SHORT COMMUNICATION

ADAPTING LONGITUDINAL CLINICAL CLERKSHIP IN INTERNAL MEDICINE TO SIMULATION MODE LEARNING.

YD Singh[1], KM Helmy[1], Sobana Jaiganesh[2], Ruban Ravi Chandran[3], KR Sethuraman[4].

[1] *Unit of Medicine, Faculty of Medicine, AIMST University, Kedah, Malaysia*
[2] *Unit of Physiology, Faculty of Medicine, AIMST University, Kedah, Malaysia.*
[3] *Peer Supervisor, Faculty of Medicine, AIMST University, Kedah, Malaysia*
[4] *Unit of Medicine and Medical Education, Faculty of Medicine, AIMST University, Kedah, Malaysia.*

Corresponding Author
Prof. Dr. YD Singh
Department of Medicine, AIMST University, 08100 Malaysia.
Email: ydsingh@aimst.edu.my

Abstract
Background: During the current COVID-19 pandemic, non-availability of public hospitals for undergraduate teaching purposes has stalled the face to face clinical experiential learning for all medical students world over including Malaysia. We designed, developed, implemented and assessed a simulated longitudinal clinical clerkship programme in our Clinical Simulation Centre (CSC).
Materials and Methods: The pilot study was conducted in the CSC of the institution in Feb 2021 for five days. A total of 20, year-5 medical students were included in the pilot study. Structured simulation-based clinical teaching of the cardiovascular and respiratory systems was undertaken. The hybrid simulation model combined simulated patients, normal volunteers, high-fidelity mannequins and other simulation devices were used. Communication, perceptual, psychomotor and cognitive skills of the learners were assessed before and after the week-long (five days) session. Focus Group Discussion on the teaching-learning process was performed on randomly selected students and near-peer supervisor.
Results: All parameters, Communication skills ($P<0.001$), Perceptual Skills (auscultation) ($P=0.044$), Psychomotor skills (physical examination) ($P=0.007$) and Cognitive skills ($P< 0.001$), have shown statistically significant improvement. All students found this simulated programme useful.
Conclusion: Our adaptation of longitudinal clinical clerkship in internal medicine to simulation mode learning has been an original effort as there are very sparse references in medical literature to similar simulation. Our initial pilot study results are very encouraging and we plan to conduct a larger study to validate the data. This simulation mode model of longitudinal clinical clerkship may be used as a supplement to normal year-5 clinical teaching.
Keywords: COVID-19 pandemic, Longitudinal clerkship Simulation, Internal Medicine Clerkship, Year-5 medical programme, Simulated Clinical Teaching

Introduction

During the current COVID pandemic, the non-availability of public hospitals for undergraduate teaching has stalled the face to face clinical experiential learning for all medical students world over. Hence, most medical schools in Malaysia were required to devise simulation of clinical encounters using hybrid methods, combining standardized patients, mannequins and other modes of simulation. However, simulation of longitudinal clinical clerkship is more challenging as there is sparse literature on this modality.[1-6]

We follow the British model curriculum and conduct the year-5 programme fully as "shadow houseman ship". This required us to design, develop, implement and assess a simulated longitudinal clinical clerkship programme in our clinical simulation center (CSC). The program was approved by the Senate of the University for implementation. Prior to implementation *in toto*, a pilot study was done by us in Internal Medicine during early 2021 and is described in this article.

Subjects and Methods

Year-5 medical students of our institution were the subjects for the study. All year-5 medical students of the institution were eligible to be included in the study. Students who did not / could not attend the entire five-day session or who missed the pre / post-test assessment were excluded from the study.

The pilot study was conducted in the Clinical Skills Center of the institution from 01 Feb 2021 to 05 Feb 2021 (a total of five days; Monday to Friday, 8 AM to 5 PM daily with a lunch break from 12 to 2 pm). Forenoon sessions were devoted to the cardiovascular system and afternoon sessions to the respiratory system. Medical resource persons for the Cardiovascular and respiratory system remained constant through the five days intervention.

A total of 20 students were included in the pilot study [n=20]. Seven students could not attend the entire five days sessions or missed the pre / post-test [n =7]. Finally, 13 [n=13] students could complete the intervention sessions and also undergo pre and post-test.

Intervention: Structured, simulation-based clinical teaching of the cardiovascular and respiratory system was undertaken. A hybrid model combining simulated patients, normal volunteers, high-fidelity mannequins and other simulation devices were used.

In order to provide an authentic environment of medical wards, one of the CSC hall was converted into a mini-medical ward equipped with real hospital beds with special linen, bedside cardiac monitors, IV fluids with stands, pulse oximeters, BP apparatuses, thermometers, spirometers, nebulizers with masks, ECG machines, crash cart trolleys loaded with various IV fluids, drugs, syringes and cannulas.

Relevant skills of perception, communication, higher cognition, and psychomotor performance of the learners were assessed before the start of the intervention (Monday morning) and after the end of day five sessions (Friday evening) by facilitators not involved in the teaching-learning activities. A Focus Group Discussion on the teaching-learning process was performed on randomly selected students and near-peer supervisors.

Students were asked following questions during Focus Group Discussion:

    (a) Was this simulated teaching-learning course useful?

    (b) In what way you found this course useful?

    (c) Should this mode of teaching be extended to other systems like Neurology and Nephrology?

    (d) Would this mode of teaching be useful for imparting practical training for year 4 and year 3 students?

    (e) What shortcomings did you observe during the simulated training?

    (f) What are your suggestions to improve the course?

    (g) Any other comment you will like to make?

Session objectives for the longitudinal clerkship over five days were as follows:

- Day One was used to revise the essentials of Cardiovascular / Respiratory system history findings and their interpretation to formulate a possible clinical differential diagnosis. Students were required to obtain history from a standardized patient and draw suitable conclusions. First encounter scenario with the simulated patient was set in Hospital Emergency area, then the scene was shifted to the medical ward after admission of a patient to the hospital to simulate day-1 of a case admitted to the ward.

- Day Two was used to revise the essentials of Cardiovascular / Respiratory system clinical examination and elicitation of certain clinical findings on a normal individual. They were required to interpret clinical findings in a high-fidelity mannequin or other simulation devices and formulate a possible clinical diagnosis / differential diagnosis after taking into consideration the facts recorded in the history.

Students were required to initiate necessary investigations and make an outline plan of management.

- Day Three was devoted to interpreting the investigations initiated the previous day and fine-tune the diagnosis / differential diagnosis. Thereafter the patient was reviewed (as done in the ward rounds in the morning) and students were told that new findings had developed. They were required to analyse the case afresh and consider possible complication which had occurred. Now they were required to start appropriate treatment and initiate more investigations if required. Various management guidelines and criteria were discussed.

- Day Four was used to interpret the previously initiated investigation and review the patient as done during ward rounds. Later, the patient was presumed to have improved and was discharged to home. Students were required to learn discharge formalities and counseling of patients and answer various usual questions asked by the patients. Students were required to discuss diet, drugs and other preventive measures recommended.

- Day Five was devoted to the review and assessment of the same patient in an outdoor clinic (as if the patient was back after 15 days at home). Various investigations were reviewed and treatment was changed accordingly. There was a brief question-answer session to clarify any doubts of the students. In the end, students underwent post-test and exit interview

Standard statistical methods were used for the analysis of the data. The variables were analysed initially by normality tests and histogram analysis. Distribution curves were expressed as means $\pm$ SD. ANOVA test was applied for normally distributed data. Statistical significance was set at $p < 0.05$.

Results

A total of 20 students were included in the pilot study. Seven students could not complete the five days sessions and/ or could not appear in pre/post-test assessment. Longitudinal clinical Clerkship learning was completed by 13 students. Mean Pre and Post-test scores are given in table 1. Communication skills, Perceptual Skills (auscultation), psychomotor skills (physical examination) and Cognitive skills show appreciable improvement. Pre and post-test Histogram comparison of these parameters is shown in Figure 1.

Table 2 depicts paired statistical outcome of various skill sets. All parameters viz. Communication skills, Perceptual Skills (auscultation), Psychomotor skills (physical examination) and Cognitive skills, show statistically very significant improvement ranging from $p < 0.05$ to $p < 0.001$

FOCUS GROUP DISCUSSION

Students' feedback:
For Simulation-based session:
1. I learnt auscultation well since I had the chance for repeated practice.
2. I feel during hospital posting I learnt blindly on patients without the basic knowledge.
3. I feel it is good to have a pre and post-test since it gives a chance to assess myself
4. Since I repeatedly practised on the simulated patient, I feel I had learnt history taking well.
5. I feel I have learnt few clinical skills which I could not be possible in the hospital.
6. I felt the teaching was elaborate, repeated and lecturers teach us in detail from basic concepts.
7. I learnt cases randomly each day in the hospital. But since in the Simulation lab I learn from admission up to the final discharge I am getting an overall idea of the clinical disease.
8. We learn about the possible complications also which helps me to understand and learn better.
9. I am happy to learn the discharge and follow up is done. This is new to me.

Against Simulation-based session:

1. The process consumes lot of time. Since 20 of us belong to the small group, for each skill (auscultation on the mannequin) I had to wait for my turn until my team mate's practice. *(Later two identical mannequins were deployed for auscultation to cut down waiting time)*
2. Only 2 cases were discussed in the whole week. I feel in the hospital I would have got more case exposure. (*The student later realised that each disease had 3 to 4 different outcomes built-in to simulate the variations as seen in a cardiac or a pulmonary ward setting)*

Near peer supervisor feedback:
1. I felt good since the entire process was systematically well organised.
2. The real scenario of the ward setting was created hence students appeared keen to learn.

3. Even though the sessions were long stretching morning and afternoon students were attentive.
4. I felt the students were actively involved and practised skills like auscultation of murmurs, breath sounds, physical examination etc.

All students found the Longitudinal Clinical Clerkship Simulated Learning programme useful.

Discussion

The stress of COVID-19 pandemic on the medical system has uncovered and worsened pre-existing fissures in medical education and obligated a reassessment and restructuring of many core methodologies of clinical medical education. Non-availability of the public hospitals for undergraduate teaching purposes has stalled the face to face clinical experiential learning for all medical students.

Simulation of longitudinal clinical clerkship for year-5 medical students is more challenging as there is sparse literature on this modality.[3] Most studies are limited to simulation of a single encounter or simulation of one or more of the relevant clinical skills. This required us to design, develop, implement and assess a simulated longitudinal clinical clerkship programme in our clinical simulation centre (CSC). The deanery has been periodically releasing general guidelines for adapting the curricular delivery during the pandemic disruptions, after getting approval from the University senate.[7-10]

Although the sample size of our pilot study is small (n=13), none the less, improvement in Communication skills ($P<0.001$), Perceptual Skills (auscultation) ($P<0.05$), Psychomotor skills (physical examination) ($P<0.01$) and Cognitive skills ($P<0.001$), have shown statistically significant improvement. Following this pilot phase, we have been holding similar sessions to the other student groups of Year-5 MBBS programme.

Conclusion

During the current COVID-19 pandemic, non-availability of the public hospitals for undergraduate teaching purposes has stalled the face to face clinical experiential learning for all medical students. We designed, developed, implemented and assessed a simulated longitudinal clinical clerkship programme in our Clinical Simulation Centre (CSC).

All parameters like Communication skills, Perceptual Skills (auscultation), psychomotor skills (physical examination) and Cognitive skills, have shown statistically significant improvement. All students found this simulated programme beneficial

We recommend our simulation mode model of longitudinal clinical clerkship may be used as a supplement to normal year-5 clinical teaching. We intend to carry forward lessons learnt to undertake a larger study to validate this significant data of the pilot study.

Table 1. Mean pre-test and post-test score

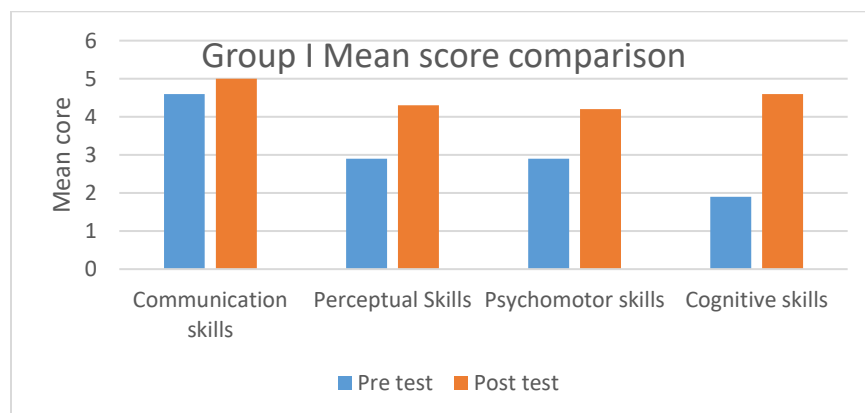|	Mean pre-test score	Mean post-test
Communication skills	4.6	5
Perceptual Skills(auscultation)	2.9	4.3
Psychomotor skills (physical examination)	2.3	4.0
Cognitive skills	1.9	4.6

Figure 1. Mean pre and post-test score

Table 2. Paired samples statistics

		Mean	N	Std. Deviation	Std. Error Mean	Mean differences	Sig.(*P*) (2-tailed)
Pair 1	Communication Skill Pre test	4.577	13	.2774	.0769	-.4231	<0.001
	Communication Skill Post test	5.000	13	.0000	.0000		
Pair 2	Perceptual skill pre test	2.846	13	2.4781	.6873	-1.3846	<0.05
	Perceptual skill post test	4.231	13	1.8777	.5208		
Pair 3	Psychomotor skill pre test	2.277	13	1.9644	.5448	-2.5385	<0.01
	Psychomotor skill post test	4.004	13	2.2504	.6241	-	
Pair 4	Cognitive skill pre test	1.907	13	1.2558	.3483	3.9615	<0.001
	Cognitive skill post test	4.538	13	.7489	.2077		

Image 1: Mannequin auscultation

Image 2: Clinical Bedside Examination by the students on simulated patient

Image 3: History taking on simulated patient by students

References

1. Goldenberg MN, Hersh DC, Wilkins KM, Schwartz ML. Suspending medical student clerkships due to COVID-19. Med Sci Educ. 2020;30(3):1273-1276. https://doi.org/10.1007/s40670-020-00994-1
2. Murdock HM, Penner JC, Le S, Nematollahi S. Virtual Morning Report during COVID-19: a novel model for case-based teaching conferences. Med Educ. 2020;54(9):851-852. https://doi.org/10.1111/medu.14226
3. Sukumar S, Zakaria A, Lai CJ, Sakumoto M, Khanna R, Choi N. Designing and implementing a novel virtual rounds curriculum for medical students' internal medicine clerkship during the COVID-19 pandemic. MedEdPORTAL. 2021;17:11106. https://doi.org/10.15766/mep_2374-8265.11106
4. Association of American Medical Colleges. Important guidance for medical students on clinical rotations during the coronavirus (COVID-19) outbreak. 2020. https://www.aamc.org/news-insights/press-releases/important-guidance-medical-students-clinical-rotations-during-coronavirus-covid-19-outbreak.
5. Inpatient Clerkship Goals and Objectives. University of Iowa web portal: https://medicine.uiowa.edu/internalmedicine/education/undergraduate/inpatient-clerkship/goals-and objectives

6. The utility of simulation in medical education: what is the evidence? Okuda Y, Bryson EO, DeMaria S Jr, Jacobson L, Quinones J, Shen B, Levine AI. Mt Sinai J Med. 2009 Aug;76(4):330-43. doi: 10.1002/msj.20127.

7. Sethuraman KR. AIMST University Plan for Imparting Clinical Skills Online: Structured Learning and Assessment of Clinical Component Skills (SLACCS) February 2021. DOI: 10.13140/RG.2.2.19915.72480
https://www.researchgate.net/publication/348986755_AIMST_University_Plan_for_Imparting_Clinical_Skills_Online_Structured_Learning_and_Assessment_of_Clinical_Component_Skills_SLACCS

8. Sethuraman KR. AIMST University Rescue Plan for Online Learning of Clinical Skills: Component Analysis of Clinical Skills to plan teaching-learning for the Students of Medical and Health Professions. February 2021.
https://www.researchgate.net/publication/348980851_AIMST_University_Rescue_Plan_for_Online_Learning_of_Clinical_Skills_Component_Analysis_of_Clinical_Skills_to_plan_teaching-learning_for_the_Students_of_Medical_and_Health_Professions

9. Sethuraman KR. AIMST University Mini-CEX Model for Clinical Skills Learning (peer reviewed online file) Feb-2021. DOI: 10.13140/RG.2.2.12893.23521
https://www.researchgate.net/publication/348555232_The_AIMST_University_Mini-CEX_Model_for_Authentic_Simulation_of_Clinical_Skills_Learning

10. Sethuraman KR. AIMST University Model of Fusion Teaching by Multimodal Pedagogy (the full version of the brief submitted to the deans of private medical schools of Malaysia in January 2021)
https://www.researchgate.net/publication/349621470_AIMST_University_Model_of_Fusion_Teaching_by_Multimodal_Pedagogy