Sharing PATH's experiences with the global health community

DIRECTIONS IN GLOBAL HEALTH

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Jacques Daniel Ly

Increasing access to children's vaccines

Country experience proves the value of a multifaceted approach

Immunization is one of the world's most cost-effective health interventions. In the 1990s, however, coverage rates decreased in many developing countries, particularly in sub-Saharan Africa and eastern and central Europe.

To reverse this trend, PATH's Children's Vaccine Program (CVP) has been working with partners to revitalize the international commitment to universal childhood immunization. By collaborating with the World Health Organization (WHO), UNICEF, the World Bank Group, The Vaccine Fund, private-sector companies, and other partners in the Global Alliance for Vaccines and Immunization (GAVI), CVP integrates its activities into global projects and builds alliances with organizations at the country and regional levels.

Since its inception in 1998, CVP has promoted equal access to new and lifesaving vaccines by strengthening immunization programs, building human and financial-planning capacity, advocating for immunization programs, and introducing new vaccines and related technologies. This comprehensive approach to immunization programming is key to the impact that CVP is achieving.

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INSIDE:

Solar power fuels the cold chain

More reliable, less expensive refrigerator keeps vaccines safe

Project name
SolarChill Evaluation

Location
Indonesia, Senegal

Methods
Field evaluations

Partners
Danish Technological Institute, Greenpeace, GTZ, UNEP, UNICEF, WHO

Funders
Bill & Melinda Gates Foundation, USAID (for PATH's HealthTech program)

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The vaccine cold chain, which protects vaccine potency at every point between manufacture and administration, is difficult to maintain in low-resource settings. High temperatures, scarce resources, and the long distance between health care facilities can lead to disruptions. If the vaccines are exposed to excessive heat, valuable vaccine supplies are wasted, and children may receive damaged vaccines that cannot protect them from disease.

Refrigeration is the most important aspect of the cold chain. Most refrigerators, however, require a reliable power supply and regular maintenance—both of which may be in short supply in the areas where immunization is needed most.

PATH is evaluating a unique solution to these obstacles: the SolarChill refrigerator. Developed by a group of Danish government and industry collaborators, the refrigerator relies on ice as a simple and expedient backup for solar-powered cooling.

Weak links in the chain

Currently available solar-powered refrigerators meet some of the challenges of low-resources settings: they don't depend on electricity, which may be unavailable or unreliable in remote areas, and they don't require constant refueling.

These solar-powered refrigerators are expensive, however, and they use batteries to supply cooling energy at night and on cloudy days. Batteries are the weak link in these systems; they require frequent maintenance, and they can be taken for other uses, leaving the refrigerator without backup power.

Better protection for vaccines

The SolarChill refrigerator was initially developed by the Danish Technological Institute, in cooperation with Vestfrost and the Danfoss Company, with funding from the Danish Energy Agency. Greenpeace International, GTZ, the United Nations Children's Fund (UNICEF), the United Nations Environmental Programme (UNEP), and the World Health Organization (WHO) provide financial support, technical assistance, and expertise in environmental issues. The goal of this international collaboration is to create a refrigerator that would be less expensive and more reliable than standard cooling options, take advantage of the efficiency of solar power, and alleviate the environmental cost associated with the use of chloro- and hydrofluorocarbon refrigerants.

The innovative SolarChill refrigerator replaces batteries with a bank of ice packs that keep vaccines cool when direct sunlight is unavailable. In addition, the SolarChill's cooling system and insulation use hydrocarbon refrigerant and new foaming agents that do not contribute to ozone depletion or global warming. These environmental benefits have caught the attention of Greenpeace and UNEP, which are interested in promoting use of the new technology not only in the vaccine cold chain, but also for food storage. The new refrigerator design will be nonproprietary and thus more accessible and affordable to developing-country health care systems.

Testing SolarChill on site

In 2003, PATH joined the SolarChill collaboration to carry out field evaluations, coordinating monitoring, data collection, and user feedback efforts in Indonesia and Senegal. In April 2004, staff installed SolarChill units at health centers in Yogyakarta province in Indonesia.

With training and supervision from PATH, staff from the ministry of health in Indonesia conducted a series of tests. Evaluators selected three health centers in remote areas that frequently experience power outages and invited cold chain managers from each health center to observe the tests. These tests measured the time required for the ice packs to be completely charged (frozen), how long the ice packs can maintain the required temperature range (2°C to 8°C) on cloudy days and at night, and the effect of frequent opening of the refrigerator door, as occurs when vaccines are removed during an immunization drive.

After the first two months of the one-year evaluation process, data demonstrated that the units were working well. The refrigerators are easy to operate, and health workers appreciate the savings in fuel and electricity. The temperature range in the vaccine compartment between day and night appears to be wider than is recommended by WHO, and PATH is continuing to monitor this to determine whether it is acceptable—or even beneficial. For most vaccines, freezing is a greater threat to potency than short-term heat exposure, so slightly higher operating temperatures may be advantageous for vaccine storage.

Local health staff, including managers from WHO's Expanded Programme on Immunization, have expressed strong interest in the refrigerators and their potential for greatly simplifying management of the cold chain. Some have said that, given the high cost of electricity, SolarChill refrigerators might be useful even in areas with reliable electricity supplies.

From evaluation to use

Industrial partners, including UNICEF's largest supplier of ice-lined refrigerators for vaccine storage, are eager to begin scale-up that will lead to a commercially available product. The price of the SolarChill refrigerator (approximately US$1,500) will be similar to that of many currently available vaccine refrigerators and much less than the cost of other solar-powered refrigeration systems, with the additional advantage of reduced maintenance and no fuel costs.

PATH will continue to monitor the performance of and reactions to the SolarChill refrigerators and report the findings to our partners through March 2005. The results of these tests will determine whether the design needs further refinement before the manufacturing and commercialization stages can begin. ■

Health workers reach into a SolarChill refrigerator that is part of a one-year testing process to determine whether these systems are ready for commercialization.

A modification allows installation of the solar panel of a SolarChill refrigerator outside a health facility in Indonesia.

Preventing cervical cancer

Demonstration projects achieve results

Project name
Alliance for Cervical Cancer Prevention

Location
Global (PATH focuses on Kenya and Peru)

Methods
Field research, service-delivery models, community involvement

ACCP partners
EngenderHealth, International Agency for Research on Cancer, JHPIEGO, Pan American Health Organization

In-country partners
Maendeleo ya Wanawake Organization, Kenya Cancer Association, Pan American Health Organization, Kenyan and Peruvian ministries of health

Funder
Bill & Melinda Gates Foundation

For more information
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Cervical cancer is a preventable disease, yet it kills more than 233,000 women each year. Approximately 80 percent of cases occur in low-income countries, where programs based on Pap smear screening are difficult to implement.[1,2]

The Alliance for Cervical Cancer Prevention (ACCP) has been working since 1999 to refine, promote, and implement strategies that prevent cervical cancer. The alliance assesses screening and treatment approaches, improves service-delivery systems, incorporates community perspectives into program design and implementation, and increases awareness of cervical cancer prevention strategies. Each of the five partner organizations implements projects in one or more countries in sub-Saharan Africa, Latin America, and South Asia.

Community involvement in Peru

In Peru's San Martín region, PATH is collaborating with the Pan American Health Organization and the Peruvian Ministry of Health (MOH) to assess approaches in which screening and treatment occur in a single visit. The project focuses on improving service quality by making acceptability a central goal. It has two main components:

- Providing women with education and information so they can make informed decisions about preventing cervical cancer and obtaining high-quality services.
- Ensuring that women who undergo screening and treatment are satisfied with the services they receive.

To increase community awareness, about 80 promotion teams made up of local health center staff and community leaders are reaching 25- to 49-year-old women and their families with cervical cancer prevention information. These teams also organize and support the activities of more than 60 community advisory groups—which include leaders and representative authorities—to provide educational messages and motivate women to undergo screening.

To make services more acceptable, the project team trained midwives and physicians who provide cervical screening in communication and counseling skills, helping them understand women's concerns. The team also implemented a continuous quality-improvement mechanism in which trained clinic staff systematically measure client satisfaction. Exit interviews and participatory mechanisms for responding to feedback allow the program to identify and address concerns before they become obstacles to care. Client feedback also has helped providers improve patient privacy, client confidentiality, and informed-consent processes and has helped programs ensure that their services are accessible. An evaluation at 13 health facilities found a significant improvement in client satisfaction levels over time.

The project team also collaborated with the regional MOH office, which integrated the methodology into their broader quality-of-care work in San Martín. PATH has worked with the MOH to make the project's education and community-involvement aspects sustainable through an integrated approach to health promotion that can be applied to other regional health priorities.

A model intervention in Kenya

PATH, the Kenya Cancer Association, Maendeleo ya Wanawake Organization (MYWO), and the Kenyan MOH are developing and evaluating a model prevention

program for rural, low-resource settings in Africa. The project's two-year pilot evaluation centered on three divisions of Kenya's Busia district. Focusing on 30- to 39-year-old women, the model built on the existing MOH service-delivery structure and a network of community health workers organized by MYWO. The project team developed a curriculum to train community health workers and local opinion leaders to inform women about the importance of screening, diagnostic referrals, and post-treatment check-ups. The team also strengthened services at health centers and the district hospital, as well as links to clinical support from specialists at the provincial hospital.

In the model program, health center nurses perform initial screening using visual inspection with acetic acid (VIA). If they detect a suspicious lesion, they refer women to the district hospital, where nurses and clinic officers trained in VIA and other screening methods provide cryotherapy if needed. The cost of services is covered by the usual registration fees paid by clients and local health budgets.

To evaluate the effectiveness of the screening model, providers used colposcopy, Pap smear, and biopsy, if indicated, to determine the true diagnosis. They also asked women treated with cryotherapy to return to the district hospital for a final check-up (including a repeat Pap smear and colposcopic exam) one year later.

Among the nearly 1,600 women seen during the project's pilot phase, VIA positivity rates were approximately 22 percent, which is comparable to rates seen elsewhere. A small substudy in which all women underwent colposcopy demonstrated that the accuracy of VIA was similar to that reported in other studies. The team is currently analyzing treatment success rates for the 68 women who were identified as having precancerous lesions.

At the end of the pilot phase, the team assessed the feasibility of project expansion and worked to institutionalize sustainable systems for service delivery. A group of local and international master trainers trained additional nurses and strengthened the screening and treatment skills of provincial gynecologists. An additional screening test, visual inspection with Lugol's iodine, was added to the basic program. Services have since expanded to the rest of the Busia district, and all centers now offer cervical cancer screening services.

As part of the Alliance for Cervical Cancer Prevention, PATH is evaluating screening and treatment approaches that show promise for reducing the incidence of this preventable disease. The participation of women, health workers, and community leaders is key to the projects' success.

Encouraged by these results, the Kenyan MOH convened a cervical cancer working group and asked PATH to help develop a plan for rolling out services nationwide. Using the Busia model as the basis for a sustainable, integrated approach, the MOH is currently finalizing its five-year national strategy for cervical cancer prevention.

Building on project successes

As the ACCP completes its fifth year, its partner organizations are working with the World Health Organization, the United Nations Population Fund, and other international agencies to improve awareness of cervical cancer prevention strategies and explore partnership opportunities. PATH is also pursuing follow-on activities that focus on higher-tech approaches to cervical cancer diagnosis and prevention, such as new biochemical tests for certain types of human papillomavirus and the development and introduction of vaccines that protect against strains of human papillomavirus that cause cervical cancer. ■

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2. Ponten J, Adami HO, Bergstrom R, et al. Strategies for global control of cervical cancer. *International Journal of Cancer*. 1995;60:1–26.

Strengthening private-sector health interventions

Technology transfer leads to better health

Project name
Program for Advancement of Commercial Technology—Child and Reproductive Health

Location
India

Methods
Technical assistance; technology transfer; private-sector partnerships; information, education, and communication

Partners
ICICI Bank, local businesses

Funder
USAID

For more information
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A rapidly growing biotechnology industry and history of investment in science are helping India respond to public health challenges. Program for Advancement of Commercial Technology—Child and Reproductive Health (PACT-CRH) is helping India's private sector fulfill a vital public health role: making appropriate health technologies more widely available and affordable.

Through grants, loans, and technical assistance, PACT-CRH supports the introduction and commercialization of technologies that improve reproductive health, increase child survival, and reduce the impact of infectious diseases, such as HIV/AIDS, in India. The Industrial Credit and Investment Corporation of India manages the program and provides financing and business-development services. Since 1996, PATH has provided technical assistance and leadership to the program's introduction and commercialization efforts.

A broad range of supportive interventions

PACT-CRH implements numerous projects to improve child and reproductive health. One significant project has been increasing the availability and acceptability of oral rehydration solution (ORS), a simple, inexpensive, and potentially life-saving treatment for childhood diarrheal disease. PATH planned, financed, and helped implement a mass media campaign that provided valuable information to consumers about the importance of ORS. PACT-CRH partnered with the Indian Academy of Pediatrics to train more than 7,800 physicians in the importance and correct use of ORS. It also created a program that reached more than 4,500 pharmacies with messages about appropriate use of ORS. As a result of these efforts, prescriptions for ORS increased by 11 percent, and ORS became available over the counter, instead of only through prescription.

In India, PACT-CRH is bringing technical assistance and expertise to the private sector, which in turn is advancing technologies that improve child and reproductive health.

PATH plays a leading role in many other PACT-CRH projects. For example, PATH:

- Is involved in introducing and commercializing auto-disable syringes, such as the Uniject™ prefilled, single-dose injection system. PATH has built the capacity of two Indian firms to fill the Uniject device with hepatitis B vaccine, and at least three designs for auto-disable syringes are now licensed to Indian manufacturers or made in India by multinational companies.
- Is developing and testing needle-remover devices that allow health care providers to remove needles from single-use syringes and dispose of them safely, reducing the danger of needle reuse and sharps injuries that can transmit bloodborne infections.
- Guided Indian condom manufacturers through the process of setting higher quality standards by reviewing current policies, conducting workshops on quality improvement, and helping develop a new national standard. As a result, higher-quality condoms are now available throughout the Indian marketplace and in the national family planning and AIDS control programs.
- Assisted the Confederation of Indian Industry in producing materials used to educate employees about prevention of HIV infection and AIDS. The materials were distributed in the workplaces of more than 1,000 industrial organizations.

Faster diagnosis for faster treatment

Currently, PACT-CRH's focus is on increasing the availability and quality of tools for rapid diagnosis. PATH is working to raise the profile of rapid diagnostic tests, transfer appropriate technologies to Indian companies, and help the companies develop and refine their own rapid diagnostic tests. Since the late 1990s, the project has transferred rapid-results tests for HIV infection, falciparum malaria, hepatitis B, and syphilis. Several of the companies are already in production. One manufacturer has sold more than 10 million rapid diagnostic tests for malaria and 3.3 million tests for hepatitis B. Another Indian producer has sold 6.25 million rapid-results HIV tests.

In 2003, PATH began transferring a rapid and simple test for diagnosing gonorrhea that provides results within 20 minutes, allowing immediate treatment and counseling, when appropriate. The ability to rapidly and accurately identify this infection means that less money may be spent on drugs and that morbidity may be reduced—breaking the cycle of infection and decreasing the chance that antibiotic resistance will develop as a result of inadequate or delayed treatment.

The test is being transferred to a major Indian pharmaceutical company for product development and manufacturing scale-up. PATH experts will facilitate procurement of the antigen used in the test and assist in test kit development, quality assurance, and production.

PATH has also developed protocols for and managed independent evaluations of rapid HIV and syphilis tests produced by an Indian company. The evaluation results will be used to validate or improve the performance of the tests and enhance the company's credibility among key government decision-makers.

In addition, PACT-CRH aims to improve the quality of diagnostic products manufactured in India by asking major companies to open their manufacturing facilities to auditors who will provide quality audits similar to those performed by the U.S. Food and Drug Administration for United States–based companies. The results of these audits will provide guidelines that companies can use to reach and maintain quality benchmarks, which can then be used to improve manufacturing facilities and the quality of diagnostic products.

Future steps

PATH will continue its work to evaluate condoms and to introduce a version of the Uniject device that is filled with oxytocin and can reduce the risk of postpartum hemorrhage. PACT-CRH may also begin working to introduce an iron-fortified version of PATH's Ultra Rice® micronutrient vehicle to combat iron-deficiency anemia, which is the most pervasive of all nutritional deficiencies in India and which primarily affects pregnant women, adolescent girls, young children, and infants. In addition, PACT-CRH hopes to increase emphasis on voluntary counseling and testing for sexually transmitted infections, including HIV, and promote the use of safer injection technologies through information, education, and communication activities. ■

Assessing the impact of delivery kits

Studies show health benefits for mothers and newborns

Project name
Delivery Kit Evaluation

Location
Nepal, Tanzania

Methods
Quantitative and qualitative studies

Partners
CARE; Maternal and Child Health Products, Ltd.; National Institute of Medical Research; Save the Children; Tanzanian Ministry of Health

Funders
Bill & Melinda Gates Foundation, USAID (for PATH's HealthTech program)

For more information
Please contact Siri Wood, program officer, at swood@path.org.

Each year an estimated 57 million women give birth with only the help of an untrained attendant or family member or with no help at all.[1] Many deliveries take place at home or in other places where unhygienic conditions exist, placing mothers and newborns at risk for infections—a leading cause of maternal and infant mortality in low-resource settings.

PATH and other organizations have developed and marketed single-use delivery kits that provide tools and instructions for reducing infection rates. The global health community has accepted that delivery kit interventions are effective on the basis of intuition and experience, but research addressing the effect of the kits on health outcomes has been limited. To contribute to knowledge in the field, PATH has evaluated delivery kits used in Nepal and Tanzania.

Effect of kits on cord infection in Nepal

In the late 1990s, PATH and Save the Children assessed the effect of delivery kit use on the rate of simple umbilical cord infection (a precursor to more serious infections and an indicator of potential exposure to tetanus) in 1,660 households in three districts in Nepal.[2] The kit—developed by PATH, Save the Children, and the small Nepali business Maternal and Child Health Products, Ltd. (MCHP)—contains soap for hand-washing, a plastic sheet to serve as the delivery surface, string for tying the cord, a clean razor blade for cutting the cord, a cord-cutting surface, and pictorial instructions that illustrate the sequence of delivery events and hand-washing. The Nepali Ministry of Health has officially approved the kit.

During the study, field workers located and surveyed new mothers and inspected infants' umbilical cords and the surrounding skin. A neonatalogist later reviewed field notes and photographs and confirmed cases of cord infection.

When controlled for confounding variables such as district, newborn age, field worker, and season, results suggest that the kits are beneficial. Non-kit deliveries in which the birth attendant did not use a boiled blade or a clean surface for cutting the umbilical cord were more than twice as likely as kit deliveries to result in cord infection. There was no significant difference, however, between kit deliveries and non-kit deliveries when attendants used clean blades and surfaces, suggesting that clean cord-cutting may be one of the most important practices in preventing infection. In addition, attendants who used the kits were significantly more likely to wash their hands before cutting the cord than were attendants who did not use a kit.

Effect on genital tract and cord infection in Tanzania

In 2002 and 2003, PATH partnered with the National Institute of Medical Research and the Tanzanian Ministry of Health to study the effect of delivery kits in reducing puerperal sepsis, or genital tract infection after childbirth, among mothers and cord infection among their newborns. The study used the United Nations Population Fund single-use delivery kit, which is similar to the kit assessed in the Nepal studies. Researchers enrolled 3,262 pregnant women during prenatal visits at local health centers in the Mwanza Region of Tanzania. Trained health workers visited mothers and their newborns on the third and fifth days after birth, conducted structured interviews with mothers, and examined the infants for infection.

Preliminary data analysis suggests that newborns of mothers who did not use the delivery kit were substantially more likely to develop cord infection than were newborns whose mothers used the kit. This result was obtained after adjusting for

The delivery kit used in Nepal—which contains soap, a plastic sheet, string, a clean razor blade, a cord-cutting surface, and pictorial instructions—reduces the risk of infection.

location of the delivery, whether any substances were put on the cord stump, and whether a woman had a bath before delivery. The probability of developing cord infection was smallest when the kit was used and mothers had bathed.

The data also show that women who did not use the kit for delivery were substantially more likely to develop puerperal sepsis than women who did use the kit. This result was obtained after adjusting for location of the delivery, duration of labor, and whether a woman had a bath before delivery. As with the findings for cord infections, the probability of developing puerperal sepsis was smallest for women who had used the kit and who had bathed.

Final results from the delivery kit study in Tanzania will be posted on the PATH website by the end of 2004.

Use and acceptability of kits

In addition to these quantitative studies, PATH's qualitative research has yielded information on the use and acceptability of delivery kits. For example, structured interviews and role-playing with women in Nepal indicate that mothers and birth attendants who used the kit found it hygienic, convenient, affordable, and culturally acceptable.[3] Overall awareness and use of the kit, however, were low, and the kit had only limited effect on hand-washing. The findings also suggest that future delivery kit interventions in the study districts should focus on the importance of using each kit only once and not saving the components for additional births.

Planning for future programs

PATH's studies of delivery kits suggest that women value them and that the kits can positively affect health outcomes. Each study yielded location-specific information that will inform future maternal and child health interventions in those communities.

Having built the capacity of MCHP in Nepal to produce and market the delivery kits, PATH will focus future delivery kit work in Africa—specifically, in Tanzania and Ethiopia, where infection rates are high and local partners are interested in developing or scaling up kits. We are currently pursuing funding for this work. ■

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A guide to delivery kit interventions

To help program managers develop delivery kits that meet local needs, PATH produced the *Basic Delivery Kit Guide*, a step-by-step manual that provides comprehensive and practical information on the design, development, distribution, and promotion of disposable delivery kits. Sample materials such as focus-group scripts, needs-assessment tools, and data-collection forms may be customized. The guide can be downloaded from PATH's online publications catalog at www.path.org.

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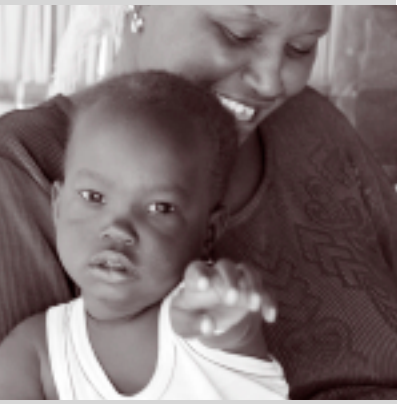

Project name
Children's Vaccine Program

Location
Global

Methods
Building human and financial-planning capacity; advocacy and communications; introducing new vaccines and technologies

Partners
Ministries of health and finance, UNICEF, WHO, World Bank, GAVI, The Vaccine Fund, vaccine manufacturers and suppliers, NGOs

Funder
Bill & Melinda Gates Foundation

For more information
Please contact Laura Cooley, program officer, at lcooley@path.org or visit www.childrensvaccine.org.

Once immunization needs are identified, CVP guides health providers and communities in implementing strategies that improve program effectiveness and sustainability:

- Microplanning helps programs identify approaches that will allow them to achieve their goals.
- Financial sustainability plans help staff identify key steps and targets that will make programs sustainable over the long term.
- Supportive supervision fosters better performance by health providers.

As the following country profiles show, CVP brings its multifaceted approach to each project, tailoring the emphasis to local needs and circumstances.

Establishing microplanning in Senegal

Like much of West Africa, Senegal's St. Louis and Matam regions had low health indicators when CVP began working there in 2002. Immunization rates barely reached 50 percent of the at-risk population.[1] Collaborating with the Senegalese Ministry of Health and local communities, CVP led an effort to introduce innovative, practical technologies to improve vaccine delivery and safety and to encourage an environment in which these technologies would be effective.

From the start, CVP focused on microplanning, helping district health staff and local communities plan vaccination sessions and map hard-to-reach communities. To foster a shared sense of responsibility, CVP strengthened linkages among Senegalese health authorities at various levels of the health system. The team jointly identified simple indicators of immunization coverage and system performance. Currently, staff at district health posts regularly monitor the results and report them to subnational and national health information systems. Health workers use this feedback mechanism to share successful approaches, troubleshoot problems, and develop methods for improving services.

CVP's partnership with the Senegalese government demonstrates that careful planning and implementation can achieve results. In the St. Louis and Matam regions, coverage for the diphtheria, pertussis, and tetanus (DPT) vaccine—a barometer for overall progress in immunization—increased from 51 percent in 2002 to 91 percent in 2004. In addition, CVP helped each health post become fully equipped with auto-disable syringes and needle cutters (which remove potentially harmful needle tips) and have access to waste incinerators and concrete-lined pits for burying infected needles.

The Senegalese government is already developing plans—including a financial sustainability plan—to adopt these innovations nationally. With support from GAVI, they are also introducing hepatitis B and *Haemophilus influenzae* type b (Hib) vaccines.

Increasing financial sustainability in Cambodia

Financial constraints are among the most significant impediments to broad immunization coverage. Frequent financial shortfalls can decrease immunization coverage and may complicate introduction of new vaccines.

To address these issues, CVP worked with GAVI partners to implement long-term strategies for financial sustainability. In partnership with WHO and UNICEF, CVP conducted intensive, multicountry training programs to help staff from ministries of health and finance create financial sustainability plans. Such plans are required for GAVI/Vaccine Fund funding.

Cambodia was one of the first GAVI-supported countries to create a financial sustainability plan. CVP and its partners provided government health staff with training and tools that they have since used to update resource and cost projections and to identify funding gaps. In 2003, after the government addressed these shortfalls, almost 25,000 more children were immunized with the six routine childhood vaccines than in 2002, and DPT coverage increased by 19 percent at the district level.

The adoption of coverage improvement plans (a form of microplanning) that are linked to clear, output-based performance measures has helped Cambodia focus on monitoring and managerial support of its immunization program. In the Kampong Cham province, the combination of these plans with social mobilization strategies led to an increase in immunization coverage from 44 percent in 2002 to 84 percent in 2003.

CVP is also helping Cambodia develop a national strategy for introducing birth doses of hepatitis B vaccine among infants born at home. The experience CVP gained from assisting Indonesia with a nationwide effort to institute vaccination of newborns against hepatitis B has been invaluable to strengthening parallel activities in Cambodia.

Developing a model immunization program in India

To demonstrate that large-scale health system improvements are both feasible and affordable, the Indian state of Andhra Pradesh has worked with CVP to build a model immunization program. The program has achieved significant increases in immunization coverage in the state's population of more than 75 million people.

CVP and ministry of health staff first conducted advocacy and communication activities aimed at reaching high-level decision-makers, health professionals, and the public. To strengthen the performance of frontline service providers, the team trained more than 23,000 vaccine administrators, including nurses, health workers, supervisors, and physicians. In addition, staff from CVP and the Andhra Pradesh government collaborated with local medical colleges, visiting primary health care centers and other immunization sites and providing responsive, supportive supervision. This three-pronged approach enhanced knowledge among decision-makers, improved the skills of health care providers, and strengthened immunization management systems.

Advanced Immunization Management

To build the skills of senior-level immunization managers, PATH collaborated with Stanford University's SUMMIT program and GAVI partners to produce the Advanced Immunization Management (AIM) e-Learning modules. Available on CD-ROM and online (http://aim-e-learning.stanford.edu/), the AIM modules address topics such as vaccine introduction and immunization financing. A module on rotavirus vaccine will be added in 2005.

Since the project began, the percentage of fully immunized infants in Andhra Pradesh has increased from 58 to 72 percent, and dropout rates for measles vaccination have decreased from 22 to 8 percent. The partnership also achieved universal hepatitis B vaccine coverage of infants in Andhra Pradesh for the first time. In 2001, CVP helped the Andhra Pradesh government obtain one million doses of vaccine for Japanese encephalitis, a disease that kills nearly one-third of those infected and causes severe disability in those who survive. Since then, the annual number of deaths due to Japanese encephalitis in Andhra Pradesh has decreased from 250 to less than 5.

CVP also led a multi-stakeholder effort to expand the use of auto-disable syringes, which self-lock after use. Today, health workers throughout Andhra Pradesh—including those at more than 12,000 health centers—use such syringes, and the Indian government has made injection safety a priority in its national health agenda. Training materials on injection safety developed in Andhra Pradesh are being used in other parts of India. The Andhra Pradesh government has committed to paying 100 percent of all immunization program costs in 2006 and beyond.

Looking ahead

PATH and its partners are using these experiences to introduce and develop new vaccines against diseases such as malaria, rotavirus infection, meningitis, Hib infection, and Japanese encephalitis. As new vaccines become readily available at affordable prices, a multifaceted approach to vaccine introduction and integration will help ensure that all communities can achieve and sustain the benefits of immunization. ■

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PATH's immunization programs

To prevent diseases that disproportionately affect developing countries, PATH develops and introduces vaccines, strengthens immunization systems, and works to ensure vaccine safety. Collaboration with private-sector partners and international groups such as the Global Alliance for Vaccines and Immunization and the World Health Organization is essential to the success of these programs. More information is available at www.path.org and at the websites listed below.

Children's Vaccine Program

www.childrensvaccine.org

PATH's Children's Vaccine Program links with the world's leading immunization experts and national partners to strengthen immunization programs, build human and financial capacity, and introduce new vaccines and immunization technologies.

In 2003, PATH launched a major initiative to eliminate clinical Japanese encephalitis in Asia and the Pacific. The project team is strengthening surveillance activities, accelerating development of a more effective vaccine, and increasing regional and national commitments to vaccine introduction. Learn more at www.jeproject.org.

Meningitis Vaccine Project

www.meningvax.org

A partnership between the World Health Organization and PATH, the Meningitis Vaccine Project (MVP) seeks to eliminate epidemic meningitis in sub-Saharan Africa. MVP's goal is to develop, test, and introduce appropriate and effective conjugate meningococcal vaccines.

Malaria Vaccine Initiative

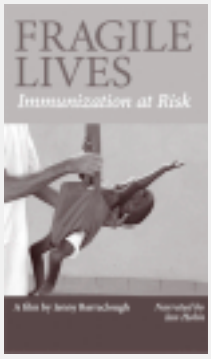
www.malariavaccine.org

PATH's Malaria Vaccine Initiative (MVI) is accelerating the development of promising malaria vaccines and working to ensure their availability and accessibility in the developing world. Through public- and private-sector partnerships, MVI advances promising vaccine candidates and technologies and explores commercialization and delivery strategies that will maximize the availability of the eventual vaccine.

Rotavirus Vaccine Program

www.rotavirus.org

Through a PATH affiliate, the Rotavirus Vaccine Program (RVP), PATH, the World Health Organization, and the U.S. Centers for Disease Control and Prevention are working to reduce child morbidity and mortality from this diarrheal disease. To accelerate the availability of rotavirus vaccines for use in developing countries, RVP is harnessing the resources of the vaccine industry, public health organizations, donors, and governments and assessing and addressing barriers to vaccine introduction. ■



Film focus: immunization

To increase support for immunization, PATH produced *Fragile Lives—Immunization at Risk*. The film tells of the challenges faced by immunization workers in Africa, Asia, and Europe. More than 100 million viewers saw *Fragile Lives* on BBC World in May 2004. To watch the film online, visit www.childrensvaccine.org.

PATH is an international, nonprofit organization that creates sustainable, culturally relevant solutions that enable communities worldwide to break longstanding cycles of poor health. By collaborating with diverse public- and private-sector partners, we help provide appropriate health technologies and vital strategies that change the way people think and act. Our work improves global health and well-being.

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