PROJECT SUMMARIES

Wolbachia-Infected Mosquitoes

Scaled Deployment of Wolbachia-Infected Mosquitoes to Block Disease Transmission

Organization: Eliminate Dengue Program, Monash University

Location: Melbourne, Australia

Problem: Dengue is estimated to threaten the health of almost 4 billion people living in tropical and subtropical regions of the world and Zika is currently exploding as an emerging global disease with major outbreaks underway throughout tropical South America.

Solution: Infect mosquitoes with Wolbachia, a naturally occurring bacteria proven to block the transmission of dengue fever and Zika virus from mosquitoes to humans. The approach provides a natural, sustainable, cost-effective new tool for preventing transmission of a range of arboviruses including Zika, dengue and chikungunya. The project, which has been proven to work over long-term field tests, will now be tested in much larger populations in several Latin American communities. This method represents a paradigm shift in arboviral disease control. It's an innovative, cutting edge technology that provides a sustainable, long-term intervention for communities affected by arboviral diseases. Compared with conventional insecticide-based or genetic population suppression control methods that may provide limited, short-term reductions in the mosquito population, once Wolbachia has established in the local population, it persists without the need for continual reapplication or additional insecticide--based control methods while reducing the risk of infection with dengue, chikungunya and Zika viruses. In addition, residents are not required to change their behaviour or participate in ongoing activities after the mosquito releases are concluded. This research, which is the first of its kind in the world, could potentially benefit an estimated 2.5 billion people currently living in arboviral disease transmission areas worldwide.

Wolbachia-Infected Mosquitoes

Testing Wolbachia-infected Mosquitoes to Suppress Population and Block Disease

Organization: Michigan State University

Location: East Lansing, Michigan, USA

Problem: Traditional vector control approaches, which rely heavily on chemical insecticides, have failed in dengue control and will be unlikely to be efficient for Zika control because the same mosquito species transmit both diseases. There is a critical need to develop novel intervention strategies to control Zika transmission.

Solution: Researchers at Michigan State University will field test a multi-pronged Wolbachia-based strategy to effectively control Zika: the release of Wolbachia-infected males to suppress the population (up to local eradication), followed by seeding of Wolbachia-infected females to establish a viral resistant population. Once the resistant population grows to a certain density, males carrying a second Wolbachia strain will be released to further suppress the population. By reducing both mosquito density and the ability of mosquitoes to transmit viruses, when fully deployed the project expects to arrest disease transmission immediately.

Natural Yeast-based Larvicides

Developing and Testing Yeast Interfering RNA Larvicides

Organization: Trustees of Indiana University, Indiana University School of Medicine, and the University of Notre Dame

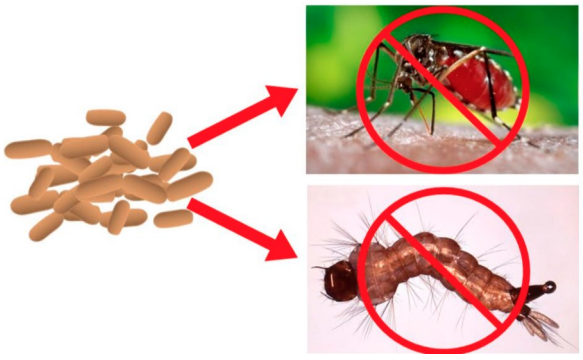
Location: Bloomington, Indiana, USA

Problem: Larviciding is a key component of integrated Aedes control and disease prevention strategies. Given the increase of reported insecticide resistance to existing larvicides and the rising concern for negative effects of pesticides on non-target organisms, the current larvicide repertoire is faced with great challenges to sustainability. New larvicidal agents are vitally needed to address emerging arthropod-borne infectious diseases such as Zika.

Solution: Researchers at Indiana University have developed yeast interfering RNA larvicides that kill nearly 100% of A. aegypti larvae in laboratory assays. The researchers will conduct a field evaluation of yeast interfering RNA larvicides, a novel class of larvicides for the control of mosquitoes that transmit Zika virus. The interfering RNA molecules identified represent a novel class of larvicides with untapped potential for biorational and sustainable mosquito control. Interfering RNA can be propagated through cultivation of yeast, which is inexpensive to culture. Yeasts have been cultivated worldwide for thousands of years, and this technology can be adapted to resource-limited countries with constrained infrastructures. Dried yeast can be packaged and shipped in either active or inactive forms, facilitating regional distribution.

Chromobacterium

An Environmentally Friendly Biopesticide



Organization: Johns Hopkins University

Location: Baltimore, Maryland, USA

Problem: Current Zika control strategies are mainly based on the use of insecticides and personal protectants. A continuous emergence of mosquito resistance to insecticides and the lack of drugs and vaccines to Zika, dengue, Chickungunya, and other mosquito –transmitted pathogens render the development of novel cost-effective mosquito control strategies urgent.

Solution: Development of Chromobaterium Csp_P as a cost-effective, environmentally-friendly and logistically simple mosquito control biopesticide. Chromobateria are abundant soil bacteria and have already been developed for agricultural pest control by live spraying on fields, but not for mosquito control. The unique properties of Chromobaterium Csp_P, which can kill larvae and adults of all mosquito vectors (Ae. aegypti, Ae. albopictus, Anopheles gambiae and Culex pipiens have been tested thus far), and block pathogen infection of mosquitoes, renders it a highly potent weapon against current and future mosquito-borne diseases.

PERSONAL/HOUSEHOLD PROTECTION

Electric Force Field

Repulsing Mosquitoes with Electric Pulses

Organization: Barcelona Institute For Global Health

Location: Barcelona, Spain

Problem: Vector control programs have historically relied on the use of insecticides to control mosquito populations, but the efficacy of this vector control tool will decrease rapidly as mosquitoes develop resistance to common insecticides.

Solution: Electronic Mosquito Barriers (EMBs) use high power pulsed electric fields to repel mosquitoes. Using pulsations that vary randomly in both strength and frequency, the EMBs create a mosquito-repelling force field. The unpredictability of the pulsations makes it nearly impossible for mosquitoes to learn or adapt to when, where, and with what force the electric field is coming. EMBs could prevent mosquito bites for multiple species, and can provide bite protection for individuals or groups of people in various indoor and outdoor settings. EMBs may also repel other arthropod disease vectors of medical and veterinary importance, such as sand flies, biting midges, tsetse flies, fleas, and kissing bugs, preventing the spread of other infectious diseases.

Low-cost Treated Sandals

Developing Sandals to Release Wide-Area Spatial Mosquito Repellents

Organization: Ifakara Research Institute

Location: Dar es Salaam, Tanzania

Problem: The feet and ankle-biting Aedes mosquitoes, which transmit most of the arboviral infections that the world is least prepared to combat, are largely non-responsive to long-lasting insecticide-treated nets and indoor residual sprays. As a result, people need to consistently apply repellent, or risk potential infection.

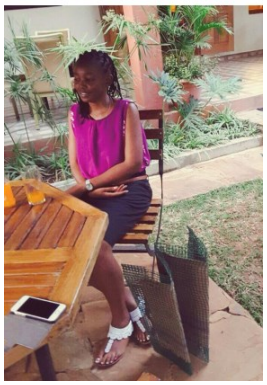
Solution: These sandals release highly effective, wide-area spatial mosquito repellents, creating full-time protection against both day-biting and night-biting mosquitoes at individual and household level. The low cost sandals provide round-the-clock protection against Dengue, Zika, Chikungunya and Malaria using hessian strips impregnated with off-patent but highly effective and safe repellent, transfluthrin. The sandals can provide protection to the feet and ankles for up to 6 months. This approach will increase protective coverage and access to the lowest income households.

Low-Tech Treated Fabric for Outdoor Use

Testing Transflutherin-treated Fabric for Protection from Mosquitoes Outdoors

Organization: Liverpool School of Tropical Medicine

Location: Liverpool, United Kingdom



A portable, foldable self-standing transfluthrin emanator, in which the hessian strip is protected from moisture on the ground, and users are protected from physical contact with the active ingredient, by sandwiching it within a wire mesh cover with wide margins.

Problem: Existing repellents are too expensive and impractical for continuous, indefinite use. New, affordable, rapidly scalable repellent products are urgently needed to protect at-risk populations against mosquito-borne pathogens.

Solution: This simple, affordable low-tech transfluthrin emanator provides more than 90% protection for over 6 months against nocturnal Anopheles and Culex mosquitoes. This project will test it against Aedes populations. The emanator costs only $0.15, and uses widely-available Hessian fabric, which can be treated and re-treated safely by any individual, community, program or local manufacturer.

Low-cost Treated Wall Hangings for Indoor Use

Testing Treated Net Hung Indoors to Prevent Mosquito-Human Contact

Organization: QIMR Berghofer Medical Research Institute

Location: Brisbane, Queensland, Australia

Metofluthrin has a powerful impact on mosquito behavior and survival. Single units of impregnated netting can create large, bite-free areas within a house.

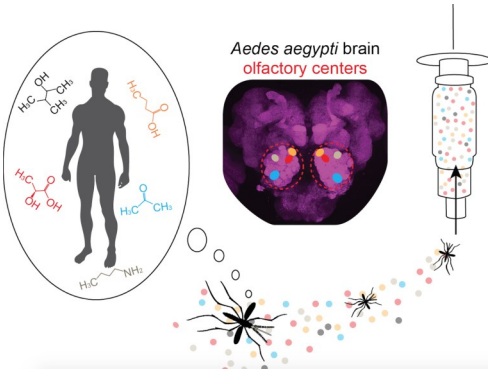
Problem: The re-introduction of Indoor Residual Spraying (IRS) for emergency Zika control is strongly supported by the WHO with the provision that it must be methodically applied and achieve high household coverage. IRS, however, is time -consuming, expensive, and dependent on specialized human resources. Issues of community compliance and failure to reach threshold coverage requirements are further constraints to its effective implementation.

Solution: A treated net impregnated with metofluthrin, which maintains efficacy for a three-week period. Small units of net, or emanators, are hung indoors and create protected zones that prevent mosquito-human contact. These devices have a powerful effect on mosquito behaviour and can prevent all biting within a 3-8 meter radius in urban indoor spaces. They also cause knock down and death in the mosquito population. This tool - a community-friendly, fast, effective insecticide formulation that breaks contact between mosquitoes and humans - is also effective against existing pyrethroid-resistant populations of Ae. aegypti. A successful proof of impact of the metofluthrin emanators will increase our capacity to combat a number of urban arboviruses, including Zika.

PERSONAL/HOUSEHOLD PROTECTION

Human Scent Mimic Mosquito Trap

Developing a Chemical Lure Mimicking Human Scent to Trap Ae. Aegypti



Organization: Johns Hopkins Bloomberg School of Public Health

Location: Baltimore, Maryland, USA

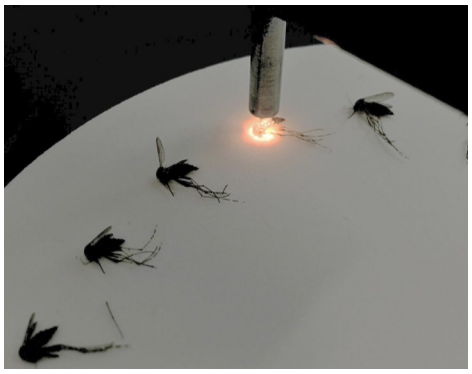
Problem: Coupled with its genetic competence for pathogen transmission, the strong penchant of Ae. aegypti for human scent makes this mosquito species a prolific vector of Zika and an array of other vector-borne diseases. The highly domesticated mosquito also can be difficult to control in urban environments. Attractive lures that can be combined with traps for effective and efficient vector control and surveillance have proven elusive.

Solution: This team aims to identify the specific components of human scent that are actively perceived by olfactory centers in the Ae. aegypti brain and drive mosquito attraction towards humans. With this knowledge, they will develop a powerful chemical lure that mimics the signature profile of human scent for the targeted trapping of Ae. aegypti. The development of a highly attractive lure for this mosquito species will have profound implications for trapping strategies for both vector control and disease surveillance purposes to combat Zika and future arthropod-borne disease threats.

VECTOR SURVEILLANCE

Near Infrared Spectroscopy

Detecting Transmission Hotspots with Single 3-Second Reading



Organization: University of Queensland

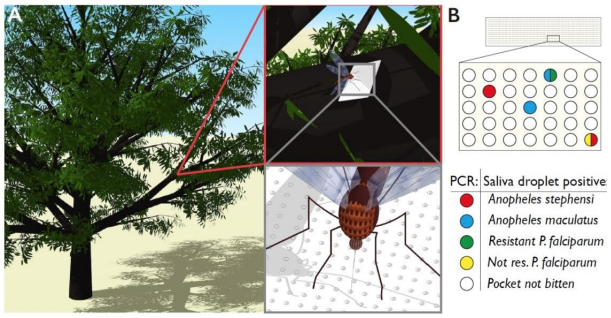
Location: Brisbane, Queensland, Australia

Problem: Brazil is currently burdened by simultaneous outbreaks of dengue, chikungunya, and Zika, and there is limited information about where these arbovirus transmission occurs within cities since most cases never produce symptoms or present to hospital. Current vector control interventions are often applied in a blanket approach across urban areas, and therefore likely miss the transmission foci.

Solution: Near-infrared spectroscopy (NIRS) is a non-destructive technique that can be used to measure multiple characteristics of a mosquito sample with a single, 3-second reading. This reading could then be used to identify unique signatures of arbovirus in mosquitoes to help with identification of hotspots and rapid management. NIRS can be performed on approximately 1000 mosquitoes per day,16× faster and 35× cheaper than conventional PCR and microscopy. Results can be analyzed and reported immediately. The NIRS machines are rugged and portable enough for field use, and they can be run on rechargeable batteries. The use of NIRS to measure more than one parameter simultaneously, using portable equipment and simple protocols, will considerably improve the speed, accuracy and capacity of arbovirus evaluations and risk mapping exercises.

VectorChip

Designing and Testing Tools for Pathogen Identification in Wild Mosquito Populations



Organization: Stanford University

Location: Stanford, California, USA

Problem: Effective disease surveillance requires up-to-date knowledge of disease incidence and risk, but collection of this data from humans is limited by under-use of local health systems, which typically lack diagnostic capacity, and the cost of frequent population-based blood testing. Tracking disease in vectors can provide a reliable record that directly mirrors the dynamics of human infections, but collecting such data with traditional methods at scale has prohibitive challenges: they require bulky, chemically- or even human-baited traps for mosquitoes that have to be taxonomically sorted by hand, and individually selected for dissection and downstream processing using highly specialized and expensive equipment.

Solution: A novel microfluidic platform - VectorChip - that enables the large-scale autonomous collection of individual saliva droplets originating from single mosquito bites that can be used to identify the mosquito and pathogen species, including a broad range of human biting mosquitoes (Anopheles, Aedes, Culex) and numerous pathogens (including Zika, Dengue and Malaria). The low cost of sample collection and analyses allows for high spatiotemporal resolution monitoring of pathogen occurrence in mosquitoes. This continuous and fine-grained monitoring of mosquito-borne infections enables the design of swift, effective and minimal interventions to control their spread.

VECTOR SURVEILLANCE

Intelligent Trap to Enhance Zika Surveillance

Developing a Trap that Attracts, Captures, and Automatically Classifies Ae. Aegypti Mosquitoes

Organization: São Paulo University

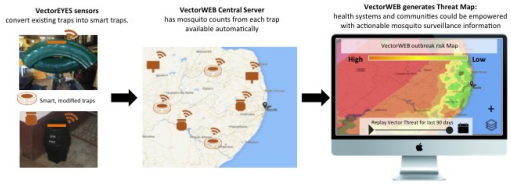
Location: São Paulo, Brazil

Problem: It is essential to eliminate the misconception that the Ae. aegypti control is an exclusively public administration problem. The solution requires the participation of the public administration at several levels, including educational campaigns, epidemiological surveillance, and public health; however, mosquito eradication can only be possible with the active participation and support of the population.

Solution: The team will produce an inexpensive, intelligent trap that will empower the population with the knowledge of Ae.aegypti densities, motivating mosquito control activities. The trap attracts and captures adult Ae. aegypti mosquitoes, automatically classifies captured mosquitoes into species and sex and provides counts of these insects and then connects to mobile devices, providing local density estimates of the mosquito population. The mobile app instructs the users to control possible mosquito aggregations and breeding locations in their residences. It also uses geo-referenced services and weather forecasting to contextualize the analysis and control activities.

VectorWEB

A Low-Cost Network of Cloud Connected Ovitraps



Organization: Johns Hopkins University Center for Bio-engineering, Innovation, and Design

Location: Baltimore, Maryland, USA

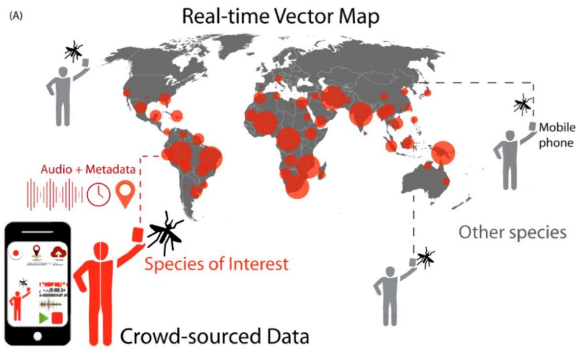
Problem: Currently, mosquito surveillance efforts are neither timely nor dynamic. Most mosquito surveillance requires sending an experienced technician to field sites to collect mosquito larvae, set out new adult mosquito traps and bring samples back to be identified and counted in the lab. Mosquito traps are typically only checked weekly and, as a result, mosquito population growth data are not immediately available and are time and human-resource intensive to collect.

Solution: VectorWEB is a novel low-cost, cloud connected system of smart ovitraps that will provide real-time mosquito surveillance data to health administrators, communities and individuals. This proposed mosquito surveillance allows for outbreak modeling, targeted resource allocation/redirection and community-driven interventions. VectorWEB's real-time surveillance information will give public health professionals the tools to develop targeted interventions and provide individuals key information to better understand their risk, which is a major driver of protective behavior. VectorWEB will also allow health systems to leapfrog critical gaps in current methods. Eventually, VectorWEB data may be combined with data on local suspected infections to better understand the infectious disease dynamics of Zika virus outbreaks.

VECTOR SURVEILLANCE

MosquitoFreq

Crowdsourced Detection of Mosquito Species Using Simple Flip Phones



Organization: Stanford University

Location: Stanford, California, USA

Problem: It is imperative to accurately and sensitively monitor the complex transmission dynamics involving mosquitoes and man. However, the scale of such an effort can be overwhelming, as there are more than 200 million insects for every human being on our planet. Surveying these vast and diverse populations poses the tremendous challenge of tracking billions of mosquitoes, to get a statistically accurate picture of their interaction with humans

Solution: Using a simple flip-phone, this application allows for the detection of mosquito species using acoustic surveillance through global crowdsourcing. Mosquito-generate species-specific sounds (from flapping wing beats) that can be recorded on a cellphone by any individual across the world. The distinct frequencies are processed to build distinct biomarkers for a given species, and together with phone-based metadata enable the species-specific identification of mosquitoes in near real-time. This citizen science endeavor will dramatically amplify our capability to probe vector populations at high spatio-temporal resolutions, thus enabling truly data-driven solutions for the monitoring and control of mosquito-borne infectious diseases.

Mosquito Challenge Community Campaign

Kid Citizen Science to Combat Zika

Organization: Institute for Global Environmental Strategies and University Corporation of Atmospheric Research

Location: Arlington, Virginia, USA
Boulder, Colorado, USA

Problem: The global health crisis posed by vector-borne diseases is so great in scope that it is insurmountable without the active help of tens or hundreds of thousands of individuals working to eradicate risk in communities around the world.

Solution: This initiative connects health education, environmental awareness, scientific discovery and community-based action in a citizen science effort with direct benefits to NASA science and public health decision-making. Using the GLOBE Program's Mosquito Protocol, citizen scientists collect and share mosquito data and then use the data to develop a local mitigation strategy that reduces the risk of disease in their communities. This project will create new data sets that do not exist today, catalyze populations at risk (primarily students) to better understand their environment and mitigate risk, delivers the new data sources to those that need it (health officials, citizens), and enables the efforts to be replicated throughout the world.

Rapid Habit Optimization Tool (R-SHOT)

A Field Tool that Recommends Optimal Habits and Motivational Tactics

Organization: Johns Hopkins Center for Communication Programs

Location: Baltimore, Maryland, USA

Problem: To stop Zika in its tracks, households and communities in affected areas need to make the proper and consistent cleaning of large standing water sources a habit. Changing habits and attitudes can be very difficult, and most personnel in the field do that have the tools for identifying and creating vector control habits.

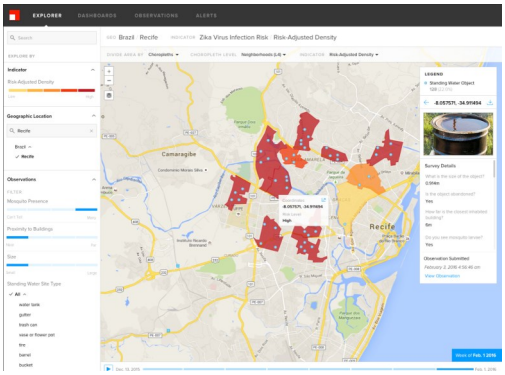
Solution: The Rapid SBCC Habit Optimization Tool (R-SHOT) is a simple field tool combining local data with evidence-based principles to recommend the optimal habit and motivational tactics for a given audience and setting. The tool will help communities determine how to disrupt existing habits and insert new vector control habits into people's lives, what the most effective motivational levers to drive behavior change are, and how these tactics should be tailored/optimized for different settings and audiences. Compliance will remain low if people need to think carefully about when, how, and why to act to prevent Zika. Vector control behaviors for Zika need to become "automatic habits". To be successful, habit creation tactics need to be tailored to local contexts and leverage the existing behaviors of end users.

Citizen-led Disease Risk Mapping and Vector Monitoring

Data Analytics Platform to Collect Geo-Tagged Data on Environmental Risk Factors

Organization: Premise Data

Location: San Francisco, California, USA



Note that this is sample data

Problem: Current measures against mosquito-borne diseases are heavily reactive, targeting vector control activities primarily after infections are reported. Current reporting mechanisms are slow and manual, which reduces experts' service delivery and prohibits timely aggregation of localized data to maximize operational impact.

Solution: Premise will enhance existing surveillance and vector control efforts by deploying its mobile-based data and analytics platform, which measures hyperlocal ground truth in real time. A network of local data contributors in the selected municipalities will collect geo-tagged data on environmental risk factors, which will be transformed into a daily heat map to enable real-time reporting for vector control workers and community leaders. Premise's solution will improve the speed, quality, and accessibility of risk-identification information, thereby allowing vector control workers to detect threats earlier and respond in a more targeted way. The insights generated by Premise will enable policy makers to more strategically target resource allocations for remediation efforts based on evidence and potential future outbreak through predictive modeling

Identifying Data "Cold Spots"

Identifying and Forecasting Zika Hot Spots by Finding the Data Cold Spot

Organization: Dimagi

Location: Cambridge, Massachusetts, United States

Photo Credit: TulaSalud

Problem: To combat Zika and future threats, it is crucial for health care systems and policy makers to identify and forecast geographies that have been impacted or are likely to be impacted by Zika before the disease spreads. By analyzing communities that are data "cold spots" - where little to no data from exists, from health indicators, to demographics, to banking data - it's often the case that communities in these cold spots have not been checked, mitigated against, and/or treated for Zika. The challenge for health care systems and policy makers is to find these cold spots, and take action before data cold spots become disease hotspots.

Solution: Dimagi, the Arnhold Institute for Global Health, and TulaSalud (supported by the Tula Foundation), will leverage one of the most widely used Frontline Worker systems, CommCare, and cutting edge geospatial and predictive algorithms from ATLAS to identify cold spots and compute their risks for different diseases across Latin America. This information can be acted upon to gather more information to detect and manage disease outbreaks. The program will combine three key elements: real-time geo-coded data from front-line workers who are using CommCare, automated population estimates from satellite image analysis through machine learning, and data-driven Zika risk indices inferred from additional spatial and health data such as density of pregnant women, bodies of standing water, air temperature, and humidity. These inputs will be combined, using open standards such as OpenHIE when appropriate, with a new algorithm to create a risk score for cold spots. This new approach will provide actionable insights for managers and decision makers (e.g. community health worker managers, MOH) into where to prioritize short-term resource allocation.

DISEASE SURVEILLANCE

Telecom Data for Enhanced Zika Surveillance

Merging Telecom Data with Zika Incidence Data to Create Nearly Real-time Monitoring of Zika Risk Flows

Organization: Dalberg Data Insights

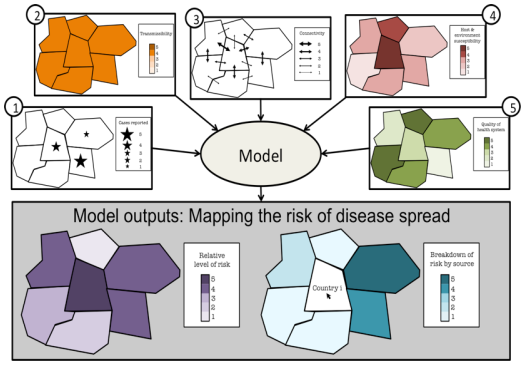
Location: Brussels, Belgium

Problem: The main driver of long-distance Zika transmission are human travelers who are responsible for introduction of the disease into new locations. However, little is known about mobility patterns of people in developing countries, and reliable systematic insights regarding people's travel are not available for surveillance and intervention planning.

Solution: The Dalberg Data Insights team will leverage telecom data which is systematically collected, covers large proportions of population and is rich on information about individual and collective mobility. This data is routinely collected by mobile phone operators for billing purposes and, when aggregated to small geographical areas, can be merged with Zika incidence data. Dalberg Data Insights will develop an interactive user-friendly tool that allows for nearly real-time monitoring of population movement and related Zika risk flows, thus enabling identification of new areas susceptible to Zika introduction, and prioritizing small-scale areas where Zika interventions would have the highest impact. Insights from the app will be used for strategy planning at the state level in Brazil. This means a significant improvement in data availability for decision makers, who currently do not have any information on people's mobility and expected spreading direction.

Mapping the Risk of International Infectious Disease Spread

User-friendly Tool Mapping the Risks of Outbreak Events



Organization: International Society for Infectious Diseases/ ProMED/Imperial College London/HealthMap/healthsites.io

Location: Brookline, Massachusetts, USA

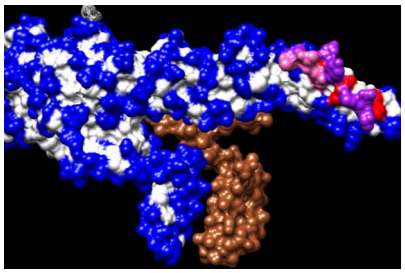
Problem: In our increasingly interconnected world, it is crucial to understand the risk of an outbreak originating in humans or animals in one country or region and then spreading to the rest of the world. This has been done in the past for specific pathogens, but there is no automated probabilistic framework that allows real-time mapping of the risk of exportation of an outbreak event from country X to any other country Y.

Solution: ISID, along with Imperial College London, HealthMap, and Healthsites.io, will develop and deploy a user-friendly tool to estimate and visualize risks posed by outbreak events reported on ProMED to the rest of the world by combining multiple data streams into a single probabilistic framework. Developed for one pathogen and focusing on one geographic region, the prototype will be designed to be rapidly scalable by extending it to pathogens of significance to humans and animals on a global scale. The system will inform public health experts, health care workers, and the public of the risks of an outbreak spreading, and will aid government and non-governmental decision makers globally in allocating resources and preparing for the possible importation of an infectious disease threat to their country or region.

DIAGNOSTICS

Identify Peptides to Speed Development of Zika Diagnostics

Peptides to Distinguish Flaviviruses



A 3-D structure of Zika virus E (white) and M (brown) proteins with amino acids exposed on the surface colored in blue. One region we predict to be recognized by the human immune system and used to detect Zika virus is colored in red and purple.

Organization: J. Craig Venter Institute

Location: Rockville, Maryland, USA

Problem: Zika-specific surveillance is difficult because clinical confirmation requires detection or sequencing of viral RNA, which only circulates in the human bloodstream for approximately 1 week after onset of symptoms, and because there is broad cross-reactivity of existing serological methods. Accurately measuring the prevalence or diagnosing a patient after recovery from infection depends on the ability to distinguish serum reactivity among the various Flaviviruses.

Solution: The team proposes to design a high-throughput peptide array technology to identify immunodominant peptides capable of distinguishing 10 Flavivirus taxa. Using the identified immunodominant peptides, the team will generate an indirect ELISA protocol that can be used in developing countries to accurately measure the seroprevalence of multiple Flavivirus species simultaneously, including ZIKV and be developed further into a point-of-care diagnostic. The solution will provide increased insight into the demographic, geographic, and clinical attributes that contribute to ZIKV infection. The peptide array results will greatly augment the 9-currently-known human epitopes for non-Dengue Flaviviruses and will enhance future surveillance and detection efforts.

Handheld Point of Care Diagnostic

Rapid Handheld Diagnostic for ZIKV, DENV, and CHKV

Organization: Abbott's Ibis Biosciences Business

Location: Carlsbad, California, USA

Problem: Existing tools to detect ZIKV are laboratory based, require clean facilities, reliable power, and a cold chain that is not readily available in areas of most need. Obtaining early, accurate medical diagnostic information is critical to properly manage the response to ZIKV and other emerging pathogens.

Solution: Ibis proposes to move three technologies from the lab to the field to address critical unmet needs. The team will develop an automated collection, sample preparation and storage cartridge that can be used to purify viral nucleic acids from blood, urine, sputum, and nasal swabs using a Mobile Analysis Platform. They will also enhance an assay for patients presenting with fever to identify viral infection using a finger stick of blood, and a customized assay kit designed for use on the Mobile Analysis Platform. Finally, the team will develop an immunoassay for ZIKV on the Mobile Analysis Platform. They will also enhance an assay for patients presenting with fever to identify viral infection using a finger stick of blood, and a customized assay kit designed for use on the Mobile Analysis Platform. Finally, the team will develop an immunoassay for ZIKV on the Mobile Analysis Platform. The combination of these three technologies will support testing of specimens in the field and provide the ability to extract nucleic acids from blood, urine or swabs using the same hardware that can also be used to perform specific PCR-based assays, with the potential to reduce cost, simplify logistics, and increase speed to diagnosis.

DIAGNOSTICS

Viro-Track

Rapid Point of Care Diagnostics for ZIKV, DENV, CHKV Using Blue Ray Technology

Organization: BluSense Diagnostics

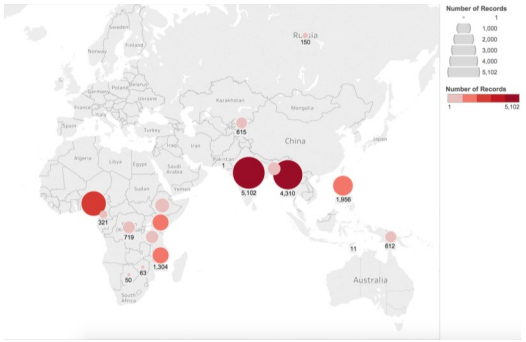
Location: Copenhagen, Denmark

Problem: In order to control the epidemics, and to provide care to infected people avoiding further complications, ZIKV blood tests need to be available at the point-of-care (POC) without the need of central hospital laboratories. Tests should be affordable, quantitative, easy-to-run, requiring minimal sample, and results should be quickly available.

Solution: BluSense is developing a one-drop-of-blood quantitative POC tests for DENV and ZIKV. The solution consists of a reader, and single-use blood test cartridges, specifically designed for targeting different viruses. The VIRO-Track cartridges have been designed and developed to be the first quantitative rapid tests able to quickly and accurately diagnose dengue, zika and chikungunya, using a single drop of blood. By combining microfluidic technology and a patented opto -magnetic nanoparticle-based readout, differential quantification of biomarkers is carried out in few minutes, with minimum user interaction. VIRO-Track will allow doctors operating far from centralized laboratories to quickly identify the severity and the nature of the infection, without the need of waiting for lab confirmation and will allow patients to receive appropriate treatment promptly.

Aspect

IoT Software to Prevent Future Outbreaks



SystemOne's I-o-T software to prevent future outbreaks

Organization: SystemOne

Location: Springfield, Massachusetts, USA

Problem: Historically, diagnostic devices in the developing world have operated in the dark, with results copied by hand to paper forms and registers then transported by motorcycle to report. This delays treatment, increases time for disease to spread, and makes visibility into the system and resource allocation nearly impossible.

Solution: SystemOne is developing a connectivity platform (Aspect) that provides an end-to-end solution enabling diagnostic devices to report results and integrate with health systems in real-time. The web-based application delivers disease and device information with easy to understand dashboards and messaging to key stakeholders around the world for appropriate action. The solution allows visibility into diagnostic systems and results, which enables reduced time to patient treatment, real-time surveillance of disease, and clear picture of device operation and supply consumption.

UAV Network for Surveillance and Delivery

Health System Strengthening for Routine Threat Surveillance and Commodity Delivery by UAV Networks

Organization: Vayu

Location: Ann Arbor, Michigan, USA

Problem: Poor ground transportation infrastructure impedes over 1 billion people worldwide from accessing consistent quality healthcare services. Health outcomes suffer without the essential commodities and supplies needed to provide health care services and appropriate disease surveillance systems to identify and respond to emerging threats. The reach and frequency of the surveillance network is severely limited when expeditions require a team of trained researchers carrying heavy equipment including refrigerators and generators for temperature-sensitive samples.

Solution: In partnership with Stony Brook University and Johns Hopkins School of Medicine, Vayu will develop, pilot and evaluate the potential to scale the use of Unmanned Aerial Vehicles (UAVs) to strengthen national health systems' coverage, reach and responsiveness to address existing and future health threats. The pilot will focus on Ministry of Health mandated institutions that provide health services nationwide, whose operations in remote areas are hindered by poor roads. The team will create an optimized, reliable, and cost-effective UAV-integrated system that can support the delivery of products to last mile facilities as well as pick up samples and other critical items from those facilities. The proposed work will be in Madagascar, and the results will provide essential information for integration of UAVs to healthcare networks in other countries similarly challenged by poor road infrastructure. Health system strengthening is critical for preparedness to combat the next emerging threat before it occurs.

Aerial Robotics for Vector Control

Sterile insect release mechanism that is compatible with UAVs

Using Aerial Robotics to Reduce Zika and other Threats to Public Health

Organization: WeRobotics

Location: Washington D.C., USA

Problem: When well integrated with other conventional control methods, the sterile insect technique (SIT) is a powerful additional tool to fight mosquitoes, allowing populations of human disease vectors to be managed with less insecticide use. However, traditional ground-based release methods are limited to areas accessible by land and it's difficult to achieve uniform distribution.

Solution: WeRobotics in partnership with Joint Food and Agricultural Organization/International Atomic Energy Agency (FAO/IAEA) Insect Pest Control Lab (IPCL) will develop a release mechanism compatible with Unmanned Aerial Vehicles (UAVs) to ultimately release sterilized male mosquitoes aerially. The team will conduct lab-testing and field-testing of the release mechanism. In addition, testing will be carried out to identify optimal flight parameters that UAVs need to follow in order to maximize the impact of the release mechanism. The teams will follow the WeRobotics model to accelerate and scale community-engagement through the localization and sustainable use of appropriate aerial robotics solutions.