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Tremor and Other Hyperkinetic Movements

Brief Reports

Telemedicine Enables Broader Access to Movement Disorders Curricula for Medical Students

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Abstract

Background: The impact of tele-education for movement disorders on medical students is unknown. The present study had three objectives. First, to create a tele-education program for medical students in regions with limited access to movement disorders curricula. Second, to analyze the feasibility, satisfaction, and improvement of medical knowledge. Third, to assess the main reasons of medical students for attending this course.

Methods: In 2016, a program was piloted in a low-middle income (Cameroon) and a middle-high income (Argentina) country. Medical students were offered a free movement disorder tele-education program (four medical schools in Argentina, and 1 medical school in Cameroon). Six real-time videoconferences covering hyperkinetic and hypokinetic movement disorders were included. Evaluations included attendance, pre- and post-medical knowledge, and satisfaction questionnaires.

Results: The study included 151 undergraduate medical students (79.4% from Argentina, 20.6% from Cameroon). Feasibility was acceptable with 100% and 85.7% of the videoconferences completed in Argentina and Cameroon, respectively. Attendance was higher in Argentina compared to Cameroon (75% vs. 33.1%). According to student reports, the topics and innovative educational environment were the main reasons for attendance. Both groups ranked satisfaction as moderate to high, and medical knowledge improved similarly in both countries.

Discussion: Tele-education can improve movement disorders knowledge in medical schools in high-middle and low-middle income countries lacking access to other educational opportunities.

Keywords: Parkinson's disease, telemedicine, tele-education, movement disorders

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Introduction

Nurses and doctors in low-income countries traditionally have limited access to continuing training. Medical education continues to be offered as in-person training sessions that can be costly and strain the healthcare system by removing clinicians from their facilities for days or weeks. The last few years have seen renewed interest from the World Health Organization (WHO), telecommunications companies, and medical associations on the use of telemedicine for education.[1] In this regard, medical education has also undergone significant changes, and online learning is increasingly replacing on-site lectures.[2] There is growing evidence that online curricula might have several advantages including standardization of content across large audiences, lower cost, and decreased dependence on expert human resources for teaching.[3,4]

To help increase access to care and to train providers around the world using technology, the International Parkinson's Disease and Movement Disorder Society (MDS) has sponsored pilot projects in care and education to help reach people with Parkinson's disease (PD) and other movement disorders. A recent study designed to provide

tele-education in PD management for 33 healthcare providers (physicians and allied health professionals) in Cameroon showed that PD medical knowledge was improved, but participants' ability to continuously attend long-duration tele-education programs was moderate (higher for allied health professionals compared to doctors).[5] To our knowledge, there are no data on the impacts of a movement disorders tele-education program on medical students in different settings. We therefore contacted medical schools in Argentina and Cameroon based on limited access to movement disorders curricula.

Argentina is a middle-high income country, with 43 million inhabitants and 27.6 neurologists per million people.[6] The standard medical school curriculum in Argentina includes a 3-week general neurology training program, as well as tele-education and e-health programs.[7] Few movement disorders training programs are available after the neurology residency program, which takes place in the main cities.

Cameroon is a low-middle income country, with a total population of 23 million (2015 available information) and 1.1 neurologists per million people.[8] The standard medical school curriculum includes 60 hours of general neurology training. There is only one general neurology residency program, and movement disorders subspecialty training is not available.[8]

The main objectives of this study were to create an information technology based tele-education program for medical students in a low-middle income (Cameroon) and middle-high income (Argentina) country with limited access to movement disorder curricula. We wanted to analyze its feasibility, satisfaction, and improvement of medical knowledge and to assess the main reasons of medical students for attending this course.

Methods

Design

We designed a 3-month, medical school-based tele-education program with pre- and post-education assessments.

Overall Procedure

This study was approved by the local Institutional Review Board at Hospital Universitario Burgos, Spain. Final year medical students at the Argentinian and Cameroon sites were invited via fliers and announcements to attend the free course. Before starting the program, a feasibility questionnaire was sent to the institutions to obtain the following information: frequency and number of videoconferences to be established based on student availability, equipment, and internet access. Only Cameroon requested equipment and internet connectivity to offer the course. The educational events utilized streaming content (videoconferences) and web-based teaching material (PowerPoint files including videos of movement disorder patients). The curriculum content for a basic education training level was reviewed for content validity in each country (work-up tests and treatment options based on different geographic access).

Two courses were independently offered for 3 months in 2016 in Argentina and Cameroon. Speakers were members of the MDS, and the courses were conducted in Spanish in Argentina and English and French in Cameroon. Certificates of attendance were provided to students who attended at least 80% of the time. The online SurveyMonkey platform used to collect student information in Argentina, and paper questionnaires were used in Cameroon.

Provision of infrastructure and support

Internet connectivity, equipment, and software (WebEx) were provided to the medical school in Cameroon. The school in Argentina conducted the course independently with its local internet and infrastructure (videoconference and software equipment, protocol H.323/SIP).

Course content

1) Argentina: six videoconferences covered gait disorders, PD, differential diagnosis of parkinsonism, hyperkinetic movement disorders, and tremor; 2) Cameroon: seven videoconferences covered overview of movement disorders, ataxia, dystonia, chorea, PD, tremor, tics, and myoclonus. After a videoconference, time for questions and interaction was given with a total connection time of approximately 90 minutes. Teaching material including slides and articles were available in both sites.

Pre-program student interview

Before starting, participants filled out a questionnaire regarding their main motivation for participating in the course. Baseline medical knowledge about movement disorders was tested with 15 basic questions related to diagnosis and management of clinical cases with PD, essential tremor, gait disorders, tics, and myoclonus.

Post-program feedback and medical knowledge testing

The pre-test was re-administered at the end of the course. Semi-structured questionnaires were given to medical students and speakers to collect information about satisfaction and difficulties.

Outcomes

We analyzed the feasibility defined by the ratio of the number of centers invited versus included, ratio of the number of medical students invited versus included, videoconferences successfully completed by each center, and adherence defined by the number of participants who completed the course. Medical student satisfaction was assessed by a structured satisfaction questionnaire independently designed for each country using a 6-point Likert-type scale (1 = less satisfied to 6 = most satisfied). Satisfaction questionnaires included questions on course content, quality of interactions, and technological quality. Students in Argentina were asked to report their overall satisfaction for the entire course. Students in Cameroon rated satisfaction on each topic. A faculty post-program survey addressed videoconference quality (audio, visual, and other technical considerations), the quality of interactions with students, and any other feedback. Motivation was investigated with a semi-structured questionnaire, and improvement of medical knowledge was assessed by the change in correct answers between the pre- and post-tests.

Analysis

Statistical analyses were performed using SPSS Version 21.0 (IBM Corp., Armonk, NY). Descriptive statistics (i.e. means $\pm$ standard

deviations, medians [range], and frequency [percentages]) were used to describe the demographic and study data. Pre- and post-course information was only obtained for those students who attended the first session and completed the course.

Results

The tele-education course included four medical schools in Argentina (Buenos Aires, Tucumán, La Matanza, del Sur), and one medical school in Cameroon (University of Douala). One hundred and fifty-one medical students were included (79.4% from Argentina, 20.6% from Cameroon) with similar representations of males and females in both countries. Overall results are summarized in Tables 1 and 2. In terms of feasibility, 100% and 85.7% of the videoconferences were completed in Argentina and Cameroon, respectively. Adherence was higher in Argentina compared to Cameroon (75% vs. 33.1%). Although the percentage improvements in medical knowledge were similar, baseline medical knowledge was higher in Argentina compared to Cameroon. As outlined in the methods section, medical students' satisfaction data were reported differently in Cameroon and Argentina, so the results were not directly comparable. However, both groups reported satisfaction with the course.

Discussion

In our study, tele-education improved medical students' movement disorder knowledge in high-middle and low-middle income countries with limited access to movement disorders curricula. Overall, students and faculty members involved in this international endeavor were satisfied with the course. The topic and innovative nature of course delivery were the main reasons medical students participated. However, the videoconferences delivered to Cameroon were rated as moderate quality by speakers and students, likely due to technical problems including interrupted internet connectivity resulting in limited interaction between faculty and students. This may explain the lower attendance in Cameroon compared to Argentina.

The WHO suggested that telemedicine needs to be expanded in underserved areas to include undergraduate professional development since it has the potential to improve access to scarce academic resources.[9]

Table 1. **Tele-education in Argentina (n = 120 Medical Students)**

Feasibility	
Medical school participation (included/invited) (%)	4/17 (23.5)
Student participation (included/invited) (%)	120/179 (67.5)
Completed videoconferences (%)	6/6 (100)
At least 80% medical student attendance	91/120 (75)
Demographics	
Gender, female (%)	80 (66.7)
Motivation for Medical Students	
"Why did you participate in this course?" Average answer[1]	
The topic	3
Innovative method	3.5
MDS as organizer	2.5
Medical school as organizer	1.8
Medical Knowledge Improvement[2]	
Correct answers (pre-/post-test) (%)	50.1/74.0 (31)
Satisfaction	
Students (98 responders)	
Very satisfied with the speaker (%)	62/98 (51.6)
Very satisfied with the use of videos (%)	80/98 (66.6)
Very satisfied with the interaction (%)	32/98 (26.6)
Speakers (6 responders)[3]	
Average satisfaction with the quality of the audio	5.8
Average satisfaction with the quality of the video	5.8
Average satisfaction with the interaction	5.3

Abbreviation: MDS, Movement Disorder Society.
[1]Average answer was calculated based on the 5-point Likert-type scale from 5 = strongly agree to 1 = strongly disagree.
[2]Medical knowledge improvement was calculated as the average percentage of students with correct answers in the pre- and post-tests.
[3]Overall average satisfaction for the whole course was measured using a 6-point Likert-type scale (6 = most satisfied to 1 = less satisfied).

Table 2. **Tele-education in Cameroon (n = 31 Medical Students)**

Feasibility	
Medical school participation (included/invited) (%)	1/1 (100)
Student participation (included/invited) (%)	31/91 (34.0)
Completed videoconferences (%)	6/7 (85.7)
At least 80% medical student attendance	11/31 (33.1)
Demographics	
Gender, female (%)	15 (48.3)
Motivation for Medical Students	
"Why did you participate in this course?" Average answer[1]	
The topic	4.6
Innovative method	3.7
MDS as organizer	3.9
Medical school as organizer	3.2
Medical Knowledge Improvement	
Correct answers (pre-/post-test) (%)[2]	39.4/56.0 (29.7)
Average Satisfaction[3]	
Students (17 responders)	
With the content	4.2
With the audiovisuals	3.7
With the speaker	4.2
Speakers (5 responders)	
With the quality of the audio	3.8
With the quality of the video	3.2
With the interaction	3.2

Abbreviation: MDS, Movement Disorder Society.
[1]Average answer was calculated based on the 5-point Likert-type scale from 5 = strongly agree to 1 = strongly disagree.
[2]Medical knowledge improvement was calculated as the average percentage of students with correct answers in the pre- and post-tests.
[3]Overall average satisfaction for the whole course was measured using a 6-point Likert-type scale (6 = most satisfied to 1 = less satisfied).

A systematic review of telelearning technologies in delivering education and training materials/programs to health professionals provided evidence that telelearning models achieve comparable outcomes compared to face-to-face learning.[10] The pedagogical argument for developing international tele-education systems is strong for specialties where human resources are limited and the content is challenging to teach. Despite the high prevalence and disease burden of neurological disorders,[11] most low-income countries have less than one neurologist per one million people and lack medically trained personnel.[12]

Population aging and changes in risk factor distribution have accelerated the epidemic of non-communicable disease in many developing countries.[11,13] As a result, the burden of age-related conditions including neurodegenerative diseases is expected to increase.[14] If the population structure follows current projections and the incidence rates remain stable, the 2025 prevalence rates of PD and essential tremor are projected to increase by 184% and 178%, respectively.[15] Moreover, in a recent study conducted in Cameroon, out of 20,131 medical charts reviewed (13% from rural areas), 4,187 (20.8%) patients with neurological complaints were identified. Movement disorders were diagnosed in 134 (3.2%) patients from urban centers exclusively, indicating that movement disorders are likely underdiagnosed in the rural Cameroon.[16] It is clear that improving access to patients with movement disorders must be coupled with greater education to raise awareness of these diseases.

Tele-education has been shown to improve access to education and training in resource-constrained settings.[9] In some countries, the benefits of digital medical education and information are obvious. In the United States, the Extension for Community Healthcare Outcomes uses video conferencing technology to train local primary care providers to provide specialized chronic care management for remote populations who do not see a specialist.[17] The University of KwaZulu-Natal Medical School in South Africa has conducted videoconference-based education in a number of medical disciplines since 2001, including pediatric surgery and rural midwifery.[18] In this context, videoconference and face-to-face education were considered equivalent, and the report concluded that the results were grade B (moderate)

evidence-based support of the utility of healthcare tele-education.[19] While online tele-educational resources in wealthier countries can change the form of knowledge delivery, access to online tele-educational resources in low-income countries with less developed educational infrastructures can dramatically change not only the form, but the quality and quantity of the educational content available to local trainees.[2] Overall, tele-education courses should be viewed as an additional tool to deliver medical education, and cost-effectiveness should improve as the price decreases and access to technology improves.

Future research should further examine curriculum design (different levels based on medical training), alternative formats (web-based learning, webcasting, etc.), and the combination of asynchronous (not delivered in real time) and synchronous (delivered in real time) online education. Several strategies can be identified to improve consistent attendance and outcomes. In our study, attendance was higher in Argentina compared to Cameroon, suggesting that stable technology infrastructure may be important for retaining student participation. Nevertheless, long-term follow-up of educational activities is needed to establish the real impact on the clinical care of patients with movement disorders in underserved areas.

Evaluating the effectiveness of healthcare tele-education and comparing it with face-to-face education is difficult due to the heterogeneity of outcomes, measurements, and participants (type and location). In evaluating the effectiveness of our international study, our main limitation was the small sample size and selection bias due to the low number of questionnaire responders in Cameroon.

The challenges in conducting this pilot study taught important lessons that are vital to adopt sustainability steps. Perhaps synchronous online education is feasible in countries with adequate technology infrastructure, but asynchronous tele-education may be a more reasonable option in countries with limited internet access. Nevertheless, technology is becoming more accessible and affordable, and the current limitations may soon be resolved in developing countries. Ongoing strong medical association partnerships and local healthcare system support are needed to scale-up successful tele-education programs.

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