Ebola Innovation Summit
21st Century Tools to Tackle Ebola and Improve Health

Summary Report
# Ebola Innovation Summit

## Summary Report

April 21, 2015

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OVERVIEW: A Call and Opportunity to Innovate Together

More than 300 participants from across public and private sectors, and around the world, gathered on April 21, 2015 at the Innovation Hangar in San Francisco to discuss ways to bridge the innovation gaps that stand in the way of getting to zero Ebola cases and improving health systems globally.

The event was convened by the Paul G. Allen Family Foundation, in partnership with the Skoll Global Threats Fund and the U.S. Agency for International Development (USAID). Attendees came from a range of backgrounds – 35% from the private/technology sector, 25% from nonprofits, 15% from government, 9% from academia, 6% from philanthropies, and others from a variety of fields.

The program was deliberately nontraditional. It aimed to foster collaboration and innovation, and conversations were structured to break familiar patterns and spark new ideas. Throughout the day, lessons learned from Ebola response were intertwined with action-orientated conversations among participants.

The event brought together leaders from Sierra Leone, the African Union, Silicon Valley entrepreneurs, US government officials, officers from multilateral agencies such as UNICEF and the World Food Programme, scientists, health workers, and in-the-field innovators to connect, share insights and opportunities and develop new partnerships. As one facilitator put it, “I have never been at an event where people were so desperate to talk with each other.”

The morning began with a welcome from philanthropist and entrepreneur Paul G. Allen, Founder of Vulcan, Inc. and the Paul G. Allen Family Foundation (PGAFF), as well as Vulcan, Inc. President Barbara Bennett. PGAFF Ebola Program Director, Gabrielle Fitzgerald, then set out the event’s goals in bringing people together to develop new technologies and approaches to get to zero Ebola cases and prepare for the next challenge—whether it is Ebola or another outbreak.

From there, a series of panels and speakers dove into deeper discussions on a number of topics, including lessons learned from the Ebola response, the need for innovation to respond to global threats, an overview of innovation challenges that were being addressed during the summit, a discussion on scaling innovation in the developing world and a discussion of how innovation happens (Hint: hard work and many people working together over a long period of time).

At lunch, the participants moved to breakout sessions to focus on one of four Innovation Challenges: Data Strengthening and Coordination, Diagnostics, Social Mobilization and Emergency Infrastructure and Logistics. These focus areas were identified before the Summit through conversations with more than 70 organizations involved in responding to the Ebola outbreak of the past year. In the Challenge groups, sector leaders and subject

“Ebola is not somebody else’s problem. It is ours. Let’s define a collective vision and ways to create a better future.”

- Paul G. Allen

Paul Allen opens the Ebola Innovation Summit.
matter experts were paired with facilitators from entrepreneurship centers around the country to lead groups. In each Challenge, 60-80 participants worked through a process to identify and advance new collaborative solutions to the innovation gaps identified in the Ebola outbreak.

At the end of the day, participants reconvened for a closing plenary to report back on the solutions discussed in each Challenge group and share more opportunities to work together. During this time, Dr. David Nabarro from the UN Special Envoy on Ebola, invited the group to join his weekly Ebola response leaders call to stay connected to each other and the ongoing efforts to stop this outbreak. Gabrielle Fitzgerald closed the day with an announcement that PGAFF will provide support to advance the new ideas and partnerships coming out of the Summit, and will reach out to other funders.

After the closing session, a reception featuring local specialties was held while participants continued informal conversations for over two hours.

As participants left the Innovation Hangar, several shared reflections from the day including:

- “This event helped private sector companies and entrepreneurs see the role they can play in pandemics”
- “Today the technology and development communities came together. We've been wanting to work together for a long time but didn't know how.”
- “An amazing conversation. A healthy conversation”
- “I saw people I haven't seen for a longtime and met new people.”
- “I'm going to work with someone now that I have known for years but never would have connected with on my next project if not for this event.”
- “This was a win because this group of people acknowledged together the problems and ways to move forward. It was a significant advancement in the sector.”
- “This galvanized the community.”
A CLOSER LOOK AT THE MORNING SESSION

View from the Frontlines of the Response

The morning session included a panel discussion that featured remarks from African leaders who are leading the fight against Ebola in their own countries. Hon. Madina Rahman, Sierra Leone Ministry of Health, described the shock and confusion that accompanied the initial outbreak.

“When the Ebola crisis struck, people were dying, and we didn’t know what to do,” Minister Rahman said. “Our health system was weak and fragile, and that is what landed us here. If our systems were a little bit stronger, we would not be sitting here today.”

Minister Rahman pointed out two critical lessons that Sierra Leone learned over the course of the epidemic. First, she emphasized the importance of health systems and the need to actively invest in strengthening the public health infrastructure to prevent the next outbreak.

Second, she argued in favor of creating separate Ebola treatment facilities to ensure that the population does not respond by avoiding medical system entirely. Minister Rahman noted that more than 90 percent of recent deaths in Sierra Leone were not Ebola-related, but instead resulted from people who did not receive medical attention for diabetes, hypertension, or other health problems.

Dr. Olawale Maiyegun, African Union, emphasized the importance of working in partnership with affected countries, rather than dictating solutions. He called on the international community to learn the lessons of the HIV response, and provide assistance when needed, but to look for leadership on the ground in the affected countries.

Dr. Daniel Lucey, Georgetown University Medical Center, who has made several trips to West Africa to treat Ebola patients, noted the importance of innovation at all levels, both high-tech and low-tech. Dr. Lucey discussed a number of innovations, such as using drugs intended for cholera for Ebola patients, making oral rehydration therapy more easily available and using larger tents to improve patient comfort in the Ebola treatment centers.

“The most important innovation was helping the stronger patients take care of the weaker patients,” Dr. Lucey said. “That’s what changed most for us.”
Global Leaders Describe Lessons Learned

A number of global leaders also addressed the summit, offering lessons from the Ebola response. Dr. David Nabarro described how Ebola had produced a paradigm shift on infectious disease. The Ebola pandemic, Nabarro explained, had permanently elevated pandemic diseases to a level that would command the attention of presidents and prime ministers, not only ministers of health.

Nabarro went on to list a number of “Ps” that he felt the Ebola response has taught the world: The importance of putting “people” first, the critical role of “presidents” and political leaders, the value of working with “partners”, the importance of using “precision” data and the need to “prepare” for the next epidemic, among other lessons.

Denise Rollins of USAID highlighted the U.S. Government’s response to the Ebola outbreak, which included bringing together resources from across agencies to combat the outbreak and creating a platform to let other governments support the outbreak as well. She also asked the question, “How do we help these countries rebuild?” This highlighted the need to repair the economic system, school system, and other important areas to help Liberia, Sierra Leone and Guinea get back on track.

Dr. Rajiv Shah, former administrator of USAID and currently with the Georgetown University School of Foreign Service, emphasized the importance of having precise, real-time data to respond to emerging threats like Ebola. Shah also described the importance of bold leadership in taking innovation to scale.

“How do innovations actually get to scale?” Shah asked. “It takes a certain boldness, a certain willingness to break rules. It takes a willingness to provide real political leadership—not when it is easy, but when it is hard—in order to drive these changes at scale.”

Dr. Larry Brilliant, Skoll Global Threats Fund, delivered a message of hope to the delegates, citing the world’s success against smallpox as an example of what a global effort could achieve. Smallpox killed 500 million people during the 20th century, Brilliant explained, but had been defeated by vaccines, as well as innovative public health measures.

“It took innovations to solve the great problems we have had in global health in the past,” Brilliant said. “Fortunately, there is a ton of great innovation happening now.”
AFTERNOON CHALLENGE GROUPS:
Responses to Innovation Challenges

The afternoon gave the delegates an opportunity to break into four specific challenge areas. The sessions were kicked off by Innovation Chair, Scott Case, who asked delegates to stand if they had 40, 30, 20, 10, 5, or 1 year of experience in their fields, demonstrating that, together, they had thousands of years of experience that they could draw on to develop innovative solutions.

Rather than coming from a lone genius, Case reminded delegates that innovation most often emerges from layers and layers of expertise, and that every new advance builds upon the work of a number of people over a long period of time. Case challenged delegates to keep up the momentum on innovation to fight Ebola by committing to action in the afternoon Challenge sessions.

The challenge groups focused on four areas:
- Data Strengthening and Coordination
- Diagnostics
- Social Mobilization
- Emergency Infrastructure and Logistics

Data Strengthening and Coordination Challenge Group

The Data Challenge Group was led by Merrick Shaefer of USAID’s Global Development Lab, Adam Thompson of eHealth Africa, and Andy Stoll of Seed Here Studio as the facilitator. Dr. Raj Shah opened the group with an introduction.

The group’s mandate was to brainstorm better ways to enable collection and sharing of health data, including event detection, contact tracing, decision support, client tracking, SMS communication, and map-based visuals. The delegates in the Data Challenge Group noted that the Ebola-affected countries stand at a critical juncture, where there is an opportunity to invest now to build real-time data systems capable of transforming epidemic response and also improving health systems more broadly. Opportunities include the possibility of creating new platforms to crowd-source health data and the promise of developing new data sets that are open to all researchers.

Challenges
The Data Challenge Group noted a number of specific challenges impairing the better use of data to combat Ebola. These included:

- Limited feedback loops: Data is collected by workers on the ground in Ebola-affected countries, but these data collection workers are often not informed about the purpose of their work or the results of the data they collect. Sharing more information with these workers could increase public support for data collection and improve the quality and quantity of data collected.
- Duplicative data: Data collection efforts are often duplicative, and the forms used are often needlessly complex, creating confusion and lowering the quality of data collected.
• **Data ownership and governance**: Data sets are owned by many different types of organizations, and data are often not shared easily between different groups. This leads to competition among systems, perception of overlapping solutions, and the absence of technical governance mechanisms that can produce institutional paralysis, duplication of effort, and missed opportunities.

**Opportunities**
The Data Challenge Group reached consensus on three major recommendations:

- **Expand interoperability of systems**: Data systems should be harmonized to improve mechanisms for shared health data collection, event detection, contact tracing, decision support, client tracking, SMS communication and map-based visuals. Prioritize information management and coordination across data gathering entities. This would move us toward a global real time data portal.

- **Invest in local data capacity**: Ebola response efforts should prioritize information management, work to provide feedback to community data collectors, improve the design of data collection tools to make them more user-centered, and leverage high-performing data collectors.

- **Create open-access data sharing policies**: The delegates agreed that more work should be done in advance on the legal and policy level to ensure there is an existing framework to allow sharing of data.

- **Address privacy and civil liberties issues**: Delegates discussed the need to address privacy issues that impact data sharing. This includes developing polices that apply to cell phone companies, who have sometimes been reluctant to share data, even data without personally identifiable information, with public health researchers.

**Diagnostics Challenge Group**

The Diagnostics Challenge Group was led by Gene Walther, with the Paul G. Allen Family Foundation, Mickey Urdea and Rich Thayer of Halteres Associates, Mark Perkins of FIND, and facilitated by Trey Bowles of the Dallas Entrepreneur Center and Matt Hunckler of Verge.

After initial discussion, the breakout separated into two sub-groups: Lessons Learned and Fever Panel.

**Lessons Learned Sub-Group**
The Diagnostic Challenge Group prioritized a number of lessons learned from the effort to develop an Ebola test with an eye toward pain points that would significantly advance deployment efforts and are not yet being addressed by other groups. These included the following challenges and proposed solutions:

- **Challenge**: Lack of trained workers to administer diagnostics: There is a lack of workers trained to administer, analyze and develop diagnostic tests.

“Back during the height of the epidemic, the WHO had tons of researchers asking if they could use our data. But we were only the custodians of the data—the data was the property of the government—so we could not share it.”

- Ravi Shankar Santhana, WHO
Possible solution: Delegates proposed the creation of a “Peace Corps” system for diagnostics, which would allow experienced professionals or recent graduates to live abroad and train local populations to use and develop diagnostics. To have an impact, these volunteers would place themselves on a list ready to be mobilized, like the National Guard, in times of outbreaks.

Challenge: Limited access to clinical samples: Clinical samples are controlled by a variety of different institutions (WHO, CDC, MOHs, etc.), and it is difficult for researchers to access samples in a timely manner.

Possible solution: Delegates proposed establishing a collective database—including demographic and outcome data—that would make data more widely available. This would include working with countries, before the next epidemic, to develop protocols for transparent and ethical use of collected samples for prioritized research related to improved epidemic management.

Challenge: Lack of harmonization between regulators: Regulators were slow to approve diagnostic tools because of clashing regulations among different regulatory bodies.

Possible solution: Delegates proposed working to bring regulators together now to determine what data will be required in future outbreaks to obtain emergency authorization. This authorization would serve as a certificate of free sale in the country of manufacture and an authorization to import and sell in the country of use. The authorization could be carried out by any stringent regulatory authority, but would have time limits, both for how quickly a decision must be made and for how long the authorization would last.

Challenge: Lack of R&D funding for diagnostics: funding for diagnostic research and development needs to be broadened, with smaller amounts of funding going to an array of different research topics.

Possible solution: Donors must maintain funding for diagnostic development between epidemics, and should “right-size” grant funding for R&D. Rather than large amounts of money going to one idea, it would be wiser to invest in several $3-5 million grants to explore different approaches. Additionally, donors should invest in supporting efforts to transform successful research into marketable and sustainable products that satisfy unmet needs.

Fever Panel Sub-Group
The other subgroup of the Diagnostic Challenge Group met to consider ways to develop a fever panel that can be completed through development by June 2016. The team considered use cases, economic models, number of pathogens that may constitute a fever panel and complexity of the panel.

The subgroup made the following recommendations:

- **Target location and intended use:** The greatest unmet need discussed was for a field test for use in community or village settings, such as health posts in Ebola affected areas, to help determine whether isolation and/or referral is indicated and as a triage test to help screen patients entering Level 1 health centers, both to protect medical workers and other patients.

- **Usability:** The test must be easy to use with the result clearly displayed, because some workers may be partially illiterate. The result must be actionable, e.g., to inform treatment or other action to be taken.
Key question: The most important issue the test needs to determine is who to isolate and who does not need to be isolated. For example, the test needs to be able to distinguish Viral Hemorrhagic Fever (VHF) from malaria. The test must also distinguish between other diseases that present with similar clinical symptoms, such as Lassa fever, typhoid and measles, upon initial presentation.

Versatility: The sub-group selected two use cases on which to give priority focus at this time. These are 1) a screening test for use in remote/village/community settings, and 2) a triage test to be performed on patients with fever who enter health centers (or maybe referral hospitals) to determine who should be isolated, both to protect the hospital staff and for the safety of other patients. There was some discussion because the test is likely to be used interchangeable for both indications anyway.

The subgroup selected the following five targets for initial focus: Malaria, Lassa, Ebola and/or Filovirus family, Typhoid and Measles. Going forward, there will be significant work required to complete the Fever Panel Target Product Profile. Some of the parameters will require input from modeling work that will need to be undertaken quickly. For example the cost justification (price) will need to be modeled to show the impact value that can justify the price per test for the fever panel. Other inputs will simply be informed assumptions in order to initiate the development work by the end of June 2015.

Social Mobilization Challenge Group

The Social Mobilization Challenge Group was charged with identifying new ways to accelerate behavior change in emergency response and recovery. They focused on more effectively incorporating community perceptions into program design and situational analysis. The session was led by Mark Smolinski from Skoll Global Threats Fund, Dr. Sharad Sapra with UNICEF, Dr. Mark Grabowsky from the UN, Abdul Jalloh with the Medical Research Centre, and facilitated by Doug Vilsack from the Posner Center.

Challenges

The Social Mobilization Challenge Group identified a number of challenges to implementing behavior change. These include:

- **Holistic communication:** The group discussed the challenges associated with ensuring that communications on Ebola goes both ways—from top to bottom, but also from the community up to the government and international partners.
- **Return on engagement:** The group discussed the need to incentivize community participation in information gathering. This can include soft benefits (information, education, community validation), and also hard benefits (cell phone credit, solar chargers, health services).
- **Legal/privacy infrastructure:** The group discussed the need to ensure that legal systems are in place to govern the collection of data. This also needs to include privacy protections to ensure that data collection respects privacy.

Dr. David Nabarro also presented five specific questions about combatting Ebola in Guinea.
1. When is it best to listen to communities versus telling them what to do? There is a huge tension between telling people how to bury their dead versus listening to people about why they are not burying bodies safely. What is the best course of action?
2. How do you identify the “right” leaders? What happens when the local partners you are working with identify one set of leaders for you to partner with, but then the government tells you those are not the right leaders?
3. How can we address the perception of militarization? In Guinea, communities see health workers wearing uniforms, driving military-style cars, etc. How can we address this challenge and be viewed more favorably by the local population?
4. Should we use traditional greetings and offerings? Healthcare workers may be hesitant to use traditional greetings or follow traditional rituals when working in communities. When is it appropriate to decline?
5. What is the right pace of interaction? Many communities do not open up to talk about their problems until healthcare workers have spent several days eating and talking with the community. When is it appropriate to rush this process?

Opportunities
Members of the Social Mobilization Challenge Group identified a number of potential solutions to improve communications practices:

- **Improve relationships with communities**: Social mobilization workers should do more to recruit staff from within the communities, and should work with communities to ensure that the benefits of engaging with international partners accrue to the communities.
- **Engage local community leaders**: Social mobilization workers should do more to engage respected local spokespersons, such as sports stars, local media/celebrities, religious leaders, etc. to promote health messages.
- **Engage mass communication tools**: Social mobilization workers should effectively use radio and other mass media to disseminate information.
- **Tailor messages**: Social mobilization workers need to tailor messages to their audiences, because mothers may respond differently than fathers, youth, etc.
- **Improve ways to measure impact**: Even while operating in a crisis setting, social mobilization workers must find ways to measure the impact of their work, including the assessment of long-term public health, social, and economic impacts.

Emergency Infrastructure and Logistics Challenge Group

The Infrastructure and Logistics Challenge Group was charged with reimagining the ideal emergency infrastructure and logistics system to overcome physical infrastructure challenges in order to effectively move people and supplies during health emergencies. The group was moderated by Tommy Thompson from the World Food Programme, Kelly Bradley and Dave Taylor from USAID, and facilitated Jess Knox from Olympico Strategies.

Challenges
The group agreed on a number of common infrastructure challenges, including:
• **Demand modeling:** It is difficult to model demand for specific products, such as PPE, making it difficult to know what is needed.

• **Shelf-life/storage:** There is insufficient information about the shelf life and storage requirements of various products.

• **Lack of information about suppliers:** There is not enough information about who the potential equipment suppliers are, and what their prices and delivery timelines are.

• **Supply chain challenges:** Due to a limited number of manufacturers and the large quantities of items needed, some significant delays occurred disrupting delivery schedules sometimes by weeks and months. These delays led to timing problems with supplies being delivered long after they were needed.

**Opportunities**

• **Closer coordination with governments:** Donors can do more to work with local governments to build local system and local capacity to manage logistics challenges.

• **Partnership with private sector:** There is immense capacity for the humanitarian sector to tap into the capacity that already exists in the private sector, such as in the transportation and telecommunications industries.

• **Virtual supply chain:** Response organizations can explore ways to use technology to better prioritize supply chain challenges and share information with suppliers.

**Specific Recommendations**

• **Develop universal specs for PPE:** WHO, CDC, DOD, or another group could develop a set of universal specs for PPE, where a barcode would communicate the expiration date, standards, and levels of protection.

• **Build regional emergency response hubs:** These could be physical or digital hubs of individuals, to provide services including mapping, data services, and private-sector engagement.

• **Map capacity:** Humanitarian groups should map existing capacity in the private sector ahead of time to build bridges across those gaps.

• **Communicate with industry:** Humanitarian groups should tell industry what they need before the next crisis strikes.

• **Build relationships:** Humanitarian groups need to begin working now to establish trusting relationships with leaders in the private sector who will commit institutional, long-term support for helping problems of today and tomorrow.

*Discussion amongst the Emergency Infrastructure and Logistics group*
CLOSING SESSION

Following the afternoon’s Challenge Group breakout sessions, the delegates reconvened for a brief plenary that included reports from representatives of each of the Challenge Groups. Each chair gave a brief presentation of the main challenges, opportunities and recommendations made by their group.

Scott Case moderated the discussion, re-emphasizing a comment shared by Carol Chapelier of BBC Media Action (Social Mobilization Challenge representative), that sometimes moving slowly in tandem with others is the fastest route to significant innovation.

Among the questions that received the most enthusiasm was whether there would be a follow-up summit held in Africa. Case encouraged the person who suggested an Africa Summit to take the lead in organizing such a venture.

Dr. David Nabarro shared closing reflections with the group and invited the group to email him to be connected to his weekly Ebola response leaders call to stay connected and keep the conversation going.

Gabrielle Fitzgerald ended the day announcing that the Paul G. Allen Family Foundation will provide funding to advance the new ideas and partnerships cultivated at the Summit, and committed to encouraging other funders to support these efforts as well. Fitzgerald also shared that many participants had asked for ways to stay connected – and attendees agreed to share their contact information with each other – so that the collaboration could continue post-Summit.
APPENDIX 1: Ebola Innovation Summit Agenda

Tuesday, April 21, 2015

9:00AM Welcome
Paul G. Allen, Barbara Bennett, Vulcan, Inc. and Gabrielle Fitzgerald, Paul G. Allen Family Foundation Ebola Program

9:30AM Lessons Learned from the Ebola Response
- Hon. Madina Rahman, Sierra Leone Ministry of Health
- Dr. Olawale Maiyegun, African Union
- Denise Rollins, USAID
- Dr. Daniel Lucey, Georgetown University
- Dr. David Nabarro, United Nations

10:15AM Break

10:30AM Global Threats and the Innovation Imperative
Annie Maxwell and Dr. Larry Brilliant, Skoll Global Threats Fund

10:45AM Overview of the Innovation Challenges
- Adam Thompson, eHealth Africa
- COL Matthew Hepburn, DARPA
- Sharad Sapra, UNICEF
- Tommy Thompson, World Food Programme

11:30AM Implementation and Scale in the Developing World
Dr. Rajiv Shah, Georgetown University

11:45AM How Innovation Happens
Scott Case, Main Street Genome

12:00PM Break

12:30PM Lunch and Innovation Challenge Groups
- Data Strengthening and Coordination
- Diagnostics
- Social Mobilization
- Emergency Infrastructure and Logistics

3:30PM Break

4:00PM Innovation Challenge Recap and Closing Remarks

5:00-6:30PM Reception
APPENDIX 2: Exhibits Showcasing Innovations to Tackle Ebola

The Ebola Innovation Summit was pleased to present an exhibit of diverse concepts that bring to life new approaches and ideas around communications, data, diagnostics, health worker safety, social mobilization and logistics.

**Behavior Change Media, Africa United**
Global team of soccer stars, celebrities, international health organizations and corporations committed to stopping the spread of Ebola in West Africa. Videos developed by Africa United leverage the power of soccer in Africa and the influence that football players have in the region. The videos were developed to show solidarity for healthcare workers and remove some of the stigma and resistance they face in responding to the Ebola crisis.

**Emergency ‘Smart’ Pod, Baylor College of Medicine**
Emergency smart pod prototype that repurposes easy-to-access shipping containers as modular, scalable, rapidly deployable and potentially semi-permanent Ebola treatment units. The pod includes training and process pathways, as well as patient and supply tracking systems. It has capacity to be semi-permanent or sent into remote settings with EVD flare-ups. The pod can also be repurposed and used as a labor and delivery suite, procedural/surgical suite, primary care facility and more, depending on the location and needs of a particular community.

**Electrostatic Sprayers and Equipment, ByoPlanet**
Advanced electrostatic delivery systems that provide disinfection and decontamination coverage to any surface without the threat of cross contamination. ByoPlanet products include a mobile backpack, sprayer and canister unit. ByoPlanet’s goal is to improve overall surface and air quality while reducing the environmental footprint.

**Cepheid Xpert® Ebola Test and GeneXpert® System, Cepheid**
WHO-endorsed GeneXpert® system, Xpert® MTB/RIF test, and newly released Xpert® Ebola test, which enable accurate, rapid testing for Ebola. These products represent a dual-target design to ensure high-accuracy and sensitivity for detecting the Ebola Zaire virus.

**Rapid Test Kit and Lateral Flow Test, Corgenix and Fio**
The Corgenix ReEBOV Antigen Rapid Test is the only Ebola rapid diagnostic test authorized for emergency use by the FDA and listed by the WHO. The Fio Deki Reader is a universal reader of lateral flow tests, with connectivity to a remote information management system.

**CommCare, Dimagi**
Open source mobile platform built by Dimagi that enables health programs to build and deploy their own mobile apps. With CommCare, community health workers can collect data, register and track clients, use decision support and logic, and reach clients with SMS. Programs can then view real time reports online.

**Data Informed Response, Ground Truth Solutions**
Ground Truth Solutions in Sierra Leone provides a regular flow of data on the perceptions of frontline staff and the general population on a set of key perception indicators related to the response.
Community Education Platform, *IBM Research Africa*

Innovative community engagement platform that facilitates two-way communication between public health officials and citizens. The platform uses basic mobile phones to generate real-time, on-the-ground information about public perceptions and community needs.

*mHero, IntraHealth International*

Free communications platform that connects health workers and health officials together and to critical information that can save lives, using the basic mobile phones that most health workers already have. It offers ministries of health and health workers in low- and middle-income countries a trusted channel of information not only on Ebola, but also on a broad range of health services, including primary care, maternal and child health, family planning, HIV, malaria, and nutrition.

Redesigned Healthcare Worker Suit, *Johns Hopkins University’s Center for Bioengineering Innovation and Design (CBID), and Jhpiego*

Healthcare worker suit redesigned for quicker and safer removal with integrated cooling features and improved visibility.

Tablet for Patient Care, *Médecins Sans Frontières/Google: projectbuendia.org*

Open-source medical record system designed for relief missions, developed by Google in partnership with Médecins Sans Frontières. The system includes a server unit that runs on batteries for a week, and a tablet encased in plastic that is fully immersible in chlorine and can be charged wirelessly.

Inflatable Treatment Unit, *Otherlab*

Configurerable inflatable structures that enable rapidly deployable small-scale treatment centers. Advanced manufacturing equipment produces these structures from commodity plastics with price points that allow for short-term single-use applications.

Wearable Patient Sensor, *Rhythm Diagnostic Systems*

Disposable, blue-tooth enabled patient sensor that utilizes state-of-the-art advances in wearable technologies and analytics. The sensor goes on like a Band-Aid and enables remote measurement of key vital signs, including, ECG, heart rate, HRV, blood oxygen, respiration rate and relative depth, activity level, body position, and skin temperature. Relative blood pressure is under development.

Spray on Barrier, *SPR Advanced Technologies, Inc.*

Long-lasting, spray-on barrier that kills and repels microbes with electro-static fields to prevent surface contamination and allow for more breathable PPE materials.

Decontamination Chambers, *TOMI Environmental Solutions*

State-of-the-art, easy-to-assemble chambers that decontaminate health care workers and equipment in less than three minutes without hazardous chemicals.

*Google’s Ka-Ping Yee demonstrates the Buendia tablet system.*
APPENDIX 3: Participant Post-It Notes

The below represents the unique ideas, comments and questions posted by participants to the Challenge Boards located in the Summit general session area.

Data Strengthening and Coordination

Data Infrastructure
- What does the future telecoms look like in Africa?
- How do you extend data connectivity?
- Are there solutions for visualizing data in real time?
- What is possible with big data now that never was before?
- Develop agreements on minimal data standards for various subject areas

Role of Government
- Data governance. (Licensing, ownership, policies for responsibilities, and standardization). Lack of global framework for data sharing. Covering co-set and data sovereignty. Standardization of metadata. (How do we know we mean the same thing?)
- Support data collectors
- Give government mechanism to negotiate sharing of valuable data (across regions)
- Regional government framework for data collection and sharing liked to IHR
- Data governance and ownership especially - data use agreements are not in place, takes months to share, data are not interoperable, incentives are aligned against sharing, underfunding of coordination
- Create data sharing polices, prioritizing open access, setting the stage for precompetitive space for data - especially across funders
- Align funders around common problems/goals set by government
- Let’s not forget about privacy and civil liberties - privacy by design

Better Preparedness
- How do you do data collection when literacy levels are low?
- How do we avoid reinventing everything with each new crisis?
- Establish a toolkit for development for next time
- Develop a data integration platform that enables rapid and effective coordination of the international response by giving high-level decision makers a unified picture of the crisis and response in real time
- Pre-negotiate data use agreements
- We need a platform ecosystem map
- Logistics - open source software for inventory management for low resource settings
- Connectivity between entities of all types
- Geo-locating: addressing & finding people in space
- Increase ratio of case load trained investigators
- Form an African IED Peer Learning Network to develop regional capacity long-term
- Set up a community driven system to self-report health problems: a text based system to ping people to test how they are feeling. Use this “crowd-sourced data to generate automated alert systems (like “weather alerts”) for near real time visualization, and identify “sparks” quickly to use to deploy remedial action.
• Routinely collect actionable data with people and electronics. One trusted health worker at the community level who shares that patient data with very minimal reporting, on a constant basis.

Financing
• Create financing for non-crisis time data collection
• Create crisis philanthropic fund that is replenished by governments after it is initially used up
• Develop International Surveillance Fund
• Make ongoing investment in local data culture and capacity prioritizing information management, feedback loops to community, providers and data collectors, and community- and crowd-sourced data
• Health Insurance for health workers!

Private Sector Engagement
• Incentivize the private sector to get involved
• Smart phones and mobile data are tech-makers. Africa will be using weekly in 2-4 years. Average V.C.A.D problem? 3-5 years. These tech mobiles for data collection and information. Discrimination will be easy.

Goal Setting
• How can we better track pandemics with big data?
• Strengthen data by planning for the future, not the past
• How do you build heat maps (in real time) that help visualize different data trends?
• There is a lack of clear incentives for data sharing
• There is no feedback loop to communities and data collectors - they do not benefit from data collection. Create a quality loop that incentivizes individuals to collect and share quality data. Use data to assess low and high performing data collectors and provide feedback to the collectors. Use data to tailor training and resources for collectors.
• Define problem set, set surveillance objectives and only collect data that you need to meet objectives

Design Principles
• User-centered design with local communities
• Warning system <> Ease of Adoption <> Trust
• Use all data collection methods and technologies
• To promote practices based on science rather than fear-standardization of data collection for patient care and caregiver safety in order to guide development and implementation of effective technologies and abandonment of practices
• We need to identify the data we need to collect and choose data that errs on the side of social impact
• Remove complicated processes and forms, duplicative data collection
• Improve data quality at point of collection
• Get to the appropriate granularity of data
• Create more standards (like HXL) that anyone can adopt.
• SMS-based syndromic reporting > Crowdsourced
• Unlock context of calls/text (in addition to location) that is anonymized, to be mined
• Worry about the details: Standards, platforms, ownership, sharing, governance
Facilitate the decentralization of the response by allowing frontline responders to use the data collection tools they consider to be most effective in their location -- leverage technology to solve the data standardization problem upstream. Rapidly integrates data from new sources and tools into the unified picture as they come online in the response.

Let's start with basic data rather than big data

What are good design/order principles for interoperability?

**Diagnostics**

Emergency and Routine Infrastructure

- Community / local treatment versus hospitals
- Keep emergent infections separate from hospital infrastructure
- Diagnostics IPPE/Mobility tools: Protect diagnostics in the field society do not spread disease. Make all surfaces Anti-microbial. Prepare Surfaces to participate in fight against Ebola.
- Innovation: apply known technologies to communities, during good times, are not invasive
- Routine screening. Introduce malaria testing at schools
- Tighten Relationships of Research Labs and Clinical Diagnostic and Care Facilities

Ideas for Better Preparedness:

- Diagnostic Rapid Test to distinguish pneumonia, malaria, and Ebola as a triage/screening avenue
- Would be whether HEPA filtration would be sufficient to capture the virus but may not have been proven?
- Pre-symptomize detection
- Pretreat surfaces with bacteria and virus killing solutions to prevent incidental contamination
- How to monitor for emerging zoonotic diseases? National reference labs house in the run by either national universities or MOH’s. Make sure they have the equipment, ensembles, regiments, and training to test samples on an ongoing basis. Make sure it’s known nationwide to bring them samples. Connect them in a network so they can alert each other and international authorities and share data.
- Interstate surveillance programs automatically win primary care programs/ DX Programs
- Emergency anti-viral discovery, customized antiviral drug fragment libraries ready for testing in high -- throughput screening (HTS), labs (like GNL) on Virus in BSL-4 -100,000 tests per day!
- Develop a sustainable program that addresses routine DX as well as energy pathogens with routine surveillance

**Financing**

- Purchasing mechanism like global fund

**Private Sector Engagement**

- How can we create more access to e-reporting mechanisms? Better management.
- Free specialized cellphone’s, see health issues, and work on anti-vaccine cultural bias

**Design Principles**

- Data Intersection with results and EPI studies
- Pre-symptomatic POC, Real time diagnostics with full date connecting
- What are the best use cases to drive our work today?
• Make sure we understand the clinical and economic impact of any new potential solution/technology upfront by early outcomes modeling. Compare impact of various solutions before implementing and investing in R&D to ensure we allocate R&D’s app walls
• Technology is necessary but not sufficient. Also consider investors, training policy, adaption, access, education, quality, health, economics and other appropriate metrics.
• Incorporate information and communications technologies to prove, analyze, and report in real time what happening in the field

Social Mobilization

Social Mobilization Infrastructure
• How do we form strong social mobilization units?
• How can we tap into existing networks?
• Early detection and response preventing the next pandemic: We need to strengthen frontline community healthcare and health workers and empower/enable/train them to serve as warning systems for outbreaks. Requires a sustained investment in the health workforce.
• Few People impacted by Ebola own smart phones. If they own one, their battery is likely dead.
• From strategic aid partners: text – radio = communication with masses in Africa. Music + sports = what masses are interested in. Early Detection of infectious diseases = communication with the masses. To Strengthen African Healthcare system, strengthen music + Sport communication.
• Use the radio for storytelling and search for commonalities... has used radio on Sierra Leone

Role of Government
• Decentralization and Capacity Building of Government systems
• Governance – needs “control towers” to create, action plan, response correction, mechanism the push into the actions
• Capacity building at local level to involve local people in policy development.
• There are ships in the Calgronez streets-U.S Navy use them as warehouses or hospitals

Better Preparedness:
• Simple solutions-bottom up not top down. Infection control protocols, community/local health, leadership engaged before an outbreak.
• Networking with other areas of humanitarian aid. Learn from their lessons as well
• Create = emergency Health Channel Network of Info @ Different levels of Health Literacy and Language, mobile, radio, T.V.
• Connect with the local level through change agents such as returned peace corps volunteer who know the grass roots community
• How to help communities take ownership themselves. Registering visitors to the community, local people taking charge of it in a community
when visitors come into the community from other places. Your biggest threat are your neighbors crossing the line.

- Religious leaders and traditions. Leaders key message.
- Engage diaspora communities to disseminate messages to family and friends in home countries
- Community engagement and empowerment to take part in health service delivery - engage them to be the early warning system
- Networks Tracing – Add network items to surveys to focus on, How info is shared, with whom, how is trust built?
- Knowledge management of lessons learned from social mobilization in Ebola
- Draw from lessons/principals of other strong community builders (AirBNB. FYFT, etc.)
- How are you feeling? SMS health reporting, immediate feedback to user, return aggregate data, mothers report in family, discounts on cell cot?, village aggregate data, return illness diagnosis
- Question? How do we set the general population to support collision? Something as common as the flu? An app that poses the question “how are you feeling today?” Incentive usage: mobile phone discount? (plan usage)
- How do we share benefits/ best practices with community? Two – Way communication
- Free text service 311. Ask a health question-get a response. Allows surveillance of data gathering.
- Empower and encourage Africans to provide solutions for Africa and World! Use African private sector, e.g. PPE Mosfodine.
- Create a no more epidemics campaign to help government resources and the commitments they are making now. Everyone here joins the campaign and bring their respective assets/s skills.

Financing
- Need to use trusted voices for BCC: footballers, religious leaders, musicians
- Innovation begins and ends in community. The change happened when they recognized the problem. Bringing the ability to recognize, treat, the disease to people. DO NOT HAVE TO BRING MASSIVE HUMANITARION RESPONSE. 1. Virtual stockpiles 2. Surge funding for communities.

Private Sector Engagement
- Coke or water bottles to distribute social messages – Toum Choirs - Contest? Share information
- Companies willing to donate airtime, billboards, etc.
- Make cell phones for health workers free
- Empower the patient and healthcare worker with simple “smart” technologies. AVB

Design Principles and Questions
- Early reporting has to happen at the community level. Social mobilization needs to be integrally linked to surveillance data reporting and diagnostics.
- How do you balance fear of repercussions?
- How do we ensure that our tech solutions are compassionate solutions?
- “Culture always wins” How do we work to use culture instead of fighting against culture?
- Feedback mechanisms important to data collection/reporting. If feedback exists (i.e. publicized trends) data respondents will be more motivated to support thoroughly.
- Information flows all ways always, creating tracking trust and respect
- Need effective health messages. How to find local champions to lead Ebola response efforts?
• If we use SMS of similar types of technology to share or collect info how do we ensure that the most vulnerable (women, children, illiterates, poorest of the poor) are included when they are the least likely to access to a phone?
• How do we combat social stigma?
• Physical contact is necessary
• What else do communities need? Food, business, education, security
• How do we ensure that burials are safe and respectful of local traditions?

Emergency Infrastructure and Logistics

Emergency and Routine Infrastructure
• Establish routine prescribed services, don’t have an epidemic response system - build it as part of an integrated system
• Health system capacity building is important outside of pandemics. We must build capacity and resiliency of health systems so that they can deal with regular response and respond to crisis better. This must be done through partnerships with business, government and civil society.

Role of Government
• Build crisis response - communications, communications, communications led from top of government - 24/7 - across world of government - and throughout all levels of government down to community level
• How can we better collaborate with local organizations? Need stable resources to treat deployed workforce if they become ill. (Preferably in their home nation)
• Government and Rapid Response: Every country needs a standing coordinated national multi-sectoral response capacity with command and control led out of the highest political level (office of president) with ministry of finance fully behind it
• Use government systems to hold leaders accountable and connected
• How do we secure country boarders to avoid transmission spread?

Better Preparedness
• Develop a reproducible model for bio-risk management, capacity building in regions, countries and facilities
• Develop regional response teams -- response teams also regional/local champions/trainer to build capacity
• Basic Healthcare Infrastructure for all: shipping container clinics, + trusted, trained local health workers, +telemedicine, e-health connection to medical experts, + mobile phone interaction between individuals, families, healthcare workers, +date-capture, analysis, sharing +common operating picture *do something outside with Africa e.g. Somalia!
• Pre-position “all hazard packs” with rotating supplies that can be rolled out or absorbed into inventory when near expiring
• Rapidly deployable internet infrastructure e.g. “LOON” “INTERNET.ORG”
• High speed remote (OAV) Sample Gathering
• Create Infrastructure to Expedite Vaccines (Reduce Risk/designate producers)
• Develop kits of PPE’s – easier for logistics
• Design Innovate new PPE’s easier to use safer, R+D to have evidence
• Smaller light weight, infectious disease ETU infrastructure (micro 6-12 bed ETU)
• Prepare surfaces for the next pandemic, create infrastructure with anti-microbial surfaces. Built-in protection
• Low Skill High Flow Emergency Rehydration Kits (Survivability)
• Market place for micro tasks. Easy, cheap and fast way to get action done in the real world, even in the most remote areas. Tasks are paid with airtime.

Financing
• Financing for global pandemic reserve facility set up
• Let’s build a pandemic emergency financing facility that uses market mechanisms like insurance or capital markets/at-risk bonds to mobilize financing that is ready to disburse within hours/days of an outbreak and enable rapid response from national and global organizations
• We need a global Health Reserve Corps and Health Strengthening Funding

Private Sector Engagement
• Call Fed Ex/UPS, Coca-Cola or Amazon on logistics supply chain management
• Inventory Management System – to manage, track, and coordinate distribution of medicines, equivalent water
• Doesn’t collaborate sometimes means consolidation?

Goal Setting
• Establishing measures to help facilities, regions, etc. to measure preparedness - set goals supporting continuous improvement
• Score cards, which help identify gaps and set goals

Design Principles
• Locally – driven solutions, user-centered design
• ID traditional channels of interaction, spatial relationships
• Hand of Diagram and support Technology
• How do we build sustainable systems?
APPENDIX 4: Organizations in Attendance

Anheuser-Busch InBev
African Democratic Institute
African Technology Foundation
African Union
Airlink
The Alliance for International Medical Action (ALIMA)
American Institutes for Research
American Refugee Committee
Amida Technology Solutions
Amref Health Africa
Arizona State University
Ask.com
Ativa Medical
Biomedical Advanced Research and Development Authority (BARDA)
Baylor Global Initiatives
BBC
bgc3
Bill & Melinda Gates Foundation
BlueSpark Technologies, Inc.
Boston Consulting Group
Boston University
Brigham and Women's Hospital & Harvard Medical School
ByoPlanet
Cascade Designs
Center for Disaster Philanthropy
Center for Strategic and International Studies
Centers for Disease Control and Prevention (CDC)
Cepheid
Ceres Nanosciences
ChemBio Defense
Concentric Advisors
Connecting Organizations for Regional Disease Surveillance (CORDS)
Corgenix
David and Anita Keller Foundation
Defense Advanced Research Projects Agency (DARPA)
Diagnostics for All
Dimagi
Direct Relief
Doctors of the World
DX Up Close
Ebola Deeply
Education Development Company (EDC)
eHealth Africa
Environment, Health and Safety Online (EHSO)
Enhancing Learning and Research for Humanitarian Assistance (ELRHA)
Equatorial Coca-Cola Bottling Company
Environment Resources Management (ERM)
Experiment.com
Fair Access Medicines
Fathom
Feedback Labs
Flora Bioscience
Foundation for Innovative New Diagnostics (FIND)
Fio Corporation
Fondation Mérieux
General Catalyst Partners
Georgetown University Medical Center
GETF
Global Communities
Global Giving
Global Health LLC
Global Health Strategies
Global Outbreak Alert and Response Network (GOARN)
Gobee Group
Google
GTX Corp
Halteres Associates, LLC
HDR Architecture
Humanitarian Toolbox
Human Needs Project
Humanitarian Data Exchange
Humanity United
IDEO
Idibon
Infectious Disease Research Institute (IDRI)
Innovative Support to Emergencies Diseases and Disasters (InSTEDD)
Intel
International Medical Corps
International Rescue Committee (IRC)
IntraHealth
Inveneo
Invisible Children
International Society for Infectious Diseases (ISID)
Jhpiego
Johns Hopkins University
Johnson & Johnson
Journey Apps
Keystone Accountability
KYNE
Labcyte Inc.
Last Mile Health
Lawrence Berkeley National Laboratory
Lawrence Livermore National Laboratory
Main Street Genome
Makerere Medical University in Kampala
Management Sciences for Health (MSH)
MAP International
Mass Design
Massachusetts General Hospital
MasterCard
McCann Health
Medical Research Centre
Medical Teams International
Médecins Sans Frontières (MSF)
MedShare
MercyCorps
Microsoft
MIT DLab
Mobile Alliance for Maternal Action (MAMA)
Nanobiosym
Nanomix
National Peace Corps Association (NPCA)
National Security Council
Naval Medical Research Center (NMRC)
NetHope
Olympico Strategies
OncoSynergy, Inc.
Open Philanthropy
Otherlab
Page Family Foundation
Palantir Technologies
Partners In Health
PATH
Paul G. Allen Family Foundation
PCI Global
Phillips
Posner Center for International Development
Powerstorm Capital
Pricewaterhouse Coopers (PwC)
Question Box: Lifelines for Help
Rabin Martin
Red Cross
Reliefwatch
Rhythm Diagnostic Systems
Sabeti Lab
Salesforce.com Foundation
Save the Children
Seed Here Studio
Seeding Labs
Senegal Ministry of Health
Sierra Leone Ministry of Health and Sanitation
Skoll Global Threats Fund (SGTF)
Silicon Valley Community Foundation
Singularity University
Slalom LLC
Social Impact.com
Speak Up Africa
SPR Advanced Technologies, Inc.
SSG Advisors LLC
Stanford Center for Global Health
InnovationStanford University
Stanford University School of Medicine
Tableau
The Brewer Group
The Coca-Cola Company
The Data Guild
The Patterson Foundation
The Village Link
The White House Office of Science & Technology Policy (OSTP)
The World Bank
Theranos
Tiller
TOMI Environmental Solutions
Tony Blair Africa Governance Initiative
University of California San Francisco
United Nations Population Fund (UNFPA)
UNICEF
United Nations Special Envoy for Ebola
University of Massachusetts Medical School
University of Massachusetts Worcester
University of Nebraska Medical Center (UNMC)
University of Pittsburgh Medical Center (UPMC)
United States Agency for International Development (USAID)
U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID)
U.S. Department of State
U.S. Food and Drug Administration (FDA)
Verge
Vulcan Inc.
Wellbody Alliance
Wellcome Trust
Washington Global Health Alliance (WGHA)
World Health Organization (WHO)
World Food Programme
World Vision