Applying the unique advantages of Global Good and Intellectual Ventures Lab to eliminate disease and improve healthcare outcomes
The Global Health Technologies (GHT) portfolio of Global Good focuses on the conception, development, adaptation, and deployment of technological innovations to address major global causes of illness and mortality in low-resource countries.

FOCUS & APPROACH

We’re developing tools that enable primary care clinics and communities to reduce their burden of disease and accelerate elimination of malaria and other tropical diseases. Our work addresses environmental risk factors that affect health and disease vulnerability such as vector control, nutrition, and access to clean water and air. And we seek to provide clinics with more effective equipment, supplies and other resources so as to empower quality care for all people, especially those at the periphery of the health system—from remote villages and districts to high-density urban environments.

The GHT approach is to invent and adapt technologies for clearly defined target product profiles. A solution may be attainable through innovative application of an existing technology, thus providing more immediate benefits with less risk in the development process. Alternatively, we may see the need to invent entirely new technologies and products. Regardless, our ultimate aim is to provide solutions appropriate to the needs of low resource settings—easy to use, robust, stable, and affordable.

AGILITY & CAPABILITY

In several respects, GHT is differentiated from other organizational models in academic, NGO, and private sector environments. Our unique business model and capabilities enable us to focus on otherwise underserved areas of health product development.

Supported by flexible funding with an agile development mindset, we’re able to quickly redirect resources as needed while maintaining accountability over short-term milestones.

And by leveraging the use of our multipurpose technology platforms, we can more efficiently support a broad spectrum of work types including diagnostics and screening, non-drug...
therapies, biometrics, and environmental influencers of disease.

GHT is directly partnered with the highly versatile Intellectual Ventures Laboratory (IV Lab), which is comprised of a multidisciplinary staff and physical lab spaces—all collocated within a single facility. Our immediate access to the IV Lab includes the flexibility to transfer staff and priorities across projects along with the capacity for rapid prototyping.

TEAMWORK & PARTNERSHIPS

In addition to forming internal teams based on domain expertise, we leverage external partner proficiencies in research, product development, field evaluation, and commercialization. Our partners range from individual technical advisors to commercial partners with regional market expertise and influence.

We establish long-term partnerships with key large public health and research institutions in the U.S. and abroad. In addition to providing their strategic and technical inputs, these institutions collaborate with Global Good to conduct high-quality field evaluations in the countries of intended product use. The evaluations result in valuable practical feedback to guide further product development.

Key experts are also engaged through individual consultation or in technical advisory panels working to collectively discuss and refine target product profiles, advise on development options, and establish market awareness and support. And sometimes we look to a selected institution for specific high-level expertise for a project, working in targeted collaboration for a specific product development project or geographical site.

LOOKING AHEAD

The pages that follow include examples of Global Good's health-related work and areas of investigation—ranging from previous projects completed to future possibilities under consideration. Feel free to contact us for additional information about any of these.

Addressing community influences on high-burden disease

In addition to our work on diagnostics, therapies, and healthcare systems, we seek to address environmental and nutritional risk factors that contribute to poor health. Here are a few of our focus areas:

Safe water supply

Clean drinking water is critically important to community health. In order to rapidly detect E. coli in water supplies, we are developing a phage-based assay that will reduce time to results from 24 hours to less than 4 hours.

Indoor air quality

Poor indoor air quality is a known major contributor to many health problems. We are developing an improved cook stove design that will provide safer indoor environments by significantly reducing unhealthy stove emissions.

Insect control

Our vector control program helps toward malaria elimination goals, but also supports vector-free living and work spaces. These efforts reduce the entry of harmful pests while maintaining airflow and security.

Child growth/nutrition

Targeting nutrition support and growth monitoring, we’ve improved upon tape devices used for measuring a child’s upper arm circumference, a commonly used indicator of growth. A high-tech approach also uses a hand-held infrared spectrometer to assess nutritional status via fat content measurements.

Photo credit: Alexander Upfill-Brown
Malaria poses a significant health threat to nearly half of the world’s population, with the highest mortality in sub-Saharan Africa. In all populations, the risk of life-threatening infection is higher for pregnant women, infants, and children under five years of age. Global malaria elimination efforts include countering mosquito-based parasite propagation, drugs to prevent infection, and treatment medicines for those who have already been infected. Global Good is assisting across this entire spectrum by applying our unique capabilities in research and partnership work. We’re developing a range of interventions including a suite of diagnostic tools to support case management, surveillance, and elimination.

Vector Control

Studying and stopping mosquito-based spread of the disease.

The female *Anopheles* mosquito is the primary transmission vector for the spread of malaria. Our mosquito exclusion project supports safer living spaces by impeding insect entry at doors, windows, and other possible points of access. Other vector work includes tools to aid the study of mosquito behaviors, their means and capacity to spread malaria, and possible ways to diminish transmission.

Computational Modeling

Solution-focused research of malaria propagation in mosquitoes and human populations

We’re seeking ways to improve the detection and tracking of malaria transmission through people groups and geographies. This will enable more precise assessment of malaria infections, present and past, across child and adult populations—including those who travel or migrate between geographies. These technologies will be helpful to avoid recurrence of outbreaks in many areas where malaria has otherwise been nearly eradicated.

Computational support for this work is performed by our Institute for Disease Modeling (IDM) at Intellectual Ventures. Working on high-performance computer clusters, the IDM develops quantitative modeling and statistical approaches for simulation and analysis of vector behaviors. The IDM also provides tools and support to the global health community.

Rapid Diagnostic Tests

Ultra-sensitive point-of-care testing for early detection of parasites

Currently available paper-based test strips can quickly indicate high levels of the malaria parasite. However, many malaria-infected people carry the parasite at a low level that is undetectable with current field technologies. Global Good’s next-generation rapid diagnostic tests (RDTs) will dramatically improve detection sensitivity with the same convenience of other available test strips. We are also developing a reader device that will enhance test sensitivity of existing and next-gen strips by providing

IDM visualization of mosquito densities along the Thai-Myanmar border
Malaria

Automated Microscopy

WHO-quality detection via software-based analysis of sample slides

The standard optical microscope is one of the most affordable and effective tools for diagnosing infectious diseases in low-resource areas. However, analysis of blood films requires significant time from trained WHO-certified microscopists. And very few of these experts exist in the areas that need them most.

To help with this problem, Global Good has developed the Autoscope, an automated microscope that can examine sample slides and provide diagnostic accuracy that meets the standards of WHO Level-1 expertise. This advanced system captures ultra-high-resolution images which are then interpreted into diagnostic decisions by an artificial intelligence algorithm that has been “trained” using a database of thousands of real malaria parasite images.

Beyond diagnosis, the Autoscope technology platform has many other potential applications, including tracking drug effectiveness and improving drug and vaccine trials.

Drug Quality Testing

Hand-held technology to detect falsified medicines in the field

Artemisinin-based drugs are effective against malaria. However, surveys of antimalarial drugs in sub-Saharan Africa indicate that some artemisinin combination therapy (ACT) drugs in circulation are counterfeit—containing fake ingredients—or otherwise substandard. Low-income countries often lack the laboratory capacity required for routine centralized testing, and available “mobile lab” products are generally cumbersome and costly.

Global Good is investigating the use of low-cost handheld devices to assess drug quality in the field. These new near-infrared spectroscopy (NIRS) systems can rapidly analyze reflected wavelengths from subject drugs to assess their chemical composition. Successful application of this technology could help prevent treatment failures resulting from use of falsified medicines, improve confidence in health systems, and strengthen pharmaceutical supply chains.
Tuberculosis (TB) continues to impose a significant global burden of illness and death, especially in low income nations. In 2015, WHO estimated 10.4 million new TB cases worldwide, which included more than a million children. Fortunately, international efforts for TB prevention and patient care are making progress; WHO estimations indicate a 22% reduction in TB-caused death between 2000 and 2015. Global Good seeks to further improve TB diagnostics as well as patient care and the systems that support global TB programs.

Effective diagnosis of TB is quite challenging due to the complexity of the disease and difficulty in obtaining suitable specimens. TB appears in several variations and levels of progression across infected populations. For example, while it is typically evidenced in the lungs, TB can also exist in extra-pulmonary forms—especially in HIV-infected individuals. Unfortunately, currently available diagnostics fail to detect about 45% of new TB cases and miss about 65% of HIV-TB combination cases. Additionally, the tests insufficiently indicate whether, or to what extent, the TB cases are drug-resistant. In fact, current TB programs fail to identify 80% of multi-drug-resistant cases. TB diagnosis methods can also be expensive and time consuming as the work is referred to higher level facilities in the healthcare system; it cannot be done at the local clinic.

To enable more accurate, informative diagnosis of TB in its many forms, Global Good is developing solutions intended to be more accessible at the community level. Our TB efforts employ some of the same approaches that we are developing to combat alaria.

Rapid diagnostic paper-strip tests

Our high-sensitivity Lateral Flow Assay (LFA) based rapid diagnostic tests will provide more effective, affordable detection of TB-specific biomarkers at the community level.

Bacteria growth detection platform

Our new culture technologies aim to offer affordable, rapid testing for TB bacteria viability in collected samples. This capability will help to monitor treatment efficacy and provide individualized, patient-centered case management.

Solution-scenario modeling

Our Institute for Disease Modeling computationally simulates disease transmission dynamics specific to TB and HIV. Their studies address the effectiveness of treatment programs and the potential impact of new strategies and tools.

New molecular point-of-care tests

Nucleic-acid-amplification molecular tests aim to simplify rapid detection in TB-suspected cases along with rapid prediction of drug susceptibility or resistance.
Clinical Capability

Improving patient care in low-resource settings

Many of the world’s poorest populations obtain primary healthcare at local neighborhood clinics. In some healthcare systems, these facilities are referred to as the “lowest level” in relation to more advanced regional health centers. All too often, community-based clinics lack sufficient capabilities to meet patients’ needs. One of our core intentions is to help move capabilities toward the local clinic so as to decrease the need for referral to distant follow-up support. To improve the quality of care provided at the local clinic, we focus on providing better tools for diagnosis and therapy, reliable information handling, and supportive infrastructure.

Cervical Cancer Screening

Saving lives with improved early detection

Currently available cervical cancer screening methods are inaccurate or require expensive equipment and highly skilled health workers and thus are rarely used in low-resource healthcare systems. And for the few women who are tested, delayed results impede proper follow-up and treatment. With our industry partners, we work to provide more accessible and effective detection of cervical cancer indicators.

Therapeutic Oxygen

Supply reliability and delivery efficiency

Oxygen therapy is vitally important in clinical care—especially for supporting the treatment of acute respiratory infection, a leading cause of child mortality. However, resource-constrained areas have difficulty maintaining a reliable oxygen supply.

Electrically powered concentrators can create oxygen supplies from ambient air, but many low-resource clinics have unreliable power. Alternatively, oxygen delivered in high-pressure tanks requires no electricity, but the supporting supply chain often fails.

To overcome the drawbacks of each of these supply modes, Global Good is developing an approach that applies the advantages of both. When sufficient power is available to run a concentrator, the system generates more oxygen than is immediately required for patient use and stores the reserve in pressurized tanks to use if needed for potential power outages. We are also developing a high-efficiency nasal mask delivery system specifically designed for children. Our mask reduces oxygen loss while maintaining the standard of care of a cannula.

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Portable Ultrasound

Affordable advanced diagnostic systems

Ultrasound imaging is highly effective for some medical diagnostics, such as in obstetrics and emergency triage. However, most rural and low-resource areas do not have access to ultrasound systems. This is mostly because of system cost, system size, and a lack of skilled staff for image acquisition and analysis. We are developing a mid-level, portable ultrasound system with software-assisted image interpretation—initially focused on lung pathologies such as pneumonia, pneumothorax, and pleural effusions. This more usable system will enable image capture and diagnosis by minimally trained personnel in scenarios where ultrasound might be impractical or simply unavailable.

Patient Info Systems

Positive identification for consistent care

Reliable digital database systems will help clinics correctly identify patients and access their records for all visits, diagnoses, and follow-up care. We are developing a patient information system that supports patients of all ages—from infancy to adulthood—and integrates with our cardiopulmonary monitoring applications and our biometrics program. Biometrics methods typically require the patient’s cooperation, which is sometimes difficult for infants, so we are exploring the use of alternative modalities for children. And to facilitate implementation in low-resource settings, we’re seeking ways to capture biometric identifiers on smartphones.

Supporting Infrastructure

The foundations of local clinic success

By improving the supporting infrastructure for clinics, we can improve the quality and availability of care. Our infrastructure solutions seek to address safety, cleanliness, environment, waste handling, cold chain, supply chain, clean water, power, and communications. We endeavor to develop technologies that support the following necessary elements of clinic operation.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>CONSIDERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Capability</td>
<td>Equipment, Accessories</td>
</tr>
<tr>
<td></td>
<td>Specimen Storage</td>
</tr>
<tr>
<td></td>
<td>Diagnostics</td>
</tr>
<tr>
<td>Pharma Supply,</td>
<td>Cold Chain</td>
</tr>
<tr>
<td>Drugs</td>
<td>Supply Chain</td>
</tr>
<tr>
<td>Medical Records</td>
<td>Patient Data, Storage &amp; Retrieval</td>
</tr>
<tr>
<td></td>
<td>Regional Connectivity</td>
</tr>
<tr>
<td></td>
<td>Infrastructure</td>
</tr>
<tr>
<td>Utilities</td>
<td>Electricity, Lighting</td>
</tr>
<tr>
<td></td>
<td>Water Supply</td>
</tr>
<tr>
<td></td>
<td>Toilet/Sanitation</td>
</tr>
<tr>
<td></td>
<td>Waste Disposal</td>
</tr>
</tbody>
</table>
Millions of people suffer and die each year from causes that humanity has the scientific and technical ability to solve. Global Good is a collaborative effort between Bill Gates and Intellectual Ventures to address this. We take on some of humanity’s toughest problems through the power of invention by drawing on resources normally reserved for commercial pursuits in wealthier markets. Global Good combines IV’s unique invention prowess with the expertise of leading humanitarian organizations, forward-looking governments, and commercial partners that share our vision. Together, we invent, develop, and deploy commercially viable technologies that aim to improve life in low-income nations.