

**GUIDELINES FOR TRAINING PERSONNEL
IN DEVELOPING COUNTRIES
FOR
PROSTHETICS AND ORTHOTICS SERVICES**



International Society
for Prosthetics and Orthotics



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INTRODUCTION

More than 600 million people in the world experience disabilities of various types and degrees. The global disabled population is increasing as a result of population growth, ageing, chronic conditions, malnutrition, war, landmines, violence, road traffic, domestic and occupational injuries and other causes often related to poverty. These trends are creating an overwhelming demand for health and rehabilitation services.

An estimated 80% of the world's disabled people live in developing countries. The majority of them are poor and find difficulty in accessing health and rehabilitation services which ultimately leads to their exclusion from society. With appropriate rehabilitation services, the majority of people with disabilities can become important contributors to society and allocating resources to their rehabilitation is an “Investment”.

Despite the incremental progress made in the past 25 years, today, the vast majority of people with disabilities cannot access even basic rehabilitation services. The majority also cannot exercise their Human Rights, which are defined as the “...right to a standard of living adequate for the health and well-being of individuals and their family, including food, housing and medical care and necessary social services...”

In response to this, the United Nations has issued Standard Rules on the Equalization of Opportunities for Persons with Disabilities* as guidelines in health, education, work and social participation (UN, 1993). The mandate of the WHO is to provide technical support to the Member States, in order to implement the following Standard Rules:

RULE 2. Medical Care:	RULE 3. Rehabilitation:	RULE 4. Support Services:
States should ensure the provision of effective medical care to persons with disabilities.	Rehabilitation is a fundamental concept in disability policy. States should ensure the provision of rehabilitation services to persons with disabilities in order for them to reach and sustain their optimum level of independence and functioning.	States should ensure the development and supply of support services, including assistive devices for persons with disabilities, to assist them to increase their level of independence in their daily living and to exercise their rights.

*Adopted by the United Nations General Assembly, forty-eighth session, resolution 48/96, annex, of 20 December 1993

One of the most important components of rehabilitation and support services is assistive devices which often provide the first step to ensure that people with disabilities are equal members of society. Among assistive devices, prostheses and orthoses are required by the majority of people with physical disabilities.

Persons with physical disabilities, who have a need for prosthetics/orthotics and related rehabilitation services in developing countries, represent 0.5% of the population. In 2004 there are 5.1 billion people in Africa, Asia and Latin America so there will be 25.5 million people in need of prosthetic/orthotic devices. The vast majority of these persons can remain free of deformities or be re-established to function in society if provided with appropriate prosthetic/orthotic devices.

They can be at least partly removed from poverty and become active contributors to their families, communities and society welfare at large, if provided with rehabilitation services by an integrated multi-disciplinary health and social welfare team. Beneficiaries of prosthetics and orthotics services can contribute positively to the socio-economic condition of the country.

Mobility is the first step to access basic rights including access to food, shelter, education, job/income, equal opportunities and equal citizenship. The most important components in the restoration of mobility are assistive devices such as orthoses, prostheses and mobility aids. Prosthetics and orthotics services play a major role in enabling a person with a disability to change from being immobile to becoming mobile, a passive receiver to an active contributor, and isolation to inclusion. They also help to provide further means towards equality by helping a child with disability to go to school or an adult with disability to go for skills training or income generation activities.

To provide the necessary quality of prosthetics and orthotics services it is important that the personnel providing them should have an adequate level of education and training.

A World Health Organization Consultation on training of personnel for prosthetics and orthotics services in developing countries took place at the Eastern Mediterranean Regional Office, Alexandria, Egypt, in June 1990. The purpose of the Consultation was to prepare a general description of the work done by personnel who provide prosthetics/orthotics and related rehabilitation services, and a guide for training them based on the work they must perform. This resulted in the publication *Guidelines for Training Personnel in Developing Countries for Prosthetic and Orthotic Services* (WHO, 1990).

The International Society for Prosthetics and Orthotics (ISPO), at the request of the World Health Organization (WHO) coordinated a follow-up consultation at the WHO Collaborating

Centre, the National Centre for Training and Education in Prosthetics and Orthotics, University of Strathclyde, Glasgow, Scotland, United Kingdom in September 2003, in order to identify development and changes in the 13 years since the Alexandria meeting.

The Temporary Advisers who attended the Consultation were from schools in developing countries that educate and train personnel for prosthetics/orthotics services, and from organisations that have been involved in the development and support of such training programmes. (See Annex I for the list of participants in the Consultation).

This document presents the tasks for various types of personnel and the guidelines for their training. In addition, the document presents information on issues related to training, as well as the distribution of prosthetics and orthotics services and personnel, which could be used as an important tool in any kind of national planning of rehabilitation or prosthetics and orthotics services.

NEED FOR PERSONNEL FOR PROSTHETICS AND ORTHOTICS

By the year 2010 the combined population of Africa, Asia and Latin America will be approximately 6 billion. The estimated number of people in need of prosthetic and orthotic devices will be 30 million. The personnel estimated to provide services in prosthetics and orthotics would therefore be 180,000. Approximately, 40,000 trained Category I and II level personnel (as defined in Annexes A and C) are estimated to be needed.

There are approximately 24 schools of varying levels and standards in developing countries which train personnel qualified in some measure to fit, fabricate and assess the biomechanical function of orthopaedic appliances. They graduate no more than 400 personnel per year for all developing countries. It is clear that the existing training arrangements are totally inadequate in comparison to the need. More than 75% of developing countries have no prosthetics and orthotics training programmes which leads to a poor coverage of prosthetics and orthotics services. Urgent measures need to be taken to increase the numbers of personnel being trained in order to ensure all persons with disabilities or who need such kind of services could receive the same regardless of their socio-economic condition and where they live. Prosthetics and orthotics services also need to be decentralised to ensure they are in reach of all. Special emphasis needs to be given to ensure women and girls also get equal opportunities to access the service.

The prosthetics/orthotics professionals are usually part of a multi-disciplinary rehabilitation team. To ensure prosthetics and orthotics service users get a quality service, ISPO has taken several important steps to facilitate and enhance the education of all health care disciplines involved with prosthetics and orthotics throughout the world. The Society has detailed appropriate education and training programmes for the full professional prosthetist/orthotist (Category I), orthopaedic technologist (Category II) and orthopaedic technician/bench worker (Category III). The philosophy and curricula are widely accepted by most of the international governmental and non-governmental agencies in the field of rehabilitation and prosthetics/orthotics services. Category I and II personnel are responsible for direct service. Category III technicians/bench workers are also needed to support Category I and II personnel but are not considered as service providers.

In order to estimate the numbers of personnel needed in prosthetics and orthotics services, the following criteria could be considered:

- the number of persons needing prosthetics and orthotics services in the country (calculated from the prevalence or incidence);
- rate of work = persons visiting centre;
- levels of referral (existing or predicted);
- type of prosthetic and orthotic devices needed;

- the number of persons to be provided with prosthetics and orthotics services per orthotist/prosthetist;
- the prosthetist/orthotist: orthopaedic technologist: technician ratio.

It is also necessary to look into:

- the socio-economic condition of the country;
- the prioritisation and spreading of services.

TYPES OF PERSONNEL

The categorisation of prosthetics and orthotics professionals described in this guideline represents the desirable aim for the planning and development of prosthetics and orthotics services. Throughout this document the ISPO Categorisation system for personnel is used and is summarised in Table 1 and appropriate detail is provided in the Annexes. Category I is the level of professional who should ideally provide prosthetics and orthotics service within the rehabilitation team. In countries where resources and finances are not available to train all workers to this level, training to Category II level is believed to represent a compromise which will still provide quality service preferably with supervision by Category I personnel in difficult cases.

Category	Nomenclature	Normal Minimum Entry	Training
CLINICAL STAFF			
Category I	Prosthetist/orthotist (or equivalent term)	University entry level	4 years formal structured education leading to University degree (or equivalent)
Category II	Orthopaedic Technologist	Usual national requirement for paramedical education	3 years formal structured education – lower than degree level
Category II (lower limb prosthetics)	Lower limb prosthetics technologist	Usual national requirement for paramedical education	1 year formal structured education plus clinical experience in only lower limb prosthetics to Category II level
Category II (lower limb orthotics)	Lower limb orthotics Technologist	Usual national requirement for paramedical education	1 year formal structured education plus clinical experience in only lower limb orthotics to Category II level
Category II (upper limb prosthetics/orthotics and spinal orthotics)	Upper limb prosthetics/orthotics and spinal orthotics technologist	Usual national requirement for paramedical education	1 year formal structured education plus clinical experience in only upper limb prosthetics/orthotics and spinal orthotics to Category II level
TECHNICAL STAFF			
Category III (not a service provider)	Technician (bench worker or equivalent term)	Usual national requirement for technician training	2 years formal structured or 4 years on-the-job or in-house training

FOOTNOTE:

Component manufacture is an industrial production process which does not normally involve the above categories.

Table 1: Types of personnel

Category I personnel are educated and trained in all areas of prosthetics and orthotics practice and related rehabilitation issues whilst Category II personnel are educated and trained in only the major areas of prosthetics and orthotics which are commonly needed.

Many developing countries have special situations, which require the production of unusual numbers of some common types of prostheses and/or orthoses. In these situations personnel may be trained through modules in either prosthetics or orthotics. Such individuals would be described as Category II (Lower Limb Prosthetics Technologist), Category II (Lower Limb Orthotics Technologist) or Category II (Upper Limb Prosthetics/Orthotics and Spinal Orthotics Technologist). These personnel should be trained within the framework of Category II training but specific to a particular branch of prosthetics and orthotics. Effort should be made to keep open the possibilities of upgrading to ensure a person who has completed one module could complete other modules and could become a full Category II professional.

To ensure persons with disabilities get a quality service irrespective of their socio-economic condition, it is essential for governments and other prosthetics and orthotics service providers to ensure that the provision of direct service to the individual remains the responsibility of at least a Category II professional. In some countries there may be trained technicians not up to category II level providing direct service. Efforts need to be made to upgrade those technicians' knowledge and skill by modular programmes, distance-learning programmes or by means of e-learning.

Persons with disabilities need a quality prosthetics and orthotics service which would ensure equal opportunities and better quality of life with full functional and economic independence. Persons with disabilities also have the right to choose the type of prostheses or orthoses that would benefit them most. To satisfy such requirements the minimum training need in any country is for Category II or its component parts. Any other kind of training of lesser duration and/or level in the field of prosthetics and orthotics would not meet the needs or requirement of persons with disabilities.

An example of a modular approach to formal training designed to run alongside prosthetics and orthotics clinical and technical services can be seen in a well structured training format following a sequence of 4 modules which are delivered as circumstances allow. This can be seen as a flexible solution in training staff to the best potential possible in a variety of situations. The modular approach to training facilitates progression from one module to another as needed in each situation. Each module takes an average of 12-18 months to complete. This modular approach is represented in the diagram below:

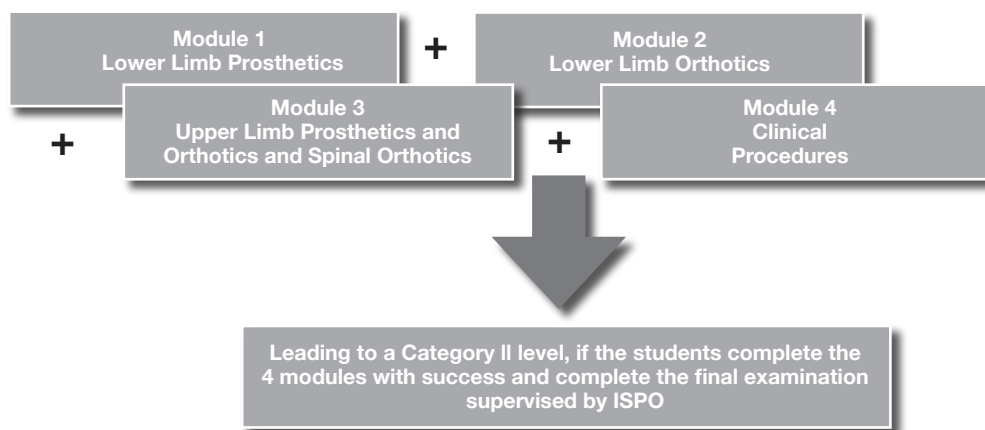


Diagram 1: An example of a modular approach to training

The completion of all four modules is intended to lead to ISPO recognition at the Category II level.

The professionals described as Category I, II and III within this document do not work alone, but form part of a rehabilitation team, where available. If not, at least they need to work alongside other paramedical professionals such as therapists, social workers and community-based rehabilitation workers for the optimal benefit to the persons who require prosthetics and orthotics services.

It is important that services are set-up in a way that is sustainable and affordable. One important issue is the need of continuing education for the professionals practising in prosthetics, orthotics and related rehabilitation services. In all situations it is essential to ensure the equalisation of opportunities for all prosthetics and orthotics personnel regardless of gender.

TASKS OF PERSONNEL

Before describing the training of the various types of personnel it is necessary to identify the tasks they are expected to perform. Their training will equip them with the necessary knowledge and skills for the tasks involved. It should be remembered in identifying these tasks that prosthetics and orthotics is an area of rehabilitation and the prosthetists/orthotists and orthopaedic technologists are members of the rehabilitation team.

The **prosthetist/orthotist** (ISPO Category I) is responsible for direct user/patient services and management of the orthopaedic workshop usually at Reference Centres or Training Institutions. A detailed list of the tasks of the prosthetist/orthotist is contained in the professional profile in Annex A. These tasks fall into the categories: patient care or providing direct service to persons with disabilities; management and supervision; training and education; community services; research and development. They are carried out within an ethical code and complying with medical and legal requirements.

In respect of providing user service, the prosthetist/orthotist is a full member of the rehabilitation team, can advise on the design of an appropriate prosthetic/orthotic device to meet the needs of any user requiring prosthetics/orthotics service and with the assistance of the orthopaedic technologist and technician/bench worker prepare the prosthesis or orthosis to fit the individual, and ensure its optimum use and user's satisfaction. He/she will have the skills necessary to assess the fit and function of the device and make adjustments as necessary.

The management tasks of the prosthetist/orthotist relate to the functions of the orthopaedic workshop/laboratory and the staff under his/her supervision. He/she may also interact with governmental and non-governmental agencies in respect of the planning and implementation of national services and with other rehabilitation professionals at local and national level. He/she will interact as required with personnel involved in community-based rehabilitation programmes.

The prosthetist/orthotist may supervise and conduct the training and education of other prosthetists/orthotists, of orthopaedic technologists (ISPO Category II) and technicians/bench workers (ISPO Category III) and be involved in lecturing and demonstration to other members of the rehabilitation team.

The prosthetist/orthotist will conduct a continuing evaluation of his/her activities and may participate in formal research and evaluation programmes, and will participate in professional meetings and may contribute papers to scientific/professional journals.

The **orthopaedic technologist** (ISPO Category II) will be responsible for direct patient care or providing direct service to persons with disabilities and management of the orthopaedic workshop if a Category I professional is not available and at provincial and district level institutions. A detailed list of the tasks of the orthopaedic technologist is contained in the professional profile in Annex C. These tasks are similar to those of the prosthetist/orthotist but with some differences in emphasis. The orthopaedic technologist is capable of providing quality service for persons requiring the more common levels of prosthetic/orthotic devices. For more difficult conditions he/she will normally have access to a prosthetist/orthotist either for advice on treatment or for onward referral. The orthopaedic technologist will not normally be involved in research and development activities.

The **lower limb prosthetics technologist** (ISPO Category II), the **lower limb orthotics technologist** (ISPO Category II) and the **upper limb prosthetics/orthotics and spinal orthotics technologist** (ISPO Category II) are capable of carrying out all tasks allocated to the orthopaedic technologist but in only one branch of the speciality.

The **technician/bench worker** (ISPO Category III), in direct assistance to the prosthetist/orthotist or orthopaedic technologist, fabricates and assembles prosthetic/orthotic devices and takes part in their maintenance, repair and replacement. He/she will be responsible for the economic use of tools and materials and may have management supervision and training duties assigned to him/her. The technician/bench worker is not involved in direct prosthetics/orthotics service to the user. A detailed list of the tasks of the technician/bench is contained in the professional profile in Annex E.

TRAINING OF PERSONNEL

The primary objective of this document is to provide guidelines for training of personnel based on their tasks in prosthetics/orthotics and related rehabilitation services. A secondary objective is to discuss the training of personnel with regard to national planning for services. The guidelines present recommendations for theoretical and practical instruction, which will provide each category of professional with the knowledge and skills needed to perform the required tasks.

The tasks of professionals (Categories I and II) are presented in Annexes A and C. The guidelines for training professionals (Categories I and II) are available in Annexes B and D.

The training of lower limb prosthetics, lower limb orthotics and upper limb prosthetics/orthotics and spinal orthotics technologists (Category II) is based on the training of the orthopaedic technologist (Category II) but is limited to a single discipline. The entry-level requirement and examination procedure should be the same as for the orthopaedic technologist (Category II).

The length and content of training will determine the type of recognition the different categories of personnel will have at the end of the training period. It is important that professional development pathways (schemes of service) are developed for prosthetics and orthotics personnel so that these personnel receive comparable recognition educationally and in the services to which they are assigned.

Supervised clinical practice/field attachment is an essential section of the training programme. Suitable clinical facilities (including adequate clinical and technical supervision) need to be available for all students.

The training curricula and training time period should be in accordance with the ISPO Information Packages (ISPO, 1997; 2002a) but may be adjusted to meet specific need of a country or region.

Most countries do not have formal training programmes for Category III personnel. This may be achieved in various ways. The tasks of professionals (Category III) are presented in Annex E. The guidelines for training professionals (Category III) are available in the ISPO Information Packages (ISPO, 2002b).

When a country is preparing plans for the training of personnel, consideration should also be given to people in the country who may have already had some training in prosthetics and

orthotics under less formal arrangements. This would include personnel who may have been trained many years ago, or who were trained in an emergency situation following conflict or a natural disaster. Some of these people are still working in the production of prostheses or orthoses, either under the supervision of qualified personnel, or independently. Some of these previously trained people can be upgraded professionally. Upgrading training may be delivered in a variety of ways including full time or part time study and by direct tuition or by distance learning.

There is a need for more training facilities for prosthetics/orthotics personnel in developing countries. Training may be developed on a national or multinational basis. When a training programme is established, provision should be made not only for the initial costs of setting up the school, but also for the long-term maintenance of the programme. A list of resources needed for a school is presented in Annex G. This is merely a guide to the major items, which must be considered. Planning a school requires a more detailed analysis carried out by people within the country where the school will be located. Prosthetics/orthotics personnel and other members of the rehabilitation team must be involved in the planning of service provision, clinical/laboratory facilities, equipment and materials.

Any training programme should include a plan for monitoring the outcome of training students throughout the training programme. The importance of setting criteria for the assessment of training early within the planning phase of setting up a training course should not be underestimated.

SERVICES

The prosthetics and orthotics service is an integral part of the health and rehabilitation services in a country. It is important that these services follow the health care referral system of the country. In order to have an optimum access to prosthetics and orthotics services throughout a country it needs to have a strong linkage with the primary health care services and community-based rehabilitation programmes.

This document focuses on the training of personnel for the distribution of prosthetics and orthotics services. It is not intended to be a guide for all aspects of the development of services. However, some aspects of the services should be mentioned because they relate to the development of personnel.

Where possible, people with disability should be consulted concerning the provision and development of prosthetics and orthotics services. Prosthetics and orthotics provision and related rehabilitation services should be linked to mainstreaming development activities and poverty reduction strategy programmes.

The national planning for the provision of prosthetics and orthotics and rehabilitation services is the responsibility of government. It is recommended that due consideration is given to the plans and structure of the health services. Many international and non-governmental organisations are involved in the provision of prosthetics and orthotics services and their contributions also should be considered when formulating the plans. New services should be developed within the national plan of the country. Prosthetics and orthotics provision and related rehabilitation services should not be developed in isolation, but as an integral part of the health services and in collaboration with the government.

It is recommended to develop services on different levels, these are:

National;
Provincial;
District/Zone.

It is recognised that when prosthetics and orthotics services are being developed they will have to be progressively introduced.

Rehabilitation services at community level generally do not exist. Community-based rehabilitation activities can assist people with disability to access proper prosthetic, orthotic and rehabilitation services. For prosthetics and orthotics provision and related rehabilitation services, community-based rehabilitation and outreach activities provide an important connection to people with disability in the community.

DISTRIBUTION OF PERSONNEL AND SERVICES

The following calculation has been provided as an example of an estimate of the prosthetics and orthotics personnel necessary for a population of 10,000,000 people in an ideal situation. All countries have different needs and resources and the example shown provides only some guidance in estimating the numbers of personnel required for prosthetics and orthotics services within a country. The calculation takes into account:

- the number of disabled people in the country requiring prosthetic and orthotic devices calculated at an incidence of 0.5%
- the rate of provision calculated on the basis of the supply of 1 device every 3 years to each individual
- numbers of prosthetics and orthotics centres required at the different levels:
 - national centre = 1
 - provincial centres = 2
 - district centres = 10
- rates of persons referred per level:
 - referrals to district level = 100%
 - district level to provincial level = 20%
 - provincial level to national level = 30%
- the average the number of disabled people that can be treated per Category I/ Category II professional per year is 250. Due to the complexity of the individual treatments at the different levels a weighting factor needs to be applied to this number to determine the number of people a professional can deal with each year:
 - district centre = 1.2×250 = 300 disabled people per Category II
 - provincial centre = 1.0×250 = 250 disabled people per Category I/II
 - national centre = 0.5×250 = 125 disabled people per Category I/II
- the Category I/II professional: technician/bench worker (category III) ratio at the different levels is as follows:
 - district centre = 1:5
 - provincial centre = 1:3
 - national level = 1:1

Calculation of number of people requiring devices

Total number	= 10,000,000*0.5/100	= 50,000
Number per year	= 50,000/3	= 16,700
Numbers at district centres (10)	= 16,700*80/100	= 13,360
Numbers at provincial centres (2)	= 16,700*20/100	= 3,340
Number at national centre (1)	= 3,340*30/100	= 1,000

Numbers of Category I and/or Category II personnel required

At district centres (10): 13,360/300	= 45 Category II fully trained personnel for 10 centres
	= 5 Category II per district centre
At provincial centres (2): 3,340/250	= 14 Category II for 2 centres
	= 7 Category II per provincial centre
At national centre: 1,000/125	= 8 Category I/II per national centre

Numbers of Category III personnel required

At district centre	= 5*5	= 25 per district centre
At provincial centre	= 7*3	= 21 per provincial centre
At national centre	= 8*1	= 8 per national centre

Basic determination of the distribution of personnel and services

Every country could consider the above as a basis for prosthetics and orthotics service planning.

It is recommended that national plans should consider the final outcome within a given time frame

Implementation of services could be planned step-by-step in an incremental fashion following a prioritization of national needs and economic possibilities.

COMMUNITY-BASED REHABILITATION

WHO has recognized that although most basic rehabilitation activities can be carried out in the disabled person's own community, many persons with disabilities have to be referred to other rehabilitation services outside their own community. Among this group are those persons who require prostheses and orthoses. This is because prostheses and orthoses of an acceptable quality cannot realistically be made in every single community within a country. This means that for the successful, widespread provision of prosthetics and orthotics services there needs to be a strong relationship between the specialized services and community-based rehabilitation programmes.

The relationship between prosthetics and orthotics services and community based rehabilitation is outlined in a joint statement between WHO and ISPO which was the outcome of wide consultation. It was first published in 1999 and revised in 2003 (Appendix H).

Identification of people with disabilities occurs by a number of methods including self-referral, referral by community-based rehabilitation outreach programmes and referral from other health and social facilities and services.

Services for people with disabilities who need prostheses and orthoses should include not only the provision of the devices, but training regarding prevention of deformity and the use/care of the device.

The quality of prosthetics and orthotics services must be at an appropriate level. In the interest of quantity of service delivery, the issue of quality should not be ignored. Services developed under a quality management system, will develop quantity of service. If a service focuses primarily on numbers of devices delivered, quality improvement and maintenance of quality standards of services will prove difficult.

Different technologies and materials are available for the production of prostheses/orthoses. Sustainability of the service will depend on a number of factors, including that appropriate, cost-effective and affordable technologies and materials are used. The subject of appropriate technology was discussed fully in the ISPO Consensus Conference on Appropriate Prosthetic Technology for Developing Countries held in Phnom Penh, Cambodia in 1995 (ISPO, 1996) and the ISPO Consensus Conference on Appropriate Orthopaedic Technology for Low Income Countries held in Moshi, Tanzania in 2000 (ISPO, 2001). These conferences were held in collaboration with the Leahy War Victims Fund of the United States Agency for International Development (USAID) and WHO. Copies of the reports of these conferences are available from ISPO.

Personnel and services for people with disabilities are needed throughout developing countries. With a view to the long-term goal of providing services to all people, short-term goals should be set for the development of the necessary personnel and services. Over the relatively short span of ten years, an impact can be made by meeting short-term goals each year.

ANNEX A - Professional profile Category I

A. PROFESSIONAL PROFILE FOR CATEGORY I (PROSTHETIST/ORTHOTIST, ORTHOPAEDIC ENGINEER, ORTHOPAEDIC MEISTER ETC.)

The following professional profile has its basis in the Report of the United Nations Inter-Regional Seminar on Standards for the Training of Prosthetists (UN, 1968) - the so-called Holte Report. It has moreover been modified to comply with Guidelines for Training Personnel in Developing Countries for Prosthetic and Orthotic Services (WHO, 1990), further refined by the Education and Certification Committees of ISPO and finally updated at the WHO/ISPO Consultation on Training Personnel in Developing Countries for Prosthetics and Orthotics Services, Glasgow, 2003.

A.1 Prosthetics/orthotics service

Formulation of treatment

- A.1.1 Participates as full member of the clinic team; takes part in the examination and prescription; and advises on the design of the prosthetic/orthotic device, including the socket or body/device interface, suspension and selection of proper components.
- A.1.2 Assists and advises on relevant aspects of pre-surgical, post-surgical, medical and therapeutic management of individuals requiring prosthetic/orthotic devices.
- A.1.3 Records and reports any pertinent information regarding users and users' families, including a determination of expectations and needs.
- A.1.4 Communicates appropriate information to the users and their families.

Fitting, fabrication and treatment

- A.1.5 Supervises and directs the activities of individuals in Category II (orthopaedic technologists) and Category III (bench technicians) in fitting and fabrication.
- A.1.6 Identifies physical and other relevant characteristics of the user.
- A.1.7 Formulates prosthetics or orthotics designs, including selection of materials, components and additional aids.
- A.1.8 Takes all casts and measurements required for proper fabrication and fitting.
- A.1.9 Modifies positive and/or negative models and/or layout of design to obtain optimal fit and alignment.

A.1.10 Carries out fitting, static and dynamic alignment and, where appropriate, preliminary training and initial check-out.

A.1.11 Performs and/or supervises fabrication of the prosthesis or orthosis.

Evaluation and follow-up

A.1.12 Advises the team and participates directly in final check-out and evaluation of fit, function and cosmesis.

A.1.13 Instructs the user or family in the use and care of the device.

A.1.14 Takes part in follow-up procedures as well as maintenance, repairs and replacement of the appliance.

A.1.15 Recognises the need to repeat any of the identified steps in order to optimise fit and function.

A.1.16 Collaborates and consults with others engaged in the management of the person requiring prosthetics/orthotics service.

A.2 Management and supervision

A.2.1 Supervises the activity of supporting staff as appropriate.

A.2.2 Manages clinical and laboratory/workshop activities assigned to him/her, including:

- use and maintenance of tools and equipment
- maintenance of safe working environment and procedures
- inventory and stock control
- personnel matters
- financial matters
- appropriate record keeping
- total quality management

A.2.3 Devises improved job methods for increasing efficiency.

A.2.4 Interacts with professional groups and, where appropriate, governmental and non-governmental agencies.

A.2.5 Takes part in planning and implementation of technical orthopaedic care systems.

A.3 Training and education

- A.3.1 Supervises and conducts the education and training of individuals in Category I (prosthetists/orthotists), Category II (orthopaedic technologists) and Category III (technicians/bench workers).
- A.3.2 Lectures and demonstrates to colleagues in his/her profession and other professionals concerned with prosthetics/orthotics and also to other interested groups.
- A.3.3 Is required to take part in and contribute to the process of continuing professional development.
- A.3.4 Keeps abreast of new developments concerning prosthetics/orthotics and teaching techniques.

A.4 Community services

- A.4.1 Makes a professional contribution to and takes part in community rehabilitation programmes.

A.5 Research and development

- A.5.1 Conducts continuing evaluation of his activities.
- A.5.2 Participates in formal evaluation and research programmes.
- A.5.3 Participates in scientific/professional meetings and contributes papers to scientific/professional journals.

A.6 Medical, legal and ethical requirements

- A.6.1 Provides service to the user within a recognised prosthetics/orthotics code of ethics.
- A.6.1 Provides service to the user, which complies with medical/legal requirements.

Annex B - Guidelines for training Category I personnel

(based on the ISPO Information Package (ISPO, 2002a))

B LEARNING OBJECTIVES OF COURSE FOR CATEGORY I

The following outlines the learning objectives of a course for Category I personnel in respect of theoretical subjects (B.1 to B.12), closely supervised practical instruction (B.13) and clinical practice (B.14). It should be emphasised that this is a guideline and local variations may still produce an acceptable course. In respect of the supervised practical instruction, regional requirements may influence the emphasis in areas of prosthetics/orthotics service.

It is also noted again that the course which encompasses these learning objectives will normally be of three or four years duration full-time study and the entrants will have satisfied University entrance requirements (12/13 years schooling). This provides guidance as to the expected level of the course and its place within the national educational framework.

B.1 Anatomy and physiology

In the area of anatomy and physiology the student should have knowledge of the following:

- gross anatomy;
- structure and properties of biological substances;
- cell biology;
- basic tissues;
- physiology of body symptoms;
- locomotor system;
- detailed anatomy of lower limb, upper limb, spine and trunk;
- human development;
- body fluids and defence mechanisms;
- cardiovascular and respiratory systems;
- skin;
- nervous systems;
- proprioceptive system.

The student should have an understanding of the function of individual joints and muscles and be proficient in explaining their interaction. He/she should be knowledgeable in the area of pathological deviations and be able to analyse them by means of appropriate measuring instruments as well as by applying his/her knowledge of range of motion in order to be able to identify a viable prosthetics/orthotics treatment. The student should recognise that biomechanical as well as pathological factors must be viewed concurrently with anatomical factors.

B.2 Pathology

The student will have knowledge of the following areas particularly as they relate to prosthetics and orthotics:

- general pathological processes;
- pathology of the locomotor system;
- pathology of the cardiovascular and respiratory systems;
- pathology of skin;
- pathology of the nervous system;
- abnormalities present at birth (congenital deformities).

The student should be able to comment on the aetiology and progression of the disease in question, as well as on its care and treatment. He/she must demonstrate proficiency in anatomy, physiology, biomechanics and pathology as well as the ability to coordinate these factors and arrive at the appropriate end result in his/her role as a prosthetist/orthotist.

B.3 Mechanics and biomechanics

The student will understand the following subjects:

Mechanics:

- forces and force effects;
- resolution and summation of forces and moments;
- free body diagrams;
- linear and angular motion
- stress and strain;
- shear force and bending moment diagrams;
- bending and torsion;
- beams;
- theories of failure;
- connections;
- fluid mechanics;
- control systems.

Biomechanics:

- human tissue mechanics;
- human movement;
- joint force analysis
- lower limb;
- upper limb;
- spine;
- lower limb prosthetics;
- upper limb prosthetics;
- lower limb orthotics;

- upper limb orthotics;
- spinal orthotics;
- prosthetics/orthotics design applications.

The student will have a thorough grounding in basic mechanical principles. He/she will be capable of applying these principles to relevant aspects of the human body system and prosthetics/orthotics applications.

B.4 Mathematics and statistics

The student will have a knowledge of the following areas of mathematics and their application to mechanics, biomechanics and prosthetics and orthotics:

Mathematics:

- algebraic manipulation;
- trigonometry;
- functions, polynomial, rational, exponential, logarithmic;
- differentiation;
- integration;
- differential equations.

Statistics

- organisation of data;
- probability;
- probability models;
- estimation;
- regression.

B.5 Materials technology

The student will have an understanding of the characteristics, properties and the processing of the following commonly used materials with particular reference to their applications in prosthetics and orthotics:

- steel and its alloys;
- non-ferrous metals and their alloys;
- plastics: thermoforming, thermosetting, composites;
- wood;
- leather;
- textiles;
- plaster of Paris;
- adhesives.

B.6 Workshop technology

The student will understand and be able to apply, in the field of orthopaedic technology, the following areas of knowledge:

- hand tools: their selection, use and maintenance;
- measuring instruments: use and methods of application;
- machine tools: selection, installation, use and maintenance;
- welding processes and equipment for metals and plastics;
- sewing machines: selection, use and maintenance;
- general equipment: ovens, compressors, vacuum pumps, fume and dust extraction apparatus;
- workshop layout;
- health and safety regulations and practice.

B.7 Clinic, workshop and business management

The student will have knowledge of the theory and application of:

- materials acquisition, handling and stock control;
- workforce management;
- production cost calculations;
- budgeting, invoicing, receipting and accounting;
- clinic management, appointment systems, record keeping;
- property management, care and maintenance;
- environmental/ecological considerations;
- quality management;
- health systems;
- ethical considerations.

B.8 Graphical communication

The student will have basic knowledge and practice in the following:

- first and third angle projection;
- auxiliary views and sections;
- use of drawing standards;
- application of machining tolerances;
- simple assembly drawings;
- applications in orthopaedic technology.

B.9 Prosthetics and orthotics science

The student will understand the biomechanics, anatomy, related pathology, available prosthetic and orthotic devices, user/device matching and fitting and alignment principles for the following areas of prosthetics and orthotics provision:

- partial foot prosthetics;
- ankle disarticulation prosthetics;
- trans-tibial prosthetics;
- knee disarticulation prosthetics;
- trans-femoral prosthetics;
- hip disarticulation and trans-pelvic prosthetics;

- partial hand prosthetics;
- wrist disarticulation prosthetics;
- trans-radial prosthetics;
- elbow disarticulation prosthetics;
- trans-humeral prosthetics;
- shoulder disarticulation and forequarter prosthetics;

- foot orthotics;
- ankle-foot orthotics;
- knee orthotics;
- knee-ankle-foot orthotics;
- hip orthotics;
- hip-knee-ankle-foot orthotics;

- hand orthotics;
- wrist-hand orthotics;
- elbow orthotics;
- elbow-wrist-hand orthotics;
- shoulder orthotics;
- shoulder-elbow-wrist-hand orthotics;

- sacro-iliac orthotics;
- lumbo-sacral orthotics;
- thoraco-lumbar orthotics;
- thoraco-lumbo-sacral orthotics;
- cervical orthotics;
- cervico-thoraco-lumbo-sacral orthotics;

- orthopaedic footwear and shoe modifications;
- fracture bracing.

B.10 Clinical studies

The student will gain an appreciation of relevant diseases and their treatment including prosthetics or orthotics provision. He or she will have knowledge of patient/user management in respect of physical, social, psychological and ethical considerations. The subject will particularly relate to prosthetics and orthotics provision and areas covered will include:

- the clinic team;
- amputation surgery;
- rehabilitation;
- psychology of loss and disability;
- demyelination disorders;
- skin disorders;
- foot disorders and chiropody;
- upper motor neurone disorders;
- lower motor neurone disorders;
- abnormalities present at birth;
- peripheral vascular disease;
- age related disabilities;
- spinal injuries;
- fracture treatment;
- joint and skeletal disorders;
- X-rays interpretation;
- patient/user handling and safe movement;
- research methodology.

B.11 Electrotechnology

The student will have knowledge of the following principles of electricity with particular reference to applications in prosthetics, orthotics and workshop practice:

- basic concepts;
- DC circuits;
- inductance and capacitance;
- AC circuits;
- power supplies;
- amplifiers;
- feedback;
- interference rejection techniques;
- measurement;
- myoelectrodes;
- safety.

B.12 Computer studies

The student will have basic knowledge of the use of personal computers and an introduction to the following areas of computer application:

- computer aided measurement and device manufacture;
- commercially available systems for device design;
- internet communication;

B.13 Prosthetics and orthotics practice

The basis of prosthetics and orthotics practice is the closely supervised practical instruction of the student in manufacturing and fitting devices to patients. The student will then practise manufacturing and fitting under supervision and demonstrate his or her capability of attaining satisfactory results. The following areas of practice will be addressed:

- partial foot prosthetics;
 - ankle disarticulation prosthetics;
 - trans-tibial prosthetics;
 - knee disarticulation prosthetics;
 - trans-femoral prosthetics;
 - hip disarticulation and transpelvic prosthetics;
-
- partial hand prosthetics;
 - wrist disarticulation prosthetics;
 - trans-radial prosthetics;
 - elbow disarticulation prosthetics;
 - trans-humeral prosthetics;
 - shoulder disarticulation and forequarter prosthetics;
-
- foot orthotics;
 - ankle-foot orthotics;
 - knee orthotics;
 - knee-ankle-foot orthotics;
 - hip orthotics;
 - hip-knee-ankle-foot orthotics;
-
- hand orthotics;
 - wrist-hand orthotics;
 - elbow orthotics;
 - elbow-wrist-hand orthotics;
 - shoulder orthotics;
 - shoulder-elbow-wrist-hand orthotics;
 - sacro-iliac orthotics;
 - lumbo-sacral orthotics;

- thoraco-lumbar orthotics;
- thoraco-lumbo-sacral orthotics;
- cervical orthotics;
- cervico-thoraco-lumbo-sacral orthotics;

- orthopaedic footwear and shoe modifications;
- fracture bracing.

B.14 Clinical practice

The student will have experience in the clinical environment of supplying prostheses and orthoses to patients/users. This experience should cover as wide a range as possible but with emphasis on the major levels of provision. The aim is to develop skills in:

- assessment and prescription;
- clinical provision of prostheses and orthoses;
- manufacture of prostheses and orthoses;
- interpersonal relationships;
- professional activity;
- communication;
- organisation and management;
- clinical research.

Where the clinical practice takes place in centres other than the main teaching institution such clinical placement centres must satisfy specified standards of the teaching institution and the student's work must be supervised by a Category I professional.

Annex C - Professional profile Category II

C. PROFESSIONAL PROFILE FOR CATEGORY II (ORTHOPAEDIC TECHNOLOGIST)

The following professional profile is specific to workers in low income countries. The Category II professional is a compromise to replace the Category I professional if not available or affordable in low income countries. Its origin is in the Guidelines for Training Personnel in Developing Countries for Prosthetic and Orthotic Services (WHO, 1990), it has been further refined by ISPO to ensure compliance with its categorization system and finally updated at the WHO/ISPO Consultation on Training Personnel in Developing Countries for Prosthetics and Orthotics Services, Glasgow, 2003.

C.1 Prosthetics/orthotics service

Formulation of treatment

- C.1.1 In the absence of a Category I professional participates as full member of the clinic team; takes part in the examination and prescription; and advises on the design of the prosthetic/orthotic device interface, suspension and selection of the proper components.
- C.1.2 Assists and advises on relevant aspects of pre-surgical, post-surgical, medical and therapeutic management of individuals requiring prosthetic/ orthotic devices.
- C.1.3 Records and reports any pertinent information regarding patients/users and their families, including a determination of expectations and needs.
- C.1.4 Communicates appropriate information to patients/users and their families.

Fitting, fabrication and treatment

- C.1.5 Identifies physical and other relevant characteristics of the patient/user.
- C.1.6 Formulates a range of prosthetic or orthotic designs including selection of materials, components and additional aids.
- C.1.7 Takes all casts and measurements required for proper fabrication and fitting.
- C.1.8 Modifies positive and/or negative models and/or layouts of design to obtain optimal fit and alignment.
- C.1.9 Carries out fitting, static and dynamic alignment and, where appropriate, preliminary training and initial check-out.
- C.1.10 Performs and/or supervises fabrication of the prosthesis or orthosis.

Evaluation and follow-up

- C.1.11 Advises the team and participates directly in final check-out and evaluation of fit, function and cosmesis.
- C.1.12 Instructs the patient/user or family in the use and care of the device.
- C.1.13 Takes part in follow-up procedures as well as maintenance, repair and replacement of the appliance.
- C.1.14 Recognises the need to repeat any of the identified steps in order to optimise fit and function.
- C.1.15 Collaborates and consults with others engaged in the management of the patient/user.

C.2 Management and supervision

- C.2.1 Supervises the activity of supporting staff as appropriate.
- C.2.2 Manages clinical and laboratory/workshop activities assigned to him/her, including:
 - use and maintenance of tools and equipment
 - maintenance of safe working environment and procedures
 - inventory and stock control
 - personnel matters
 - financial matters
 - appropriate record keeping
 - total quality management
- C.2.3 Devises improved job methods for increasing efficiency.
- C.2.4 Interacts with professional groups (as well as) and, where appropriate, governmental and non-governmental agencies.
- C.2.5 Takes part in planning and implementation of technical orthopaedic care systems.

C.3 Training and education

- C.3.1 May supervise and take part in the training of individuals in Category II (orthopaedic technologists) and Category III (technicians/bench workers).
- C.3.2 May lecture and demonstrate to colleagues in his profession and other professionals concerned with prosthetics/orthotics and also to community and other interested groups.

C.3.3 Is required to take part in and contribute to the process of continuing professional development.

C.3.4 Keeps abreast of new developments concerning prosthetics/orthotics and teaching techniques.

C.4 Community services

C.4.1 Makes a professional contribution to and takes part in community rehabilitation programmes.

C.5 Medical, legal and ethical requirements

C.5.1 Provides patient/user care within a recognised prosthetics/orthotics code of ethics.

C.5.2 Provides patient/user care, which complies with medical/legal requirements.

Annex D - Guidelines for training Category II personnel

(based on the ISPO Information Package ISPO, 2002b)

D. LEARNING OBJECTIVES OF COURSE FOR CATEGORY II

The following outlines the learning objectives of a course for Category II personnel in respect of theoretical subjects (D.1 to D.9) and closely supervised practical instruction (D.10). It should be emphasised that this is a guideline and local variations may still produce an acceptable course. In respect of the supervised practical instruction, regional requirements may influence the emphasis in areas of prosthetics/orthotics service. However, the outline in D.10 is considered to represent the minimum essential elements of prosthetic and orthotics practice which should be contained within the learning objectives. Where possible, other elements of provision should also be included.

It is also noted again that the course which encompasses these learning objectives will normally be of three years duration full-time study and the entrants will have completed Ordinary ('O') level or equivalent schooling (11 years schooling). This provides guidance as to the expected level of the course and its place within the national educational framework.

D.1 Anatomy and physiology

In the area of anatomy and physiology the student should have knowledge of the following:

- basic cell biology and histology;
- the structure of the skeletal system, particularly the bones and joints of the lower and upper limbs, the shoulder girdle, the spine and the thorax;
- the structure and function of the muscular system, with emphasis on the muscular systems of the lower and upper limbs, the shoulder girdle and the spine and thorax;
- the structure and function of joints, including axes of rotation, range of movements and stabilisation;
- consideration of the body as a whole system, identification of physiological deviations and of their significance;
- the nervous system, tissues, cardiovascular system, pulmonary system, immune system, endocrine system, and the secretory organs.

The student should have an understanding of the function of individual joints and muscles and be proficient in explaining their interaction. He/she should be knowledgeable in the area of pathological deviations and be able to analyse them by means of appropriate measuring instruments as well as by applying his/her knowledge of range of motion in order to be able to identify a viable prosthetics/orthotics treatment. The student should recognise that biomechanical as well as pathological factors must be viewed concurrently with anatomical factors.

D.2 Pathology

The student will have an understanding of the following areas:

- inflammatory diseases;
- degenerative diseases;
- post-traumatic conditions;
- tumours;
- metabolic disorder;
- abnormalities present at birth (congenital deformities);
- aseptic bone necrosis;
- paralysis resulting from nerve lesion;
- circulatory disorders;
- amputations;
- post-traumatic osteoporosis;
- diseases of the spine;
- spinal and thoracic deformities;
- diseases of the pelvis and hip;
- diseases of the knee;
- diseases of the foot;
- diseases of the shoulder, elbow and hand;
- limb deformities;
- skin disorders and wound repair.

The student should be able to comment on the aetiology and progression of the disease in question, as well as on its care and treatment. He/she must demonstrate proficiency in anatomy, physiology, biomechanics and pathology as well as the ability to coordinate these factors and arrive at the appropriate end result in his/her role as an orthopaedic technologist.

D.3 Biomechanics and prosthetics and orthotics science

The student should have an understanding of the following topics:

- the anatomical planes and reference points of the body;
- prosthetics and orthotics measurement techniques;
- anatomical joint types, their functions and interaction;
- muscle physiology and biomechanics in relation to joint functions;
- the interaction of anatomical joints and prosthetic/orthotic joints;
- normal human locomotion and the gait cycle;
- kinetic and kinematic analysis and the calculation of external and internal force actions;
- biomechanics of the lower limb;
- lower limb prosthetic components and their application;
- stump/socket forces and lower limb socket design;

- bench, static and dynamic alignment of lower limb prostheses with reference to biomechanical implications;
- pathological gait, its analysis and the application of appropriate orthotic treatment;- body/orthoses forces and interface design;
- orthoses for lower limb diseases;
- lower limb orthoses for upper motor neurone diseases;
- lower limb orthotic components and their application;
- biomechanics of the spine and thorax;
- orthoses for diseases and deformation of the spine and thorax;
- biomechanics of the upper limb;
 - * - upper limb prosthetics fitting, alignment and function;
 - * - upper limb prosthetic components and their application;
 - * - upper limb orthotics fitting, alignment and function;
 - * - upper limb orthotic components and their application.

The student requires the above knowledge in order to provide optimal prosthetics and orthotics care to the user.

* *these subjects should be included according to regional need and demand.*

D.4 Mathematics

The students will have a knowledge of the following areas of mathematics and their applications to Biomechanics and Prosthetics and Orthotics Science:

- elementary mathematics: simple algebraic manipulation, indices, logarithms, solution of equations, trigonometric functions, standard trigonometric identities, solution of simple trigonometric equations;
- functions: polynomial, rational, exponential, logarithmic;
- differentiation: simple techniques, use in optimisation and curve sketching;
- integration: simple techniques, evaluation of areas, use of approximation procedures;
- differential equations: first order equations, uses in biological modelling;
- mastery and proper usage of resources such as mathematical tables, formulae and calculators.

D.5 Mechanics

The student will have an understanding of the applications of the following in the area of Biomechanics and Prosthetics and Orthotics Science:

- terminology and units;
- vector and scalar quantities;
- linear/angular motion and motion of a solid body;
- resolution of forces and moments in two dimensions;
- equations of equilibrium;
- free body diagrams;

- calculations of centre of gravity and mass;
- Newton's Laws of Motion;
- work, power and energy;
- strength of materials: stress, strain and Hooke's Law.

D.6 Materials technology

The student will have an understanding of the characteristics, properties and the processing of the following commonly used materials with particular reference to their applications in prosthetics and orthotics:

- steel and its alloys;
- non-ferrous metals and their alloys;
- plastics: thermoforming, thermosetting, composites;
- wood;
- leather;
- plaster of Paris;
- adhesives.

D.7 Workshop technology

The student will understand and be able to apply, in the field of orthopaedic technology, the following areas of knowledge:

- hand tools: their selection, use and maintenance;
- measuring instruments: use and methods of application;
- machine tools: selection, installation, use and maintenance;
- welding processes and equipment for metals and plastics;
- sewing machines: selection, use and maintenance;
- general equipment: ovens, compressors, vacuum pumps, fume and dust extraction apparatus;
- workshop layout;
- health and safety regulations and practice.

D.8 Clinic, workshop and business management

The student will have knowledge of the theory and application of:

- materials acquisition, handling and stock control;
- workforce management;
- production cost calculations;
- budgeting, invoicing, receipting and accounting;
- clinic management, appointment systems, record keeping;
- property management, care and maintenance;
- environmental/ecological considerations.

D.9 Technical drawing

The student will have knowledge and practice in the following:

- isometric sketching and three-dimensional visualisation;
- first and third angle projection;
- auxiliary views and sections;
- use of drawing standards;
- application of machining tolerances;
- simple assembly drawings;
- applications in orthopaedic technology.

D.10 Workshop and clinical practice

The student will be proficient in the following practical areas and clinical applications with an understanding based on the integration of his/her theoretical studies:

- general workshop practice: use of hand tools, machine tools and materials, component production;
- patient/user examinations and prescription;
- measuring and casting, cast rectification, fabrication, fitting, aligning and finishing the following devices:
 - ankle disarticulation/partial foot prostheses
 - trans-tibial prostheses
 - knee disarticulation prostheses
 - trans-femoral prostheses
 - shoe modifications
 - shoe inserts/foot orthoses
 - ankle-foot orthoses
 - knee-ankle-foot orthoses
 - hip-knee-ankle-foot orthoses
 - cervical orthoses
 - cervico-thoraco-lumbo-sacral orthoses
 - wrist-hand orthoses

The above represents the essential learning objectives in respect of prosthetics/orthotics provision for Category II professionals. Where possible, it is desirable to give instructions and/or practice in other levels of provision.

N.B. Modular courses for Lower Limb Prosthetics Technologists, Upper Limb Orthotics Technologists and Upper Limb Prosthetics/Orthotics and Spinal Orthotics Technologists should use the relevant parts of the above curriculum.

Annex E - Professional profile Category III

E. PROFESSIONAL PROFILE FOR CATEGORY III (PROSTHETICS/ORTHOTICS TECHNICIAN/BENCH WORKER)

The following professional profile has its basis in the Report of the United Nations Inter-Regional Seminar on Standards for the Training of Prosthetists (UN, 1968) - the so-called Holte Report. It has moreover been modified to comply with Guidelines for Training Personnel in Developing Countries for Prosthetic and Orthotic Services (WHO, 1990), further refined by the Education Committee of ISPO and finally updated at the WHO/ISPO Consultation on Training Personnel in Developing Countries for Prosthetics and Orthotics Services, Glasgow, 2003.

E.1 Prosthetics/orthotics fabrication

In direct assistance to the Category I professional (prosthetist/orthotist) or Category II professional (orthopaedic technologist):

- E.1.1 Fabricates and assembles prosthetic/orthotic devices, including component parts, sockets, suspension systems as designed by the Category I or Category II professional;
- E.1.2 Performs bench alignment of the device to the specifications of the Category I or Category II personnel;
- E.1.3 As directed assists the Category I or Category II personnel in fitting and aligning activities with patients/users;
- E.1.4 As directed performs finishing operations on prostheses and orthoses, including the use of alignment transfer tools and equipment;
- E.1.5 Reports any pertinent information regarding the device to the prosthetist/orthotist;
- E.1.6 Takes part in follow-up procedures in respect of maintenance, repair and replacement of the appliance;
- E.1.7 Is responsible for the care and economical use of laboratory materials, equipment and tools.

E.2 Management and supervision

- E.2.1 Supervises the activity of supporting staff as appropriate.

E.2.2 Manages laboratory/workshop activities assigned to him, including:

- use and maintenance of tools and equipment
- maintenance of safe working environment and procedures
- inventory and stock control
- personnel matters
- financial matters
- appropriate record keeping
- total quality management

E.2.3 Devises improved job methods for increasing efficiency.

E.2.4 Reports to the prosthetist/orthotist on special needs regarding laboratory materials, equipment and tools.

E.3 Training and education

E.3.1 May supervise and take part in the training of individuals in Category III (technicians/bench workers).

E.3.2 Is required to take part in and contribute to the process of continuing professional development.

E.3.3 Keeps abreast of new developments in materials, tools, equipment and processes which apply to his duties in the laboratory.

E.4 Medical, legal and ethical requirements

E.4.1 Complies with any medical/legal or ethical requirements of the employing institution.

Annex F - Guidelines for training Category III personnel

(based on the ISPO Information Package (ISPO, 2002b))

F. LEARNING OBJECTIVES OF COURSE FOR CATEGORY III

The following outlines the learning objectives of a course for Category III personnel in respect of theoretical subjects (F.1 to F.9) and closely supervised practical instruction (F.10). It should be emphasised that this is a guideline and local variations may produce an acceptable course. In respect of the supervised practical instruction, regional requirements may influence the emphasis in areas of prosthetics/orthotics service. However, the outline in F.10 is considered to represent the minimum essential elements of prosthetics and orthotics practice which should be contained within the learning objective for a course to produce a technician qualified in all areas of prosthetics and orthotics. Where possible other elements of provision should also be included.

It is also noted that courses which encompass these learning objectives may have different structures. For example a course may be offered within a formal college or school environment or it may be offered as structured “on the job” training augmented by formal teaching. For guidance a course offered in a formal school environment would be of about 2 years duration while an “on the job” or in-house programme might be of about 4 years. Entrants to this training will have adequate schooling to permit them to benefit from the theoretical teaching.

F.1 Anatomy

In the area of anatomy the student should have basic knowledge of the following:

- the structure of the skeletal system, particularly the bones and joints of the lower and upper limbs, the shoulder girdle, the spine and the thorax;
- the structure and function of the muscular system, with emphasis on the muscular systems of the lower and upper limbs, the shoulder girdle and the spine and thorax;
- the structure and function of joints, including axes of rotation, range of movements and stabilisation;
- introduction to the nervous system:

The student should have a basic understanding of the musculo-skeletal system. He/she should be familiar with the relevant anatomical terminology

F.2 Pathology

The student will have an introduction to the following areas:

- paralysis resulting from nerve lesions, stroke and other causes;
- amputations and amputation levels;
- spinal and thoracic deformities;
- limb deformities.

The student should have a knowledge of the pathological conditions giving rise to prosthetics/orthotics provision and be familiar with the relevant terminology.

F.3 Biomechanics (alignment principles)

The student should have an understanding of the following topics:

- the anatomical planes and reference points of the body;
- prosthetics and orthotics measurement techniques;
- the interaction of anatomical joints and prosthetic/orthotic joints;
- lower limb prosthetic components and their application;
- bench, static and dynamic alignment of lower limb prostheses with reference to biomechanical implications;
- orthoses for lower limb diseases;
- lower limb orthotic components and their application;
- orthoses for diseases and deformation of the spine and thorax;
- upper limb prosthetic alignment and function
- upper limb prosthetic components and their application;
- upper limb orthotic fitting, alignment and function;
- upper limb orthotic components and their application.

The student requires the above knowledge in order to fabricate prosthetic and orthotic devices.

F.4 Elementary mathematics

The student will have a knowledge of the following areas of elementary mathematics and their application.

- simple algebraic manipulation;
- indices;
- solution of simple equations;
- geometry;
- trigonometric functions;
- solution of simple trigonometric equations;
- use of calculators and mathematical tables.

F.5 Materials technology

The student will have an understanding of the characteristics, properties and the processing of the following commonly used materials with particular reference to their applications in prosthetics and orthotics:

- steel and its alloys;
- non-ferrous metals and their alloys;
- plastics: thermoforming, thermosetting, composites;

- wood;
- leather;
- plaster of Paris;
- adhesives.

F.6 Workshop technology

The student will understand and be able to apply, in the field of orthopaedic technology, the following areas of knowledge:

- hand tools: their selection, use and maintenance;
- measuring instruments: use and methods of application;
- machine tools: selection, installation, use and maintenance;
- welding processes and equipment for metals and plastics;
- sewing machines: selection, use and maintenance;
- general equipment: ovens, compressors, vacuum pumps, fume and dust extraction apparatus;
- workshop layout;
- health and safety regulations and practice.

F.7 Graphical communication

The student will have knowledge and practice in the following:

- isometric sketching and three-dimensional visualisation;
- first and third angle projection;
- auxiliary views and sections;
- use of drawing standards;
- application of machining tolerances;
- simple assembly drawings;
- applications in orthopaedic technology.

F.8 Prosthetics and orthotics services

The student will have an appreciation of:

- the clinic team, functions and members;
- prosthetics and orthotics personnel;
- ethical considerations;
- prosthetics and orthotics care systems.

F.9 Clinical sciences

The student will by observation have an experience of:

- patient/user examination;
- measurement and casting;
- cast rectification;
- dynamic alignment, fitting and delivery.

F.10 Workshop practice

The student will be proficient in the following practical areas with an understanding based on the integration of his/her theoretical studies:

- general workshop practice: use of hand tools, machine tools and materials;
- fabrication, bench, alignment and finishing the following devices:
 - partial foot prosthetics;
 - ankle disarticulation prosthetics;
 - trans-tibial prosthetics;
 - knee disarticulation prosthetics;
 - trans-femoral prosthetics;
 - trans-radial prosthetics;
 - trans-humeral prosthetics;
 - foot orthotics; (FO)
 - ankle-foot orthotics; (AFO)
 - knee-ankle-foot orthotics; (KAFO)
 - hip-knee-ankle-foot orthotics; (HKAFO)
 - wrist-hand orthotics; (WHO)
 - elbow-wrist-hand orthotics; (EWHO)
 - thoraco-lumbo-sacral orthotics; (TLSO)
 - cervical orthotics; (CO)
 - cervico-thoraco-lumbo-sacral orthotics; (CTLSO)

Annex G - Resources needed for a school for prosthetists/orthotists

G.1 Faculty

Prosthetist/orthotists (orthopaedic technologists)

Physicians, scientists

Engineers

In practical sessions and clinical experience, the teacher/student ratio should be 1/8 to 10.

G.2 Facilities

Lecture rooms with audio-visual facilities

Laboratory for practical work

Clinical teaching facilities

Library

Common room, cloakroom and other supporting facilities

G.3 Laboratory equipment

Appropriate machine tools, work benches, hand tools, casting aids and adequate environmental control equipment.

G.4 Materials

Raw materials: (a) metals (b) wood (c) fabric (d) plastics (e) leathers (f) plaster of Paris (g) other local material.

Prosthetic and orthotic components.

G.5 Books and materials

Appropriate manuals – existing material may be utilized for preparing these manuals.

Books – standard text books related to the curriculum.

Journals – major prosthetics and orthotics journals.

G.6 Audio-visual aids

Software packages for lecture preparation.

Multi-media equipment including projection equipment.

Digital photography equipment (hardware and software).

G.7 Other

Office equipment such as photocopying machine, scanners, telephones.

Hostel and kitchen equipment may be required

G.8 Funds

Adequate funds should be made available for the items listed above as well as for replacement of equipment and purchase of consumable materials.

Annex H - Community-based rehabilitation

International Society for Prosthetics and Orthotics (ISPO)

World Health Organization (WHO)

THE RELATIONSHIP BETWEEN PROSTHETICS AND ORTHOTICS SERVICES AND COMMUNITY-BASED REHABILITATION

A Joint ISPO/WHO Statement

Revised December 2003

Introduction

In the 1970s the World Health Organization (WHO) introduced a new approach to disability prevention and rehabilitation known as community-based rehabilitation (CBR). The aim was to ensure that rehabilitation services can be provided to all persons with disabilities, whether they live in a city or in the countryside or whether they are rich or poor.

This approach involves measures taken at community level to use and to build upon the resources of the community as well as drawing on the services offered at district, provincial and central level. Thus the complete rehabilitation structure of this model consists in all of four levels: community, district, provincial and central. The last three of these levels constitute the referral system for the first, i.e. the community level.

The personnel of institutions at the central and provincial levels are those who can be expected to work in conventional rehabilitation and health services. At central level they may, for example, include specialized physicians, therapists, and prosthetics and orthotics personnel. At provincial level they may be general physicians, some (though usually few) specialized physicians, therapists, and prosthetics and orthotics personnel.

The personnel based at district level, however, are not likely to possess any specialized training in rehabilitation. They are usually general physicians and nurses who are concerned with the provision of health care services. Nevertheless, as discussed below, they may play an important role in the referral system and in the transfer of knowledge and skills in rehabilitation to the community level.

Finally, at community level, there are usually no specialised personnel at all, in either health or rehabilitation. The persons working there - usually called community health workers or community rehabilitation workers - often do their work on a voluntary and part-time basis in addition to their normal duties in the community. Since they are likely to have limited or minimal education in health and rehabilitation, they need to receive training and support from personnel in the referral system.

The success of this approach to rehabilitation will depend on the development of an integrated and coordinated programme in which the activities at each level are clearly defined. It will also depend on the development of an educated and trained workforce, with clear definition of the role of the different types of personnel.

WHO has recognized that although most basic rehabilitation activities can be carried out in the disabled

person's own community, many persons with disabilities have to be referred to other rehabilitation services outside their own community. Among this group are those persons who require prostheses and orthoses. This is because prostheses and orthoses of an acceptable quality cannot realistically be made in every single community within a country. This means that for the successful, widespread provision of prosthetics and orthotics services there needs to be a strong relationship between the specialized services and community-based rehabilitation programmes.

With regard to the provision of prosthetics and orthotics services, the International Society for Prosthetics and Orthotics (ISPO) has gone some way towards defining the job descriptions and educational requirements for the different categories of personnel directly involved in this field. These categories are: prosthetist/orthotists (Category I); orthopaedic technologists (Category II); and prosthetics/orthotics technicians (Category III). Some consideration needs to be given to the use of these categories of personnel in the referral system on which WHO's approach depends and in particular to the role and training in prosthetics and orthotics of primary health care personnel and community health/rehabilitation workers.

Ideally, each country should have adequate numbers, possibly hundreds or thousands depending on population, of community health/rehabilitation workers. All of these workers need to receive training so that they possess a certain minimum knowledge of rehabilitation. The obvious challenge with respect to the prosthetics/orthotics component is how to manage the transfer of this knowledge when so few resource persons are normally available in prosthetics and orthotics services especially in low-income countries. It may not be possible that prosthetics and orthotics personnel could be directly involved in the training of community health/rehabilitation workers. At best, they can only contribute to the training of primary health care personnel, so that these in turn can include issues related to prosthetics and orthotics service in the various training programmes for persons working at the community level.

The following sections offer guidance on how community-based rehabilitation and the referral system may be used to assist in the promotion and improvement of prosthetics and orthotics services.

Basic community level

Most of the rehabilitation activities in village or community are carried out by community health/rehabilitation workers, who usually work under the supervision of Primary Health Care (PHC) personnel or mid-level rehabilitation workers where available. In matters related to prosthetics and orthotics, the activities at community level will increase awareness to disability and rehabilitation with focus on prevention. In addition it will:

- assist in identifying persons with disabilities with a focus on early detection;
- identify persons requiring prosthetics and orthotics services;
- promote awareness of the benefits of using prostheses and orthoses ;
- act as a link between the person with disability, the family, and the prosthetics and orthotics services, or an adequate supervising body
- assist with follow-up of the person with disability with regard to the use of, and adaptation to, the device;
- assist with adaptation of the environment and take measures to facilitate accessibility, good hygiene and activities of daily living;

- provide information to the appropriate support level with regard to follow-up and the acceptance and use of prostheses and orthoses;
- assist in reducing further impact of impairments, e.g. through good hygiene, wound treatment, and prevention of secondary complications such as contractures and bed-sores;
- encourage the person with disability to carry out needed exercises;
- arrange for maintenance and repairs to prostheses and orthoses. It is important for the community health/rehabilitation worker to understand what repairs can be done at community level;
- support and advise in the provision of simple assistive devices such as special chairs, parallel bars and crutches;
- assist with the social rehabilitation of the person with disability.

District support level or sub-district level (health care)

This support level does not normally offer any specialized rehabilitation services, since specialized physicians, therapists, and prosthetics and orthotics personnel are rarely available here. However, basic and general rehabilitation services may be provided by health care personnel, such as general physicians and (in particular) nurses. Where prosthetics and orthotics personnel are available, general prosthetics and orthotics services, including repair and replacement of prostheses and orthoses should be provided. These services must include the most common and most needed devices, i.e. prostheses and orthoses for the lower limb.

At district level, in matters related to prosthetics and orthotics, primary health care personnel and/or mid-level CBR workers will:

- refer persons with disabilities to the appropriate support or service level together with information about the needs and expectations of the person;
- explain the rehabilitation programme to the person with disability and the family;
- assist persons with disabilities in preparation for the fitting and use of prostheses and orthoses, including physical therapy and wrapping of the stump;
- guide persons with disabilities towards sources of funding for rehabilitation service;
- provide information to the provincial service level on the numbers of persons with disabilities, the types of disabilities found and treated, the numbers and types of prostheses and orthoses fitted, and outcomes of the services.
- consider the socio-economic situation and needs of persons with disabilities;
- assist persons with disabilities to be integrated into society, e.g. through education and work opportunities;
- provide support in rehabilitation issues to the community;
- provide training to community health/rehabilitation workers in rehabilitation, including basic prosthetics and orthotics related issues as there is a great need to educate and train community health/rehabilitation workers for their role in prosthetics and orthotics. This training should be based on a curriculum set centrally. Supervision and advice on their work in prosthetics and orthotics will continue to be needed as there is no tradition or depth of experience in this field.

Provincial support level

This intermediate support level is situated in a provincial institution and, apart from other medical and paramedical personnel, may be staffed by all categories of prosthetics and orthotics personnel up to and including Category II.

The intermediate support level will:

- provide general prosthetics and orthotics services, including repair and replacement of prostheses and orthoses. The services that it should offer must include the most common and most needed devices, i.e. prostheses and orthoses for the lower limb. However, prostheses and orthoses for other levels may be fitted if there is a particular need and demand for such a service;
- refer persons with less common disabilities to the specialized service level;
- participate in the training of health care personnel in prosthetics and orthotics related subjects so that all these personnel, in turn, can include prosthetics and orthotics issues in the training they provide for community health/rehabilitation workers. As in the case of training for community health/rehabilitation workers, the training of primary health care personnel should be based on a curriculum set centrally;
- provide support in rehabilitation issues to the district level;
- monitor and evaluate prosthetics and orthotics services and programmes of disability prevention from a provincial viewpoint;
- provide information to the specialized service level on the numbers of persons with disabilities, the types of disabilities found, the numbers and types of prostheses and orthoses fitted, and outcomes of the services.

Specialized service level

The specialized service level is usually situated in a central or national institution and should be staffed by all categories of prosthetics and orthotics personnel up to and including Category I.

The specialized service level will:

- provide specialized prosthetics and orthotics services, i.e. the full range of prostheses and orthoses and services;
- contribute to the development and coordination of a national policy with regard to prosthetics and orthotics services and referral. The specialized service level is expected to provide support and advice to government in the development of its policy on the planning, organization and administration of prosthetics and orthotics services and national policies related to persons with disabilities. This is of great importance if the concept of community-based rehabilitation in prosthetics and orthotics is to be adopted by a country;
- contribute to the development of a central policy for disability prevention in the field of prosthetics and orthotics;
- contribute to the organization of programmes of education and training for all personnel involved in the provision of prosthetics and orthotics services, including primary health care personnel and community health/rehabilitation workers (the education and training of primary health care personnel and community health/rehabilitation workers is discussed below);

- participate in the training of primary health care personnel on prosthetics and orthotics issues;
- provide support in rehabilitation issues to the provincial level;
- develop an information package for primary health care personnel and community health/rehabilitation workers outlining the prosthetics and orthotics delivery system;
- oversee the professional development of all personnel involved in the provision of prosthetics and orthotics services;
- monitor and evaluate prosthetics and orthotics services and programmes of disability prevention from a national viewpoint. It is important for all services and programmes to be evaluated in order to check whether they meet the needs of the country and to determine ways in which they may be improved and their quality can be assured.

Training of community health/rehabilitation workers

It is important to bear in mind that the community health/rehabilitation worker is neither a prosthetist/orthotist nor an orthopaedic technologist and will not be expected to fit prostheses or orthoses. He or she has a wide range of information on many different aspects of rehabilitation, of which prosthetics/orthotics is one. Thus some prosthetics and orthotics related subjects need to be included in training for community based rehabilitation (CBR). A three-day training programme, including practical exposure, could be sufficient for primary health care personnel or mid-level community based rehabilitation (CBR) or health workers.

Training of primary health care personnel/mid-level CBR workers

This training normally lasts up to three-months. A two weeks training in prosthetics and orthotics including practical exposure could be an important component for training of primary health care personnel or mid-level community based rehabilitation workers.

The training of such personnel should be carried out by prosthetics and orthotics and rehabilitation personnel with experience in community based rehabilitation activities.

A syllabus to achieve this might include components on:

- types of impairments that can be treated by prostheses or orthoses;
- prosthetics and orthotics services available in the country and how to gain access to them;
- the range of prostheses and orthoses available from district, provincial and specialized institutions and how the supply system works;
- fit and function of prostheses and orthoses. This is important in helping to determine whether there is a problem with regard to fit and/or function of a prosthesis or orthosis;
- measures for preparing a person with disability for the fitting of prostheses and orthoses, including exercises and wrapping of stumps;
- use, maintenance and hygiene of a prosthesis or orthosis, including exercising;
- simple repairs of prostheses and orthoses. The community health/rehabilitation worker should know what repairs can be carried out by a local craftsman and what repairs need to be referred to a prosthetics/orthotics centre/workshop;
- construction and use of simple assistive devices;
- adaptation of the environment;

- data collection. The community health/rehabilitation worker should be taught simple techniques to gather information about numbers of persons with disabilities, range of disabilities found and use of prostheses and orthoses;
- sources of funding to access prosthetics and orthotics services;
- integration of the person with disability into society after successful fitting of prostheses and orthoses.

Training of prosthetics and orthotics personnel in community-based rehabilitation programme:

In order to ensure that there is an effective relationship between the prosthetics and orthotics services and the rehabilitation activities at community level, it is important for prosthetics and orthotics personnel to be made aware of the role and function of the community rehabilitation services.

A syllabus to achieve this might cover:

- the philosophy of community-based rehabilitation;
- the United Nations Standard Rules on the Equalization of Opportunities for Persons with Disabilities;
- knowledge on national rules or legislation ensuring equal opportunities and full participation for persons with disabilities;
- the national health service structure, including primary health care and community-based rehabilitation;
- community-based rehabilitation activities in the country;
- interaction of prosthetics and orthotics services, primary health care and community-based rehabilitation;
- problems of persons with disabilities in rural areas especially women or girl children
- adaptation of prostheses and orthoses to local conditions;
- need for and benefit of interaction with Disabled Peoples Organizations (DPO)
- ways of providing advice in a simple and effective manner;
- basic physical therapy (exercises) before and after fitting prostheses and orthoses which can be carried out at community level.

Team approach

The foregoing sections outline the roles of the technical personnel directly involved in the provision of prostheses and orthoses: prosthetics/orthotics personnel; specialized and non-specialized personnel especially primary health care personnel and community health/rehabilitation workers. Most persons who require a prosthetic or orthotic device also require assistance from other medical and health personnel, such as surgeons and other physicians, occupational and physical therapists, and social workers, who along with prosthetics and orthotics personnel form a rehabilitation team. In order for those involved to work together effectively, they should be encouraged to share information with each other and, based on their respective professional and personal viewpoints, offer suggestions on measures that need to be taken to assist in the person's rehabilitation. In this respect, though not all of them meet face to face at one and the same time, the persons involved in the rehabilitation process should be seen as a team. The person with disability and his or her family have an important role in this team and should be positioned at the centre of the relationship between prosthetics and orthotics services and community-based rehabilitation activities. For the rehabilitation services to be effective in the provision of prostheses and orthoses, an integrated approach by all the members of the team at the community level, the intermediate support levels and the specialized service level is essential.

Conclusions

A number of matters need to be addressed to enable adequate prosthetics and orthotics services to be provided in low-income countries. Some of these are set out below:

- community, district, provincial and centralized services should all be part of the overall prosthetics and orthotics services. In order to provide an adequate prosthetics and orthotics delivery system, all services need to function in a coordinated way;
- there is a lack of trained personnel in the prosthetics and orthotics services. There is still a great need to train Category I, Category II and Category III personnel as well as training primary health care personnel and community health/rehabilitation workers in subjects related to prosthetics and orthotics services;
- the training of primary health care personnel and community health/rehabilitation workers should not be seen as a substitute for training personnel in prosthetics and orthotics;
- there is a lack of financial resources. It is not possible to solve all the problems related to prosthetics and orthotics immediately. It is important to plan for the future and ensure prosthetics and orthotics services at any level are part of the National Plan. The ultimate aim is that prosthetics and orthotics services need to be available for the majority and nearer to where they live;
- awareness of community-based rehabilitation and its role in prosthetics and orthotics needs to be increased. There is a need to make the public, existing prosthetics and orthotics personnel and the government aware of community-based rehabilitation and how it can be used to improve the prosthetics and orthotics care system;
- a team approach is crucial. When possible, proper use must be made of all members of the team in order to ensure a better quality of rehabilitation service.

To sum up, this document attempts to describe the relationship between prosthetics and orthotics services and community-based rehabilitation activities. It shows how the services offered by central/specialized, provincial and district institutions and the community can work together to provide a comprehensive prosthetics and orthotics service across the country. It should be noted that no definitive model of community-based rehabilitation in prosthetics and orthotics is available; each country requires to develop its own system according to its needs and the resources available.

Annex I List of participants

<p>Dr M. Berre Directeur Institut de Fromation aux Carrieres de Sante Riad S1 Aissa, Marracech MOROCCO Tel: +212 4444 2195 Fax: +212 4444 1469 Email: mberre@yahoo.com</p>	<p>Mr H. Casanova V.P. International Programmes CIR 351 E. Huron, 2nd Floor Annex Chicago, IL 60540, USA Tel: +312 926 0030 Fax: +312 926 7662 Email: h-casanova@northwestern.edu</p>
<p>Mr K. Chapal Technical Officer, MNC/DAR Room No. 6109, 6th Floor World Health Organization 20 Avenue Appia CH-1211, Geneva 27, SWITZERLAND Tel: +41 22 791 3499 Fax: +41 22 791 4874 Email: khasnabisc@who.int or chapal@vsnl.net</p>	<p>Mr S. A. Deshpande Department of Prosthetics and Orthotics All India Institute of Physical Medicine & Rehabilitation Haji Ali Park, Haja Ali Mahalazmi, Mumbai 400 034 INDIA Tel: +91 22 2 496 4331-32 Fax: +91 22 2 496 2737 Email: aiipmr@bom2.vsnl.net.in</p>
<p>Mr C. Harte Cambodia Trust 83 Slievenaboley Road Dromara Dromore County Down NORTHERN IRELAND Tel: 028 406 50531 Fax: 028 406 50839 Email: carson.harte@btopenworld.com</p>	<p>Mr S. Heim President, ISPO Im Haggarten 5 38337 Ohningen GERMANY Tel: +49 7735 2332 Fax: +49 7735 1499 Email@ ot-heim@t-online.de</p>
<p>Professor J. Hughes ISPO NCTEPO, University of Strathclyde Curran Building, 131 St James Road Glasgow G4 0LS SCOTLAND, UK Tel: +44 141 552 4049 Fax: +44 141 552 1283 Email: j.hughes@strath.ac.uk</p>	<p>Professor N.A. Jacobs ISPO NCTEPO, University of Strathclyde Curran Building, 131 St James Road Glasgow G4 0LS SCOTLAND, UK Tel: +44 141 552 4049 Fax: +44 141 552 1283 Email: l.mclachlan@strath.ac.uk</p>

<p>Dr J.S. Jensen Honorary Treasurer, ISPO ISPO Head Office Borgervænget 5 2100 Copenhagen Ø DENMARK Tel: +45 3920 7260 Fax: +45 3920 7501 Email: steen@ispo.ws</p>	<p>Mr D.X. Khang VIETCOT 50 Giai Phong Hanoi VIETNAM Tel: +84 4574 9014 Fax: +84 4574 1054 Email: khang.vietcot@netnam.vn</p>
<p>Dr B. McHugh Honorary Secretary, ISPO NCTEPO, University of Strathclyde Curran Building, 131 St James Road Glasgow G4 0LS SCOTLAND, UK Tel: +44 141 552 4049 Fax: +44 141 552 1283 Email: mchugh@ispo.ws</p>	<p>Dr E. Pupulin World Health Organization CH-1211 Geneva 27 SWITZERLAND Tel: +41 22 791 3656 Fax: +41 22 791 4874 Email: pupuline@who.ch</p>
<p>Mr Y. Sarhan Dean, Faculty of Rehabilitation Sciences University of Jordan Queen Rania Street Amman JORDAN Tel: +962 6 5355 000 Ext 3281 Fax: +962 6 535 6746 Email: ysarhan@yahoo.com</p>	<p>Dr B. Sarwar Managing Director Pakistan Institute of Prosthetics and Orthotic Sciences Plot No 6-B, B-3 Phase V, Hayatabad Peshawar, PAKISTAN Tel: + 92 91 9217 150/811592 Fax: +92 91 9217 364/817179 Email: sarwarbakht@hotmail.com</p>
<p>Ms E. de Sermeno Director of O & P Department Don Bosco University Calle a Plan del Pino, Canton Venecia Soyapango, San Salvador EL SALVADOR Tel: +503 292 4440 or +503 292 4436 Fax: +503 292 4440 or +503 292 4436 Email: udbtop@navegante.com.sv zelayacornejo@hotmail.com</p>	<p>Dr J.P. Singh Rehabilitation Council of India 23-A Shivaji-Marg New Delhi – 110015 INDIA Tel: +91 11 259 13021 Fax: +91 11 259 11967 Email: rehabstd@ndc.vsnl.net.in</p>
<p>Ms M. Scott Director Cambodian School of Prosthetics and Orthotics PO Box 122, Calmette Hospital Preah Monivong Blvd Phnom Penh, CAMBODIA Tel: +855 23 368 241/427 067 Fax: +855 23 427 067 Email: msscott@online.com.kh</p>	<p>Mrs S. Sexton NCTEPO University of Strathclyde Curran Building, 131 St James Road Glasgow G4 0LS SCOTLAND, UK Tel: +44 141 548 3692 Fax: +44 141 552 1283 Email: s.sexton@strath.ac.uk</p>

<p>Mr H.G. Shangali Director TATCOT PO Box 8690 Moshi TANZANIA Tel: + 255 27 27 53986 Fax: +255 27 27 52038 Email: tatcot@eoltz.com</p>	<p>Mr M. L. Stills Leahy War Victims Fund/USAID DCOF/LWVF North Tower, Suite 700 1300 Pennsylvania Avenue NW Washington DC 20004 USA Tel: +202 789 1500 Fax: +202 789 1601 Email: msstills@pionet.net</p>
<p>Mr C. Tardif Physical Rehabilitation Unit ICRC 19 Avenue de la Paix 1202 Geneva SWITZERLAND Tel: +41 22 730 2510 Fax: +41 22 734 6001 Email: ctardif@gva.icrc.org</p>	<p>Ms Pham Thuy Project Coordinator VIETCOT 50 Giai Phong Hanoi VIETNAM Tel: +84 4 574 0914 Fax: +84 4 574 1054 Email: thuy.vietcot@netnam.vn</p>
<p>Ms I. Urseau Orthopaedic Section Handicap International 14 Avenue Berthelot 69 361 Lyon Cedex 07 FRANCE Tel: +33 4 78 69 67 41 Fax: +33 4 78 69 79 90 Email: i.urseau@handicap-international.org</p>	<p>Mr C. Zelaya Don Bosco University Calle a Plan del Pino Soyapang San Salvador EL SALVADOR Tel: +503 292 4440 or 292 4436 Fax: +503 292 4440 or 292 4436 Email: udbtop@navegante.com.sv zelayacornejo@hotmail.com</p>

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