AMA Research Challenge 2021 finals

Watch 5 finalists present research and compete to win

With 1,100 submissions, 5 finalists present their research to an elite panel of judges and compete to win a $10,000 grand prize sponsored by Laurel Road in this year’s AMA Research Challenge.

Host

Todd Unger, AMA chief experience officer

Finalists

Marielisa Cabrera-Sánchez

- **Interview:** Making the Rounds podcast episode and transcript
- **Poster:** Genomic Adaptation of Moraxella catarrhalis During Persistence in the Airways of COPD patients (PDF)
- **School:** University of Puerto Rico School of Medicine

Naga Ganti, MBBS

- **Interview:** Making the Rounds podcast episode and transcript
- **Poster:** Epidemiology and prevalence of lung disease amongst e-cigarette users in the USA—A national study (PDF)
- **Institution:** Keystone Health

Anastasia Piersa, MD

- **Interview:** Making the Rounds podcast episode and transcript
- **Poster:** How do Medical School Experiences Differ between Students from Low vs. Higher SES Backgrounds? A Multicenter U.S. Survey Study. (PDF)
Unger: On behalf of the American Medical Association, welcome to the 2021 AMA Research Challenge. I'm Todd Unger, the AMA's chief experience officer, and I'm thrilled to host this event.
where we’ll showcase and judge the best of the best in research from medical students, residents and fellows, and the international medical graduate communities. But before we jump in, a little background on how we got here. For the second year in a row, we hosted our annual research poster event virtually.

And for the second year in a row, despite a pandemic, we had a record number of submissions, which is amazing. So a big thank you to everyone for your interest, participation and enthusiasm for this year’s research challenge, which generated these incredible numbers, 1,100 submissions, approximately 800 of which were selected for presentation in our virtual research challenge poster session. And of those, the 50 top scored posters made it to our semifinals and were voted on by participants, which brings us to today’s five finalists, a group whose work represents the innovative thinking we need to drive medicine forward.

I want to have one more number to mention: 10,000. That's right, this year for the first time ever, the challenge has a grand prize of $10,000. Thank you, Laurel Road for supporting research as the bedrock of science, medicine and improved patient care. So there you have it. That's how we got to today's final round of the AMA Research Challenge, where each finalist will have five minutes to present their idea and compete for this year's $10,000 grand prize.

And with that, let's get rolling and meet our fantastic blue ribbon panel of judges who'll be making the final call. Dr. Vineet Arora, the Herbert T. Abelson professor of medicine and dean for medical education at the University of Chicago's Pritzker School of Medicine, Dr. Sanjay Desai, the AMA's chief academic officer and group vice president of medical education and Dr. Clyde Yancy, vice dean of diversity and inclusion, professor of medicine and medical social sciences, and chief of the division of cardiology at Northwestern University's Feinberg School of Medicine.

Thank you judges for being here today. And now, it's time to meet our incredible finalists, the five top vote getters from the 2021 AMA Research Challenge semifinals. First up, we have Marielisa Cabrera-Sánchez, a second-year medical student from the University of Puerto Rico School of Medicine. Marielisa, what inspired you to go to medical school?

Cabrera-Sánchez: At the age of 10, I looked at a drop of salt water under the microscope, and I became fascinated about this microscopic world and the microbes that I was seeing. However, it wasn't until my undergraduate years at Cornell University, that I could formally participate in a real research project. Since then, I have done additional research within the fields of infectious diseases across different academic institutions in the U.S. and I continue to do so during medical school. Having said this, what started as a mere scientific curiosity about microbes during my childhood eventually developed into a professional aspiration to do research.

Unger: Thank you, Marielisa. Next up, please welcome Dr. Naga Ganti, an international medical graduate and research assistant at Keystone Health. Dr. Ganti, this has been another challenging year
to say the least, what keeps you motivated?

**Dr. Ganti:** Yes, I would definitely agree that this has been another challenging year for everyone, but I believe that there will always be light at the end of the tunnel and personally, spending some quality time with my family and friends who are my support system makes me feel much better and keeps me motivated to do what I'm doing.

**Unger:** Thanks for being here, Dr. Ganti. Next, Dr. Anastasia Piersa, a resident at Massachusetts General Hospital. Dr. Piersa, what inspired you to get involved in research?

**Dr. Piersa:** I think going into medicine, I wanted to make an impact on patients one at a time, but I also wanted to figure out a way to make a more global impact and on large groups of patients all at once, and research, I think is a really nice way to do that because you are answering questions that the responses to those questions can potentially benefit a lot of people. So I think that is what's inspired me to try out research and see how I could incorporate that into my career.

**Unger:** Great to have you here, Dr. Piersa. Now let's welcome, Priya Shah, a fourth-year medical student at Harvard Medical School. Priya, what are your plans after you graduate?

**Shah:** I'm currently a fourth-year student applying into pediatrics residency programs. I hope to integrate both medical education and legislative advocacy into my future career. I believe that pediatricians have an important duty to educate patients and their families about disease prevention and treatment. And they also have a unique vantage point on children's health and can use their firsthand experiences to tell impactful stories that shape the direction of our country. In addition to providing compassionate patient centered care, I aim to use my distinctive voice and leadership skills to create educational programs and push forward legislative efforts that directly benefit the health and safety of our youth.

**Unger:** Thanks, Priya. And finally, Arman Shahriar, a fourth year medical student at the University of Minnesota School. Arman, what inspired you to get involved in research?

**Shahriar:** So research, it's kind of satisfied intellectual curiosity that I have while I've been in medical school. I'd always had my eyes on different projects, but I was never super involved until I started medical school, but it's helped me answer questions and bring attention to topics that I think are really important.

**Unger:** Great. Thanks, Arman. And thank you to all of our finalists for being here today. Good luck everyone. Let the Research Challenge begin. First up, Marielisa Cabrera-Sánchez.

**Cabrera-Sánchez:** Good evening, everyone. My name is Marielisa Cabrera-Sánchez and I am a second year medical student at the University of Puerto Rico School of Medicine. Tonight, I will be
discussing the genomic adaptation of Moraxella catarrhalis during persistence in the airways of chronic obstructive pulmonary disease patients, a collaborative project between Dr. Timothy Murphy and Charmaine Kirkham from the University at Buffalo, Dr. Hervé Tettelin from the University of Maryland, and me.

COPD is a chronic inflammatory disease of the respiratory tract and is the third leading cause of death worldwide. Moraxella catarrhalis, M. cat, causes exacerbations and persists in the airways of COPD patients for months and years contributing to progressive decline in lung function. Ubiquitous surface proteins, UspA1, 2, and 2H in M. cat mediate adherence to the airway epithelium and also functioning aggregation, biofilm formation and complement resistance.

We hypothesize that M. cat persists in the airways of COPD patients by altering its genome. In order to carry out our study, 78 persistent strains of M. cat were isolated from COPD patients as part of a 20-year perspective study at the Buffalo VA Center. The key to our study is the longitudinal collection of strains that enables us to observe and catch genomic changes during the time they persist in the airways. The strains were isolated from sputum that was collected during monthly visits and a time of exacerbations.

Subsequently, the complete genomes of selected serial isolates from acquisition until clearance were sequenced. Genomic protein and phylogenetic analysis was done using a variety of bioinformatic tools. Western blots of whole cell lysates were probed with a pan-UspA antibody. To identify which genes were being altered during persistence, I performed comparative genomic analysis using nuclide and protein alignments by writing scripts to implement a variety of bioinformatic tools on the University of Buffalo compute cluster.

We found that M. cat indeed alters its genome during persistence and the genes that were most altered were UspA1, 2 and 2H, genes that encode surface proteins important for virulence. Interestingly, all of the alterations observed upstream and within the genes occurred at repeat regions. For UspA1, I found that M. cat decreases the number of dinucleotide repeats in the promoter, decreasing the expression of the encoded UspA1 protein. This is noted by the blue arrow in the Western blot for patient 48. On the other hand, I observed that M. cat alters several repeats upstream and within the UspA2 and 2H genes, but this does not affect the expression of the proteins.

These include the AG18 nuclear type repeat and the Q-amino acid repeat in UspA2, as well as the seven amino acid repeat in both UspA2 and 2H. This is noted by the orange arrows in the Western blot for patients 25 and 84. Previous studies done entirely in Vitro show that altering the AGA2 repeat upstream of UspA2 significantly affects its expression. By contrast, our study was performed with strains that persisted in-vivo, in the airways of COPD patients likely explaining our unique results.

We also discovered a novel mechanism by which M. cat alters its genome. For patient 14, I analyzed the sequences of four sequential isolates and identified a recombination event between UspA1 and 2H.

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occurring between visits 18 and 21. This is the first report of intragenomic recombination occurring in M. cat that generates new chimeric UspAs.

When I align the amino acid sequences of all of the UspAs from our collection and generated a phylogenetic tree that chimeric cluster separately from all previously observed UspAs. In summary, we discovered that M. cat alters genomic repeats in UspA1, 2 and 2H genes, which results in the change of expression and modification in the antigenic structure of these critical surface proteins facilitating persistence in the airways of COPD patients.

The significance of this study is that the big data computational approaches that I apply lead to novel observations. The ... mechanisms used by M. cat to persist in the airways of COPD patients. These findings are fundamental when designing and engineering drugs and vaccines that target M.cat in the human airways. These therapeutics have the potential to increase quality of life and decrease mortality of COPD. Thank you for your attention.

**Unger:** Good work, Marielisa. Thank you. And now it's time for our judges. Dr. Arora, why don't you kick us off?

**Dr. Arora:** Sure. I want to commend Marielisa on this outstanding presentation and really groundbreaking work as somebody who sees a lot of end-stage COPD patients in the hospital who are suffering from chronic bronchitis and infections and you're trying to figure out, why are the antibiotics not working? This really gave me a lot of pause to think about how could we target those therapies and vaccines in the future to help eradicate people's airways so that they could actually have a better quality of life. And certainly, there seems to be so many implications right now, especially as we think about variants and the pandemic. And so, it's just really fundamental work, I agree.

**Unger:** Dr. Desai?

**Dr. Desai:** I want to also commend you. As a pulmonologist, this is the center of much of the clinical work that I do. And I think the approach that you've taken, this felt in many ways like a PhD level of research in terms of the sophistication that you used and the methodology, and it was clear the mastery of the methodology that you personally had in this research. The question that comes to my mind is that this creates a lot of opportunity to build further research in terms of making it clinically even more relevant.

And you made a comment about how this has implications to quality of life and mortality. And I think that making the exact connections from the mutations that were seen to numbers of exacerbations, to mortality, to quality of life, would be an important step in between. We know that if Moraxella is there and it's persisting, then it leads to these complications and unfortunate outcomes. But connecting that to the numbers of mutations and when these mutations occur, I think would be particularly helpful.
I also think that there may be opportunity to look at other similar conditions. So cystic fibrosis is an example. We know pseudomonas as an example colonizes regularly, and to see if the same types of mutations or same families of mutations are occurring there and whether interventions that we've learned, because we've made transformational change in the management of patients with cystic fibrosis might be able to be modified and used in patients with COPD as well. So, I think that there is so much to build on and it was inspiring to see the sophistication of the research and the novelty of using a longitudinal method and in vivo modeling, so congratulations.

Unger: And Dr. Yancy.

Dr. Yancy: Well, I too extend my congratulations and I echo the sentiments expressed by Vineet and by Dr. Desai, Sanjay, because clearly we've seen a very talented investigator bring forward some exciting research. But I'd like to shift my frame to the investigator, all good research, inevitably yields new questions. And I think this work exactly does that trying to help us understand what is the pathophysiology or the persistence of these pulmonary pathogens that drives such a clinical scenario like COPD into territories where we see so much more morbidity and mortality.

So kudos to the investigator and to the team because it's evident that there's been very good mentoring. There's been very good access to crisp methodology, but even more importantly than that, the investigator did a brilliant job of synthesizing the search, presenting it clearly. And for someone so early in their research career, I walk away with this sense of great potential for an eruptive future of terrific discoveries.

So, accolades all around for the mentoring, for the availability of resources, for the synthesis, for the presentation and because you've accomplished the most important thing about research, you yielded new questions and new directions. Really kudos for such brilliant work.

Unger: Thank you judges. Next up, Dr. Naga Ganti.

Dr. Ganti: Hello, everyone. My name is Naga Ganti. I'm an international medical graduate. I completed all U.S. Medical Licensing Examinations and looking forward for specialty training. Today, I will be presenting our project titled “The epidemiology and prevalence of lung disease amongst e-cigarette users in the United States of America, a national study.” Let me start by giving you a brief introduction of our project. E-cigarettes are handheld devices that produce aerosols of nicotine and toxins like formaldehyde, acetaldehyde, acrolein and metallic nanoparticles, et cetera.

These toxins are associated with inflammatory processing lung tissue causing remodeling and fibrosis leading to decreased pulmonary function capacity. Elevated levels of inflammatory biomarker, YKL-40 were noticed in the serum of e-cigarette users. The vapors from e-cigarette also damaged the DNA repair mechanism leading to cancer. The prevalence of e-cigarette use has increased significantly over the last five years. And according to National Youth Tobacco Surgery, more than two million U.S.
youths currently use e-cigarettes every day. These statistics and numbers ... interest to work on this project.

In our study, we aim to evaluate the prevalence of lung disease amongst e-cigarette users. Coming to the methodology of our study, this is a population based retrospective cross-sectional study based on National Health and Nutrition Examination Survey of CDC from the years, 2015-2018. Adults who use e-cigarettes, traditional smokers, dual smokers and non-smokers were identified. And we compared their social demographic characteristics with the prevalence of lung disease by using chi-square test for categorical variables, Mann-Whitney and student unpaired t-test for continuous variables.

Respondents are 18 years old and missing demographics and outcomes were excluded from this study. The results are as follows. Out of 178,157 respondents, we found that e-cigarette use is highly prevalent in females, Mexican-Americans, age group, 18 to 44 years, and the population whose annual household income is greater than $100,000. We also found that the prevalence of asthma is highest among e-cigarette users compared to traditional smokers or non-smokers.

And the prevalence of COPD is highest among dual smokers compared to e-cigarette users alone or traditional smokers. From the table two, we found that median age at which asthma is diagnosed in e-cigarette users is seven compared to traditional smokers, it is 25. From these results, we conclude that the prevalence of e-cigarette use is higher among females, Mexican-Americans, youth and high annual household income population. The higher prevalence of e-cigarette among youth may be due to factors like easy availability and accessibility of ... flavors and absence of strict policies on age cutoff to buy e-cigarettes.

Public health measures like creating awareness and regulating the industry and its marketing can decrease the use of e-cigarettes. Going forward, we would like to expand our study to learn more about the morbidity and disability caused with e-cigarettes in long distance population. Before I end my presentation, I would like to thank my team and mentors and AMA, for giving us this platform to present our work. Thank you so much.

**Unger:** Thank you so much, Dr. Ganti. And now to our judges, first up, Dr. Desai.

**Dr. Desai:** Great. I want to congratulate you for such an ambitious project and it's highly creative. And it explores such an important issue right now, not just because of lung health. As I mentioned, I'm a pulmonologist, so this is a big area of focus for me, but globally lung health is one of the most common areas of focus that we need more attention on. And then secondly, e-cigarettes, which is a problem that has already emerged, but certainly has tremendous risk of becoming a much bigger problem, not only in this country, but globally as well.

So thank you for taking on such an ambitious project. I think that this research raises many other questions and creates hypotheses that we could then test, which would connect the work that you've
done, the epidemiology work to clinical application and clinical ... And the example that comes to my mind listening to you is that of asthma and the use of e-cigarettes. You demonstrated that those that use e-cigarettes get diagnosed with asthma at the age of seven, the median age of seven.

So clearly they’re diagnosed before they’re using the e-cigarettes and it’s interesting to think about why that correlation may occur. Is there something colinear with the diagnosis of asthma that leads you preferentially to use e-cigarettes? Maybe they seek health care sooner. Maybe there are other confounders that we should be looking at to understand why that correlation is there. And I think that’s an area that if we can understand it better, would be area for potential intervention.

Another hypothesis that you could generate from your data relate to COPD. And it was interesting because when you use large data sets, you’re confined and limited by the data that is in that data set. And here is an example of where COPD, actually the prevalence was higher in non-smokers than in e-cigarette smokers. And I think, again, this is an example of where that may be an artifact of the data set, or it may be that there’s another confounder that we need to understand better to understand how we make interventions on this. So again, congratulations on such an ambitious project.

**Unger:** Dr. Yancy?

**Dr. Yancy:** I also want to extend my congratulations, but I also want to acknowledge that in this AMA Research Challenge, we’ve done a brilliant job so far of really endorsing diversity. Our first presentation came from the University of Puerto Rico, and now we’re dealing with an aspiring immigrant physician who is involved deeply in clinical science. I think this is as it should be. I really enjoy the way in which we saw the use of the National Health and Nutrition Examination Survey data set, because it really lets us know that this tool is available and there are many questions that could be answered.

The public health implications are very important, but it was a very interesting observation that unlike many traits that are associated with a burden of disease that retain to the social construct, if you will, there was an association with higher income here. We need to understand more clearly what that means. Is it just simply the cost of access or is there something culturally about persons in different economic structures? We have to be careful to suggest that anything is causal, but we do this kind of epidemiology to tease out, as Dr. Desai rightly said, new hypotheses.

So I applaud the investigator. I applaud the AMA for bringing in different kinds of investigators, but I also think the public health questions become much more robust now that we see these early data and we begin to look and characteristics of those exposed and as the investigators so aptly stated, we need to understand much more about the disability. I delighted in the use of that word, the disability associated with this behavior. So I’m extending my congratulations as well.

**Unger:** And Dr. Arora?
**Dr. Arora:** Thank you. I want to also start off by congratulations on really important public health work and I certainly agree with Sanjay and Clyde on their excellent comments. I could not help, but think about the groups, the affinity groups that are attracted to e-cigarettes that this study really out outlined. And I think in the public eye, a lot of us know that e-cigarettes are very popular among young people and teens, but this was the first time I was really seeing women outlined as a group that's using e-cigarettes as well as Mexican-Americans and already highlighted by Clyde, this interesting finding about groups that were of higher income.

And it made me really wonder about things like advertising and stigma, is there a certain type of stigma associated with traditional cigarettes that is not associated with the e-cigarettes? And how do we break the stigma? And so I just had a lot of interesting places to go for interventions, targeting women, figuring out how to engage and partner with groups like women and Mexican-Americans to understand further what is driving their use because those cultural beliefs are going to be critical to helping actually improve the help of those populations.

**Unger:** Dr. Yancy, did you want to add to that?

**Dr. Yancy:** I really do. I want to thank Vineet for really connecting the dots here. We're looking at women, we're looking at the youth, we're looking at those that are more fluent. It really does seem as if there's some socially acceptability about the e-cigarettes. We can't let this become cool, because once it becomes cool, the proliferation is uncontrollable. So, we need this kind of research to help us understand what are the characteristics of the users while we're also pursuing the disability associated with this. So again, applauding the research and really endorsing in these really great comments.

**Unger:** Great discussion, judges. Now, our next finalist, Dr. Anastasia Piersa.

**Dr. Piersa:** Hello, everyone. My name is Anastasia Piersa, and I am excited to present this work on socioeconomic diversity in medicine. Over the years, medical schools have increased their efforts to recruit diverse medical students. However, a 2018 AAMC report showed that the representation of students coming from low socioeconomic status or SES backgrounds remains low. Additionally, those students face higher rates of attrition in medical school, as well as academic difficulties.

This study set off to understand the differences in experiences between lower SES medical students and their higher SES peers. We surveyed students from 14 different medical schools across the country with a good mix between private and public institutions. We developed our survey with the input from current medical students to include both quantitative Likert scale questions, as well as standardized tools, such as the Maslach Burnout Inventory or MBI and the UCLA Loneliness Scale.

We also included qualitative question to better capture medical students’ experiences. Because there isn't one definition of low socioeconomic status in the literature, we used three different definitions that are found out there and combined them together to better identify medical students coming from low
SES backgrounds. We then compared the responses between low and higher SES medical students using multi-variable generalized estimating equation models. And we made sure to adjust for different confounders using the backward stepwise selection process.

Overall, 1,500 students responded to our survey and around 1,200 were included in our final analysis for a total response rate of 23%. Of those students, around 30% were considered to be low SES. The students that we reached were fairly diverse in terms of age, gender, year in school and predictably, race and ethnicity emerged as important confounders for socioeconomic status, with black and Hispanic students being more likely to be low SES as well. We made sure to adjust for those in our analysis. We found a number of significant results in our study.

From a financial perspective, low SES medical students were 2.9 times more likely to report experiencing financial strain in medical school. Low CS medical students were also less likely to report feeling confident about affording not only educational resources, but also basic resources such as food and shelter. From a social perspective, low CS medical students reported feeling less connected to their medical school community and also feeling less confident about being able to afford to share their experiences with their peers.

And from a mental health and wellness perspective, low SES medical students were one and a half times more likely to be burned out, and also scored higher on the loneliness scale. The quantitative questions and responses that we got really helped contextualize and confirm some of this qualitative findings. Some of the qualitative responses I would like to share with you include a response from one student, "I felt wholly out of place coming from a low SES background, some of my classmates cars cost the same as my parents' home."

Another student shared, "Low SES students don't have access to the same advice and social circles as their high SES peers, which puts them at a great disadvantage." And finally, a third medical student noted that the medical education system itself is set up against low SES medical students. Stating that, "The idea that we are expected to pay for away rotations, study resources and travel to interviews is criminal." I wish I could share more of these qualitative responses with you, as they capture all the difficulties that low SES medical students face.

In summary, this study showed that low SES medical students faced difficulties compared to their higher SES peers that span beyond financial difficulties and would benefit from more support. This underscores the importance of creating and following evidence-based recommendations on how to support low SES medical students and promote diversity in medical education. We present some of our recommendations based on our data here. More studies are needed on this important topic. Thank you so much for listening. And I would like to thank everyone of the medical students who filled out the survey and all of our collaborators that made this study possible. Thank you

Unger: Very interesting work, Dr. Piersa. Now to our judges. Dr. Yancy, will you kick us off?
Dr. Yancy: Happy to do so, and let me really congratulate Dr. Piersa, but congratulate her in a very intentional way. We’re just beginning to unravel what’s important about culture, about life and living circumstances that associates with success in the pursuit of all careers and the life sciences, but particularly medicine. These echoes that we’ve heard from Dr. Piersa about the results of the survey, particularly the qualitative echoes, should not be overlooked. A sense of loneliness, a sense of burnout.

I would love to see this happen again with even more rigorous qualitative methods, so we can understand to what extent that’s represented throughout the cohort, the sample. I'd love to know, what about the students that didn't respond to the survey? Is there even more depth that we haven't captured? This is so vitally important if we really are to create an environment that encourages belongingness, because what we've heard from Dr. Piersa is that what's missing is belongingness.

And how does that relate to future performance? How does that relate to competence? How does that impact the other students? We don't have that information, understanding how other students feel in this setting. One of the challenges that Dr. Piersa faced, which is a difficult one to reconcile, is how do you define low SES? Is it a self-assigned trait? Is it based on parents? Is it something that the AAMC declares? There’s a lot of work it has to do.

This is at an incipient level, but I'm delighted that an early career investigator takes this on and wants to pursue first the characteristics, but then I hope we continue to pursue what are the consequences, not just the characteristics, but what are the consequences of entering a really rigorous medical education process and having to work through yet another barrier, yet another challenge. So, this conversation is just beginning courtesy of Dr. Piersa, but it needs to continue and go forward.

Unger: Dr. Arora?

Dr. Arora: Let me add my congratulations, but also deep respect for the findings of this important work to Dr. Piersa and her colleagues. As dean for medical education in a busy admission season, I am acutely aware of the really gross income disparities that medical students and future physicians we have among in our ranks where 70% of students are coming from the top two quintiles of family income in the United States. So, we really need to think very carefully and about how we are closing out this career from a generation of people because of income.

And so, I think thinking about this as a medical school, how do we support students so that they don't have, accumulate these hidden costs and face this stress from just trying to get through the day and fill out a residency application is incredibly important. I also had some really interesting ideas about workforce, are there differences in where people practice? We know that people are more likely to serve their communities.

And so, this is even more important to really improve burnout and loneliness and keep those people in practice so that they can actually contribute to medicine also with specialty choice and educational
debt. So, I think these are all really important factors. And so, this is an important needs assessment, but we need to actually fix this in medical education and move forward.

**Unger:** Dr. Desai?

**Dr. Desai:** I want to congratulate you as well. And I find this work to be so compelling in terms of exploration of an issue that's central to what we need to solve. And I think the comments by my colleagues, Clyde and Vineet, as leaders of medical schools, demonstrate how important this issue is for all of us and for the country. I think, to me, I was impressed with how we can move this forward and try to identify interventions. Survey research, all of us that have done it recognize how difficult it is and the response rate of 23%, I think Clyde brought this up as well, it will be important for us to be careful in terms of understanding how this might be generalized and what we might be missing.

You also mentioned the experience that COVID, how COVID may have influenced the experience of the students that were surveyed. And we know that COVID has a disproportionate impact on those with low SES as well. And so, understanding how we disentangle that so that we understand the interventions and maybe that's through future studies that are similar to what you've already started. And the third that comes to my mind in terms of intervention is understanding what might be driving it.

And you mentioned financial strain. And if there's an opportunity, either through the research that you have done or building on it, to look at schools that provide different levels, various levels of financial support, which may mitigate some of the burden related to the cost of education and if that changes the experience of the medical students, but this is very similar to the stories that we hear about minoritized students of various characteristics. And I think really builds on this story and is, again, so compelling for us to move forward in addressing. So, thank you for this research.

**Unger:** And thank you judges. Now for our fourth finalist, Priya Shah.

**Shah:** Hello, my name is Priya, and I'm a fourth year student at Harvard Medical school. My project is titled, "Trauma-informed care in pediatrics, an interactive module for clerkship students." Trauma-informed care is an approach in which a provider recognizes that an individual is more likely than not to have a history of trauma, evidenced by the landmark CDC-Kaiser Adverse Childhood Experiences Study published in 1998. In this study, over 17,000 patients filled out surveys about their childhood experiences relating to abuse, neglect and household challenges, as well as their current health status and behaviors.

Almost two-thirds of study participants had at least one adverse childhood experience, and more than one in five reported three or more adverse childhood experiences, also known as ACEs. They found a graded dose response relationship between the number of ACEs and the risk for negative outcomes relating to injury, mental health, maternal health, infectious disease, chronic disease, risky behaviors, and educational and professional opportunities.
A follow-up study published earlier this year showed that up to 60% of children with high numbers of ACEs are not receiving the behavioral health services that could improve their developmental outcomes. Thus, this is an incredibly prevalent issue that we are not adequately addressing.

Research has shown that using a trauma informed lens can prevent the use of language, behaviors and procedures that may inadvertently re-traumatize patients. Our goal was to create a session for pediatric clerkship medical students to better understand the effects of trauma and development, learn how to counsel caregivers on positive parenting and practice exploring psychological etiologies of physical symptoms through a simulated patient interview.

I developed and ran an hour-long curriculum for medical students during their core pediatrics clerkship. The session consisted of a didactic portion followed by an interactive role-playing simulation. During the didactic portion, we reviewed the CDC-Kaiser Adverse Childhood Experiences study. We discussed the broad definition of trauma and the multitude of ways in which trauma can manifest, which can potentially lead to misdiagnosis. And we explored ways in which toxic stress leads to permanent change in the body, focusing on brain development, immune function, and epigenetics.

This portion set the stage for students to understand both the prevalence and lifelong impact of trauma on development. We then transitioned into learning and practicing tangible strategies for students to use with their patients and their families, including positive parenting techniques that promote healthy neuronal connections during childhood development. The final portion of the session was a role-playing simulation.

The students practice with two cases, one in which they played the patient or caregiver role and the other in which they were the provider. The first case was an eight-year-old male presenting with regressive bedwetting. And the second was a 15-year-old female presenting with stomach aches. Through gathering a detailed history in a sensitive manner, the provider would learn that each of the patients had difficult situations going on at home that may have been contributing to their presenting symptoms. We concluded the session by debriefing the simulation and sharing examples of specific verbiage that was helpful in exploring psychological ideologies of physical symptoms.

Students were asked to complete pre- and post-session surveys that addressed knowledge and confidence surrounding five session objectives, each measured on a five-point Likert scale, as well as a two week post-session survey with qualitative comments regarding their application of trauma informed care principles during their clerkship. A total of 36 students attended the session and 24 completed the surveys.

The anonymously paired pre- and post-session survey responses indicate that there was a highly significant improvement in students' knowledge and confidence in providing trauma informed care with a P value of less than 0.00001. Qualitative comments describe the use of trauma informed care in settings ranging pediatric primary care offices, to the emergency department, to inpatient wards.
highly significant learning gains, as well as the rapid application of concepts learned in a breadth of settings, speak to both the need and utility of medical school curricula that address trauma informed care.

Future directions for this project include testing longer term retention and use of lessons learned as well as creating an overarching centralized teaching on trauma-informed care, paired with clerkship specific modules to enhance learning through spaced repetition. I’d like to thank Dr. Katie O'Donnell for her mentorship on this project. And thank you all for your time and attention to this important topic.

**Unger:** Great work, Priya. And now to our judges. Dr. Arora, you're first.

**Dr. Arora:** Thank you, Priya, for this outstanding presentation really documenting the effectiveness of this novel curriculum on a really important topic on trauma informed care, particularly for pediatrics, a novel space. Certainly, this is near and dear to my heart as somebody who does a lot of medical education research and thinking about that long-term retention of knowledge and application. And so I loved the idea of the mixed methods and that you got this really powerful qualitative data.

I would've loved to see a little bit more of that qualitative data around how students were using it. And then one really substantive question that I often am seeing a lot of is, we are training our students and our residents, our newer learners in these concepts, but how do we train our faculty? How do we really make the patient the center and make sure that we get the data that we need from patients in a very patient centered way, especially when we're discussing trauma? And so, I would love to know a little bit more about what faculty preceptors thought about this work as well.

**Unger:** Dr. Desai?

**Dr. Desai:** Yes, I'd also like to commend you. I think that it was a wonderful presentation and your knowledge of this space material is clear, as you speak about it. It also fills, I think an unmet need in many traditional curricula. And so, I think will be a welcome addition to the way that we teach this important topic. As I listen to you, I think the thoughts that cross my mind are, how do we ensure that the impact that's created is durable and that it can be sustainable?

It was actually very impressive, the personal investment that you made in actually teaching this to the students, but it's highly resource intensive. So how do you create one that again is durable and impacts? You mentioned measuring further out beyond two weeks, so I think that's an important next step. And then thinking also about the audience that we train. So, the one idea that crossed my mind as I listened to you was, do we train the trainers?

Do we actually direct this curriculum to faculty so that it becomes more sustainable and feasible in the longer term and potentially could scale? But again, such an important topic and a very creative approach. Thank you.
Dr. Yancy: Priya, I also congratulate you, but Todd, let me just tell you, as enjoyable as it is to listen to young investigators like Priya, it’s really a blast to listen to Vineet and Sanjay basically say, "Wow, and here’s a new idea. Here’s a new idea."

So, let me continue the theme of a new idea, I would love to see this revisited in a more contextual way, because not only are the students learning about trauma induced experiences, and I'm a big advocate of a deeper understanding of adverse childhood experiences for lots of cardiovascular implications, but what about the adverse childhood experiences of the learner, of the medical student?

Can we contextualize the way the learning proceeds when we take into consideration that some of those who are in the learning environment may have had one, two or three ACEs as well? There’s so much power in this kind of conversation. And again, I’m enthused to share this dais, if you will, with really excellent leaders in medicine, and to think carefully about the right directions to go with this really important work.

Unger: You’re right, Dr. Yancy. I am loving these judges’ conversations. And now for our fifth and final finalist, Arman Shahriar.

Shahriar: Hi, my name is Arman Shahriar and I'm a fourth year medical student at the University of Minnesota Medical School and a current internal medicine applicant. I'm going to be presenting our poster titled, socioeconomic diversity of matriculating U.S. medical students by race and ethnicity from 2017 to 2019. Because our study design is actually quite simple, I'm going to spend the first two minutes discussing the background.

Patients generally prefer to see physicians with whom they share identity or lived experiences. Unsurprisingly, patients also tend to do better when seen by physicians who share some form of identity with them. Lived experiences can be a result of race and ethnicity, but can also be a result of socioeconomics, language, neighborhood, religion, and much more. Concerning medical students, diversity efforts and scholarly work to date have focused primarily on visible forms of identity like race and gender. This is really important work.

The most recent analysis titled, diversity of the national medical student body, four decades of inequities, was published in “The New England Journal” in April. The findings were in line with several papers before it, that gender-based diversity has improved, but that the needle on racial and ethnic diversity has not moved much in decades. The interesting thing is that in this paper and several before it, there was no mention of socioeconomics, finances or money.

Existing racial-economic disparities have deep roots in structural and other forms of racism. Coupling this reality with a profession that has made itself either intentionally or unintentionally accessible
primarily to the rich, we have a new theory as to why there has been such little progress in increasing the racial and ethnic diversity in medical schools. It is within this context that we design this simple but important exploratory study. We believe that socioeconomics are a critical missing component of the conversation.

Moving to our methods, to be brief, we used the best available data to compare the income composition of the medical student body with that of the general population stratified by race and ethnicity. The data for medical students came from the AAMC’s matriculating student questionnaire, and the data for the general population came from the U.S. census. On both surveys, race and ethnicity were self-reported from categories defined by the investigators.

Shifting our attention to the findings, in the figure, colors represent household income groups divided into quintiles. The highest quintile is further stratified to show the top 5% in red. For all three years, the how household income to be classified as a top 5% household was around 230 to $250,000 a year. Right away, what stands out is the difference in size of the red pink segment when comparing medical students with the U.S. population.

High income households are overrepresented both overall and within each racial ethnic group. Low income households are consistently underrepresented. To put this into context, on the right-hand side of the poster, we show the racial and ethnic composition of the two extremes, the top 5% and the bottom 20%. For each subgroup, we show a representation index indicating the degree of overrepresentation, values above one, or underrepresentation, values below one, in medical schools.

For example, looking at the first row in the red table, the top 5% is 4.8 fold overrepresented in the medical student body. The top 5% accounts for 16.4 million individuals and there is significant under representation of Black and Hispanic individuals in this group. Together they make up about 12%. The opposite is true for the bottom quintile, where Black and Hispanic individuals account for just under half of the entire group. So, what does this all mean?

If medicine is far less accessible to low-income individuals and low-income individuals are disproportionately Black and Hispanic, then racial socioeconomic disparity, which is rooted in structural racism is a very probable root cause of the racial and ethnic diversity gap in medical schools. Medical schools and organized medicine have roles to play in addressing the socioeconomic diversity gap, both immediately and in the long term, which I will briefly touch on.

Immediately during the admissions process, priorities should be placed on assessing socioeconomic disadvantage using specific essays and standardized tools like the parental education and occupation indicator, which is a validated metric available on the AAMC’s application server. In the long term, intentional longitudinal interventions targeting low income high school students are needed.
A low socioeconomic status significantly decreases the likelihood that a high school student who is interested in medicine will apply or gain acceptance into medical school. These efforts could have effects on both socioeconomic and racial and ethnic diversity. As this was an exploratory study looking at three years only, we plan to do a larger study looking back decades to see how socioeconomic diversity has evolved over time by race and ethnicity. On behalf of our whole team, thank you for taking the time to listen to our work.

**Unger:** Great work, Arman. Thank you. Judges, you're up. Dr. Desai, please start.

**Dr. Desai:** Congratulations and thank you. This is such an important topic, and I think this was so well presented that the comments that come to my mind just listening to you is it is elegant in its simplicity, and it’s so powerful in the messages that you are concluding from this. I find it not surprising that minoritized races are overrepresented in higher SES segments as well. And it reiterates the challenge that we have in the country that this is a structural problem, and it's well beyond any one characteristic including race or ethnicity or gender.

And for me, it brings to mind a brainstorming session on what are the interventions that we think will be effective and that should be explored. And there are short-term and there are long-term ones, but more and more, it reminds me that the solutions that are going to have the greatest impact and that are going to be the most durable are the ones that go as upstream as possible.

I recognize those also have the longest arc, but that for me, gives us also a reason and an urgency to start to act on those as soon as possible. So I can imagine short-term interventions related to costs of medical school or to admission selection criteria. But again, I think the longer term interventions thinking about pathway programs, how to create visibility for those that are not easily visible, these are structural issues. And I think you have inspired us to take these on very seriously. Thank you.

**Unger:** Dr. Yancy?

**Dr. Yancy:** I really want to just say boom, because I think this was really brilliant and I would issue the use of the word simple, because it's a very important concept and with the clarity of the presentation, it goes from being simple, to being actionable. Actionable, meaning that we generate more understanding.

I would love to see this extended out over a long period of time, but I would also love it to go beyond socioeconomic status and include contemporary measures of life and living circumstances like the social vulnerability index, like the distress communities index, like the area deprivation index to really dive even deeper and say, what is it about a challenging SES scenario that really does limit access to higher education or just a STEM education.
This is such a fundamentally important issue. Many people take exception to the use of the word structural, but increasingly the evidence tells us there are some structural impediments without any question that limit the matriculation, the development, the opportunity for all persons to participate fully and our new enterprises would go forward.

And so, I think the team at the University of Minnesota really deserves a strong congratulatory message and a continued impetus to do this work and help us get more clarity and understand exactly what are the characteristics here. We need to get to a point in time where this conversation is no longer about race or ethnicity, but it really is about the modifiable characteristics that matter that we can actually target and improve the opportunities for most of all persons.

**Unger:** Dr. Arora?

**Dr. Arora:** Thank you, Arman and colleagues, for this fantastic work. And I certainly agree with my colleagues and judges here that this is a lot of food for thought. And thank you for juxtaposing race and income together. So much of us, we are fed data and it’s not together and we’re not able to see the whole story. And so, I really liked how you put together that story. When you use the word structural, so much of what we have been talking about in health care is structural inequities in health care. What do patients experience and are they able to get health care?

I think we need to think about partnering outside of our sector and think about structural inequities in education and K-12 education, reaching out to communities. It's not just about setting up a pathway program at the undergraduate level, but how are we really bolstering economic and education opportunity for the communities that we serve? I mean, that is really what's going to get us to where we need to be, not just addressing the structural inequities in health care, but also those structural inequities and in the entire environment that many of our neighborhoods are facing. And so, a lot of ideas going through my head right now, so thank you.

**Unger:** Thank you so much, Arman, for that terrific work. An excellent job by all of our finalists, such insightful presentations. And now the challenge shifts to our judges and the tough decisions that they have to make to decide a winner. So let's check back in with our panel and get their final thoughts on crowning the 2021 AMA Research Challenge Winner. Judges, the floor is open.

**Dr. Arora:** Well, I'll go first since I recall this was a very tough job last year and it's even tougher this year, since we are seeing so much diversity and the type of excellent scholarship that's been put forth by the finalists. So, I do want to congratulate all of you on just state-of-the-art presentations, as well as your methods, whether it was doing genomic work, medical education research, or health services research, it was really just outstanding to see and you've just made our jobs a lot tougher. And so, I am mulling things over, but I'm curious to hear what my colleagues think in terms of their framing.
Dr. Desai: Thank you. I can go next. I also agree that this will be very challenging and I'll rely on the wisdom of my colleague judges as we move forward. But my feeling after listening to these five is just inspiration. I think that the breadth of the research that's been presented, the ambition and passion that each of you has committed to such big problems, and then the rigor with which you approach those problems, it represents you and it represents the mentors that you have. It is truly inspiring for our future. So I'm grateful for the work that you've done and not so grateful for having to make a choice.

Dr. Yancy: Well, I'll go next, obviously. Remember, this is the AMA Research Challenge, and it started with over 1,000 entries and it's come down to these five brilliant finalists. I hope I can convey to everyone that you are a winner. I spend much of my time mentoring early career scientists, clinician investigators, students, and having this kind of positive experience, knowing that you … it's a threshold, that is very relevant, is very important.

The theme that I saw sitting through the presentations, reading them before coming on board, listening to them, is that there was a sense of purposefulness that was on display and that kind of motivation, that kind of drive, is the sword of catalytic energy that helps us understand the big questions that we face in medicine. Questions in science, we need new scientific discovery. Questions in education has been already articulated, but also questions about this important intersectionality of health and the social model. Can we be more sophisticated? Can we understand how best to interpret what we observe and then make it actionable? I'm so inspired to use Sanjay's word, when I look at this next generation and see what their capabilities are. I accept the challenge of having to make a choice, because I can already declare that everyone is a winner.

Unger: That's amazing. The three of you make me want to go to medical school so I can hear you discuss my work. All right, we're going to give our judges a couple of private minutes to discuss their choices and come to a final decision. Well, I know that must have been hard. So let's head back to our judges and see where they've come at. Judges, do we have a decision?

Dr. Arora: We do. Thank you, Todd, for helping us get here to this point. And gosh, definitely it was a heated debate in there. And I want to thank my esteemed colleagues for helping to judge this phenomenal AMA Research Challenge. And after a heated debate, we have all arrived unanimously at the one winner for the AMA Research Challenge. And I am so thrilled to announce that we will be awarding first place to Marielisa Cabrera-Sánchez, congratulations. And I know there are many reasons that we were very attracted to Marielisa's presentation and her work. And so, Clyde, Sanjay, any final comments that you'd like to make?

Dr. Yancy: Sanjay?
Dr. Desai: Sure, I'll start. I think Marielisa was so impressive. I think that you took on a question that has such large implications globally and for so many patients, for their quality of life and disability, and what was even more impressive was the ability for you to take such sophisticated science and communicate it in such an accessible way for many of us that don't perform that level of science. And again, very impressive, very meaningful, congratulations.

Dr. Yancy: And not only echo that I fully endorse our selection and the reasons that Sanjay has so nicely articulated, but I also want to really recognize the AMA Research Challenge. I want to really recognize the resources made available so that we can provide a cash award. It is this kind of platform that really inspires the next generation to explore science. And so there are a lot of winners today. It's remarkable to see what's happened and delighted to be a part of this, and especially to work with my co-panelists. It's been fun, guys.

Unger: Thank you so much to our judges, Dr. Arora, Dr. Desai, Dr. Yancy, that was amazing. And congratulations to our winner, Marielisa Cabrera-Sánchez. And now we get to tell Marielisa the good news. We've got her on the line and she has no idea that she's won. So let's bring her in. Hi, Marielisa, how are you?

Cabrera-Sánchez: Hello? I'm good. How are you?

Unger: Well, I'm terrific. And I just want to say, thank you again for participating in the AMA Research Challenge. We just have one follow-up question for you. Are you ready?

Cabrera-Sánchez: I am, yes.

Unger: How does it feel to be the winner of this year's AMA Research Challenge with a $10,000 grand prize?


Unger: Congratulations. What are you going to tell all your coworkers who worked with you on this project?

Cabrera-Sánchez: Well, I'm going to give them a thank you for helping me throughout this entire journey. I had not done this type of research before, bioinformatic research was completely new to me. So they helped me a lot, not only to get acquainted with the programs, but also to jump through any hoops that I encountered along the way. So, I want to give a big shout out to Dr. Timothy Murphy from the University of Buffalo and Dr. Hervé Tettelin from the University of Maryland. Thank you for your help throughout this process. It wouldn't have been possible without you. I am very grateful.
Unger: Well, it seems to have gone pretty well for your first time doing this kind of work. So congratulations to you and all of the folks that worked on this with you. Again, an amazing achievement and a beginning of a great career in medical research. Congratulations, Marielisa.

Cabrera-Sánchez: Thank you.

Unger: Wow. Congratulations to all of our finalists and to our 2021 AMA Research Challenge winner, Marielisa Cabrera-Sanchez, impressive, thoughtful, relevant work all the way around. On behalf of the AMA, I, again, thank all of the participants, co-authors, and mentors for your contribution to the research projects. And again, thank you, Laurel Road. Research is what propels medicine and science forward. Judging by the enthusiasm and quality of the work that we’re seeing at the AMA Research Challenge, we are in very good hands indeed. Thank you, be safe, and in the coming new year, let’s all do our part to recognize and support the vital role of research in medicine.

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