

Title: CardioNerds @AHA23: Speech Analysis to Detect Worsening HF in ADHF Patients

Participants: Dr Hanad Bashir and Prof William T Abraham

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Dr Hanad Bashir

" Hello everyone, and thank you for tuning in to the CardioNerds Radcliffe coverage of AHA 2023. My name is Hanad Bashir, and I'm a second-year general cardiology Fellow at the Christ Hospital in Cincinnati, Ohio, and a cardio nerds ambassador. I'm extremely delighted and honored to be joined here at AHA with Dr. William Abraham, who is a world-renowned heart failure and transplant cardiologist at the Ohio State University in Columbus, Ohio, to discuss his trial validation of speech analysis application in detecting worsening heart failure events in ambulatory heart failure patients. Thank you so much for meeting with me, Dr. Abraham.

Prof William Abraham

Thank you. My pleasure.

Dr Hanad Bashir

I think this trial is extremely interesting and very fascinating. So let's dive into the trial. The first question I have is what clinical limitations or challenges in managing heart failure events in ambulatory heart failure patients prompted you to develop the speech analysis application?

Prof William Abraham

Well, heart failure represents a major and growing public health concern, and despite our current standard of care, we just can't keep patients well and out of the hospital. So we need newer technologies that can give us early warning to decompensation so that we can intervene as an outpatient and help keep those patients out of the hospital.

Dr Hanad Bashir

Dr. Abraham, can you provide details on the patient population, the key intervention implemented using the speech analysis application, and what were the primary outcomes of your trial?

Prof William Abraham

Yeah, the population consisted of heart failure patients, symptomatic heart failure patients at risk for future heart failure events, regardless of their left ventricular ejection fraction. Now, this wasn't an interventional study, but it was a study performed to further develop, refine, and test this speech-processing algorithm or application and understand its value, its predictive value in monitoring heart failure patients. So we were looking primarily at sensitivity, specificity false positive, false negatives, etc. And in the trial, the system performed very well and much better than what is the current standard of care. For example, the sensitivity for detecting or predicting a future heart failure event was 80% with about two and a half or three false positives per year, or about one false positive alert every four months. That is in contrast to daily weight monitoring, our current standard of care, which in other studies has been shown to have about a 10% to 20% sensitivity. In our study, about a 34% sensitivity, but still poor in comparison to this speech-processing technology.

Dr Hanad Bashir

Truly fascinating. Dr. Abraham, were there any noteworthy or unexpected results in either the primary, and if there were any secondary or subgroup analysis results that may have some clinical significance?

Prof William Abraham

Yeah, at this point, I don't think that there were any surprises. But it's important to note that there are ongoing studies. We are still in a learning period with this technology. There is an ongoing US FDA pivotal trial, which will add additional learnings and additional confirmation of the validity of the system in the future.

Dr Hanad Bashir

Interesting, is it possible to introduce longer sentences into the software where you can increase the sensitivity and specificity to hopefully capture more patients that may be at more risk for future heart failure events?

Prof William Abraham

Yeah, it's a great question, but the system has been really optimized to make these predictions with the patient speaking five standardized sentences into their smartphone each day. Each one of those sentences from each one of those sentences is derived about 20 speech features, and with the five sentences taken together, about 100 speech features per day. So that over time, there are hundreds and thousands, and ultimately tens of thousands of data points on each particular patient.

Dr Hanad Bashir

Okay. How is the algorithm or the software able to differentiate certain elements that may affect the patient's voice, such as the patient gets a cold or pneumonia or they had just woken up from a nap or sleep and their vocal cords haven't warmed up yet? How is the algorithm or the software able to differentiate that, and are there ways for it to address those issues?

Prof William Abraham

There are, and I think this is where the use of the neural network, the artificial intelligence, really helps in improving the specificity of the measurement. So the way the development of the system works is that it's a look back. So when heart failure events occur, we look back at the speech changes that have occurred over the prior 30 days. We also try to then improve the specificity so that it is only triggering notifications for those specific heart failure events. Now, as I mentioned earlier, there are a couple or three false positive alerts per year. We need to learn more about what those are. Perhaps that's the upper respiratory infection or the COPD exacerbation or something

else. Or perhaps those are worsening heart failure events that just didn't meet the threshold of hospitalization or outpatient treatment with IV diuretics.

Dr Hanad Bashir

Interesting. Dr. Abraham, do you think this speech analysis application is ready for primetime? And if so, what additional steps are needed for it to become more mainstream? Where heart failure cardiologists or general cardiologists are using this software, this algorithm, or this AI technology in their heart failure patients?

Prof William Abraham

I think the data that we generated in this study do suggest that it's ready for primetime. But there are a few other steps ahead of us. One is mentioned; we have an ongoing US FDA pivotal trial. So we need to see that trial complete and replicate the observations of this current study in order to achieve FDA regulatory approval and make this available in the United States for use by clinicians and, of course, by our patients as well. In addition to that, while I think this is a technology that is simple yet elegant and has high predictive value and should lead to early adoption by clinicians, we'll plan future studies to also continue to demonstrate the value proposition in using this technology.

Dr Hanad Bashir

Fantastic. In light of your phenomenal results, do you have any unresolved gaps or critical issues that still remain in managing heart failure events in the outpatient setting?

Prof William Abraham

Yeah, well, I think now we have to figure out the right treatment algorithms for these patients. The improved diagnostics, the remote monitoring is sort of half of the equation here. The other piece of this is sort of a human factor. One, monitoring technologies don't improve patient outcomes unless they're used by patients and by clinicians. And in order to support that use, we need decision supported algorithms to help.

Dr Hanad Bashir

Okay. And then lastly, Dr. Abraham, how can fellows or cardiologists early in their career get involved with the medical industry? As of recent, over the past couple of years, there has been an uptrend in newer technologies, newer devices. How can one get involved? And any advice for those who are interested?

Prof William Abraham

Yeah, there is just so much happening in device development, in cardiovascular disease. It's a really exciting time. And I think the keys here are mentorship. Seek out a mentor who is involved with this type of work, who can help open doors for you and create opportunities, and then be willing to walk through those doors and work hard. And you can achieve a lot in this field. It's where I started and where I've helped a lot of young people start. And so mentorship is the key. Thank you much, Dr. Abraham, and thank you for sharing your results. And congratulations on your findings. Thank you so much for everyone for tuning in. Thank you.