SHORT REPORT

A comparison of approaches to teaching clinical skills

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Abstract

Background: The most appropriate timing and mode for teaching clinical skills as preparation for medical students' clinical rotations or clerkships is not widely agreed upon. Increasing pressure on placement opportunities has led to a shift towards simulation-based teaching in the early years of medical training.

Approach: A major curriculum renewal provided an opportunity for comparison of the effectiveness of a largely ward-based (early patient exposure) curriculum with a largely simulation-based one in preparing students for clinical rotations.

Evaluation: We surveyed students from two different programs and invited them to take part in voluntary objective structured clinical examinations (OSCEs) to compare their skills and self-reported preparedness. Qualitative data was also collected from focus groups with a small number of students.

Implications: The findings suggest that the more structured, simulation-based curriculum is at least equivalent to the ward-based approach in teaching clinical skills and preparing students for clinical rotations. Students' clinical reasoning skills could be enhanced in a simulation-based curriculum through more explicit training to prepare them for being asked questions on clinical placement.

Keywords: clinical education; curriculum development; assessment of clinical skills

Background

Achieving competency as a clinician involves the development of an array of skills in clinical examination, clinical reasoning and communication. The development of these skills represents a major focus of medical curricula and is the subject of much research and debate. While medical education literature is laden with examples of approaches for teaching clinical skills and reasoning, clear consensus on effective approaches and ideal timing for such teaching within longitudinal curricula has not been reached.

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Much of the literature focuses on the transition to postgraduate practice and preparedness for medical internship, which offers some guidance for the training required in clinical components of medical programs (Monrouxe et al., 2017; Monti et al., 2020). The earlier transition, however, from preclinical, or largely classroom-based teaching, to clinical rotations or clerkships is less well researched. Some efforts to improve students' preparedness for this transition have been documented, focusing on intensive orientation, preparation for clerkship programs (Ryan et al., 2020) or curricula running parallel to early clerkship experiences (Duca & Glod, 2019).

Surmon et al. (2016) conducted an inductive thematic synthesis of literature relating to students' preparation for their first clerkship. Emerging themes identified modifiable elements relevant to the curriculum prior to clerkship, with students suggesting a more gradual transition in learning style and preparation for self-directed learning, longitudinal mentoring, weekly bedside teaching and early patient contact. While some themes were amenable to being addressed through an orientation or transition program, others require more attention in preclinical years.

In the 5-year joint medical program (JMP) at the University of Newcastle, students engage in problem-based learning to explore both medical science and clinical reasoning, accompanied by application to clinical examination skills. Increases in student numbers and reduced access to patients has intensified pressure on ward-based learning for junior medical students. Although simulation offers the benefit of standardisation of learning and an assurance that all students have had opportunities to meet specified learning objectives, there is potential for students to miss valuable experiential learning opportunities that come with exposure to real patients.

A major curriculum redesign in the JMP included a shift from ward-based learning of history-taking and physical examination skills with real patients, facilitated largely by practising clinicians in the Bachelor of Medicine (BMed) program, to primarily simulation-based learning in the classroom in the Doctor of Medicine (MD) program. Key differences include the introduction of more formal formative assessment opportunities with the provision of feedback based on marking rubrics, additional summative objective structured clinical examinations (OSCE) stations and larger group sizes in the MD (7–9 students compared with 4–5 in BMed clinical groups).

The teach-out of the BMed program and concurrent roll-out of the MD provided an opportunity to investigate differences in student learning associated with the two approaches. Here, we report on an investigation of students' history-taking, physical examination and clinical reasoning skills as well as their self-reported preparedness for clinical rotations, comparing students enrolled in the two programs. The first data collection took place prior to the first predominantly clinical year in both programs, though BMed students had engaged in 6 weeks of general practice placement (compared with 2 days for the MD students at Time 1).

Approach

At the beginning of the 2019 academic year (Time 1), students entering Year 4 of the BMed and Year 3 of the MD programs were invited to take part in a series of OSCE stations as an optional formative exercise and to complete an online survey exploring their sense of preparedness for clinical rotations. Twelve months later (Time 2), the same students were invited to repeat the survey, with some additional reflective questions, and MD students were invited to repeat the OSCE stations. In the interim, students were also invited to participate in focus group discussions or interviews to further explore their clinical practice experiences and preparedness. The 14 BMed participants and 50 MD participants represented 10% and 40% of the cohorts, respectively, with average ages in line with the full cohorts (22.6 and 23.5 years, respectively). The BMed participant group was overrepresented by females (64%) compared with the whole BMed cohort (57.1%). The MD participant group was more representative of the gender split (52% female) of the whole MD cohort (52.4% female).

The OSCE stations assessed fundamental clinical skills taught and assessed in the prior years of both programs (respiratory, neurological and gastrointestinal examinations, and history taking). Each station also included clinical reasoning questions. In the physical examination stations, students were required to identify a clinical sign from an image, discuss the pathophysiology and identify a potential diagnosis. For the history station, they were required to answer questions related to the case. Stations were assessed using rubrics that included mechanical, communication and clinical reasoning components, allowing for analysis of total score as well as each component separately. The online survey asked students how well they felt the program to date had prepared them for a range of skills and the application of knowledge and skills (see Tables 1 and 2). Focus group and interview questions were designed to delve deeper into students' learning experiences to aid understanding of the survey responses and quantitative data collected. Two researchers independently reviewed the transcripts to identify themes and met to discuss and arrive at an agreed set of overarching themes in line with the key ideas identified through the quantitative data. The most pertinent quotes illustrating these ideas were selected for inclusion.

The project was approved by the University of Newcastle Human Research Ethics Committee, Approval No. H-2018-0396.

Table 1

Summary of Results From Survey Data

Survey		Time 1		Time 2		Comparison of Means: Main Effect (program)* *p*	Comparison of Means: Main Effect (time)* *p*	Program* Time Interaction**
		BMed (n = 14) Mean (SD)	MD (n = 50) Mean (SD)	BMed (n = 15) Mean (SD)	MD (n = 35) Mean (SD)			
At this stage in your medical training, how confident do you feel in your ability to:	Know what is expected of you as a medical student on a hospital ward	1.07 (0.730)	1.46 (0.762)	2.80 (0.862)	2.37 (0.808)	0.906	< 0.0001	0.018
	Remember medical science from previous years	1.21 (0.699)	1.66 (0.688)	2.40 (0.986)	2.20 (0.677)	0.438	< 0.0001	0.043
	Remember clinical skills from previous years	1.79 (0.699)	1.98 (0.589)	2.67 (0.816)	2.43 (0.778)	0.884	< 0.0001	0.153
	Apply medical science knowledge to clinical scenarios	1.43 (0.756)	1.66 (0.688)	2.87 (0.915)	2.26 (0.657)	0.227	< 0.0001	0.008
	Perform a physical systems examination on a real patient	1.86 (0.663)	1.90 (0.647)	2.67 (0.900)	2.31 (0.758)	0.322	< 0.0001	0.207
	Detect physical signs on a real patient	1.14 (0.663)	1.38 (0.780)	2.67 (0.724)	1.91 (0.781)	0.120	< 0.0001	0.003
	Take a medical history from a real patient	1.86 (0.864)	2.20 (0.700)	3.33 (0.488)	3.06 (0.873)	0.839	< 0.0001	0.061
	Practise appropriate infectious disease protocol	1.93 (0.616)	2.30 (0.707)	3.33 (0.617)	3.03 (0.747)	0.027	< 0.0001	0.826
	Overall confidence	1.29 (0.914)	1.64 (0.563)	2.13 (0.640)	1.77 (0.547)	0.009	< 0.0001	0.977

Survey		Time 1		Time 2		Comparison of Means: Main Effect (program)* *p*	Comparison of Means: Main Effect (time)* *p*	Program* Time Interaction**
		BMed (n = 14) Mean (SD)	MD (n = 50) Mean (SD)	BMed (n = 15) Mean (SD)	MD (n = 35) Mean (SD)			
Please indicate how adequately you feel the program so far has prepared you for each of these skills that you may have had the opportunity to develop/ practise during clinical teaching or placements this year.	Gathering a comprehensive medical history	3.07 (0.730)	3.18 (0.774)	3.40 (0.632)	3.37 (0.490)	0.784	0.077	0.639
	Measuring blood pressure	3.21 (0.579)	3.42 (0.609)	3.67 (0.488)	3.49 (0.702)	0.927	0.057	0.153
	Examining the chest for cardiac and respiratory systems	2.79 (0.975)	3.02 (0.654)	3.33 (0.488)	3.20 (0.719)	0.740	0.018	0.228
	Examining the gastrointestinal system	2.86 (0.949)	3.06 (0.712)	3.27 (0.458)	3.23 (0.690)	0.593	0.063	0.435
	Examining the musculoskeltal system	2.14 (1.027)	2.62 (0.830)	2.93 (0.594)	2.71 (0.667)	0.448	0.010	0.042
	Examining the neurological system	2.50 (1.092)	3.04 (0.669)	3.13 (0.640)	2.77 (0.690)	0.576	0.253	0.005
	Examining the thyroid	1.14 (1.292)	2.50 (0.789)	2.00 (0.926)	2.69 (0.718)	< 0.0001	0.006	0.074
	Performing a mental state examination	1.29 (1.204)	2.34 (0.823)	2.47 (1.060)	2.34 (0.873)	0.021	0.004	0.004
	Performing a dermatological examination	1.93 (1.072)	0.88 (0.849)	2.47 (0.990)	1.29 (1.017)	< 0.0001	0.023	0.747
	Explaining the pathophysiology of detected clinical signs	2.00 (0.877)	2.26 (0.803)	3.00 (0.378)	2.63 (0.877)	0.747	< 0.0001	0.069

Survey		Time 1		Time 2		Comparison of Means: Main Effect (program)* *p*	Comparison of Means: Main Effect (time)* *p*	Program* Time Interaction**
		BMed (n = 14) Mean (SD)	MD (n = 50) Mean (SD)	BMed (n = 15) Mean (SD)	MD (n = 35) Mean (SD)			
Holistic care Please indicate how adequately you feel the program so far has prepared you for:	Appreciating the interaction of social factors with disease (e.g., poverty, unemployment)	3.43 (0.646)	3.28 (0.607)	3.53 (0.640)	3.43 (0.850)	0.404	0.404	0.885
	Appreciating the importance of a patient's cultural/ethical and religious background	3.14 (0.864)	3.44 (0.541)	3.40 (0.507)	3.54 (0.701)	0.111	0.192	0.575
Interpersonal skills Please indicate how adequately you feel the program so far has prepared you for:	Interacting and building rapport with patients	3.00 (1.038)	3.32 (0.653)	3.67 (0.488)	3.54 (0.505)	0.488	0.002	0.119
	Discussing difficult sensitive and/or emotional issues with patients	2.57 (0.938)	2.98 (0.742)	3.13 (0.640)	3.23 (0.547)	0.100	0.009	0.304
	Explaining concepts to patients	2.79 (0.699)	2.96 (0.755)	3.13 (0.640)	3.14 (0.692)	0.553	0.089	0.595
Confidence/coping skills Please indicate how adequately you feel the program so far has prepared you for:	Coping with stress caused by my study and clinical experiences	2.00 (1.109)	2.66 (0.823)	2.20 (1.265)	2.06 (1.110)	0.241	0.361	0.070
	Balancing my work/study and personal life	1.93 (1.207)	2.60 (0.857)	2.27 (1.100)	1.86 (1.061)	0.546	0.351	0.014
	Remaining calm in difficult situations	2.00 (0.961)	2.62 (0.667)	2.80 (1.082)	2.34 (1.162)	0.687	0.198	0.009
	Asking questions of supervising clinical staff	2.57 (1.016)	2.98 (0.769)	2.80 (1.082)	2.69 (0.953)	0.486	0.876	0.217
	Speaking up when you are unsure about something	2.64 (0.842)	2.82 (0.774)	2.87 (1.060)	2.57 (1.220)	0.780	0.953	0.265

Survey		Time 1		Time 2		Comparison of Means: Main Effect (program)* *p*	Comparison of Means: Main Effect (time)* *p*	Program* Time Interaction**
		BMed (n = 14) Mean (SD)	MD (n = 50) Mean (SD)	BMed (n = 15) Mean (SD)	MD (n = 35) Mean (SD)			
Collaboration and self-directed learning Please indicate how adequately you feel the program so far has prepared you for:	Working with and learning from staff from other health professions	2.79 (0.579)	2.84 (0.738)	3.23 (0.725)	3.03 (0.861)	0.669	0.063	0.455
	Working effectively in a team	2.71 (0.825)	3.28 (0.536)	3.38 (0.650)	3.41 (0.665)	0.039	0.006	0.056
	Investing time in developing my knowledge and skills	2.79 (1.051)	3.20 (0.571)	3.00 (0.816)	3.09 (0.777)	0.126	0.744	0.333
	Knowing what to focus on in my own reading/study	2.00 (1.177)	2.52 (0.931)	2.38 (1.121)	2.38 (0.907)	0.247	0.586	0.230

* Univariate pairwise comparisons of the variable of interest with program or time separately

** ANOVA using between subjects effects, assessing the interaction between program and time for each variable

Note: Small numbers precluded the assessment of program-based differences at each time point separately.

Table 2

Summary of Results From OSCE Data

OSCE	BMed (n = 14)	MD (n = 50)	Independent Samples *t* Test of Total Score, *p*	Independent Samples *t* Test of Clinical Reasoning Component, *p*	Independent Samples *t* Test of Communication Component, *p*	Independent Samples *t* Test of Mechanics Component, *p*
Neurology exam	72.185 (4.674)	75.859 (6.849)	0.064	0.022	NA	< 0.0001
Respiratory exam	73.429 (6.720)	77.253 (6.729)	0.070	0.213	NA	0.103
GI exam	71.513 (6.706)	76.447 (5.386)	0.006	0.407	NA	0.001
History taking and handover	76.952 (7.729)	75.627 (6.095)	0.501	0.091	NA	0.718
Total (4 stations)	294.1 (16.9)	305.11 (5.27)	0.022		NA	
Total clinical reasoning component	38.64 (4.58)	36.68 (3.96)		0.119	NA	
Total communication skills component (history only)	22.85 (2.54)	22.88 (1.99)			0.972	

Evaluation

The findings from our quantitative evaluation are summarised in Tables 1 and 2. Overall, they support the simulation-based approach taken in the MD as preparing students to at least an equivalent level to the previous program.

Despite having 1 year less medical training at Time 1, the students in the MD program demonstrated equivalent skills and self-reported confidence and preparedness to the students in the BMed program, largely reflecting a sense of being "somewhat adequately" prepared and between "not very" and "somewhat" confident. While quantitative comparison is not possible, this level of confidence is in keeping with the concern and perceived deficiencies common in the studies reviewed by Surmon et al. (2016). At Time 2, two-way analysis of variance (ANOVA) with time (stage in student learning) and program (BMed vs. MD) as factors was performed between subjects. This showed a significant interaction between time and program on some confidence scores (knowing what is expected of students on a hospital ward, remembering medical science, applying medical science to clinical cases and detecting physical signs on real patients) but no main effect of program, with the exception of practising infectious disease protocol and overall confidence. A subsequent analysis for time as a single factor showed both groups had substantially increased their confidence across all skills. Further analysis showed that the BMed students were consistently more confident than their MD counterparts

at Time 2 despite less confidence among this group at Time 1. This could be due to the increased total length of clinical experience or volume of medical science learning among the BMed students by the end of Year 4 compared to the MD cohort at the end of Year 3. Differences between cohorts were observed in preparedness for thyroid, mental state and dermatological examinations (see Table 1), which is largely reflective of changes in the curriculum emphasis rather than teaching approach. This finding provides some informal validation of the impact of structured teaching.

While differences in the skills demonstrated in OSCE stations were small, MD students appeared to demonstrate superior skills, overall, in the mechanical and communication components of the gastrointestinal and neurology stations and in the clinical reasoning component of the neurology station at Time 1. In the other two stations, differences were not significant, suggesting equivalent skill levels between cohorts in the stations, overall, as well as each component separately. Small numbers precluded between-cohort analysis of the Time 2 OSCE data, but the MD data supports ongoing improvement and high-level performance among this cohort (data not shown).

While differences between BMed and MD in students' sense of preparedness for clinical rotations were largely non-significant, BMed students reported higher average preparedness for only three out of the 24 skills. Both cohorts expressed a general sense that the best preparation for the hospital environment was to be immersed in it, as encapsulated by one student:

> *I think I felt quite out of my depth when I first arrived. I had no idea what was expected or what to do, but the longer you observe it, the more you get the hang of it. I don't really know how you work around that though, because you can only give people so much information, and you just have to experience because each place is going to be a bit different.* [Female, BMed]

This notion was supported by students' hesitancy about clinical rotations at Time 1, which improved by Time 2 after a year of experience.

Students generally agreed that the clinical examinations learned in the classroom prepared them well for the partial examinations more commonly required of them in the clinical setting, as described by one student:

> *I think it's important to learn the full exam, but I can certainly see why the consultants or other medical professionals might do a shorter or more focused exam.* [Female, BMed]

These reflections are also supported by responses in the survey to the open question asking students what skills they learnt in the previous year that they would apply in their clinical rotations. Students responded with a range of both general and specific physical examination and procedural skills, as well as communication and history taking.

On the other hand, the limited nature of experience in the clinical setting perhaps

restricted students' opportunities to practise what they were later assessed on and to hone their skills in detecting pathologies:

> *[We] didn't get that opportunity, so [we] weren't confident going into the [summative] OSCE that [we] had heard enough that they could interpret something.* [Female, MD]

One common theme raised by students was being unprepared for, and lacking confidence in, answering questions asked by clinicians:

> *As a 3rd year, it's definitely confronting being with doctors who … roast you.* [Male, MD]

Also, most students described limited opportunities to be observed by and receive feedback from clinicians:

> *Most of the time, there just wasn't even time to present the case, like I went and talked to this patient, but the team was busy doing jobs, so … you don't really want to bother them.* [Female, MD]

Several students commented that the formative OSCE stations and the clinical reasoning questions included in the stations were helpful in preparing them to answer questions verbally "on the spot" [multiple students], promoting recall of knowledge.

Implications

Importantly, the Time 1 data indicates equivalent skill levels across the cohorts, despite the fact that the MD cohort were a year behind in their training. This is particularly promising for the success of this curriculum and the teaching and learning approaches adopted in overcoming the deficiencies of capricious clinical experiences.

The findings of this evaluation support the ongoing implementation of the simulation-based curriculum and have also informed improvements in its delivery. In response to students' comments relating to the clinical reasoning questions, we have now incorporated clinical reasoning questions into OSCE assessments beginning in Year 1.

The simulation-based curriculum is supported by evidence demonstrating that simulation provides opportunities to immerse basic science learning within clinical cases for preclinical students (Cavuoto Petrizzo et al., 2019). Further evidence suggests that simulation is not inferior to clinical placement (Fitzgerald et al., 2019), which supports the adoption of this approach in a climate of increased pressure on clinical exposure opportunities for students. Simulation can provide assurance that students develop good clinical habits, are able to detect clinical signs and receive feedback on their performance, all elements that occur in a more opportunistic fashion in clinical environments.

Even before the Covid-19 pandemic, placements were at a premium, and in the post-Covid world, the ability to continue student learning without relying on exposure to real patients on wards will be increasingly important. Further work is needed to explore the long-term retention and clinical application of skills learnt in simulation-based

preclinical years, but this evaluation has provided confidence in the approach adopted in contemporary curricula.

Conflicts of interest and funding

The authors declare that they have no conflicts of interest. A small internal faculty grant supported the payment of simulated patients for the OSCEs.

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