THE GLOBAL ELIMINATION OF BLINDING TRACHOMA: PROGRESS AND PROMISE

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Abstract. Trachoma is the world’s leading cause of preventable blindness. It affects approximately 150 million people living in the world’s poorest, rural communities and causes an estimated loss of $2.9 billion in productivity annually. In 1985, the Edna McConnell Clark Foundation joined with the World Health Organization to support studies on trachoma epidemiology and control, resulting in the elaboration of the surgery, antibiotics, facial cleanliness and environmental improvement (SAFE) strategy as the basis for the elimination of this blinding disease. Founded in 1998 by the Clark Foundation and Pfizer, Inc., the International Trachoma Initiative (ITI) is the only organization dedicated to eliminating blinding trachoma through support to national control programs. The availability of donated Zithromax® (azithromycin) by Pfizer, Inc. has been paramount to the support of the ITI for implementation of SAFE in 10 country programs. The program has made considerable progress in four years. More than seven million individuals have received treatment, resulting in a cumulative reduction of 50% in active disease rates in children. More than 60,000 have also benefited from lid surgery that has halted progression to blindness. Morocco is expecting to attain the elimination of blinding trachoma by 2005. However, the challenges facing the goal of global elimination by 2020 involve a vital program expansion, increased financial and technical support, environmental improvement, and continued advocacy efforts.

INTRODUCTION

Although trachoma remains the world’s leading cause of preventable blindness, its elimination as a public health priority may be in sight. From the mid 1980s, a decade of renewed investment in research and program development led to the formulation of the tools and strategy necessary to attain success. More recently, over the last five years, these tools have provided the basis both for the founding of the International Trachoma Initiative (ITI) and for the development of national trachoma control programs, many of which are making measurable progress toward elimination. This paper will review recent developments in the global effort to eliminate blinding trachoma and will outline the scope of the challenge ahead.

HISTORY AND DEVELOPMENT

It has been noted that trachoma is among the oldest recorded diseases based on documentation dating from Pharonic Egypt.1 During the 19th and early 20th centuries, trachoma was widespread in Europe and North America and was a leading exclusion criterion for European immigrants coming through Ellis Island into the United States.2 Due in large part to improvements in hygiene and sanitation, trachoma is no longer endemic in these areas. Rather it persists in the world’s poorest, under privileged, and least served communities.3

Today, the distribution of trachoma corresponds with that of poverty in much of Africa and Asia. Conditions that facilitate the transmission of Chlamydia trachomatis, such as household crowding and access to and use of water, define risk.4 Those that remain vulnerable include Aboriginal communities in Australia, women and children in Africa living in rural communities and dry areas, and marginalized communities in Asia and the Middle East living in relative poverty. An estimated six million people, two-thirds women, are blind due to trachoma.5 The World Health Organization (WHO) also estimates that 11 million individuals with trichiasis are in need of surgical treatment and that 150 million children have active disease. Trachomatous blindness accounts for an estimated $2.9 billion per year in productivity losses.6 Given the disproportionate burden of trachomatous blindness borne by women, and productivity losses prior to visual impairment, this conservative estimate likely represents an underestimate of the social cost of the disease.7

It has been noted that trachoma is a neglected disease, but this has not always been the case.8 Soon after the founding of the WHO, trachoma control was a priority in much of Africa, Asia, and Europe.9 As the disease came under control in urban and periurban areas of countries such as Egypt, and pediatric conditions associated with infant and child mortality gained attention, the disease lost priority and interest in trachoma control waned.10,11

From the mid 1980s, trachoma began to receive renewed attention when the New York–based Edna McConnell Clark Foundation expanded its grant making to include research on the epidemiology and control of blinding trachoma. This research culminated in the development of a comprehensive strategy to address the problem. The strategy called SAFE is comprised of the following four components: 1) surgery to correct trichiasis, the immediate precursor to blindness;12 2) antibiotics, particularly azithromycin donated by Pfizer, Inc. to treat active disease;13 3) facial cleanliness to reduce transmission;14 and 4) environmental improvement to affect the determinants of vulnerability.15

By attending to the medical, behavioral, and environmental determinants of trachoma, the SAFE strategy addresses both the immediate risk of blindness, as well as the root cause of disease. Because each component of the SAFE strategy uses appropriate and readily adaptable technologies, trachoma control can be integrated with broader health and development efforts targeting poor and vulnerable populations.16

These advances in medical and social sciences provided the basis for the World Health Assembly in 1998 to call for the elimination of blinding trachoma by the year 2020, which was underscored by an additional resolution in 2003.17,18

THE INTERNATIONAL TRACHOMA INITIATIVE

The ITI is the international agency dedicated solely to the elimination of blinding trachoma.19 Founded by the Edna
McConnell Clark Foundation and Pfizer, Inc., ITI is established as a public charity in the United States and receives financial support from several other sources, including the Bill and Melinda Gates Foundation. The mission of the ITI is to achieve global elimination of blinding trachoma by 2020. The activities of the ITI are organized around strengthening national trachoma control programs focusing initially on the countries designated by the WHO as “first priority” for intervention.20 At the same time, ITI invests in applied research to improve how the SAFE strategy is used in the differing economic, social, and epidemiologic settings and communication and advocacy to both educate the public and decision-makers of the program’s impact and mobilize key constituencies to support the elimination effort. National trachoma plans are reviewed by an independent committee of scientific experts in public health, trachoma control, and social development.21 The Board of Directors of the ITI, currently comprised of 10 members representing ITI’s supporters as well as public members, provides governance. The ITI supports national control programs through the provision of technical assistance, targeted financial, and in kind support, and development of health education, communications, and resource development activities.

In its support for national programming, ITI coordinates the donation of Zithromax® (azithromycin) by Pfizer, Inc. for trachoma control. The availability of azithromycin for trachoma control is a central element of the ITI’s support for the SAFE strategy. An oral, systemic preparation taken once per year, azithromycin has been proven to be more effective and easier to administer than the previously recommended regimen of tetracycline eye ointment twice a day for six weeks.22 Questions remain regarding the optimization of treatment strategy in community-based programming. Timing and frequency of treatment, particularly in hyperendemic settings, needs further exploration.23 With the exception of Morocco, no national program has gone to scale. Ongoing evaluation in Morocco and other countries will generate data about how long treatment is necessary and under what circumstances.

The issue of program sustainability is also a concern. Attention has focused on the cost of antibiotic treatment, particularly that of donated azithromycin, although data are wanting on the affordability of conventional therapy in the context of a national elimination effort. It has been noted that for the world’s poorest nations, even free medications may be unaffordable due to delivery costs.24 Early analysis of large-scale trachoma control programs in Africa suggest that the marginal cost of treatment delivery is similar to those reported by the African Program for Onchocerciasis Control and the Global Alliance to Eliminate Lymphatic Filariasis (less than $0.50 per person). A more fundamental question revolves around who would support the cost of these programs as they strive to go to scale.

For its support of the global effort to eliminate blinding trachoma, ITI facilitates, encourages, and builds coalitions with partners and agencies with the competencies necessary to implement the full SAFE strategy. By linking immediate treatment needs with long-term preventive services, the program provides immediate, tangible services as a basis of trust for affecting the impact on social behavior and hygiene change necessary to ameliorate risk. This approach entails the necessary participation of a range of international, governmental, and non-governmental organizations in the health, education, and social development sectors. The ITI works with the ministries of health and other partners from basic planning and program development, through implementation and evaluation.

As shown in Figure 1, ITI-supported programming is currently underway in 10 countries that the WHO has recognized as priority for trachoma control. During its first two years, ITI supported SAFE strategy in Ghana, Mali, Morocco, Tanzania, and Vietnam.25 Based on early results, program support has been extended to Egypt, Ethiopia, Nepal, and Sudan.

![Figure 1](http://www.who.int/pbd/trachoma/img/world%20trachoma%202.jpg)
Additional program expansion is anticipated in the coming years.

**PROGRAM PROGRESS**

The ITI-supported national programs have made substantial progress in disease control within a short period of time. Whether considered in terms of program output or program impact, the early results are promising. Ongoing challenges relate to scaling up SAFE to achieve full national coverage and ensuring sustainability of intervention until elimination goals are reached.

Table 1 illustrates that there has been considerable growth in the output of the national programs supported by ITI. Between 1999 and 2002 annual program output increased more than five-fold for trichiasis surgery from 5,576 to 30,002 and more than four-fold for antibiotic treatment from 705,685 to 2,864,967. The increases are due both to growth in program scope and increasing the number of country programs. While this provides an indication of program scope, it does not provide information on program impact.

Earlier methods for diagnosing trachoma in individuals or assessing disease burden in populations entailed employment of highly trained nurses and physicians. Responding to the human resource constraint observed in many trachoma endemic settings, a simplified system for community health workers to assess trachoma was developed in 1987. This simplified grading scheme neatly differentiates clinical disease into five states: trachomatous follicular (TF), trachomatous inflammation—intense (TI), trachomatous scarring (TS); trachomatous trichiasis (TT), and corneal opacity (CO). This system provided the basis for a WHO-published manual for health workers on epidemiologic assessment of trachoma at the community level.

A key challenge to assessing program impact is defining standards for its assessment with respect to each element of the SAFE strategy. The definition of these standards is complicated for facial cleanliness and environmental improvement components of the strategy due to a dearth of information on how these interventions relate to reduction in the prevalence of either active disease or trichiasis. The challenge with respect to impact assessment of surgery relates to the relative low occurrence of trichiasis, which rarely exceeds 5% in women more than 40 years old. In spite of this difficulty, the output figures reported in Table 1 do give a sense of cases of blindness averted. Despite a lack of consensus on age distributions, the prevalence of active disease - trachoma follicular (TF), the presence of five or more follicles in the upper tarsal conjunctiva and/or trachoma intense (TI), and pronounced inflammatory thickening of the upper tarsal conjunctiva that obscures more than half of the normal deep vessels is a meaningful measure of program performance and impact.

Tables 2, 3, and 4 summarize key evaluation data from selected national programs. It is important to note that these assessments were conducted as operational evaluations and data generated from routine surveillance under program conditions. Program assessment used stratified random sample surveys, with variation in actual survey design. The function of external evaluator was fulfilled by different organizations on an ad hoc basis. For example, Dr. A. D. Negrel, then of the WHO, worked with the Morocco program, the group of Professor Sheila West from Johns Hopkins University worked with the Tanzania program, and the group of Dr. Deborah Dean from the Childrens’ Hospital Oakland Research Institute worked with the Vietnam program.

The progress in the reduction of active disease in Morocco is summarized in Table 2. The program covers the entire endemic area of the five provinces between the Haute Atlas Mountains and the Sahara Desert. The sample varied from year to year but consisted of 11,000 children less than 10 years old in the 2003 survey. Since 1997, the program has achieved a 90% reduction in the prevalence of active disease. Based on these data, there is strong evidence that Morocco will succeed in its effort to eliminate blinding trachoma as a public health problem by 2005.

Data on active disease in preschool children in Kilosa District of Tanzania is shown in Table 3. The sample consisted of approximately 1,000 children less than eight years old or 74% of the children enumerated in three randomly selected program villages. Following three years of treatment, there is continued reduction in active disease, particularly in TI or severe disease. Although these results are less dramatic than those observed in the program’s first and second years, continued reduction in disease points to ongoing progress.

Data on active disease in Vietnam in areas implementing the full SAFE strategy, surgery and antibiotics alone, and in additional program expansion is anticipated in the coming years.

### Table 1

<table>
<thead>
<tr>
<th>Program output of the International Trachoma Initiative–supported national trachoma programs</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trachiasis surgeries</td>
<td>5,576</td>
<td>6,593</td>
<td>14,158</td>
<td>30,002</td>
</tr>
<tr>
<td>Antibiotic treatments</td>
<td>705,685</td>
<td>895,227</td>
<td>1,510,360</td>
<td>2,864,967</td>
</tr>
</tbody>
</table>

### Table 2

| Prevalence of active disease in the five endemic regions in Morocco over time |
|------------------|------|------|------|------|
|                  | 1997 | 1999 | 2001 | 2003 |
| Zagora           | 69.0%| 53.0%| 23.0%| 8.4%| |
| Errachidia       | 31.0%| 35.0%| 10.0%| 1.1%| |
| Tata             | 32.0%| 16.0%| 5.0% | 0.5%| |
| Ouarzazate       | 7.0% | 3.0% | 1.0% | 0.2%| |
| Figuig           | 9.0% | 1.0% | 0.0% | 0.1%| |

### Table 3

<p>| Prevalence of active disease in preschool children in the Kilosa district of Tanzania during third year of program implementation |
|-----------------------------------------------------------------------------------------------------------------|------|------|------|------|</p>
<table>
<thead>
<tr>
<th>Active trachoma</th>
<th>Severe trachoma</th>
<th>Total</th>
<th>2001</th>
<th>2002</th>
<th>%Δ</th>
<th>2001</th>
<th>2002</th>
<th>%Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease prevalence (%)</td>
<td>39.2</td>
<td>32.7</td>
<td>−16.6</td>
<td>5.8</td>
<td>3.1</td>
<td>−46.6</td>
<td></td>
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</table>
control villages are summarized in Table 4. The sample consisted of approximately 1,200 children less than 15 years old from program villages receiving SAFE, the medical components of S and A, and from non-program villages. A secular trend in disease reduction has been observed in other low-prevalence countries.29 This may be the case in Vietnam as well, although program interventions would appear to be expediting this process.

Data on the change in active disease as a result of the trachoma control program in Zinder Province, Niger are also promising. The sample consisted of two arms, each with approximately 700 children less than 10 years old in six randomly selected program and non-program villages. Prior to program implementation, the prevalence of active disease in Zinder was 62%. A survey conducted eight months post-treatment found the prevalence of disease to be 21.7% in villages receiving intervention versus 42.6% in those that did not. Although this was not designed as a case-control study, the magnitude of difference between the intervention and non-intervention areas is striking. Following this first year of implementation, coverage expanded seven-fold to 700,000 people in 2003.

PROGRAM PROMISE

The progress against blinding trachoma attained by a number of countries, including those reported in this paper, points to the feasibility of the SAFE strategy in trachoma control and the attainability of the WHO elimination goal. In less than four years, some of the world’s countries with the least resources have planned and implemented successful programs and demonstrated measurable short-term impact. These early successes point to the feasibility of implementing SAFE in a wide variety of program conditions, namely geographic regions, population densities, and economic disparities. Thus, the prospects of the elimination of this disease as a public health priority are promising and will become a reality in Morocco by 2005. These accomplishments, in conjunction with ongoing practical innovation and improvements in making SAFE implementation easier in the field, such as the validation of height-based antibiotic treatment, provide a solid basis for anticipating the national and international scale-up necessary to attain further success.30

Promising news, however, does not diminish the magnitude of the challenge ahead. As previously noted, an estimated 11 million individuals have trichiasis with 150 million more having active disease. This translates into 11 million people requiring surgery, and based on currently recommended treatment strategies, 500 million or more persons eligible for antibiotic treatment.31 Reaching this scale of program expansion, maintaining high quality services, not to mention necessary coverage in health promotion and environmental improvement, will entail a major increase in the pace of program expansion.

It is neither likely nor appropriate that the global effort to eliminate blinding trachoma will receive the priority currently afforded tuberculosis, malaria, or human immunodeficiency virus/acquired immunodeficiency syndrome.32 The burden of trachoma stems from disability and productivity losses, rather than mortality per se. It is the promise of elimination that provides the argument for investing in trachoma control. Unlike many other public health interventions, SAFE is a research-based, field-proven strategy for trachoma control. Elimination of blinding trachoma in the short term could free up resources for other conditions while at the same time improve the standard of living for society’s most vulnerable populations.

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REFERENCES


