Diffusion of Innovation: Enhancing the Dissemination of the Ponseti Method in Latin America through Virtual Forums

Abstract:

This ethnographic study evaluated the use of low-bandwidth web-conferencing to enhance diffusion of a specific best-practice, the Ponseti method to treat clubfoot, in three economically diverse countries in Latin America. A ‘Ponseti Virtual Forum’ (PVF) was organized in Guatemala, Peru and Chile to examine the influences of economic level and telecommunication infrastructure on the effectiveness of this approach.

Across the three countries, a total of 14 different sites participated in the PVFs. Thirty-three Ponseti-trained practitioners were interviewed before and after each PVF, which included interactions with a Spanish-speaking Ponseti method expert. Semi-structured interviews, observations, and IP address data were triangulated and analyzed. The results demonstrated that 100% of the practitioners rated the sessions as very useful and that they would use this approach again. The largest obstacles to using PVFs were financial (7 out of 9 practitioners) in Guatemala; a lack of equipment and network access (6 out of 11) in Peru; and the organization and implementation of the conferences themselves (7 out of 9) in Chile. This study illustrates the usefulness of Ponseti Virtual Forums in Latin America. Health officials in Peru are currently developing a large-scale information session for traumatologists about the Ponseti method, while practitioners in Guatemala and Chile are organizing monthly scholarly meetings for physicians in remote areas. This initial feedback suggests that low-bandwidth web-conferencing can be an important vehicle for the dissemination of best-practices such as the Ponseti method in developing countries.

Introduction:

Congenital idiopathic clubfoot occurs worldwide in up to 1-8 per 1000 children, making it the most common congenital musculoskeletal birth defect. Clubfoot is characterized by plantar flexion of the foot at the ankle joint (equinus), inversion deformity of the heel (varus), and medial deviation of the forefoot (adductus) with increased foot arch (cavus). It can occur in an otherwise normal child (idiopathic) or as a part of a syndrome. It occurs twice as often in males than females and up to 50% of all cases are bilateral.
Traditionally, clubfoot has been treated with surgical interventions that are very expensive and highly technically demanding. In addition, this type of operation has many disadvantages including up to a 50% complication rate and, when complications do occur, they are very difficult to treat\textsuperscript{11}. In developing countries, where resources and health care professionals are very limited, surgery is not always a feasible option and this is one of the factors leading to many children not receiving treatment. Globally, neglected clubfoot is the most common cause of physical disability among musculoskeletal birth defects\textsuperscript{11}.

Importantly, a method of clubfoot treatment developed by Dr. Ignacio Ponseti at the University of Iowa in 1963 has demonstrated tremendous success in correcting this deformity in many countries\textsuperscript{13}. This simple, effective, quick and economical method is based on a very specific manipulation and casting technique, and requires a minor procedure, a percutaneous Achilles Tenotomy, which can be performed under local anesthesia in the office\textsuperscript{11,19}. A foot abduction brace is worn at night for a few years to prevent relapses\textsuperscript{11}. The Ponseti method allows complete clubfoot correction in over 95% of patients in as short of a time as 16 days\textsuperscript{2,3,4,6,7,9,10,13,17,21}.

To date, education programs have been successfully implemented in more than 50 nations\textsuperscript{8,11}. However, despite these efforts, there are still barriers to the dissemination of this innovation in developing countries\textsuperscript{5}. When the current diffusion of the Ponseti method is analyzed using Everett Rodgers ‘Diffusion of Innovation’ model, it can be concluded that the progress made so far is due to ‘early adopters’ and some ‘early majority’ that have accepted the method\textsuperscript{15}. This progress mirrors growth in the United States prior to the development of internet-based support groups of parents sharing their children’s successes being treated with the Ponseti method\textsuperscript{11}. This internet-based sharing led to information exchange and worldwide growth of interest in the Ponseti method\textsuperscript{22-35}. However, while the demand from parents to treat their children with the Ponseti method increased, the need for well-trained Ponseti practitioners also increased. While many practitioners have been formally trained by the Ponseti International Association, many are practicing the method with limited training. The use of the Ponseti method by those who are untrained, or have limited training, may result in sub-optimal results that counteract the positive patient interest generated by the internet-based support groups. Poor treatment from untrained practitioners can disseminate through the same Internet based
support groups and reduce patient confidence and demand for the method. Maintaining well-trained, high profile early adopters/practitioners of the Ponseti method is a key step in maintaining successful diffusion of this important ‘best practice.’

The success of the Internet in spreading the Ponseti method to parents of children with idiopathic clubfoot suggests that the Internet may also be a means to enhance practitioner knowledge of the Ponseti method, helping maintain optimal results, and therefore fueling patient demand for the method. Collaboration between the Global Health Campus of the University of Iowa College of Public Health and the Ponseti International Association has led to the creation of Ponseti Virtual Forums (PVFs); a web-conference-based electronic collaborative workshop for Ponseti practitioners to exchange information about difficult cases, patient follow-up, public health measures, and any other pertinent information.

Elluminate Live! is a low-bandwidth videoconferencing software program which is relatively easy to use, can text chat, can display multimedia, and supports live video streaming on a low-bandwidth internet connection. It can serve as the ideal catalyst for high-yield information diffusion. The Global Health Campus network through the University of Iowa College of Public Health utilizes this software to deliver health information to more than 600 Internet sites in over 60 countries. PVFs between the Ponseti International Association Providers and novice/intermediate practitioners in developing countries should foster a teaching environment to include different levels of practitioner experience. Eventually, PVFs have the potential to create a self-sustainable regional network for collaborative reinforcement of the Ponseti method. The development of this network of well-trained Ponseti practitioners is imperative for the advancement of the Ponseti method in developing countries.

This study analyzes the introduction of Ponseti Virtual Forums in Latin America to support the diffusion of the Ponseti method. Three specific countries were chosen to understand the effect of GDP and telecommunication infrastructure. A GDP analysis from the CIA World Factbook suggested that Guatemala ($5,300 per capita), Peru ($8,500 per capita) and Chile ($14,900 per capita) would provide a reasonable spectrum of economic development in Latin America. The telecommunications infrastructure, measured through percentage of the population with access to the Internet reflects GDP: Guatemala with 14.76%, Peru 24.12% and Chile 32.86%.

Materials and Methods
Semi-structured interviews, observation, and IP address data were compared in an ethnographic study in Guatemala, Peru and Chile. Ponseti-trained practitioners were contacted through email prior to observation and interview. Interviews were conducted at each practitioner’s respective clinical facility. This study was previously approved by the University of Iowa Institutional Review Board. Informed consent was obtained by having interviewees review a consent sheet prior to the interview. No names were attached to the data and the data was kept in a secure location.

Each practitioner was first briefly introduced to the web-conferencing program (*Elluminate Live!* ) and asked to complete an interview regarding the potential of the program. A virtual conference with a Spanish-speaking expert in the Ponseti method was then scheduled in each country using the web-conferencing system. After this web-conference, practitioners were asked to complete a questionnaire about the effectiveness of their experience.

The interviews were conducted in Spanish by one of the authors (AJ). The interview data was then coded manually and sorted into themes. The validity of the data was confirmed via triangulation using a combination of on-site observations and IP address data, which was compiled on the University of Iowa Global Health Campus network. A team approach was used to draw conclusions about the collected data.

Observation of the telecommunication infrastructure of each facility, interactions with families of clubfoot patients, and observation of individual physicians’ treatment of clubfoot took place in the following hospitals in Guatemala: IGGS (semi-private, Guatemala City); San Juan de Dios (public, Guatemala City); Clinica Privada de Dra. Ana Zambrano (private, Guatemala City); San Juan de Dios (public, Quetzaltenango); Clinica Privada de Dr. Carlos Payeras (private, Quetzaltenango).

Observations in Peru took place in the following clinical facilities (all in Lima, Peru): Hospital Emergencia de Pediatria (public); Hospital Edgardo Rebagliati (public); Hospital San Juan de Dios (public).

Observations in Chile took place in the following clinical facilities (all in Santiago, Chile): Hospital Roberto del Rio (public); Clinica Davilla (private); Hospital Luis Calvo MacKenna (public); Instituto Teleton (public); Hospital San Borja (public); Hospital Exequiel Gonzales Cortez (public); Clinica Servet (private); Clinica INDISA (private); Hospital Felix Buhnes (public); La Clínica Privada de Dra. Dalia Sepulveda (private).
Results

Thirty-three total practitioners were interviewed. This number included 9 from Guatemala, 11 from Peru, and 9 from Chile who responded to the pre-PVF survey. Four practitioners from Guatemala, 1 from Peru, and 8 from Chile responded to the post-PVF questionnaire. Some practitioners responded to both the pre- and post-surveys while some only responded to the pre-surveys. One hundred percent of those interviewed (33 of 33) stated that they would like to continue use of the web-conferencing approach and that training sessions with a Spanish-speaking expert in Ponseti would be very useful for their practice. The most common reasons cited for the continued use of PVFs in the future were: to share successes and failures with other Ponseti-practicing physicians; to discuss complicated cases; and to improve personal technique by communicating directly with Ponseti experts.

Guatemala

Success: In Guatemala, practitioners gave PVFs an average satisfaction rate of 4.75 out of a possible 5, the highest of any country introduced to PVFs (Figure 2). One intra-country session was conducted between Guatemala City, the capital and Quetzaltenango, a city in the highlands. Another session was successfully completed between the University of Iowa Orthopaedics Department and Guatemala City. Remarkably, these sessions were completed using a borrowed computer and a 56k mobile-broadband card paid for by a Guatemalan practitioner. Practitioners were very impressed with the amount of media exchange they were able to achieve using a simple portable cell-phone modem.

Barriers: Predictably, the largest barrier cited in Guatemala was financial (7 of 9 practitioners). This was despite the fact that each practitioner knew they would not have to pay for the web-conferencing service. The majority of doctors don’t own personal computers and the computer services at hospitals are limited and out-dated. Six of 9 practitioners cited computer access as a barrier to using PVFs. Six of 9 also stated that the actual implementation of the forums was a barrier. Convincing hospitals to allocate time and space for events such as this may be a challenge and was addressed by at least one physician. Finally, in addition to the financial barriers faced by Guatemalan doctors, 4 of 9 cited network access as a barrier to using PVFs. In Guatemala, the percentage of average monthly GDP per capita spent on the Internet is 21.4% (Figure 1). This statistic is
particularly alarming when compared to the typical United States average monthly GDP per capita spent on the internet of 0.5%

The majority of practitioners cannot afford regular Internet service, and most access it through internet cafes.

Future Use: Practitioners were asked how they would consider using the web-conferencing system. Nine of 9 indicated they would use a PVF to consult on cases with their fellow colleagues in other parts of the country. Seven of 9 wished to use PVFs to learn and master the technique of the Ponseti method. Seven of 9 thought PVFs would be useful to share experiences, including successes and failures, so others practicing the method would not make similar mistakes. Five of 9 thought that the use of PVFs would specifically increase the acceptance of the Ponseti method in Guatemala. Three of 9 mentioned that they would like to use PVFs to help document the use of the technique in the country of Guatemala.

Peru

Success: One successful PVF was held between Peru and the University of Iowa Department of Orthopaedics. Due to a miscommunication at the University of Iowa, the first PVF was cancelled. Only one practitioner was able to attend the second PVF due to it being rescheduled. However, this practitioner gave it a 4.25 satisfaction rating out of 5 (Figure 2).

Barriers: The largest obstacle encountered in Peru was equipment and network access (6 of 11). Similar to Guatemala, computer access is limited within hospitals and wireless connections are only available in private hospitals. Five of 11 practitioners cited finances as an obstacle. The percentage of average monthly GDP per capita spent on the internet is 19.2%, not much less than Guatemala (Figure 1). Doctors mentioned that they face a dilemma, they need to be seeing the overwhelming amount of patients that are at their offices and don’t have the time to attend a training session for the Ponseti method, despite understanding that some training could occur through a PVF. The infrastructure of Peru is much more developed than in Guatemala, however the number of Ponseti practitioners is limited. Not a single practitioner knew of other Ponseti-trained practitioners outside of the capital city of Lima.

Future Use: Eleven of 11 Peruvian physicians wished to use PVFs to perfect their technique in the Ponseti method. Nine of 11 wished to use the method to learn more about the method. Seven of 11 wished to use it to consult with other physicians
about specific cases. Seven of 11 also wished to use PVFs to share experiences regarding patients. Finally, 5 of 11 specifically stated that the use of PVFs will be important in spreading the Ponseti method throughout the country.

**Chile**

*Success:* The first intra-country conference between Santiago, Chile and Antofagasta, Chile, a city in the north, failed because of an unexpected surge of orthopaedics patients in Antofagasta during the scheduled PVF. However, the most successful PVF took place soon after between Chile and the University of Iowa Orthopaedics Department. This PVF included 18 different computer connections among 7 different hospitals in 5 different cities within Chile. The participants included both orthopaedic surgeons and their residents. The satisfaction of this PVF was 3.52 out of 5 (Figure 3).

*Barriers:* The largest obstacles to using PVFs in Chile were the implementation of the PVFs themselves (7 of 9 practitioners). Chile is now considered a developed country and many doctors admit reluctance to take advice from the United States. They do not want to be treated like a country that needs help to be dug out of poverty. The infrastructure in Chile is vastly improved compared to the infrastructure in both Guatemala and Peru. Only 2 of 9 practitioners cited equipment access as being a problem and only 1 of 9 believed network access may hinder the success of PVFs. The percentage of average monthly GDP per capita spent on internet was only 6.1%, far lower than both Guatemala and Peru, although still remarkably higher than the United States (Figure 1).

*Future Use:* Seven of 9 practitioners interviewed stated that they would use PVFs to share their experiences with other practitioners. Five of 9 believed they could use the web-conferencing system to consult regarding specific cases with other physicians. Five of 9 wished to use it to perfect their technique of the Ponseti method. Three specifically stated they would like to use web-conferencing to help document their work with the Ponseti method. Two of 9 specifically mentioned the use of PVFs in diffusing the Ponseti method around the country. One of 9 wanted to receive updates about the method using PVFs.

**Public Awareness**

Past success of the dissemination of the Ponseti method has been based on an increase in patient demand through internet-based support groups. While PVFs have shown to enhance diffusion of the Ponseti method among physician
practitioners, this same internet-driven web conferencing can be applied to the education of the general public of the Ponseti method.

Centro Ann Sullivan de Peru (CASP) is a non-profit organization in Peru that works with children of different abilities including autism and Down Syndrome. The Center has been utilizing web-conferencing to provide distance education for parents, teachers, and children since 2008. They have educated over 10,000 people in over 12 different countries using their network of auditoriums and facilitators. In collaboration with the University of Iowa Department of Orthopaedics, CASP assisted in organizing a PVF administered to the general public. This lecture appealed to general health practitioners, students of healthcare, as well as parents and friends of children with clubfoot. The initial session was broadcast to the cities of Lima (12 attendees) and Mancora (20 attendees). The 12 who attended in Lima completed a similar questionnaire assessing the Ponseti Virtual Forums.

Nine of the 12 who responded were fully satisfied with the PVF, 1 was not fully satisfied and two did not respond to the question. The overall satisfaction with the event was rated 3.92 out of a possible 5. Those who attended were very satisfied with the amount of information they gained from the lecture and suggested that further advertising and expansion of these forums would be beneficial. Examples of specific information gained included parents understanding how to use their brace, physical therapists learning how to advise their clubfoot patients, and physicians understanding specific details about the method. Participants particularly enjoyed the presentation format, which included a PowerPoint presentation with video, photos, and an interactive question and answer session.

**Discussion**

Each of the three countries visited presented remarkably different challenges. However, while each was economically, geographically, and culturally diverse, the PVFs could succeed in each individual country. The self-sustainable and locally-driven nature of PVFs allows for country-specific uses. For example, in Guatemala where practitioners have only been recently introduced to the Ponseti method, they wished to organize a monthly scientific meeting between all practitioners in which they could discuss experiences with the method, challenging cases they have had, and any other pertinent issues. In Chile, where practitioners have a well-established Ponseti network, practitioners similarly wished to organize a PVF on a regular basis.
However, in Chile the Sociedad Chilena de Orthopedia y Traumatologia (SCHOT) wished to use PVFs at their annual meetings to discuss their experiences with the Ponseti method as well as other orthopaedic advances. Finally, in Peru, where the largest obstacle is a lack of trained practitioners, practitioners suggested utilizing PVFs to contribute to larger scale Ponseti training conferences using a similar framework to what CASP used to create their public awareness PVF.

The Ponseti method to treat clubfoot was invented over 50 years ago, however, despite the best efforts of orthopaedic surgeons around the world and the obvious benefit of the Ponseti method, this best-practice has not yet cemented a place in the treatment for clubfoot in developing countries. While many orthopaedic surgeons are at the forefront of this change, there are still many who are not using the Ponseti method for a variety of different reasons. Much of this is simply due to both a lack of knowledge about the method that includes both practitioners and the general public. Ponseti Virtual Forums have the ability to address these issues in both areas.

The orthopaedic surgeons who have already adopted this change are known, through Rodgers’ Diffusion of Innovation theorem, as ‘early adopters.’ They are typically innovative, constantly the leaders of their respective fields and seek out change independently and unprompted. After witnessing the success of the ‘early adopters,’ those who adopt the method are called the ‘early majority.’ Finally, the ‘late majority’ and ‘laggards’ eventually accept the innovation but only after much prompting and often only after it is a required change. According to Rodgers, a potential means to expedite the diffusion of innovation is through increasing communication between the different groups of adopters. Although it is known in the academic world that the Ponseti method to treat clubfoot is the ‘gold standard’ best-practice clubfoot treatment, many orthopaedic surgeons in developing countries still have doubts. These doubts are often due to a lack of knowledge about the method, poor personal outcomes with the method due to improper technique, or a surgeon’s preference for highly-skilled technical procedures versus the simply, non-surgical Ponseti method. Direct communication among practitioners, enhanced with video, photos, and audio, may provide an easy feasible way to dispel falsehoods about the Ponseti method.

PVFs allow a level of communication between orthopaedic surgeons that simple email or phone conversation cannot provide. The communication between Ponseti practitioners can facilitate individual mastery of the method by allowing
communication of doubts among different levels of ‘adopters’. The Internet should transcend the various geographic barriers that have previously made this form of instant communication impossible. As a matter of fact, in the developed world, web-based conferencing is already being utilized. The *Elluminate Live!* program simply allowed Ul to use this technology to reach medical professionals in the low-bandwidth arena of developing countries.

The potential of PVFs in Latin America is supported by the opening and interest in information technology. Guatemala experienced the highest satisfaction rate of any country introduced to the Ponseti Virtual Forums which may be due to the lack of internet resources in the country. The PVF allowed instant communication with Ponseti practitioners on a different continent to take place on a single 56k cell-phone modem. The high satisfaction rate may correlate to the novelty of the virtual forum in a place where the internet is yet to become ubiquitous. However, despite the currently inadequate telecommunications infrastructure in Guatemala, the country has experienced unprecedented growth in Internet connectivity over the past decade (3408%) when compared to Peru (223%), Chile (376%) and the United States (152%)36.

This remarkable internet growth rate is not limited to Guatemala. Numerous developing countries around the world have experienced dramatic increases in internet use in the past decade. The entire continent of Africa has averaged 2357% growth while Asia (621%) and Europe (352%) are also experiencing growth. As the Internet continues to grow, specific high-yield education tools such as the PVF should mirror that growth as well.

**Conclusion**

Although there are many specific challenges to the widespread implementation of Ponseti Virtual Forums in Latin America, the initial success of PVFs suggests that low-bandwidth web-conferencing may be used to enhance the worldwide diffusion of best-practice medical knowledge. The ease of use, low-bandwidth requirements, and the ability to have multiple simultaneous connections may make web-based conferencing an important player in the spread of medical knowledge around the world.

**References:**

3. Lu, Ning, Zhou, Li, Da, Ouyang, Xiaohua, Duan, Jiang, Xiyue, Zhou. "From Casting to Casting: Impact and Initial Barriers to the Ponseti Method of Clubfoot Treatment in China.”
Figure 2. Ponseti Virtual Forum satisfaction by country. Practitioners satisfaction with PVF after first use with program reveals highest satisfaction in Guatemala (4.75/5.00), second in Peru (4.25/5.00), and lowest in Chile (3.52/5.00).

Figure 3. Barriers to Ponseti Virtual Forums by country. The highest rated barrier in Guatemala was financial (7 of 9 practitioners); the highest in Peru was equipment and network (6 of 11 practitioners); and the highest barrier in Chile was the actual implementation (7 of 9 practitioners).