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A very low-cost, nonelectric bCPAP and oxygen blending device that provides a stable and reliable source of pressurized, blended gas for treating small and sick newborns (SSN) with respiratory distress syndrome (RDS) to reduce the risk of brain, eye, and lung damage, and death.

**Need**

Premature babies suffering from respiratory distress require a means of respiratory support to assist with breathing.

**PATH's role**

PATH identified the need, designed prototypes and validated and verified the bCPAP and oxygen blender device in Uganda. PATH is currently seeking a commercialization partner for technology transfer and funding to support implementation research around delivery of a comprehensive SSN package of services that includes bCPAP and oxygen blending.

**Partners**

Adara Development, Kiwoko Hospital, Seattle Children's Hospital, University of Washington Department of Neonatology.

**Country**

Uganda.

**Donors**

Innovation Fund (PATH), Saving Lives at Birth.
A single-size contraceptive barrier that fits most women, designed to be easy to use and comfortable for both partners, as well as easy to supply and provide. Developed through human-centered design principles and involving women in multiple countries. Marketed as the Caya™ contoured diaphragm.

Need
Many people want a nonhormonal contraceptive method that is under their control, has few side effects, and can be used while breastfeeding.

PATH's role
PATH and our partners developed, validated, and clinically evaluated the single-sized diaphragm in multiple countries. We assisted in manufacture scale-up, regulatory submissions, and introduction. PATH provides technical assistance to expand Caya introduction to low- and middle-income countries.

Manufacturer
Kessel Medintim GmbH.

Partners
Medintim, DKT, and Caya distribution partners.

Countries
Approved or registered in more than 40 countries, including 10 low- and middle-income countries.

Donors
Kessel medintim, USAID (previous).

Addresses United Nations Sustainable Development Goal 3.7: By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes.
A fully assembled, quick to deploy, cost-effective uterine balloon tamponade (UBT) to address postpartum hemorrhage in low-resource settings.

Need

Uncontrolled postpartum hemorrhage (PPH) is a life-threatening emergency and the most common cause of maternal death and disability worldwide. Women in resource-poor settings are at greatest risk of dying from PPH.

PATH’s role

PATH defined the need and product requirements and established a strong partnership with Sinapi Biomedical to develop, commercialize, and manufacture the Ellavi UBT (www.ellavi.com). PATH conducted implementation research in Ghana and Kenya to inform introduction and scale, and serve as a model for wide-scale implementation in low- and middle-income countries.

Partners

South African Medical Research Council, University of Stellenbosch, University of Nairobi, Kenyan Ministry of Health, Ghana Health Services.

Countries

Registered in 16 countries and more than 30,000 devices have been sold.

Donors

FCDO, Anonymous Swiss Foundation, Janine Luk Foundation.
MEDICAL DEVICES AND HEALTH TECHNOLOGIES

Low field magnetic resonance for infant cerebral imaging

A compact, portable, low field MRI device that plugs into a standard electrical outlet and is safe to use at the child’s bedside. Developed by Hyperfine Research (USA), this technology enables neonatal and pediatric brain imaging where MRI access has traditionally been limited.

Need

Globally, an estimated 170 to 250 million children under 5 years of age suffer from stunting and wasting. Portable magnetic resonance imaging (MRI) technology is enabling global neuroimaging studies in at-risk infants and children, revealing the impacts of nutrition on the risks of long-term cognitive deficits.

PATH’s role

PATH is collaborating with a consortium of partners to support research using low field MRI on patterns of early brain growth and interventions to maximize healthy brain development in low- and middle-income countries.

Countries

Bangladesh, Botswana, Ethiopia, Ghana, India, Kenya, Malawi, Pakistan, South Africa, Uganda, Zambia, and Zimbabwe.

Manufacturer

Hyperfine Research.

Donor

Bill & Melinda Gates Foundation.

Product manager

Jaclyn Delarosa, jdelarosa@path.org.

Addresses United Nations Sustainable Development Goal 3.4: By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.
A device able to produce chlorine at the push of a button using salt, water, and a power source.

Need
Inadequate water, sanitation, and hygiene services in health care facilities directly contribute to the spread of preventable health care–associated infections. Chlorine is widely recommended by national infection prevention and control guidelines for disinfection. However, an estimated 36 percent of health care facilities globally lack access to chlorine.

PATH’s role
PATH supports the governments with the introduction and scale-up of the device into public health systems. PATH is supporting evidence generation, scale-up plans, and commercialization strategies for the device.

Partners

Countries
Ethiopia, Ghana, Kenya, Mozambique, and Uganda.

Donor
Conrad N. Hilton Foundation.

Product manager
Adam Drolet, adrolet@path.org.

Addresses United Nations Sustainable Development Goal 6: Ensure access to water and sanitation for all.
MEDICAL DEVICES AND HEALTH TECHNOLOGIES

Buccal naloxone fast-dissolving tablet for treatment of opioid overdose

Convenient, quick-dissolving buccal (between the gums and the inner lining of the cheek) tablet for rapid delivery of naloxone to reverse fatal opioid overdose.

Need

According to World Health Organization estimates, approximately 115,000 deaths annually are attributable to opioid drug use. Current approaches for treating opioid overdose involve syringe and needle injection or nasal spray of a rescue drug, naloxone. These methods also require training and are prohibitively expensive for single use.

PATH's role

PATH is developing a low-cost and self-contained buccal formulation of naloxone to address the limitations of currently available products, improving acceptability and usability as well as increasing the efficiency of distribution and refills.

Partners

University of Washington, Oregon Freeze Dry.

Country

United States.

Product manager

Dr. Manjari Lal, mlal@path.org.

Addresses United Nations Sustainable Development Goal 3.5: Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol.
Comparative evaluation of mRNA-LNP manufacturing platforms

Evaluating various lipid nanoparticle (LNP) manufacturing platforms’ ability to produce consistent, reproducible, and efficient mRNA-LNP vaccines.

Need
Recently, mRNA-LNP vaccines have revolutionized the global immunization landscape by offering a more efficient method of production and delivery. Several methods have been documented for the preparation of LNPs using microfluidic mixing. However, there are significant gaps in the existing literature about how the mRNA-LNPs produced using these various methods differ in terms of yield, encapsulation efficiency, and thermostability.

PATH’s role
PATH is conducting a technical assessment of various LNP platforms for producing mRNA-LNP vaccines by comparing the product attributes through structural characterization and in vitro testing.

Country
United States.

Donor
Bill & Melinda Gates Foundation.

Product manager
Dr. Manjari Lal, mlal@path.org.

Addresses United Nations Sustainable Development Goal 3.B: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines.
MEDICAL DEVICES AND HEALTH TECHNOLOGIES

Heat-stable oral insulin tablet for diabetes management

Thermostable formulation of gastric-resistant, lipid-coated insulin for treatment and management of diabetes via oral tablets.

Need
Insulin therapy remains underused due to treatment adherence barriers, such as required daily subcutaneous insulin injections, which can cause pain or discomfort. The stability of commercial insulin products is poor when exposed to elevated temperatures and sunlight. The World Health Organization estimates more than 400 million people globally live with diabetes.

PATH’s role
PATH is the technology developer of encapsulated, gastric-resistant oral tablets for easy and convenient packaging, delivery, storage, and use in any setting.

Country
United States.

Product manager
Dr. Manjari Lal, mlal@path.org.

Address United Nations Sustainable Development Goal 3.4: By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.
A globally accessible mRNA potency assay.

**Need**
Existing mRNA potency assays require complex quantification methods such as flow cytometry that are not widely adaptable for routine use by low- and middle-income country manufacturers or National Regulatory Agency laboratories.

**PATH’s role**
PATH is using existing reagents and experience to develop methods for global use to optimize mRNA vaccine potency methods for both monovalent and multivalent SARS-CoV-2 vaccines as model targets.

**Country**
United States.

**Donor**
NIIMBL.

**Product manager**
Dr. Jessica White, jawhite@path.org.

Addresses United Nations Sustainable Development Goal 3.B: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines.
Sensitive immunoassay to support development of COVID vaccines

Quantitative and stability-indicating assays to monitor antigen and adjuvant content in the vaccine product.

Need

Development of sensitive, stability-indicating analytical methods to measure the antigen and adjuvant content in the final vaccine formulation are required for vaccine release and stability studies.

PATH's role

PATH is conducting initial method development for, and transfer of, the bioanalytical method to manufacturing partners in low- and middle-income countries. PATH is also harmonizing assay results across manufacturing sites.

Partners

Butantan, The Government Pharmaceutical Organization, Institute for Vaccines and Medical Biologicals, Mt. Sinai.

Countries

Brazil, Thailand, and Vietnam.

Product manager

Dr. Jessica White, jwhite@path.org.

Addresses United Nations Sustainable Development Goal 3.B: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines.
MEDICAL DEVICES AND HEALTH TECHNOLOGIES

Thermostable formulation platforms for mRNA-LNP based vaccines

Development of thermostable formulations of messenger RNA lipid nanoparticle (mRNA-LNP) based vaccines.

Need

Leading mRNA-LNP based vaccines rely on complex cold chain infrastructure for delivery. These specific storage and transportation requirements are often not only expensive and logistically complex, but also limit equitable distribution to underserved populations and hard-to-reach communities.

PATH's role

PATH is applying freeze-drying and spray-drying stabilization technologies to develop thermostable lyophilized and spray-dried formulations of an mRNA-LNP vaccine.

Country

United States.

Donors

University of Delaware/NIIMBL.

Product manager

Dr. Manjari Lal, mlal@path.org.

Addresses United Nations Sustainable Development Goal 3.B: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines.
Fixed-dose syringe that locks after injection, preventing reuse and potential transmission of bloodborne pathogens.

**Need**

Autodisable (AD) syringes are already widely adopted, but COVID-19 supply chain disruptions threatened adequate and timely supply at acceptable prices to meet global immunization needs. Additionally, sharps injury prevention (SIP) features that can prevent needlestick injuries are commonly used in high-income countries, but are not yet widely accessible on AD syringes.

**PATH’s role**

PATH was instrumental in the development and introduction of AD syringes, and now routinely provides market intelligence to manufacturers and global health stakeholders to ensure a stable supply is available to the many countries that require AD syringes. PATH is also assessing sustainability interventions and working to advance the accessibility of SIP features on AD syringes.

**Manufacturers**

Multiple.

**Partners**

Gavi, the Vaccine Alliance, PAHO, UNICEF, WHO.

**Countries**

Global.

**Donor**

Bill & Melinda Gates Foundation.

**Product manager**

Courtney Jarrahian, cjarrahian@path.org.

Addresses United Nations Sustainable Development Goal 3.B: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines.
A novel fill/finish process and primary container technology that can be used for oral delivery of novel oral polio vaccine (nOPV). Blow-Fill-Seal (BFS) containers have the potential to simplify delivery and reduce costs.

**Need**
Low-cost primary packaging that decreases supply chain requirements and environmental impact while improving usability in low resource settings.

**PATH's role**
PATH is facilitating the development and stability testing of a novel BFS oral delivery system for nOPV.

**Manufacturer**
BioFarma.

**Partners**
Rommelag, New Horizons.

**Countries**
Germany, Indonesia, Switzerland, and Zambia.

**Donor**
Bill & Melinda Gates Foundation.

**Product manager**
Ben Creelman, bcreelman@path.org.

Addresses United Nations Sustainable Development Goal 3.B: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines.
Exploring the feasibility of novel compact, prefilled, autodisable devices (CPADs) as a lower-cost alternative to Uniject™.

Need

Lower-cost, improved CPAD devices to simplify delivery of vaccines and essential medicines.

PATH’s role

PATH is partnering with developers to evaluate whether novel CPAD devices can meet technical, cost, and programmatic suitability requirements for delivery of priority vaccines and injectable contraception. The two devices currently under consideration are Injecto’s “easyject™” prefilled syringe and 3CK’s Blow-Fill-Seal “Secureject™” design.

Partners

3CK, Injecto.

Countries

Denmark, Italy, Uganda, and Zambia.

Donor

Bill & Melinda Gates Foundation.

Product manager

Ben Creelman, bcreelman@path.org.

Addresses United Nations Sustainable Development Goal 3.B: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines.
MEDICAL DEVICES AND HEALTH TECHNOLOGIES

Delivery of long-acting monoclonal antibodies (mAbs) to prevent respiratory syncytial virus (RSV) infection in infants

Passive immunization (lab-made antibodies that block the virus) to protect infants from severe respiratory infections and death.

Need
RSV is the world’s top cause of severe respiratory infections and hospitalizations in infants and young children, with most deaths occurring in low- and middle-income countries (LMICs). The mAbs bind to the virus and block it, preventing severe disease. They come in single-dose, non-standard volume presentation and are administered intramuscularly soon after birth to confer protection for six months, when infants are most at risk.

PATH’s role
PATH assessed the programmatic fit of delivery device options for LMIC immunization programs to inform manufacturers on the best container option for this new product. PATH will assess acceptability of maternal versus infant immunization and gather recommendations on the most feasible infant RSV prevention strategy for LMICs.

Partners
Merck.

Countries

Donor
Merck.

Addresses United Nations Sustainable Development Goal 3.2: By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births.
A dual-chamber reconstitution injection device.

**Need**
Simpler reconstitution of vaccines and essential medicines.

**PATH's role**
PATH has developed a design for a novel dual-chamber device that enables mixing of dry and liquid components within the device itself, reducing the risk of errors in preparation and delivery of vaccines and essential medicines.

**Country**
United States.

**Donor**
Bill & Melinda Gates Foundation.

**Product manager**
Dan Myers, dmyers@path.org.

Addresses United Nations Sustainable Development Goal 3.B: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines.
MEDICAL DEVICES AND HEALTH TECHNOLOGIES

Intranasal vaccine delivery devices

Devices that provide intranasal administration of vaccines with no sharps waste.

Need
Intranasal delivery of vaccines may be less painful and lead to a stronger immune response for some vaccines, such as COVID-19.

PATH’s role
PATH conducted usability evaluations to assess ease of use, acceptability, and programmatic feasibility of two devices for intranasal delivery of vaccines.

Manufacturers
Teleflex, Zeteo Biomedical.

Partners
BP Koirala Institute of Health Sciences, Nepal Ministry of Health.

Countries
Kenya, Nepal, and United States.

Donor
International AIDS Vaccine Initiative (IAVI).

Product manager
Jennifer Foster, jfoster@path.org.

Addresses United Nations Sustainable Development Goal 3.B: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines.
Microarray patches (MAPs) consist of microscopic projections that are applied to the body like a small bandage, penetrating the skin's outermost layer to deliver a drug or vaccine to the top layers of the skin.

**Need**

The global health community needs highly effective, well-tolerated, low-cost, and easy to administer delivery systems to enable new scenarios of administration and expand access to vaccines and medicines.

**PATH’s role**

PATH and various partners are collaborating on multiple projects to advance the development of MAPs for delivery of priority vaccines and essential medicines, including antiretrovirals and contraceptives.

**Partners**

Micron, Vaxxas, Cardiff University, Queen’s University Belfast, CDC, MRC Gambia, Gilead, WHO, UNICEF, Gavi, the Vaccine Alliance, ViiV, Janssen, Pharmetheus.

**Countries**


**Donors**

Bill & Melinda Gates Foundation, Gavi, the Vaccine Alliance, National Institutes of Health.

Addresses United Nations Sustainable Development Goal 3.B: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines.
MEDICAL DEVICES AND HEALTH TECHNOLOGIES

PharmaJet® Tropis®

Needle-free, disposable syringe jet injector which provides intradermal injections with no sharps waste.

Need
Intradermal delivery of fractional doses of vaccines—such as the polio and COVID vaccine—can improve efficacy, reduce costs, and address supply shortages. However, the conventional injection technique is difficult to perform, particularly in campaign settings, and requires sharps waste disposal.

PATH’s role
PATH is collaborating on a study assessing coverage rates, acceptability and feasibility, and the potential for reduced costs associated with using Tropis for fractional-dose inactivated polio vaccine (IPV) delivery in routine immunization, compared to the current standard of intramuscular delivery of full-dose IPV using needle and syringe.

Manufacturer
PharmaJet.

Partners
PharmaJet, National Primary Health Care Development Agency (NPHCDA), Jhpiego, and the Sydani Group.

Countries
Nigeria, Pakistan, and Somalia.

Donor
USAID.

Product manager
Courtney Jarrahian, cjarrahian@path.org.

Addresses United Nations Sustainable Development Goal 3.B: Support the research and development of vaccines and medicines for the communicable and noncommunicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines.
Universal implant inserter

The device is designed to insert next-generation biodegradable contraceptive implants currently in development. The inserter could potentially work with implants for other use cases as well, such as HIV prophylaxis implants.

**Need**

A universal inserter that works with implants from multiple manufacturers could:

- Simplify implant development by allowing developers to concentrate specifically on the implant.
- Reduce the training burden on health care workers.
- Reduce inserter costs through economies of scale.

**PATH’s role**

Research and develop.

**Country**

United States.

**Donor**

Bill & Melinda Gates Foundation.

**Product manager**

Dan Myers, dmyers@path.org.

Addresses United Nations Sustainable Development Goal 3.7: By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes.
Freeze-preventive cold box

A vaccine cold box used for transporting large volumes of vaccines between health facilities with an engineered barrier that prevents exposing vaccines to freezing temperatures.

**Need**

Many vaccines are freeze-sensitive and can lose potency when exposed to freezing during transport.

**PATH’s role**

PATH engineered a solution that allows users to place frozen ice packs in the cold box without risk of vaccine exposure to freezing temperatures. PATH transferred the technology of this freeze-prevention barrier to multiple manufacturing partners to bring the first product to market. PATH evaluated a cold box from one manufacturer in Nepal.

**Manufacturers**

Leff Trade.

**Partners**

B.P. Koirala Institute of Health Sciences, Nepal Ministry of Health, the United Nations Children’s Fund, the World Health Organization.

**Countries**

Globally available.

**Donor**

Bill & Melinda Gates Foundation.

**Product manager**

Steven Diesburg, sdiesburg@path.org.

**Addresses United Nations Sustainable Development Goal 3.8:** Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.
A vaccine carrier with an engineered barrier that prevents accidental freezing of vaccines.

**Need**
Many vaccines are freeze-sensitive and can lose potency when exposed to freezing during transport and outreach.

**PATH's role**
PATH engineers pioneered a novel solution that allows users to place deeply frozen, or solid frozen ice packs in the carrier while protecting vaccines in a separated compartment, virtually eliminating exposure to freezing temperatures. PATH's design was adopted by multiple manufacturers who have in turn gone on to make additional innovations, accelerating the introduction and adoption of this breakthrough innovation.

**Manufacturers**
Multiple.

**Partners**
B.P. Koirala Institute of Health Sciences, Nepal Ministry of Health, the United Nations Children's Fund, the World Health Organization, and manufacturers.

**Countries**
Globally available.

**Donor**
Bill & Melinda Gates Foundation.

**Product manager**
Sandeep Kumar, sdkumar@path.org.

**Addresses United Nations Sustainable Development Goal 3.8:** Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.
MEDICAL DEVICES AND HEALTH TECHNOLOGIES

National cold chain information system for improved vaccine management

The Cold Chain Information System (CCIS) is a digital asset management tool built upon the Open Data Kit X platform. The app allows user-friendly digital data reporting and monitoring of cold chain equipment and other assets using Android-based mobile phones and tablets.

Need
Countries need a robust system for collecting, managing, and reporting on the large data sets involved with supply system asset management. Updating these data for effective decision-making has traditionally been slow and costly and, as a result, they are often out-of-date. Tracking the functional status of equipment and spare parts has been problematic for many countries.

PATH’s role
PATH helped Uganda’s national immunization program pilot and scale the technology for a Cold Chain Equipment (CCE) inventory application. Within one year, 6,095 CCE across 160 districts were entered into the national inventory, 5,990 CCE maintenance records were logged, and 29,119 temperature records were collected. Uganda immunization and cold chain officers now rely on CCIS for holistic cold chain inventory management, procurement strategizing, and prioritizing CCE repair and maintenance activities.

Partners
Uganda National Expanded Programme on Immunization, Uganda National Medical Store, University of Washington.

Countries
Globally available.

Addresses United Nations Sustainable Development Goal 3.8: Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.
The energy harvest control (EHC) provides safe access to excess solar electricity generated by solar panels.

Need
Electricity to power basic clinic functions such as lighting and low-power medical devices is often not available in remote locations.

PATH's role
PATH carried out field-validations in Senegal to evaluate several EHC appliances and continues to support both expanded use of the technology and solar power for health facilities.

Partners
Senegal Ministry of Health and Family Welfare, Sunny Day LLC, the World Health Organization, and manufacturers.

Countries
Globally available.

Donors
Bill & Melinda Gates Foundation, Gavi, the Vaccine Alliance.

Product manager
Steven Diesburg, sdiesburg@path.org.

Addresses United Nations Sustainable Development Goal 7.B: By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries.