2021 AMA Research Challenge finalist: Marielisa Cabrera-Sánchez

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Making the Rounds

Genomic adaptation, 2021 AMA Research Challenge finalist

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Featured topic and speakers

In this episode of Making the Rounds, Marielisa Cabrera-Sánchez, second-year medical student at Puerto Rico School of Medicine and AMA Research Challenge finalist, shares about her early enthusiasm for understanding microbes and infectious diseases, as well as how COVID-19 has impacted her research in genomic adaptation.

Learn more about the AMA Research Challenge.

Speakers

- **Marielisa Cabrera-Sánchez,** second-year medical student, University of Puerto Rico
- **Brendan Murphy,** senior news writer, American Medical Association

Host

- **Victoria Danan**, 2020 co-winner of the AMA Research Challenge

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Transcript

Danan: The AMA Research Challenge is the largest national, multi-specialty research event for medical students and residents. Hello, I'm Victoria Danan, co-winner of the 2020 AMA Research Challenge with Shamsh Shaikh. Today's interview features one of this year's five finalists for the 2021 AMA Research Challenge, interviewed by AMA Senior News Writer Brendan Murphy.

Murphy: Hello there. My name is Brendan Murphy. I'm a writer for AMA News covering issues related to medical students, residents and medical education. It is my pleasure today to have Marielisa Cabrera-Sánchez with me, a second-year medical student from the medical school of the University of Puerto Rico. Marielisa is a finalist in the 2021 AMA Research Challenge for her project, “Genetic adaptation of Moraxella catarrhalis during persistence in the airways of COPD patients.” Thank you so much for being with us, Marielisa.


Marielisa Cabrer-Sánchez, one of five AMA Research Challenge finalists.

Cabrera-Sánchez: Thank you for having me.

Murphy: So tell us a little bit about this topic, why it appealed to you and how you got involved in the research challenge?

Cabrera-Sánchez: My project focused on studying the genomes of Moraxella catarrhalis, which is a bacteria that is commonly found in COPD patients, and it causes exacerbations in COPD patients. We were looking at how M. cat adapts and persists while in the airways of these patients. We hypothesized that it is persisting in these airways by changing its genome. So using a lot of bioinformatics tools, we decided to see exactly what was changing in these genomes. We used 78 strains of M. cat and these strains were isolated from different patients and also throughout different visits. So we had a lot of data to work with since the beginning of the project.

So this project I did as part of a summer internship at the University of Buffalo, with Dr. Timothy Murphy and Dr. Hervé Tettelin, who is a faculty at the University of Maryland. What appealed to me the most about the project was the fact that it worked with infectious diseases, which is an interest of mine. I have actually had that interest for a few years now. I also wanted to work with this project because first, I have zero experience in bioinformatics, so this was definitely going to be very good learning experience for me regarding that field. Also, I did not know much about COPD nor Moraxella catarrhalis, I had not studied them during my undergraduate years. I had not had any experience regarding these bacteria and this condition. So it was an excellent learning opportunity for me. I got involved with the AMA challenge because one of the students that was part of the internship told me about this poster session, and then the competition, I did not know about it. So I looked into it and decided to submit an abstract and my project was elected to compete in the semi-finals. Now my project will proceed to the finals.

Murphy: Well, congratulations, it's very exciting. You mentioned not a ton of experience with this subject matter and it's certainly a dense topic for a physician, let alone a medical student. What were some of the challenges you encountered in doing this research and how did that faculty that you worked with in Buffalo help you overcome those challenges?

Cabrera-Sánchez: Good question. So the topic was definitely dense. I think that what made this project difficult was the technicality of the project. As I mentioned before, I didn't have any experience in bioinformatics research. So definitely that first week was kind of a shock but thankfully my mentors, both Dr. Hervé Tettelin and Dr. Timothy Murphy, they were very available, to not only help me get acquainted with the programs and the algorithms, and the computer language that we were using for our project but they were also available whenever I got stuck in a specific code. Or if I needed help constructing a code to do what I wanted to do, they were definitely available by phone, by Zoom. I did the program virtually because of COVID restrictions. I guess that open communication that we always had available definitely helped me not only adapt, that first week but also jump through any hoops that I had to overcome throughout the project.

Murphy: It does seem that medical student research is becoming more prevalent, medical students are more empowered. What advice would you offer to medical students who are conducting research on a highly technical topic like you did?

Cabrera-Sánchez: So my project, I would say that professionally as a physician, it is not so typical. I myself do not see myself as a professional doing this type of project with this technicality as a professional. However, I think that we have learned throughout the COVID pandemic, the bioinformatics and computer science have played and will continue to play a major role in advancing sciences and also the medical field. So I think that it is a door that will continuously be open for medical students to take. But as I said, I do not see myself as a professional doing it. Therefore, I don't have any specific advice to offer. I guess, that the door is always open, if it is a topic of interest for

you. You might need to find mentors that are not necessarily physicians. For example, I had Hervé Tettelin, who is a scientist with a PhD and a faculty member who is an expert in bacterial genomics. So maybe getting that extra collaboration with scientists that are experts in that field and technicality part of your project is the way to go as a future physician.

Murphy: Does the research have translational value in your view and are there next steps to this work?

Cabrera-Sánchez: Yeah, definitely. So all of our findings are important because right now there is no vaccine against M. cat available for COPD patients. So infection with this bacteria is associated with high morbidity and mortality amongst COPD patients. Yet we do not have any effective way of preventing these infections. Therefore, we are in need of a vaccine in order to help these patients. The specific findings of my project help identify exactly which changes were occurring in the genome. So eventually, which genes should we take into consideration to serve in a vaccine.

So let's say antigens. What I found was that the ubiquitous surface proteins called UspA1, 2 and 2H that are present in M. cat, they were changing a lot. I would say that specifically, right now, this finding is important because scientists are designing vaccines based on UspAs, to serve as antigens. If we have learned something from SARS-CoV-2, and the spike protein is that when you have an antigen, like the spike protein that is continuously changing over time, then vaccines might not be as effective to combat these new mutations and these new strains. This is the same scenario in COPD. So right now we have clinical trials running based on UspAs to serve as antigens yet my project shows that they are continuously changing. We have the question of how effective will these vaccines be eventually because you have bacteria that's consistently changing this antigen. Therefore, it might compromise the efficacy of the vaccine.

Murphy: You mentioned that maybe this isn't mirroring your career path, how will your experience doing this research influence what you go into as a specialty, how you practice as a physician, will it inform any of that?

Cabrera-Sánchez: As an aspiring physician that wants to work in the field of infectious diseases, I think that this field specifically, it has a lot of intersections. So you have the clinical intersection, you have the medical intersection and also the basic sciences. Bioinformatics, as I mentioned before, has played a major role in fighting recent microbes like SARS-CoV-2 and will continue to do so. I think that my role will be more to work at this intersection and collaborate with scientists that are experts in different fields of the basic sciences. Also, health care workers that are experts in clinical trial settings, for example. Also, physicians that can help me with the more clinical presentations of these infectious diseases and the impact that these microbes have on patients' health.

Murphy: We've discussed this work in a good amount of detail but are there other aspects of the work you'd like to highlight? Other are aspects that are medical student, resident and physician listeners

should know about what you've done and maybe what the future holds?

Cabrera-Sánchez: I mentioned this before but I think that if there is anything that I would highlight about my project is that there is an ever in increasing important role of bioinformatics in the medical fields, especially with infectious diseases. Therefore, an active collaboration of experts in the bioinformatics field, as well as diseases and other health care workers, is crucial. I think that also my project reflects what we have been going through with the COVID pandemic, the fact that we have SARS-CoV-2 strains that are mutating, spike protein, and it might be affecting vaccine efficacy. Therefore, I think that what I would highlight about my project is exactly what I just mentioned. So the ever-increasing important role of bioinformatics. Also, the fact that when we are designing vaccines, we have to choose good antigens. Antigens that are not changing over time in order to keep vaccines as effective as possible.

Murphy: What else should our listeners know about your journey in medicine? Where you come from, where you've been and where you plan on going?

Cabrera-Sánchez: So my journey in medicine, I would describe it as non-standard for two main reasons. First, I have known since a very early age, what I wanted to do professionally. So, I wanted to work with microbes and infectious diseases. Therefore, since an early age, I have been trying to seize opportunities and experiences around these two fields. So if you think about it, I kind of chose a subspecialty before even entering my undergraduate education. Also, second, I felt that when I compare myself to my peers that are medical students, I fell in love with the science part of medicine before the humanity aspect. I feel that is kind of different because when I ask my friends, "Why are you doing medicine?" They answer, "Oh, because I want to help people." In my case, I first fell in love with the science. So I was like, "Oh, wow, look at how the rabies virus is traveling up on neuron towards our brain." Then through our clinical experience, I grew fond of the human aspect of it.

So I guess that everyone has their own journey. Everyone has a reason that might be different for entering the medical field. I, as a professional, want to be present in-patient care. But for me, I really want to have some sort of research as a professional. I am going to try to find time to be in lab, to collaborate with different professionals in the basic sciences because it is something that fills me. So, I do not see myself just as a physician being 100% of my time next to the patient. I also see myself doing lab work.

Murphy: You mentioned an interest at an early age in infectious disease and stopping the spread of them. Was there anything that motivated that particular interest?

Cabrera-Sánchez: When I was 10-years-old, I asked Santa Claus to give me a microscope. So, I got the kit that Kmart sells where you have your basic microscope. I also got a telescope that Christmas and I was very excited about that too. I looked at a drop of salt water under the microscope. The first time that I looked at those microbes, I was like, "Oh my God, there is a whole world in there that we

just don't see with the naked eye." So first my fascination was about these microbes that I can't see and now I'm seeing them with this microscope and that was so cool. Then I started learning that these microbes affect human health. I started learning about dengue fever because I am from Puerto Rico and therefore, dengue fever is something that we have epidemics every two or three years.

We also have obviously influenza. So, I started learning about the flu and how was caused by a virus. For me, it was just so weird and at the same time, I was very intrigued by the fact that something microscopic that you can't see is so important for your health. Whether it is good, like your gut microbiota, and also bad at the same time, like all of these pathogens. For me, that was just mesmerizing. Then throughout the years in middle school and also high school, whenever we had a topic related to viruses, bacteria, fungi, in our biology courses, I was just jumping in my desk while I was learning about them. I was very excited about it.

Murphy: I'm guessing you're aware that the AMA Research Challenge comes with a $10,000 grand prize sponsored by Laurel Road. What would you do with that prize money?

Cabrera-Sánchez: I would use that money to pay my medical school debt.

Murphy: Very practical.

Cabrera-Sánchez: Yeah.

Murphy: Well, I think that's all we have today. So, thank you so much for your time, Marielisa and best of luck in the finals. Please stay tuned for additional episodes of this series with the finalist of the 2021 Research Challenge. I'm Brendan Murphy. Have a wonderful day.

Cabrera-Sánchez: Thank you, Brendan.

Danan: Join us on December 8 at 7 P.M. Central time to see all five finalists present their research to an elite panel of judges. The overall winner will receive a $10,000 grand prize sponsored by Laurel Road. For full details, visit ama-assn.org/research2021.

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