Clinical Chemistry

Medicine Unplugged: The Future of Laboratory Medicine

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Guest:
Dr. Eric Topol is Director of the Scripps Translational Science Institute and Professor of Genomics at the Scripps Research Institute.

Bob Barrett: This is the podcast from *Clinical Chemistry*. I'm Bob Barrett.

It wasn't all that long ago that telephones were used solely for making phone calls. Now with countless apps, such as the *Clinical Chemistry* App, smartphones have brought added functionality unthinkable a decade ago. Leveraging the power of over 6 billion active cellphones, thought to be greater than the number of toothbrushes or toilets in the world, these devices can be used anywhere to allow access to mobile health technologies.

In the December 2012 issue of *Clinical Chemistry*, Drs. Ravi Komatireddy and Eric Topol published a Perspective article on "Medicine Unplugged: The Future of Laboratory Medicine."

Dr. Topol is Director of the Scripps Translational Science Institute and Professor of Genomics at the Scripps Research Institute. He is our guest in this podcast.

Dr. Topol, you mentioned in your article that in the future, a combination of innovative computer programs and next generation diagnostic devices could replace 80% of physicians. Now how will that impact…

Dr. Eric Topol: No, no, I didn't say that. I quoted a prominent venture capitalist, Vinod Khosla, who said that. I don't agree with that, I want to be clear. But the point is that there is a lot of technology today where it actually bypasses traditional physician oversight or involvement. So that is basically data that's captured by an individual or by, here we're talking about lab-on-a-chip, on a phone, and that data can be analyzed independent of a physician and be available to consumers. This whole type of new parity of information - this is setting up a potential seismic change. I don't think it's going to reduce the need for physicians, but it certainly

counters the idea that we're growing into a big shortage of physicians, which I don't think is at all likely.

Bob Barrett: You mentioned "lab-on-a-chip." Now we've heard about that for quite a while. When will this become reality and what needs to change before we can say, "Go to the supermarket and buy a panel of lab tests?"

Dr. Eric Topol: Well, it's already there. It's here now. There's an iPhone that you can measure various analytes today, like thyroid hormone, or whether it's glucose. We're going to see increasing use of edge to phones, smartphones basically, mini-portable computers that have microfluidics and basically are conducting important laboratory assays with a read-out to the phone for display, very nice graphic display and trend plotting and archiving and then of course relaying to a physician or whoever else that data needs to go to.

Bob Barrett: When do you think that we'll see unplugged or bloodless devices for testing, that'll require a little more heavy lifting, something like troponins or even nucleic acid analysis?

Dr. Eric Topol: Well, I think in a genomic space, we already can do rapid genotyping with a cheek swab, buccal swab, or even saliva in getting a particular genotype or a few genotypes through that so that it would circumvent any need for blood sample. So that's just one example, obviously.

That would be a trend in the future to get away from the need for fingersticks or blood samples, that would be nice. We know, for example in tears that you could get an assay of glucose from tears and actually many other analytes. The breath can be digitized and there's a lot of information that can be found there.

So there are many other routes to get that critical information about digitizing human beings with important laboratory data, but still of course today, a blood sample is considered reference standard.

Bob Barrett: Earlier you talked about smartphones, and they seem to be getting smarter every day. What will their role be in medicine, particularly laboratory diagnostics, say in the year 2020?

Dr. Eric Topol: 2020 will come before you know it. But as we move forward over these next several years, the smartphone will be increasingly the hub of medicine, and that is whether it's a smartphone or a tablet device, because that's where not only there will be a most important physiologic metric, whether it's things like blood pressure, all the vital signs, glucose, the list goes on and on, laboratory testing through one's phone, but in addition, the whole idea of sequencing a

genome, which you can work on and look at on one's tablet, it's a lot easier than working on a small phone device.

So I think that's going to become a commonplace, so what you're suggesting in where we're going to be in 2020, I think it'll be increasingly common that people will have their genome sequenced and they'll have considerable value of information, particularly people who've taken ill for some reason or other, but the long-term uses to prevent illness, but also increasing use of this whole as we're talking about this wireless laboratory medicine that I think is going to be an important trend.

Bob Barrett: Smartphones, say 20 years or 30 years ago, were science fiction. So let's talk about a little science fiction: Star Trek, Dr. McCoy and his tricorder. Are we going that way or are the Dr. McCoys of the future going to be using tricorders?

Dr. Eric Topol: Well, not only are we going that way, but there's even a $10 million prize for the best medical tricorder now, which is going to, it would be given over the next couple few years, so that's a science in times. But that award, as I understand it, the Qualcomm X Prize, I think it's what it's called, that award is predicated on a consumer device that makes elegant diagnoses simple, quickly, cheaply. So that's where this is headed in basically. It will be a smartphone doing something that's extraordinary and we already have some examples of that: smartphones that basically can do ultrasounds of any part of a body, do laboratory testing, so it's going to be interesting how that gets revved up for this tricorder contest.

Bob Barrett: Studies have shown that point-of-care testing can lead to generating results faster, but getting the results to the right person and having them act on them often takes a lot longer. How will technology help address this problem?

Dr. Eric Topol: Oh, I think the jumps in technology here are the likes of which we've never seen before. It's all part of this greater shake-up of medicine in history. And what's clear is each of these technologies in their own right have to be validated, that they're not only measuring the thing we're saying that they're going to measure, but that they also are changing medicine for the good, that is the patient's outcomes are better, the expense is less, and we don't have a long history in healthcare of having new technology which lowered cost, for example. So that's going to have to be validated and that's a very important part of the future of ushering this in.

Bob Barrett: Well, finally, let's get to the important stuff now. You've been selected to be one of the country's 12 Rock Stars of Science by GQ Magazine. So what's that like? Sold out lectures, groupies, and entourage?

Dr. Eric Topol: No, no, none of that stuff. That was a couple of years ago that they set up this thing to try to promote science among young people. I guess, now they're having this on an annual basis. But the whole idea was the true Rock Star, in my case, I was paired up with Seal, so that was an interesting experience to meet him, but the whole idea was to get the sense -- the real rock star is to have such a following as you eluded to that they could help get the scientists to get some credibility and interest. As I think you know, we have a real problem among young people not nearly going into areas of math and science as ever before, and so that I think is an interesting way to try to capture the imagination and interests of the younger generation and hopefully that and many other things will be done to help restore the excitement of science among young people.

Bob Barrett: Dr. Eric Topol is Director of the Scripps Translational Science Institute and Professor of Genomics at the Scripps Research Institute. He's been our guest in this podcast from *Clinical Chemistry*. Dr. Topol's book, "The Creative Destruction of Medicine," was published earlier this year.

I'm Bob Barrett. Thanks for listening.