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**Friend-in-Need Society
Jaipur Foot Project**

A Review and Recommendations
for Upgrading Prosthetic and
Patient Care Services

March 12–April 7, 2000

Rob Singer

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LIST OF ACRONYMS

AK	above knee
AP	anterior-posterior
BK	below knee
CBR	community-based rehabilitation
FINS	Friend-in-Need Society
FINS/Colombo	Colombo Friend-in-Need Society
FINS/Galle	Galle Friend-in-Need Society
FINS/Jaffna	Jaffna Friend-in-Need Society
FINS/Kandy	Kandy Friend-in-Need Society
GDO	general development officer
HDPE	high-density polyethylene
ICRC	International Committee of the Red Cross
IPOS	Institute for Polymers and Organic Solids
ISO	International Standards Organization
ISPO	International Society of Prosthetics and Orthotics
LTTE	Libertarian Tigers of Tamil Elam
LWVF	Leahy War Victims Fund
ML	medio-lateral
NGO	nongovernmental organization
PTA	physical therapy assistant
PVO	private voluntary organization
USAID	United States Agency for International Development
VAPC	Veterans Administration Prosthetic Center

EXECUTIVE SUMMARY

Introduction

More than 15 years of armed conflict in Sri Lanka have left no one untouched. Thousands of people from all walks of life, age groups, and ethnic and religious persuasions have had their lives changed by land mines, bullets, and other wartime material.

In 1985, the Friend-in-Need Society (FINS) pioneered its Jaipur Foot Program to fill a need scarcely affected by government hospitals. Since 1991, USAID, through the Global Bureau's Leahy War Victims Fund (LWVF), has partnered with FINS to extend services to more than 6,000 amputees. Several small private organizations address the physical mobility needs of civilian amputees and other persons with physical disabilities, but the number of prosthetic devices they contribute is quite small compared to the number contributed by FINS, and the cost of their services is beyond the means of the average Sri Lankan. FINS, Sri Lanka's oldest social service organization, remains the single largest provider of prosthetic and orthotic services in Sri Lanka. In 1999, FINS fit 1,402 artificial limbs to beneficiaries. Furthermore, new Jaipur Foot workshops in Batticaloa and unauthorized Jaipur Foot workshops in Mannar are springing up.

LWVF in Sri Lanka

In 1989, the United States Congress established the Leahy War Victims Fund (LWVF), a program conceived by Senator Patrick J. Leahy with the purpose of aiding war victims in developing countries. Incorporated into U.S. foreign assistance legislation and administered by the U.S. Agency for International Development (USAID), the LWVF exists today because of Senator Leahy's strong leadership as well as the support of many both inside and outside of Congress who recognize the need for a U.S. response to the rising problem of civilian war casualties.

Under the umbrella of USAID's humanitarian assistance, the LWVF provides a dedicated source of financial and technical assistance for civilian victims of war who suffer from mobility-related injuries, including children who contract paralytic polio during periods of strife when immunization programs are discontinued. They too are considered *victims of war*. Increasingly, the Fund is incorporating innovative social and economic reintegration activities into its traditional portfolio of programs.

Scope of Work

Rob Singer, the American prosthetist who supervised the workshop of the Jaipur Foot Program during its first year of production, visited Sri Lanka from March 12 to March 31, 2000, to conduct an evaluation of the FINS programs in Colombo, Kandy, Galle, and Jaffna. Structural weaknesses in the programs have been noted for years (in a 1993 assessment by Singer and in two subsequent assessments by Hovarth and Staats in 1997 and Hovarth and Savino in 1999). FINS has done little to strengthen those weaknesses, however, and the situation has remained unchanged.

Rob Singer was asked by the LWVF to conduct a training needs assessment, analyze equipment needs, and assess the provision of rehabilitation services as well as the prosthetic systems in use. The complete scope of work for the three-week assignment can be found in Appendix A. The purpose of the analyses was to yield a solid working plan to enable FINS to better serve the rehabilitative needs of Sri Lanka's population of persons with physical disabilities.

Recommendations

Training Needs

- With input from a qualified prosthetist, design and implement a training program for all FINS technicians that emphasizes solid basic skills necessary for the production of modular thermoplastic prostheses
- Send one technician from each workshop as well as the FINS/Colombo Workshop Manager to Addis Ababa, Ethiopia, for International Committee of the Red Cross (ICRC) training if a tripartite agreement between ICRC, USAID, and FINS is signed
- Train technicians to make prostheses from ICRC components
- Develop appropriate criteria and search for a candidate to attend an internationally recognized program, leading to a Category II certification

Equipment Needs

- Identify and purchase equipment necessary to improve plastics fabrications capabilities at FINS/Colombo
- Review KINS/Kandy's purchase of equipment from India to determine its compatibility with modular thermoplastic prostheses, and consider prorated reimbursement on the basis of the equipment's applicability
- Upgrade basic aluminum-working equipment for the FINS/Galle workshop, and purchase equipment (cutters, grinders, and finishing tools) to finish thermoplastic devices

Rehabilitation Services Provided

- Upgrade physical therapy services at the Colombo, Kandy, and Galle workshops by using the services of a visiting physiotherapist from the United Kingdom
- Purchase wheelchairs for the Kandy, Galle, and Colombo workshops (Jaffna makes its own wheelchairs) from Motivation, a local NGO, and send FINS patients to wheelchair skills camps run by Motivation
- Hire and train a physical therapy assistant (PTA) for the Galle workshop
- Utilize community-based rehabilitation (CBR) techniques within Sri Lanka to improve communications with patients and thereby improve the quality of care
- Develop more appropriate, aesthetically pleasing temporary prostheses that patients will not reject

Prosthetic Systems at FINS

- Deemphasize the use of all-aluminum below-knee (BK) and above-knee (AK) prostheses
- Continue to produce plastic and aluminum (blended) BK and AK prostheses, but attempt to shift toward ICRC components
- Shift a significant proportion of prosthetic production to ICRC-style prostheses on the basis of cost analysis
- Deemphasize production of high-tech prostheses made with donated secondhand components, and focus on offering the solid basic skills necessary for the provision of good-fitting, alignable devices that use ICRC or comparable components
- Encourage FINS to develop (by July 2000) a Jaipur Sach-style foot, which is suitable for use with modular components

INTRODUCTION

Background

In 1985, inspired by the works of the Jaipur foot pioneer, Dr. P. K. Sethi, Mrs. Swarna Ferdinand, Honorary Secretary of the Colombo Friend-in-Need Society, introduced the Jaipur Foot Program to Sri Lanka. Three trainees were sent to Jaipur, India, for several months to train under the supervision of Rob Singer, an American prosthetist who had traveled to India to learn the Jaipur limb system. The trainees and Mr. Singer returned to Colombo to set up Sri Lanka's first Jaipur limb workshop.

In its first year, the workshop produced approximately 475 AK and BK prostheses—two or three times the previous entire national output. From 1985 to 1991, activities at the workshop increased and FINS steadily expanded its production of devices. During that period, FINS also began providing income-generating grants and hosted sporting activities for prosthetic limb users.

In 1991, USAID began to support FINS by providing funds from the Leahy War Victims Fund. The goal of the partnership was to extend rehabilitation services to as much of Sri Lanka's civilian population of persons with physical disabilities as possible. As a result, FINS has become the largest provider of rehabilitation services in all of Sri Lanka.

Along with USAID financial support came technical oversight for LWVF-funded activities. By 1993, it was evident to visiting consultants that the Jaipur limb technology had several inherent shortcomings that adversely affected the fit and performance of prosthetic devices. The aluminum sockets of both AK and BK prostheses are not made from a mold of the amputee's residual limb. Consequently, they often create fitting problems such as wounds and ulcers that, in turn, result in delays in production and long hostel stays while the patient is healing.

An additional problem is that neither the AK nor the BK prostheses are easily alignable according to Western standards, and only crude adjustments may be made by cutting, wedging, and welding the shank of the prosthesis to make lateral and angular shifts. Equally significant and detrimental is the locked knee design of the AK prosthesis, which is considered unacceptable—especially for healthy and active limb users.

In other countries with similar socioeconomic situations, NGOs were working to develop low-cost alignable modular components that, when wedded to custom-molded polypropylene sockets,

produced relatively inexpensive, better-functioning prosthetic devices. ICRC has been in the forefront of this movement (although Art Forman has also produced a low-cost prosthesis that can be aligned).

Consultants have periodically visited the FINS program and recommended ways to upgrade the technological quality of prostheses. FINS began producing custom-molded plastic sockets in 1993; with that exception, however, methods have not changed at FINS for the past seven years.

Major Changes

The situation became critical during the visit by Hovarth and Savino in February 1999. The visit generated a report that stated that the following major changes had to occur at FINS before future funding would be considered:

- Provide more training in order to upgrade the skills of all FINS technicians
- Assess equipment at FINS workshops and upgrade if necessary
- Improve rehabilitation services provided by FINS
- Review and assess the current prosthetic systems in use (including Jaipur, Atlas, and ICRC) and determine which system might be appropriate for FINS

Those four imperatives govern the scope of work for the three-week evaluation of the project. (See Appendix A for the scope of work in complete form.)

TRAINING NEEDS ASSESSMENT

Current Levels of Training

Although different levels of training and expertise exist at different workshops and among different workers in the same workshop, all technicians would benefit from additional training. Galle practices basic Jaipur limb technology. Kandy practices basic Jaipur limb technology plus knowledge recently acquired in Madras, India. The Jaffna workshop is capable of making Jaipur limbs and ICRC limbs. And Colombo uses a wide range of technology, including basic Jaipur limb technology, blended plastic and aluminum technology, the Atlas system, and sophisticated devices made from secondhand Blachford components.

Training Needs

Jaipur Limb Technology

In a report of their June 1997 visit, LWVF advisor Rob Hovarth and consultant Dr. Tim Staats maintain that FINS/Colombo technicians continue to turn out BK sockets of average quality and that AK sockets usually manifest a lack of understanding of AK socket design parameters and, therefore, often fit poorly.

Technicians at the Kandy workshops are capable of producing Jaipur-style limbs of a quality comparable to the devices made in Colombo. They tend to do a better finishing job on their devices, however, and produce a more attractive cosmetic finish.

The newest workshop is in Galle and has two technicians. The Senior Technician produces standard-quality Jaipur devices while the Junior Technician needs upgraded training in order to meet the normal Jaipur standards.

Thermoplastics Training

Of all the centers, the Colombo workshop makes the greatest use of thermoplastics; many AK and BK prostheses are fashioned from them. Although technicians work with thermoplastics daily and are capable of thermoforming good-quality seamless and seamed sockets and pelite liners, the devices they make fall short in the area of socket fit. Sometimes sockets must be

remade two or three times to achieve a good fit. Occasionally, BK amputees can be observed wearing as many as six stockinettes to compensate for loose-fitting liners.

The need for training and/or supervision is evident in the area of cast taking and cast rectification. Because technicians are not using nails, plaster splints, or colored plaster to judge the thickness of the buildups, they often lose control of the cast rectification process and end up producing loose-fitting liners and sockets.

Hand-cast AK sockets often fail to conform to normal quadrilateral socket parameters, thereby signifying a lack of understanding of AK socketry. The use of cast brims (such as the IPOS brims being used at a teaching facility in Phnom Penh, Cambodia) or a VAPC casting stand would greatly improve socket fit.

The Kandy workshop recently sent three technicians to Madras, India, to learn the Mukti prosthetic system, which appears to be a variation of the high-density polyethylene pipe technology that was developed in Jaipur in the late 1980s. Unfortunately, the AK prosthesis uses orthotic joints like the Jaipur AK joints and the patient must walk with a locked knee.

Because the Mukti prosthetic system is built on a plaster model, the Kandy technicians may have learned some casting and cast modification skills from their training. Those skills may help them make the transition to thermoplastic socketry. The consultant could not ascertain the skill level of the Kandy technicians because they were awaiting the arrival of equipment from India and had not begun casting patients.

Prosthetic Alignment Skills

Technicians at all workshops continue to make crude alignment changes to both the aluminum and blended AK and BK devices. If the patient has a residual limb that falls into normal alignment parameters, some technicians are capable of making simple angular shifts by cutting and wedging the shanks of the prostheses. But design limitations and lack of knowledge often prevent technicians from making more sophisticated alignment changes.

Technicians who work with the Atlas systems, which provide for anterior-posterior (AP), medio-lateral (ML), and angular shifts, often display a lack of understanding of the basics of alignment. All technicians would benefit from training in alignment.

Recommendations

- With the assistance of a qualified prosthetist, design and implement a training program for all technicians that would include the following elements:
 - Anatomy
 - Biomechanics
 - Cast taking by hand
 - Cast taking by using brims
 - Cast rectification techniques, including AK and BK socket theory

- Alignment of AK and BK devices by using adjustable alignment devices
- Thermoforming techniques for socket fabrications
- Gait analysis
- Send a qualified prosthetist and the FINS/Colombo Workshop Manager to the ICRC center in Ethiopia for training in the use of ICRC components
- Provide ongoing support and feedback to reinforce the results of training
- Purchase IPOS (or other) quadrilateral casting brim sets, and attempt to locate a VAPC casting stand (possibly from Shriners Hospital in Portland, Oregon) for training purposes and for the use of all workshops that make thermoplastic devices
- Provide immediate remedial training for the Galle Junior Technician to upgrade skills
- Deemphasize production quotas during the training period because the production staff will not be able to produce a normal output of prosthetic devices during that time
- Develop and implement a training program to upgrade and enhance the production of thermoplastic orthotic devices at all workshops
- Develop appropriate criteria and search for a candidate to attend an internationally recognized program, leading to Category II certification

It should be noted that FINS has made numerous attempts to hire persons for various positions in the past and has had little success. The prerequisites for sending someone abroad for training are an A-level certificate and English-language competency, but the market for such well-educated persons is tight and FINS has little to offer in terms of pay, chances for advancement, and pensions compared to the private sector. Also, rehabilitation in general is not regarded as an appealing line of work. In the past, new employees have often quit after a few days on the job. Keeping people after FINS has invested time and money in their training is another problem. Senior FINS technicians have been lured away and hired by the military, which can offer greater security and better perquisites.

ANALYSIS OF EQUIPMENT NEEDS

If workshops are to shift toward the production of thermoformed plastic prostheses and orthoses, they must not only upgrade old equipment but also acquire new equipment. Several workshops (most notably the FINS/Colombo) already have some of the required equipment.

FINS/Colombo

With the exception of a few machines, the Colombo workshop's equipment is in good shape. It has four vacuum pumps, several vacuum-forming stations, belt sanders, a modern Western-style oven, and a locally made oven. The workshop also has two air compressors, and it uses air tools. In fact, the only equipment needs are a good-quality Western-made router (which would be used heavily), a pneumatic oscillating-style cast cutter, and an abundant supply of sanding cones and belts to finish sockets. Fortunately, FINS has had no problem securing polypropylene. (FINS purchases polypropylene sheets from Otto Bock and one-half-inch polypropylene blanks [for seamless sockets] from North Sea Plastics in the United Kingdom.)

FINS/Kandy

It is difficult to determine what equipment the Kandy workshop will need. It recently placed an order for Cey Rs 2,000,000 (approximately U.S.\$28,000) worth of equipment from India to produce the Mukti prosthesis. The Kandy workshop ordered the equipment without notifying FINS/Colombo and did not seek assurance that it would be reimbursed by LWVF via FINS. At the time of the consultant's visit, the new equipment had not arrived, but one can hope that it will be useful for all thermoplastic applications—and that the ovens will be suitable as well.

FINS/Galle

Of all the workshops, the one in Galle is the most basic. It needs various hand tools and a new blower unit (approximately U.S.\$150) to temper aluminum sheets. The Galle workshop, which has been requesting thermoplastics training for some time, feels that it is losing patients to the

Colombo workshop because patients seek out the hybrid plastic and aluminum prostheses rather than the aluminum devices that Galle produces. Although it may not be cost effective to set up a complete thermoforming production unit at the Galle workshop now, if the Galle technicians were trained to cast patients and modify casts, the plaster models could be sent to Colombo; the sockets could be centrally fabricated in Colombo and returned to Galle for assembly. Good transportation links between Colombo and Galle would enhance the feasibility of such a scheme. (A FINS/Galle board member who is engaged in commerce in Colombo makes daily trips from Galle to Colombo and back.) If this scheme were to be implemented, the Galle workshop would need an electric oscillating cast cutter or saber saw, a locally made router, and sanding cones to finish sockets.

FINS/Jaffna

With support from ICRC, the Jaffna workshop appears to be meeting all its equipment needs. ICRC has provided the equipment required to produce the ICRC prostheses. The Jaipur limb production unit at Jaffna is also functioning well and is not constrained by lack of equipment.

Recommendations

- Purchase a router, a pneumatic cast cutter, and sanding and smoothing cones for the Colombo FINS workshop
- When Kandy receives equipment from India, review it for appropriateness and applicability for production of thermoformed modular prostheses and orthoses, and consider some form of prorated reimbursement (possibly under the direction of the expatriate prosthetist upon arrival in Sri Lanka)
- Purchase the equipment requested by the Galle workshop and plan to upgrade thermoplastics finishing capabilities, and consider a possible shift to in-house production in the second year (which would also require an oven and vacuum-forming equipment)

ASSESSMENT OF REHABILITATION SERVICES PROVIDED

FINS/Colombo Center

The Colombo center provides AK, BK, and upper extremity prosthetic devices; long and short leg orthoses; some orthopedic boots; crutches; and wheelchairs (for bilateral amputees). FINS also provides physical therapy services to patients who have come for prostheses.

Typically, a repeat patient will spend approximately two weeks at the center to receive a new prosthesis while a new patient may spend as many as four or five weeks, or more. Some new patients spend extraordinary amounts of time at the program if their prostheses are ill fitting and they have to wait while “Band-Aid”-type efforts are made to correct the problem. Ultimately, a new device is made after a delay of 10 or 12 days, and the process begins again.

The problems of ill-fitting prostheses and the time it takes to correct them arise for two main reasons: (1) inappropriate selection of devices for patients and (2) the pain and wounds caused by a bad fit.

The decision-making process for “who gets what” is rather arbitrary and lacks a rational medical team approach to prescription and production. The need for such a strategy was pointed out by the consultant, and FINS has agreed to assemble a team that will include a physiotherapist, a Workshop Manager, and the patient. The participation of an orthopedist would enhance the process.

Although plans were made to introduce temporary prostheses for recent amputees, only two have been made. Patients refuse to wear these temporary devices because they are bulky, heavy, and antiquated in design. Patients also object to having a peg leg and insist on having a device with a Jaipur foot.

The physiotherapy section at FINS/Colombo currently consists of one full-time PTA (Mr. Gomez) and one part-time physiotherapist (Mr. Rohan Perera). (FINS, recognizing the need to improve its rehabilitation services, had been seeking a candidate to train with Mr. Gomez, but the trainee quit after one day!)

The British High Commission has agreed to send Mr. Gomez to Great Britain for two months of training. During that time, a British physiotherapist will come to FINS to cover for Mr. Gomez.

FINS/Colombo should make every effort to find a trainee to work with the British physiotherapist and, if possible, to conduct in-service training sessions for staff persons involved in rehab activities at the Kandy, Galle, and Jaffna workshops.

Orthotics

Although Colombo has a highly developed thermoplastics capability, almost no plastic orthoses are being produced. This situation can be attributed to a lack of training on the part of technicians. Efforts should be made, however, to provide thermoplastic orthotic devices to patients.

Wheelchairs

FINS/Colombo has requested U.S.\$8000 for wheelchairs in its most recent proposal. Motivation, a United Kingdom-based NGO located at the Ragama Rehabilitation Hospital, produces two models of locally made, technologically appropriate wheelchairs that are custom made to the patient's measurements. Motivation, whose primary mandate is to assist patients with spinal cord injuries, also runs wheelchair camps where people are trained to develop wheelchair skills.

FINS continues to give out wheelchairs that are outdated and not designed for outdoor use. Often, these wheelchairs have been donated from abroad, and they are barely suitable for active people whose goal is mobility.

Client Follow-up

FINS/Colombo uses a follow-up survey to gather data about patients and to shape its follow-up care. On the recommendation of Rob Singer, FINS/Colombo has made efforts to establish a pilot program in conjunction with the Ministry of Social Services CBR Program; village-level CBR workers in the Kandy district will attempt to contact FINS patients at their homes to obtain feedback and enhance their follow-up capabilities. FINS has also set up a database. (See Appendix D for a sample.)

Recommendations for FINS/Colombo

- Develop a rational medical team model for the prescription of prosthetic and orthotic devices
- Train a second physical therapy assistant with the help of a visiting British physiotherapist, and conduct in-service training for rehabilitation staff at other workshops
- Purchase wheelchairs from Motivation for distribution to patients
- Enroll patients in wheelchair camps to help them develop wheelchair skills
- Pursue CBR-based client follow-up and feedback

- Develop more appropriate, better-fitting temporary prostheses
- Develop a Sach-style Jaipur foot suitable for use with ICRC components

FINS/Kandy Center

The Kandy Center produces AK and BK prostheses and provides physical therapy. Patients requiring upper extremity prostheses are referred to the Colombo workshop. Staff members report that there is virtually no call for orthotic devices.

No thermoplastic devices are produced because of the lack of equipment and training. The workshop has sent three trainees to India to learn to make the high-density polyethylene (HDPE) Mukti prosthesis. As previously mentioned, that training and thermoforming equipment from India could pave the way for thermoplastic prosthetic and orthotic device production using other, more appropriate designs.

The Kandy board has hired a retired physical therapist (at Cey Rs 450 per day) to train two technicians to assist patients with basic physiotherapy services such as gait training, mobilization, exercise, and reduction of contractures. The technicians will be trained for three months.

The consultant has suggested the use of innovative, obstacle course–type rehabilitation aids rather than the Exercycle and treadmill that the center was so keen to acquire. The Kandy management’s response was lukewarm.

In terms of outreach, the Kandy workshop is by far the most proactive of all the branches. Through the combination of working with local NGOs to locate patients and purchasing a vehicle to pick up and transport patients, the Kandy center is meeting the needs of many more patients and growing its program. As a result, the workshop is projecting its patient load to grow by 25 to 50 percent for 2000. The Kandy center treated 240 patients in 1998 and 285 patients in 1999, and it claims to have treated 126 patients in the first three months of 2000. At that rate, the center would treat 504 patients for the year. (As a note, FINS/Colombo claims that the Kandy workshop is always quiet and appears to be underutilized when any of its staff members visit.)

Recommendations for FINS/Kandy

- Provide additional plaster work and thermoforming training for technicians
- Purchase wheelchairs from Motivation whenever possible, and send the recipients to wheelchair camps
- Embrace a technology (e.g., ICRC) that will allow the workshop to produce AK prostheses with a free knee and alignable BK devices

- Seek partial reimbursement for equipment purchased in India to produce ICRC-type prostheses and orthotic devices
- Utilize temporary prostheses developed by FINS/Colombo

FINS/Galle Center

The Galle center is the newest of the four FINS Jaipur limb workshops. It is staffed by two technicians and a Workshop Manager and has the smallest patient load—111 prostheses were fitted in 1999. Two possible reasons for the workshop's limited activity are (1) its location in a geographic area not particularly affected by war and civil unrest and (2) a preference of some patients for the Colombo workshop, especially those who want a plastic and aluminum device.

The Galle workshop provides AK and BK prostheses produced in the original, all-aluminum Jaipur style. It occasionally produce some leg splints, too.

The workshop provides physical therapy on a very limited basis by paying the hospital where it is housed for physical therapy services (which happens approximately three times a month). The Senior Technician determines whether physiotherapy is required—usually for contractures.

In discussions with the consultant, the Workshop Manager expressed the difficulty in getting patients to return for follow-up visits. Patients claim that they lack the bus fare for return visits. The Workshop Manager stated the desire to have a small transportation budget to bring patients to the workshop.

Recommendations for FINS/Galle

- Upgrade the technical skills of both technicians through additional training in Colombo, including skills for casting and cast modification
- Incorporate funds for training into the Galle workshop budget
- Adopt a more proactive attitude toward physical therapy
- Hire a staff person for half-time clerical work and half-time physical therapy assistance (with funds budgeted to Galle for training by the visiting British physical therapist)
- Try to work with the village's health infrastructure at the local level to improve communication with patients, identify new patients, and provide travel vouchers for patients to attend follow-up visits at the workshop
- Replace and upgrade tools as necessary, and add equipment to work with plastics (excluding oven and vacuum-forming equipment)

- Use centrally fabricated plastic sockets (made in Colombo) to shift to a metal and plastic hybrid system and possibly to the ICRC AK and BK system at a later date

FINS/Jaffna Center

The Jaffna center relies on outside assistance from ICRC to obtain materials but is highly independent in other ways. The center functions under great adversity and consequently has become quite resourceful. For example, because the Jaffna workshop does not have an oven to vulcanize the Jaipur feet it produces, it “barbecues” them instead over a coal fire—and in this fashion turns out two feet per day.

Besides producing AK and BK prostheses, the Jaffna center makes upper extremity prostheses, orthotic devices, and mobility aids such as crutches and wheelchairs.

The workshop has made great strides in providing physical therapy for patients by having two staff persons trained at the government teaching hospital in Jaffna under the direct guidance of the Chief Physiotherapist. In this way, patients may be seen five days a week.

This workshop has recently begun to produce the ICRC-style prostheses and is having difficulty adapting the ICRC foot alignment components to the shape of the Jaipur foot.

Recommendations for FINS/Jaffna

Have FINS/Colombo develop and provide a short Sach-type Jaipur foot for Jaffna that is compatible with ICRC components.

CURRENT SYSTEMS IN USE

FINS/Colombo

The Colombo workshop produces an array of prostheses ranging from the simple all-aluminum Jaipur BK device to a seamless plastic-socketed AK device with a Blatchford stance and swing-control pneumatic knee joint and quantum foot. Between these two extremes are the more common blended plastic and aluminum BK and AK prostheses and some Atlas AKs and BKs.

Basic Aluminum AK and BK Prostheses

All workshops continue to make aluminum devices despite the difficulties encountered when attempting to fit any residual limb that is not well shaped. The bonier and more irregularly and conically shaped the residual limb, the more difficult the fitting becomes—at times impossibly difficult. Both AK and BK aluminum devices lack the benefit of a device built around an accurately taken cast of the patient's residual limb, and the results are often unacceptable. Also, as pointed out by Singer, Staats, Hovarth, and Carlson during different evaluations, the aluminum system offers the possibility of crude alignment changes at best. It should be noted, however, that a small number of patients are very satisfied with the aluminum devices. Some patients are able to do heavy work while wearing their prosthesis (especially a BK device), and they consistently request that their new prosthesis be made the same way. If FINS is to continue to produce such devices, it should be on that basis alone. FINS claims that if it were to lose its USAID funding, it might have to revert to the basic aluminum technology.

Blended Aluminum and Plastic AK and BK Prostheses

Fortunately, more blended AK and BK prostheses are being made, and patients who receive those devices are more comfortable. Comfort and socket fit vary from patient to patient and from technician to technician. It is hoped that better-fitting sockets will be produced in the future, thereby adding to the comfort of blended devices. The lack of alignability will still be an issue regardless of comfort, however. For that reason, blended prostheses should not be considered the most desirable.

It should be noted that both the all-aluminum and the blended aluminum AK devices are designed to be used with a locked knee. Although a few patients are able to walk with a free knee, the limitation should be regarded as unacceptable—especially for young, healthy amputees who will be wearing the prosthesis for the rest of their lives.

Atlas Limb

In 1999, Dr. Panagama, a Sri Lankan orthopedist practicing in the United Kingdom, encouraged FINS/Colombo to enter into a working relationship with Blatchford-Endolite, the prosthetics company that produces the Atlas limb. FINS raised funds to purchase 30 Atlas kits (each containing a foot/shin unit, an alignment device, cosmetic sheaths, and an AK knee joint). Blatchford sent two technicians, Mr. Joe McCarthy and Mr. Ron McGaw, to Sri Lanka for two weeks. During that time, seven patients were fitted with prosthetic devices (four BK and three AK).

One of the Blatchford technicians, Ron McGaw, returned to Sri Lanka to volunteer his services at FINS. He has been very helpful in the areas of thermoforming, fabricating, and working with Blatchford components. Ron McGaw has taught the technicians how to form seamless sockets and E.V.A. liners, and he has set up three vacuum-forming stations. On a more disturbing note, however, he has encouraged FINS to seek ISO 9003 certification, which will allow the FINS/Colombo workshop to service sophisticated high-tech prosthetic devices. It is questionable whether such service is compatible with development of a sustainable workshop and whether that service will distract FINS from the goal of producing well-fitting and functioning technologically appropriate devices. It must be stated again that a significant portion of the seamless sockets do not fit very well; the situation suggests the need to reinforce the basics before moving on to a more sophisticated endeavor.

FINS has fit 18 Atlas prostheses (12 BK and 6 AK) and has not detected any defects in the components. But the army, which has fit more than 350 Atlas limbs, has discovered several problems with the components. First, the locking portion of the knee joint is plastic, and everyday use can cause parts to wear in a way that will lead to failure of the knee joint. Second, the army has found that heavy users and patients engaged in athletic activities will cause the I-beam shin to deform and break in some cases. The army has expressed a desire to replace the foot with an articulated one that it produces, but the system does not allow for changeability of feet because there is no tube clamp adapter compatible with the I-beam design. Although the alignments device does allow for AP, ML, and angular adjustments at the pylon socket interface, there is no corresponding alignability at the foot.

Durability is certainly an issue, but price is the greatest obstacle for FINS. The BK kit (consisting of shin/foot, alignment device, and cosmetic sheath) costs about U.S.\$90 while the AK kit (consisting of foot/shin, knee joint, and alignment device) costs about U.S.\$225. Of course, the costs of plaster bandages, plaster of Paris, polypropylene, leather belts, cosmetics for AK devices, and labor are additional. By comparison, FINS has quoted the aluminum BK device at U.S.\$66, the aluminum-blended BK device at U.S.\$86, the standard aluminum AK device at U.S.\$95, and the blended AK device at U.S.\$126.

ICRC Prostheses

ICRC components offer the advantages of alignability both at the socket pylon interface and at the pylon foot interface, thus allowing for angular adjustments of the foot that are not possible with the Atlas system.

However, one must consider the cost of the ICRC components, the cost of the complete BK and AK prostheses, and the impact of those costs on the current and future fiscal sustainability of FINS. It has not been possible to create an accurate workup of such costs. Geneva has provided incomplete figures for components, and no costs were for finished devices. Mr. Fitzpatrick, the ICRC prosthetist working in Jaffna, has given a rough estimate of U.S.\$100 for BK components and parts and of U.S.\$150 for AK parts only.

According to the formula designated in the LWVF funding agreement, FINS/Colombo is required to contribute 50 percent of the cost of a prosthesis and USAID the other 50 percent. In its most recent proposal, FINS has requested that USAID pay 75 percent of the costs. Sound decisions cannot be made in the absence of accurate financial data, but it is certain that FINS will suffer if the ICRC system places an intolerable financial burden on it.

The technical committee has been wary of the ICRC prosthesis for several reasons (some of which appear reasonable under the circumstances). First, despite the good “track record” that the ICRC components have, FINS is being asked to commit to prosthetic design that it has never seen in use by a real person. Second, FINS is concerned about the perceived flimsiness of the knee joint. (The committee has not seen the new Swiss-made model that has metal bearings instead of plastic bushings.) An additional concern of the technical board is the perception that in one year Jaffna has produced only three ICRC prostheses. However, the plastics program only recently began producing devices.

In essence, FINS has been asked to accept the ICRC system on good faith and on the basis of its trust in the consultant. He has given FINS his personal assurance of the quality and durability of the ICRC components.

Other Technologies

A large quantity of Endolite components, including knee units, BK alignment devices, pylons, and quantum feet, has been collected and sent to FINS/Colombo by Dr. Panagama. The Endolite components create a dilemma in terms of how to allocate them or whether to use them at all. Ron McGaw has been selectively fitting these components to “appropriate” patients. It can be disconcerting to see sophisticated components combined with sockets that may fit poorly. Therefore, FINS could use the Endolite components with caution. In addition, some patients seem to use their AK prosthesis with locked knees. The problem may be due to lack of adequate gait training, or it may be caused by difficulty in adjusting to a free knee after using a locked knee in the past.

Resins and laminating materials appear to be readily available in Sri Lanka. The army is purchasing resins and other laminating materials from the Otto Bock distributor in Sri Lanka, and it produces many laminated sockets to use with Otto Bock components.

Recommendations

- Phase out aluminum AK and BK prostheses except for repeat patients who specifically request them
- Continue to make blended aluminum AK and BK devices while moving toward greater use of alignable BK and AK prosthetic systems (such as the ICRC system)
- Require LWVF to carefully analyze the impact that the added costs of ICRC components will have on the sustainability of the FINS program in the future
- Through a tripartite agreement, clearly delineate (by June 2000) the nature of the relationship between USAID, ICRC, and FINS and under what conditions ICRC will provide FINS with components
- Hire a qualified prosthetist (a condition for ICRC support) to supervise the Colombo workshop and to facilitate the transition to ICRC components
- Send the selected attendees to Addis Ababa for training (the second condition for ICRC support) in October 2000
- Train the FINS/Colombo technicians in the ICRC system, and later conduct training for other workshops
- Have FINS/Colombo develop a workable Jaipur Sach-style foot for use with ICRC and other modular components (a necessary prerequisite for new alignable modular prosthetic systems)
- Deemphasize the use of high-tech components (e.g., Endolite) and focus on the development of basic core competencies such as cast taking, cast modification, and alignment
- Likewise, subordinate to more pressing needs the idea of ISO 9003 certification and becoming licensed to service Endolite products
- Explore alternative technologies such as Art Forman's polypropylene prosthesis or the edoskeletal polypropylene BK device (e.g., Endoflex) in the event the ICRC system were determined to be inappropriate

APPENDIX A: SCOPE OF WORK

Context

Sri Lanka has suffered over a decade of civil war and strife that has left an estimated 90,000 dead, displaced several hundred thousand internally, and resulted in a massive refugee exodus. Untold and uncounted have been the civilian victim survivors of landmine blasts, shelling, and crossfire.

In 1995, two massive government military offensives retook the northern peninsula of Jaffna, a Liberation Tigers of Tamil Elam (LTTE) stronghold. With government initiatives to appease the Tamil population in Jaffna relatively well received and the LTTE resistance apparently quashed, it appeared Sri Lanka was on the path to lasting peace. However, the Tigers regrouped and, by mid-1996, were able to launch damaging counterattacks on government troops in Jaffna as well as terrorists strikes in Colombo. Military and LTTE offensives and counteroffensives continue to prohibit any return to normalcy in the north and east of Sri Lanka. Instead, populations remain relatively contained in either government welfare centers or geographically isolated areas, and depend on outside assistance and aid.

Beginning in 1997 the government began an intensive push to unite the central portion of the country with the Jaffna peninsula by clearing road Route 1. While initially successful, the government has not been able to maintain territory taken. Fighting has intensified since that time and recent suicide bombings in Colombo, including one which injured the President, and elsewhere appear to indicate that the LTTE will continue to retaliate with relative disregard for civilian casualties.

Background

In 1991, the Leahy War Victims Fund (LWVF), administered by the Office of Health and Nutrition of the U.S. Agency for International Development (USAID), provided \$420,000 to the Colombo Friend-in-Need Society (FINS/Colombo) for a two-year grant. The grant would allow FINS/Colombo, a 150-year-old indigenous charity organization, to expand its prosthetic assistance program. In February 1996, a new one-year \$100,000 grant was signed with FINS to improve the administration and workshop facilities of its branch workshops in Galle, Kandy, and Jaffna as well as to produce and provide approximately 2,000 prosthetic, orthotic, and wheeled

mobility devices to people with disabilities. The grant was amended in November 1996 to provide an additional \$200,000 in LWVF money. Targets were also revised to provide over 3,500 prosthetic and orthotic devices. The grant was amended further in September 1998 and an additional \$200,000 provided. The latest amendment, in September 1999, provided the program with an additional \$300,000 and extended the grant completion date until September 2000.

An LWVF technical review was conducted on the program in June 1997. The resulting report, *Colombo Friend-in-Need Society Jaipur Foot Programme—A Review of the JAIPUR FOOT PROJECT in Sri Lanka*, outlines a number of findings as well as programmatic and administrative recommendations. As part of a larger country review, a follow-up of the FINS program was conducted in February 1999. This report, *Displaced Children and Orphans Fund and War Victims Fund Activities in Sri Lanka*, notes that the program remains weak in several areas and that a solid analysis of FINS's role in rehabilitation and the direction that the program should take needs to be conducted before LWVF commits additional significant resources.

Tasks at Hand

It is proposed that LWVF consultant Rob Singer, CO, travel to Sri Lanka between approximately March 9 to March 31, 2000. His assignment is to look at the existing LWVF-funded FINS program and its impact on and contribution to rehabilitation services. While some retrospective analysis is required, the majority of his time should be spent analyzing how the program needs to evolve in the future. He will make recommendations to both the Mission and the LWVF regarding future directions for the program and will work with FINS to put those recommendations into a solid action plan and subsequent project proposal. From a USAID/Sri Lanka and USAID/LWVF perspective, additional funding is likely if FINS is able to develop an achievable, effective, and impact-oriented proposal. Issues and recommendations from the previous two assessments (by Horvath and Staats in 1997 and Horvath and Savino in 1999) must also be taken into consideration in developing this proposal. Specific to the assessment Rob will be asked to perform the following tasks:

1. Conduct training needs assessment—Rob will look at current staffing patterns and future requirements for the centers in Colombo, Galle, and Kandy. From this analysis, Rob will work with the respective centers to develop a realistic and achievable training curriculum (This curriculum will most likely be illustrative and for proposal purposes only. A more detailed curriculum would be developed at a later date.) The curriculum may include in-country and international workshops and courses.
2. Analyze equipment needs—Rob will work with the three centers to develop a realistic list of equipment needs. To the extent possible, emphasis should be placed on using local equipment suppliers and developing creative solutions to the needs. For example, an outdoor “obstacle course” with stairs, a rocky incline, and an “A”-shaped climbing bar can be built so that separate pieces of costly equipment do not have to be purchased.
3. Assess the current provision of rehabilitation services at each of the centers, with an emphasis on Colombo—Rob will assess the current provision of client services and make recommendations for changes to existing services and the addition of necessary services that

are lacking. His assessment will include, but not be limited to, prosthetics, orthotics, crutches, wheelchairs, physiotherapy, and client follow-up.

4. Assess the current systems in use (Jaipur, Blachford, ICRC, etc.) and make recommendations that address future needs and constraints—These recommendations should be made on the basis of an analysis of current and projected workshop utilization as well as managerial, administrative, and fiscal constraints.

Schedule of Assessment (Illustrative)

March 11:	Arrive in Colombo
March 13–18:	Meetings with Mission; work with FINS/Colombo
March 20–25:	Travel to and work with FINS/Galle and FINS/Kandy
March 27–30:	Follow up work with FINS/Colombo; debrief with Mission; write final report

Questions

Rob will be asked to answer a number of questions relating to the technical, administrative, and managerial capacity and programming of FINS. The questions include, but are not limited to, the following:

1. What are the existing levels of technical expertise in each of the three centers? Where should they be? If there is a difference in where they are and where they should be, what is the most appropriate and effective way to get them from point A to point B?
2. Are staffing levels adequate? If not, can the centers (FINS) support more staff?
3. What is the status of physiotherapy in each of the centers? Is it sufficient and effective? If not, how can it best be strengthened?
4. Do the three centers have sufficient and appropriate equipment to produce Jaipur limbs? What would be the equipment needs if the centers produced polypropylene (ICRC) limbs? Resin? Is this equipment regularly maintained?
5. If resin or ICRC-type legs are produced, can materials be purchased locally? If they cannot be purchased locally, are they easily imported? How is ICRC shipping materials into country? Are there difficulties in clearing customs? What is the estimated cost of producing these types of legs?
6. How are services delivered to clients? Is there any outreach or do all clients have to travel to the centers? What is the average length of time it takes to produce a limb for a new user? A

- former user? What other services are offered at the centers? Is there a medical team approach to prescription and production? How do the technicians interact with the doctors?
7. FINS/Colombo was to begin introducing a temporary limb for use by new amputees. Is this limb in production? Is it accepted by the clients? Is it appropriate and useful?
 8. Is wheelchair production sufficient and appropriate?
 9. Is there any interaction between ICRC and FINS (branches other than Jaffna)? How about Blachfords? What commitments has FINS made to either of these organizations?
 10. All funds now flow through FINS/Colombo Is this an acceptable and amenable method? Can and should funds go directly to the individual centers? How can this be done without increasing management units for the USAID/Sri Lanka office?
 11. How does the FINS program fit into USAID/Sri Lanka's overall country strategy? Can and will USAID continue to support the program? Should or will it continue status quo?
 12. How does the FINS program fit into the overall rehabilitation strategy of Sri Lanka? Is the FINS program effective in this regard? Is the FINS approach to rehabilitation and services appropriate in client-oriented context? How might the program be strengthened?

Suggested Visits (Including, but Not Limited to)

1. Friend-in-Need Society Rehabilitation Centers
 - a. Colombo
 - b. Galle
 - c. Kandy
2. International Committee for the Red Cross
3. Sri Lankan Military Rehabilitation Center (in Colombo)
4. Other nearby private providers of rehabilitation services
 - a. Sunflower center
 - b. Local wheelchair manufacturing center
5. USAID/Sri Lanka
6. Rehabilitation service recipients
 - a. Jaipur limb
 - b. Blachford limb
 - c. SL Military limb (Otto Bock)

APPENDIX B: PERSONS CONTACTED

Army Rehabilitation Center

Ragama

Telephone: 958458/9

Lt. Col./Dr. S. W. Sunil Somaweera

Mr. Le Kamage, Senior Prosthetist

Friend-in-Need Society (FINS)

FINS/Colombo

171 Sir James Peries Mawatha

Colombo 2

Telephone: 544992

Mrs. Rupa Jayasekara, Program Coordinator

Mrs. Kalyani Ranasinghe, Honorary President, FINS/Colombo

Mr. M. D. G. B. Basnayake, Production Manager

Mr. M. K. Karunsena, Assistant Production Manager

Prosthetic and Orthotic Technical Staff

Mr. Gomez, Physical Therapy Assistant

FINS/Galle

Located on the Teaching Hospital Premises

Mahamodera, Galle

Mr. Jhanasena Godage, Administrator and Workshop Manager

Junior Technician

FINS/Kandy

Digama Road

Kundasale

Telephone: 087 – 34621

Mr. Siriwardane, Administrative Manager

Mr. Amarasinghe, Administrator

Technicians

Patients

FINS/Jaffna

Mr. X.S.Y. Francis, Colombo-Based Program Coordinator

International Committee of the Red Cross (ICRC)

29 Layards Road

Colombo 5

Telephone: 503346/7

Dr. A. Rajahalme, Assistant Medical Coordinator

Mr. François Friedel, Member of Orthopedic Team, Geneva

Motivation

Rehabilitation Hospital

Ragama

Telephone: 959039

Mr. Priyantha Pieris

National Council for Persons with Disabilities

Ministry of Social Service

Colombo

Mrs. Somarasinghe, Director

Dr. S. C. Paul, Consultant Surgeon

Teaching Hospital

Kurunegala

Sunflower Village

316/5 Udumulla

Mulleriyawa

Telephone: 5767641

Mr. Lional S. Dissanayake, General Manager

USAID/Sri Lanka

356 Galle Road

Colombo 3

Telephone: 574333

Mr. Gary Robbins, General Development Officer

Mr. Mark Silva, Program Officer

APPENDIX C: ITINERARY

Sunday	03/12/00	Arrive in Sri Lanka
Monday	03/13/00	Meet with USAID/Sri Lanka Mr. Mark Silva Meet with ICRC Dr. A. Rajahalme François Friedel
Tuesday	03/14/00	Meet with FINS Mrs. Rupa Jayasekara Workshop Managers Technicians Patients
Wednesday	03/15/00	Meet with USAID Mr. Gary Robbins, General Development Officer Meet with FINS Dr. Weerasekara Board of Directors
Thursday	03/16/00	Visit FINS Technicians Patients Observe Workshop
Friday	03/17/00	Travel to Galle with Dr. Weerasekara Visit FINS Workshop Mr. Jhanasena Godage, Workshop Manager Junior Technician
Saturday	03/18/00	Return to Colombo
Monday	03/20/00	Travel to Kandy Visit FINS Workshop

Displaced Children and Orphans Fund

Tuesday	03/21/00	Return to Colombo Visit FINS Workshop
Wednesday	03/22/00	Visit FINS Workshop Visit Sunflower Village Rehabilitation Community
Thursday	03/23/00	Visit Army Rehabilitation Center Visit Motivation Wheelchair Production Unit Visit National Council for Persons with Disabilities Mrs. Somarasinghe, Director
Friday	03/24/00	Visit FINS Discuss Action Plan Mrs. Kalyani Ranasinghe
Saturday	03/25/00	Attend FINS Workshop Administrative Meeting
Monday	03/27/00	Meet with USAID/Sri Lanka Mr. Mark Silva
Tuesday	03/28/00	Work on Report
Wednesday	03/29/00	Visit FINS Work on Action Plan Mrs. Kalyani Ranasinghe Work on Report
Thursday	03/30/00	Visit FINS Work on Report
Friday	03/31/00	Visit FINS Work on Report
Thursday	04/06/00	Meet with USAID Ms. Lisa Chiles, Mission Director
Friday	04/07/00	Depart from Sri Lanka

APPENDIX D: RECIPIENTS OF LOWER LIMBS AND APPLIANCES

Database available in hardcopy only