

This Case Story was submitted to the 2016 CLA Case Competition. The competition was open to individuals and organizations affiliated with USAID and gave participants an opportunity to promote their work and contribute to good practice that advances our understanding of collaborating, learning, and adapting in action.

Emergency Ebola Design Challenge: Crowdsourcing for Innovation

Theresa Norton
Jhpiego

What is the general context in which the story takes place?

For more than 40 years, Jhpiego, an affiliate of Johns Hopkins University, has innovated solutions to global health challenges in low-resource settings. These innovations address aspects such as technology development, program implementation, and response to disease outbreaks. In 2014, Ebola reached epidemic proportions in West Africa, affecting countries with which Jhpiego works. By the end of 2014, more than 14,000 cases of Ebola were recorded, of which more than 5,000 had resulted in death. Of the more than 500 health workers who were affected by Ebola in West Africa, more than 300 died.

Given Jhpiego's global reach and expertise in training health workers, organizations began reaching out to us to help address health worker needs related to Ebola, including Centers for Disease Control, World Bank, and ministries of health in Guinea and Liberia. In 2014, USAID and partners launched Fighting Ebola: A Grand Challenge for Development. The Ebola Grand Challenge encouraged crowdsourcing, competition, and partnerships to innovatively address barriers faced by health care workers in combating the Ebola epidemic and better prepare the world for future outbreaks. By adapting a process previously used for medical device innovation—bringing together “unlike minds” for an intensive “hackathon” (a quick, iterative design challenge) event—Jhpiego and partners led teams in creating new personal protective equipment (PPE) designs for health workers, one of which won the USAID Challenge and is slated for manufacturing. The partners—Jhpiego,



Ebolappe Prototype. Credit: Jhpiego.

Johns Hopkins Center for Bioengineering, Innovation and Design (CBID), and Clinvue—organized the hackathon event in fall 2014.

What was the main challenge or opportunity you were addressing with this CLA approach or activity?

Given the need for partnerships to urgently address the epidemic—and with the impetus of USAID’s Grand Challenge—Jhpiego decided to explore innovations to address health worker barriers to Ebola care and treatment. Decades of global experience working with health care workers and facilities in infection prevention and control had led Jhpiego to develop internationally recognized infection prevention reference and training materials (e.g., *Infection Prevention Guidelines for Healthcare Facilities with Limited Resources Learning Resource Package*, 2003). This rich background led Jhpiego to examine how infection prevention and control was being handled with the unique challenges of Ebola, such as its high mortality and infectious characteristics.

Jhpiego identified a major challenge in protecting health workers caring for those with Ebola regarding the use of PPE and its design at the time of the Ebola epidemic. The procedure recommended by the World Health Organization required donning and doffing PPEs using many precise steps, and error in any steps resulted in possible exposure. The PPEs were uncomfortable, hot to work in, and required shorter working periods and more frequent donning and doffing, increasing the potential for exposure and possible infection. The design of PPEs in 2014 impeded performance of medical tasks, lacked personal comfort for health workers, and were expensive. These flaws offered an opportunity for innovation.

Jhpiego’s had worked with CBID on other medical innovations, and this relationship led to a dialogue on how best to work together to innovate a new PPE design. CBID and Jhpiego brought Clinvue, a medical device innovation company, into the collaboration to co-facilitate the event. Clinvue uses a research approach called Insight Informed Innovation that combines observation techniques and cross-disciplinary group discussion to reveal stakeholder needs and lead to innovative solutions that could be assessed for viability given a medical solution landscape and market. The three organizations agreed to work together on an adaptation of Clinvue’s approach, combined with aspects of a collaborative hackathon approach used in other industries, such as software application development.

Because of the need to innovate quickly, with lives literally on the line from the Ebola outbreak, the partners decided to plan a “collaborate, learn, and adapt” event that would yield PPE innovative designs within days. In addition to providing subject matter expertise in infection prevention and control, Jhpiego had a network of contacts in public health organizations and throughout Johns Hopkins that it could tap for participation in the event. CBID had a network of contacts as well. The partnership of the three organizations, what each brought to the table, and their ability to quickly tap into their networks became key factors in success of the event.



Describe the CLA approach or activity, explaining how the activity integrated collaborating, learning, adapting culture, processes, and/or resources as applicable.

The objectives of the Ebola PPE hackathon CLA activity were to: gain insights into the Ebola epidemic; understand the challenges and shortcomings of current PPE in protecting frontline health workers; explore the landscape of available solutions for PPE; create multidisciplinary teams (the “unlike minds”) that would *Think, Discuss, Create, Build, Review, Share* some creative new solution; and develop PPE prototypes.

Given the urgency of the epidemic, planners aimed for rapid implementation. They organized the event in 10 days, and held “Emergency Ebola Design Challenge: Personal Protective Equipment” October 24-26, 2014, at John Hopkins University’s Homewood Campus. The planners reached out to their professional networks through e-mail, phone, Twitter, and Facebook to recruit more than 100 participants, of which 70 attended all 3 days. The participants came from Jhpiego; CBID; Johns Hopkins Medical Institutions; Johns Hopkins Office of Critical Event Preparedness and Response; Johns Hopkins Department of Biomedical Engineering; Johns Hopkins School of Medicine; Johns Hopkins Applied Physics Laboratory; and the Maryland Institute College of Art. With the aim of bringing together “unlike minds” to foster innovation, planners assembled a wide range of skills and backgrounds—including a college freshman, a wedding dress designer, a robotics expert, infectious disease experts, and biomedical engineers—resulting in collaboration internal and external to the Johns Hopkins community. Participants indicated their areas of expertise during event registration, and planners even allowed extra participants after registration closed to ensure diversity.

Day 1 of the event focused on learning and establishing a technical evidence base, with presentations on the background of the Ebola epidemic, review of the health care situation in West Africa, and a landscape analysis of PPE. Participants also engaged in hands-on activities such as hand washing exercises and donning and doffing of currently available PPE for experiential learning and observation. Planners reviewed the design process and guiding principles, such as clear differentiation from existing approaches, low cost, promise of near-term and longer-term impact, and ability for rapid scaling. Later feedback on the event pointed to the key value of another feature of Day 1: a marketplace with stations in which participants could have one-on-one time with experts to ask questions.

Day 2 involved CLA activities, per USAID LEARN’s CLA Framework, for adapting (pause and reflect), culture (relationship building through teams; continuous learning and improvement), and processes (decision-making; knowledge cycle); resources (human and supplies); and collaboration. Participants began by capturing their primary insights through observation, experience, and desktop research on PPEs during Day 1 and reflecting on their relative importance. They continued their learning as they defined, brainstormed, and prioritized unmet need statements, looking for opportunities for high-value and high-impact design. Teams formed and began making decisions on specific design options to pursue. Two biomedical engineers served on each team to provide technical expertise. The day ended with teams beginning development of preliminary proof of principle prototypes with supporting data and examples. Planners provided sewing machines and supplies from Home Depot, Michaels, and Target to use in building prototypes. Teams exhibited a sense of urgency—as well as competition and cooperation—as they progressed through the prototype process.



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On Day 3, teams finalized their prototypes in preparation for presentations to a panel of peers and judges made up of technical subject matter experts plus one business development expert. Prizes were awarded in multiple categories, including seed money to continue refining design aspects (e.g., cooling). The CLA activity approach was later used to foster innovation in Zika virus protection and postural support devices for wheelchair users in low-resource settings.

Were there any special considerations during implementation (e.g., necessary resources, implementation challenges or obstacles, and enabling factors)?

Later reflection identified three key success factors of the CLA event: learning on Day 1 related to the technical evidence base and background through presentations, observation, and experiential activities; extensive participation in the event by technical experts, as well as “unlike minds”; and the availability of funding to continue design work, testing, and manufacturing of designs after the event.

The importance of partnerships was demonstrated not just in conducting the activity, but in providing funding and other resources to continue work on the promising PPE designs. Clinvue allowed adaptation of its Insight Informed Innovation proprietary process, and gave its time to the event pro-bono. The BioMaryland Center in Baltimore, Maryland, provided funding to continue the design process in the form of cash prizes for the top four design components from the CLA event, giving three awards for \$5,000 and one award for \$10,000. Under Armour provided use of a lab after the event to continue work on designs. And finally, USAID’s Grand Challenge award matched the winning innovation group with a commercial manufacturing partner (DuPont).

The event cost approximately \$10,000 to conduct, including photographer services, transportation for the expert presenters, catering, and supplies for the prototypes. The cost did not include staff time (approximately six people for 10 days). To address issues of design ownership, all participants signed a waiver to give Johns Hopkins rights to the intellectual property. It is not yet known the percentage of the total budget for development the event costs represent, as the PPE field testing and refinement process is ongoing.

The only challenge faced during implementation of the CLA event regarded getting all desired participation on short notice, because the event was organized in only 10 days. For example, planners hoped to have Under Armour participate to provide technical expertise as a sports equipment manufacturer, but this was not possible.

With your initial challenge/opportunity in mind, what have been the most significant outcomes, results, or impacts of the activity or approach to date?

The major outcome of the Emergency Ebola Design Challenge event was generation of viable design solutions, leading to winning the USAID Grand Challenge competition in October 2015, with an award of close to \$1 million. Four designs from the event received funding to continue work on design aspects such as cooling systems, community use, and ways to improve doffing efficiency (i.e.,

reducing the number of steps); these eventually won the USAID Grand Challenge. Planners did not conduct specific monitoring and evaluation for the event, but a key success indicator was development of four viable, innovative PPE designs.

Other outcomes concerned subsequent PPE design, feedback, testing, and manufacturing. Iterations of the designs were shown to stakeholders in Guinea and Liberia to get feedback. The designs were also demonstrated to the World Health Organization and Doctors Without Borders to gather feedback and raise awareness. In addition, usability testing was conducted in Liberia and the United States. The team field tested the PPE design with 25 clinicians and 10 non-clinicians working in an Ebola setting, which revealed the need for further refinements (e.g., the suit was still too hot to work in for more than a limited time). Monitoring and evaluation data from the field testing provided valuable insights. Several patents were filed, and the design was licensed with a commercial manufacturer (DuPont).

If your project or activity is in the development phase or just recently underway (less than 1 year into implementation), how do you intend to track results and impact? What outcomes do you anticipate?

As field testing and refinement of the PPE design reaches an end and the suit starts being manufactured, monitoring and evaluation data will be gathered on quantities of suits distributed by country, region, and service delivery points (facilities, community). The timeline for scale-up will be closely tracked, as rapid scale-up was a guiding principle for the design challenge.

The improved PPE design has potential to benefit stakeholders and beneficiaries in a variety of health care settings in low-resource settings where infection prevention and control for health workers is critical. The Emergency Ebola Design Challenge CLA event approach, adapted from Clinvue's Insight Informed Innovation approach, has already been repurposed for other biomedical innovation challenges such as Zika virus protection and postural support devices for wheelchair users in low-resource settings. To package the solution for implementation, Jhpiego is designing training materials and an introduction plan.

What were the most important lessons learned?

The success of the Emergency Ebola Design Challenge CLA event resulted in several lessons learned. The value of partnerships was key, with partners contributing a wide range of subject matter expertise, professional networking contacts, and funding. It was important that all participants had first-hand access to experts to ensure that the technical evidence base was kept in mind. Multidisciplinary teams—the bringing together of “unlike minds”—provided rich ground for innovation. Beginning the CLA event by defining the problem provided a clear way to assess solutions. Demonstrations, presentations, and exercises helped participants from a variety of disciplines understand the context of the problem. The setting of the CLA event as an open collaborative space where teams could ask experts questions at any time helped the rapid pace of



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solution development. A valuable team dynamic that contributed to success was willingness to not latch on to any one idea right away, but to continue innovating. Finally, the culture of the event embodied a critical enabler for innovation success: tolerance for risk and thinking outside the box.

Any other critical information you'd like to share?

The Emergency Ebola Design Challenge was featured in multiple news outlets, including:

- ABC News (<http://abcnews.go.com/Health/wedding-dress-designer-helps-ebola-suit/story?id=28930598>)
- Washington Post (<https://www.washingtonpost.com/news/grade-point/wp/2015/09/28/a-johns-hopkins-team-designed-an-ebola-suit-so-good-its-going-on-the-market>)
- Johns Hopkins communications (<http://hub.jhu.edu/2015/08/27/ebola-suit-index-award-finalist>)

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