

Mobile Phone EEG for Epilepsy Diagnosis in Bhutan

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Background

Epilepsy is a disease caused by excess electrical charges in the brain and, when diagnosed properly, can be treated with medications that are not expensive and already easily available in Bhutan. It is estimated that approximately 7,000 people suffer from epilepsy in Bhutan. This is a serious disease. When left untreated, epilepsy can cause severe injuries, car accidents, drowning, as well as long-term brain damage. It also can lead to significant disability; many children with epilepsy are not sent to school and adults might not be able or allowed to practice their occupation. Thus it is imperative it is diagnosed and treated in a timely fashion. However, the currently available technology makes diagnosis and treatment difficult; in Bhutan the diagnostic equipment is not functioning well currently and there are no specialists available to interpret EEG – the most accurate diagnostic tool for epilepsy. EEG interpretation requires many years of training, is complicated, and furthermore does not lend itself to a providing care to rural populations – as it cannot easily be moved and requires patients to travel to a center with the equipment.



Traditional EEG: requires a computer, many wires, complicated head placement, glue

When someone has a seizure in Bhutan, it is frequently witnessed by family members or friends, but cannot be diagnosed and characterized by EEG measurement, which makes it difficult for a physician or healthcare worker to distinguish what type of epilepsy the patient has – and whether or not epilepsy is even the correct diagnosis. Bhutan has a high uptake of mobile technologies in the general population (>90% of the population), and a strong network of primary health care provision.

Mobile EEG Machine for Bhutan

We have developed a tool at Harvard University along with colleagues in Denmark to facilitate diagnosis of epilepsy in rural settings and ease the burden on patients. This is an innovative technology that will likely be extremely beneficial for epilepsy patients in Bhutan as well as many other countries worldwide. This new technology is much more mobile, using mobile phones for interpretation, and simple headsets instead of complicated wires and glue.

The new device is portable so that it has great potential to reach rural populations in Bhutan. It is also comfortable and easy-to-use so that patients that need longer term monitoring, such as during sleep, will likely be able to do that in their own home instead of having to stay in the hospital overnight. Lastly, it uses a technology that means it can be interpreted more easily. Amongst its main applications, the test can help confirm the diagnosis of epilepsy, distinguish the type of epilepsy and therefore help determine the best treatment.



The New Device Uses a Headset and Mobile Phone – No Computer is Needed

The Project Plan

We have been awarded a grant for this project, to be split between Canada/the United States and Bhutan, pending approval from Bhutan. This funding comes from the Canadian Government and is for an initiative to improve health worldwide. The initiative was developed as a model similar to the Gates Foundation and is meant to support innovative and collaborative projects between Canadians, Americans, and doctors from around the world to focus on improving healthcare of the underserved groups related to brain disorders in developing countries. This will be a two-year project and with potential for extension if it proves to be successful in the initial stages. Bhutan will, of course, be provided with diagnostic tools through this grant that they will be able to keep permanently.

We aim to create two simultaneous arms of the initiative in which we will be examining this new EEG technology in the United States at Massachusetts General Hospital (MGH), Harvard Medical School (HMS), Boston as well as the National Referral Hospital in Thimphu. As a first step, we will have patients who have a question of epilepsy use both the new and “old” headsets, and learn if the new one is as accurate as the traditional computer-based one.. We will then compile all of the information collected in Bhutan and the USA and examine how this technology can best be used, how to spread it to other parts of Bhutan, and how to offer it to other countries.

We believe that Bhutan represents an ideal site for the project together with MGH/HMS for several reasons. Firstly, (1) we are excited to work with Dr. Chencho and Dr. Dambar as they are enthusiastic, extremely knowledgeable, and has been tracking patients with epilepsy here in Bhutan for many years. It is of great importance to us to work together with local physicians and healthcare workers and to ensure that they learn to use the technology in such way so they can implement it in the future independently. Secondly, (2) with the high proportion of rural population in Bhutan, we believe that if it can be developed here in Bhutan, it can most likely be implemented and offered to others in other countries who also live in rural environments. Thirdly, (3) the rich cultural history of Bhutan would allow for

development of a software interface that reinforces traditional Bhutanese culture within a modern technological framework. We hope to help other countries – also with rich traditions and cultures at risk of being superseded by other more media-prominent cultures – develop programs that are culturally-reinforcing. We aim to provide a model in which physicians, healthcare workers, and artists can collaborate between two cultures, learn from one-another, and create long-term relationships for future exchanges.



The Device Incorporates Culturally-Sensitive Software Design and Instruction

With Bhutan's valuable participation, this product can create a model of collaborative discovery, instead of the traditional model of developing technology in wealthier nations and then disseminating it after-the-fact. We are hoping that collaborations with scientists, physicians, healthcare workers, patients, and technologists in Bhutan will allow us all to work together to produce the most useful tool possible, help Bhutanese healthcare workers develop skills and expertise, and lead to the improvement of the lives of many people around the world. We hope that this will also provide a framework and training for Bhutanese scientists and healthcare workers so that they may engage in similar scientific investigation in future years.