

# THE VIRTUAL NEUROLOGY EXAMINATION AS A LEARNING TOOL FOR MEDICAL STUDENTS UNDERGOING CLINICAL CLERKSHIPS DURING THE PANDEMIC ERA OF COVID-19

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## ABSTRACT

**Background:** Due to the critical importance of the COVID-19 pandemic in the educational system, medical academics must consider safe and appropriate clinical clerkship learning methodologies and models implemented during the pandemic.

**Aims:** This study aimed to construct and evaluate virtual neurology examination as a tool for medical students undergoing clinical clerkships.

**Case Discussion:** This learning media review was action research conducted at Bethesda Hospital Yogyakarta, Indonesia. This study was conducted in two stages: developing a virtual neurology examination and evaluating student feedback. This study enrolled 12 medical students, the majority of whom were female (58%). The majority of medical students agreed that the virtual neurology assessment was a good overall experience (83%), with the majority stating that the image and sound quality were good (75%) and the virtual neurology examination cases were quite varied (66.5%). Nine medical students (75%) strongly supported the continuation of the virtual neurology examination program, while three medical students (25%) supported its continuation.

**Conclusion:** This study indicates that virtual neurology examination is feasible and can serve as a helpful learning tool for medical students undergoing clinical clerkships during the COVID-19 pandemic.

**Keywords:** Clinical clerkship, Examination, Teleneurology, Telemedicine, Medical student

## PRACTICE POINTS

- Patients and families who are frightened to visit the hospital due to COVID-19 pandemic rely on the media to contact their physician.
- Clinical clerkship activities conducted face-to-face prior to the pandemic might be substituted with an online approach.
- The limitation of virtual neurological examination is that not all examinations can be conducted virtually.

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**INTRODUCTION**

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pathogen, which is also responsible for coronavirus disease 19 (COVID-19), has caused unparalleled global morbidity and mortality.<sup>1</sup> Indonesia is one of the countries worldwide that has suffered noticeably in recent year.<sup>2</sup>

Globally, the COVID-19 pandemic has resulted in policy reforms by nations. Since the pandemic outbreak, the Indonesian government has implemented tiers of physical and social restrictions, limiting the Indonesian people’s mobility.<sup>2</sup> This policy also affects the health and education sectors, decreasing outpatient and inpatient hospital visits. The previous study has demonstrated that the COVID-19 pandemic has caused most of the population, including chronic disease patients who require regular medical treatment, to limit their exposure to the outside environment out of fear of getting the disease.<sup>3,4</sup>

Due to the critical importance of the COVID-19 pandemic in the educational system, medical academics must consider safe and appropriate clinical clerkship learning methodologies and models implemented during the pandemic. From the beginning, the Ministry of Education and Culture advised and contributed to the online delivery of lectures and learning during the COVID-19 pandemic.<sup>5,6</sup> Numerous universities and teaching hospitals, including Duta Wacana Christian University and Bethesda Hospital as the primary educational hospital, responded quickly to government instructions in March 2020 by issuing notification letters regarding academic policies in response to the spread of COVID-19.

Online education has its own set of advantages, disadvantages, and difficulties to overcome. Interacting with patients, conducting interviews, and performing physical tests are critical components of medical practice. Clinical experience involving patient interactions is a pre-requisite.<sup>6</sup> Patients and families who are frightened to visit the hospital rely on the media to contact their physician. Virtual neurology examination is a subset of telemedicine that was explicitly created for neurological patients.

Its potential as a source of learning media in clinical clerkships has rarely been studied. According to our knowledge, this is the first action research study using telemedicine in the field of neurology in Indonesia. This study aimed to construct and evaluate virtual neurology examination as a tool for medical students undergoing clinical clerkships at Bethesda Hospital Yogyakarta.

**LEARNING MEDIA REVIEW**

This study utilized an action research methodology - a method in which researchers describe, interpret, and explain a situation while also making adjustments or interventions. Additionally, action research is a cycle of action that includes reflection, feedback (feedback), evidence (evidence), and evaluation of previous activities and the current circumstance. The purpose of action research is to contribute to practical issue solving in time-sensitive settings.<sup>7,8</sup>

The research was conducted in two stages: developing a virtual neurology examination and evaluating student feedback. The teleneurology service model is developed through an evaluation of existing services. The software was designed by the information technology (IT) team in collaboration with neurologists. The IT team, in coordination with neurologists, produced teleneurology software in Visual zbasic.net and asp.net 2005. This system was connected with an already-existing electronic medical record and e-prescribing module.

Feedback is collected via closed questions on a google form from 12 medical students in the neurology department. The research sample was taken consecutively throughout the one-month development phase. At the beginning of the questionnaire, participants indicated their willingness to respond anonymously to questions. Respondents have the right to withdraw from the study at any time. This study was approved by Bethesda Hospital Yogyakarta’s research and development department. The data will be analyzed in a descriptive form.

The developed software can assist neurologists and lecturers in determining which neurology examinations can be performed virtually as part of the implementation of teleneurology services.

Virtual neurology examinations are conducted following established protocols and under ideal settings. The patient is seated in a bright room with no visual obstacle between him/her and the camera. The room is spacious and silent, allowing the patient to roam freely in and out of the camera's field of view. Additionally, the big room allows for easy observation of the patient's gait (Figure 1 and Figure 2).

The characteristics of respondents and their responses to the deployment of teleneurology-based learning are summarized in Table 1. This study enrolled 12 medical students, the majority of whom were female (58%). The majority of medical students agreed that the virtual neurology assessment was a good overall experience (83%), with the majority stating that the image and sound quality were good (75%) and the virtual neurology examination cases were quite varied (66.5%). Nine medical students (75%) strongly supported the continuation of the

virtual neurology examination program, while three medical students (25%) supported its continuation.



**Figure 1. Teleneurology Service Software that will be Enhanced for Use in Clinical Clerkship Education**

Pemeriksaan Motorik	Saraf Kranial	Pemeriksaan Sensorik	Tes Kognitif
<b>PEMERIKSAAN MOTORIK</b>			
<b>REKAM MEDIS RAWAT JALAN</b>			
1. Kekuatan Lengan			
Kanan : 5 Kiri : 2			
2. Kekuatan Tungkai			
Kanan : 5 Kiri : 2			
3. Reflek Fisiologis			
Lengan Kanan : +      Lengan Kiri : + Tungkai Kanan : +      Tungkai Kiri : +			
4. Reflek Patologis			
Lengan Kanan : -      Lengan Kiri : + Tungkai Kanan : -      Tungkai Kiri : +			

**Figure 2. Teleneurology Learning Software Interface**

**Table 1. Subjects' Characteristics and Their Responses to the Virtual Neurology Examination (N=12)**

Characteristics	n	%
Gender		
Male	5	42%
Female	7	58%
Overall experience on virtual neurology examination		
Very good	1	8.5%
Good	10	83%
Need improvement	1	8.5%
Image and sound quality of virtual neurology examination		
Very good	2	16.5%
Good	9	75%
Need improvement	1	8.5%
Case diversity		
Extremely varied	3	25%
Quite varied	8	66.5%
Not varied enough	1	8.5%
Continuance of the virtual neurology examination program		
Strongly support	9	75%
Support	3	25%

**DISCUSSION**

The results suggest that virtual neurology examinations can be developed and used to teach medical students undergoing clinical clerkships during the COVID-19 pandemic. Students' support and favourable responses are pretty positive. There are improvements to be made in terms of image and sound quality and case diversity. This result is consistent with prior research indicating that telehealth can be an effective learning tool.<sup>9</sup>

The pandemic demands adaptations to all sorts of activities connected to the potential for COVID-19 transmission.<sup>1</sup> Various activities must still be carried out because of their nature and necessity for individuals and society. In education, the usage of technology or video conferencing programs is a possibility during the pandemic.<sup>10</sup> Clinical learning involves learning through direct interaction with patients under the supervision of a clinical lecturer

at the bedside (bedside teaching). This is not necessarily overcome with online lectures. Virtual neurology examinations have a great opportunity to enhance clinical learning through e-learning.<sup>9</sup>

Teleneurology had a role in this study by assisting doctors in monitoring patients' clinical status via virtual visits and clinical learning media during the COVID-19 pandemic. Additionally, this approach has the potential to establish a new standard for neurological examination in the future. It should be made available to medical students as soon as possible. The challenge to establishing a virtual neurological examination is adapting a conventional physical examination to a virtual examination, which doctors and patients feel.<sup>5</sup> The limitation of virtual neurological examination is that not all neurological examinations, such as muscle strength assessment during neuromuscular consultation, headache consultation, and vertigo maneuver, can be conducted virtually.<sup>10</sup>

It is not easy to regulate clinical clerkship activities for medical students during a pandemic (COVID-19). Students can still acquire knowledge and skills in accordance with the established standards but with proper health precautions in place. Clinical clerkship activities conducted face-to-face prior to the pandemic, such as journal reading, might be substituted with an online approach. Previous research has demonstrated the potential for telemedicine approaches to be used in education in neurology.<sup>5</sup>

There are several aspects of clinical clerkships that necessitate daily interaction with patients due to their skill-related nature.<sup>9</sup> Direct engagement with patients in hospitals is vital as a source of objective data to strengthen clinical abilities.<sup>11,12</sup> Specific clinical procedures require close monitoring by a clinical teaching physician and cannot be performed remotely. Clinical skills, patient interaction experience, and features of professionalism cannot be replicated using online approaches. This is a significant difficulty in the COVID-19 pandemic era. Virtual neurological examinations can help bridge this divide. The long-term effects of adopting telemedicine as a learning tool must be researched.<sup>5</sup>



This study has limitations since it does not evaluate the impact of the virtual neurology examination on the competency enhancement of medical students. Moreover, this study did not use a qualitative method to evaluate participants' perceptions. Long-term research evaluating medical students' competence and qualitative perceptions is required. Since the study enrolled a small number of clinical supervisors and clinical clerkship participants, a bigger study was necessary to generalize the findings.

### CONCLUSION

Virtual neurology examination is feasible and can serve as a helpful learning tool for medical students undergoing clinical clerkships during the COVID-19 pandemic.

### RECOMMENDATION

During the COVID-19 pandemic, medical schools can use virtual neurology examinations as a learning tool. Future studies assessing medical students' competency after learning through virtual neurology examination and other research involving virtual examinations other than neurology need to be carried out.

### CONFLICT OF INTEREST

Authors declare no conflict of interest related to this study.

### AUTHORS' CONTRIBUTION

**Rizaldy Taslim Pinzon** - Developing research proposal, collecting data, data analysis, writing original draft, supervision

**Vanessa Veronica** - Writing original draft, review and editing, publication manuscript

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