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Performance, Safety, and Patient Experience of an Autonomous Robotic Phlebotomy Device: A Multicenter Trial

Article:
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Guest: Dr. Luuk Giesen is Chief Medical Officer of Vitestro in Utrecht, the Netherlands.

Bob Barrett: This is a podcast from *Clinical Chemistry*, a production of the Association for Diagnostics & Laboratory Medicine. I'm Bob Barrett. High-quality clinical laboratory testing is dependent on high-quality samples, but phlebotomy is often viewed as a short-term position, with turnover rates approaching 50% in some locations. Maintaining quality in a workforce consisting largely of new hires is therefore a continuous challenge.

Further, with ever-increasing volumes of clinical laboratory testing, the demand for phlebotomists is expected to grow, a trend that may simply add to the number of already hard-to-fill positions. Faced with the same problem of an increasing workload paired with a shrinking workforce, clinical laboratories radically transformed their workflows, replacing manual, labor-intensive processes with automation. Is that the answer here? Is automated, robotic phlebotomy the way of the future?

A new research article in the August 2026 issue of *Clinical Chemistry* presents the results of a clinical study evaluating an autonomous robotic phlebotomy device. In this trial, the authors evaluated first-stick success rate, adverse event rate, and patient experience compared to traditional phlebotomy.

Today, we welcome the article's lead author. Dr. Luuk Giesen is the Chief Medical Officer of Vitestro in Utrecht, the Netherlands. He is responsible for clinical affairs and designed the multi-center ADOPT clinical trial.

So, Dr. Giesen, your robotic phlebotomy device uses multimodal imaging, which includes near-infrared, ultrasound, and Doppler. Can you explain the benefits of multimodal imaging?

Luuk Giesen: Yes, sure I can. Yeah. So, the autonomous robotic phlebotomy device, ARP, uses different imaging technologies to identify a suitable vein and leverages the benefits of each technology. So first, near-infrared is used to create a model of the patient's arm and to identify a starting position for the ultrasound probe, which improves the efficiency of the vein

detection process. The device then makes a decision to perform venipuncture based on the ultrasound images.

The addition of ultrasound is important because of the inherent limitations of near-infrared. Most importantly, if you were to use near-infrared only in patients with deeper-lying veins, such as patients with difficult venous access or high BMI patients, it would not be possible to visualize the veins in these patients so, they would have to be excluded without using ultrasound; but with ultrasound, you can actually visualize the depth, diameter, and direction of the vein, creating a model of the vein. So, that's very powerful technology, and ultrasound is also not impacted by skin color.

Because you use ultrasound, you also have access to a third imaging technology, that's Doppler ultrasounds. With Doppler ultrasound, you can identify blood flow direction and thereby assess whether the vessel is a vein or an artery to ensure it is actually a vein, improving safety compared to manual phlebotomy. So, it's really the combination of these technologies together that optimizes for performance, safety, and efficiency of the device.

Bob Barrett: In your study, the device's first-stick success rate was over 94.5% overall and stayed high in different venous access patients, the elderly, and obese patients. What does this mean for the generalizability of these results to other healthcare settings?

Luuk Giesen: The study was performed in the Netherlands across three trial sites. So, Amsterdam University Medical Center, which is an academic hospital, St. Antonius Hospital, and OLVG Lab at OLVG Hospital, which are large teaching hospitals. So, in this setting, we randomly recruited and enrolled a diverse outpatient population, but it's very important to assess how the ARPD performs in subgroups to understand whether the study's findings are representative for other healthcare settings. So, for example, compared to the Netherlands, the prevalence of obesity may be lower or higher in other countries such as the US.

And also, between healthcare systems, there may be differences in demographics, such as the prevalence of difficult venous access or the age of the patient population. And the study shows that the ARPD clearly works across the study population in a sample of nearly 2,000 patients. So that provides robust evidence that demographics do not meaningfully impact the performance of the ARPD. And for laboratories across the world, well, this actually indicates that even if your patient population is slightly different compared to the study population, it is likely that the ARPD could perform similarly at their sites.

Bob Barrett: Your device standardizes tourniquet application, vein identification, insertion angle and speed, and tube inversion. Which of these has the biggest potential to reduce pre-analytical variability?

Luuk Giesen: So, we think it's the combination of factors. So, it's the time and pressure control tourniquet application. It's the standardized needle insertion. So same speed of needle insertion, but also same direction, and always aiming at the middle of the vein. And the identical handling and inversion of the blood collection tubes. And that altogether, it fully standardizes the phlebotomy process and thereby eliminates the manual variability. Because with manual phlebotomy, it's known there's a lot of variation between phlebotomies. And it's also known that phlebotomy technique can really impact blood sample quality. So, in the study, we also observed a very low hemolysis rate when compared to manual phlebotomy at the respective sites. And hemolysis is, well, the leading pre-analytical cause of sample rejection. So, this outcome, yeah, it may really improve diagnostic accuracy and efficiency.

Bob Barrett: So, what did your study tell you about patient acceptance about a robot doing something this personal?

Luuk Giesen: So first, we were surprised to learn that patients were really open and willing to use a device for phlebotomy. So, in the European part of the study, we randomly called in patients presenting with their test requisition in the phlebotomy station and we asked them whether we could perform today's blood trial with the ARPD, which they had never seen before.

And the far majority of patients were willing to use the ARPD. We then replicated this finding in the U.S. study at Mayo Clinic, where we showed that 86% of patients were willing or very willing to use the ARPD for phlebotomy. So, this shows that beyond the Dutch population, patients in the U.S., and we believe likely across the globe, are receptive to this new technology. And what's very important is not only that patients are open to using the ARPD once, but that they will also use it again after use. So, the study has collected strong data to support this.

So, in the study, after the ARPD blood trial, we asked the patients how they compared the pain compared to manual. So, 90% of the patients indicated the blood trial was less painful, far less painful, or comparable to manual phlebotomy. And this is an important finding because pain experience is arguably the most important parameter for patient satisfaction. It will also be an important driver of whether the patients would like to reuse the device again.

Bob Barrett: Well, finally, Dr. Giesen, this technology could ease workflow shortages, but changes the phlebotomist into a supervisor of multiple devices. How does this reshape daily workflow?

Luuk Giesen: Yeah, so first, patients should always be given a choice to select the ARPD or manual phlebotomy. And based on the patient preference data that we collected in the study, we think this is also a suitable option. So, the study showed that 82% of the patients indicated that after the ARPD blood trial, that they would prefer, strongly prefer, the ARPD for future blood trials, or that they would have no preference, which is also an important statement. So, the phlebotomy department, in our view, will be a mix of phlebotomists performing blood trials manually, and phlebotomists overseeing up to three ARPDs simultaneously.

So, we see it can be a challenging new task for phlebotomists to learn and expand their skill set and create perhaps a more dynamic job with more variation. So, the setup will be similar in a way to self-service and cashier lane setup in supermarkets. And the role of the supervisor, the device supervisor, will be focused on comforting and reassuring patients, on supporting the use of technology, and on monitoring patients. So, this new model for phlebotomy could contribute to address the critical staffing shortages laboratories to face in clinical practice, and we believe considerably improve access to care.

Bob Barrett: That was Dr. Luuk Giesen from Vitestro in Utrecht, the Netherlands. He wrote a research article in the August 2026 issue of *Clinical Chemistry* describing a new autonomous robotic phlebotomy device. He's been our guest in this podcast on that topic. I'm Bob Barrett. Thanks for listening.