



MAGNIFY

the art & science of diagnostic medicine

Spring 2023

Exploring the Legacy and Future of Transfusion Medicine at ARUP Laboratories

In this latest issue of Magnify: The Art and Science of Diagnostic Medicine, we explore how ARUP has grown its transfusion medicine, blood banking, and immunohematology programs to serve patients and demonstrate how to optimize blood utilization.



the art & science of diagnostic medicine

In Magnify, we share stories that bring laboratory medicine to life.

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A Message From the CEO



Many of us donate blood, and when we do, we understand that we are doing something good for our community. Seldom, however, do we pause to consider just how precious a lifesaving gift we are giving.

In 2022 alone, University of Utah Health performed more than 32,000 blood transfusions, nearly all of which were possible thanks to donations made through ARUP Blood Services, the sole provider of blood products to the U of U Health system. Transfusions save the lives of patients such as 25-year-old Luccas Borges, whose incredible story of survival you can read in these pages.

As 2023 gets underway, Transfusion Medicine at ARUP and U of U Health finds itself at an important inflection point, having completed a carefully planned leadership transition following the retirement of Robert Blaylock, MD, its leader for more than 35 years.

Section Chief Ryan Metcalf, MD, CQA(ASQ), sees the need for transfusions only continuing to grow with the rapid expansion of U of U Health. He, his team, and clinicians throughout U of U Health are working to optimize the use of blood products. At the same time, ARUP Blood Services, under the direction of new Medical Director Waseem Anani, MD, is adopting new and innovative approaches to increasing blood collection.

The stories on these pages introduce you to Metcalf and Anani, who is also the medical director of the Immunohematology Reference Laboratory. You can learn more about the massive effort behind lifesaving transfusions that occur every day and will come to appreciate even more why it's so important that all of us donate blood.

Andy Theurer, CEO

A New Era for Transfusion Medicine: Through Carefully Planned Leadership Transition, Fast-Growing Section Stays True to Patient-Focused Mission



When an alarm sounds at the University of Utah Hospital Blood Bank, laboratory scientists scatter to quickly retrieve and prepare blood products for transport to wherever they're needed to treat a patient. Here, they're shown collecting units of O-negative blood and plasma for a critically ill or injured patient who had arrived at the hospital emergency room.

On a recent morning, the Blood Bank at University of Utah Hospital resembled any other laboratory. Medical laboratory scientists wearing full personal protective equipment (PPE) worked bent over their benches while a handful of colleagues typed on keyboards or talked on telephones nearby.

Then an alarm sounded with shrill beep, beep, beeps. It looked as if someone had stepped on an anthill as people scattered in all directions. In less than five minutes, they had selected and prepared blood products—four units of O-negative blood and two units of plasma—for delivery to the emergency room (ER) for a Trauma 1, or a critically ill or injured patient. Then it was back to other tasks, at least until the next alarm.

Day in and day out, these laboratorians save lives, and they know this. Without the therapeutic product they provide,

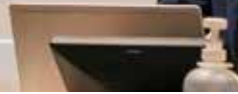
patients will die. That's why they're here.

Seldom, though, is the lifesaving power of their essential product and the work they do more apparent than when one among them has the chance to meet the likes of Luccas Borges.

A little more than two years ago, Borges, a lifelong skier, was descending a slope at Deer Valley Resort when the binding on one of his skis snapped. The ski flew off, and his efforts to regain control while careening at an estimated 50 miles per hour failed. Borges collided with a ski-lift column, sustaining what is commonly referred to as a "handlebar injury," characterized by a focal blow, which severed a branch of his aorta and caused other severe abdominal trauma.

What happened next was nothing short of miraculous.

Life As A Trauma Survivor



Luccas Borges speaks during a trauma case review attended by first responders and University of Utah Hospital emergency medical personnel. Borges would receive 177 units of blood products as part of the medical care that saved his life after his ski binding broke, causing him to collide with a ski-lift column while skiing at Deer Valley Resort on December 13, 2020.

The resort's ski patrol responded immediately, followed by Park City Fire District emergency medical technicians, who cared for Borges while he screamed in pain and later lost consciousness as an ambulance raced him to the U ER. In the hours that followed, Borges hovered near death. Toby Enniss, MD, FACS, Ram Nirula, MD, MPH, Alexander Colonna, MD, MSCI, FACS, and dozens of their colleagues challenged the depths of their broad expertise and experience to save him. A determined Enniss remained at Borges' bedside through that harrowing first night.

In all, the medical team drew on 85 units of red blood cells, 78 units of fresh frozen plasma, and 14 units of platelets to sustain his life, using nearly every unit of product matching his blood type that the Blood Bank had available.

Borges, a 25-year-old Harvard University graduate and master of business administration student at the University of Chicago, proved to be a fighter. Slowly, astonishingly, he began to improve, when few thought he would survive his horrible injuries.

Borges is thriving, even though he remains on a difficult road to full recovery as he awaits a small intestine transplant. In early February, he returned to Utah for the first time since his accident to participate in a review of his case and to thank the large medical team that saved him.



Trauma survivor Luccas Borges embraces University of Utah Hospital Trauma Medical Director Toby Enniss, MD, FACS, during an emotional review of Borges' case on February 8, 2023. Enniss played a key role in Borges' survival after the 25-year-old Chicago resident nearly died in a Utah skiing accident.

"To say my survival was miraculous discredits your work," he told the first responders and U hospital emergency personnel gathered for the case review. All around, members of the medical team shed tears—of relief, empathy, shared purpose, and pride. "Thank you. Truly," Borges said as he wiped away tears himself. "Thanks so much to all of you."

The Patient, First and Foremost

Before Borges, Kelly Cail, MT(ASCP), had met only one other survivor in person in her 21 years working for ARUP Laboratories' Transfusion Medicine section, where she is now operations director, yet Borges and others like him are the reason she specialized in the field and never once

considered doing anything else. "We see the benefit of what we do for patients every single day."

Her commitment is mirrored throughout the Transfusion Service and Blood Services, even as the Transfusion Medicine section is at an important inflection point in a carefully planned and orchestrated leadership transition.

In February 2023, Robert Blaylock, MD, retired after more than 35 years as medical director for the Transfusion



Tyler Anderson, DPT(ASCP)^{CM} (left), a blood inventory specialist at the University of Utah Health Blood Bank, discusses the need for blood products on a given day with Kelly Cail, MT(ASCP), operations director of the Transfusion Medicine section. Ensuring that enough blood is available for both scheduled surgeries and to respond to possible trauma incidents is a daily challenge.

"He was not one to send an email or wait for someone to return a call. If there was something that needed attention, he would go right to the ICU [intensive care unit] or to the executive offices and make sure the need was understood."

—Kelly Cail, MT(ASCP),
Transfusion Medicine Operations Director

Service, Blood Services, and the Immunohematology Reference Laboratory (IRL), but only after working with colleagues for five years to transition the departments. Ryan Metcalf, MD, CQA(ASQ), joined ARUP in 2017 as a medical director and became section chief of Transfusion Medicine in 2021.

Blaylock created a culture of teamwork that was built on his unwavering commitment to patients and their safety, Cail said. That culture is intact, as both new and longtime employees remain loyal to his ethos.

"Doing the right thing was so important to Rob," she said. "He was not one to send an email or wait for someone to return a call. If there was something that needed attention, he would go right to the ICU [intensive care unit] or to the executive offices and make sure the need was understood."

"Because of Dr. Blaylock, we understand and have a great appreciation for the importance of our jobs," added



Candace Thomas, a blood component specialist, is shown here next to specialized instruments at the University of Utah Hospital Blood Bank that are used to wash blood products, or to separate plasma from red blood cells, for example.

Candace Thomas, a blood component specialist who, like Cail, has worked in Transfusion Medicine and the Blood Bank for 21 years.

During Blaylock's tenure, the section grew in complexity and sophistication as U of U Health added hospital beds and expanded services. The number of patients who underwent transfusions from 2002 to 2022 increased 60% to 5,475 in the 2022 fiscal year alone. Red blood cell transfusions increased 44% to 16,418, while platelet transfusions increased 210% to 7,098.

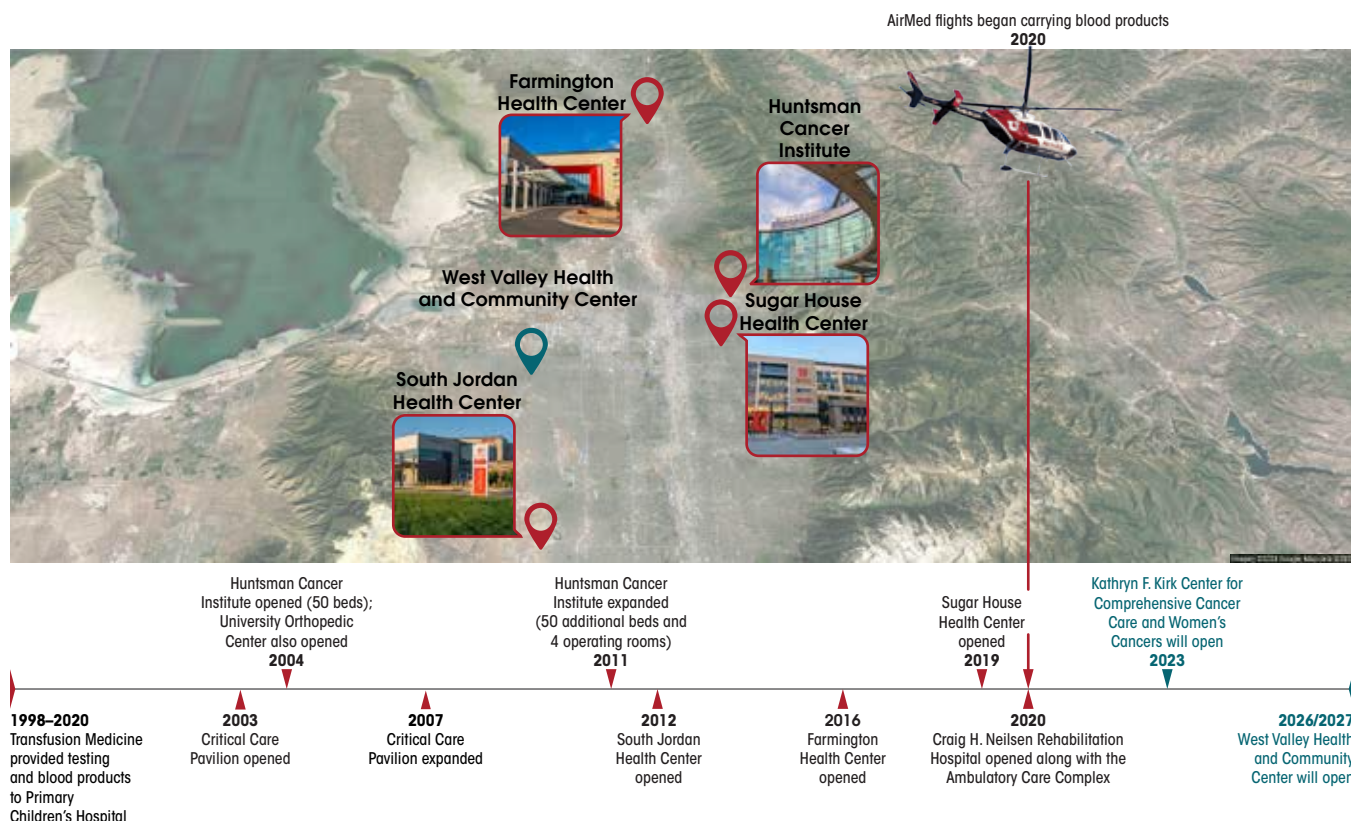
"Because of Dr. Blaylock, we understand and have a great appreciation for the importance of our jobs."

—Candace Thomas, Blood Component Specialist

In all, Transfusion Medicine now has about 125 employees working at the U Hospital and Huntsman Cancer Institute, donor centers in Salt Lake City and Sandy, and the IRL at ARUP, and traveling daily to numerous mobile blood collection sites.

Planning for the Future

Cail said demands on the section will only continue to increase with the opening in mid-2023 of the Kathryn F. Kirk Center for Comprehensive Cancer Care and Women's Cancers, which will add 50 beds to Huntsman. The number of red blood cell transfusions is projected to increase by 8% and the number of platelet transfusions by 19%.



U of U Health also intends to add a West Valley Health and Community Center in late 2026 or early 2027, for which she and Metcalf already are planning.

“We want to foster a culture of continuous improvement that is blame free as we improve processes. It has been fun to show that we’re able to use data to get better and better over time.”

—Ryan Metcalf, MD, CQA(ASQ),
Section Chief of Transfusion Medicine

As section chief, Metcalf has hired Waseem Anani, MD, as medical director of the IRL and Blood Services, and Steven Baker, MD, PhD, and Erica Swenson, DO, both associate medical directors of Transfusion Medicine.

Metcalf also continues to build on initiatives already in place to optimize use of blood products, which he noted are among the “most overused in medicine.”

“As always, patient safety is paramount,” Metcalf said. “Within that context, our goal is to provide the right product for the right patient at the right time for the right reason.”

An expert in data-driven/informatics approaches to patient blood management, he and colleagues throughout the U of U Health system are using data to better understand the many factors that influence how blood products are used. Often, the data reveal information that can lead to more efficient use of blood and better patient care.

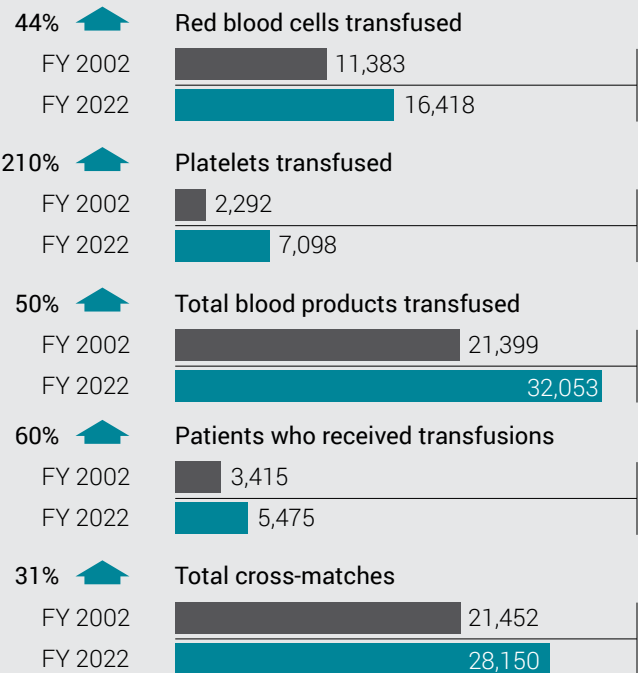
They are working to reduce complexity and add precision to blood product ordering and transfusion practices and to decrease the time it takes to get the right products to patients. They also continue to perform research and evaluate the research of others on whole blood and other emerging blood therapies to ensure that ARUP is offering the best blood products.

“We want to foster a culture of continuous improvement that is blame free as we improve processes,” Metcalf said. “It has been fun to show that we’re able to use data to get better and better over time.”

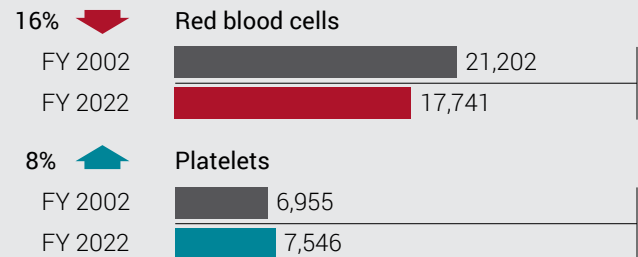
Growing Demand for Transfusion Services

As University of Utah Health has added hospitals and clinics to its system in the last 20 years, the demand for transfusion services has grown dramatically, challenging ARUP Blood Services to collect enough blood products to meet the needs.

Transfusion

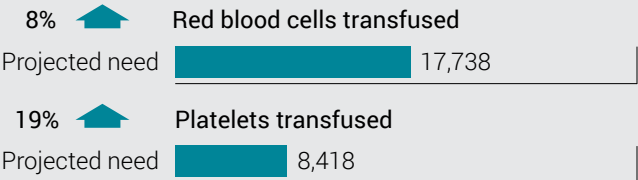


Collection



Projected Needs

With the completion of the Kathryn F. Kirk Center for Comprehensive Cancer Care and Women’s Cancers in mid-2023, the need for transfusion services is expected to increase significantly.





Lead Medical Laboratory Scientist Sheila Villanueva, CLS, has seen significant growth and change in her 28 years at the University of Utah Blood Bank.

Boosting Collections to Meet Demand

He said the improvements are better for patients, but they also make the section more resilient to blood shortages, a consideration that is ever more important given the challenges of collecting enough blood products to meet the demand for transfusion services. From 2009 to 2022, for example, collection of units of red blood cells by ARUP Blood Services decreased by 16%.

Managing the inventory of blood products is a daily challenge for the Blood Bank. A single serious accident, such as that which injured Borges, can quickly deplete the supply, said Tyler Anderson, DPT(ASCP)^{CM}, a blood inventory specialist. When it happens, he is spurred into action, contacting ARUP's donor centers and, if necessary, searching outside ARUP to procure what's needed.

"We never want to have to tell a patient a surgery will have to be postponed because we don't have the blood that would be needed," Anderson said.

Boosting collections is another prerogative of Metcalf, Anani, Cail, and their colleagues. A creatively aggressive

"When you talk about loyalty, I have it. I just love being part of what we do here. I will be here for the rest of my career."

—Sheila Villanueva, CLS,
Lead Medical Laboratory Scientist

outreach program that educates communities about the importance of blood donation to increase collections is more important than ever.

One effort, for example, will focus on raising awareness in West Valley City in advance of the opening of the U's new health center there as part of a goal to encourage blood donations in communities near where the blood products will be used, Cail said. ARUP Blood Services is also expanding its digital capabilities to engage donors by allowing as much flexibility as possible in scheduling donations and redeeming rewards.

Borges said he knows he never would have survived his accident if it hadn't been for the dozens of blood donors whose gifts were used in his care. He shares his story broadly with the hope that it will help inspire more blood donations.

"So many things could have gone very differently for me, but there were so many people who made it possible for me to continue living, to continue writing my story," he said.

Laboratorians are used to being behind the scenes, to "hiding in the basement," where many hospital labs—and the U Hospital Blood Bank—are located, said Sheila Villanueva, CLS, a lead medical laboratory scientist. She said it's rewarding when their efforts are called out, and when it's recognized how stressful and unpredictable their jobs can be as they do their part in the race to save lives.

Her work, her team, and the sense of purpose she feels when she hears stories such as Borges' have kept her at the Blood Bank for 28 years.

"When you talk about loyalty, I have it. I just love being part of what we do here," Villanueva said. "I will be here for the rest of my career."

Ryan Metcalf: Proponent of Data-Driven and Evidence-Based Practice Has Transformed Transfusion Medicine



Ryan Metcalf, MD, CQA(ASQ), section chief of Transfusion Medicine at ARUP and University of Utah Health and medical director of the Transfusion Service, has used data to optimize patient blood management and clinical practice. His initiatives have improved patient outcomes while saving U of U Health more than \$1.5 million annually.

Ryan Metcalf, MD, CQA(ASQ), accepts no conclusions without evidence. His determination to maximize the power of data as section chief of Transfusion Medicine at ARUP Laboratories and University of Utah Health has transformed the efficiency and effectiveness of transfusion practices at the University of Utah Hospital, and his efforts have driven positive outcomes for both patients and health systems.

"My vision for transfusion medicine, which I think translates to other areas of healthcare, is to identify how we can best use data and a quality-based framework to improve clinical practice," said Metcalf, who is also medical director of the Transfusion Service.

Since joining ARUP and the U in 2017 as part of a carefully planned leadership transition for the Transfusion Medicine section, Metcalf has worked with teams and spearheaded several initiatives that have had a measurable impact on the section's operations. Shortly after his arrival, Metcalf implemented decision support resources to help providers order blood products according to the most recent evidence-based guidelines.

"There's a vast amount of information that physicians and surgeons need to retain to perform their jobs," Metcalf said. "By making up-to-date blood ordering recommendations readily accessible in their workflows, we can positively affect patient outcomes and the health system."

To learn more about what's new at ARUP, visit [**aruplab.com/magnify-spring23**](https://aruplab.com/magnify-spring23).



Steven Baker, MD, PhD, associate medical director of Transfusion Medicine, aided Metcalf in the implementation of an improved blood cooler design at Stanford University as well as a maximum surgical blood order schedule (MSBOS) at ARUP Laboratories.

In collaboration with his colleague, Steven Baker, MD, PhD, associate medical director of Transfusion Medicine, Metcalf has also implemented a maximum surgical blood order schedule (MSBOS), which recommends preoperative blood ordering based on historical usage by procedure.

"If you can make a prediction about how many blood products are needed for a particular type of surgery, you can tailor the amount of blood you set up for that patient," Baker said.

This new system replaced the earlier "keep ahead" system that allowed physicians to reserve extra "just-in-case" units that were often not transfused. By using more accurate predictions, the Transfusion Service can reduce unnecessary testing—such as blood typing, antibody screens, and cross-matching—and reduce waste of blood products. In total, these initiatives to improve decision support tools and implement the MSBOS have saved the U \$1.5 million per year.

Metcalf's vision reaches beyond the use of generalized transfusion threshold guidelines that are based on large randomized trials or historical blood usage. He has devoted the past several years to developing a sophisticated data solution in collaboration with the Scientific Computing and Imaging (SCI) Institute at the University of Utah. He, along with Alexander Lex, PhD, associate professor of computer science at the SCI Institute, U PhD student Haihan Lin, and Jack Wilburn, a software developer at the U, developed a tool to rapidly and flexibly visualize patient blood management practices, in clinical context and tied to patient outcomes and costs. The data visualization tool, called Sanguine, can also provide risk-adjusted benchmarking to help surgeons understand how their transfusion practices and patient outcomes compare with those of others within their facility. In addition, Sanguine can be used as a personalized tool to predict outcomes and assess risks for an upcoming patient by looking at how past patients with similar characteristics fared, and it represents a significant step toward using data to power personalized medicine.



Units of blood are stored in specialized refrigerators to preserve blood products.

"In my view, the value of Sanguine can extend well beyond transfusion medicine," Metcalf said. "This tool is tied to key patient outcomes, and it can be an example for data-driven practices for other areas in healthcare."

Early Focus on Quality and Evidence-Based Practice

Metcalf's focus on using data and evidence-based guidelines to improve clinical practices manifested early in his career. As a transfusion medicine fellow at Stanford University, Metcalf, along with his colleagues, intervened when blood products sent to the operating room were no longer at the right temperature when they were returned to the blood bank, which effectively ruined the products. He was part of a team that devised a new cooler to maintain blood products at proper temperatures to solve the problem. Not only was the temperature maintained inside the cooler, but the additional weight of the cold pack in the lid forced the cooler to shut on its own.

"The new cooler design markedly decreased the waste of our plasma products and led to an annual savings of more than \$88,000 dollars," said Baker, who also completed his residency at Stanford. "It was better for patient care, better for healthcare costs, and it was the sort of simple intervention that is typical of Ryan." Baker aided in the statistical analysis of the new cooler design. The coolers are still used at Stanford today.

After completing his fellowship, Metcalf joined the University of Washington as an assistant professor. While there, he had the opportunity to work with colleagues to build a new U.S. Food and Drug Administration (FDA)-registered, hospital-based transfusion service laboratory within a hospital that didn't previously have an in-house service.

The project required building everything from the ground up, including setting up systems to store and track blood products, facilitate blood ordering by physicians, track transfusions, and monitor patient risks and adverse reactions.

During this time, Metcalf began to wonder to what extent the team's decisions were supported by evidence and data.

"I learned the value of trying to deeply understand challenging problems instead of relying too much on my initial assumptions," Metcalf said. "I became interested in the idea of using data to better understand the current state of practice and to try to define the impact of an optimal state of practice, based on the available evidence. Leveraging data can be a powerful tool to accomplish that."

According to Metcalf, in some ways, the experience of building the transfusion service felt like cramming 10 years' worth of experience into just two, and it ignited his passion for data-driven transfusion medicine.

A Leader and Relentless Transformer

In 2017, the incredible skiing and other outdoor recreational opportunities in Salt Lake City lured Metcalf there, and the chance to work for a renowned academic laboratory led him to the U and ARUP. Since then, Metcalf has continued to push the boundaries of data use to transform transfusion medicine. He has built a team of professionals dedicated to continual improvement in their field.



Erica Swenson, DO, associate medical director of Transfusion Medicine, joined ARUP and the U last year.

"His reputation preceded him," said Erica Swenson, DO. Swenson, who was hired to join the Transfusion Service in 2022, had heard of Metcalf's achievements and focus on quality while at Stanford. Swenson joined the U and ARUP, in part, for the

opportunity to work with Metcalf. "Ryan has had an amazing career in a short period of time. I hope I can accomplish half of what he's accomplished—one quarter, even—in the time that he has," she said.

The list of his accomplishments certainly is impressive. In addition to improving decision support resources to optimize blood ordering, Metcalf and Kelly Cail, MT(ASCP), operations director of Transfusion Medicine, helped lead

an effort to implement sophisticated radio frequency identification (RFID) technology to track blood products at remote helicopter base locations so that blood can be used for trauma patients before they arrive at the hospital. This was part of work Metcalf and Cail have done with AirMed so patients can safely receive lifesaving transfusions in the prehospital setting.

Metcalf has also participated in several research studies on the efficacy of convalescent plasma in treating COVID-19 and helped develop related clinical guidelines, and he is the chair-elect for the Clinical Transfusion Medicine Committee of the Association for the Advancement of Blood and Biotherapies (AABB).

"He knows so much of the ins and outs of transfusion medicine ... [and has such an] understanding of regulatory issues and the facts and figures of blood products. There's constant wisdom pouring out of him in the most kind and thoughtful way," Baker said, who followed Metcalf to the U and ARUP from Stanford.

"As a mentor, Ryan is focused on whole-person health. There's always a focus on mental health and creating a psychologically safe work environment that allows all employees to be their authentic selves at work—their best, most healthy selves," Swenson said.

Recently, Metcalf launched a randomized controlled study to determine the efficacy of best practice alerts in the electronic health record (EHR). The study will randomly select providers to receive pop-up alerts about best practices as they order blood, when alert criteria are met. The study will then keep track of how blood ordering practices are affected by the alerts and the impact that has on the health system. It will also track patient outcomes.

"Our focus each day is trying to improve transfusion practice, both at a local level and outside the institution, with wonderful staff and colleagues—simply put, making sure that we get the right product to the right patient for the right reason at the right time," Metcalf said. "I'm grateful to work where I have the freedom to think creatively and, if it's a reasonable idea, see if we can put that into practice and measure it. All of this requires teamwork, and I have been lucky to be a part of such great teams of people."



Metcalf and Kelly Cail, MT(ASCP), operations director of Transfusion Medicine, have worked with AirMed to implement sophisticated radio frequency identification (RFID) technology to track blood products at remote helicopter base locations so that blood can be used for trauma patients before they arrive at the hospital.

Waseem Anani: Medical Director Pushes Boundaries of Immunohematology Testing to Meet a Growing Health System's Needs



Waseem Anani, MD, a passionate immunohematologist with a blood services background, was appointed as medical director of ARUP Blood Services and the Immunohematology Reference Lab in July 2022.

Before Waseem Anani, MD, became an immunohematologist, he was an undergraduate studying geology and anthropology, with his heart set on graduate school. He had an eye for the heuristic and an interest in exploring how small subtleties might hold the key to solving big problems. To some, his decision to attend medical school was a sudden redirect, but to Anani, it was a once-in-a-lifetime opportunity to investigate some of the biggest and most important mysteries of our time.

Anani believes his undergraduate studies helped him think outside the box. Immunohematology requires a sort of detective mindset and the ability to combine bits of patient information to complete a bigger picture.

"In immunohematology, you have the tools, but it's your choice to use them in whatever way it takes to find the right answer. You must interpret every step you do ... that's why I love it," Anani said. "It is like detective work; the only difference is, you're producing your own clues."



Waseem Anani, MD, medical director of ARUP Blood Services and the Immunohematology Reference Lab, spends his time on the bench solving puzzles of rare and unique blood.

Now, as the new medical director of ARUP Blood Services and the Immunohematology Reference Lab (IRL), Anani is laser focused on optimizing the collection and use of lifesaving blood products for the growing University of Utah Health system. It's expected that the additions of the Kathryn F. Kirk Center for Comprehensive Cancer Care and Women's Cancers in 2023 and the West Valley Health and Community Center in late 2026 or early 2027 could nearly double the system's total blood use. Since beginning his tenure in July 2022, Anani has worked to increase blood collection, make donation more inclusive, and further develop ARUP's menu of immunohematology testing.

Anani's ability to solve the puzzles of rare and unique blood using ARUP's tests sets him apart as he aims to help ARUP cement its position as a center of immunohematology testing in the western United States. He saw an opportunity to expand ARUP's test offerings after the closure of an influential American Red Cross laboratory left a gap in the West's rare blood testing labs.



Anani has unique expertise in blood collection, testing, and processing, as well as donor optimization and engagement.

Anani spends his days with his colleagues on the bench, developing new tests and improving methods for detecting antibodies. One new test, an extended direct antiglobulin test (DAT), improves on the DAT offered by most hospitals and blood banks. ARUP's test, Anani said, will look for immunoglobulin A (IgA) antibodies not detected by most labs and use more sensitive methods (4°C low ionic strength saline wash) to detect weak antibodies.

"I want to build esoteric testing, and with that comes the opportunity for unique publications [to enrich our knowledge] and samples from around the world," Anani said. "It will challenge us to grow, and that is the exciting part of it. We all get to build something newer and bigger."

The Path to a Perfect Fit

After earning his medical degree from Penn State College of Medicine, Anani's propensity for the detailed fact-finding he pursued as an undergraduate led him to his residency at the University of Pittsburgh Medical Center (UPMC), where he fell in love with clinical pathology.

Pittsburg is a powerhouse for transfusion medicine, Anani

said, and after developing an interest in blood services, he decided to pursue training in transfusion medicine at the renowned Blood Center of Wisconsin. During his fellowship, he trained under his mentor, Gregory Denomme, PhD, in Wisconsin's IRL, studying rare blood samples from around the world. Now, he is one of a small number of physician immunohematologists in the country.

Before starting at ARUP, Anani was medical officer at the Canadian Blood Service's National Immunohematology Reference Laboratory in Ontario, where he oversaw 70% of the country's total blood supply. From 2020 to 2022, Anani developed unique expertise in blood collection, testing, and processing, and he began identifying new opportunities for donor optimization and engagement.

At the same time, Ryan Metcalf, MD, CQA(ASQ), section chief of Transfusion Medicine and director of the Transfusion Service at ARUP and University of Utah Health, was thinking about how he could adapt the Transfusion Service and other areas of the Transfusion Medicine

section to meet the needs of an expanding health system. It made sense, he said, to start thinking about who would be the next medical director dedicated to blood collection at ARUP.

Additionally, the complex testing performed in the IRL allows ARUP to produce personalized products for patients from a broad geographic area whose rare or unique antibodies make it challenging to find safe blood for transfusions.

"This is an area where we could expand our overall presence and provide value to patients across the country," Metcalf said.

Anani was uniquely positioned to become ARUP's new medical director. He had the blood services experience, testing expertise, and passion for immunohematology needed to expand ARUP's ability to provide more lifesaving blood products and push the envelope on testing.

"I'm very happy with how quickly he's learning our system and bringing in new ideas. He's taking initiative and doing things in a very hands-on way," Metcalf said. "He's taking his enthusiasm and applying it to practice ... having Waseem here will only help us to further advance what we do."



Anani works closely with his team to provide lifesaving blood products for University of Utah Health.

Adapting to a Rapidly Expanding Health System

As the sole provider of blood products to U of U Health, Blood Services forms a direct link between ARUP, the U hospitals and clinics, and the patients they serve.

“To keep the business partnership positive, it’s important for ARUP, and the university, to keep Transfusion Medicine moving forward,” Anani said. “The leaner we run, the less money we lose, and it’s my job to optimize the blood supply side of Transfusion Medicine at ARUP.”

Anani has led a number of projects to optimize how ARUP makes and collects critical blood products such as cryoprecipitate, a byproduct of plasma collection that is used to treat blood clotting in patients with serious or rare conditions. Now, 50% of the cryoprecipitate previously purchased from outside suppliers can be made in-house, in less time, and with fewer blood products, meaning that more plasma is available for patients at a fraction of the cost.

Additionally, Anani’s vision for donor optimization and engagement will play a key role in adapting ARUP’s blood supply for the growing demands of the U of U Health system. In collaboration with Metcalf, Anani and the ARUP Blood Services team have been working to update donor guidelines and to retain, recruit, and reengage previously deferred donors in a new way.

In May 2022, the U.S. Food and Drug Administration (FDA) made a long-awaited update to its blood donation guidelines to allow individuals who lived or worked in the United Kingdom from 1980–1996 to donate blood. Previously, these individuals were prevented from donating due to concerns they could transmit variant Creutzfeldt-Jakob disease, or mad cow disease. Following the FDA

update, Anani went back and looked at every prospective donor who was deferred because of the former guidelines. He identified 197 individuals who were deferred in the past two years and sent hand-signed letters inviting them to return. Shortly after, ARUP Blood Services began receiving phone calls from individuals across the state, asking if they could return and donate.

ARUP Blood Services is focused on expanding donor eligibility by more closely aligning with FDA guidelines, Anani said. Reaching, educating, and retaining donors through personalized letters, phone calls, social media outreach, and new advisories is a top priority.

During the next few years, Anani predicts that 30% of donors who were deferred could return to donate blood. Moreover, he anticipates changes to FDA donation guidelines for individuals with cardiac disease and gay and bisexual men could further increase the percentage of returning donors.

“We tend to treat our donors differently than other blood suppliers,” Anani said. “Our staff works hard to form relationships with our donors, so when they come in, they feel like they’re family.”

Anani’s ability to turn small subtleties—such as a hand-written letter—into impactful solutions has invigorated ARUP Blood Services and the IRL. With the help of his team, Anani has strengthened ARUP’s ability to provide lifesaving blood products now and in the future. His teammates’ support, Anani said, has provided the greatest tailwind for achieving his goals for Blood Services and the IRL.

“They were willing to embrace rapid change and roll with it,” Anani said. “This is a huge undertaking, and yet they’ve committed to these changes because it’s better for donors, and it’s in line with ARUP’s core values, which, to me, are something that we need to live.”

ARUP Blood Services Meets

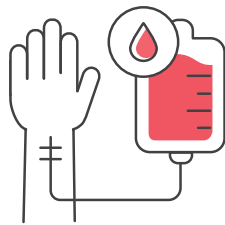
Urgent Need for Blood Products

ARUP Blood Services works day in and day out to collect blood products essential to patient care in Utah. Each day presents new and different challenges, yet there are **always** patients in urgent need of blood transfusions.

Give Local, Save Local

ARUP Blood Services is the sole provider of blood products to all University of Utah Health hospitals and clinics.

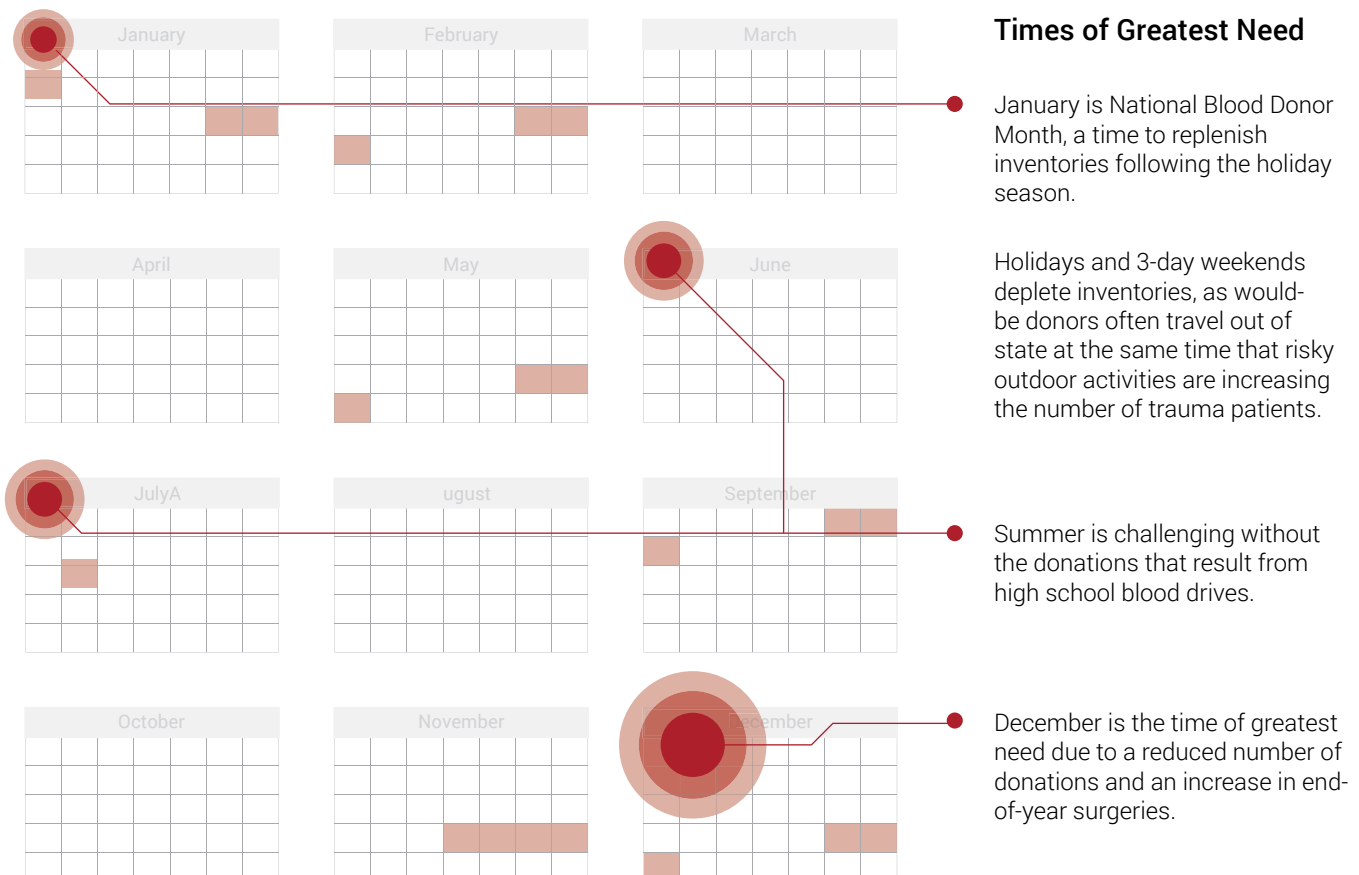
Meeting the
NEED
requires:



75 donors
per day

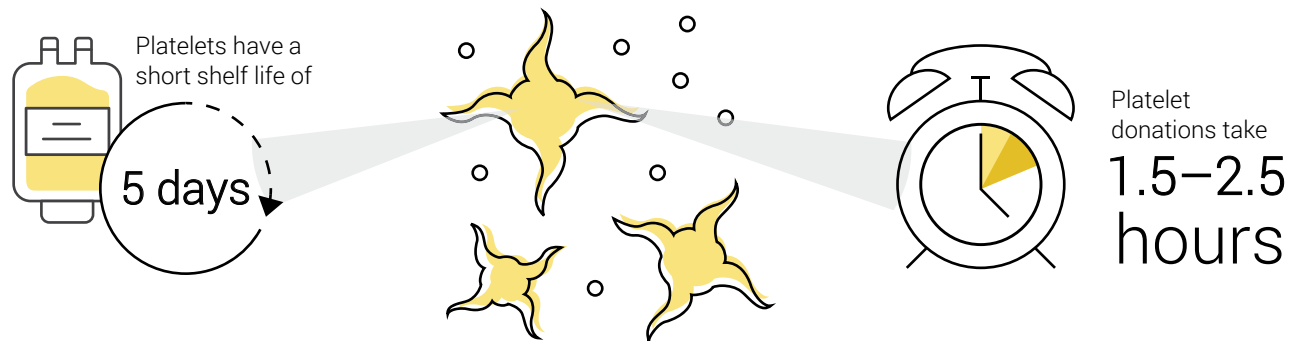


2,200 units
of whole blood and
platelets per month

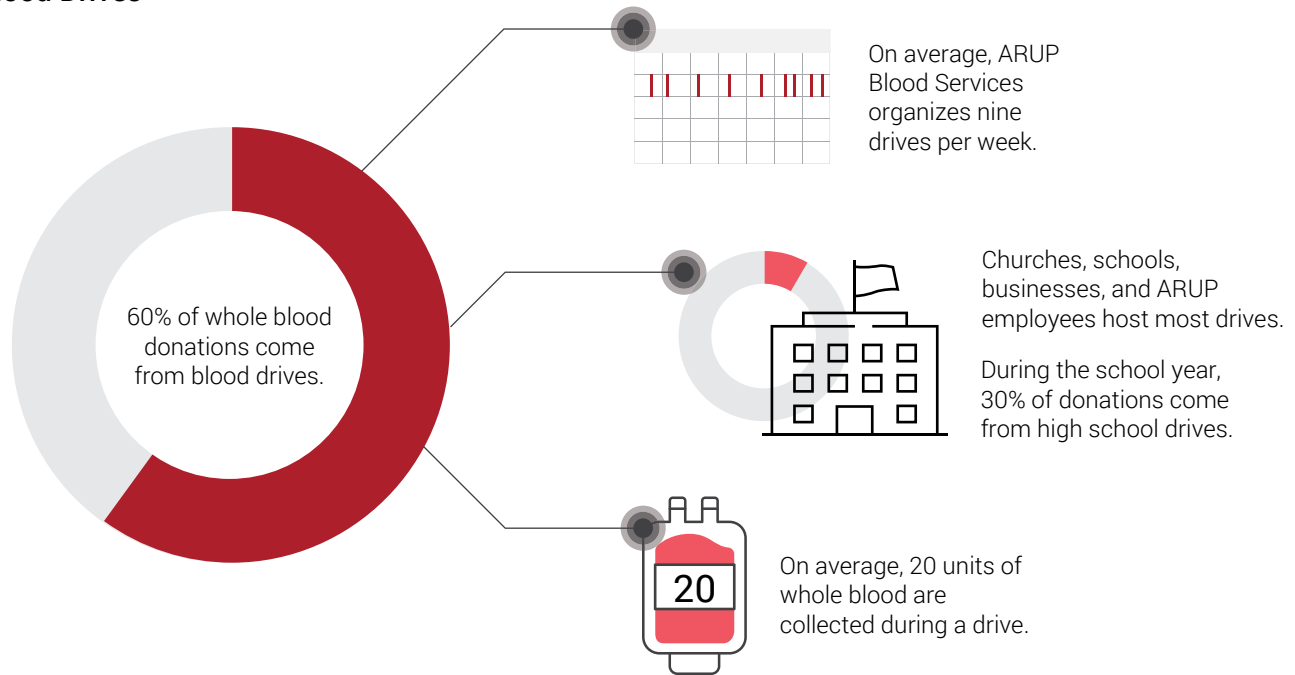


Need for Platelets

Platelets take longer to donate and have a shorter shelf life, so donations are ALWAYS needed. Platelets are used to treat people with cancer and blood disorders as well as those undergoing open heart surgery, among others.



Blood Drives

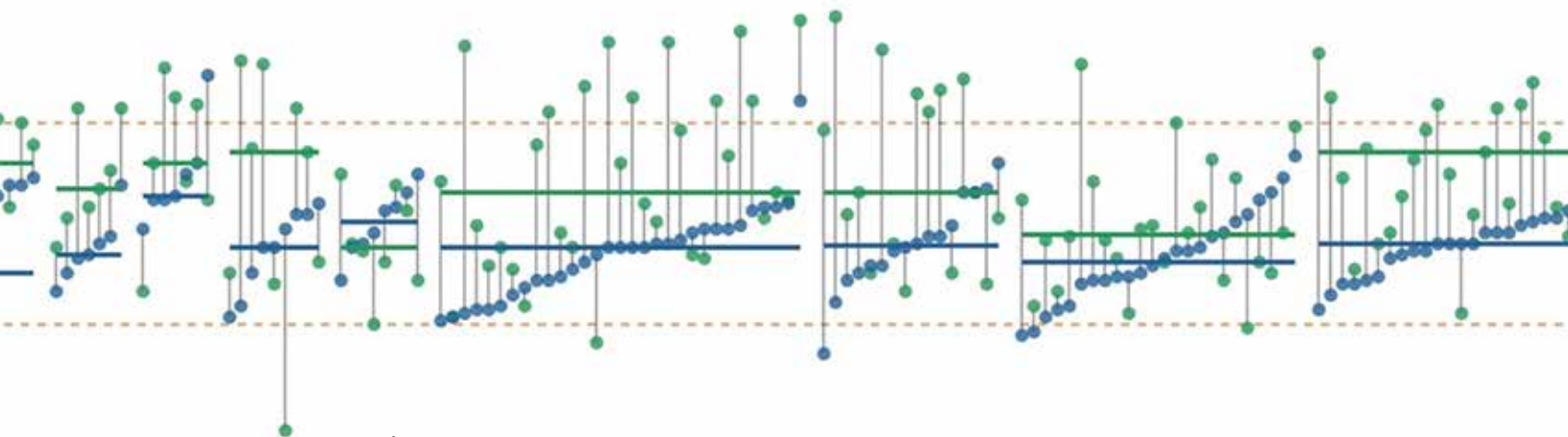


How to Help

DONATE at an upcoming drive or at donation centers in Salt Lake City and Sandy. Organize a blood drive by calling **801-583-2787, ext. 2639**, or sending an email to deborah.jordan@aruplab.com.

1. Pick a date for the blood drive, ideally 2–3 months in advance. Bonus: Schedule over the summer or winter to help when donations are needed most.
2. Recruit at least 35 donors to sign up.
3. Secure an appropriate location. Choose a place for the bloodmobile to park or a spacious indoor area.
4. Roughly three weeks before the drive begins, begin promoting the drive by word of mouth and with marketing materials provided by ARUP Blood Services.
5. Provide an on-site representative to coordinate logistics on the day of the drive.

Remember: Give Local, Save Local. Help your community by scheduling a blood drive today.



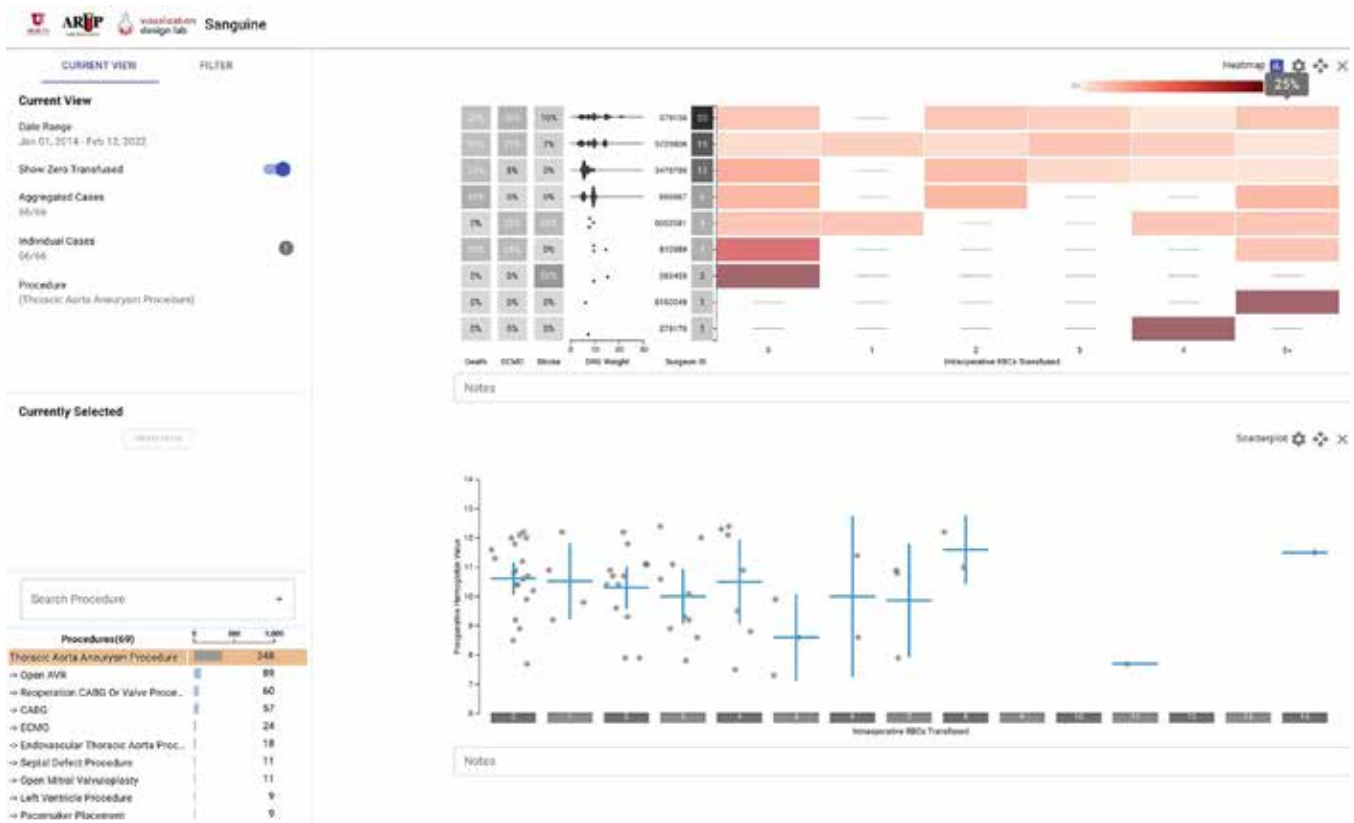
Sanguine, a New Data Visualization Tool, Predicts Transfusion Needs and Provides Risk-Adjusted Benchmarking to Improve Patient Outcomes



Ryan Metcalf, MD, CQA(ASQ), section chief of Transfusion Medicine at ARUP Laboratories and University of Utah Health and medical director of the Transfusion Service, demonstrates Sanguine, a new data visualization tool that provides physicians with insight on how their transfusion practices and patient outcomes compare to those of other clinicians within their facility and enables them to predict transfusion needs for their patients.

Joshua M. Zimmerman, MD, can visualize several scenarios in which he could use granular data about a patient's transfusion risk to better prepare his patients for surgery. With the right information, the medical director of the preoperative clinic at University of Utah Health could intervene weeks or days before a surgery to minimize a patient's risk for transfusion.

Ryan Metcalf, MD, CQA(ASQ), section chief of Transfusion Medicine at ARUP Laboratories and U of U Health and medical director of the Transfusion Service, has spent the past several years developing a tool that provides exactly the type of information Zimmerman needs. Along with a dedicated team from the University of Utah Scientific Computing and Imaging Institute (SCI)—Alexander Lex, PhD, associate professor of computer science,



Physicians can use Sanguine to filter data according to procedure type and their patient's preoperative characteristics, which allows them to gain insights into their patient's specific transfusion risk based on historical data.



Joshua M. Zimmerman, MD, medical director of the preoperative clinic at University of Utah Health, offers insight into how Sanguine can be leveraged to better prepare patients for surgery and optimize their outcomes.

Zimmerman said. "It's extremely rare to have a powerful enough tool that allows us to predict the likelihood of how an individual patient will respond."

Sanguine uses filters based on historical data to estimate how many units of blood patients might need, based on their preoperative characteristics. By using Sanguine, physicians can take measures to reduce risk by employing preoperative, preventive strategies, such as managing

Haihan Lin, PhD student, and Jack Wilburn, software developer—Metcalf has developed a new data visualization tool, Sanguine, that is capable of the level of granularity and complexity required to map a truly accurate assessment of patient blood management practices.

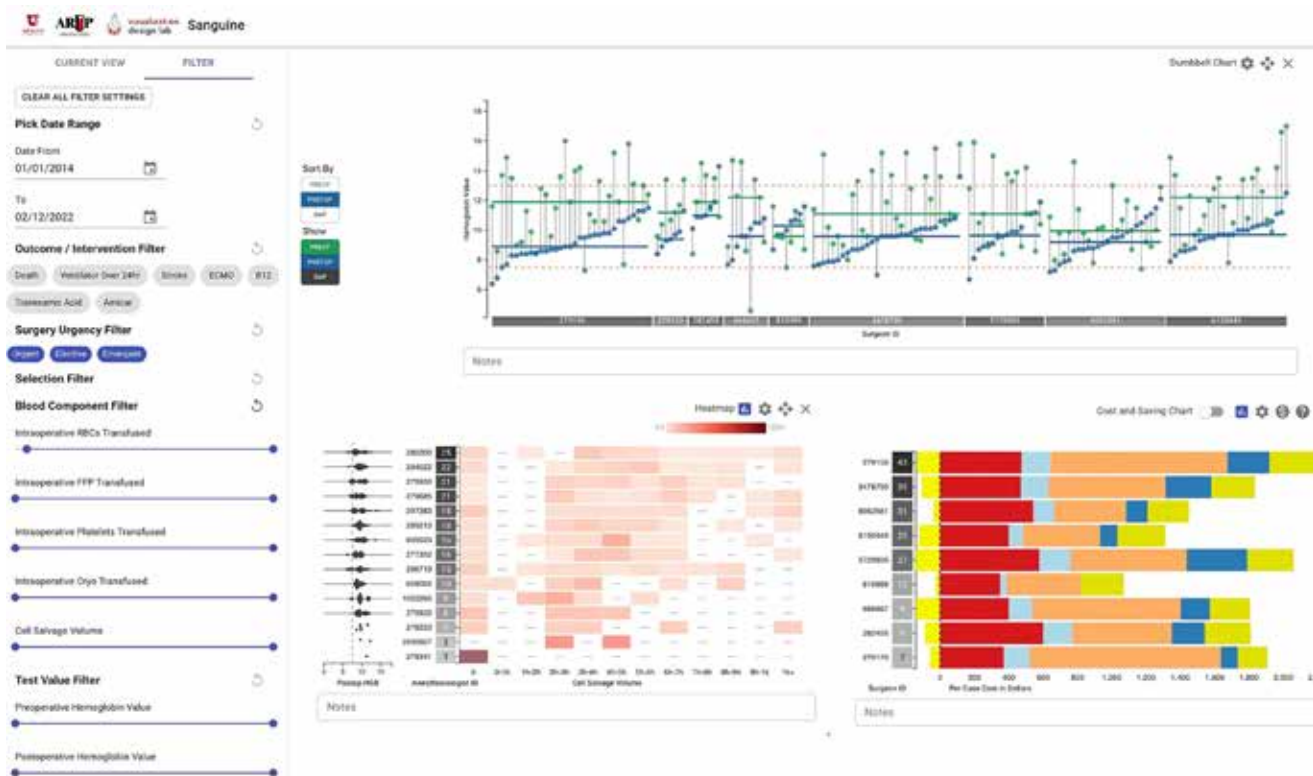
"As valuable as it may be to have an idea of how data apply to a population, we're never taking care of a population in the operating room. We are taking care of an individual patient,"

anemia or using cell salvage techniques, and ultimately improve patients' surgical outcomes.

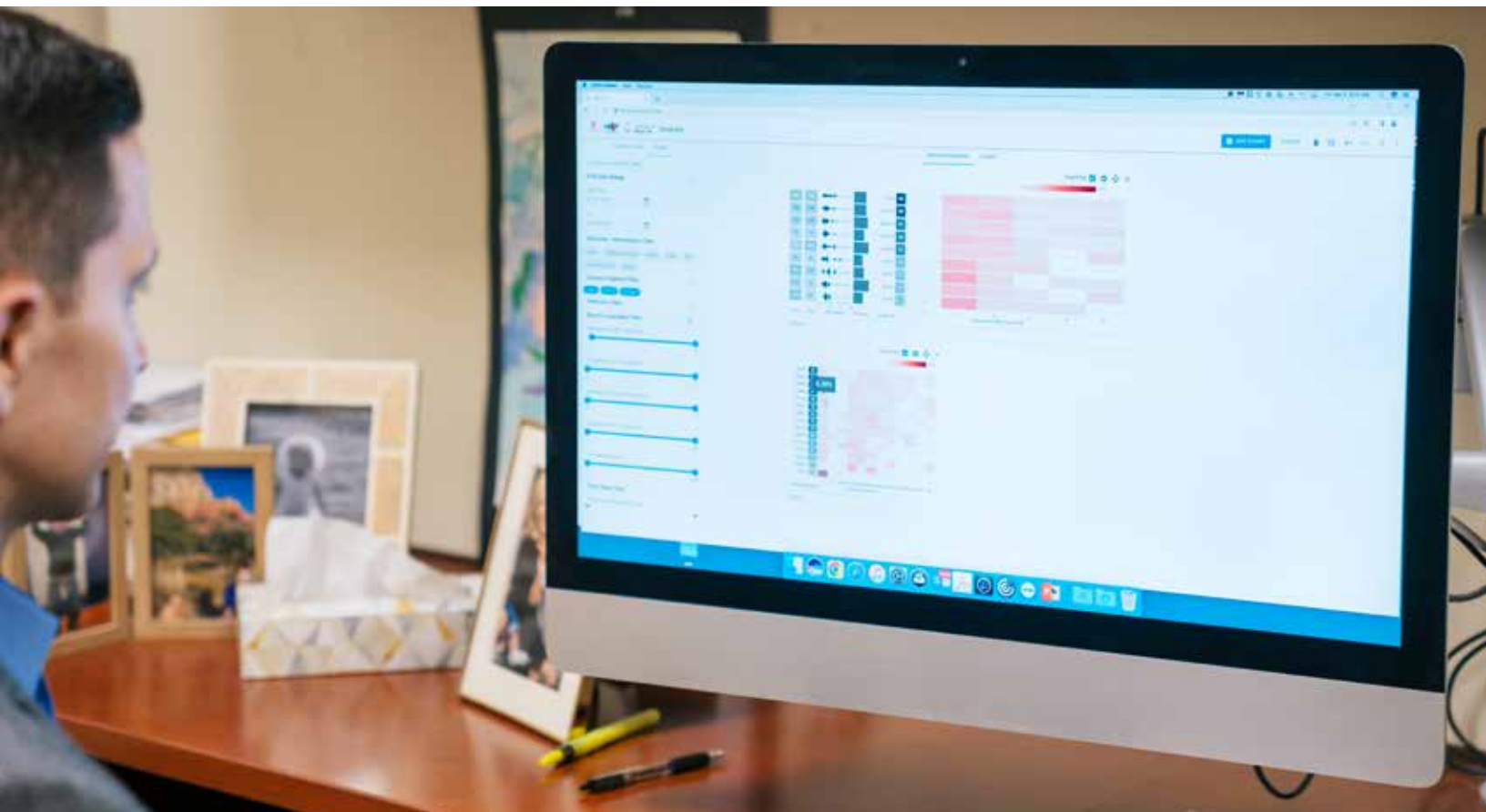
The tool also provides risk-adjusted benchmark data to help surgeons better understand how well they've incorporated evidence-based guidelines into their transfusion and patient blood management practices and how their patients' outcomes compare with those of other physicians within their facility.

Metcalf hopes Sanguine will empower physicians with the insights they need to implement appropriate patient blood management strategies, an approach to transfusion medicine that optimizes transfusion practices, maximizes the use of blood products, and minimizes the need for transfusion.

"Our goal with advanced data visualization was to create a new approach to visualizing PBM [patient blood management] practices that is rapid, flexible, in context, and tied to patient outcomes," Metcalf said. "We can build any number of customizable visualizations to rapidly access meaningful insights into the data and [gain an] understanding of practice that doesn't really exist elsewhere, to my knowledge."



Sanguine uses benchmarking data to help healthcare systems and physicians use optimal, evidence-based transfusion practices, which promotes better patient outcomes.



Metcalf demonstrates how Sanguine uses flexible, rapid filters to visualize patient blood management practices and access meaningful insights.



Blood transfusion is the most commonly performed procedure in the United States, and it's one of the most overused procedures, according to Metcalf.

A Patient Like Mine

Transfusion often saves lives, but it also carries significant risk of adverse effects, such as transfusion-associated circulatory overload (TACO), which occurs when blood volumes become too high and can lead to pulmonary edema. Optimizing transfusion practices and patient blood management strategies can significantly reduce risk.

"Blood transfusion is the most commonly performed procedure in the United States by far, and it's one of the most overused procedures," Metcalf said.

Recently, Metcalf has turned his attention to refining a feature of Sanguine he refers to as "patients like mine." This feature allows surgeons to drill down into the data to identify past transfusion trends based on preoperative characteristics that are similar to those of their current patient.

Zimmerman, who has participated in creativity workshops during the development of Sanguine to provide his insight

on preoperative challenges, often encounters preoperative anemia. To better understand where a patient's hemoglobin levels should be before surgery, Zimmerman needs a better idea of how much blood that patient will lose during surgery.

"As simple as that question is, I don't have a good way to understand it. I have a generic answer at a national level, but I don't have the ability to predict that in a real patient with their surgeon and preoperative characteristics," Zimmerman said.

With Sanguine, Zimmerman can estimate the amount of blood loss a patient will experience during surgery based on that patient's procedure type, surgeon, and factors such as the number of red blood cell units that were transfused in similar cases. Zimmerman could evaluate a patient for iron deficiency, then decide to treat with intravenous iron to increase hemoglobin levels before surgery.

"The really valuable pieces of this are the ability to predict, not in general, not all patients on average, but how much will this patient likely need because of their preoperative and surgical characteristics," Zimmerman said.

Zimmerman also envisions using Sanguine to better inform patients of the risks they might face during surgery.

"If a patient is likely to need 10 units of packed red blood cells during their surgery, they deserve to know that. There's a risk that we see this as routine because it's something we do every day, but it's never routine to the patient. The more informed our conversations, the more informed their consent will be," Zimmerman said.

Risk-Adjusted Benchmarking

Metcalf and his colleagues have also built a mathematical model for risk adjustment using billing code weights. This model makes it possible to examine clinical performance within various groups or hierarchies in a facility and tie that performance to important metrics for patient outcomes.



*Alexander Lex, PhD,
associate professor of
computer science at the
U's Scientific Computing
and Imaging Institute and
the School of Computing*

One of the biggest challenges Metcalf and his team faced is ensuring that the performance comparisons remain fair. Senior physicians, for example, may typically see patients who have more complicated or riskier conditions. Metcalf and his team performed a study to determine how best to adjust their comparisons based on risk and then incorporated it into their design.

"It's important to treat these results as nuanced because it's never a simple story. These are real people, and they have very complex conditions. We designed this tool very consciously to account for the many factors that play a role in risk and outcomes," Lex said. Lex directs the Visualization Design Lab at the U and has spent his career transforming raw data into a visual, functional tool for end users.

In the next phase of the project, Metcalf and Lex want to



"In my view, the value of Sanguine extends far

beyond transfusion medicine.

This tool is tied to key patient outcomes, and it can be an example for data-driven practices for any area of healthcare."

—Ryan Metcalf, MD, CQA(ASQ), Section Chief of
Transfusion Medicine at ARUP and University of Utah
Health and Medical Director of the Transfusion Service

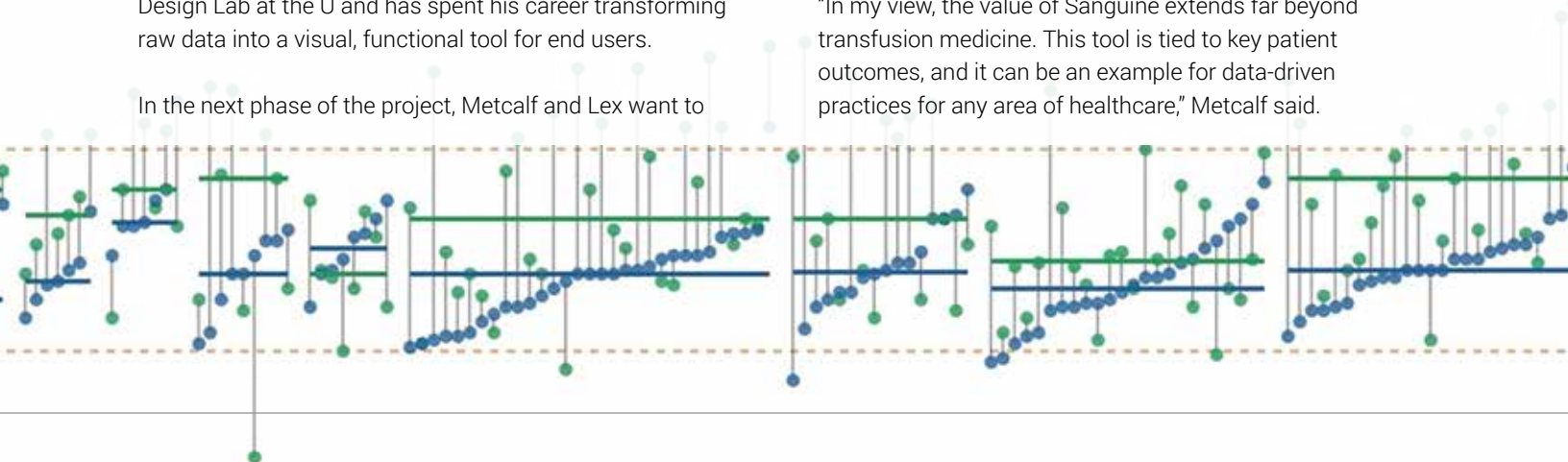
focus on simplified visuals and a customized report that would examine cases for a particular surgeon.

"Not every surgeon cares deeply about the data, but what they do care about is their outcomes," Lex said.

Sanguine was initially developed using data from cardiothoracic surgeries, but Metcalf plans to expand its usage to additional procedure types, particularly those that present a high risk for blood loss, such as complex cardiac surgery, liver transplant, trauma surgery, high-risk obstetric procedures, and orthopedic surgery. He plans to implement Sanguine more widely across the U Hospital later this year.

In addition to refining the usability of the tool, Metcalf is collaborating with other institutions to determine how to apply Sanguine within their facilities.

"In my view, the value of Sanguine extends far beyond transfusion medicine. This tool is tied to key patient outcomes, and it can be an example for data-driven practices for any area of healthcare," Metcalf said.



New Advanced Practice Clinical Laboratory Training Center Will Broaden Medical Laboratory Science Student Training Opportunities, Help Ease Staffing Shortages



Sierra Cunningham has gotten valuable, on-the-job training working as a full-time technician in an ARUP research lab while also going to school to earn a bachelor's degree in medical laboratory science (MLS).


As a kid growing up in Pinedale, Wyoming, Sierra Cunningham loved science.

In middle school, her investigation into the efficacy of antibacterial soap versus hand sanitizer earned her a trip to the Wyoming State Science Fair. In high school, whenever field science classes presented an opportunity for her to traipse out into the nearby Wind River Range to put what she was learning into practice, she was there.

Cunningham brought that same passion with her to Utah,

"There's something about looking through a microscope that just really gets me. My whole life had been leading up to this."

—Sierra Cunningham
ARUP Lab Technician



where an abstract for a project she worked on about neonatal health disparities in Peru won the top prize at the University of Utah School of Medicine's 2016 Student Global Health Initiative Conference. In 2017, she presented with a group at the American Chemical Society conference in San Francisco on the topic, "Vapor-Infused Volatiles from Gin in Specialty Dark Chocolate and Analysis via GC-MS."

She earned associate's degrees in chemistry and biology at Salt Lake Community College and completed numerous science courses at the U, believing she might want to become a doctor.

Along the way, though, a friend who worked at ARUP Laboratories introduced her to the world of laboratory medicine, and it wasn't long before she knew exactly where she belonged.

"There's something about looking through a microscope that just really gets me," said Cunningham, who works as a lab technician in an ARUP research lab and will earn her bachelor's degree in medical laboratory science (MLS) later this year. "My whole life had been leading up to this."

ARUP needs dozens more Sierra Cunninghams.

Like other clinical laboratories nationwide, ARUP faces a critical shortage of qualified medical laboratory scientists as testing volumes grow at the same time that large numbers of medical technologists and technicians are reaching retirement age or choosing to leave the fast-growing profession for other reasons.

The most recent projections from the U.S. Bureau of Labor Statistics (BLS) show clinical laboratories nationwide will need 25,600 more medical laboratory scientists each year through 2031. BLS puts the annual job growth rate for the profession at 7%.

"An estimated 70% of all medical decisions are based on the results of tests performed at ARUP and other clinical laboratories, so it goes without saying that these are important jobs that directly impact patient care," said Tracy George, MD, ARUP president and chief scientific officer. "There is ample opportunity in laboratory medicine for the many young people out there who want to work in fields where they can make a difference."

George has been instrumental in an innovative project that she hopes will help entice more students to pursue laboratory medicine while also helping them complete their education and training more quickly. Joined by ARUP Chief Medical

Officer Jonathan Genzen, MD, PhD, CEO Andy Theurer, and Diana Wilkins, MS, PhD, division chief of Medical Laboratory Sciences at the U, she worked with Utah Rep. Chris Stewart's office to help secure \$3 million in federal funding through the Health Resources and Services Administration to build a new Advanced Practice Clinical Laboratory Training Center at ARUP.

The \$3 million in community project funding was included in the Labor, Health and Human Services, and Education Division of the Consolidated Appropriations Act approved by Congress and signed by President Biden on December 29, 2022. It will pay for construction and equipment for the new training center, which, when it opens in 2024, will enable the U MLS program to double the number of students it graduates each year to a total of 80, Wilkins said.

An important factor in the shortage of medical laboratory scientists has been the difficulty that programs such as Wilkins' face in finding enough clinical laboratories for students to complete the 18 weeks of on-the-job training required for them to earn their degrees.

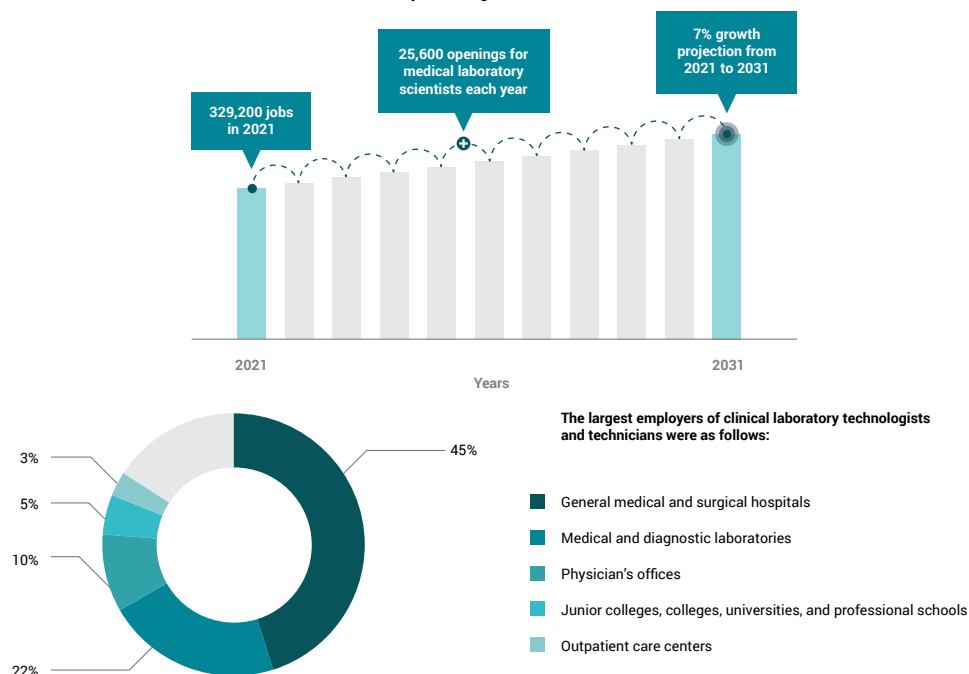
As it is conceived, the new training center will help alleviate that challenge by providing a highly realistic environment where students will be able to gain real-world experience in the basics of testing in clinical chemistry, hematology, coagulation, immunohematology, microbiology, virology, and immunology. They will learn and practice laboratory workflows and decision-making and will gain experience working with a laboratory information system (LIS), thanks to a grant the U's MLS Division has secured to help pay for an LIS for the training center.

Currently, students in the U MLS program practice all of these skills by completing rotations in ARUP's clinical laboratories and in labs belonging to other program partners, such as hospitals in Utah and surrounding states and the Utah Public Health Laboratory. Wilkins said these partners do all they can to offer more training opportunities, but, understandably, they must balance their desire to help with their need to meet the testing demands of their labs.

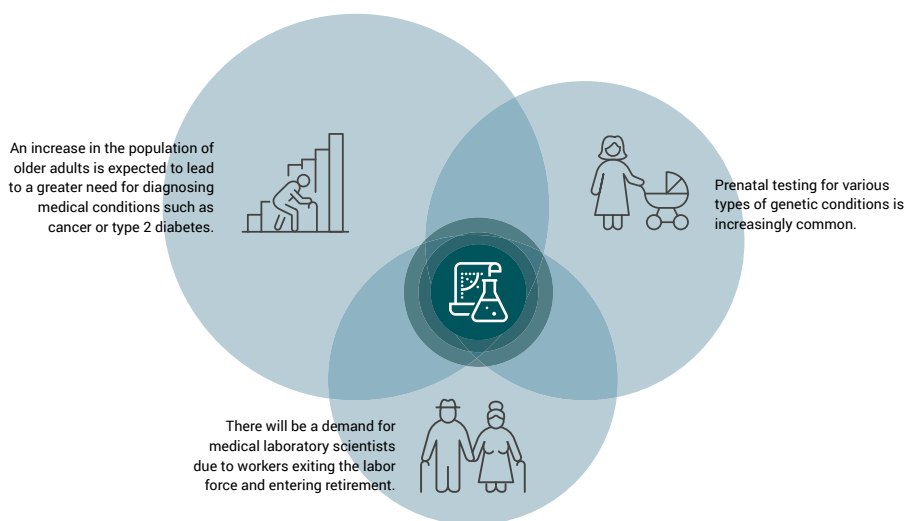
"The new center will make a huge difference in the training of future laboratory professionals by providing more opportunity for students to quickly complete these more general rotations so they can advance to more specialized training rotations at ARUP and elsewhere," she said.

Jeff Chumley, a group manager who oversees the Hemostasis/Thrombosis, Special Hematology, and Hematologic Flow Cytometry Labs at ARUP, is among lab

Laboratory Technologist and Technician Jobs



Increased Demand for Clinical Laboratory Technologists and Technicians



Source: U.S. Bureau of Labor Statistics. *Occupational Outlook Handbook: Clinical laboratory technologists and technicians.* <https://www.bls.gov/ooh/healthcare/clinical-laboratory-technologists-and-technicians.htm> (accessed on February 27, 2023).

leaders who cheered the announcement of the new training center. As a graduate of the U MLS bachelor's and master's programs himself who has advanced into leadership in his 10 years at ARUP, he understands the challenge from both ends.

Clinical rotations such as those he completed as a student at ARUP are essential because "through them, you begin to see the big picture," he said. "The preanalytical, analytical, and postanalytical work all starts to come together to paint a real picture of what the job is like."

Yet for Chumley and his peers, "a tension exists between

wanting to provide a high-quality training experience and helping as many students as possible, and needing to focus all of our attention on patient care and what's on the bench on any given day," Chumley said. "Finding the balance can be really challenging at times."

The new training center will help with that balance, he said. "I find it really exciting, as both an employee and as a former MLS student."

The center will occupy about 2,800 square feet of space that will be remodeled in ARUP's central facility at the U's Research Park. Remodeling will begin after the \$3 million in federal funds are received.

In addition to the funding to pay for construction costs and equipment, the U Department of Pathology and the MLS Division will provide nearly \$500,000 for ongoing faculty and staff support and medical supplies needed to operate the training center.

Cunningham, the ARUP lab technician, will not benefit from the new training center herself. She will graduate from Weber State University's MLS program in August before the center opens.

And, at least initially, it will be U MLS students who will do their rotations at the training center, although the goal is to make elective rotations at the center available to students in other MLS programs, Wilkins said.

Cunningham sees the benefit the center will bring and hopes it will open doors for other students to the profession that she loves.

"Those of us who do this work know what we want to do and what we're good at," she said. "We're using our skills to make patients' lives better even when we don't ever talk to them."



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*ARUP is a nonprofit enterprise of the University of Utah
and its Department of Pathology.*

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