

# Orthopaedic Clinical Officer Program in Malawi

## A Model for Providing Orthopaedic Care

Nyengo Mkandawire BMBS, MCh (ORTH), FCS (ECSA), FRCS Eng,  
Christopher Ngulube BSc (HSE), Christopher Lavy MD, MCh, FRCS

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**Abstract** Malawi has a population of about 13 million people, 85% of whom live in rural areas. The gross national income per capita is US\$620, with 42% of the people living on less than US\$1 per day. The government per capita expenditure on health is US\$5. Malawi has 266 doctors, of whom only nine are orthopaedic surgeons. To address the severe shortage of doctors, Malawi relies heavily on paramedical officers to provide the bulk of healthcare. Specialized orthopaedic clinical officers have been trained since 1985 and are deployed primarily in rural district hospitals to manage 80% to 90% of the orthopaedic workload in Malawi. They are trained in conservative management of most common traumatic and nontraumatic musculoskeletal conditions. Since the program began, 117 orthopaedic clinical officers have been trained, of whom 82 are in clinical practice. In 2002, Malawi began a local orthopaedic postgraduate program with an intake of one to two candidates per year. However, orthopaedic clinical officers will continue to be needed for the foreseeable future. Orthopaedic clinical officer training is a cost-effective way

of providing trained healthcare workers to meet the orthopaedic needs of a country with very few doctors and even fewer orthopaedic surgeons.

### Introduction

Malawi has a population of about 13 million (1985 data). The GDP of the country is US\$8.3 billion with a Gross National Income per capita of US\$620. The economy is predominantly based upon cash crops (tobacco, tea, cotton, and sugar). Mining, manufacturing, and tourism contribute only modestly to the economy. Eighty-three percent of the population lives in rural areas, and 42% of the population lives on less than \$1 per day [4].

Malawi is a land-locked country south of the equator bordered by Tanzania in the northeast, Mozambique in the south, southeast, and southwest, and Zambia in the northwest. It is a long narrow country lying in the Great African rift valley. It is 901 km long and between 80 and 160 km wide. The total surface area is 118,484 km<sup>2</sup> of which 94,276 km<sup>2</sup> is land; the remainder is water in Lake Malawi, the third largest lake in Africa. It has a tropical continental climate. Malawi, then Nyasaland, was a British protectorate/colony from 1891 to 1964 when it gained independence and assumed the name Malawi. From 1964 to 1994 it was a one-party state. The multiparty political system was adopted in 1994 after a landmark referendum in 1993 [2].

Total health expenditure is 12.9% of GDP. The per capita total health expenditure by government is US\$14.4. Government expenditure on health constitutes 28.8% of total government expenditure. Government contributes 74.7% of the total national health expenditure. Health indicators for Malawi are poor: the neonatal mortality rate is 40:1000 live births; the infant mortality rate is 109:1000 live births; and

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N. Mkandawire (✉)  
Department of Surgery, College of Medicine, University of Malawi, P/Bag 360, Chichiri, Blantyre, Malawi  
e-mail: ncmkandawire@malawi.net

C. Ngulube  
Department of Surgery, Queen Elizabeth Central Hospital, Blantyre, Malawi

C. Lavy  
Department of Orthopaedics, Oxford University, Oxford, UK

**Table 1.** Major causes of death

Causes	N	Percent
HIV/AIDS	86,000	34
LRTI	29,000	12
Malaria	20,000	8
Peritoneal conditions	8000	3
Cerebrovascular accidents	7000	3
IHD	6000	3
TB	6000	2
MVA	3000	1
All causes	252,000	100

LRTI = lower respiratory tract infections; IHD = ischaemic heart disease; TB = tuberculosis; MVA = motor vehicle accidents.

the maternal mortality ratio is 1800:100,000 live births; life expectancy at birth is 41 years. The adult (15–49 years) HIV prevalence is 14.2%. The HIV pandemic has resulted in increased incidence and prevalence of TB; these are 413 and 501 per 100,000 respectively [4]. The two most common causes of death are HIV and lower respiratory infections. There are scanty data recording trauma as a cause of death. However, motor vehicle crashes feature at number eight as a common cause of death (Table 1) [4]. Using WHO estimates the prevalence of disability is 5% to 10%. The major causes of musculoskeletal disability are trauma, infection (TB, pyogenic, HIV), congenital deformities such as clubfoot, and degenerative conditions.

In this paper we present an overview of the health services in Malawi, and then summarize the medical and paramedical training programs with special emphasis on the orthopaedic clinical officer training program. An attempt will be made to show the cost-benefit and cost-effectiveness of the orthopaedic clinical officer training program. We recommend the Malawi model for providing orthopaedic services be considered in other countries with similar health and social economic constraints.

### Health Service Delivery

The main cadres of health care workers in Malawi are: (1) medical assistants who complete a 2-year course plus 1 year of internship following secondary education; (2) clinical officers who complete a 3-year course plus 1 year of internship following secondary education; (3) medical doctors who complete a 5-year course plus 18 months internship following high school education; and (4) specialist doctors who have 4 to 6 years further training after medical school and internship.

There are three tiers to the health services in Malawi, namely the health center, the rural/district hospital, and the central hospital. The primary facility is a rural health

**Table 2.** Nkhata Bay District: a typical district hospital profile

Variable	N
Population	212,850
Doctors	1
Nurses/midwives	19
Medical assistants	10
General clinical officers	3
Orthopaedic clinical officers	1
Health surveillance assistants	120

center, which is usually staffed by a medical assistant and a nurse, and has five to 10 beds. There are about 10 to 15 health centers per district hospital. In total there are 300 health centers for 26 district hospitals, with the goal of having a health center no more than 10 km from any populated area. The next tier is a district hospital with between 100 and 200 beds. Medical staff at a district hospital include five to 10 medical assistants, five to 10 clinical officers, and one or two doctors. Each district hospital also has 100 to 120 health surveillance assistants trained as community-based health educators in health and hygiene (Table 2). Church missions also offer services at the health center and secondary hospital levels with similar staffing levels as the government services. There are 45 district/mission hospitals of which 26 are government district hospitals. The tertiary referral level consists of five central hospitals which offer specialist services. These are usually between 500- and 800-bed facilities. Sixty percent of the health services are provided by government and the remaining 40% provided by church/mission hospitals. Health services are free in government institutions. The church/mission hospitals offer services at a subsidized fee, not for profit. In some instances church/mission hospitals have signed memoranda of understanding and provide free services especially for maternal and child health services.

The medical council of Malawi [3] has on its register 266 doctors, of whom 85 are specialists in various fields. There are nine registered orthopaedic surgeons and an orthopaedic surgeon to population ratio of about 1:1,500,000.

There are 7264 nurses registered with the nurse's council in Malawi. Paramedic healthcare workers registered with the medical council include 584 medical assistants and 515 clinical officers. There are 10 registered physiotherapists, four occupational therapists, five orthotists/prosthetists, and 15 rehabilitation technicians.

### Medical Training

The Malawi College of Health Sciences and the Malamulo College of Health Sciences train medical assistants and

clinical officers with an annual output of about 50 graduates. The College of Medicine of the University of Malawi started medical training in 1991, and initially had an annual output of 20 doctors; the output has recently increased to 50 to 60 doctors per year (2006).

In 2004, Malawi introduced a university-based 4-year curriculum leading to a Masters of Medicine (MMed) degree in medicine, surgery, pediatrics, ophthalmology, anesthesia, and orthopaedics. In addition to the MMed program, beginning in 1999, a 5-year fellowship training program for two or three trainees per year became available in surgery and orthopaedics under the auspices of the College of Surgeons of East Central and Southern Africa (COSECSA). The College of Surgeons includes eight countries including Ethiopia, Kenya, Uganda, Tanzania, Malawi, Mozambique, Zambia, and Zimbabwe. As of 2007, two orthopaedic surgeons have been trained in Malawi through the COSECSA program.

### Orthopaedic Clinical Officer Training Program

Having noted the dire need of healthcare workers in general and orthopaedic workers in particular, Dr. Edward Blair started the orthopaedic clinical officer training program in 1985. Ed Blair came to Malawi in 1984 as a Rotary International volunteer orthopaedic surgeon to work with the disability organization Malawi Against Polio (MAP). At that time Malawi was the 10th poorest country in the world, had no medical school, very few doctors, and no orthopaedic surgeons. The goal was to train orthopaedic paramedical personnel to provide primary care for common crippling musculoskeletal conditions and prevent disability, perform certain effective orthopaedic procedures, and reduce the workload of orthopaedic surgeons. The orthopaedic clinical officer would be able to manage common musculoskeletal conditions at the district hospital and provide urgent care for major orthopaedic trauma at the primary or secondary facility before referral to a higher center. The cadre to be trained was the already existing medical assistants in government service.

### The Course for Clinical Officer Training in Orthopaedics

The course leading to a Diploma in Clinical Orthopaedics requires 18 months of study. The minimum entry requirements are a strong school leaver's certificate with science credits, a Medical Assistant's Certificate, and 4 years of clinical practice as a medical assistant. The program is affiliated with the Malawi College of Health Sciences, and

the Diploma is recognized by the Medical Council of Malawi. Between 10 and 15 candidates enter each year.

The program is based at Queen Elizabeth Central Hospital, the main teaching hospital in Malawi. The program is run by a course director. The lecturers include local orthopaedic consultants, visiting orthopaedic surgeons under the Orthopaedic Overseas (HVO) program, two senior orthopaedic clinical officers, and five orthopaedic clinical officer tutors. The program has a fully staffed and equipped secretarial staff, lecture rooms, a well-stocked library with 24-hour Internet access, and a hostel to accommodate the students.

The first 4½ months involve training in anatomy, physiology, biochemistry, and pathology. The next 12 months cover regional musculoskeletal trauma and general orthopaedics. One and a half months is spent in a district hospital. Throughout the 18 months, the clinical officers work as apprentices with emphasis on hands-on experience. Didactic lectures are held every morning, after which the trainees go to their assignments in clinics, theatres, ward rounds, and fracture clinics. Each student should complete a research project during the 18-month period. Assessment is based on several approaches: continuous assessment (30%) through weekly tests and end of quarter assessments, end of course examinations (60%), and presentation of the research project (10%). The final examination consists of written papers and the clinical Objective Structured Clinical Examination (OSCE).

### Competencies

The primary competencies expected of orthopaedic clinical officers include the following:

- Primary treatment of orthopaedic/trauma cases at district and central hospitals
- Nonoperative treatment of fracture/dislocations
- Débridement of open fractures and application of external fixators
- Wound débridement and tendon injuries
- Amputations following trauma, vascular, and neoplastic disorders
- Treatment of burn injuries and skin grafting
- Treatment of musculoskeletal sepsis
- Treatment of clubfoot deformity including use of Ponseti treatment; minor soft tissue surgery such as tenotomy
- Biopsies of tumors
- Appropriate referral to specialists at central hospitals
- Training other healthcare workers in rural areas in emergency first aid for trauma victims

At the central hospitals, where orthopaedic clinical officers are directly supervised by orthopaedic surgeons and the capacity for more complex surgery is present, competencies for the orthopaedic clinical officers also include open reduction and internal fixation of fractures of the radius/ulna and humerus, and K nail fixation of femur fractures (femur and hand); correction of pediatric angular limb deformities by osteotomy; and clubfoot surgery.

### Program Output and Costs

Between 1985 and 1995, six courses were held and 45 orthopaedic clinical officers were trained. During this time funding for the program was from the Canadian Development Agency (CIDA), Rotary International districts 708 and 709, the Rotary Foundation, other Rotary Clubs in Bermuda, United Kingdom, and Malawi, and the Malawi government (which provided food and accommodation costs) [1]. The major costs included student books, basic orthopaedic equipment for each student upon graduation, and project operational costs such as salaries and office expenses. Approximately CA\$1,500,000 was spent during this 10-year period. The actual cost of training each student was therefore about CA\$20,000. The remaining funds were used for improving infrastructure, eg, operating theatre facilities.

Dr. Blair left in 1995 and the project fell into abeyance due to lack of funds. The project restarted in 1998 when Prof. Chris Lavy, an orthopaedic surgeon from the United Kingdom, came to Malawi and secured funding from the United Kingdom Department For International Development and the Nuffield Foundation through THET (Tropical Health Education Trust). This funding covered the period 1998 to 2007, and supported the training of 72 orthopaedic clinical officers. The cost for 18 months training is approximately £42,000, and total spending during this period was £252,000 (\$522,260 at current exchange rates). This translates to about US\$7253 per orthopaedic clinical officer trained. This second phase of the program included strengthening continuing medical education and professional development of qualified clinical officers, as well as introducing a short trauma course for rural health center nurses and medical assistants. A total of 360 health center nurses and medical assistants have attended these short trauma courses.

Since the program began in 1985, 117 clinical officers have been trained. Of these, 82 are in clinical practice (Table 3), providing an orthopaedic clinical officer to population ratio of about 1:159,000. Thirteen have resigned, retired, or taken leave of absence. Sadly, 22 have died. Of all the orthopaedic clinical officers trained, 89 were employed by government, 14 by mission hospitals,

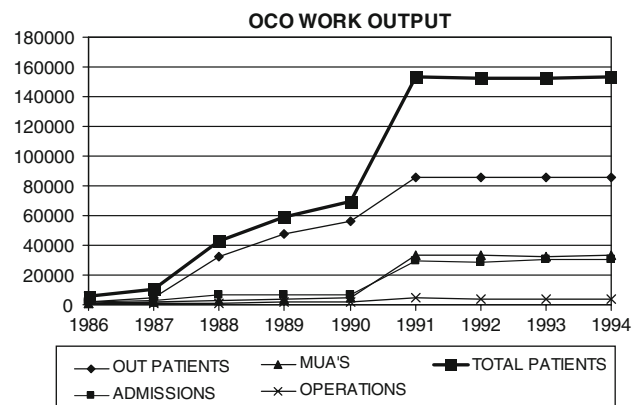
**Table 3.** Distribution of the 82 orthopaedic clinical officers in clinical practice

Institutions	Number of clinical officers
Queen Elizabeth Central Hospital	7
Zomba Central Hospital	5
Kamuzu Central Hospital	5
Mzuzu Central Hospital	4
All district hospitals	36
All mission hospitals	12
Malawi Army	4
Malawi Police	1
Nongovernmental organizations (not for profit)	4
Private institutions	4

five by the Army, one by the police, and eight by other nongovernmental organizations or private institutions. Each government institution in the country has at least one orthopaedic clinical officer.

### Effectiveness

Statistics of the first 10 years document the remarkable impact the program had in providing orthopaedic services in the country. By the 10th year, orthopaedic clinical officers were seeing about 153,000 patients annually, performing about 33,000 bone manipulations and about 3700 minor operations per year (Fig. 1, Table 4) [1]. Fifty-six percent of interventions were for soft tissue injuries, and 41% were for the treatment of bony injuries, mostly by manipulation under anesthesia (MUA). Surgical procedures accounted for 3% of interventions (Fig. 2). The spectrum of pathology was weighted towards trauma (93%) and infection (5%) (Fig. 3, Table 4).

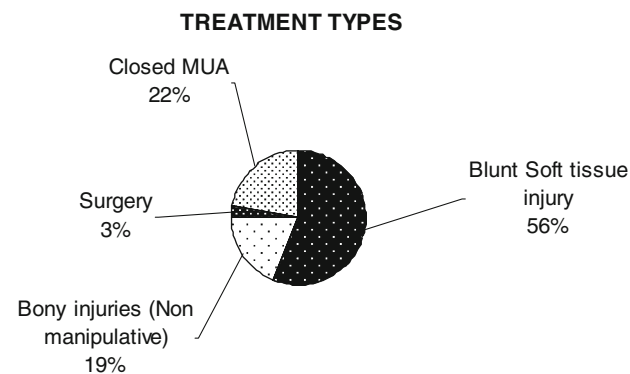


**Fig. 1** This graph illustrates the output of work by orthopaedic clinical officers (OCO): 1985–1995.

To further illustrate the workload of an orthopaedic clinical officer at a district hospital, data are available for a single officer from 2000 to 2004. He saw 7236 outpatients (6% of all outpatients) and admitted 1547 patients (3% of all admissions). He made 12 health center visits to supervise health center medical assistants and nurses. He was visited twice a year by a consultant orthopaedic surgeon and attended at least one CME activity annually (Table 5). The most common procedures were manipulations of upper and lower limb fractures, incision and drainage of abscesses, and aspiration of joints (Table 6).

**Table 4.** OCO work output

Year	Outpatients	Admissions	MUAs	Operations	Total patients
1986	1505	2195	1080	524	5304
1987	4753	2970	1806	811	10,340
1988	31,920	6990	3044	1302	43,256
1989	47,228	6606	3706	1828	59,368
1990	56,519	6770	4535	2176	70,000
1991	85,728	29,639	33,032	4938	153,337
1992	86,102	28,991	32,979	4198	152,270
1993	85,811	30,001	32,202	4236	153,250
1994	86,182	30,293	32,995	3692	153,162

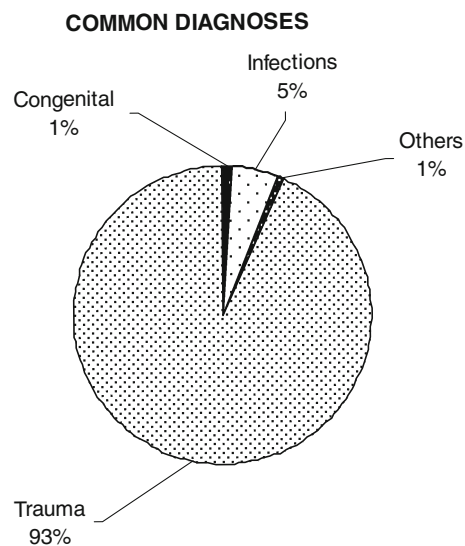


**Fig. 2** The major types of management/treatment administered by orthopaedic clinical officers are shown in this graph.

**Discussion**

**Where Are We Now?**

While most people wish to be treated by a doctor or a medically trained specialist, this is not always possible, especially in a country like Malawi where there are few doctors and even fewer specialists. The orthopaedic clinical officer program has produced healthcare workers competent to manage most orthopaedic conditions conservatively in small rural district hospitals, where the majority of the population lives. Considerable morbidity may be averted by safe and timely treatment of bony and soft tissue injuries, as provided by this cadre of health workers. The key is to produce a healthcare worker with well-defined and well-prescribed clinical competencies within which he or she is allowed to practice, including the knowledge of how and when to make appropriate referrals. They must be continually supported by orthopaedic surgeons and are obligated to attend continuing medical education programs.



**Fig. 3** The main diagnostic groups managed by orthopaedic clinical officers are shown in this graph.

**Table 5.** Nkhata Bay District Hospital OCO workload

Variable		2000	2001	2002	2003	2004	Total	%
Admissions	Total	13,479	11,609	11,361	12,694	10,772	59,915	100
	Orthopaedic	304	292	286	311	354	1547	3
OPD attendance	Total	32,513	24,384	20,558	21,274	31,321	130,050	100
	Orthopaedic	2048	1924	1328	983	953	7236	6
Health center visits		12	12	12	12	12	60	—
Specialist visits		2	2	2	2	2	10	—
Orthopaedic CME attended		1	1	1	1	1	5	—

**Table 6.** Nkhata Bay District Hospital OCO case range

Procedure	2000	2001	2002	2003	2004	
Open fracture débridement	12	2	3	3	5	
Ex fix open fracture		2			1	
Major limb amputation	3		1	1	1	
Clubfoot surgery	Tenotomy	14	13	6	6	5
	Major	2				
Sequestrectomy	3	6	4	2	2	
Limb osteotomy	2	1	1	1	1	
Incision and drainage	84	85	37	27	20	
Upper limb fracture manipulation	160	97	140	150	135	
Tibia manipulation	60	55	45	53	60	
Skeletal traction femur	10	15	12	13	7	
Joint aspiration	20	26	28	13	15	
Major joint reduction	20	25	19	17	25	

Recognizing that training more orthopaedic surgeons is also required, the orthopaedic clinical officer has provided a cost-effective mechanism to expand the delivery of orthopaedic services. It costs US\$7253 to train an orthopaedic clinical officer for 18 months. In contrast, training an orthopaedic surgeon requires 5 years of medical school (total costs US\$40,000), plus 4 years of postgraduate training (total costs US\$12,000). This investment of US\$52,000 over a minimum period of 9 years could train seven orthopaedic clinical officers within just 18 months. The orthopaedic clinical officer program produces a competent orthopaedic practitioner who can be deployed in the rural areas at a relatively lesser cost within a shorter period of time. This is acceptable as long as the limitations and competencies of this practitioner are recognized.

All the orthopaedic clinical officers trained have remained in the country. Of the 117 trained, 82 (70%) remain in active clinical practice; 22 (19%) have died; and 13 (11%) have retired, resigned, or taken leave of absence. This is a remarkable achievement considering the major problem of “brain drain” of healthcare workers in the country. This high retention rate most likely reflects job satisfaction, as the orthopaedic clinical officers have a more prestigious title versus medical assistants. Orthopaedic clinical officers have also played a crucial role in training lower cadre workers such as medical assistants and nurses at health centers in basic trauma care. This multiplier effect has generally improved the primary care of patients with regard to musculoskeletal trauma.

Local orthopaedic surgeon training programs began in Malawi in 1999 for the fellowship program of the College of Surgeons of East Central and Southern Africa (COSECSA) and in 2004 for the Masters program in orthopaedics at the University of Malawi, College of Medicine. Over the next few years one to three orthopaedic surgeons will graduate

per year. The plan is to deploy these surgeons at central hospitals to provide specialist services and also to be trainers of the orthopaedic clinical officers who will continue to be needed in Malawi for the foreseeable future.

The model of using paraprofessionals to deliver medical or surgical services has been explored in various African countries, and the specifics differ between countries, as do specific job descriptions. Zambia has a cadre called clinical officers but none receives specialized training as do our orthopaedic clinical officers. Uganda also has orthopaedic officers, however they are not allowed to perform surgery. Mozambique has surgical technicians who perform general surgical and obstetric emergencies, but has no orthopaedic surgical technicians. Tanzania has trained assistant medical officers in general medical care, but has not trained any paraprofessionals to deliver orthopaedic care. There are also considerable differences between countries with regard to accepting the role of paraprofessionals in delivering selected medical or surgical services. While Malawi has taken the view that well-trained paraprofessionals can provide safe and effective interventions, including relatively major surgical procedures, several other countries have not shared this view. Sadly, such views persist even with the near complete absence of trained health workers such as doctors to provide the care.

The Malawi model involving training of orthopaedic clinical officers is a cost-effective mechanism to provide select orthopaedic services. A well-structured training program to produce a clinician with well-prescribed competencies is essential. The approach to orthopaedic training must be multipronged in such a way that training of orthopaedic clinical officers must continue to meet the current need of basic orthopaedic practitioners, while training of orthopaedic surgeons is strengthened and expanded for future long-term needs. This model must be

considered in other countries with socioeconomic status similar to that of Malawi.

In this paper we have attempted to illustrate the current status of orthopaedic services in Malawi, a developing nation with a critical shortage of doctors and less than 10 fully trained orthopaedic surgeons. Orthopaedic clinical officers are currently being trained to provide adequate basic orthopaedic care to the majority of the rural population in the country.

#### Where Do We Need To Go?

Malawi aims to continue training orthopaedic clinical officers to meet the orthopaedic needs of the nation. At the same time the shortage of doctors in general and orthopaedic surgeons in particular is being addressed with the introduction of postgraduate orthopaedic training programs. This dual approach model for training orthopaedic practitioners in Malawi will continue for the foreseeable future.

#### How Do We Get There?

We recommend the orthopaedic clinical officer training program be not only maintained, but expanded to train more practitioners to meet the need for orthopaedic services in the country. We would go further to recommend such a program be considered in countries with similar socioeconomic and health needs, especially those in this subregion of Africa. Indeed, this would be an opportunity to have a standardized orthopaedic paramedical training program for the subregion. The clinicians trained will have well-defined job descriptions and clinical competencies. To ensure standards and acceptability of the program, a regional training and accrediting body such as the College of Surgeons of East Central and Southern Africa (COSECSA) needs to be involved so that the paramedical diploma is recognized.

We also believe training for doctors in general and specialists such as orthopaedic surgeons be intensified in Malawi and in the region so that more orthopaedic surgeons are trained to provide specialist services at central and referral hospitals and also assist in training and mentoring orthopaedic clinical officers. Orthopaedic services must be brought nearer to the population by training more orthopaedic clinical officers and deploying them in rural, district, and mission hospitals where the majority of the population lives. Each such hospital must have at least one orthopaedic clinician.

**Acknowledgments** The Malawi orthopaedic clinical officer training program was the vision of Dr. Edward Blair who sadly passed away in 2007. His devoted effort and commitment for over a decade in a foreign land away from family and friends is commendable. Funding from CIDA and Rotary International was crucial in the first 10 years.

Another dedicated individual was Prof. Chris Lavy who resurrected the program in 1998 having seen the importance of the program. Funding from DFID and Nuffield Foundation through THET was important in restarting the program. He also spent a decade in Malawi from 1996 to 2006.

All other stakeholders including Malawi Ministry of Health, Malawi College of Health Sciences, Queen Elizabeth Central Hospital, University of Malawi College of Medicine, and Beit Cure Hospital are thanked for supporting the program.

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