

# **EVALUATION REPORT**

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## **OUTCOMES OF LYMPHATIC FILARIASIS (LF) SURGERIES IN WESTERN AFRICA**



### **THE WEST AFRICAN LF MORBIDITY PROJECT**

*August 2007*

## Executive Summary

The present report synthesizes experiences in several West African countries under the West African LF Morbidity Project, which aims to bring good quality, modern LF-surgery treatment to patients in rural Africa as quickly as is reasonably possible.

In addition to external evaluations in Burkina Faso, Ghana, and Togo using two very different approaches, the report is based on experiences at a training workshop in Senegal in June 2007 and routine surgeries in Niger under two different sets of circumstances in June 2007. The report includes the Protocols / Terms of Reference, in addition to the external evaluation reports themselves.

The three external evaluations were funded by the Bill and Melinda Gates Foundation under its grant via the World Bank to study the feasibility of global LF elimination. Observations in 2007 were made as part of field work under a grant from NORAD (government of Norway) to HDI-Norway in support of the West African LF Morbidity Project.

### Major conclusions

Based on observations in five countries, major conclusions are that:

- The method of surgical LF-hydrocele (filaricele) repair taught under the West African LF-Morbidity Project using the approach developed in Brazil and recommended by WHO, is popular among surgeons and patients, easy to learn, easy to carry out, requires shorter hospital stays, and gives excellent surgical and socio-economic results when done properly in West African district hospital settings. Surgeons express surprise and pleasure at how much better the new procedure is than what they had previously used;
- When antibiotic cover is **not** properly implemented, when patients who live far away are discharged from hospital before the skin has closed properly, and when patients do not receive postoperative care right until integrity of the skin has been reestablished, normally about 7 days when the procedure is done correctly, then unacceptably high rates of postoperative infections, often fairly mild but sometimes horrific, regularly occur in West African district hospital settings. Disastrous clinical outcomes including death can occur;
- Attention to seemingly small details of the surgical procedure (e.g. careful skin closure that does not leave open gaps, correct application of the recommended bandaging technique after the skin has been sutured, and good antibiotic cover pre- and post-operatively) makes a major difference to LF-surgical outcomes in African district hospitals.
- Surgical “campaigns” seem to have considerable disadvantages and may lead to worse outcomes than the same surgeons can achieve routinely in the same under-resourced settings.

### Changes that Resulted from the External Evaluations

The External Evaluator for Burkina Faso and Togo, urologist and professor of surgery Serigne M. Gueye, the Project Surgeon, specialist in urology Dr. Sunny D. Mante, and HDI’s executive director, Dr. Anders R. Seim, met in Dakar, Senegal on June 13-14, 2007 to review results of the evaluation process. They decided on certain immediate modifications to the Project.

Specifically: i) Patients **MUST** be under antibiotic cover pre- and post-operatively; ii) Special care must be paid to skin closure to avoid all “gaps” during suturing of the skin. Three extra minutes at surgery prevents weeks of postoperative problems for the patient; iii) Patients must be kept in hospital for a week or until the skin has regained its integrity, usually less time than required after the traditional method.

Revisions were written into HDI’s LF-Surgery Handbook to take account of these changes.

Observations in Niger then supported previous observations and strengthened the decisions about what modifications are needed in response to the findings of the external evaluations.

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## Background

To improve availability of modern LF treatment for patients in this sub-region, HDI initiated activities in 2001 that led to the West African LF Morbidity Project (WALFMP) in 2004.

The hope is that this model may be useful in other regions too, as a way to rapidly disseminate knowledge about modern treatment principles, to best benefit lymphatic filariasis patients globally.

The Project's main focus was chosen because district surgeons in West Africa rarely if ever get much opportunity for "continuing education," and most filariciele (LF-hydrocele) patients are treated in district hospitals. To speed the availability of optimal treatment for this disease, the Project therefore set out to teach modern principles of filariciele surgery through hands-on workshops, aiming to reach 12 West African countries. Participants include district surgeons, surgeons who teach surgery to medical students, and surgeon-nurses where applicable. The Project also conveys information on modern LF-lymphoedema treatment to stop progression and provide relief to LF-lymphoedema patients.

HDI sees quality control and outcomes-evaluation as important aspects of the Project if one is to assure appropriate treatment to patients in remote locations of developing countries. It is especially important to ensure that good outcomes are being produced when offering advice on an elective surgical procedure designed to replace procedures that are known to often result in unacceptably high rates of post-operative recurrence as well as infections, lymph scrotum and other disastrous outcomes. Ethically, this is especially true if offering treatment as part of an organized national disease elimination program.

By a 2005 meeting of the Gates Grant Review Committee (GGRC), training workshops had been held in Ghana, Burkina Faso and Togo. Funds (\$50,000) were therefore provided by the GGRC so HDI could arrange for independent evaluation of surgery outcomes in those three countries.

## Evaluation Procedures

For Ghana, a rather extensive evaluation protocol was developed because so many patients had been treated there (> 1,000). The large number of surgeries in Ghana is thanks to support from Catholic Medical Mission Board (CMMB) to Ghana's Upper West Region.

NOTE: The evaluation in Ghana was only carried out in Upper West Region, one of Ghana's poorest, least accessible and least developed areas. LF-surgery outcomes may have been significantly different elsewhere.

The protocol to evaluate outcomes in Ghana was developed independently of HDI at the Atlanta LF Support Center, then based at Emory University, and the Centers for Disease Control and Prevention (CDC). The evaluation protocol for Ghana contained a fairly extensive questionnaire aimed at assessing the socio-economic outcomes of surgeries provided as a result of the Project, in addition to purely somatic surgical outcomes. A team of 25 2<sup>nd</sup>-year nursing students was recruited to carry out the external evaluation in Ghana. Both physical examination of the external genitalia and the socio-economic part of the evaluation were done by these students under the auspices of the Health Research Unit of The Ghana Health Services in April 2006. The Ghana protocol and the report of the evaluation are attached (p. 11 - 19 and 20 - 48).

For Burkina Faso and Togo, a simpler protocol was developed for the evaluations (p. 49 - 53). Much fewer patients had been operated on. The Ghana protocol would therefore have been inappropriate, and resources did not permit three such extensive studies. In Burkina Faso and Togo the focus was on surgical outcomes, with some effort to assess socio-economic outcomes. After considerable delay due to health and other issues pertaining to the doctor originally recruited to do evaluations in Burkina Faso and Togo, these were done in October - November and December 2006, respectively. External Evaluator for these countries was urologist and head of surgery at the University of Dakar medical school, Professor Serigne M. Gueye.

Reports from the three evaluations were received by HDI in May and June of 2007 and are attached.

In June 2007, additional detailed information was garnered in the following ways:

- 1) Interviews of Prof. Gueye on June 13<sup>th</sup> and 14<sup>th</sup> ;
- 2) Further investigations by contacting a surgeon in Togo for information about two patients;
- 3) Interviews of surgeons trained by the Project at Niger's September 2006 workshop;
- 4) Inputs from participants trained in Senegal in June 2007;

- 5) Postoperative clinical examination of patients after Senegal's June 2007 workshop;
- 6) A patient who had been operated on the same morning by a participant at Niger's workshop was examined by HDI's executive director during an unannounced visit to a district hospital, and the surgeon was interviewed; and
- 7) Ten patients at a different hospital in Niger were examined 2-8 days after surgery. They had been operated on by one or more of a team consisting of two surgeons and two "surgical attaches" (surgeon-nurses), specially trained nurses who do a specified list of surgical procedures on their own. One member of that team had participated in Niger's September 2006 training workshop. These patients were treated as part of a series of outreach surgery campaigns organized at the initiative of Niger's head of state, during which a wide variety of surgery is conducted, LF-hydrocele being just a frequent example. The visit was planned and announced only the previous day. It became clear that no special interventions were introduced between the time the visit was announced and its occurrence the next morning.

These additional data sources provided significant information not available in the original external evaluation documents. Therefore, the analysis based on all of the available information is presented first, and the original external evaluation documents are included afterward.

The External Evaluator for Burkina Faso and Togo has seen this evaluation and has confirmed that he agrees with the analysis and conclusions presented in these first ten pages.

### **Outcomes - Summary**

Based on observations in five countries, the three external evaluations in 2006 and observations by HDI in June 2007, the main conclusions are that:

- The surgical method for LF-hydrocele (filaricele) repair that is taught under the West African LF-Morbidity Project, using the general approach developed in Brazil and recommended by WHO, is popular among surgeons and patients, easy to learn, easy to carry out, requires shorter hospital stays than the traditional method, and gives excellent surgical and socio-economic results when done properly and when patients are carefully followed up post-operatively, also in West African district hospital settings;
- Unacceptably high rates of postoperative infection (though usually fairly mild) regularly occur in West African hospital settings, and disastrous clinical outcomes can occur, when the pre- and post-operative antibiotic cover is not properly carried out, and when patients who live far away are discharged from hospital and do not receive postoperative care right until the skin has regained its integrity, normally about 7 days when the procedure is done correctly;
- Attention to seemingly small details of the surgical technique, e.g. careful closure that does not leave open gaps in the sutured skin, correct application of the recommended bandaging technique after suturing the skin, and correct use of antibiotic cover during and after these operations, make a major difference to surgical outcomes in African district hospitals;
- Surgical "campaigns" seem to have considerable disadvantages and may lead to worse outcomes than the same surgeons can achieve routinely in the same under-resourced settings.

Modifications of pre-operative antibiotic cover, length of hospitalization and the organization of follow-up care are mandated by unacceptably high rates of (usually mild) post-operative infections, in spite of the fact that the new LF-surgery technique gives excellent results with few if any complications when done properly in ordinary African district hospitals.

Patients are generally very pleased with the results of the operation, even most of those who had infections and were reached by external evaluators for follow-up assessment.

Of the 2,109 patients known to have been operated on in five countries as of June 2007, one patient is known to have died of post-operative infection 12 days after he was operated on during a "surgery campaign." An additional man whose surgical wound was initially infected but then healing, died of causes

apparently unrelated to the infection. Details are provided below. While it happens in northern countries too, although hopefully not from infection, death as a result of elective surgery is unacceptable.

### **Consequences of the Evaluation**

When HDI received the external evaluations, the Project Surgeon, the External Evaluator for Burkina Faso and Togo, and HDI's executive director promptly introduced modifications to the procedure and the Project's handbook for district surgeons, to address the identified weaknesses. These modifications are summarized in the Executive Summary (p.1), on page 7, and in the Conclusions of this report (p. 10).

The fact that a Nigerienne surgeon had, on his own, adapted the pre- and post-operative procedures along the same lines as one is now recommending, and that he is obtaining consistently excellent results with no infections or other problems, is an early indication that the proposed remedies are likely to be successful and give good results if applied conscientiously.

HDI will seek funding to do a subsequent external evaluation of the procedure when the modifications have been in place for a year or two and more surgeons have been trained in more countries.

### **Specific Findings From the Evaluations and the Supplemental Investigations**

In the evaluated countries, Burkina Faso, Ghana, and Togo, a total of 1,771 patients had been operated on (266, 1254, and 251 respectively) and 399 were reached for the evaluations (125, 302, and 16 respectively).

#### **PLEASE NOTE:**

When reading the numbers below, it is important to remember that: 1) the data was collected retrospectively, and 2) neither the number of patients operated on, nor patients found / not-found for evaluation were presented as age-stratified data. Ghana reports the age of those found for evaluation as on average 54 years (range: 4 – 92 years) (p. 27). It also says, "The few that still have some problems with mobility and self care have on the average 68.4 and 69.4 years respectively...." (p. 42), and it gives information on the elderly status of men reporting sexual problems. But age-stratification tables are generally not presented in the external evaluations. The report from Ghana does report age-range and mean age for the Quality of Life categories in Table 7 and 8 (p. 46 – 47).

### **Positive Aspects and Outcomes of the WALFMP's Surgical Procedure**

- 1) **The great majority of patients are very pleased with the clinical and socio-economic outcomes of their operations. In all three externally evaluated countries, patients were reported to be overwhelmingly satisfied.**

In Ghana, 92.4% of respondents reported "very high satisfaction with the surgery" (p. 21), i.e. reported having "no problem with the surgery" (p.33), while 7.0% reported "some problems" which included potency issues among patients 50-80 years of age (average 67.8) that may actually be unrelated to the surgery (p. 42), and 0.6% (equivalent to 1-2 individuals among the 302 respondents) "wished they had not done it at all" (p.33).

Satisfaction numbers are not reported in the Burkina Faso and Togo reports, but the External Evaluator insisted when interviewed that essentially "all" the patients he met were well satisfied, even those who recovered from severe post-operative infections. (Nevertheless, see below. Two elderly patients died.)

The external evaluators in Ghana concluded (p. 42) that the many men who were not reachable for evaluation were probably experiencing good post-operative outcomes. Men who could not be found for follow-up were thought to by and large have traveled to "Southern Ghana for better job opportunities." That statement and personal communication from the Ghana evaluation team give the impression that many men of income-generating age were unavailable for the evaluation because they were away for employment reasons, which is a good sign.

The Ghana report documents that operations allowed patients to be more economically active in the great majority of cases. Among respondents in Ghana, 88.3% reported being better or much better able to work (63.3% much better, 25.0% a little better, 6.7% no difference and 5% worse) (p.33). And 70.6% of respondents reported their economic situation as improved (42.6% much better, 28.0% a little better, 25.3% no change, and 3.7% worse) compared with the situation prior to surgery (p.33).

Similarly, very considerable improvements were seen on the social side and as concerns quality of life generally, using WHO's Euro-Qual assessment tool. Much or a little better family life was reported by 78.9% of Ghana's respondents and much or a little better sex life by 52.8%, etc (p. 33). The number who had "any problem with mobility" went down from 66.6% to 9.9% after LF-hydrocele surgery, and "any problem with self-care" went down from 34.8% to 3.6% (p. 34, where additional data is also presented). Also, problems with "pain and discomfort," "anxiety and depression," and "usual activity" improved.

"They generally have a much better quality of life after the surgery in terms of their ability to work, economic life, family life and sex life (fig. 8)." (p. 41).

## **2) Surgeons report being pleased with the new surgical procedure in Niger, Senegal, and the three externally evaluated countries.**

Prof. Gueye conducted a focus-group discussion and interviews with surgeons trained by the Project in Togo and a focus group discussion with hospital staff and surgical nurses in Burkina Faso. He reports the impressions and suggestions made by four Togolese surgeons (p. 74 – 78), also as concerns the running of surgical "campaigns", and he briefly summarizes recommendations made in Burkina Faso (p. 64).

Written reports of the external evaluations for Burkina Faso and Ghana do not comment on how surgeons view the procedure with excision of the filaricele sac. However, notes taken by Professor Gueye allowed him to strongly assert, during the interviews of him, that surgeons and surgeon-nurses like the procedure.

Prof. Gueye reported during the interviews that the procedure is described by surgeons in both countries and by surgeon-nurses in Burkina Faso as being easy to learn, easy to do, quick to carry out, not expensive, gives shorter hospital stays than their traditional eversion technique with a surgical drain, and gives more esthetic results than their previous method. Some spontaneously said they especially like the mid-line incision; it gives easy access and results in considerably less bleeding and a nicer scar.

Several participants spontaneously expressed similar sentiments independently of each other to Dr. Mante and/or Dr. Seim after the Senegal workshop in June 2007. They expressed surprise and pleasure at how much better the new technique is than what they had previously used.

## **3) Success is in the details. Attention to seemingly small details of the procedure (e.g. careful closure that does not leave open gaps in the sutured skin, correct application of the recommended bandaging technique after the skin has been sutured, and good antibiotic cover per- and post-operatively) make a big difference to surgical outcomes in African district hospitals. There are district hospital surgeons/surgeon-nurses in all four African countries where we have longer-term data, who perform the procedure with excellent results including few if any infections.**

Detailed interviews and focus group discussions with surgeons and surgeon-nurses conducted by the External Evaluator in Burkina Faso and Togo, as well as observations by HDI in Niger, indicate that:

- i) there are practitioners in each country who carry out the procedure with excellent outcomes and few if any complications after participating in a single workshop;
- ii) treatment of individual patients in a routine setting by a conscientious practitioner (surgeon-nurse or surgeon) seems to more easily result in good outcomes than filaricele surgeries conducted as part of a "surgery campaign" that aims to operate on a maximum number of patients (e.g. 100 or more) in a week or a similarly short period of time, be it specifically for LF or otherwise.

At the same time, significant deviation from the pre-, per-, and post-operative procedure can result in highly unacceptable outcomes, as presented below.

## **Negative Aspects and Negative Outcomes of the WALFMP's Surgical Procedure**

- 1) In the West African district hospital setting, post operative infections, bleeding, and other complications can easily arise with completely unacceptable frequency and severity unless essential details of the procedure are carried out properly, especially as concerns antibiotic cover during and after the operation, careful hemostasis, proper skin closure, and careful post-operative care until the skin's integrity has been re-established.**

All manner of observations from the five countries, and massive data from the three external evaluations confirm that statement.

The Project and everyone dealing with LF surgery in Africa owes a vote of thanks to Dr. Ambarka, Togo's District Surgeon in Sokodé, for an astute observation that cut through the fog of multifaceted data. Dr. Ambarka appreciates the new filaricele procedure, and he has done about two such operations weekly since learning the method in 2005. Dr. Ambarka noticed that he had excellent results and never any problems for patients who live in Sokodé town where the hospital is located. However, among patients who lived far from hospital, so their bandages were changed by local nurses after discharge a day or two post-operatively, he had an unacceptably high 20% of patients returning to hospital with infections.

Observations in Senegal and Niger strongly reinforced decisions on what parts of the procedure to modify as a result of the external evaluations: a) the pre-, per-, and post-operative systemic antibiotics regime; b) careful skin closure so there are no gaps showing subcutaneous tissue; c) keeping patients in hospital until the skin is dry and healed.

Dr. Nameoua Babadi, District Surgeon in Dosso, Niger and a participant at Niger's September 2006 workshop, provided important confirmatory observations. He has already modified the procedure along these lines, on his own, and he has been achieving excellent results with the all of the filaricele patients he has operated on since then. He always has patients on ampicillin and metronidazole during the operation and for a week afterward, and he keeps the patient in hospital until the skin is nicely healed and dry, usually 7-8 days. This is more than the 1-2 days the Project initially recommended based on experience outside of Africa, but much shorter than he was accustomed to with the traditional technique. Dr. Babadi describes the current technique as a major improvement compared to what they used previously, which typically led to month-long hospitalization due to post-operative infection after removal of the surgical drain that was routinely used. Dr. Babadi has yet to see a postoperative infection after he began using the new procedure.

## **Why the Need to Tighten Up the Procedure? Examples of Problems**

Cow-dung poultices are, it turns out, commonly placed on wounds in rural West Africa. Ghana's evaluation described the tradition of cow-dung application to surgical wounds as one of several reasons for the observed 20% post-operative infections rate (p. 40) (range: 10% - 30% at the various hospitals, Table 9, p. 47). Cow dung applied to a fresh surgical wound after 2-3 days is not what the doctor ordered.

Especially during surgical campaigns but in other situations too, patients were sometimes not given antibiotics as described in the Project's procedure. A variety of reasons were reported. One is that the nurses simply did not give the medication to the patients. In some cases it was intimated that some nurses may have kept the (free) antibiotics from these patients in order to sell them to others in the future. Several respondents suggested that it is more reliable to give the entire week's medications to the patient and his accompanying relative, with careful verbal instructions for how to use them, than to depend on sometimes unreliable nursing staff.

In some cases (in Burkina Faso and Togo, but probably also in Ghana and Niger) people skipped the pre-operative dose of antibiotics for various reasons, such as the patient arriving on the morning of surgery, for lack of supply (never the case during the Project's workshops but might be the case for routine surgeries at a district hospital), because they forgot, or for other reasons.

In at least one case (Senegal), the patient removed his bandage himself the same day he was discharged from hospital, a day before his scheduled bandage change using aseptic technique. He returned to hospital with a dirty bandage that had been sloppily wrapped around the scrotum in a way that also included the penis, contrary to all that was taught during the just completed workshop. Other patients presumably also remove their bandage as soon as they are discharged from hospital, at least to have a look.

In some cases (Ghana, p.41), patients sought treatment from traditional healers rather than returning straight to hospital or the nearest health post if they started getting an infection. Financial constraints are suggested as one reason people may go to the traditional healer rather than to trained medical staff or a pharmacy.

Nurses at health posts are universally NOT trained in aseptic technique for post-operative bandage changes, and they are certainly not trained in the special bandaging technique used in this procedure. That technique provides adequate supportive compression to the scrotum without constricting circulation or causing edema of the penis or other structures. Also, health post nurses do not have the right kinds or enough materials to do this properly, even if they had been trained in this special technique. Thus, patients referred to rural health posts for postoperative care are essentially guaranteed to receive suboptimal, inadequate treatment. As mentioned above, a surgeon in Togo observed unacceptably high postoperative infection rates in patients who live far enough away so they went to the local health clinic for bandage changes, while he got uniformly excellent results in patients who live in the town where his hospital is located.

There are all too few surgeons in West Africa, so the Project's original suggestion that surgeons do initial bandage-changes on their own patients is unrealistic in almost every case. These surgeons do not change bandages. Unfortunately, the Project had not emphasized the need to train one or a few competent nurses in the appropriate and unique bandaging technique that this procedure entails. Surgeons should supervise each nurse who is to be delegated this responsibility until certain that the nurse can do the changes reliably. Completely inadequate bandaging, with resulting consequences, has been observed in several countries when a random nurse was simply told to change the bandage.

There is too little equipment in many district hospitals to handle large numbers of operations each day. Perceived pressure to operate on a large number of patients per day often means there are not enough sets of sterile surgical instruments. And there is not enough capacity to sterilize the instruments quickly enough. Respondents have described situations where instruments were simply rinsed or washed and dipped in disinfectant before being used on the next patient. Gowns were reportedly also re-used because re-sterilization was a rate-limiting step, constraining the number of patients the "campaign" could otherwise operate on. Etc. This is of course disappointing and completely unacceptable, and seems a strong argument against doing surgical campaigns in district hospital settings in most West African countries.

Also, during "surgery campaigns," more patients are operated on than the hospital and its staff can handle properly. As a result, patients were reportedly sent home the next day, for post-operative care at the hands of nurses who have neither the training nor the equipment for proper changes using aseptic technique. Similarly, few if any of the hospital nurses were trained in this post-operative care and they were thus unable to properly care for the large number of patients who remained in hospital.

Some patients were recruited for "surgery campaigns" by hospital staff from among their own relations, although the patient lived perhaps 200 kilometers away. In those situations, returning to the hospital for treatment of post-operative infection or other problems was unrealistic.

During Burkina Faso's initial surgery workshop, a senior teacher of surgery insisted that surgical drains should be inserted in all patients, although this is, for several very good reasons, not part of the procedure taught by the Project. Surgical drains are typically removed after 1-3 days, and the opening from which the drain was removed is typically left to heal on its own, unsutured. 60% of patients experienced post-operative infections after Burkina Faso's June 2005 workshop. The external evaluation found that other factors may also have contributed. Apparently some or all patients were sent straight to surgery by the

nursing staff, without thorough pre-operative washing of the entire patient with soap and water the previous afternoon. Especially the genital area is also to be washed the previous day and the morning of surgery.

The external evaluations, and supplementary observations in Niger, uncovered that some practitioners continue to place surgical drains in the scrotum if the filariccele is very large. There seems no rationale to justify doing so, and in future workshops the Project will address the issue of surgical drains in more detail.

### **Two “surgery campaign” patients died postoperatively, one due to infection**

One patient, 75 years of age, died of septicemia 12 days postoperatively. He reportedly lived alone in a village quite far from the nearest road. When he became ill postoperatively, he was unable to walk the considerable distance to the road where public transportation is available, and he was thus unable to return to the hospital for care. Because he lived alone, he was reportedly also unable to raise the alarm that he needed help getting to hospital until late, and he arrived in septicemic shock. Intravenous antibiotic and other i.v. treatment was initiated. But the hospital did not have supplies to continue the treatment; his family did not fill prescriptions for lack of funds, and the patient died after three days.

One patient, 50 years of age, died 28 days post-operatively of causes unrelated to infection. He returned to hospital 19 days after surgery with localized infection and torpor. Under treatment his surgical wound was again healing nicely, and all seemed to be going well when he became delirious and agitated. He was given paracetamol and injectable diazepam. He died at night during a brief second episode of agitation before the doctor managed to arrive from home. Alcohol consumption in the area is reportedly excessive in large parts of the population. One does not have information about this patient’s habits prior to his hospitalization.

Both of these patients were operated on during a surgical campaign in northern Togo.

The mortality rate was, thus, 0.95/1,000 among those known to have been operated on in the five countries during this period and 1.13/1,000 operations in the evaluated population. Mortality directly caused by surgery/postoperative infection, was 0.47/1,000 among those known to have been operated on, and 0.56/1,000 operations in the evaluated population.

Although it happens in northern countries too, death as an outcome of elective surgery is of course unacceptable.

Modifications to the protocol as described above, and attention to the selection of patients for surgery in light of their individual health status rather than including patients less attentively or even willy-nilly in “surgery campaigns,” should prevent such tragic outcomes and the unacceptable postoperative infection rates that this evaluation has documented in some settings.

This evaluation also documents that it is possible to achieve excellent clinical and socio-economic results in local African hospitals. The evaluation has shown that even under very challenging circumstances, African colleagues often do beautiful work that restores dignity and can hugely benefit their patients.

HDI intends to seek funding for a subsequent evaluation of surgery and socio-economic outcomes under the West African LF Morbidity Project when modifications to the protocol have been in place for a time, when more patients have been treated, and more surgeons trained in more West African countries.

## CONCLUSIONS

- 1) The vast majority of patients benefited, often considerably and in several areas of their life, when LF-surgery using modern methods was made available to them as a result of the West African LF-Morbidity Project;
- 2) Surgeons in all five countries from which one has data (and surgeon-nurses where those exist) say the procedure is easy to learn, easy to carry out, less expensive than the method they previously used, and that it gives excellent esthetic and clinical results;
- 3) Surgeons and surgeon-nurses can reliably achieve excellent outcomes using the surgical procedure that the Project teaches, even in poor district hospital settings in West Africa;
- 4) Proper pre- and post-operative care, especially in ways that reduce the risk of infection, are essential if acceptable outcomes are to be achieved in West African settings.

Sloppiness with regard to one or more factors that constitute normal surgical hygiene and adequate antibiotic cover will regularly lead to completely unacceptable postoperative infection rates and can lead to catastrophic clinical outcomes, even death.

- 5) The approach as taught by the West African LF Morbidity Project should be modified in the following ways:
  - a. Proper antibiotic cover, hemostasis, and good surgical technique must be emphasized even more strongly, along with the lack of need for surgical drains during normal LF-hydrocele surgery no matter how large the filaricene may be;
  - b. Special care must be paid to skin closure, taking care to avoid all “gaps” during suturing of the skin. Three extra minutes expended at the operating table prevents weeks and more of post-operative problems for the patient;
  - c. Patients must be kept in hospital for 7 – 8 days or until the surgical wound is dry and the skin has closed properly, which is, still, less time than required after the procedure that was previously standard;
  - d. Surgeons who do LF-surgery are responsible for training those to whom they delegate.

If critical elements of post-operative care are delegated to others, it is the surgeon’s personal responsibility to personally train the nurse and supervise that nurse until the surgeon knows the nurse can do the tasks reliably. This is especially important for persons delegated to carry out complex tasks such as the aseptic bandage-changing technique that is used with this surgical procedure and the success of which is important to a successful outcome by helping to prevent scrotal oedema, bleeding, and infection postoperatively.

- e. Surgeons should consider whether “surgical campaigns” that aim to treat the largest possible number of patients within a short period of time may normally be contraindicated in most West African settings.

If surgeons do participate in surgical campaigns, they must assure themselves that adequate numbers of surgical-instrument sets, surgical gowns, drapes, and other supplies are available, and that adequate numbers of beds and trained hospital staff are available, so each patient can receive ethically acceptable and clinically adequate levels of pre-operative, operative, and post-operative care.