

# Epilepsy for primary health care: a cost-effective Latin American E-learning initiative\*

## A report from the Education Commission of the International League Against Epilepsy

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**ABSTRACT – Aims.** A lack of neurologists in Latin America forces primary health care providers to manage epilepsy. With the main goal of improving diagnostic and therapeutic management of patients with epilepsy through training of physicians in the primary health care level, the International League Against Epilepsy Education Commission (2013-2017) created a low-cost, regional, virtual course.

**Methods.** The course, set-up in Moodle platform, was structured in eight modules, each lasting for a week. Teaching was based on written didactic material, videos, and interactive discussions, both in Spanish and Portuguese. Topics included epidemiology, diagnosis, classification, treatment, prognosis, social issues, and epilepsy policies. Each course was limited to 50 participants and priority was given to general practitioners. Certification was given to those approving the final examination.

**Results.** Since 2015, five courses have been developed, involving 143 participants from 17 countries and 21 tutors. Of the participants, 61% worked in primary health care services. A total of 129 participants (90%) completed the course, and 110 submitted the final examination with an approval rate of 95%. From 85 participants completing the course evaluation, 98% would recommend the course to other colleagues, and 99% showed interest in taking other similar courses. High self-confidence for the management of patients with epilepsy increased from 21% at baseline to 73% after the course.

**Conclusions.** The online course on epilepsy for primary care physicians in Latin America was shown to be a cost-effective course, with good retention and excellent approval rates. Our current challenges include periodic updating, complete self-sustainability, and exploring different strategies to reach our target audience more effectively.

**Key words:** epilepsy, Latin America, online course, primary care, training, e-learning

Besides a similar cultural background and language, Latin America is characterized by diversity. Health systems differ between countries, and the complexity and availability of health services vary even in the same country. Social, political, and economic backgrounds are also diverse and highly variable, making public health policies and services frequently unstable. Social determinants, such as violence, forced internal or international migration, inadequate farming, unsafe housing, analphabetism and/or cultural beliefs, can hinder appropriate health service development (Cotlear *et al.*, 2015).

Although epilepsy is a public health problem, as recently recognized by the Pan American Health Organization and World Health Organization (WHO, 2015), most Latin American countries do not have national programmes or policies for epilepsy care. Primary health care (PHC) is frequently not only the first, but the only care system people in rural or even

some urban areas are offered (PAHO, 2013; Morales, 2016). Therefore, PHC providers have to deal with epilepsy (a prevalent neurological disease) and its consequences with insufficient knowledge and competence (Devinsky *et al.*, 1993; Levav *et al.*, 1999).

From the viewpoint of medical education, there are also significant differences regarding the availability of training in neurology/epilepsy in different countries, with a great need for specialists in the entire region. On the other hand, there are some regional well-recognized universities and growing involvement of inter-institutional collaboration and international networking, mostly during the last decade, which allows for steadily increasing training opportunities (Braga, 2013).

Taking into account the growing availability of the internet and social media, the Education Commission of the International League Against Epilepsy (ILAE) decided to contribute to the challenge of reducing the

**Table 1.** Course modules and tutors (courses: 2015-2017).

Module	Tutors
Epidemiology	Jorge Burneo (Peru/Canada), Marly Albuquerque (Brazil), Lady Ladino (Colombia)
Diagnosis and semiology of seizures	Elza Márcia Yacubian y María Luiza Manreza (Brazil), Guilca Contreras (Venezuela)
Seizures: differential diagnosis	Kette Valente (Brazil), Rodrigo Solarte (Colombia), Loreto Ríos (Chile)
Diagnosis of epilepsy and paraclinical studies	Alicia Bogacz (Uruguay), Ana Carolina Coan (Brazil)
Pharmacological treatment	Katia Lin (Brazil), Angélica Uscátegui (Colombia)
Interaction between health care levels	Patricia Braga (Uruguay), Viviana Venegas (Chile), Ana Paula Martins (Brazil)
Prognosis and social aspects	Lilia Morales (Cuba), Laura Guilhoto (Brazil)
Laws. Who-paho drafts	Jaime Carrizosa y Álvaro Izquierdo (Colombia), Adélia Henriques-Souza (Brazil)

educational and treatment gap in epilepsy through a virtual educational initiative, developed as a continuous medical education (CME) tool.

The major goal of this e-based course was to enhance knowledge on epilepsy for physicians working at the first level of care, thus aiming to improve the diagnostic and therapeutic management of patients with epilepsy. Additional goals were:

- development of a regional virtual platform in native languages (Portuguese and Spanish) that could be used to host the course and eventually other related courses;
- evaluation of the feasibility and receptivity of an online course, prepared by regional professionals and devoted to Latin American practitioners, delivered in their native languages;
- and evaluation of the cost-effectiveness of the initiative. Finally, the course was considered an opportunity to promote the development of a network of collaboration between the ILAE and Latin American universities. We present the results of this educational experience in terms of adherence and engagement during the course, evaluation of students' knowledge and self-confidence, and a global estimation of cost-effectiveness.

## Methods

### The course

The course directors were the Latin American members of the 2013-2017 ILAE Education Commission (JC, PB), who designed the course, selected the initial

topics, and invited recognized epileptologists from several regional universities to join the teaching staff. The course included eight topic-oriented and evidence-based modules, each lasting for one week (*table 1*). The following competences were covered:

- to acknowledge common aetiologies of focal and generalized epilepsies in children and adults;
- to recognize seizures, identify and describe semiology using standardized terminology and classification systems according to updated ILAE guidelines;
- to recognize non-epileptic events as alternative diagnosis;
- to diagnose epilepsy and most prevalent epilepsy syndromes;
- to become familiar with the basic ancillary studies in epilepsy, e.g. EEG and neuroimaging;
- to understand and address the culturally appropriate aspects and consequences of diagnosis;
- to manage pharmacotherapy for epilepsy in an evidence-based manner, including special considerations for pregnancy and the elderly;
- to refer appropriately for a higher level of care;
- to be knowledgeable about the epidemiology of epilepsy;
- and to learn about WHO Epilepsy Draft and national epilepsy programmes or policies.

Both Spanish and Portuguese-speaking tutors were assigned to each module. They prepared the teaching material and reviewed and translated their fellow tutors' material into Spanish and Portuguese. In addition to basic didactic material (presentations, written documents, and open-access published papers), several modules required essential supplementary

**Epilepsias para atención primaria/Epilepsias para atenção primária 2017 1ªed**

Página Principal ► Mis cursos ► EAP 2017 (1)

**Epidemiología de la epilepsia/Epidemiologia da epilepsia**

Manejo de conceptos básicos en epidemiología y análisis de la situación en América Latina.  
Manejo de conceitos básicos em epidemiologia e análise de situação em América Latina.

- GENERALIDADES
- Foro módulo 1
- Materiales del curso/Materiais do curso
- MOD 1-EJERCICIOS / EXERCICIOS
- Autoevaluación módulo 1 (español)
- Autoavaliação módulo 1 (português)
- Evaluación módulo 1 (esp)
- Avaliação módulo 1 (por)

**Diagnóstico diferencial de las crisis epilépticas./Diagnóstico diferencial de crises epilépticas**

Diagnóstico diferencial de las crisis epilépticas.  
Diagnóstico diferencial de crises epilépticas.

- GENERALIDADES
- Foro módulo 3
- Materiales del curso/Materiais do curso
- Videos de diagnóstico diferencial de crises/Videos crise diagnóstico diferencial
- Videos para ejercicios
- EJERCICIOS / EXERCICIOS
- Autoevaluación módulo 3 (español)
- Autoavaliação módulo 3 (português)
- Evaluación módulo 3 (esp)
- Avaliação módulo 3 (por)

**Foro módulo 2**

Espacio para el intercambio de información y actividades prácticas relacionadas al módulo

Añadir un nuevo tema de discusión

Tema	Comenzado por	Rélicas	Último mensaje
Ejercicios Módulo II	Ernesto Sotolongo	0	sáb, 24 de jun de 2017, 12:46
ejercicios modulo 2	Lizandra Castillo	0	sáb, 24 de jun de 2017, 12:46
Ejercicio modulo 2	Jesús Ramon Rivera	0	Jesús Ramon Rivera mié, 21 de jun de 2017, 09:36
Ejercicios del modulo II	Laura Baquero	1	Guilca Contreras
Módulo 2	Alejandro Thomson	1	Guilca Contreras lun, 19 de jun de 2017, 20:39
Ejercicios módulo 2	Roger Rodriguez	1	Guilca Contreras lun, 19 de jun de 2017, 19:50
Ejercicio 2	Miguel Solano	1	Guilca Contreras
Comienza el módulo 2	Patricia Braga	3	Natalia Tarutou lun, 19 de jun de 2017, 17:26
Discusión de los casos.	Guilca Contreras	8	Natalia Falco dom, 18 de jun de 2017, 00:25
Actividades modulo 2	Analia Pastrana	0	Analia Pastrana sáb, 17 de jun de 2017, 22:48

Página Principal ► Mis cursos ► EAP 2017 (2) ► Epidemiologia de la epilepsia/epidemiologia da epilepsia ► Autoevaluación módulo 1 (español)

Comenzado el	lunes, 4 de junio de 2018, 16:02
Estado	Finalizado
Finalizado en	lunes, 4 de junio de 2018, 16:04
Tiempo empleado	1 minutos 43 segundos
Calificación	0,00 de 2,00 (%)

**Pregunta 1**  
Sin contestar  
Puntúa 0,00 sobre 1,00

Las tasas de incidencia de epilepsia se refieren a

Selección una

- a. Cantidad de casos nuevos de epilepsia en 6 meses en una determinada población.
- b. Cantidad de casos nuevos de epilepsia en un año en una determinada población
- c. Todos los casos de epilepsia vistos en un año en una determinada población.
- d. Todos los casos de epilepsia vivos en una determinada población.

Incidencia siempre se define como el número de eventos nuevos (casos de epilepsia) ocurridos en un periodo de tiempo de un año, en una determinada población. Los casos de epilepsia vivos en un momento dado en una población constituyen la prevalencia.  
La respuesta correcta es: Cantidad de casos nuevos de epilepsia en un año en una determinada población.

Figure 1. Example of module contents.

material, such as videos (semiology/syndromes), case reports, slides/images (neuroimaging or EEG), or original documents such as the WHO Draft on Epilepsy (laws/drafts).

### The virtual platform

The medical school of the public university of Uruguay (*Facultad de Medicina, Universidad de la República*) was selected to host and develop the virtual platform. This selection was based on its previous experience in continuous medical education (CME), including online courses using the Moodle platform and the submitted cost-effective proposal. This academic institution provided a specifically devoted server, where the virtual platform was developed ([www.eci.fmed.edu.uy](http://www.eci.fmed.edu.uy)). The platform was programmed in Moodle version 1.9 (2015) with annual updates, up to version 3.2.

Each module contained folders and forums (figure 1). Didactic material provided by tutors was included in these folders, mostly as PDF documents (texts, slides,

and figures) to ensure compatibility and wide-reaching access. Students could either download all PDF documents to their files or read them online. Videos were uploaded into a vimeo account, taking care to respect privacy, and passwords were used to ensure confidentiality regarding recorded patients. Access to videos and the password necessary to play them was only available through the course platform.

The Moodle platform provides the opportunity of interaction through forums and direct contacts with tutors. Forums were organized as non-synchronous chats, giving priority to easy access for students and tutors, avoiding the need for advanced technologies or high-speed internet connections. Thus, participants only needed to have access to internet connection through simple equipment such as any personal computer or smartphone.

Technical support included:

- the set-up of the virtual platform;
- course development with Spanish/Portuguese interfaces;

- uploading of updated material;
- platform access for teachers and registered students;
- and predefined stepwise linking to different modules, forums, and evaluations.

Platform training for tutors was delivered during both online and face-to-face meetings, including topics such as access, forum interventions, and evaluation formats. A technical support forum, for students and tutors, was also available during the entire courses.

Finally, the platform enables additional data to be collected for individual records, related to the number of times and length of time students/tutors are online. The platform also allows for automatic correction of tests and delivers predefined statistics related to the didactic proposal.

### Teaching and learning process

Participants were expected to spend a minimum of six hours per week on the course. Students entered the platform using a personal code with access to the contents of the course for the current week and the previous weeks. For each module, they had access to selected documents, slide presentations, and could upload videos. The modules were designed in such a way that users were required to read the texts and look at the additional material. Tutors proposed tasks or presented cases for discussion, promoting analysis and argumentation through the written participation of the students in the forum. Alumni were encouraged to discuss not only with the tutors but also between themselves, sharing their knowledge and experience. Direct contact between students and professors regarding specific inquiries was also possible. Asynchronous activity allowed students and tutors to participate at any time, to suit their individual agendas, facilitating the completion of the course. Self-evaluation consisting of multiple-choice questions with automatic feedback was available following each module (figure 1).

### Course evaluation

Certification was handed out to those completing the course and passing the final online multiple-choice examination with a 60% approval threshold. The office for CME of the Medical School (*Escuela de Graduados, Facultad de Medicina, Universidad de la República, Uruguay*) offered accreditation (41 CME credits) to those completing the course and seeking approval for the final test.

On the other hand, participants were offered questionnaires to evaluate each module and the entire course.

A follow-up questionnaire on self-perceived improvement and confidence in epilepsy management was

sent at least six months after the course. A few multiple-choice questions based on four clinical vignettes were added to assess acquired competences.

### Participants

A call for applicants was officially advertised through the ILAE website. Advertisements with the basic course information regarding contents, methodology, costs, and dates were also sent to ILAE and IBE Chapters, the Latin American Academy on Epilepsy (ALADE), Latin American Summer School on Epilepsy (LASSE), and to the ILAE Latin American Commission, which in turn circulated this information via their web pages and members' databases. The course was also promoted during several local, regional and international neurology/epilepsy meetings. In a few cases, the information reached the participants through the national communication systems of their ministry of health, university, or medical association.

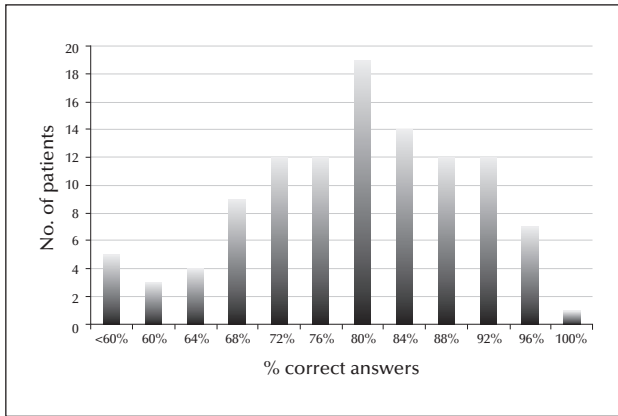
Each course was limited to 50 participants. Priority was given to general practitioners and physicians working in PHC. After the pilot course held in 2015, the course continued twice a year.

### Costs

The initiative received support from the ILAE (4,000 USD for the pilot course and 4,500 USD per course thereafter).

As the teaching staff generated no expenses, the costs were restricted to the development and maintenance of the virtual platform and technical and administrative support. The cost of all technical services was 4,000 USD for the initial set-up of the pilot course and 3,500 USD per course afterwards. Administrative support with a cost of 1,000 USD per course was available from 2016; this lasted from the opening of the call for applications to the end of each course, and included administrative management of contacts, data tabulation of applicants, a survey of registrations and verification of payment, follow-up during the course, and sending certificates.

Revenues were solely based on registration fees, which were mandatory for all participants, although full bursaries were considered. As the course was proposed to include up to 50 students, a full fee of 100 USD was defined to cover the costs and allow for a self-sustaining course. Differential fees were defined according to the participant's country and socio-economic situation, varying from 10 to 100 USD. The registration process was managed electronically through the course secretary, while payments were processed directly by the ILAE Financial Office (either bank transfers or credit card options were offered).



**Figure 2.** Distribution of students' final examination results for the online epilepsy course (n=110); the final results are shown as a percentage of correct answers, considering an approval threshold of 60%.

## Results

### Participants

Five courses have been developed since 2015 with 143 participants. Regarding background training of the registered professionals, 29 (20%) were general practitioners, 22 (15%) were paediatricians, five (4%) were family medical doctors, four (3%) were internal medical specialists, 61 (42%) were adult or child neurologists, 11 (8%) were neurology residents, and 11 (8%) were other healthcare professionals (epidemiologist, psychologist, psychiatrist, cardiologist, and nutritionist); in the entire group, 88 (61%) were working in PHC services.

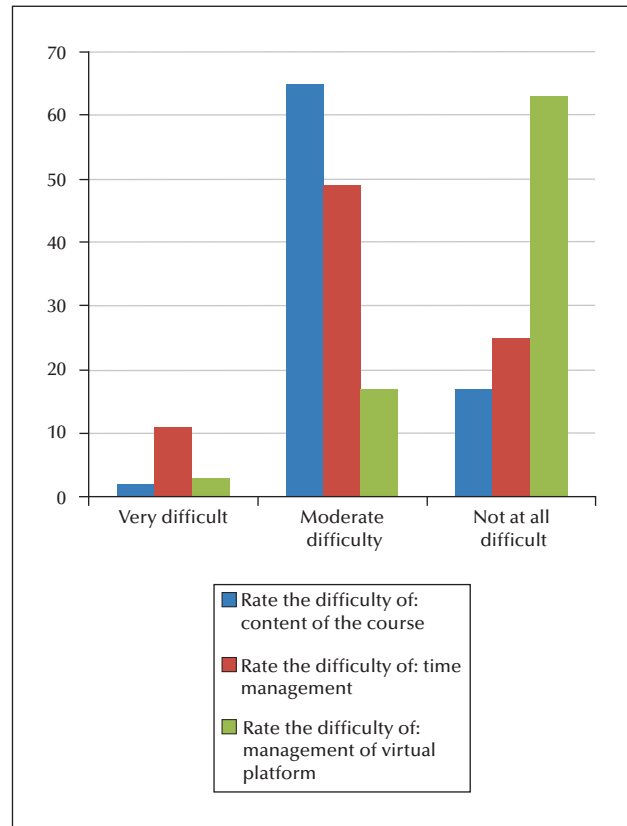
Participants were from the following 17 countries: Argentina (15; 10.5%), Bolivia (7; 4.9%), Brazil (17; 11.9%), Chile (3; 2.1%), Colombia (9; 6.3%), Costa Rica (5; 3.5%), Cuba (21; 14.6%), Dominican Republic (11; 7.7%), Ecuador (1; 0.7%), El Salvador (2; 1.4%), Honduras (5; 3.5%), Nicaragua (1; 0.7%), Panama (1; 0.7%), Paraguay (3; 2.1%), Peru (20; 14%), Uruguay (7; 4.9%), and Venezuela (15; 10.5%).

### Engagement and completion

From a total of 143 registered students, 129 (90%) completed the course; 110 took the final examination, with an approval rate of 95% (figure 2). Thus, 105 students (73% of participants starting the course) received the accreditation certificate. The course dropout rate was 10% (14/143).

### Course evaluation

The course evaluation by the students was performed through an online questionnaire, available at the same time as the final examination. Although students were



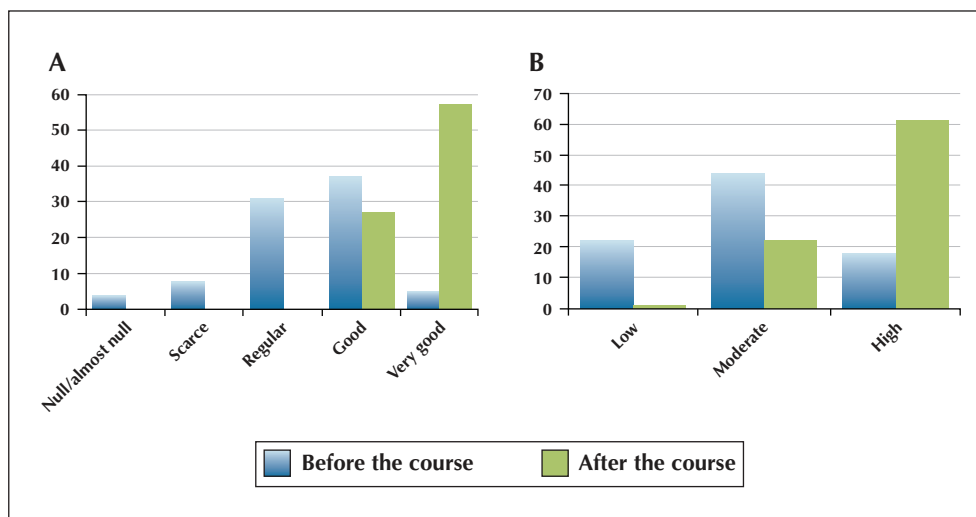
**Figure 3.** Participants' evaluation of the course regarding the level of difficulty perceived based on different predefined items.

prompted to send their answers, this was not mandatory. Eighty-five out of 129 participants who finished the course completed the questionnaire (66%).

The analysis was anonymous and included the participants' feedback from the five courses. Summarizing the main results, 68% of students found the online methodology easy to access and 77% rated the content with moderate complexity (figure 3). Most students had devoted less than six hours per week, although half of them found that it was moderately difficult to deal with the time necessary to accomplish the proposed tasks in a timely manner. Among responders to the questionnaire, 98% would recommend this course to other colleagues, while 99% showed an interest in taking other similar e-learning proposals.

### Adherence to the didactic proposal

A qualitative evaluation was performed in order to analyse the students' participation rate in the forums for each module. Forums were devoted to the open discussion of exercises, particularly those proposed by tutors and mostly based on clinical problems adapted to the module topics and contents. Participation rates varied between 30% and 59% for the different



**Figure 4.** Participants' evaluation of their (A) knowledge and (B) self-confidence regarding epilepsy management, before and after the online epilepsy course.

modules and different courses; a delay in entry to the forum was identified for students, generating an overlap with the subsequent module. Students evaluated forum dynamics as good or very good in 73% of cases regarding their own participation and in 87% of cases regarding the quality of exchange with tutors.

### Cost-effectiveness

ILAE financial support reached a total amount of 22,000 USD, while revenue of 9,155 USD was due to registrations for the five courses. As many students had reduced fees based on their residing country, and no course reached the upper threshold of its potential capacity for participants, revenues have so far not covered the costs. As a result, the net investment was 12,845 USD. The mean investment per student (net ILAE investment/total of students) was 90 USD.

Some estimates of effectiveness can be extracted from immediate evaluations of knowledge and self-confidence. Self-perception of a very good level of knowledge of epilepsy increased from 5.8% before the course to 67.8% afterwards (figure 4). High self-confidence in one's ability to manage patients with epilepsy increased from 21.4% to 72.6% after the course.

### Long-term learning and impact on clinical practice

Regarding the self-perception and knowledge questionnaire, only 28 participants sent their answers (responder rate: 22%). These preliminary results show that 60% still perceived themselves as highly self-confident regarding epilepsy diagnosis and

management (the remaining 40% with moderate confidence in both domains), while all stated that they had significantly changed their practice. A Likert-type scale from 1 (nothing) to 7 (a lot) was offered in order to evaluate improvement in the care of their epilepsy patients. The answers varied between 5 and 7, with a mean value of 6. For knowledge evaluation tests and regarding the diagnostic domain, 52% showed correct notions on ancillary tests and 66% chose correct answers on ictal semiology. Better results were seen in the therapeutic domain, as 76% showed competent decisions in the management of epilepsy in pregnancy, and 81% appropriately selected an AED according to diagnosis. On the other hand, although 81% could identify AED adverse events, up to 55% underestimated their significance. It is remarkable that all showed good responses to questions related to epilepsy management according to the different levels of care.

### Discussion

The online course on epilepsy for primary care physicians in Latin America was shown to be feasible and user-friendly, with good retention and excellent approval rates among those taking the final examination. Our main goal of increasing knowledge and competence in epilepsy management has been reasonably achieved according to the available outcome measures. In a wider perspective, this can be considered as a small step to decrease the educational gap and thus, treatment gap.

Reducing the therapeutic gap is a major challenge that can only be achieved by the convergence of interests

and actions of national healthcare authorities, medical and education institutions, health care professionals, patients, and pharmaceutical industries. As challenging as it appears, this should not preclude us from attempting to close the therapeutic gap and all possible avenues should be explored. The educational gap is one of the major components of the treatment gap, and includes both medical training and community-based education. Reducing the effects of this “educational gap” in low- to middle-income nations, as well as rural and remote areas, is one of the main challenges in extending the benefits of technology-mediated education to a worldwide audience (Ellaway and Topps, 2009).

Distance learning is still under-used but is one of the most attractive and coveted modes of training in medicine, within the context of rapid changes in clinical practice which requires constant updating. Advantages of distance learning in medicine include: worldwide (including remote locations) access to quality-assured teaching; adaptability for physicians who are working full-time and have limited time; and cost-effectiveness and time efficiency for both students and tutors, allowing the participation of worldwide renowned teaching staff (Grant and Zachariah, 2009). Regarding tools and strategies for distance learning, one should consider making educational resources freely available, ensuring that they are easy to find (open repository) and carefully designed such that the style of teaching and learning are compatible with cultural and regional differences (Ellaway and Topps, 2009; Mustafa *et al.*, 2013). In this context, different institutions are designing their own virtual campus, as well as specialized repositories of books, papers, guidelines, presentations, and tools for self-learning. Massive online open courses with automatic feedback to the students could be a cost-effective alternative to avoid the need for real-time interaction with teaching staff (Marques and McGuire, 2013). However, we preferred to develop a smaller course with tutorial interaction, which allowed us to apply for CME credits, an additional source of motivation for many participants.

Retention rates for distance learning courses are considered to be higher than those for their traditional counterparts, and are influenced by different variables, including the individuals learning, the tutors, and course features; external locus of control and the fact that some courses were paid for by a third party jointly account for up to 85% of dropouts (Parker, 1999; Bawa, 2016). Attrition rates as high as 90% have been reported for courses in other areas: in medicine, they vary from 10-15% (Montenegro *et al.*, 2008) to around 40% or even higher; mostly courses devoted to undergraduate students. The 90% retention rate for

the present virtual course can therefore be considered a success.

Academic qualifications based on final evaluations of online courses are considered to be better than those based on traditional courses, and the same is true for post-graduate virtual courses compared to those included in undergraduate curricula. It is noteworthy that 15% of those who completed the course chose not to take the final examination. In particular, 95% of those taking the final examination achieved a good performance and thus received their certification. There was a concordance between subjective perceptions of knowledge and the objective results of the final test. Evaluating outcomes following educational interventions remains a challenge, both for traditional and virtual educational initiatives. The evaluations of knowledge and competence were sent at least six months after completion of the course. The low responder rate limits conclusions that could be extrapolated to the entire group of participants, and to future courses. However, as results were relatively homogeneous, some conclusions may be drawn from this experience on the evaluation of long-term impact. First, results obtained during the shorter (six months) and longer (two years) follow-up periods were similar, in support of long-term learning being achieved. Second, the high levels of self-confidence in diagnosis and treatment of epilepsy patients, as well as the extensive impact these levels had on clinical practice, are of significance. Third and last, some topics may require further guidance during the course, such as differential diagnosis of ictal events, timely selection of diagnostic tests in certain settings, and antiepileptic drug adverse events.

Other experiences of epilepsy e-learning have been published, either involving medical students (Bye *et al.*, 2009) or postgraduate health care professionals. The former European Epilepsy Academy started e-learning courses from 2004 with the goal of training neurologists on specific epilepsy issues, within the context of a project to obtain certification in epileptology; results on the efficacy of such courses were published in relation to the Genetics of Epilepsy course (Wehrs *et al.*, 2007).

Educational interventions increasingly need to be timely, efficient, pragmatic, high quality, sustainable, and cost-effective (Rocha-Pereira *et al.*, 2015). The present initiative has strengths and limitations. Language restrictions and technical drawbacks of the first pilot course were amended for the second year, when a dedicated server and a bilingual platform were added. At the final evaluation of the course, most students highlighted the user-friendly format and the level of academic content as strengths of the course.



Regarding limitations, an increasingly significant problem was the timing of completion of tasks, as many students were unable to post their answers before the next module started, thus responses overlapped with the following module. Moreover, students were unable to actively participate in live discussions in the forum, and thus received suboptimal benefit from this tool. Some participants proposed that it might be a good idea to increase the duration of each module, however, increasing the total length of the course was considered by the teaching staff to be a barrier to actually completing the course. Alternative fragmentation of the information into fewer modules of longer duration is under discussion. Active participation in the forums was below staff expectations, but surprisingly, most participants presented a good/very good evaluation of their experience of forum interaction.

Another aspect that merits discussion is that 50% of participants were already either adult or paediatric neurologists, looking to update their training. We ought to be able to reach more general practitioners, family doctors, paediatricians, and ultimately internal medical physicians. Therefore, a significant problem is how to reach our target population, especially those who are not particularly interested in epilepsy or linked to an ILAE chapter. Although this course showed the benefits of inter-institutional collaboration between international organizations and universities, there is an emergent need to improve collaboration with medical associations, ministries of health, and health care providers in order to potentiate actions with common goals.

Our data demonstrate that this online course provides a cost-, resource- and time-effective way to implement a widespread educational experience for physicians in Latin America. Within 40 weeks, we trained 143 and successfully certificated 105 physicians; evaluations for both knowledge and self-perception showed a marked improvement after the course. Individual cost was estimated at 100 USD. Net institutional investment reached just 12,845 USD, allocated over three years, and also covered partial bursaries allocated according to country income level.

Reaching 50 students per course would allow for financial self-sustainability and is one of the major pending challenges; to extend the course to a wider population of practitioners. Offering the course to academic institutions and medical societies, with packages for group registrations, may help to include more participants and thus cover the costs.

An alternative for further cost reduction would be to transform this course into a massive online course (MOOC) with: a self-registration process; stepwise access to didactic material and tasks with predefined, automatic questions and answers; self-application to

sit the final examination; and automatic feedback (according to individual scores) and delivery of certificates. Such a course would offer the benefit of even more extensive temporal flexibility (shorter or longer) and lower costs, however, the quality of the course may decrease due to the absence of personal interaction with tutors. Also, this alternative type of course would probably not reach the quality standards required for accreditation.

The major strengths are represented by the extensive coverage of the Latin American territory (17/19 countries) and its cost-effectiveness, justifying relevance and feasibility for further development of the initiative. Concerning course quality, although the students mostly provided a good evaluation of the modules and online interaction, students' online participation was considered suboptimal by the teaching staff, similar to other e-learning experiences (Wehrs *et al.*, 2007). Periodic renewal of the teaching staff, including younger colleagues who could feel more at ease with the new technologies, as well as better tutorials for both teachers and students, could help to improve interaction. Integrating more teaching materials in video format and other new resources remain pathways to be followed in order to maintain and improve the quality of the course over time. Finally, this course is not free of the intrinsic difficulties associated with distance learning strategies regarding supervision and evaluation of clinical skills and competences.

As an ambitious project in the future, we plan to develop other courses on epilepsy with different topics, levels of complexity, and target populations. Other challenges would be to include the English language as an additional option and to develop stronger follow-up tools as pertinent and reliable outcome measures of educational intervention, in order to adapt our educational programme to the needs of the region. □

#### Supplementary data.

Summary didactic slides are available on the [www.epilepticdisorders.com](http://www.epilepticdisorders.com) website.

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## TEST YOURSELF



- (1) What are the main advantages of e-learning courses?
- (2) What is the main educational value of this e-learning course?

*Note: Reading the manuscript provides an answer to all questions. Correct answers may be accessed on the website, [www.epilepticdisorders.com](http://www.epilepticdisorders.com), under the section "The EpiCentre".*