



Isabel Christina Céspedes (center, in all black) with her university's Patient Blood Management group and Axel Hofmann (blue coat), vice president and board member, International Foundation for Patient Blood Management (Basel, Switzerland), at the Escola Paulista de Medicina at UNIFESP, October 2024. Photo courtesy of Isabel Christina Céspedes

## Studying epigenetics to avoid unwanted effects of blood transfusions

2024 Illumina Epigenetics Research Grant Winner Isabel Christina Céspedes will track changes in patients who receive a blood transfusion following heart surgery

HISTORICALLY, BLOOD TRANSFUSIONS have been the go-to lifesaving procedure for a spectrum of diseases. Since scientists first experimented with them in the mid-17th century,<sup>1</sup> they became a mainstay to treat soldiers during the Second World War, and they've continued to be common practice in modern medicine today: Patients who lose blood from injury or surgery, or who suffer from anemia or certain types of cancers, may benefit from the procedure.

Even though more than 14 million units of blood are transfused every year in the US,<sup>2</sup> clinicians and researchers are starting to question whether this procedure is necessary. New evidence suggests that patients who receive blood are at a higher risk of developing new infections, stay in the hospital longer, and have an increased risk of morbidity and mortality. In 2023, doctors assessed the necessity of blood transfusions across 15 hospitals and nearly 7000 procedures in the US. In their study published in *The*

*Joint Commission Journal on Quality and Patient Safety*, they reported that only about 14.5% of transfusions were deemed to be appropriate.<sup>3</sup> Billions of dollars could be saved every year by avoiding unnecessary transfusions that could be costing lives.<sup>4</sup>

Isabel Christina Céspedes, a researcher and associate professor at the Escola Paulista de Medicina at the Universidade Federal de São Paulo (UNIFESP), wants to know why blood transfusions can have so many unwanted effects. As the leader of the Patient Blood Management group at the university's São Paulo Hospital,<sup>5</sup> Céspedes has a vested interest in developing best practices for the management of patient blood in Brazil.

Céspedes is the 2024 recipient of the Illumina Epigenetics Research Grant,<sup>6</sup> an award that enables researchers to deepen their understanding of human disease with Illumina's latest Infinium methylation array. With it, she hopes to take the first-ever molecular

1. [aabb.org/news-resources/resources/transfusion-medicine/highlights-of-transfusion-medicine-history](https://aabb.org/news-resources/resources/transfusion-medicine/highlights-of-transfusion-medicine-history)

2. [cdc.gov/blood-safety/about/index.html](https://cdc.gov/blood-safety/about/index.html)

3. [jointcommissionjournal.com/article/S1553-7250\(22\)00246-X/fulltext](https://jointcommissionjournal.com/article/S1553-7250(22)00246-X/fulltext)

4. [nature.com/articles/520024a](https://nature.com/articles/520024a)

5. [pbm.unifesp.br](https://pbm.unifesp.br)

6. [illumina.com/techniques/microarrays/methylation-arrays/epigenetics-research-grant.html](https://illumina.com/techniques/microarrays/methylation-arrays/epigenetics-research-grant.html)

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approach to studying the epigenetic effects of blood transfusions.

“Blood transfusions have been considered a safe procedure due to the low prevalence of reports of transfusion reactions from a clinical point of view,” she says. “However, current scientific evidence has shown that there are important cellular and molecular repercussions.” Now, scientists increasingly see that transfusing blood is similar to transplanting tissue, because both procedures lead to inflammation and immunomodulation.

Céspedes hypothesizes that many impacts of blood transfusions may result from epigenetic changes—modifications to how a person’s genes are expressed. In this case, the transfused blood could introduce kinds of DNA capable of causing epigenetic changes in the recipient’s cells, and this can lead to an inflammatory response or other adverse effects.

With the grant, Céspedes will be able to use the Illumina Infinium Methylation Screening Array<sup>7</sup> to track epigenetic changes in patients who receive a blood transfusion following cardiac surgery. She will work with the Cardiovascular Surgery Discipline at São Paulo Hospital. In total, 500 patients will be studied; half of

which will receive a transfusion, the other half (the control group) will not.

Céspedes hopes that the research enabled by this grant can add to the body of basic science knowledge about the procedure, as well as change the way transfusions are performed in the clinic, strengthening the use of therapeutic options that are part of the Patient Blood Management program, as recommended by the World Health Organization (WHO).<sup>8</sup> This will provide greater safety for patients, reduce the high costs of blood components, prepare the hospital setting for potential future pandemics and for the worsening shortage in blood banks due to population aging.

The medical community needs to better appreciate the consequences of a long-established procedure, Céspedes says, and ensure patient safety: “Blood transfusions place the patient at risk for worse outcomes, including mortality.” WHO leaders agree that the need to change current transfusion practices is urgent. ♦

*To read about the winner of our polygenic risk score research contest, go to [illumina.com/company/news-center/feature-articles/prs-grant-winner-2023.html](https://illumina.com/company/news-center/feature-articles/prs-grant-winner-2023.html)*

7. [illumina.com/products/by-type/microarray-kits/infinium-methylation-screening-array.html](https://illumina.com/products/by-type/microarray-kits/infinium-methylation-screening-array.html)

8. [who.int/publications/i/item/9789240035744](https://who.int/publications/i/item/9789240035744)

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