# TRANSCRIPT EPISODE 3

Viral vs. Virus

A. UNDERWRITER ANNOUNCE 00:15

*Announcer, over music:*

"THE CROWD & THE CLOUD" is made possible by NSF, the National Science Foundation, Where Discoveries Begin."

**1. TEASE**

*Louisville kid with inhaler, Cassandra's family pix.*

IT'S INDIVIDUALS AND FAMILIES WHO GET SICK.

*Driving and drone shots of West Oakland and Louisville:*

BUT SOMETIMES IT'S THEIR *NEIGHBORHOODS* THAT TRIGGER ILLNESS.

AND THAT'S TRUE FOR ASTHMA IN LOUISVILLE, KENTUCKY …OR WEST OAKLAND, CALIFORNIA.

*Archival footage, and prints from London:*

…AND FOR DENGUE FEVER OR ZIKA IN TROPICAL CLIMATES…

…OR CHOLERA BACK IN 19$^{TH}$ CENTURY LONDON.

BUT HOW PHYSICIANS AND COMMUNITIES FIGHT BACK IS BEING REVOLUTIONIZED BY TECHNOLOGY.

Ted Smith:
We typically make it to the tops of lists that people don't want to make it to the tops of.

*Digital transition and CGI footsteps on John Snow's 1855 map:*

ONCE IT WAS PEN AND PAPER… AND POUNDING THE PAVEMENT.

*West Oakland backpack and Propeller app on smartphone:*

NOW IT'S SENSORS AND SMARTPHONES…

*GLOBE microscope and WOEIP tablets:*

INEXPENSIVE MICROSCOPES AND SMART SOFTWARE.

Margaret Gordon:
But we don't want to complain. We want to work with, to change something.

TODAY APPS THAT BEGAN IN SILICON VALLEY CAN BE CUSTOMIZED TO FIT LOCAL CONDITIONS IN KENYA, EMPOWERING COMMUNITY HEALTH WORKERS TO COMPENSATE FOR THE LACK OF DOCTORS.

Enock Musyoka:
So if we get a text message, and it saves a pregnant mother, that's big, man!

IN BARCELONA, BROOKLYN AND NEW ORLEANS, APPS AND CITIZEN SCIENCE CAN COMBAT THE SPREAD OF DISEASE-BRINGING MOSQUITOES.

Diana Escobar:
The citizen power is the right power.

I'M WALEED ABDALATI.

I'VE WORKED FOR NASA… AND USE SATELLITES TO STUDY EARTH FROM SPACE.

BUT I'M INCREASINGLY CONVINCED THAT TODAY'S TECHNOLOGIES AND PUBLIC PARTICIPATION IN SCIENCE…

…CAN TACKLE LONG TIME PROBLEMS IN TOTALLY NEW WAYS.

Waleed to camera:
IN THIS EPISODE OF "THE CROWD AND THE CLOUD"… CITIZENS AND SENSORS, SMARTPHONES AND SOCIAL MEDIA ALL WORKING TOGETHER TO EMPOWER PUBLIC HEALTH SCIENCE, UNLEASHING…

"VIRAL VERSUS VIRUS."

B. SERIES & EPISODE TITLE (00:30)
Viral vs. Virus
**1. Propeller Health**

*Waleed to camera, at kitchen table/counter, with inhaler:*

More than 25 million Americans, one in 14, suffer from asthma, a disease that makes it hard to breathe and kills ten people each and every day.

Here's how innovative technology linked to an inhaler is helping citizens manage their asthma in one typical American city.

*Panting sounds over CGI:*

Propeller Health
App vs. Asthma

*Mason running around track, we hear him breathing heavily.*

Mom:
Under three minutes…

Mason:
I need my thing (*inhaler)*, mom.

Troi (Mason's mother):

I figured you did, I heard you breathing back there.

*Mason takes medicine with his mom, they count together.*

Mason:
My name is Mason, I am nine, and I live in Louisville Kentucky.

1-2-3-4-5… he coughs

LOUISVILLE, KENTUCKY IS ONE OF THE U.S.'S ASTHMA HOTSPOTS. LIKE MASON, 13% OF THE CITY'S POPULATION SUFFERS FROM THE DISEASE.

Dawn Sirek:
It feels like an elephant is sitting on my chest.

Christine Vaughn:
You feel chest tightness. Your heart hurts, even though it's not a heart attack. Your body, basically, everything's rushing to try and get you to breathe.

L3
Ted Smith
Fmr. Chief of Civic Innovation, City of Louisville

Ted Smith:
So Louisville's air quality has been a challenge for a very long time. We typically make it to the tops of lists that people don't want to be on the tops of. So, y'know, the fourth highest rated asthma nationally. One of the 10 worst places to live if you have breathing disorders, y'know, and allergies. We've looked at some of these lists, and the people that make them, and said, y'know, "Our goal is to get off your list."

ONE OF THE FIRST CALLS TED SMITH MADE WAS TO DAVID VAN SICKLE, CEO OF PROPELLER HEALTH.

*Van Sickle at public presentation:*
Every year in the United States, asthma still causes millions of emergency room visits and hospitalizations.

VAN SICKLE'S COMPANY WAS DEVELOPING A SENSOR TO TRACK THE INHALER USE OF ASTHMA PATIENTS.

HE CAME UP WITH THE IDEA AFTER STUDYING AN ASTHMA OUTBREAK IN BARCELONA IN THE 1980S.

*To camera and VO images of the port of Barcelona port, CGI of the article, and a map of one of the outbreaks:*

Van Sickle:
There's a classic study from Barcelona, Spain where it took about 10 years for a team of expert physicians, and scientists, and public health officials to understand that these significant outbreaks of asthma that were occurring and sending lots of people to the hospital were caused by a lack of appropriate filters in harbor silos.

They put on a map for the first time, the locations where people's attacks had begun. It was really the first time that an asthmagen like that had been identified that was causing these community wide outbreaks of pretty severe disease.

THE CHALLENGE: HOW TO TRACK COMMUNITY ASTHMA ATTACKS IN REAL TIME.

THE ANSWER: A SENSOR SMALL ENOUGH TO FIT IN YOUR POCKET ND ABLE TO CONNECT TO A SMARTPHONE AND UPLOAD DATA..

Van Sickle:
We had this idea that chips, and sensors, and radios had become small and cheap enough that they can now be actually physically built into the medications that people take.

*CGI of early sensors:*

IT TOOK A COUPLE OF TRIES, AND A FEW CLUNKY PROTOTYPES BUT PROPELLER'S CURRENT SENSOR FITS SEAMLESSLY ON TOP OF A TYPICAL INHALER.

*(David shows the device to camera).*

Van Sickle:
So the Propeller sensor is this device. It attaches to a patient's existing medication, and then passively tracks when the medicine is used and sends that information onto a smartphone.

*Dawn helps her son with his homework, naming state capitals, in the kitchen, walking dog, etc.*

Son:
Richmond…

IN 2012, THE CITY OF LOUISVILLE PARTNERED WITH PROPELLER TO BEGIN DISTRIBUTING THESE SENSORS TO ITS CITIZENS.

DAWN SIREK IS ONE OF THEM.

*Dawn helps her son with his homework, in the kitchen, walking dog, etc.*

Dawn:
If you're a non-asthmatic, then you don't have to think about breathing. When you're an asthmatic, breathing is exhausting. It can be all that I can do some days, is breathe.

*Scene with Dawn at dining room table, with her medications spread around her:*

This is what asthma means to me. I do this inhaler twice a day, this inhaler twice a day, this inhaler twice a day, and then this inhaler as needed.

I track all of these medicines with the Propeller app on my iPhone.

Every time I use my inhaler, it sends a signal to the app, and it logs it for me.

It gives me all kinds of details. It tells me how many days in the last month that I've had symptoms, how many times I've used my rescue inhaler this week. It tells me the last several months, how compliant I've been with my daily meds.

L3
Melissa Williams
Respiratory Therapist, Propeller Health

Melissa:
It lets you see a trend of how the patient is doing. It allows us to outreach to the patient to kind of see what is going on. Is there an issue that we can catch prior to them getting to that point and making it to the ER?

*(Scene with Dr. Sublett, at his clinic)*

DOCTOR JAMES SUBLETT IS DIRECTOR OF LOUISVILLE'S LARGEST ASTHMA CENTER.

*Sublett walks into examination room:*

Sublett, to patient:
Let's see how you're doing here.

L3
Dr. James Sublett
Co-founder, Louisville Family Allergy and Asthma

Sublett:
The big benefit I see is we get proactively the reports of people who are needing some intervention.

PREVENTION IS ESPECIALLY IMPORTANT TO DAWN, BECAUSE SHE SEES A LOT OF ASTHMA CASES AS A PEDIATRIC NURSE AT LOUISVILLE'S KOSAIR CHILDREN'S HOSPITAL.

*Dawn at hospital, over scenes of her making the rounds:*

Dawn:
We're getting into respiratory season, where most of our kids are respiratory kids. Kids with asthma come in and they can't breathe. You have to have someone at your bedside all the time, it takes a lot of resources, it's very serious.

I think the sensors are going to revolutionize asthma treatment.

*Dawn back at her house:*

Dawn:
It's helped *me* figure out what my triggers are, because I had no idea, six months, ago what my triggers were.

(Music)

*Christine rides her bike:*

L3
Christine Vaughn
Asthma sufferer

Christine:
I have come to rely on using the sensor. It's on the main inhaler that I keep with me. It's helpful because it does track, it tracks all of it.

*Christine going through the app on her phone, showing how she uses it"*

I can go in and it shows me a map of exactly where I was when I used the inhaler, I can go in and put my triggers, that it was exercise, and then symptoms I had...

It shows me a sad face because it says my asthma is not well controlled, because I've been using it for a lot of strenuous activity, exercise, but the orange is the days that I've used it, over the last week.

It's really nice to be able to see the data, to know, instead of just trusting your instincts or your gut. You can pull that information out and you can graph it, and you can plot it, and you can play with it.

Van Sickle:
We can, over time, build up a picture of why they're having symptoms, when, and where they are, and hopefully, be there, y'know, as a companion to help unravel this mystery of what's causing their asthma to worsen when it does.

Tori, Mason's mother:
It actually puts my mind at ease when he's not with me. I'll know whether or not his asthma is acting up when he comes back to me, regardless. Because if it is, then I'll know I need to go ahead and make his appointment, get him on some steroid medications, or whatever.

THE DATA IS USED FOR DIAGNOSING MORE THAN AN INDIVIDUALS' SYMPTOMS.

Van Sickle:
Where people use their rescue medications, their inhalers, is really an important marker of what's happening in the community. There's lots of small area, spatial, and temporal variation in what's happening with asthma, but we've never been able to capture it because we've never looked, right. It's never been visible before.

APPLYING THE SAME INSIGHTS GAINED FROM STUDYING THE BARCELONA OUTBREAK, VAN SICKLE AND HIS TEAM HOPE THIS DATA CAN BE USED TO IDENTIFY ASTHMA HOT SPOTS ALL ACROSS THE CITY.

L3:
Meredith Barrett
VP, Science & Research, Propeller Health

*Meredith at computer reviews mapping data:*

Meredith:
So we have with this citizen science project and with the citizen-collected data we have access to data that's never ever been available before. And so we can look for patterns of asthma across a region and then do analyses to try to figure out what might be driving those attacks, and so it will really give us a great picture into what's going on in Jefferson County.

*Meredith points to a map on her screen with a cluster of activity east of downtown:*

We did find significant clusters. We can see a cluster in the sort of southwest area, a cluster over downtown. Interestingly, we saw a cluster that was just east of downtown, which is in a more affluent area, which was something that was very unexpected.

THEY'D EXPECTED MOST ASTHMA ATTACKS WOULD BE TRIGGERED BY INDUSTRIAL SOURCES. BUT IT TURNED OUT WIND DIRECTION COULD MOVE POLLUTION TO AREAS WITH NO SUCH SITES.

Christine:
I think that it's good that we're all connected. We all have the same sensor that goes to one central location. The data all is being pulled from different people. So they could live in west Louisville, east Louisville, south Louisville, downtown, even some in southern Indiana.

If 50 people all used their inhaler within 20 minutes, if they all look like they were in the same location, say, like "Thunder Over Louisville", "OK, maybe if fireworks aren't the best thing for asthma, maybe we're going to recommend that you don't go to the river and watch the fireworks." Or if you do, you take more precaution, because it seemed like everybody in the city was using their inhaler at that time.

Ted Smith:
We look to programs like this as, this is the things that we need to do in our community to change the statistics for these diseases here. We will get the economic benefit. We will get fewer ER admissions, we will get more productive days in the workplace. But more importantly, we'll get a place where people want to live.

Dawn and son walk off down street, with CGI URL over:

URL:
CrowdAndCloud.org/Asthma

**2. West Oakland Environmental Indicators Project**

*Waleed to camera, Port of Newark:*

Ports bring jobs and all the good things that go with them. But loading and unloading ships, and the trucks that service them, can also deliver pollution to surrounding communities.

And that's what was happening in West Oakland a decade or more back.

*There* it was data collection and citizen science and that set the City and the Port on the path to cleaner air and better health.

Counting Trucks
Clearing the Air

*Cassandra Martin family photos:*

Cassandra:
My son, Orvan, who's the light of my life… I thought he just had a cold.

L3

Cassandra Martin
West Oakland Environmental
Indicators Project

What he would do is he would get up and he would crawl to the middle of floor where it was cool at, and he would just lay there. And you could see his little chest going up and down, up and down.

If I would have been two more minutes late getting my son to the hospital, it wouldn't been nothing they could had do. His bronchial tubes would have closed up on him and he would have been gone.

I think if I would have lost that one, I would have lost me.

*Shots of Cassandra in WOEIP classroom, training the students:*

*Cassandra murmurs:*

CASSANDRA MARTIN WORKS WITH THE WEST OAKLAND ENVIRONMENTAL INDICATORS PROJECT, AN ORGANIZATION THAT ADDRESSES POOR AIR QUALITY IN HER NEIGHBORHOOD.

Cassandra, to students:
When it's small like that, that's when it gets to be really, really dangerous, and serious, OK.

Cassandra:
One of the reasons why I started doing this work, all three of my kids have asthma and so do I.

L3
Margaret Gordon
Co-founder, West Oakland Environmental
Indicators Project

Margaret Gordon:
The issue of asthma was the number one problem in West Oakland

MARGARET GORDON CO-FOUNDED THE INDICATORS PROJECT.

Margaret to intern:
OK, I'm going to send you the study that was done on environmental justice in the 21st century.

*Margaret at map:*

Margaret Gordon:
All this is considered West Oakland district… all the way around, is the Port of Oakland. It has been a poor planned community for over 50 years.

People living all over here through with those industrial areas. Here we are, right here.

WEST OAKLAND IS SURROUNDED ON ALL SIDES BY TWO INTERSTATES AND THE PORT OF OAKLAND.

INDUSTRIAL GROWTH HAS MEANT CITIZENS ARE FORCED TO LIVE WITH POLLUTANTS AND CONTAMINANTS.

Margaret Gordon:
What was the science saying from inside of the community that triggered people to have asthma?

The citizen science helped us look at root causes. One of the root causes was the shipping business.

*Drone aerial cranes down to reveal Brian outside his house:*

Brian Beveridge:
So this is my little West Oakland fixer upper. It was built in about 1886

BRIAN BEVERIDGE IS THE ORGANIZATION'S CO-FOUNDER.

Brian Beveridge:
Just over that hill and beyond that sound wall is the 6-lane, 8-lane freeway.

L3
Brian Beveridge
Co-founder, West Oakland Environmental
Indicators Project

We started with existing information to look at this snapshot of the neighborhood. And that allowed us, as a community, to prioritize the issues, and there were many.

The community then said, "Well, what is the key health problem?" Well, it appears to be diesel pollution from the whole freight industry.

*Shots of trucks coming in and out of the Port of Oakland. Containers lined up near the road.*

Margaret:
The port is over 500 acres of land. They have anywhere from 12 to 18 docks. They move on average, maybe 500,000 containers a year.

TO ADDRESS THIS PROBLEM, THE INDICATORS PROJECT LED VARIOUS TRUCK SURVEYS, GOING BACK TO 2001.

THE IDEA WAS SIMPLE: COUNT THE NUMBER OF TRUCKS PASSING THROUGH VARIOUS PARTS OF THE NEIGHBORHOOD.

(Music)

Brian:
The people of the neighborhood had been running back and forth, trying to get somebody to care.

And it wasn't until we were able to get some funding and decide, "Well, if no one else is going to do a traffic analysis of the trucks, we'll do it ourselves."

*Archival photos of truck surveys, community members sitting under umbrellas, clipboard in hand, counting trucks:*

So we taught community members to sit on the corner in a little lawn chair with a clipboard, and they counted trucks.

We did it under the oversight professional traffic surveyors, and we had research assistants to then assess the data.

ARMED WITH NUMBERS AND HARD DATA, AND NOT JUST COMPLAINTS AND ANECDOTES, THE CITIZENS GOT THE CITY OF OAKLAND TO LISTEN.

Brian Beveridge:
So we took the data from the traffic survey and went to our City Council member and said we want to do a truck route ordinance.

*CGI showing "Before" the ordinance:*

THIS IS WHERE TRUCKS TRAVELED THROUGH THE NEIGHBORHOOD BEFORE THE INDICATORS' PROJECT MAPPED THE ROUTES.

Brian:
For the most part, we were all able to rationalize the logic of having the trucks go on the freeway, around the neighborhood rather than right through the middle of the neighborhood.

*CGI showing "After" the ordinance:*

AND HERE'S HOW THE COMMUNITY SCIENCE DATA HELPED MOVE POLLUTING VEHICLES AWAY FROM SCHOOLS AND RESIDENCES, AND TOWARD THE PERIMETER.

Brian:
So that was very successful. It was a unanimous vote at city council when they changed the ordinance.

NEXT, AFTER THE TRUCK SURVEY, THE INDICATORS PROJECT BEGAN COLLECTING AIR QUALITY DATA USING AN *INTEL*-CREATED AIR MONITOR, CALLED A "DUST TRACKER."

*GoPro footage of Cassandra walking through West Oakland streets*

Cassandra:
When you have it right there in black and white to put in front of their faces that this area is contaminated and this is what you're doing to people. If you don't have consistent data to back up what you're saying, then no one's really going to listen to you.

Brian Beveridge:
We're not going to experts and asking them to please apply their expertise to us. We're going to experts and saying, "We are experts, too. We are experts in our own community. We are experts in our own lives." And we can prove it. We can work together.

Cassandra, to the students:
What I want you guys to do is get in the habit of whatever you smell…

NOW CASSANDRA IS TRAINING LOCAL TEENS ON HOW TO DOCUMENT OTHER SOURCES OF AIR POLLUTION…

Cassandra, to the students:
Can anyone tell that smell is maybe like the garbage can?

THESE STUDENTS ARE PART OF A SUMMER PROGRAM SPONSORED BY U.C. BERKELEY'S "EAST BAY ACADEMY FOR YOUNG SCIENTISTS", OR "EBAYS."

Cassandra:
The circle with the circle is the one that turns the GPS on, and then you'll get a green light here on the satellite.

THE TEENS PATROL THE NEIGHBORHOOD ALONGSIDE CASSANDRA, MAPPING POTENTIAL SITES OF POLLUTION.

*Interactions between Cassandra and students, CU of students' faces:*

Brian Beveridge:
"Citizen science," as they call it, is really powerful. We call it "community based participatory research." New buzzword. And it's powerful, beyond… beyond the data.

There's also an element of understanding your own life, sort on, filling in the blanks or adding a lot of color to the picture of our world.

Brian:
Things we hadn't noticed before now become things we notice.

*Shot of Cassandra saying 'hi' to man on bench.*
Hello, how are you? Hi, how are you?

*Cuff looks out over the Bay from LHS:*

L3
Kevin Cuff
Director, EBAYS
Lawrence Hall of Science

Kevin Cuff:
The students come away with an understanding that once you have this factual information that can't be disputed, mainly as a result of the fact that the students are using professional equipment and protocols that are accepted by the Environmental Protection Agency and other scientific bodies, they can push policymakers to perhaps mitigate some of the problems that they uncover.

EBAYS STUDENTS AREN'T JUST COLLECTING DATA FROM THE STREETS.

THEY'RE GOING UNDERGROUND, TO THE STATIONS OF THE BAY AREA RAPID TRANSIT SYSTEM, OR "BART."

Kevin:

The study essentially entails students traveling to various BART stations and ascertaining the concentration levels of particulate matter in those stations, both indoor stations and underground stations.

The Embarcadero BART station, which is the most frequently used BART station in San Francisco, we found that particulate matter concentration levels there were through the roof, way above Environmental Protection Agency mandated standards.

DUSTIN GRZESIK IS ONE OF EBAYS'S INSTRUCTORS.

*Scene of the first group going to Embarcadero.*

L3
Dustin Gzresik
Data scientist, UC Berkeley

Dustin:
When the students have been able to go and walk around the community and collect data and then observe things, they understand the correlation between the data and the sources of the pollution that they're interested in.

*Michael Johnson and the other students ride an escalator up to a BART station:*

L3
Michael Johnson
EBAYS participant

Michael:
This is called the Dust Tracker. It measures how much dust and particulate matter there is in the air. Particulate matter is the little dust particles that we cannot see.

The more cars pass by, the more particulate matter there is and the less cars that pass by the less there.

*Train comes into station, brakes squealing*

Open captions (since background train noise is so loud):

Dustin:
So the air filter in there, there's a cartridge.

And we can send that out and test the particulates.

And they found that it's different kinds of metals.

Marbella:
Oh, like from the brakes.

So those things are from the brakes,

from the wheels, and from the tracks.

So if you think about metal, you're breathing in bits of metal. It's really nasty.

Marbella:
Especially for the police officers that have to be down here

all the time. Like the security guards.

Dustin:
Yeah, yeah.

Dustin:
Because of the low-cost sensors available in the smartphones or other devices, the students can collect data and immediately begin interpreting them.

(Music)

*Pull back from inflatable AGU sign in the poster hall of Moscone Center:*

IN DECEMBER 2015 SOME OF THE STUDENTS PRESENTED THEIR FINDINGS AT THE AMERICAN GEOPHYSICAL UNION, WHICH IS ONE OF THE LARGEST AND BUSIEST GATHERINGS OF PROFESSIONAL EARTH AND SPACE SCIENTISTS.

L3:
Marbella Daniel
EBAYS participant

Marbella Daniel:
I mean coming to AGU, like that, that's amazing. I didn't really realize how big of a deal it was until I started looking into it. We have something to bring to the table too, just us high school students. And people want to hear what we have to say.

Waleed:
Yeah…

Marbella:
It's kind of exciting… that what I'm doing, like, really matters.

Waleed:
It does matter. Yeah…

Marbeya:
It gives us hope that we might change something, it might change BART.

*Scenes of EBAYS students using sensors and tablets:*

Brian:
We sometimes frighten the statisticians, because they would prefer to have a little bit of perfectly pristine, absolutely, you know, 100 percent data from a million dollar machine.

And we're saying, "No, no, let's take this, y'know, $200 machine and start making decisions based on it."

But the notion is that if you had, y'know, one million dollar machine, you can do so much with that, but if you have a million hundred dollar machines, all spewing data into the cloud, turning it back to us in a direct feedback loop, then we start to adjust behavior immediately.

Cassandra, walking with students:
Has anybody else noticed anything else?

Cassandra, to camera:
I believe in what I'm doing. I love what I'm doing. I'm learning about toxins. I'm learning how it affects you. I'm learning how it attacks the body. I'm learning how to teach other people to do what I do, so they could do it for themselves, and to better protect themselves, *and* their families.

And for me to be able to make that difference, it's important to me.

CGI URL over truck survey still:
CrowdAndCloud.org/CommunityScience

**3. JOHN SNOW: Clues to a Killer-Medical Mapping**

*B-roll of the location: hustle and bustle: Waleed VO port scenes, and to camera:*

Cities, of course, want booming economies… and that often means busy docks and crowded airports, and that's a good thing…

*Waleed to camera:*
But today's international commerce means that diseases travel from continent to continent. Illnesses such as cholera and Zika can be go global as well.

*Mapping* disease is often the first way to fight back, as we saw in Louisville. And that's a story with a fascinating but little known citizen science angle.

Ok, maybe I should call it "clergyman science" but it's when individuals mapping an epidemic first showed the value of street knowledge and boots on the ground.

(Music)

Clues to a Killer
Medical Mapping

AS A FAMOUS LONDONER OF VICTORIAN ENGLAND, CHARLES DICKENS, WAS TO WRITE, *"IT WAS THE BEST OF TIMES. IT WAS THE WORST OF TIMES."*

RICHARD BARNETT IS A HISTORIAN OF MEDICINE, AND OUR GUIDE TO WHAT HAPPENED…

L3
Richard Barnett
Historian of Medicine

Barnett to camera

In the mid-nineteenth century London was the largest city on Earth, with a population of more than two and a half million.

It was the capital of a great, world-wide empire – a truly globalized city, like modern-day Mumbai or New York.

The docks along the river Thames were filled with ships, and those ships were crammed with goods, brought from around the world.

Waleed VO:
THESE SHIPS CARRIED MORE THAN JUST THEIR CARGOES. THEY BROUGHT DEATH TO THE HEART OF THE NEW INDUSTRIAL CITIES.

*Newspaper and Death Rowing stills:*

CHOLERA CAME TO LONDON FOR THE FIRST TIME IN 1832, AND IN A FEW MONTHS IT KILLED MORE THAN SIX THOUSAND PEOPLE.

THE MAGAZINES CALLED IT "KING CHOLERA', BUT ITS CAUSES WERE FAR FROM CLEAR.

*Cut to walking feet: it's Richard Barnett in today's London.*

Barnett to camera:
Walking through the Victorian city, it seemed obvious to most observers that poverty and disease went hand in hand with stench and dirt.

These filthy streets and houses stank.

We're in Soho – it's a bustling district filled with theatres, bars, and restaurants.

Victorian Soho was lively, dirty and poor, crammed with prostitutes and parsons, brewers and businessmen. And like all Londoners, they needed to relieve themselves somewhere.

Waleed:
FOR CENTURIES, LONDONERS HAD EMPTIED THEIR CHAMBER-POTS INTO CESS-PITS IN THEIR CELLARS.

EVERY FEW WEEKS THE 'NIGHT-SOIL MEN' CLEARED OUT THE CONTENTS, AND CARTED IT OFF TO THE FARMS SURROUNDING THE CITY.

URBAN WASTE BECAME VALUABLE FERTILIZER.

*Barnett to camera beside a really nasty-looking sewer grate at the Wapping Stairs site:*

Barnett to camera:
Mainstream medical theory saw a direct connection between these bad smells and epidemic diseases like cholera. Anything that stank – whether it was sewers, factory chimneys, dead bodies – was releasing poisonous vapors, 'miasmas', into the air.

*Houses of Parliament shots:*

Waleed VO:
INSPIRED IN PART BY THIS MIASMATIC THEORY OF CHOLERA, THE GOVERNMENT PASSED THE "NUISANCE LAWS", BANNING CESS-PITS AND ENSURING THAT NEW HOUSES HAD SEWERS CONNECTED TO THE THAMES.

THIS LOOKED LIKE PROGRESS – AND IF THAT AIRBORNE THEORY WAS CORRECT, IT SHOULD HAVE SOLVED THE PROBLEM OF CHOLERA.

Barnett to camera:
The Thames, only a few decades before, had been a fairly healthy river, home to salmon, eels, and herring. But no longer.

*Barnett walks beside the Thames, and scenes from "The Water that John Drinks" animation:*

The builder Thomas Cubitt observed, "the Thames is now made a great cesspool instead of each person having one of their own."

Worse, more and more Londoners were having their drinking water pumped straight from the river into their homes.

The physician Arthur Hassall pointed out that wealthy Londoners were not only "consuming … their own excrement" but also "paying for the privilege."

With hindsight, we can see that a law intended to prevent cholera in reality had created a great cycle of reinfection.

Barnett VO:
CHOLERA CAME AGAIN IN 1848, KILLING MORE THAN SIXTY THOUSAND THIS TIME.

AND SIX YEARS LATER, IN 1854, A SMALLER OUTBREAK HIT SOHO.

Barnett to camera:
Fewer people died – but a brilliant physician and a local clergyman found an entirely new way to visualize disease and to understand its causes.

*John Snow photo with dates:*

THE DOCTOR'S NAME WAS JOHN SNOW.

*RB to camera: camera walks with him, as he talks back over his shoulder: Plaque and pub sign:*

Today he's celebrated by the medical profession, and – in typically English fashion – this teetotal doctor has a pub named after, only a few streets from where he lived.

*Photo of Whitehead with dates:*

THE CLERGYMAN IN OUR STORY WAS THE REVEREND HENRY WHITEHEAD, THEN JUST 29 YEARS OLD.

Whitehead had absolutely no medical training. Today, we might call him a citizen scientist.

*RB to camera, still in the St. Anne's churchyard:*

But it was his knowledge of the area and its residents that helped him to solve the mystery of the 1854 outbreak.

*Barnett walks out of shot, as a church bell tolls mournfully:*

Waleed VO:
CHOLERA IS A CRUEL KILLER.

UNCONTROLLABLE DIARRHEA MEANS MOST VICTIMS DIE OF DEHYDRATION AND ORGAN FAILURE WITHIN DAYS OR EVEN HOURS.

IN JUST TWO DAYS, IT KILLED TEN PERCENT OF THE PEOPLE IN THIS NEIGHBORHOOD – AND MANY OTHERS FLED.

*Barnett, leaning on railing:*

But not Snow. His experience of previous epidemics, and his work on anesthesia led him to think that poisoned air could not possibly be responsible.
Like another famous Londoner, Sherlock Holmes, Snow turned detective and went looking for clues

CGI:
Clue 1:
Where the Water
Comes From

Barnett:
THE POOR OF SOHO COULD NOT AFFORD PIPED WATER, AND USED PUBLIC PUMPS ON THE STREETS. SNOW SUSPECTED THAT THE WATER FROM THESE PUMPS WAS SPREADING THE DISEASE. BUT HE NEEDED EVIDENCE – STRONG EVIDENCE, TO CONVINCE HIS MEDICAL COLLEAGUES AND THE LOCAL AUTHORITIES.

*RB walking/talking in Soho:*

Barnett to camera:
In just one day, Snow collected detailed information from the family and neighbors of more than seventy cholera victims.

He and Whitehead pounded these pavements, going door to door. Their big question was, where do you get your drinking water?

(Music)

CGI:
Clue 2:
The Beer and the
Brewery

*RB to camera, daytime, on Broadwick Street:*

Workers at a local brewery – the Lion, which stood right here – seemed to be immune to cholera.

Of seventy employees, not one died.

But Snow discovered that the workers were taking their water from a private well inside the brewery – or, better still, they drank only beer.

CGI:
Clue 3:
The Widow
Who Died

*RB on Hampstead Heath, looking back to the City:*

Snow's researches turned up another geographical clue.

Susannah Eley had left Soho after the death of her husband, and she had come to live here in Hampstead – a village a few miles north of the city.

But she'd acquired, heaven knows how, a taste for Soho's pump water.

She had barrels of the water brought up to her house – she drank it regularly – and she died of cholera.

*He walks out of shot:*

CGI:
Clue 4:
The Dirty Diaper

*Barnett's feet walk to the curb:*

This red curbstone marks the exact spot of the pump on Broad Street.

*Barnett to camera:*

Snow found that cholera deaths clustered around this pump, famous for dispensing the sweetest water in Soho.

*Whitehead still:*

Barnett VO:
WHITEHEAD, PUTTING HIS COMMUNITY KNOWLEDGE AND SOCIAL CONNECTIONS TO WORK, FOUND WHAT TODAY WE'D CALL "PATIENT ZERO."

RB to camera:
"BABY LEWIS"—WE DON'T KNOW HER FIRST NAME—LIVED AND DIED HERE AT 40 BROAD STREET.

Mother and baby still:

WHITEHEAD FOUND OUT THAT HER MOTHER, SARAH LEWIS, HAD SOAKED DIARRHEA-SOAKED DIAPERS IN PAILS OF WATER FOR SEVERAL DAYS AFTER HER BABY HAD FALLEN ILL.

THEN SHE POURED THE CONTAMINATED WATER INTO A CESSPOOL BENEATH HER HOUSE.

EXCAVATIONS LATER SHOWED THAT THIS CESSPOOL HAD BEEN LEAKING INTO THE WELL THAT SUPPLIED THE BROAD STREET PUMP.

ITS SWEET WATER HAD TURNED DEADLY.

*Scenes in the TOWN OF RAMSGATE pub:*

CGI:
Mystery Solved.
The Pump Did It!

HERE IN SOHO, SNOW SHOWED THAT THIS NEW WAY OF THINKING ABOUT DISEASE COULD HAVE PRACTICAL REAL-WORLD CONSEQUENCES.

TAKE A LOOK AT THIS MAP. THIS WAS PUBLISHED IN A BOOK SNOW WROTE ABOUT CHOLERA IN 1855.

HE TOOK A MAP OF SOHO AND HE MARKED ON IT THE NUMBER AND LOCATION OF DEATHS FROM CHOLERA.

IN DOING SO, HE SHOWED VERY CLEARLY THAT DEATHS FROM CHOLERA CLUSTERED AROUND THE PUMP ON BROAD STREET.

NOW SNOW HIMSELF LIVED ONLY A 5 MINUTE WALK AWAY, OVER HERE ON FRITH STREET.

SO THIS EPIDEMIC WAS HAPPENING IN HIS NEIGHBORHOOD. HE WAS DEEPLY FAMILIAR WITH IT AND HE AND WHITEHEAD USED THEIR LOCAL KNOWLEDGE TO SEE THINGS THAT OTHERS SIMPLY COULDN'T SEE.

THIS IS A SIMPLE AND BRILLIANT PRESENTATION OF WHAT WE'D NOW CALL "GEO-CODED DATA." AND IT SHOWS WHY MAPS, WHETHER THEY ARE MADE WITH PAPER AND PENCIL, SATELLITES OR SMARTPHONES, ARE CENTRAL TO THE WORK OF MEDICAL DETECTIVES…

RB to camera:
WHEN IT WAS REDISCOVERED IN THE EARLY TWENTIETH CENTURY, SNOW AND WHITEHEAD'S WORK INSPIRED A GENERATION OF PUBLIC HEALTH DOCTORS AND EPIDEMIOLOGISTS AND IT CONTINUES TO DO SO TODAY. MANY OF THEM SEE SNOW'S MAP AS THE FOUNDING CHARTER OF 'GEOMEDICINE'.

AND IT WOULDN'T HAVE HAPPENED HAD SNOW AND WHITEHEAD STAYED IN DOCTORS' OFFICES AND CLINICS.

IT TOOK A POTENT MIX OF CITIZEN SCIENCE …SHOE LEATHER… AND MAP-MAKING… TO TRACK AND CONFRONT A KILLER.

CGI URL:

CrowdAndCloud.org/DiseaseMapping

Mosquito Alert: Humans Bite Back

Waleed to camera:
Dengue fever, chikungunya, Zika… Until recently these diseases were unfamiliar to many of us.

But now diseaees that originate in forest far away are being found all over the world.

They are spread by mosquitoes like Aedes Aegypti or Aades Albopictus,

Researchers think that a warming climate will bring more exotic tropical diseases in the coming decades.

But they also think that citizen science and innovative apps can be a powerful way to fight back.

Chapter head:
Mosquito Alert
Humans Bite Back

*Fifth Ward sign, pan down:*

Place ID:
Houston
Texas.

Peter Hotez:
So what we are doing now is entering the 5th Ward.

L3
Peter Hotez
Dean, National School of Tropical Medicine
Houston, TX

Hotez:
*Aedes Aegypti* is a mosquito that lives in very close association with humans. They only feed on humans.

*Car drives past STOP sign: see discarded tire*

Hotez VO:
Here's a good poster child for Zika right here. There's the discarded tire. There's the houses without window screens.

CGI stats:

| | Locally Acquired | Travel-Associated |
|---|---|---|
| US States | 185 [in black] | 4,431 [bigger, in red] |
| Puerto Rico & Territories | 34,139 [bigger, in red] | 129 [in black] |

Kristy Murray
National School of Tropical Medicine
Houston, TX

Kristy Murray:
When we go out to look for *Aedes Aegypti*, we can guarantee that we are going to find it in the poorer communities.

The mosquito that spreads dengue, zika, chikungunya are container breeders

Peter:
And so they live in tires, they live in flowerpots, they live in birdbaths. Those have to be emptied.

Waleed:
And it's not longer something far away in tropical regions.

Kristy:
Oh no, it's all right here.

*Waleed walking with Hotez:*

Peter:
I don't see how we're going to effectively control *Aedes Aegypti* mosquitoes and prevent Zika without the community involvement.

The community has to be out in front on this because if you only rely on traditional public health control measures and institutional health organizations they can't do it all.

It's house-to-house, going into poor neighborhoods, hard slogging, it is the poster child for citizen science.

*Barcelona city scenes with bells and music: on the Rambla, ham, BNC street scenes. A bell chimes. Fountains and Sagrada Familia:*

BARCELONA, SPAIN.

ONE OF THE WORLD'S MOST BEAUTIFUL CITIES, WITH PARKS, AND FOUNTAINS AND PLENTIFUL WATER.

AS EARLY AS 2004, SPANISH RESEARCHERS HAD BEGAN TO FIND AN INVASIVE MOSQUITO SPECIES, *AEDES ALBOPICTUS*, KNOWN AS THE ASIAN TIGER MOSQUITO FOR ITS DISTINCTIVE WHITE STRIPES.

INITIALLY WE KNOW IT CARRIED YELLOW FEVER AND DENGUE, BUT WE'VE SINCE FOUND OUT THAT IT TRANSMITS ZIKA AS WELL.

IN 2013, RESEARCHERS BEGAN TO ENLIST CITIZEN SCIENTISTS USING A SMARTPHONE APP TO RECORD WHERE TIGER MOSQUITOES WERE BEING FOUND.

L3:
Adreu Muriel
Mosquito Alert volunteer

Everyone in this city has been bitten by a mosquito, and it sucks. And that's the truth.

So by reporting this if I can help in any way, like eradicating and controlling the mosquitoes,

Well, I feel well about it. I mean, and everyone should feel the same.

Open captions:

Albert Sanz, Spanish speaking volunteer (translated)

I found out about the Mosquito Alert app
Reading the newspaper on my way to work.

I was interested in the project.
I download the app and started to use it.

*Uses his smartphone to take photo of grate in park near Arc do Triomf:*

The Mosquito Alert app is easy to use.

It is intuitive and it shows you easily how to identify

an *Aedes albopictus* or an *Aedes aegypti*.

Also, it allows you easily to add photos

comments and geo-locations
of the mosquitoes.

*Albert walks, puddles on street:*

Diana Escobar, VO
MOSQUITO ALERT is a very good project because it is centered in a very big problem.

L3
DIANA ESCOBAR
Science & Culture Office, City of Barcelona

That is, we have been invaded by a new mosquito species, and of course detecting them and avoiding them to reproduce is the key point.

*Scenes of City Hall in the Bario Gotic/Old Quarter:*

THROUGH THE EFFORTS OF CITIZEN SCIENCE PROPONENTS SUCH AS UNIVERSITY PROFESSOR JOSEP PERELLO, THE CITY OF BARCELONA SUPPORTS A MUNICIPAL OFFICE OF CITIZEN SCIENCE, THE FIRST SUCH OFFICE ANYWHERE.

CITY OFFICIALS HELPED FUND MOSQUITO ALERT AS ONE OF SIX PILOT PROJECTS.

L3

Francesca Bria
Digital Innovation Officer, City of Barcelona

Francesca:
So citizen science for me presents a totally different ethics where the data becomes a shared resources.

Here in Barcelona we are talking about "data commons," which is a common good, a public good that can be used to improve peoples' lives.

*Andreu at Sagrada Familia takes photos of drain cover:*

Mosquito, I guess, is expanding right now, so being able to tell where it has arrived presently I think is probably the most important preventive action you could take.

Frederic:
We have thousands of people running the app in the mosquito period.

L3
Frederic Bartumeus
Mosquito Alert, Barcelona

We are empowering citizens, that's for sure. That is part of the revolution. We are empowering citizens to do research and to promote information and to be informed themselves.

John Palmer:
Smartphones and particularly smartphones that have GPS receivers, are… they are central for our project. Which means that we can not only have people with an incredible sampling tool available we can also have something that is essentially an extension of this person's body, this person's existence…

L3
John Palmer
Mosquito Alert, Barcelona

…which is constantly sending information back and forth which can be used to communicate with us and with other citizen scientists.

Aitana:
If you participate in this project, and you are part of a group sending these pictures, and then you are informed about which actions are being taken…

L3
Aitana Oltra
Mosquito Alert, Barcelona

…I think somehow you feel that you're fighting with a problem, against this problem, but with your community. And I think this one of the, the most important motivations for participating.

*Driving through the city:*

John Palmer:

We're learning about the distribution of mosquitoes in ways that we couldn't learn before. We're learning at larger scales than we'd be able to otherwise know. Um, so we know a lot more about the mosquito distribution in, in Spain as a result of this project.

So we start to learn about how mosquitoes seem to be using global, um, transportation, global commerce chains, uh, and also medium scale transportation, probably hitchhiking in cars with people.

THIS MAP DOCUMENTS THE AREAS WHERE TRADITIONAL METHODS WERE USED TO TRAP TIGER MOSQUITOES.

*Dissolve to the yellow dots:*

REPORTS FROM THE "MOSQUITO ALERT" APP DELIVERED EVIDENCE OF A MUCH MORE EXTENSIVE GEOGRAPHIC DISTRIBUTION,

John Palmer:
That's a big, that's a big difference. And that's something where Mosquito Alert has been very useful in, in giving us the data that we need to analyze those questions.

*Dissolve to map in hands on a city eradication team:*

Aitana:
I think, one of the benefits of mapping things is to make things clear, understandable, and public to everyone.

MOSQUITO ALERT STARTED AS A WAY FOR PROFESSIONAL SCIENTISTS TO GET BETTER DATA FOR THEIR ACADEMIC RESEARCH.

SOON, CITIZEN SCIENTISTS ADDED PRACTICAL AND IMMEDIATE USES.

Frederic:
What I was telling citizens that I would do with their data is that I was going to make maps and going to make predictions.

*Miriam in the park:*

But the same citizens start to ask us, "Look, we really have mosquitoes here. Can you help us to get rid of these mosquitoes?"

"MOSQUITO ALERT" ALSO INVITES FEEDBACK FROM USERS.

So where the same notes of the citizens through the app telling us they wanted something more than "research" and a map.

*Public Health vans drive through the city:*

So therefore we started to have contact with management people. With the people that has the real skills and tools and they are capacitated to control the mosquitoes in the city.

(Music)

*Scenes of the eradication team deploying to an urban park with fountains:*

John Palmer:
So I think probably the most important result is the ability to detect mosquitoes in locations that we would not otherwise be surveiling or sampling using traditional methods.

As they are helping us to discover these new areas and to see how mosquito populations are changing they are also understanding the mosquito themselves they are and sharing that information with their friends.

Albert Sanz, Spanish volunteer:

Open captions:

I use the app every week.

Every day I go to the public parks and streets

and if a tiger mosquito annoys me
I am ready to catch it.

*Fountain scenes:*

Frederic:
We can not only say that we are doing science with their data, but we can also do… we are also doing management.

So the more they report, as this information is entering into the public health agencies the more they will be having someone controlling for the mosquitoes locally.

L3:
Lidia Fernandez
Public Health Agency, City of Barcelona:

Open captions:

Lidia (speaking Spanish):
The benefits we obtain from the citizen's participation

by sending their observations and reports
using the mobile app

not only help us to do better as professionals

but it's also a way to involve
the community in the work and actions that we develop from the public agencies.

*Montage of the three volunteers doing their thing:*

THE UNIVERSITY RESEARCHERS COMPARED THE ACCURACY OF REPORTS FROM CITIZEN SCIENTISTS AGAINST TRADITIONAL SURVEILLANCE TECHNIQUES.

*Mosquito Alert map of downtown Barcelona:*

THEY FOUND THAT THE VOLUNTEER DATA IS EQUIVALENT IN QUALITY, BUT CAN EXPAND MORE QUICKLY AND MORE ECONOMICALLY OVER LARGE DISTANCES, COMPLEMENTING THE EFFORTS OF PUBLIC HEALTH AGENCIES.

Frederic:
So it's not that citizen science is better at this moment. It's exactly the same. So we have the same data quality that we would have with scientific methods that have been used for decades.

*Montage of MA images:*

Diana:
I think Mosquito Alert is an easy platform in order to gather information. The citizen power is the right power.

Andreu:
The thing is, it's citizens working for the citizens and for the city, and I think that's like the biggest benefit from all.

I mean, all the citizens from the town benefit from the work I am doing. I benefit from the work others are doing here in town.

*Teleconference scenes with the link to Hong Kong:*

NOW THE SPANISH RESEARCHERS HOPE THEIR APP CAN GO GLOBAL, JUST LIKE MOSQUITOES AND TROPICAL DISEASES HAVE DONE.

"MOSQUITO ALERT" HAS ALREADY BEEN TRANSLATED INTO CHINESE AND IS BEING TESTED IN HONG KONG.

*Brooklyn scenes: in the community garden, and by the canal:*

AND IN THE UNITED STATES, THE "GLOBE" PROGRAM, AN INTERNATIONAL SCIENCE EDUCATION PROJECT SUPPORTED BY NASA, NSF, NOAA AND THE STATE DEPARTMENT IS ADAPTING A MOSQUITO IDENTIFICATION PROTOCOL FOR CITIZEN SCIENTISTS THAT WAS PREVIOUSLY USED IN SCHOOLS.

Becky Boger, to camera and VO:
But as you look around, let's see if you think there is standing water in places, and if there is standing water, well…

Rusty Low, off camera:
You have a habitat.

You have a habitat.

*Rusty Low, with participant at workshop, adjusting the microscope:*

The specimen should be in focus. So then you can move your light…

*Best shots of the phone, scope and images: make sure we have a diversity of faces*

THE AIM IS TO DEVELOP AN APP, USING A $6 DOLLAR MICROSCOPE THAT ATTACHES TO A SMARTPHONE, TO HELP CITIZENS IDENTIFY THE MOSQUITO SPECIES THAT BRING ZIKA.

*Rusty shows red triangles on the phone. Brooklyn Gowanus canal with tire:*

I'm going to make this a little bit bigger…

You see all those red triangles here? So here is the site that we found…

JUST AS IN SPAIN, THE APP WILL ALSO ALLOW CITIZENS TO MAP LOCATIONS WHERE STANDING WATER PROVIDES BREEDING SITES.

THAT WILL ALERT LOCAL HEALTH AUTHORITIES AND TRIGGER ERADICATION EFFORTS.

Rusty:
I have not put any samples into my phone. These are the ones that you guys have done. But it's all going up into the cloud and into the map that we all share.

*Baylor lab:*

Hotez:
We can forget about having a Zika vaccine in time for this epidemic. But there's a lot we could be doing now.

*Scenes from the New Orleans GLOBE workshop as citizens monitor used tires:*

Hotez:
It's not highly technical, a lot of it. So it's picking up discarded tires near homes. Getting rid of plastic containers that contain standing water.

All these things don't require a PhD and they don't require an MD. I think citizen science can play an important role, here.

URL CGI:
CrowdAndCloud.org/Mosquitoes

**5. MEDIC MOBILE: Doing More With Less**

*Overlooking the SFO skyline, inexpensive cell phone in hand.*

*Waleed to camera:*
In the developed world, smartphones and innovative sensors are changing the way environmental and health data can be captured and shared. In the developing world, innovative uses of simpler technologies are allowing people to do more with less.

Here's how Kenyan app developers, working with a San Francisco startup, are delivering improved health outcomes using basic $15 phones.

(Music)

Medic Mobile
Doing More With Less

Open captions.

Jane:
My name is Jane Katanu Kavita. Right now I work as the Africa regional designer at Medic Mobile…

(Digging sounds, music)

I come from Makueni County. Where we are right now is home.

*See her on camera here:*

I knew that I wanted to be a nurse pretty early.

My brother hurt his foot. Of course, he was playing without shoes on, and so he got a really bad wound on his big toe. So I decided to nurse him. Like, I decided to take some warm water, put in salt and clean it.

And I was cleaning it so thoroughly, and nice, and my brother was screaming and Dad was like, "Oh Jane, you're going to be the best nurse in the world."

(She laughs)

Being a nurse, even today, is the smile that comes on the face of my new mom when she gets a newborn baby.

I used to hate every moment that we would lose a baby. And when I looked at what the causes of death, I realize it's pneumonia, malaria, all these things that just are preventable.

So when I went to a seminar where somebody was working for Medic Mobile, explained how they were using technology, I was already "in. "

I started looking for every option to get into Medic Mobile.

*Mobile phones in use, in urban and rural settings:*

THERE ARE NOW MORE MOBILE PHONES ON EARTH THAN PEOPLE ON OUR PLANET.

ACROSS AFRICA, MOBILE BANKING HAS ALREADY REVOLUTIONIZED SOCIETY.

NOW IT'S THE TURN OF "M-HEALTH", HEALTH CARE ENHANCED BY MOBILE TECHNOLOGY.

*Agricultural scenes:*

Open captions:

L3
Enock Musyoka
Africa DIY Manager, Medic Mobile

Enock:
You would go to some like very remote area and the only thing that they have is a signal. And if they have a mobile signal, it means they can connect to the world.

*Scenes in SFO offices, and in Kenya:*

MEDIC MOBILE FOUNDER JOSH NESBIT HAD WORKED IN MALAWI WHILE STUDYING TO BE A DOCTOR AT STANFORD.

HE NOTICED HIS PHONE HAD MANY BARS OF SIGNAL… WHILE RURAL COMMUNITIES LACKED DOCTORS.

L3
Josh Nesbit
CEO, Medic Mobile

Josh:
In the last hundred years or so, we just about doubled the life expectancy for people generally on this planet, which is amazing.

The problem is that we left a lot of countries and a lot of people out of that progress, and we left people behind.

L3
Dianna Kane
Chief Design Offfice, Medic Mobile

Dianna:
Women who are pregnant have very long distances to walk just to get basic prenatal care services.

*Shots of motorbikes and passengers:*

L3:
Maeghan Orton
Fmr. Africa Regional Director, Medic Mobile

Maeghan:
…the typical distance that they would travel is between 100 and 500 miles. And that's not in their personal vehicle. That's in public transit or on the back of a motorbike.

Josh:
The main health challenges that we're seeing are things we've seen and we've known about for a really long time. It's about safe pregnancies. It's about ensuring that kids are protected from vaccine-preventable illnesses.

Maeghan:
So it's been estimated that in the world today, there are a billion people who are alive that will never see a doctor within their lifetime.

*Market scenes:*

But in direct contrast to that, those individuals live typically within 20 to 30 miles of a community health worker.

Open captions:

Jane:
So to me, as a nurse, community health workers are the pillars of health in the community, at least in the rural areas where we live.

These are people who live within the community, they've grown up in the community, they're members of the community.

*Jane and Community Health Worker pace country road:*

These are people who the government seeks to empower with basic knowledge on health, so that they can go out to the community and empower the community to take responsibility for their health.

Place locator:
San Francisco
California

Dianna:
The idea of using technology to coordinate services came, honestly, from the way that communities were already using technology to coordinate services.

*Scenes in Medic Mobile's offices in Kenya:*

We noticed that that was happening and started to create tools and systems to take the technology that's already in people's hands and enable them to do even more with it.

Open captions:

Jane:
We use the resources that are available locally, and use the mobile technology, the simplest that we have, to make sure that people access care, are there to care, and have improved quality care.

Dianna:
One of the technology tools Medic Mobile has developed enables us to run programs on really low-end phones.

This phone costs about 15 dollars and is really widely used in developing countries. The battery life lasts about two weeks. It's really durable. And it's in the hands of a lot of people. So people already know how to use it.

Open captions:

Enock:
Just to demonstrate where it goes, we put it like this underneath a normal SIM card, and we plug it inside and, voila, we have an application. (He chuckles)

Open captions:

Jane:
So the community health worker scrolls down and fills in the data items. So we come to the very end, and she's given the option of either going back to revise the data, or to save that data to transmit it later.

*Music and drone shot*

THIS COMBINATION OF SMART SOFTWARE AND SIMPLE HARDWARE HAS BEEN PUT TO WORK AT THIS RURAL CLINIC, JUST A FEW HOURS FROM THE CAPITAL CITY OF NAIROBI.

Maeghan, VO clinic scenes:
Kilala Clinic is located in Makueni County, and it's a very comprehensive clinic. The majority of the patients that you're going to find will be women.

You'll find family members there who are caring for their moms or the babies that are just been born.

It's also interesting what you won't see. You won't see a doctor.

THE APP HELPS COMMUNITY HEALTH WORKERS KEEP TRACK OF THEIR PATIENTS, REMINDING THEM ABOUT PRE-NATAL APPOINTMENTS, AND ENCOURAGING THEM TO VISIT THE CLINIC FOR A SAFE BIRTH.

Open captions:

Community Health Worker:
Before we started, we used to find many defaulters in the home deliveries. But now, home deliveries are reduced.

Jane:
You just need to talk to the clinical officer to tell you that right now the number of mothers that they are seeing for antenatal care visits, they've doubled.

THE SOFTWARE ALLOWS SIMPLE TEXT MESSAGES TO CONVEY THE INFORMATION CONTENT OF A MUCH MORE SOPHISTICATED DATABASE.

MEDIC MOBILE TOOLS CAN REDUCE A NURSE'S PAPERWORK BURDEN FROM TEN DAYS A MONTH TO JUST ONE.

CHW comments:
We used to go with the books. But that is a lot of work. But this one is very nice.

Dianna:

There's really only a few pieces that a clinic needs in order to get up and running. They need a laptop computer. They need a GSM modem to plug in to receive information from the phones deployed in the field.

You're looking about $15 for each one of these phones. The SIM application is also very inexpensive. And our software is open source.

SOME OTHER TECHNOLOGY INITIATIVES THAT STARTED IN SILICON VALLEY HAVE FAILED THROUGH A LACK OF UNDERSTANDING OF LOCAL NEEDS AND REALITIES.

MEDIC MOBILE TOOK A DIFFERENT PATH.

(Music)

Josh:
Our bosses are health workers and village elders and community members. It's not any other way around. And they're the best bosses in the world and we take all of our direction from them.

And that's why we build software in the first place. It's why we built systems. It's why we work every day across the world to get this mission done.

Open captions:

Jane
I have always known that we are the ones with the solutions to our problems.

Enock:
It's pretty exciting to see us solving some problems that we didn't think we would actually tackle.

So if we get a text message and it saves a pregnant mother or a mother who has an emergency and you save the particular pregnancy, that's big, man. (Laughs)

(Music)

52:31

CGI URL
CrowdAndCloud.org/mHealth

(Music)

**6. WRAP**

Cities, Citizens
& Citizen Science

*Sensors in use in Oakland and elsewhere:*

Brian Beveridge:
The kinds of sensors that are being developed, everything getting smaller. The scale is getting smaller. So

the scale of the research is getting more and more personal, and the size of the devices is getting more and more personal.

*Louisville scenes and Meredith at her computer:*

Meredith Barrett:
We want to see, on a block-to-block level, what air quality is doing on a minute-by-minute level.

*Louisville scenes:*

Ted Smith:
If enough of us get together, and enough of us—you know—say, I don't want to live in a place that is this way, I am willing to do something about it, I think policy-makers and others should do something about it too, this is when freeways get moved.

The first step *is* the citizen, the first step is the community, if you want ownership for the air.

*Margaret Gordon to camera and VO scenes in the WOEIP offices:*

Margaret Gordon:
You don't have to put up with stuff. There's tools, there's resources. That you don't have to be impacted by poor air quality.

But we don't want to complain. We want to work with, to change something.

(Music)

*Oakland scenes:*

Brian Beveridge:
To have something to back up your assertion that you have a problem, this is really powerful as a tool of good citizenship.

*Scenes from the Brooklyn GLOBE workshop, and EBAYS student looking to camera:*

Ted Smith:
The citizen scientist, to me, is the best thing that has happened in a long time, because the citizen scientist is also the future civic leader.

*Ted to camera and VO scenes of using the microscope and smartphone:*

And of all the things that you can be distracted with in this day and age, I would love you to be distracted with a gadget that helps you understand how your environment is.

AS WE'VE SEEN, CITIZEN SCIENCE CAN BE A WIN FOR BOTH CITIZENS AND CITIES.

AND THROUGH THE CLOUD IT HAS THE POTENTIAL TO DEVELOP DATA THAT'S HYPER LOCAL, AND ALSO ALLOW CONCERN TO GO GLOBAL,

John Palmer:

And now there's all these people, not only in Spain, but in continents all over the world who are using this app, and that's amazing. And they are interacting with something, and based on our ideas. It's almost like we're having a conversation with them.

Diana Escobar:
To have so many eyes for detecting so many places where mosquitoes can develop.

*Timelapse scenes in Africa and elsewhere:*

Josh Nesbit:
I think for a lot of people in my generation, global is the default. Like if you think about the planet, and you are asked to draw a circle around all the people that you care about, or that are worthy of your moral concern, you're going to draw a circle around the whole planet.

Open captions:

Jane Katanu:
When you realize that small actions that really are not small, through education, through using the resources that are available, it's simply just fulfilling.

Waleed to camera:
If more and more people use these new tools and approaches we can better tackle emerging threats to public health, from Asthma to Zika.

For THE CROWD & THE CLOUD, I'm Waleed Abdalati.

*Web announcement, voice and on-screen text:*

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End credits:

Underwriter announce:
"THE CROWD & THE CLOUD" is made possible by NSF, the National Science Foundation, Where Discoveries Begin."