 77.6% (SD = 7.9)) with scores ranging from 36.9-82.6% and 58.6-90.0%, respectively; see Table I. Corrected item-total correlations ranged from 0.27 to 0.62 and from 0.15 to 0.50 for technical and non-technical scores, respectively.

Table I: Scores and corrected item total correlation, by stations and skills type

<table>
<thead>
<tr>
<th>Station</th>
<th>Technical Score</th>
<th>Non-Technical Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean % (SD)</td>
<td>Min/Max</td>
</tr>
<tr>
<td>Central Line</td>
<td>65.1 (18.0)</td>
<td>21.7-91.3</td>
</tr>
<tr>
<td>Lumbar Puncture</td>
<td>70.1 (13.9)</td>
<td>33.3-90.5</td>
</tr>
<tr>
<td>Intubation</td>
<td>64.6 (16.1)</td>
<td>19.1-90.5</td>
</tr>
<tr>
<td>Knee</td>
<td>70.9 (14.1)</td>
<td>37.5-93.8</td>
</tr>
<tr>
<td>Thoracentesis</td>
<td>62.1 (19.1)</td>
<td>20.8-87.5</td>
</tr>
<tr>
<td>Total Score</td>
<td>66.6 (11.0)</td>
<td>36.9-82.6</td>
</tr>
</tbody>
</table>

Reliability. People (i.e., residents) accounted for 30% and 20% of the variance in scores for technical and non-technical skills, respectively; see Table II.

Table II: Generalizability analysis, by skills type

<table>
<thead>
<tr>
<th>Facet</th>
<th>Technical</th>
<th>Non-Technical</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Variance component</td>
<td>% variance</td>
</tr>
<tr>
<td>p</td>
<td>84.08</td>
<td>30</td>
</tr>
<tr>
<td>i</td>
<td>8.67</td>
<td>3</td>
</tr>
<tr>
<td>pi</td>
<td>185.34</td>
<td>67</td>
</tr>
</tbody>
</table>

p = people; i = items
Items (i.e., stations) did not account for a significant amount of variation in the scores. The g-coefficients derived using these variance components were 0.69 and 0.56 for the technical and non-technical components, respectively. Nine technical and 16 non-technical stations would be required to produce a g-coefficient of 0.80.

*Relations to Other variables.* For the technical component of the exam, senior residents scored significantly higher than junior residents ($F(2, 32) = 3.66$, $p = 0.037$, $\eta_p^2$ (effect size) = 0.19). Planned post-hoc pair-wise comparisons showed that PGY-3 residents scored higher (73.5%, SD = 7.9) than PGY-1 (62.2%, SD = 11.8) residents ($p = 0.029$); see Table III.

| Table III: Mean scores, by level of training and skills type |
|---------------------------------------------|----------------|----------------|
|                              | Total Score  | Total Score   |
|                              | Technical (SD) | Non-Technical (SD) |
| PGY-1 n = 15                  | 62.2 (11.8)   | 75.1 (7.2)     |
| PGY-2 n = 10                  | 66.3 (9.5)    | 75.7 (7.9)     |
| PGY-3 n = 10                  | 73.5 (7.9)    | 83.2 (6.5)     |
| Total n = 35                  | 66.6 (11.0)   | 77.6 (7.9)     |
| $F(2, 32)$                     | 3.66          | 4.32           |
| $p$                           | 0.037*        | 0.022*         |
| $\eta_p^2$                    | 0.19          | 0.21           |

Similarly, senior residents scored higher than junior residents on the non-technical component of the exam ($F(2, 32) = 4.32$, $p = 0.022$, $\eta_p^2 = 0.21$), with PGY-3 residents scoring higher (83.2%, SD = 6.5) than PGY-1 (75.1%, SD = 7.2) residents ($p = 0.024$).

Scores for the technical component of the stations differed as a function of the number of times a resident reported having previously performed a procedure for the central line ($F(3, 31) = 2.98$, $p = 0.047$, $\eta_p^2 = 0.22$), lumbar puncture ($F(3, 31) = 3.09$, $p = 0.041$, $\eta_p^2 = 0.23$) and thoracentesis ($F(3, 31) = 3.39$, $p = 0.030$, $\eta_p^2 = 0.25$) stations; see Table IV.
Table IV: Mean scores by number of times previously performed, by station

<table>
<thead>
<tr>
<th>Number of Times Performed</th>
<th>Central Line Score (SD)</th>
<th>Lumbar Puncture Score (SD)</th>
<th>Intubation Score (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>----------------------------</td>
<td>----</td>
<td>-----------</td>
<td>---------------</td>
</tr>
<tr>
<td>0-1</td>
<td>3</td>
<td>60.87 (15.68)</td>
<td>73.81 (11.90)</td>
</tr>
<tr>
<td>2-4</td>
<td>12</td>
<td>58.70 (20.18)</td>
<td>76.39 (12.82)</td>
</tr>
<tr>
<td>5-10</td>
<td>9</td>
<td>59.90 (16.38)</td>
<td>71.42 (13.63)</td>
</tr>
<tr>
<td>&gt; 10</td>
<td>11</td>
<td>77.47 (12.11)</td>
<td>83.77 (10.26)</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>65.09 (18.03)</td>
<td>77.21 (12.66)</td>
</tr>
<tr>
<td>F (3, 31)</td>
<td></td>
<td>2.98</td>
<td>1.82</td>
</tr>
<tr>
<td>p</td>
<td></td>
<td>0.047*</td>
<td>0.164</td>
</tr>
<tr>
<td>η²_p</td>
<td></td>
<td>0.22</td>
<td>0.15</td>
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Scores for the non-technical component of the stations did not differ significantly by the number of times a candidate reported having performed the procedure previously.

Of the 35 residents in this study, 27 had also participated in the IM-OSCE. There was a significant positive correlation between the IM-OSCE scores and total score for the technical (r = 0.47, p = 0.013), but not the non-technical (r = 0.35, p = 0.074) scores of the PS-OSCE.
There was a significant correlation between technical and non-technical performance on all stations ($r = 0.76$, $p < 0.001$), with the highest correlation seen on the thoracentesis case ($r = 0.87$, $p < 0.001$); see Table V.

**Table V: Correlations between technical and non-technical scores, by station and total score**

<table>
<thead>
<tr>
<th></th>
<th>Central Line</th>
<th>Lumbar Puncture</th>
<th>Intubation</th>
<th>Knee</th>
<th>Thoracentesis</th>
<th>Total Scores</th>
</tr>
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<tr>
<td>$r$</td>
<td>.35*</td>
<td>.53**</td>
<td>.48**</td>
<td>.66*</td>
<td>.87**</td>
<td>.76**</td>
</tr>
<tr>
<td>$p$</td>
<td>0.042</td>
<td>0.001</td>
<td>0.004</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
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</table>

*Acceptability.* When surveyed about their experience with the PS-OSCE compared to assessments using a mannequin alone, 23 respondents (66%) reported that an OSCE including SPs and AHPs allowed for a more valid assessment of their skills than a part-task trainer alone, eight (23%) reported that it depends on the skill, while four (11%) reported that assessing technical skills alone is more valid.
DISCUSSION

Assessing procedural skills in context allows educators to ensure that IM residents are competent in all the necessary skills required in performing a procedure, including technical ability, professionalism, collaboration, and communication skills. Standardized, formal assessment of IM residents' ability to perform procedures was effectively achieved with a PS-OSCE. Interpreting the scores from the PS-OSCE, as with any exam, requires analysis of several sources of validity evidence, that are discussed successively in this section.

Content. Content evidence refers to ensuring that the construct being assessed is completely represented on a test (20). In this case, the PS-OSCE blueprint allowed for the assessment of residents' skills in performing five procedures, which represents more than half of all required procedures of graduates of Canadian IM programs, and four of the seven CanMEDs roles. Given that trainees have variable opportunities to perform procedures while being observed by faculty (2,21), this was an efficient way to formally assess a number of skills. Attention to pilot-testing and revisions of the cases by content experts also helped to ensure that the PS-OSCE was representative of the challenges faced by residents when performing procedures. A rigorous approach to the development and pilot-testing of the instruments, including groups of content experts and a consensus survey, provides further content evidence.

Response Process. To ensure that the results reported to candidates are valid, one must ensure that the ratings provided by examiners are accurate. An important step when introducing a new assessment instrument is to ensure that raters undergo training with the instrument in question. Our examiners underwent frame-of-reference training, which was used to help them develop performance schemas in order to arrive at a consensus regarding rating varying levels of performance (22,23). This helped to prepare them for their rater role and to ensure that all raters were applying the instruments in a standardized way. Quality assurance measures, such as ensuring that all ratings were being completed after each candidate, also helped to ensure the accurate collection of data for this examination.
Internal Structure. Evidence for the internal structure of an examination is dependent on demonstration of reliable scores (24). Although the reliability of scores for this examination was adequate, given its formative nature, the number of cases would need to be increased significantly to achieve an alpha of 0.80. If a more reliable exam was required, one could incorporate some shorter cases to minimize the impact on cost and feasibility.

Other measures of internal structure include exam difficulty and correlations between items. In this study, corrected item-total correlations ranged from low to moderate for both technical and non-technical skills. For this exam, one would not expect high correlations between stations for technical ability, given the stations were developed to measure different skills (i.e., case specificity) (25). However, it is somewhat surprising that the item-total correlations for the non-technical skills were not higher. Further analysis showed that performance of the non-technical skills were moderately to highly correlated with technical skills, which may indicate that those who are more skilled in performing a given procedure may be more at ease, resulting in a greater ability to communicate effectively, collaborate with others, and behave professionally. Non-technical skills are largely contextual (i.e., physicians who behaveprofessionally in one setting may behave unprofessionally in another setting), and in the case of executing procedures, they may be dependent on trainees’ technical ability (26).

Relations to Other Variables. When considering the relationship between measures of the construct of interest with other variables, one must consider both convergent and discriminant validity as sources of evidence (27). For procedural skills, it might be expected that more senior trainees and those who have performed a given procedure more frequently would perform better. In this study, as expected, PGY-3 residents performed better overall than PGY-1 residents on both the technical and non-technical components of the stations. Similarly, for three stations (central line, lumbar puncture and thoracentesis), technical skill performance was better for those who had performed the procedure more often. For the knee and intubation stations, however, greater experience did not result in higher scores, perhaps because of the relative paucity
of participants’ experience with these procedures. Most residents (27 out of 35) had never performed a knee aspiration, or only once, and only three had performed more than ten endotracheal intubations.

Technical performance on the PS-OSCE correlated moderately with performance on a non-procedural OSCE, while non-technical performance did not correlate significantly. Given that these exams were designed to measure different constructs, one would expect a positive, yet moderate correlation between the two (i.e., discriminant validity).

Consequences. The results of this study have important implications for the IM residency curriculum. As assessment drives learning (28), we expect residents to demand more and more opportunities to practice procedures and receive feedback on their skills if they are being formally assessed. Overall scores on the PS-OSCE were low, which may necessitate revisions to the program’s procedural skills curriculum. As a formative examination, the information collected can help identify areas for improvement for individual residents, as well as identify potential weaknesses in the current procedural skills curriculum (e.g., attention to sterile technique).

The number of procedures required to achieve competency varies greatly by individual (29), and it is clear that trainees need more experience with procedures to become proficient, not just more time in training. One cannot assume that more senior trainees will be competent in performing routine procedures unless they have had sufficient opportunities to practice their skills. For each of the procedures studied, there was great variability in the amount of experience that residents had accumulated, with many residents having never performed a given procedure, despite the fact that this examination was near the end of the academic year. As emphasized by Ericsson’s theory of expertise, trainees require the opportunity for deliberate mixed practice with feedback in order to develop their technical skills (30). Training programs must ensure that trainees are gaining sufficient exposure to procedures, either with real patients or in simulated settings in order for them to become competent, and must ensure that formal assessment of these skills is occurring on a regular basis.
CONCLUSION

IM residents are required to be proficient in performing a number of medical procedures, and yet due to limited opportunities to perform some of these procedures, these skills are being performed and assessed infrequently (2,21). There is an imperative to ensure that residents' ability to perform procedures is being assessed and the PS-OSCE is one effective way to accomplish this goal. However, resources for the development and implementation of new assessment methods are limited and educators should seek ways to ensure that the results of their efforts are both feasible and valid.

Future steps will include developing PS-OSCE stations to assess IM residents' ability to perform other medical procedures and determining a fair and valid process for setting a passing standard that ensures mastery of the skills.
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2005-present
### LEADERSHIP

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<td>Vice Chair, Central Examination Committee</td>
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<td>Medical Council of Canada</td>
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<td>Ottawa Skills and Simulation Centre</td>
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<td>Resident Mentor</td>
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<td>University of Ottawa</td>
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### COMMITTEES

<table>
<thead>
<tr>
<th>Committee</th>
<th>Years</th>
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<tbody>
<tr>
<td>uOSSC Research Review Committee</td>
<td>2012-present</td>
</tr>
<tr>
<td>University of Ottawa/The Ottawa Hospital</td>
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<tr>
<td>Chair: Stan Hamstra</td>
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<tr>
<td>AIME/uOSSC Fellowship Committee</td>
<td>2012-present</td>
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<tr>
<td>University of Ottawa</td>
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<tr>
<td>Chairs: Dr. Stanley J. Hamstra, Dr. Sue Humphrey-Murto</td>
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<tr>
<td>Undergraduate Point of Care Ultrasonography Committee</td>
<td>2012-present</td>
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<tr>
<td>University of Ottawa</td>
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<tr>
<td>Chair: Dr. Michael Woo</td>
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<tr>
<td>General Internal Medicine Recruitment Committee</td>
<td>2011-present</td>
</tr>
<tr>
<td>The Ottawa Hospital</td>
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<tr>
<td>Chair: Dr. Alan Karovitch</td>
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<tr>
<td>Central Line Education Committee</td>
<td>2010-present</td>
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<tr>
<td>The Ottawa Hospital</td>
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<tr>
<td>Chair: Dr. Calvin Thompson</td>
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<tr>
<td>Accreditation Committee</td>
<td>2009-2010</td>
</tr>
<tr>
<td>Educational resources subcommittee</td>
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</tbody>
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University of Ottawa  
Chair: Dr. Max Hince

R4 Internal Medicine Resident Selection Committee  
University of Ottawa  
Chair: Dr. Heather Clarke

Medicine Test Committee  
Medical Council of Canada  
Chair: Dr. Brent Kvern

Internal Medicine Resident Selection Committee  
University of Ottawa  
Chair: Dr. Catherine Code

Club Med Planning Committee (Chair)  
The Ottawa Hospital, Division of Internal Medicine

Special Committee in General Internal Medicine  
Royal College of Physicians and Surgeons of Canada  
Chair: Dr. Sharon Card

Curricular Content and Review Committee  
University of Ottawa  
Chair: Dr. Genevieve Moineau

EDUCATIONAL ACTIVITIES

Exams
Chief Examiner, Internal Medicine Resident OSCE  
University of Ottawa  
2009-present

Co-Chief Examiner, Internal Medicine Resident OSCE  
University of Ottawa  
2008

Chief Examiner, Medical Student Teaching and Testing OSCE  
University of Ottawa  
2007-2009

Examiner, Medical Student Comprehensive OSCE  
University of Ottawa  
2007, 2008

Chief Examiner MCC Part II Exam  
Medical Council of Canada  
2006-2008

Examiner, Internal Medicine Resident OSCE  
University of Ottawa  
2005, 2007

Physician Examiner for MCC Part II Exam  
Medical Council of Canada  
2005, 2006

Examiner, Medical Student PSD OSCE  
University of Ottawa  
2005

Curricular Innovations
A Procedural Skills OSCE (Masters Thesis Project)  
Internal Medicine Residents, University of Ottawa  
2012

Central Line Insertion Curriculum  
PGY-1 Residents, University of Ottawa  
2011

Revised Procedural Skills Curriculum  
Internal Medicine Residents, University of Ottawa  
2011

Procedural Skills Curriculum  
Internal Medicine Residents, University of Ottawa  
2007

Teaching
Central Line Teaching Session (CVC) Instructor  
University of Ottawa  
2011-present

Problem Assisted Learning (PAL) Instructor (every 6 weeks)  
University of Ottawa  
2007 - 2011

Coordinator Internal Medicine Residents’  
Academic Half-Day – Procedural Skills (annually)  
University of Ottawa  
2007-present

Problem-Based Learning (PBL) Tutor, Respirology  
University of Ottawa  
2005

Lecturer - Medical Tune-Up for Surgical Residents  
University of Ottawa  
2005

Physical Skills Development (PSD) Tutor  
University of Ottawa  
2002, 2004

Link Block Tutor  
University of Ottawa  
2002 - 2003

Research

International Oral Presentations


Pugh D, Touchie C, Wood TJ, and Humphrey-Murto S. Constructed-response versus selected-response – do students change their answers based on format? Oral
presentation, American Association of Medical Colleges (AAMC), Research in Medical Education (RIME) conference. Boston, MS; November, 2009.

**National Oral Presentations**


**Local Oral Presentations**


**Pugh D, Touche C, Wood TJ, Humphrey-Murto S. Validation of a new rating scale for use in a formative resident Objective Structured Clinical Examination (OSCE). Oral presentation, Academy for Innovation in Medical Education (AIME) Medical Education Day. Ottawa, ON; April, 2011. Won “Honorable Mention for best oral presentation”.

**Pugh D, Touche C. Giving Feedback: moving beyond the sandwich. Department of Medicine, Grand Rounds, The Ottawa Hospital. Ottawa, ON; November, 2010.**


Halman S, Pugh D, Wood TJ, Touchie C, and Humphrey-Murto S. *Are we really measuring communication skills in the OSCE?* Oral presentation, Academy for Innovation in Medical Education (AIME) Medical Education Day. Ottawa, ON; April, 2010. Won “Best Oral Presentation, Junior Educator”.


Pugh D, Touchie C, Wood TJ, and Humphrey-Murto S. *Constructed-response versus selected-response - do students change their answers based on format?* Oral presentation, Academy for Innovation in Medical Education (AIME) Medical Education Day. Ottawa, ON; April, 2009.


Pugh D, Touchie C, Humphrey-Murto S, and Wood TJ. *Technical skills in Internal Medicine - Teaching and testing.* Oral presentation, Academy for Innovation in Medical Education (AIME) Medical Education Day. Ottawa, ON; April, 2008.

**National and International Poster Presentations**


**Local Poster Presentations**


**Publications**

**GRANTS**

**Medical Education Research**  
University of Ottawa, Academy for Medical Education  
Humphrey-Murto S, Touchie C, **Pugh D**, Chan J, Desjardins I, Wood T.  
$24,908

**Medical Education Research**  
University of Ottawa, Academy for Medical Education  
“The Accuracy of First Impression Ratings in an OSCE Station”  
Wood T, J Chan, Humphrey-Murto S, **Pugh D**, Touchie C.  
$25,000

**TOHAMO Innovation Grant**  
The Ottawa Hospital  
“Interactive Online Learning for Staff Physicians in Ultrasound Guided Central Venous Catheter Insertion for a Standardized Approach at The Ottawa Hospital.”  
Naik VN, Sydor D, Thompson C, Woo M, **Pugh D**, Patel R.  
$100,000

**Educational Initiatives in Residency Education**  
University of Ottawa  
“Online Learning and Simulation Training for Residents in Ultrasound-Guided Central Venous Catheter Insertion for a Standardized Approach At The Ottawa Hospital”  
Naik V, Sydor D, Thompson C, **Pugh D**, Woo M, Worthington J  
$8,500

**Department of Medicine Education Grants Program**  
University of Ottawa  
“Development of a Feedback Rating Scale”  
Halman S, Humphrey-Murto S, Wood TJ, Dudek N, **Pugh D**, Touchie C  
$9,495

**Department of Medicine Education Grants Program**  
University of Ottawa  
“Designing a New Objective Structured Clinical Examination (OSCE) station to assess the Health Advocate role”  
Desjardins I, Touchie C, **Pugh D**, Humphrey-Murto S  
$6,435
Department of Medicine Education Grants Program
University of Ottawa
“Proof of Concept: Effect of feedback in the Objective Structured Clinical Examination (OSCE)”
Armstrong M, Touchie C, Pugh D, Wood TJ, Humphrey-Murto S
$3,250

Department of Medicine Medical Education Research/Medical Innovation Project
University of Ottawa
“The remote OSCE: Can physician examiners participate from a distance?”
Chan J, Humphrey-Murto S, Wood TJ, Pugh D, Hirsh M
$25,000

Department of Medicine Medical Education Research/Medical Innovation Project
University of Ottawa
“A Procedural Skills OSCE to Assess Multiple CanMEDs roles
Pugh D, Touchie C, Humphrey-Murto S
$15,000

AIME Education Research Grant
University of Ottawa
“A Procedural Skills OSCE to Assess Multiple CanMEDs roles
Pugh D, Touchie C, Humphrey-Murto S
$7,750

Department of Medicine Medical Education Research/Medical Innovation Project
University of Ottawa
“A Procedural Skills OSCE to Assess Multiple CanMEDs roles”
Pugh D, Touchie C, Humphrey-Murto S
$7,750

Educational Initiatives in Residency Education
University of Ottawa
“Competency-Based Training: A Procedural Skills OSCE for Internal Medicine Residents”
Pugh D, Touchie C, Humphrey-Murto S
$12,000

AIME Education Research Grant
University of Ottawa
“Constructed-Response versus selected-response formats – exploring cueing and effect on scores”
Desjardins I, Humphrey-Murto S, Pugh D, Touchie C
Medical Education Research/Medical Innovation Project 2008
University of Ottawa
“Teaching and Testing Procedural Skills – Survey of Canadian Internal Medicine Program Directors and Residents”
**Pugh D, Touchie C, Humphrey-Murto S**
$3,320

Educational Initiatives in Residency Education Fund 2007
University of Ottawa
“Ongoing Technical Skills Assessment in Internal Medicine”
**Pugh D, Touchie C, Humphrey-Murto S, and Wood TJ**
$11,295

Department of Medicine Research Initiatives competition 2007
University of Ottawa
“Ongoing Technical Skills Assessment in Internal Medicine”
**Pugh D, Touchie C, Humphrey-Murto S, and Wood TJ**
$3,383

**HONORS AND AWARDS – PERSONAL**

Dale W. Dauphinee Fellowship in Medical Education 2012
Teaching Skills Attainment Award 2012
Nominated, Meredith Marks Educator Award 2011
Career Medical Education Research Award ($40,000/year) 2011-present
Career Medical Education Research Award ($40,000/year) 2008-2011
Honorable mention for best oral presentation, AIME 2011
Honorable mention for best oral presentation, AIME 2010
Certificate of Teaching Excellence for Senior Residents 2005
First Class Honors, St. Thomas University 1997
Dr. H. Lyons Memorial Prize for Psychology Honors 1997
Diamond Construction Ltd. Prize for Psychology 1996
President’s Scholarship 1993
Frances M. McLaughlin Scholarship 1992 – 1996

**HONORS AND AWARDS – SUPERVISED RESIDENTS**

Best poster presentation, IM Resident Research Day (M. Coté) 2012
Best Oral Presentation, Junior Educator, AIME (S. Halman) 2010
Best Oral Presentation, 3rd Year Resident, IM Resident Research Day (I. Desjardins) 2010

**CONFERENCES**

Ottawa, ON
Canadian Conference on Medical Education, presenter
Banff, AB
AIME Medical Education Day, rater, presenter
Ottawa, ON
RCPSC International Conference on Residency Education, presenter
Quebec City, QC
AAMC/RIME Conference
Denver, CO
CCME Conference
Toronto, ON
AIME Medical Education Day, rater, presenter
Ottawa, ON
RCPSC International Conference on Residency Education, presenter
Ottawa, ON
AIME Medical Education Day, rater and presenter
Ottawa, ON
CCME Conference, presenter
St. John’s NL
Clerkship retreat, Assessment
April Ottawa, ON
AAMC/RIME Conference, participant and presenter
November 2009, Boston, MA
CSIM Conference, participant
October 2009, Ottawa, ON
CCME Conference
May 2009, Edmonton, AB
Medical Health Professions Education Conference
July 30-31, Chicago, IL
AIME 2nd Annual Medical Education Day, presenter and participant
April, Ottawa, ON
Clerkship retreat, Assessment
April 21 Ottawa, ON
CSIM, Conference
Montreal, Quebec
RCPSC International Conference on Residency Education
Ottawa, ON
AFMC/CAME, Canadian Conference On Medical Education
Montreal, Quebec
2nd Annual Clerkship Directors and Clerkship Administrators Program
Montreal, Quebec
AIME 1st Annual Medical Education Day
Ottawa, ON
Clerkship Retreat, Objective Writing
Ottawa, ON
AIME 1st Annual Medical
Faculty Development Day for Curricular Leaders
Ottawa, ON
CSIM, Conference  
St. John’s, Newfoundland  
2007

CCME Conference  
Victoria, BC  
2007

1st Annual Clerkship Directors and Clerkship Administrators Program  
Victoria, BC  
2007

CSIM, Conference  
Calgary, Alberta  
2006

3rd Annual Stroke Retreat  
Hull, Quebec  
2004

**FACULTY DEVELOPMENT**

Faculty Development – Preparing Your Promotion Application  
Ottawa, ON  
2012

Annual Faculty Development Day  
Ottawa, ON  
2012

Annual Faculty Development Day  
Ottawa, ON  
2010

Annual Faculty Development Day  
Ottawa, ON  
2009

Medical Education Research Training Seminar Series  
6 monthly sessions  
Ottawa, ON  
2009

Ultrasound-guided procedures course  
Ottawa, ON  
2008

**PROFESSIONAL ASSOCIATIONS**

Canadian Association of Medical Educators (CAME), member
The Associate for the Study of Medical Education (ASME), member
College of Physicians and Surgeons of Ontario (CPSO), licensed member
Canadian Medical Protective Association (CMPA), member
Canadian Medical Association (CMA), member
Ontario Medical Association (OMA), member
Canadian Society of Internal Medicine (CSIM), member