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The Role of Technology in Precision Medicine

Mr. Russomano:

There are far too many diseases that do not have proven means of prevention or effective treatments. Precision Medicine is an emerging approach for treatment and prevention that accounts for individual variability in genes, environment, and lifestyle for each person. But how does a big institution like Penn Medicine contribute to precision medicine? What are the technologies and infrastructures available to help support this greater initiative? I'm your host, Frank Russomano. You are listening to Voices from American Medicine on ReachMD. Joining me today is Brian Wells, Associate Vice-President Health Technology and Academic Computing at Penn Medicine and we will be discussing the role of technology in precision medicine. Brian, welcome to ReachMD.

Mr. Wells:

Thank you, it's great to be here.

Mr. Russomano:

Tell us about your role at Penn Medicine.

Mr. Wells:

So, my role is very unique. I'm at the intersection of all three missions of Penn Medicine, both education, research, and patient care. I manage a team of about 150 people who I like to say grease the wheels of science. Their jobs are to make sure the data's available, the applications and technology is available, and that infrastructure to do research computing is available to our clinicians and research teams at Penn.

Mr. Russomano:

Is that a fairly common role that other healthcare institutions have?

Mr. Wells:

I would say no. It's not common. There are a few folks like me around the country but it's, I think, more and more organizations are realizing that you need to integrate the two domains of health data and research computing into one so that the data can flow back and forth safely and securely and really provide the raw material that researchers need to make discoveries.

Mr. Russomano:

Great. Great. Thanks. So, can you tell us a little bit about precision medicine and Penn Medicine's role in supporting it?

Mr. Wells:

So, it started out in our 5-year strategic plan that was written in 2013. It was one of the key aims in that plan. We've added staff and faculty to support it and we've made millions of dollars of investments in infrastructure to enable the data to be stored and captured, to enable the high-performance computing capacity to exist, and to allow the data and the systems to be installed and in place to manage the flow of information.

Mr. Russomano:

So, how does precision medicine impact the care that you give at Penn Medicine?

Mr. Wells:

We really think it's the future of care. Traditionally care was more trial and error. You would try different medications for different diseases and work through coming up with a standard of care based on a group of patients and how those patients did on a certain protocol. We feel now that it's becoming much more precise, that it's care that's based on patients' specific genetic mutations or other attributes and it's not just tied to body systems or past experience with groups of patients; it's very targeted and that will reduce the cost and it will reduce the impact on the patient of the trial and error aspects of medicine.

Mr. Russomano:

Right. So, how did this start and when did it start at Penn Medicine?

Mr. Wells:

It probably started, I'd say, October of 2013 was probably when we really started to get serious about it. That was when the strategic plan was in development. I'd say the first big phase was to stand up what we call the Center for Personalized Diagnostics, or CPD, and that system and that procedure and those people, their job was to begin to implement a process for sequencing genetic tumors, genetic material coming out of patient tumors to figure out what's the specific makeup of that tumor and then thereby find the most appropriate drug or treatment for that tumor. For example, many patients have melanoma but if you have melanoma with a BRAF V600E mutation that's a very different protocol of treatment than a different kind of melanoma. We found, based on that process of sequencing their DNA of their tumors, that over 80% of the patients coming through the Center for Personalized Diagnostics and getting those results had their treatment protocol modified based on their sequence results. So, that was really one of the first big steps, was standing up that organization and hiring the people to lead it and get it organized and staffed.

Mr. Russomano:

Interesting. And so, how does that information become available to the clinicians in the practice?

Mr. Wells:

Today, because genetic information is not very standardized as it can flow around between electronic medical records, it's coming out as a paper report really that's either scanned in and emailed or faxed securely inside our organization to the ordering physician. And the pathologist that looked at the results comes up with the variants that they think are clinically significant and then makes recommendations as to what drugs might be the best to use. And it's because, you know, we're working with our vendors to find a way to make that data flow more discretely in a more electronic fashion into the electronic medical record, but the systems just aren't in place yet to support that, given the newness of this technology.

Mr. Russomano:

Brian, that's interesting stuff. Tell us a little bit about PennOmics.

Mr. Wells:

Sure. PennOmics is a name we came up with to brand our internally developed and somewhat purchased system that is where we house the research data and the clinical data. We had a clinical data warehouse for years that we started building in 2007 that we called Penn Data Store, but we had no way to link that data with the research data and then de-identify it. So, PennOmics is that research data warehouse that is now -- exists internally and has about 3 million patients in it, about 1.7 trillion variants of genetic data are in that system, and it connects all that information together that allows us, the researchers, to, without institutional review board approval, they can go in and query that data and find cohorts of patients based on genetic data, based on their clinical data, based on sample availability in our biobank, and that's really a very unique tool that very few places have in the country, and it's really enabled us to make discoveries and find things that we never could before.

Mr. Russomano:

Very interesting. If you're just tuning in, you are listening to Voices from American Medicine on ReachMD and I'm your host, Frank Russomano. Joining me is Brian Wells, Associate Vice-President Health Technology and Academic Computing at Penn Medicine. Brian, this is a huge undertaking, the way that you describe the program. The support system at Penn Medicine must be significant. Can you tell us a little bit about that?

Mr. Wells:

It is pretty significant. It's not small. We're managing a lot of data, 3 million patients, 4 billion objects of data about those patients, as I said 1.7 trillion genetic variants, and then 2 petabytes of disk storage. A petabyte is a thousand terabytes, it's a lot of space, or it's a million gigabytes. It's a lot of data, a lot of space, and it takes a team of system technicians to run the high-performance computing cluster, to keep that running, that's about 2 or 3 people plus all the storage and computing capacity. I've got about 30-some people in my data access center that help bring all this data together and de-identify it, liberate it, keep it secure, explain how to use it, support the tools and technologies that are accessing it. I've got 2 or 3 folks that are running a laboratory information management system that tracks the samples that are in the biobank as they come into the bank and go out of the bank for testing and evaluation. So, it's, in my whole team there's about 150 people supporting the infrastructure and the technologies to enable some of this stuff to happen.

Mr. Russomano:

So, certainly the purpose of this is to improve patient outcomes. What are you seeing in that area?

Mr. Wells:

As I said, one of the big things was the ability to modify a patient's treatment based on the genetic makeup of their tumor. We are getting into what we call germline genetics as well where we're testing for variants like BRCA1 and 2 which are tied to ovarian cancer and breast cancer, and if a woman has that variant then we can provide genetic counseling and guidance as to what might be the best treatment for her and options for her to treat that condition. So, we're seeing, I think, better outcomes, longer life for patients. We've been able, in using genetic engineering and other technologies, we're now able to take peoples' immune cells out of their bodies, re-engineer those immune cells, put them back in their bodies to fight their own leukemia and we've treated over 130 patients for that condition with that technology and I would say 90% or more have had almost a complete remission and are on the road to, in a sense, being cured of their leukemia. So, it's exciting information, exciting technology, very promising discoveries. We're able to use the sequencing data that we did for a cardiology study to then turn around and use the same data for a glaucoma study, because the genes that we sequenced happen to apply to both conditions or similarly involved in both conditions. So, it's a very exciting area and we're trying our best to leverage the investment and provide the benefit.

Mr. Russomano:

That's great stuff. Tell us a little bit about how the clinicians, the physicians, nurse practitioners, and PAs are feeling about the program and what kind of feedback are you getting from them?

Mr. Wells:

Well, it's very new to them, right? A lot of them are saying this is too much information. I don't understand all this genetic data. I need help with interpreting it. They need it to be simplified and identified for them exactly what actions they should take and what matters. In a sense, net it out for them, so they don't have to go learn genetics. It's a complicated field. They really want electronic decision support in an electronic medical record such that, for example, we could sequence a patient's DNA, figure out that they are better off getting drug A versus drug B based on how well they metabolize those drugs, and then have pop-ups in the electronic medical record that say, "No, no, no, don't order that drug, order this drug, because it's better for that patient." So, the clinicians are asking for help in wading through the content and automating as much of it as they can and we're trying our best to make that happen. We're working with our vendors and working our experts to enable that to happen. On the research side, the researchers, they're saying things like, "Thank you. Where have you been keeping this secret weapon?" I get that comment regularly as I go around the enterprise and explain what we have and what it can do. And they are a little skeptical about the quality of the data and can they really make the discovery? We just kicked off an internal competition with PennOmics. We're going to give two $10,000 prizes out to the researches that can use the data within PennOmics to make discoveries within the data alone. So, no patients have to get involved in coming in and giving blood or doing a trial or taking a drug. We're just going to look at the data, the historical data going back 10 years, and try to make discoveries just using the data alone in a fully de-identified way so that we're not taking advantage of anyone's privacy.

Mr. Russomano:

That's really good stuff. So, what are the next steps for you and your team?

Mr. Wells:

To continue to learn and evolve the technology, to make sure that we're making it as simple as we can, to reach out to our clinicians internally about what's available and how they can use it, to reach out to external clinicians about the CPD, for example, and make sure they know that this capability exists locally and they can send their patients here to Penn for this kind of complex genetic sequencing and advice and guidance. We're hoping to get the EMRs to come up to speed to support the data that we need and the capability that we need in the system and we want to continue to expand. That we're running lower on disk space now. It's very popular. The more data we sequence the more genetics we do the more disk space we need. So, we'll be buying probably more petabytes of disk to store the output. We've learned that governance is key. Having a common governance structure over all of this to make sure that there's agreement in the investments we're making is important. So those are some of the things coming down the road. We'll continue to invest in more integration with our clinical trial management system, with the EMR to make that easier for patients to flow from the research side into the clinical side and back. And those are just some of the things coming up.

Mr. Russomano:

That's great stuff. Brian, you've educated me and I'm sure you've educated our audience. We really appreciate you joining us.

Mr. Wells:

Oh, it's been my pleasure. Thank you for the opportunity and I am happy to share the exciting developments we have here at Penn.

Mr. Russomano:

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