

## USAID Podcast: Are We Ready for the Next Outbreak?

### Episode 2: Unexpected Paths to Innovation

Speaker 1: The recent outbreaks of diseases like Ebola, Zika, and the Plague have proven the need for new and improved tools to fight infectious diseases. Today, some of the best problem solvers from around the world are collaborating with the U.S. Agency for International Development on innovative solutions that will help us prevent, detect, and respond to future outbreaks. This is the second episode in a three-part podcast series on the topic: "Are We Ready for the Next Outbreak?" which aims to explore what we have learned from fighting infectious disease epidemics like Ebola and Zika, and understand what USAID and its partners are doing to improve preparedness for the next outbreak. Now, let's turn to Irene Koek, our moderator for this podcast.

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Irene Koek: My name is Irene Koek, I'm currently the acting assistant administrator for USAID's Global Health Bureau. Today we're speaking with three of our grand challenge innovators to learn about their unexpected paths to addressing some of the most pressing and age-old challenges in public health. These innovators are: Youseph Yazdi from Johns Hopkins University, Fredros Okumu from Ifakara Health Institute, and Beth Kolko of Shift Labs.

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We are seeing tremendous innovations in technologies that will allow us to prevent or respond to future outbreaks. I'd like our listeners to hear from each of you about your innovations and how you came to be engaged in their development. Youseph, let's start with you first. Can you tell us a little bit about yourself?

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Youseph Yazdi: Sure. I'm a faculty member in the Department of Biomedical Engineering at Johns Hopkins University with appointment in also the school of business and I've been there for about eight years. Prior to that I was Corporate Director of Science and Technology at Johnson & Johnson. Basically, I run a center at Johns Hopkins that designs and does early stage development of a wide range of healthcare solutions. We work on solutions for the U.S. and for low resource environments, and we have a dual mission of both innovating and educating students in how to do that.

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Irene Koek: During the Ebola outbreak in 2014, USAID launched the Fighting Ebola Grand Challenge to encourage the development of improved personal protective equipment for healthcare workers in West Africa, why was this needed?

Youseph Yazdi: That's an excellent question. Through our research we found that we're sending some of the brightest, bravest people in places like Guinea to be on the front lines of a crisis with substandard equipment. It's a travesty. I mean, the equipment they have is good but it could be much, much better. You have equipment that hides their face, which scares people so people weren't coming to clinics because they were afraid people looked like they were from another planet. It reminded me of the scene from ET when the spacemen are coming out with the Hazmat suits and you didn't know whether they were from Mars or from Earth. So, one thing was the suit, it was not designed for that purpose, and the people using them were at risk. They were incredibly complex, there were many parts to these garments or the whole ensemble they had to put on, and you're talking about a system that's very complicated where if you make any mistake, it could threaten your life. Any mistake in putting on the goggles, putting on the mask, doffing them incorrectly, these things could be life threatening. So that lit a fire under our innovators to really do something about that.

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Irene Koek: Thanks. So you've talked a little bit about what were some of the issues with the current suit, but can you walk us through briefly the process that you used to develop the better one and what you did and what you looked at?

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Youseph Yazdi:

The process started with the folks at USAID coming to the world and saying, "We need something better and we're challenging you to do something about it and, by the way, there's this carrot at the end of the pathway," which for academics is really important. The main thing they did is convene a challenge with great partners, corporate partners, and other stakeholders to ensure that we'll have the resources we need and what we really need to do is to get together people to create creative new ideas.

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So, the first thing we did is we launched an Emergency Ebola Design Challenge, and we invited any and all people from all different departments to participate. We had people who were engineers, robotics experts from APL, public health experts of course, people from our own infectious disease control group, our own biocontainment unit were there who knew everything about PPE for advanced locations like Hopkins. We even had a seamstress from down the street who runs a shop for wedding gowns. She called me up and said, "I'm not a Hopkins affiliate, but I know how to make garments, can I join?" That's how it started.

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It was a three-day event, so we spent the first day just hearing from people who treat patients in West Africa with infectious diseases. We heard from people who had just arrived back from West Africa. In fact, one of them was stuck in New Jersey and had to communicate through Skype. And then we had nurses who were from our infection control group demonstrate donning and doffing PPE. So we wanted a team of absolute novices to rapidly get up to speed on what the challenges were, and then they could get together in teams and start dividing up the problem into sub-problems and addressing those. And we had a wide range of sub-problems. For example, heat, the difficulty and discomfort in wearing it. One of the big things was fogging of this mask that they're wearing which reduces visibility. You had ambulance drivers careening down the highway with fogged up goggles, they couldn't see where they were going and for those who have driven on roads in Guinea, if you miss a pothole your car can be destroyed by that.

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Irene Koek:

At the end of the day, and just a real briefly, describe what does the suit do that addressed all these issues?

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Youseph Yazdi:

The suit addresses three main issues. One is reducing the complexity of the ensemble, making it a little simpler. Reducing the fogging in the face mask, and making it more comfortable to wear for extended periods of time. Reducing the risk associated when you're doffing the garment.

Irene Koek:

Thank you. Fredros, let's hear from you. Can you tell us a little bit about your background fighting mosquito-borne infections?

Fredros Okumu:

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Oh yeah, thanks. I work for an organization called Ifakara Health Institute, we're based out in Tanzania in East Africa. I am primarily a mosquito catcher, so I catch mosquitoes for a living. I worked for a long time on malaria prevention, designing techniques that you can use in addition to the best tools we currently have against malaria to get better control. So, we thought about what would you need to do in rapid format to respond at a time of need in the simplest way possible in the remotest parts of the country. My colleagues and myself figured out that actually most of the mosquitoes we deal with especially the malaria mosquitoes that tend to bite you mostly on the leg region, and so there was this idea that, well, what would happen if you just covered your legs, for example? With that already you reduce, and studies have shown that you reduce about 65% of all the bites that a person gets.

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[00:07:00] At that stage, Peter Sangoro, he's a colleague of ours working in the lab, suggested at a bar one time that perhaps they should just put mosquito repellent on the shoe. Of course, there are many question such as well, does everybody wear shoes? Which is interesting, and it turns out actually that even in very poor communities people always wear some form of a shoe. It might be not the kind of shoe that you get in a high-end store but they always do wear some form of foot covering.

[00:07:30] There was obviously quite a big opportunity for us to use that format to provide a rapid response approach to controlling diseases such as Zika at a time of an outbreak. This is how we then started creating mosquito repellent sandals.

[00:08:00] This has been fantastic. I mean, of course we did have challenges in the beginning but it's taken shape quite well. We're producing now, the latest version that we have is offering about 84 percent protection. We're using a form of repellent that is wide area repellent, so it protects not only the person wearing it but also people around up to quite a distance. So you need only two in a house, you don't need everybody to be wearing it. I can already tell you that if we had today in the village where we work, if we had let's say a mosquito-borne infection that is unknown, our products work against all kinds of mosquito species. This is an advantage, so you can use it against malaria, you can use it against dengue fever, chikungunya, Zika and all that.

[00:08:30] Irene Koek: Beth, let's hear a little bit about your background and your mission at Shift Labs.

Beth Kolko: I am the CEO and co-founder of Shift Labs, which is a medical device company in Seattle. Our mission is to make affordable medical devices that are simple to use and can work anywhere in the world. I am also a professor of Human Centered Design and Engineering at the University of Washington. I started Shift Labs really as an outgrowth of my experience as an academic and seeing some of the challenges in commercializing medical products that are designed to be affordable. The U.S. system really isn't set up to support that, so we started a company that was going to create products and the business models to support them to ensure that people could have access to appropriate medical technology.

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Irene Koek: How did you come up with the idea for DripAssist?

Beth Kolko: Well, when we started the company we went out and talked to a bunch of clinicians and we said, "What's hard about what you do?" Pretty much they all said, "Administering medication and fluids to patients is really hard when you don't have the right technology." Doing what's known as infusion, gravity infusion, it's one of the most common medical procedures anywhere in the world, in any setting. What's astonishing to me is here in the US we have very wonderful technology that costs thousands of dollars but if you don't have that you are doing what's essentially known as drop counting where literally a clinician, a healthcare worker, is staring at a tube and counting drops as they fall, looking at their watch and timing how many drops fall per minute and then they do these equations in their head. They do mental math to translate those drops per minute into a dosage rate for you for your anesthesia or your chemotherapy or whatever drug it is that you're receiving.

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[00:10:00] Irene Koek: So, talk a little bit about how you see DripAssist as a game changer, particularly when it comes to working at outbreaks or dealing with patients in an outbreak setting.

Beth Kolko: It's so simple. Giving patients the right amount of medication or giving them fluid so that they could stay hydrated was an essential piece of the care that clinicians were providing, but when you're wearing that PPE, you can't see those drops with the fogging. We first found out about this problem

- [00:10:30] from our senior medical adviser actually. He was one of the first people on the ground during the outbreak in Guinea with WHO and so we had heard from him how difficult PPE is to wear, how uncomfortable it is, but also just how difficult it was to be dosing the medication.
- Irene Koek: What about other settings?
- Beth Kolko: Yeah. So, the DripAssist product, it's useful in a wide variety of settings and for us-
- Irene Koek: Almost anywhere, yeah?
- Beth Kolko: Yeah pretty much and the tool is useful in a variety of settings, and this is really important when it comes to thinking about outbreak settings because in the middle of a crisis is a terrible time to ask people to change how they do their job. If you can have tools that they use in their everyday life that can then be repurposed in the middle of a crisis and help them do their job then, you're eliminating so many barriers. One of the values that we see for the device in the field is in an outbreak setting you think about the stress, you think about the workload that the clinicians are faced with, the sheer number of deaths that they're dealing with, the risk of infection for themselves or their colleagues, any tool that can reduce that stress is going to make a difference.
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- Irene Koek: I'm going to go back to Youseph and ask you, can you talk about what role USAID played in connecting you with potential partners to bring your product to scale? You talked about there was a wide range of partners but tell us a little bit more about that, please?
- Youseph Yazdi: The role of USAID in this Grand Challenge started with the announcement of the challenge itself by insisting on articulation of who your partners are and forming strong partnerships even in the original proposals. That made us start thinking about this very early on in the process. That benefit started even before we even put together the proposal. Once the proposal was in and we went down to Washington to present, afterwards there were people from different companies and different partners, stakeholders who met with us and started working with us so those were brought together by USAID. Then we started working with our corporate partners, USAID was instrumental in nudging and cajoling and calling at all hours to really make sure we moved along the path that we said.
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- Irene Koek: How has the Combating Zika and Future Threats Grand Challenge enabled you to advance the development of the insecticide treated sandals and what do you see is the next step in bringing this product to market, Fredros?
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- Fredros Okumu: I think the most important point here is to understand that it takes quite a transformation to get people like me who are traditionally scientists with a very different motivation to start being product developers with a slightly different system. This is almost immeasurable but it's actually quite a huge challenge and so what the Grand Challenges program from the USAID has helped us to transform our thinking to begin product development in a very serious way. It's really about changing the mindset to begin being a more product oriented person, which overall is quite a good thing. I think beyond the Grand Challenges program itself, we are going to be quite a different team when that project ends because this will be transformed to our other initiatives as well.
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- Irene Koek: What are the next steps to bringing the sandals to market? Where are you in that process?
- Fredros Okumu: Yeah, so this is still quite an early stage development. We hope that we are going to have a product

- [00:14:00] that can be readily deployed when we have the next outbreak anywhere. In many tropical countries, people do use this kind of product, and by the way, we are also creating a version of the product that is for tourists, so people from temperate lands who are visiting tropical areas for leisure or something like that. And the shoe is going to be designed pretty sleek, they can be designed pretty nicely.
- Beth Kolko: Fredros, I'd like to be first in line to buy some of your shoes.
- Irene Koek: Beth, can you talk a little bit about what aspect of the Grand Challenge experience did you find most helpful and also how did your ideas evolve during the Grand Challenge process?
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Beth Kolko: The Grand Challenge experience for us was really pretty remarkable in the way that it allowed us to participate in the larger community of people addressing challenges associated with Ebola. It wasn't until we were part of the Grand Challenge that we were able to connect with the partners who really made a difference in getting our solution out there. We used the Grand Challenge as an opportunity to do a bunch of field testing. We actually went to Rwanda, which was not in the middle of an outbreak, because we wanted to do some environmental testing and we wanted to do some prolonged user testing on our interface, things that wouldn't have required an ETU. It just seemed like a much more reasonable way to get that testing done. Then we also spent some time in Sierra Leone doing, really, walkthroughs of ETUs. One of the things that was really important for our devices, how do you disinfect it? What kind of solution can you come up with? Because dumping equipment in buckets of bleach isn't always good for equipment.
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- [00:15:30] We were able to make, actually, some fantastic changes. They really helped us on the market with the user interface, our algorithms, our alarm, those all came from the user feedback. The DripAssist, it turns out, is really useful in all kinds of settings, all kinds of clinical settings but also all kinds of geographies. We built it to be simple and affordable and we thought its primary use would be outside the US, but it turns out, and I'm really proud of this, that it's product that is finding a home in the US as well. We have clinics that are using the product to do outpatient chemo in Alabama and Kentucky and it's an amazing feeling that, oh, well, our fellow citizens are benefiting from this as well and it's making a difference in people's lives.
- [00:16:00] Most recently, actually, the US military has started using it. Their surgical teams are deployed and they have fancy equipment but, much like Liberia, the fancy equipment doesn't last very long in the field and so then they're counting drops. They're literally back to counting drops by hand while they're administering anesthesia during surgery to soldiers. They heard about the product, and now they have it and it's making a difference.
- Irene Koek: That's terrific. So, can you tell us what you've learned through the Grand Challenge process, and what was the most important lesson you learned as a Grand Challenge winner?
- Youseph Yazdi:  
[00:16:30] Well, we learned so much. We've been connected to talented experts around the world who have taught us a lot about this particular problem and the way they go about problem solving it has forced us to work together with a wide range of partners and each one of those has taught us a lot.
- Irene Koek: Great. Would that be your advice for people going forward on other Grand Challenges, other looking for other solutions?
- Youseph Yazdi: Absolutely. I mean a wise man once said that the unsung hero of innovation is choosing the right

[00:17:00] problem to solve. I would say if you have a certain amount of time, spending a third of the time just understanding the problem and just really getting deep into it is critical.

Irene Koek: Great, thank you very much.

Youseph Yazdi: Sure.

Irene Koek: Fredros?

Fredros Okumu: Everything we do to the needs of the society. It's important to notice how different your thoughts can change just by spending some time in the communities that you want to support. That interaction with the community, which is kind of by design, is incorporated into the Grand Challenge's approach, it's quite important.

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Irene Koek: Beth, what about you? What would be your advice to others who are interested in entering this space, this space writ large?

Beth Kolko: It's really hard. It's also really gratifying. I loved being a professor, I love teaching, but there's something about the impact that you have when you're building a product that goes out into the world which is really not like anything else.

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Irene Koek: Fredros, what would be your advice to others interested in entering the space?

Fredros Okumu: What would be my advice to others interested? I think, sometimes that is important, to just go out there and take the risk because then if these products are successful, the PPE our colleague was talking about here, the DripAssist you're talking about, the shoes I'm talking about, if these things work then you're not just talking about one life saved or two lives saved. You're talking about quite a huge return on investment in terms of number of lives saved, millions or thousands, and plus a number of absenteeisms reduced in the workplace. It's good to take these risks.

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Irene Koek: That's great. Thank you. I'd like to thank you all very much for a really fascinating discussion and for participating in today's podcast session.

This session is part of a three-part podcast series on the topic: "Are We Ready for the Next Outbreak?"

Speaker:

[00:19:00] To listen to the rest of the series and learn more about how USAID and its partners are working to prevent, detect, and respond to future disease outbreaks visit [USAID.gov](https://www.usaid.gov).