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Sumitomo Chemical
Saving Lives with Better Nets

Malaria claims more than a million human lives every year. More than 90 percent of the deaths are among children aged five or under, and fatalities are concentrated in sub-Saharan Africa. Despite the development of proven methods of prevention and treatment and the increase in public awareness of the risks of malaria—which has been cited alongside HIV/AIDS as a target of the Millennium Development Goals (MDGs)—the disease continues to spread. Ultimately, the most effective means of controlling malaria is to control the mosquitoes that spread the disease. With this in mind, Sumitomo Chemical, a leading Japanese chemical manufacturer, has developed a mosquito net that employs new technology to make the net last longer and provide more comfort, making it more likely that families in hot climates will use the nets effectively. Sumitomo Chemical's Olyset net has gained global recognition as a highly effective tool in fighting malaria transmission and has become widely used in de-veloping countries in recent years. hrough its business ties, Sumitomo Chemical has also developed partnerships with other actors involved in the fight against malaria, notably international organizations, and it has come up with a range of malaria-related programs through which it can apply its diverse resources to this important fight.

Types of activities related to malaria

- Development and manufacture of long-lasting mosquito nets
- Transfer of mosquito net production technology to Africa free of charge
- Advocacy, awareness raising, and financial contributions to the international campaign against malaria

Evolution of Anti-malarial Mosquito Nets

Initial stages

Sumitomo Chemical is a general chemical manufacturer whose main fields include petrochemicals and basic chemicals. With its agricultural chemical operations and its leading share of the global market for the active ingredients of household insecticides, the company has long been indirectly involved in the fight against malaria. Though malaria is not endemic to Japan, the Japanese company's insecticides have been used since the 1960s to fight malaria in developing countries. In the early days of the campaign against malaria, the World Health Organization (WHO) advocated eradication through residual spraying of insecticide on interior walls and ceilings, and Japanese official development assistance (ODA) was used to spray insecticides, including chemicals developed by Sumitomo Chemicals, throughout the developing world. However, while Japan and other donor countries made important ODA commitments to provide the insecticides, they failed to provide funds to pay people to apply the sprays.[1] For this reason, the insecticides were not necessarily applied systematically, and the malaria eradication program gradually lost steam. Sumitomo Chemical's next involvement with malaria would not come about until the 1980s.

In the mid-1980s, several academic groups published a study arguing that insecticide-treated nets (ITNs)—specifically, nets treated with pyrethroids—were effective tools for preventing malaria, and the WHO and other organizations began to focus on mosquito nets as a key means of fighting this disease. The malaria-carrying Anopheles mosquito generally bites at night, so sleeping inside a mosquito net is an effective way to avoid getting bitten, thereby avoiding infection. Even nets that have not been treated with insecticide have a certain degree of effectiveness, but if the net fails to completely enclose the sleeping area, or if it has developed tears as the result of long use, mosquitoes can enter through the openings. But, if the net is treated with insecticide (soaked so that the insecticide impregnates the net), mosquitoes alighting on it even briefly as they seek to enter through the openings will be knocked down or killed. On top of that, if such nets are used in all houses in a particular area, the mosquito population

1. Interview with Dr. Takaaki Itoh, Sumitomo Chemical.

in that area can be significantly reduced. Data show that the rate of malaria infection among those using ITNs is half that of those using untreated nets.[2]

Following the publication of this significant finding, researchers at Sumitomo Chemical's Agricultural Chemicals Research Laboratory started considering what sorts of insecticides would be suitable for soaking into the nets. As they did so, however, they ran into a number of challenges. For one thing, the insecticide would be removed when the nets were washed, meaning that they would have to be re-treated. For people in malaria-affected areas who were not accustomed to using mosquito nets, even just setting up the nets properly every day would be a major undertaking, so the researchers feared that it would be impossible to get them to regularly carry out the very troublesome task of re-treating the nets. Another challenge was that the mosquito nets that had been put on the market at that time had very fine mesh that blocked ventilation, meaning that people in hot African climates might find them uncomfortable for sleeping. So, the researchers focused on developing a net that would meet three conditions: (1) it must allow good ventilation; (2) it must maintain its insecticidal property even after washing, so as not to require re-treatment; and (3) it must retain its ability to kill insects for a long time.

During the 1980s, the laboratory developed technology for embedding chemical agents in resins, such as plastics. This was the same technology that was used to control blood-sucking flies by implanting insecticide in the ear tags used to identify cattle. During the boom years of economic growth in the latter half of this decade, many Japanese companies moved their plants to suburban locations and operated them during the night as well, leading to increased demand for materials that would keep insects from getting into manufactured products; insecticidal screens were developed in response. As part of this process, the laboratory accumulated basic data concerning such matters as the types of resins and chemical agents suited for processing into nets, the relationship between the ingredients and processing of the resins and their insecticidal effectiveness, and the speed of diffusion of insecticidal agents within resins. The development team became confident that if they applied this sort of technology to mosquito nets they would be able to produce a more effective and easy-to-use product. Dr. Takaaki Itoh, who was involved in the development project, recalls, "We succeeded by fusing the technologies

2. World Health Organization, *Malaria Vector Control and Personal Protection: Report of a WHO Study Group*, (Geneva: WHO, 2006), 7.

from two fields—resins and insecticides—that we had developed as a general chemical manufacturer."

As the result of this progress, the original Olyset net was born in 1992. The insecticide permethrin was implanted in resin, which was made into yarn and then knitted to make mosquito nets. Unlike the usual polyester netting, this new kind of net used thick polyethylene fiber, which made it very robust. By taking advantage of technology to have the chemical agent gradually seep out to replace that lost from the surface due to washing, the development team created a marketable product that would retain its insecticidal effect for at least five years. At this point, the new nets went into test use in malaria-affected regions of Asia and Africa. But they did not immediately win wide acceptance.

Recognition by the WHO and widespread use

The WHO began to promote the use of ITNs in the mid-1980s, but the Olyset net failed to draw the WHO's attention when it was first launched in 1992. The net was not well known around the world, and its price at the time seemed too high both to international institutions and to governments in the developing world.[3] Also, many within the WHO tended to steer away from products like the Olyset net that did not need to be re-treated.[4] Ordinary ITNs lose their insecticide after three to five washings, at which point they must be redipped. The WHO viewed public gatherings to regularly re-treat ITNs as an ideal opportunity for health education. With the passage of time, however, it became clear that the need to re-treat ordinary nets was interfering with the spread of their use. Collective re-treatment events were found to be a burden on residents who had to travel long distances to the re-treatment sites. Except in some small or socialist countries, where governments have carried out large-scale re-treatment programs free of charge, the re-treatment rate was never higher than 20 percent, and the average rate in Africa was particularly low, at 5 percent or less.[5]

In order to overcome this challenge, the WHO eventually began to focus on the Olyset net for its long-lasting insecticidal effect, dubbing them long-lasting insecticidal nets (LLINs). The WHO hoped that the elimination of the need for re-treatment would lead to wider use of

3. Interview with Dr. Pierre Guillet, WHO.
4. Interview with Dr. Itoh.
5. Pierre Guillet, et al., "Long-Lasting Treated Mosquito Nets: A Breakthrough in Malaria Prevention," *Bulletin of the World Health Organization*, no. 79 (2001): 998.

effective mosquito nets, and it also recognized that LLINs used less insecticide than ordinary ITNs and lessened the environmental burden by not allowing insecticides to dissolve in wash water. Even so, governments in developing countries that had become accustomed to ordinary ITNs were not quick to switch to the new type of netting. Dr. Pierre Guillet, a vector control specialist at the WHO, recalls that it took several years for the WHO, the United Nations Children's Fund (UNICEF), and national governments to become convinced that LLINs were superior to conventional ITNs.

In due course, LLIN use did indeed grow dramatically. This was due in part to patient persuasion by Dr. Guillet, but there were also a number of landmark events that helped promote the cause. First was the WHO's recommendation of the Olyset net as the first LLIN to qualify under its official Pesticides Evaluation Scheme in 2000. The second came in 2002, with the establishment of the Global Fund to Fight AIDS, Tuberculosis and Malaria (the Global Fund). As of 2010, the Global Fund had committed US$19.3 billion for approved measures in developing countries to combat major communicable diseases, of which one quarter is allocated for measures to treat and prevent malaria. In 2003, 80 percent of the ITNs ordered by governments in developing countries were of the type requiring re-treatment, and only 20 percent were LLINs. But, in 2004 these shares were reversed. Dr. Guillet sees this dramatic shift as being partially attributed to the funding provided by the Global Fund.[6] The supply of LLINs was insufficient to keep up with the resulting worldwide surge in demand and actual use of bednets so that manufacturers found that they had to greatly increase production.

Technology Transfer to Africa

Increasing production capacity

At Sumitomo Chemical, as soon as the Olyset net was developed, the company recognized that the price of the net would need to be low enough for developing countries to be able to use them widely, so it was determined that the labor-intensive nets would need to be produced somewhere with low labor costs. At first the nets were produced in small numbers within Japan, but then production in China began, and thanks to

6. Interview with Dr. Guillet.

patient technical training, 20,000 nets were produced in 1999. Following the WHO recommendation noted above, demand for Olyset nets surged, and the WHO, UNICEF, and others requested a large-scale increase in production. In response to these requests, Sumitomo Chemical increased its production capacity in Changzhou, China, undertaking full-scale production of the nets in 2002.

Production in Tanzania and the Olyset Consortium

The WHO, meanwhile, had a clear vision of its own: in order to fight malaria in Africa, where the disease takes its biggest toll, it would need a large supply of LLINs like the Olyset net, and for this purpose it wanted to have the production technology transferred to local enterprises in Africa. By having Africans engage in the manufacturing of these nets, it would also contribute to Africa's economic development.[7] The WHO's Dr. Guillet thus proposed to Sumitomo Chemical that it transfer the Olyset manufacturing technology free of charge to mosquito net makers in Africa, to which the company readily agreed. Because the market for the Olyset net was small in the context of Sumitomo Chemical's total business volume, there was no major argument over the idea of a gratis technology transfer.

The problem for Sumitomo Chemical was that it had no local production experience in Africa and no idea of how to go about finding enterprises to serve as its partners. In response to this hurdle, Dr. Guillet and others arranged for the establishment of the Olyset Consortium as a public-private partnership with seven members to support the technology transfer process. The Acumen Fund, one of the partners in the consortium, identified A to Z Textile Mills, a leading mosquito net maker in Tanzania, as a candidate manufacturer since it was the only manufacturer possessing the technology and experience in both plastic extruding and fiber spinning. The consortium deployed the strengths of its members to build a partnership with A to Z aimed at large-scale manufacturing of the Olyset net in Tanzania. Local production started in September 2003 in Arusha, Tanzania, and in 2004 production capacity

7. Guillet et al., "Long-Lasting Treated Mosquito Nets"; Global Health Initiative, "Public-Private Partnership Case Example: Building a Public-Private Partnership to Transfer the Technology of a Life-Saving Malaria Prevention Tool in Africa," World Economic Forum, 2006, www.acumenfund.org/uploads/assets/documents/A%20to%20Z%20Private-Public%20Partnership%20Study%20-%20Global%20Health%20Initiative_R1udShKh.pdf.

was already up to 300,000 a year. In Dr. Guillet's opinion, the key factor underlying the effort's success has been the individuals involved. He notes that, while the support of the various participating organizations was of course important, what ultimately moved the technology transfer process and led to a successful outcome was the fact that the individuals working in the partnership understood and respected each other and worked together with a strong team spirit and confidence. The roles played by the participants in this partnership are described below:

A to Z Textile Mills, located in Tanzania, is Africa's largest manufacturer of mosquito nets. It also mass-produces polyethylene products and other goods. It is responsible for the local manufacturing of Olyset nets.

Sumitomo Chemical, as the developer of the Olyset net, supplies the manufacturing technology free of charge and recommends the most appropriate extrusion and knitting machinery for use in manufacturing. It also supplies resins containing insecticide and conducts overall quality control of local manufacturing.

The **Acumen Fund** is a public-interest venture fund established with capital from the Rockefeller Foundation and other sources. It selected A to Z as the investment target in Africa and lent US$325,000 for investment in equipment in the first year of production. In 2005, it provided a second funding package of US$675,000 (a loan of US$400,000 and a grant of US$275,000) for expansion of production facilities and development of the distribution network.

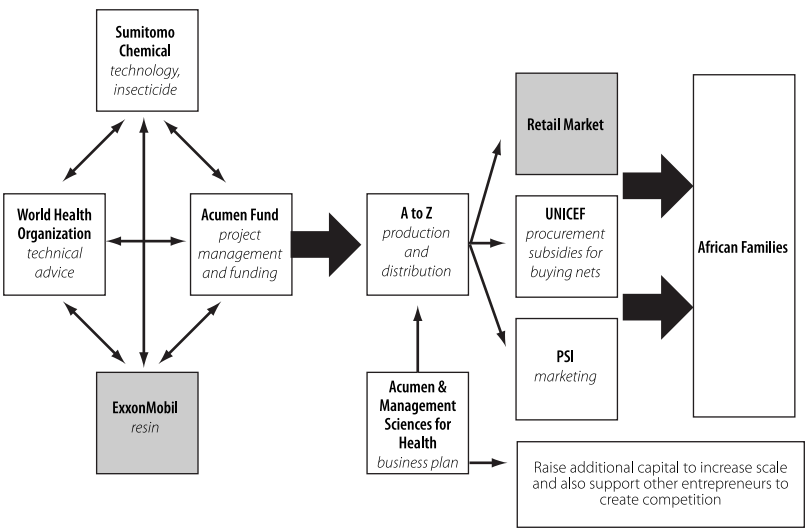
ExxonMobil, a major US-based oil company, was originally going to provide virgin resin from a plant in Saudi Arabia to A to Z, which would in turn blend it with resin with a high level of insecticide content, which was to be supplied to it by Sumitomo Chemical. This original framework was not implemented, however, because it was found that the virgin resin was not suited to the manufacturing of Olyset nets. Nonetheless, ExxonMobil has donated US$250,000 to UNICEF to procure and distribute mosquito nets and has also supported a program for the nationwide distribution of mosquito nets in Cameroon.

UNICEF is principally responsible for buying the nets produced through the partnership and distributing them directly to low-income families. UNICEF has been promoting the use of LLINs, and it distributes Olyset nets directly to groups at high risk of contracting malaria through hospitals and maternity clinics. It has also worked with the malaria program implemented by the government of Tanzania—with financial support from the Global Fund—to promote the establishment

of a voucher system for mosquito nets in that country. UNICEF is also supporting increased global production of LLINs by providing a steady flow of procurement orders.

Population Services International (PSI) is an international NGO specializing in issues related to population and public health. It has worked to promote the Olyset net as a commercially viable product through such activities as market research of African consumers; research on sales channels, including retail outlets; and advertising of the Olyset net on radio programs.

The **WHO** acts as the overall coordinator of the partnership and offers technical advice on such matters as the insecticidal effect and safety of the mosquito nets.



Source: WHO, 2003. "Transfer of Olyset Technology for Scaling up Production of Long-Lasting Insecticidal Nets (LLINs) in Africa" (WHO internal document, 2003).

Note: This diagram represents the original plan for the transfer and does not include the change in ExxonMobil's role described above.

Impact of local production

By 2007, A to Z's annual production capacity had risen to 4 million nets per year. In order to further increase the production capacity, Sumitomo Chemical and A to Z set up a joint venture called Vector Health International, launching production in its Arusha factory in February 2007. Together with this new company, the total production capacity as of

December 2008 expanded to 19 million nets a year. Reports have started to appear showing a marked reduction of malaria infection rates in villages that have received nets donated from A to Z's plant.[8] For example, in one village in Kenya, blood tests conducted two years after the distribution of Olyset nets revealed that the number of people carrying malarial parasites dropped from 50.1 percent of the population to 10.8 percent.[9] As an indirect economic effect, A to Z's overall efficiency in manufacturing the Olyset nets and other products has risen, and it has won recognition as a company with one of the highest levels of productivity in all of Africa. In addition, the company is contributing to the local economy by employing approximately 4,000 people at relatively high salaries. Also, by protecting people from malaria, the Olyset nets keep people healthy, which makes them more productive and saves them precious resources that would otherwise be used on treatment.[10]

On the cost side, meanwhile, local production in Africa has not led to the savings that were initially expected. This has been explained as reflecting the shortcomings in the area of transport infrastructure for the materials, along with the fact that local employee skill levels do not compare favorably with those found in China and Vietnam, which means that total personnel costs are not lower.[11] This suggests that African countries and their development partners need to consider measures to further improve the conditions for local production by transnational companies.

8. Global Health Initiative, "Public-Private Partnership Case Example."
9. James O. Waiero, et al., "Bednet Use in the Sauri Millennium Village" (Powerpoint presentation at the annual meeting of the Alliance for Malaria Prevention, Geneva, October 6, 2008). According to Waiero, only 22 percent of households were using bednets in Sauri before distribution began in 2005 as part of the Millennium Village project, but in 2007, Olyset nets were being used by 87.8 percent of households, and of those roughly 90 percent reported using them every day. While this undoubtedly contributed to the reduction in malaria infection in the village, the use of bednets alone was not the sole factor. The village took a comprehensive approach to fighting malaria, including distributing drugs to treat malaria and spraying insecticides to reduce the mosquito population.
10. Acumen Fund, *Investment Report, August 2005*.
11. Interview with Hideo Wada, Sumitomo Chemical.

From Business to Social Investment

Leadership to increase production

The production of Olyset nets has expanded dramatically not just in Africa but throughout Sumitomo Chemical as a whole. From a mere 20,000 in 1999, annual production increased with the addition of the Changzhou plant in China in 2002 and of a new factory built in Arusha (operated by A to Z) in 2003, bringing the total to 5 million nets in 2005. The company has continued to build up its production capacity since then, adding plants in Dalian, China; Ho Chi Minh City, Vietnam; and another in Tanzania (operated by Vector Health). As of December 2008, the total number of nets produced reached 38 million. A new plant is now being considered in Nigeria, with a maximum production capacity of 20 million nets per year. The company is now offering a full range of products to fight malaria, centering on the Olyset net but also including insecticide sprays and larvicides.

When it started to develop the Olyset net, Sumitomo Chemical did not expect it to turn into such a major business. As a manufacturer of pesticide ingredients, it was continuing its efforts to come up with materials to control malaria, but initially the net did not draw much attention within the company. Dr. Itoh, who was involved in the development process for many years, recalls that the turning point in terms of gaining in-house attention came around 2003–2004. At a launching ceremony on the eve of the third Tokyo International Conference on African Development in September 2003, Sumitomo Chemical exhibited the Olyset net in cooperation with UNICEF. In advance of the conference, the two organizations also made a joint press announcement on the free transfer of technology to Tanzania. This was the first major media coverage of the Olyset net. The following year, the groundbreaking ceremony for the new A to Z plant, which the president of Tanzania attended, was widely covered in the media and cited as a good example of public-private partnership, and it was through this attention that the company's executives and people in other departments became familiar with the Olyset net. This recognition has continued to increase and has been bolstered by the international campaign against malaria.

At the World Economic Forum Davos conference in January 2005, Sumitomo Chemical President Hiromasa Yonekura joined Columbia University Professor Jeffrey Sachs and then Global Fund Executive Director Richard Feacham for a press conference at which the development of

mosquito nets and the local production in Tanzania were introduced and won high praise. President Yonekura himself noted that he had the sense of having been thrust upon the main stage at the strong request of the United Nations and others involved in the campaign against malaria. It is certainly likely that the fact that the company's cooperation was directly requested at a high level from international organizations like the WHO and UNICEF contributed to the executive decision to increase production of the Olyset nets. Another favorable factor was that international organizations gave clear and concrete indications of demand for the product (with UNICEF initially predicting demand for 20 million nets).

Expansion into the field of philanthropy

Sumitomo Chemical began making philanthropic contributions to the fight against malaria in 2005, in addition to the contribution it was already making through its mosquito net business operations. This move is partially a response to the good business results it has enjoyed in the first few years of the 21st century and partially reflective of the increased talk in Japan about corporate social responsibility.

In March 2005, the company responded favorably to a request from the United Nations Foundation for a donation of ¥44 million (US$370,000) for the Africa Live 2005 Roll Back Malaria Concert, becoming a major sponsor of the event. The concert was broadcast in Africa and Europe, reaching 450 million viewers. In August and December of that year, the company donated a portion of its profits from the Olyset net totaling ¥30 million (US$250,000), to a nongovernmental organization (NGO), World Vision Japan, to provide support for education in Africa. The company has continued to work with this organization to build schools in Africa.

Sumitomo Chemical's philanthropic undertakings expanded in 2006. In March, the company decided to contribute to the Millennium Villages project based at Columbia University's Earth Institute. This project targets especially impoverished African villages as model sites—extending assistance with farming technology, food, education, and healthcare—as part of the drive to eradicate severe poverty, one of the MDGs. Sumitomo Chemical provided 330,000 Olyset nets (worth approximately ¥150 million or US$1.25 million) free of charge to help make the model villages malaria free. Nets were distributed to 100 villages of approximately 5,000 people each, saving approximately 500,000 people from the threat of malaria.

The company has continued to distribute nets, funding, and other goods to countries in Africa and elsewhere in cooperation with the Roll Back Malaria Partnership, UNICEF, and the international NGO Malaria No More, among others.

Sumitomo Chemical has won recognition for its sustained efforts in the areas of product development and philanthropy. In June 2005, the Olyset net was selected by *Time Magazine* as one of the "Coolest Inventions of 2004." In September 2006, the company received the Asahi Corporate Citizen Award from the *Asahi Shimbun*, one of Japan's leading newspapers, and in November of that year it was chosen as a laureate in the health category under the Tech Museum Awards program (operated by the Tech Museum of Innovation in San Jose, California), an international program recognizing innovative uses of technology that bring sustained benefit and contribute to solving the most pressing problems facing humanity.

Originally established for the purpose of removing the noxious sulfur dioxide from the emissions at Sumitomo's Besshi copper mine in Shikoku, Japan, and to use the chemical to manufacture fertilizer, Sumitomo Chemical has become a leading company in the fight against malaria. The company's experience offers useful lessons for other companies looking for ways to develop marketable products that will benefit both the company itself and communities looking for new tools to use in the fight.

Interviews

Dr. Pierre Guillet, Vector Control & Prevention, Global Malaria Programme, WHO (via email)

Dr. Takaaki Itoh, Manager, Marketing Department, International Environmental Health Division, Sumitomo Chemical

Hiroshi Kuroda, Manager, Marketing Department, International Environmental Health Division, Sumitomo Chemical

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