Early results from a ‘train the trainer’ approach to Ponseti method dissemination in a developing country: A case study of Sri Lanka

Abstract:

Introduction:
The Ponseti method has been established as the standard of care for the treatment of clubfoot in many developed countries for its utility, cost-effectiveness, and efficiency. However, despite its being described as the gold-standard clubfoot treatment method, there are still areas of the world bereft in formal training in the Ponseti method. This study analyzes a ‘train the trainer’ approach, specifically in the island nation of Sri Lanka, as a model for the future dissemination of the Ponseti method throughout the developing world.

Methods:
A rapid ethnographic study design that included interviews, focus groups, and direct observation of 162 patients and healthcare practitioners directly involved with clubfoot care was conducted.

Results:
The average patients interviewed were 75.4 weeks old (SD = 149.2), traveled 45.2 kilometers (SD = 49.8) to receive their care, and received 4 casts (SD = 2.2) at the time of interview. Since the initiation of the ‘train the trainer’ system, clubfoot clinics reportedly grew from 6-7 patients per week to over 60 patients per week. The majority of this growth was attributed to word of mouth. Major barriers to the method included casting materials, bracing materials, and a lack of a dedicated area to conduct tenotomies under local anesthesia. Of note, cost was not cited as a major barrier.

Discussion:
Early evaluation suggests great utility of the ‘train the trainer’ method – especially regarding an increased patient demand for treatment. However, further studies are necessary to understand the long-term utility of this training methodology.
Introduction:

The Ponseti method is a well-established clubfoot treatment in developing countries due to its efficacy and cost-effectiveness\textsuperscript{1-16}. Clubfoot, which is most often found in the developing world, is a deformity that can cause debilitating disability if left untreated\textsuperscript{17-22}. Furthermore, the economic impact of untreated clubfoot on a nation’s economy and labor force is profound\textsuperscript{23,24}. Although many barriers exist to enhancing global healthcare delivery, appropriate education of healthcare providers is repeatedly cited as a major barrier\textsuperscript{2,13,25}.

To date, educational programs have been successfully implemented in over 50 countries\textsuperscript{1-16}. However, despite these efforts, there are still areas bereft of appropriate clubfoot care\textsuperscript{13,26}. The Ponseti method has traditionally been taught in weekend-long hands-on workshops\textsuperscript{2,4,7,13}. However, this method of teaching leaves the country without a dedicated Ponseti expert despite many capable of providing the treatment\textsuperscript{13}.

A 'train the trainer' approach has been used in Armenia, Brazil, Croatia, Hungary, Nigeria, Sri Lanka, Bosnia, Cameroon, Ecuador, Liberia, Pakistan, and Trinidad amongst other countries as part of an effort train more Ponseti practitioners. This method utilizes a country’s existing healthcare infrastructure to establish dedicated clubfoot clinics.

Here, we analyze the country of Sri Lanka, and its progress since its participation in the ‘train the trainer’ Ponseti program. Several factors make Sri Lanka a model nation to study the effects of the 'train the trainer' program. Sri Lanka has a GDP per capita of $5700, currently 146\textsuperscript{th} in the world, making it an adequate representative of an under-resourced country\textsuperscript{27}. Sri Lanka also has a high population density as the most recent census revealed a population of 21.5 million people who inhabit an island slightly larger than West Virginia\textsuperscript{27}. To date, no formal clubfoot training has been documented in Sri Lanka prior to the current training regimen – likely secondary to the recent conclusion of the island’s 26-year civil war\textsuperscript{28}. In addition to detrimental developmental effects of the civil war, the nation was devastated by the Boxing Day Tsunami of 2004\textsuperscript{26}. Post-tsunami orthopaedic analysis revealed a high need for clubfoot practitioners due to high rates of untreated clubfoot\textsuperscript{26}.

On July of 2012, two Sri Lanka physicians participated in a 3-week training course conducted by the University of Iowa Department of Orthopaedics. These physicians mastered the Ponseti method through direct observation of trained practitioners and practice on clubfoot models. The progress of their work after their participation in the training was evaluated after 5 months in order to give practitioners adequate time to initiate changes in their practices.

This paper is a qualitative study that describes the successes and barriers to the ‘train the trainer’ approach using Sri Lanka as a model country.

Methods:

A rapid ethnographic study design was utilized. Data collection utilized a variety of qualitative methods including interviews, focus group discussions, and
direct observation (Table 1). Multiple data collection tools were used to gather and verify data in order to increase the validity of the study through data triangulation. Participants included staff and patients from: Lady Ridgeway Hospital for Children (LRH), the largest pediatric hospital in the nation; Colombo North Teaching Hospital (CNTH), a large teaching hospital for Colombo’s north district; and a private orthopaedic clinic at Leesons Private Hospital (LPH). Interviews with additional key informants included the project director of Sri Lankan School of Prosthetics and Orthotics (SLSPO), the manager of the Lady Ridgeway Hospital Orthotics program, and an Ayurvedic (traditional/alternative healing) physician who has treated clubfoot.

Direct observation of clubfoot clinics occurred at each LRH, CNTH, and LPH. Observation of the initial clinical visit by the physician, Ponseti manipulation, cast application, bracing follow-up appointment, and tenotomy procedures were observed. Additionally, the construction of the brace itself was observed. Brief parent interviews were conducted of each patient observed. These interviews collected the patient’s age, distance traveled from home to the hospital, number of casts applied, and relapse history. In-depth interviews were conducted with select parents. In-depth interviews collected information on the current and past treatment plans of the patients, challenges and barriers they have faced with clubfoot treatment, parent satisfaction with the correction, and their experiences with the brace. Effort was made to include interviews from patients at each stage of the treatment including casting, bracing and relapses.

Interviews were also conducted of the consultant orthopaedic surgeons, medical officers, and nursing staff at the clubfoot clinics. Interviews with medical practitioners solicited information on the state of clubfoot management in Sri Lanka, training methods used, perceived barriers from the patient’s perspective, changes in clinics post-Ponseti training course, and barriers to further development of Sri Lanka’s clubfoot treatment program. Interviews began with open-ended questions and the interviewer guided the interview if further questioning was needed.

Two different focus groups were conducted. One focus group consisted of the two medical officers who run the clubfoot clinics at LRH and the other consisted of two nursing staff who apply the casts at LRH and CNTH. The interview questions were open ended and the interviewer probed for more information when necessary. The focus group interview for each the medical officers and nursing staff solicited information on the set-up of the clubfoot clinics, how they were trained, and the change in clubfoot clinics over time.

Interviews and focus groups were conducted in English when possible, however, when required, a Sinhala translator was used. The Sinhala translator was a native of Sri Lanka whose mother tongue is Sinhala, but was also fluent in English. No interviews were conducted in Tamil, a language spoken by 18% of the population, most notably in the north of the country. Notes from focus groups and interviews were immediately recorded in English and transcribed to an electronic record on Microsoft Excel within 24 hours. Notes were reviewed between authors AJ, SW, and DT to ensure validity and accuracy. Electronic notes were then organized into themes based on the similarities of responses. A team approach was used to draw conclusions about the organized data.
This study was granted exemption from consent by the Institutional Review Board of the University of Iowa. No patient or parent names were collected and the data was stored in a secured location.

Results:

Sri Lankan Healthcare System:

In order to provide context to this report, a brief overview of the Sri Lanka healthcare system and orthopaedic surgeon training program will be outlined. Healthcare in Sri Lanka is provided by the government free of charge to the people. In addition to the government run healthcare system, there also exists a private system which supplements the public system for those with financial means.

There are 7 different medical schools in Sri Lanka which each produce about 150 graduates per year. The MBBS degree, equivalent to the MD degree, is awarded after 5 years of medical school. After the MBBS, a one-year internship is required. If the graduate chooses to pursue practice at this point, he or she can practice as a medical officer, however, to become a consultant specialist, he or she must pursue post-graduate medical education. Post-graduate orthopaedic training is 6 years of advanced training followed by a required international training period of 1-2 years.

Upon their return to Sri Lanka and obtaining board certification from the Post-graduate Institute of Medicine, most graduates are placed by the government for 4 year posts at hospitals around the country if they do not chose to resign from the government system. There are a limited number of ‘end posts,’ which allow the applicant to remain at that post until they retire without having to re-apply. ‘End posts’ are highly competitive and generally only received near the end of a career.

Currently, Sri Lanka has 44 practicing orthopaedic surgeons\textsuperscript{28}. With a population of 21.5 million, this leaves nearly 500,000 patients per orthopaedic surgeon\textsuperscript{27,28}. The Sri Lankan Orthopaedic Association (SLOA), the official orthopaedic association of Sri Lanka, meets annually every October for their scientific session.

Current Clubfoot Management in Sri Lanka:

Lady Ridgeway Hospital:

Lady Ridgeway Hospital (LRH), located in Colombo, Sri Lanka, is one of the largest children’s hospitals in the world\textsuperscript{29}. It currently has 901 pediatric beds and serves 2500-3000 children per day. It functions as Sri Lanka’s national referral center for all pediatric care on the island.

LRH has been running a clubfoot clinic for eight years since 2004. The clinical model now used by LRH ensures each child is seen directly by the consultant orthopaedic surgeon. The surgeon manipulates the child’s foot using the Ponseti method and determines the child’s current treatment plan (ie. more casting, tenotomy, surgery, etc.). If the child is due for casting, he or she is taken to the cast room where two teams of three nurses place Ponseti casts on the children. If the child is being treated for a relapse, a medical officer with post-graduate medical training (equivalent to an MD degree) will place the cast. Several posters with
information on the Ponseti method are displayed in the cast room. The cast room is large, with room for several beds and allows a team of health professionals to place the casts.

At LRH, each child was also seen every month for a follow-up bracing appointment. At this appointment, the medical officer observed the child wearing the brace. The patient’s clubfoot correction was also observed and appropriate clinical actions were taken if necessary. The patient and parent were asked if they had any problems with the bracing and further brace education was provided at this point.

**Colombo North Teaching Hospital:**

The Colombo North Teaching Hospital (CNTH), located in North Colombo, is one of the largest hospitals in Sri Lanka. The hospital’s catchment area includes the districts of Gampaha, Puttalam, and Kurunagala; a population of over 6.5 million people. CNTH serves both adults and pediatrics and is in the process of building a dedicated orthopaedic’s building.

The clubfoot clinic in Colombo North is a recent addition to the orthopaedic services at CNTH. Similar to LRH, the CNTH model allows each child to be seen directly by the consultant orthopaedic surgeon who manipulates the child’s foot and determines the treatment plan. A separate room is available for casting, which is placed by nursing staff, medical officers, and the consultant orthopaedic surgeon – all of which have been trained in the Ponseti method. A poster, printed from the internet, describing the Ponseti method is displayed in the cast room (Figure 1). The cast room is a very small private room.

**Leesons Private Hospital:**

Leesons Private Hospital (LPH) is located in Ragama, Sri Lanka less than a mile away from the Colombo North Teaching Hospital. The same consultant orthopaedic surgeon who runs the Colombo North Teaching Hospital holds a private clinic at the LPH. Practicing in both a public and private setting is common for Sri Lankan physicians.

There is no formal clubfoot clinic at LPH, however, clubfoot patients are seen and casted during the general clinic hours. Casts are placed by the consultant physician with the help of the nurse. No posters of visual representation of the Ponseti technique are observed in the clinic. The clinic is a small, one room unit, with a physician desk, cast cart, and patient bed.

**Participant Characteristics:**

162 total patients were observed during their clubfoot care (Table 1). 152 (94%) of the patients consented to interview and 45 (28%) consented to an in-depth interview. The majority of the interviews and observations came from Lady Ridgeway Hospital (82%), which treats the highest pediatric population of the hospitals surveyed.

The average age of the children surveyed was 75 weeks (SD = 149 weeks). On average, each had received about 4 casts (SD = 2.6 casts) at the time of the
Most patients traveled about 45 km (SD = 50 km) to receive their clubfoot care. The majority of the patients observed were in the casting stage (66%).

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<th>Table 1. Participant information.</th>
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<td><strong>Brief Parent Interviews</strong></td>
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*Same orthopaedic practitioner interviewed in each location.

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Barriers to clubfoot care:

Casting:

Casting materials were repeatedly cited as a barrier by consultant orthopaedic surgeons, medical officers and nurses. The casting material provided by the government is not a fast-drying plaster of paris. The slower drying time of the casts made it more difficult to achieve the appropriate manipulation with the cast due to the baby’s movement during the casting process. Furthermore, no 2-inch casting material is available. Four-inch plaster of paris were cut in half to achieve the 2 inch length appropriate for casting infants (Figure 1). However, the act of cutting the 4-inch material in half degraded the interior structure of the plaster of
Paris making it more difficult to handle the casting material. This further exacerbated the difficulties encountered with the slow drying casts. The lack of appropriate casting materials increased the amount of clinical time necessary to spend with each patient and decreased the likelihood of achieving an appropriate correction with the cast.

Additionally, the quality of the cotton padding provided by the government was very poor, especially at CNTH. The cotton was irregular in thickness making appropriate padding difficult. Furthermore, the cotton did not tear very easily making its application more difficult and cumbersome. Several children presented with skin abrasions and pressure sores from the casting application.

Some patients required synthetic casting if they were older or had broken previous plaster or paris casts due to excessive movement. However, synthetic casts are not provided by the government so patients were required to purchase these themselves. Most pharmacies which offer the synthetic casts are located near the hospital so a patient can purchase the cast if needed and have it placed the same day. However, occasionally a patient will be sent to the pharmacy to purchase cotton padding, synthetic casting material, or stockings and will return with the wrong supplies provided by the pharmacy.

The stockings placed underneath the cotton and plaster of paris are also not provided by the government. At CNTH, the consultant physicians purchased the stockings themselves. Many of the patients who were treated initially with the Ponseti method reported being satisfied with the casting and correction.

Bracing:

A child is measured for the brace about 3-4 weeks before the consultant orthopaedic surgeon believes the child’s casting treatment will conclude. Braces take about 3-4 weeks to be made. Braces for children who attend the public hospital are provided free of charge (Figure 2). Additionally, when a brace no longer fits a child, they can have another one made for free. Braces for patients who attended a private clinic were available for 3000 rupees (~$25). An average of 3-4 braces are used throughout the child's treatment.

Bracing materials were repeatedly identified as a barrier to clubfoot care. Several parents reported difficulty with brace compliance due to children being uncomfortable while wearing the braces. The government struggles to find a balance between providing free braces that are also comfortable for the child.

Also, a few patients reported being confused about the bracing protocol. At LRH, their questions were easily answered during their one month follow-up, however no follow-up appointment was offered at CNTH. Some patients believed they needed to wear the brace for 23 hours 6 months after casting was complete. The confusion about the bracing protocol reduced bracing compliance. At the follow-up appointment the parents were instructed that they could reduce the duration the child was in the brace.

The clinical time necessary to fit the child for the brace was deemed unnecessary by one healthcare provider. If the braces could be made with adjustable width and shoe sizes, this could be avoided. Furthermore, this would prevent children who graduated from the casting phase earlier than expected not to
have to wait for their brace to be made before wearing it. An alternate method suggested was to have pre-made braces of various sizes for hospitals to offer patients during the clinic. However, this is unlikely due to limited resources by the government providing the brace.

The Orthotics and Prosthetics Department at LRH is the largest producer of the Ponseti brace in the country. They currently produce 30-35 braces for the LRH hospital and 15-20 which are sent to other areas in the country. The unit manager revealed difficulties obtaining the raw materials for the brace. Currently, leather and aluminum used to construct the brace (Figure 3). A grant from USAID and Handicap International support the brace making operation at LRH. An additional barrier was workshop space. Despite a recent renovation of the workshop, it has struggled to keep up with the increased demand for the Ponseti braces. Subtle adjustments can be made for the children with special needs. One child was allergic to leather and was made a unique brace to help them with this ailment.

A discussion with the project director of the Sri Lankan School of Prosthetics and Orthotics (SLSPO) revealed additional barriers to brace production. Although SLSPO has not yet started to produce the brace, they plan to in the near future. However, because they primarily function as an orthotics and prosthetics school, they have various other priorities that take precedence over the Ponseti brace. They have been in contact with a local manufacturer who can create the leather shoes and a different local manufacturer who can create the steel bars. The braces made by SLSPO would be modeled after a brace donated from the United States and would include adjustable foot abduction, shoe size, and width between the shoes. The brace also would include a small pad along the heel which would help make the brace more comfortable. One issue the program director cited to successful manufacturing of the braces was a lack of uniformity amongst orthopaedic providers. They believe an endorsement from the Ministry of Health for the Ponseti protocol as well as a national training program would be a very useful step for SLSPO to make the braces.

**Tenotomy:**

In all LRH, CNTH, and LPH, the tenotomy procedure was done under general anesthesia in the operating theater. A cataract blade and percutaneous tenotomy is used for small children. Larger children receive a mini-open tenotomy and a regular scalpel blade. Roughly 60-65% of children receive tenotomies. At CNTH, the number of children receiving tenotomy would be higher if not for various barriers to completing the procedure.

Utilization of general anesthesia was a barrier to the administration of the tenotomy. In LRH, each child is given their own operating room, however, in CNTH, the OR space is limited and two patients share the same room. In LRH, a dedicated pediatric unit, anesthetists had no trouble inducing children into general anesthesia, however, the same could not be said at CNTH. At CNTH, in fact, anesthesiologists were reluctant to induce infant children under general anesthesia for the tenotomy. Also, the OR time is limited. Orthopaedic surgeons are only given one day in the OR for non-emergent procedures. In Sri Lanka, similar to many developing countries, the OR time of orthopaedic surgeons is vastly consumed by trauma. The tenotomy,
although itself a very quick procedure, took roughly 30 minutes of OR time with the majority of this time being used to anesthetize the child.

Some physicians revealed a preference for general anesthesia versus local anesthesia for the tenotomies for various reasons. First, no sterile area exists during clubfoot clinics, which at CNTH are performed on the wards. Furthermore, there is no time during clinics to conduct the tenotomies at LRH due to the high patient caseload. Furthermore, due to the lack of fast-drying casting material, there is a preference for a sedated child post-tenotomy to achieve adequate casting.

However, despite the perceived advantages of general anesthesia, there is an effort to pursue local anesthesia. The barrier to achieving this goal is the convincing of upper level management to clear a clean space during clubfoot clinics. The dedicated orthopaedic building currently being constructed at CNTH may alleviate this barrier.

Cost:
Cost of treatment is a negligible barrier for optimal clubfoot treatment in Sri Lanka. Despite the low GDP per capita in Sri Lanka, the government provides all healthcare free of charge. Additional materials that need to be purchased include stocking materials, cast padding, and synthetic casting (if necessary). Synthetic cast material cost 1700 rupees (~$13) and cast padding costs 300 rupees ($2.40). Patients who can afford private healthcare are asked to pay 4000 rupees ($31.50) for bilateral clubfeet and 2000 rupees ($15.60) for unilateral clubfeet per visit. Braces cost 3000 rupees ($23.30) if purchased through the private clinic. However, no patient interviewed directly cited cost as the major barrier to clubfoot care.

Distance traveled:
Patients reported traveling up to 280km to receive their clubfoot care. Currently, only two practitioners have been formally trained in the Ponseti method. In the small medical community of Sri Lanka, physicians are knowledgeable of the two trained Ponseti practitioners and have begun to refer patients to them from all parts of the island.

The LRH in Colombo serves as the tertiary care pediatric hospital for the entire island. Therefore, it is not uncommon for patients to travel to LRH for their treatment from various parts of the country. In fact, many mothers receive their obstetric care from one of the major obstetric hospitals in Colombo and establish care at a Colombo hospital for their child. Many parents inherently believe that treatment in the capital is better than in their local provinces despite entirely adequate regional hospitals. Often, families then create ‘medical homes’ with friends and family in Colombo, which allows them to stay locally while receiving their healthcare. One family described having parents in Colombo, who they visited once/month. They coordinated their medical visits with these trips; however, this did not allow them to achieve the once/week Ponseti care necessary for optimal correction. The hospital does not provide any housing assistance for those who have traveled long distances.

Sri Lankan healthcare system:
The unique healthcare system in Sri Lanka poses some interesting challenges to clubfoot management in Sri Lanka. The rotating government posts around the country every four years have made it a challenge to set up a consistent clubfoot clinic. However, this limitation is also an asset. Eventually, far more areas of the island will be exposed to formal Ponseti clubfoot clinics. The consultant orthopaedic surgeon currently stationed in CNTH will be moving to a large hospital in Kurunagela in January 2013. His plan is to establish a new Ponseti clubfoot clinic at this hospital.

**Ponseti training program:**
Prior to the training program undertaken by two Sri Lankan physicians, physicians reported previous use of the 'Ponseti' method. However, reports from patients and physicians alike reveal a number of different methods of casting and surgery that did not fit the Ponseti protocol. Patients treated with these alternate methods were often seen in the clinic during the duration of this study as relapsed patients. Furthermore, the clubfoot clinic at LRH prior to the Ponseti training program reportedly averaged about 6-7 patients per week.

Since two Sri Lankan physicians were trained in the Ponseti method, the clubfoot clinics have changed drastically. The nursing staff and medical officers report being given hands on casting training with clubfoot foot and bone models. Supplemental videos were also watched. Additionally, the structure of the clinics changed allowing one practitioner to see all of the patients and make their treatment decisions. Prior to this, the nursing staff collectively decided the outcomes of the child leading to high observer variance in the child's management. Other changes include the casting of relapse patients, an area where surgery was the previously preferred alternative.

Clubfoot clinics at LRH currently exceed 60 patients per week (casting and bracing), a drastic increase from the previously reported 6-7 cases. Parents reported several methods of learning about the clubfoot clinics, which included recommendations from other physicians, conversations with and observations of children treated at these clinics.

**Discussion:**

This is the first study to describe the early successes and failures of the 'train the trainer' strategy in the dissemination of the Ponseti method technique. Successes include a drastic increase in patient demand and thorough modification of the clinic set-up after physicians return from their two-week training. However, various barriers continue to exist including casting materials, brace discomfort and a great distance traveled by several patients to achieve adequate care.

The 'train the trainer' approach utilizes a country's existing orthopaedic staff, nursing staff, and clinic/hospital capital. The only cost to the utilization of this program is the cost of the plane flight for the practitioners and lodging during their stay at the University of Iowa. This model not only demonstrates early positive results, but also does so in a financially efficient manner. The results of this study
should serve as a model for other nations as they plan to undertake similar training programs of their own.

Sri Lanka can continue to improve their clubfoot management by increasing the number of practitioners with a thorough understanding of the Ponseti method, continuing to train their house officers, residents, and nursing staff in the importance of the method, and working to improve the resources available for casting and bracing.

A one-year follow-up visit by an expert Ponseti practitioner from the University of is planned to continue the assessment of Sri Lanka’s clubfoot management and also to train more physicians in the method in conjunction with the two existing practitioners. As the success of the Ponseti clinics continues spread, one would anticipate a further increase in the patients who attend the clinics. However, until the one-year training follow-up training program commences, it is likely that patients will continue traveling long distances to attend the Ponseti clinics.

This study is limited in that it only interviewed Sinhala-speaking patients in Colombo and its surroundings. No interviews were conducted with the Tamil-speaking northern districts of Sri Lanka. However, their clubfoot care has previously been documented as poor[26]. An effort should be made to include this group in follow-up training.

Follow-up studies should be conducted at 1- and 5-year time periods to appropriately document the utility of the ‘train the trainer’ method of physician education in Sri Lanka. Although this study thoroughly describes the early successes and barriers to the program, long-term conclusions cannot be drawn from a study conducted 5 months after the Sri Lanka Ponseti program was established.

Conclusions:

Sri Lanka has greatly benefited from the ‘train the trainer’ approach to their clubfoot management. Clubfoot clinics run much more efficiently and patient attendance has drastically increased. Remaining barriers include resource allocation and a great distance traveled by some patients. Planned follow-up training as well as an inevitable integration of the Ponseti method into the Sri Lanka healthcare system over time should alleviate these problems.

Acknowledgements:

This study was supported by the University of Iowa College of Public Health Practicum Fund and a University of Iowa Executive Council of Graduate and Professional Students (ECGPS) Research Grant. Funding for the Sri Lankan physicians to attend the University of Iowa was due to a grant from the Ronald McDonald House and funds raised by the American Medical Student Association chapter at Carver College of Medicine.

The authors would like to thank Dr. Vas, Dr. Terrance, and Dr. Ludowyke for their specific roles organizing this project.
References:


29. Lady Ridgeway Hospital for teaching.


Tables:

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Table 1. Participant information.
*Same orthopaedic practitioner interviewed in each location.

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<td>Kilometers traveled (SD)</td>
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<td>3.3 (1.5)</td>
<td>6.5 (3.8)</td>
<td>8 (5.4)</td>
<td>4 (2.6)</td>
</tr>
</tbody>
</table>

Table 2. Participant characteristics.
Figures

**Figure 1.** Poster at CNTH representing Ponseti method technique.

**Figure 2.** 4-inch casting materials cut in half.
Figure 3. Child wearing brace.

Figure 4. Tenotomy completed in OR under general anesthesia.