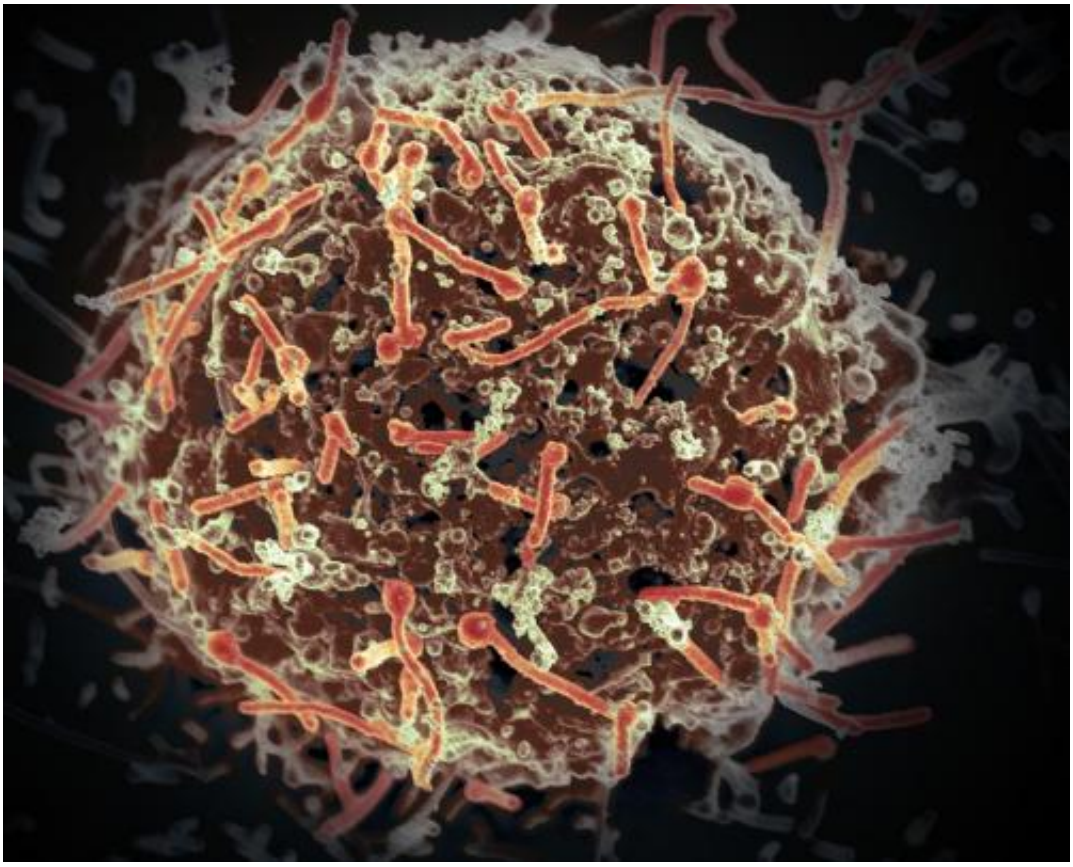
Physician discusses new score for predicting Ebola risk

April 6 2015, by David Orenstein



The Ebola virus, isolated in November 2014 from patient blood samples obtained in Mali. The virus was isolated on Vero cells in a BSL-4 suite at Rocky Mountain Laboratories. Credit: NIAID

Dr. Adam Levine spent last fall fighting Ebola in Bong County, Liberia. Using data from there, he and several co-authors have calculated a

simple, sensitive, and specific score for triaging a patient's Ebola risk.

When deciding whether a sick patient belongs in an Ebola treatment unit (ETU), doctors want to be right because any misdiagnosis is terribly dangerous. Returning an Ebola case to the community leaves a patient untreated and prolongs the epidemic, but admitting someone with a different illness exposes them to Ebola while in the ETU.

Armed with data from his work during the epidemic in Liberia last fall, Dr. Adam Levine and co-authors have develop a simple, six-symptom Ebola Prediction Score that could make it easier for doctors to determine patient risk. The score, which simplifies other systems that require parsing through algorithms based on 14 symptoms, is described in the *Annals of Emergency Medicine*. Levine discussed the score with David Orenstein.

How is a prediction score different from a more basic list of symptoms?

The problem with a very long list of symptoms is it takes a very long time to assess. In an epidemic setting where you have a lot of patients, having to go through a very long list of symptoms can be difficult, especially when you have to figure out how to translate each of those different symptoms into not only the local language but also into terminology people will understand. For instance, having people separate out pain in the joints from pain in the muscles can be difficult.

In addition, when you hire staff to work in the ETU, you have to train them on how to do triage properly. The more complicated the triage algorithm is the more difficult it is to train them and more errors are going to get made.

So the idea of a prediction score is to use statistics to pull out the small number of symptoms and signs that actually have the most predictive power—ideally the same amount of predictive power as the full list you started with.

What symptoms are components of the score and what makes those especially good predictors?

In our logistic regression analysis, one of the symptoms that came out was "sick contact"—basically direct or indirect contact with somebody who had Ebola—which is not surprising. We would expect that to be a very strong predictor because Ebola is transmitted through body fluids.

The other symptoms were diarrhea, loss of appetite, muscle pains, difficulty swallowing, and a negative predictor: abdominal pain.

I can only conjecture that these were pulled out because these were the ones that were more strongly associated with Ebola and best separated patients with Ebola from those with other diseases. One common sign that everyone thinks about is fever. But fever is not very good at differentiating Ebola from other diseases like malaria or typhoid or even influenza that are really common in West Africa.

When you have patients presenting to your ETU, it's because they are sick. You want to separate out the ones who have Ebola to keep in your ETU and then send the ones who have another disease someplace else for treatment.

As it turns out, these six symptoms have almost he same predictive power as the full 14, so nothing is lost by going from 14 symptoms to six.

How could having a score like this have helped you and your colleagues at the ETU in Liberia?

Managing an ETU requires balancing the epidemiologic imperative of trying to find every last case in order to stop the epidemic against the ethical imperative to do no harm. There really perhaps is no greater harm that I think I've done in my career than admitting patients without Ebola to our ETU, which I did many, many times, because I put those patients at risk. I especially worry about the pregnant women and the children that we admitted to our ETU who didn't have Ebola and the risk that we put them at for contracting the disease.

In that setting it's going to be one to three days minimum before you have confirmatory testing. In the meantime admitted patients are going to be kept in the suspect area. If you have a scoring system that can help you figure out who is high risk, who is medium risk, who is low risk, then you can separate them into different wards so they aren't in contamination distance to catch Ebola from their neighbor. You could make sure they have different latrines for instance.

That's the goal. It's not necessarily more sensitive than the other algorithms out there but what it does is it allows us to risk-stratify patients.

How does the EPS compare to other Ebola diagnostic tools such as the World Health Organization algorithm?

The two main algorithms are the ones developed by MSF (Doctors Without Borders) and the WHO. Both those algorithms were developed based on expert opinion. They were never derived or validated empirically.

We showed in our study that the WHO algorithm is actually pretty sensitive for picking up Ebola. It's not very specific, but it's pretty sensitive, which is its main goal. The problem with them is that they are very difficult to apply. They have a lot of 'this plus this,' or 'this plus this.' If you are trying to make sure that somebody applies this algorithm correctly every single time, it's very complicated to do it.

A simple scoring system is a little bit more intuitive. You just have a list of symptoms on a page with the points assigned and people just add up the points and they know whether the person is likely to have Ebola and how likely are they.

How optimistic are you about the development of a rapid blood test, and what role could the EPS play if such a test existed?

There was one that was just approved by WHO. It's not perfectly sensitive or specific. It doesn't eliminate the need to admit a patient to a suspect ward and wait for confirmatory testing. It would be ideal to have a highly sensitive assay that could be done at point of care, just a drop of blood on a small piece of plastic. Then within a minute you have an answer, sort of like a pregnancy test. This type of rapid diagnostic test has been in use now for about 10 years with malaria and it has really revolutionized care.

But even if all you are doing is getting a drop of someone's blood, that's still going to require you dressing up in full personal protective equipment. It's going to require a lot of human resources and lot of material resources and a lot of training just to draw that drop of blood. Having some sort of prediction score can help identify which patients don't even need the rapid test because they are so unlikely to have Ebola and those who should have the rapid test because they may have Ebola,

and perhaps those who are so likely to have Ebola that you should just admit them and do the confirmatory testing because the rapid test is not going to be sensitive enough to rule it out.

What are the next steps?

Our data was collected from a single ETU. There are several studies starting to come out now from individual ETUs around West Africa. These are important and we are learning a lot from them. What would be even more impactful is if we could pool data together from multiple ETUs across West Africa. That would give us more statistical power to not only find what are the variables that are most predictive of Ebola, but also the variables that are most predictive of mortality or survival and what types of treatments tend to work better than others. That requires a lot of different organizations coming together to collaborate and to share data, which is not something that happens frequently after humanitarian emergencies. But I'm happy to say that I'm involved in a process right now whereby a number of these different organizations that ran ETUs—including my own organization, International Medical Corps—are starting to talk about how we can pool our data.

More information: "Derivation and Internal Validation of the Ebola Prediction Score for Risk Stratification of Patients With Suspected Ebola Virus Disease" DOI: dx.doi.org/10.1016/j.annemergmed.2015.03.011

Provided by Brown University