News and Perspectives

How Drones Can Connect Organ Donors With Recipients Faster

Michelle Falci, JMIR Correspondent

Abstract

When a patient needs an organ transplant, time is of the essence for delivery. In this *News and Perspectives* article, JMIR Correspondent Michelle Falci reports on efforts to develop drone organ delivery programs in Canada and Scotland.

Key Takeaways:

- Drone delivery could reduce organ transport delays and improve transplant outcomes by streamlining logistics and bypassing traffic.
- Implementing drone delivery requires overcoming complex regulatory and operational hurdles.
- Technical challenges remain before widespread adoption, but lower costs and faster delivery make drones a promising option for the future of organ transport.

When Mekhola Hoff, PhD, was working on her transplant surgical training in Cambridge, she didn't notice issues with connecting organ donors with recipients, but when she joined the Royal Infirmary of Edinburgh as a consultant kidney/pancreas and abdominal organ retrieval surgeon, logistical issues began to rear their heads.

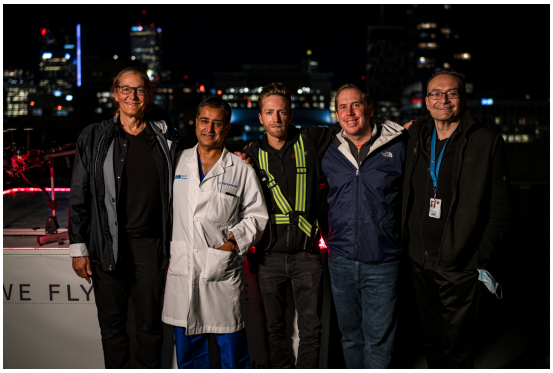
"It's difficult to quantify, but I kind of felt like the Scottish population, even though we have a national allocation system, were somehow being disadvantaged," she said.

The distance between Edinburgh and other cities in the United Kingdom poses a challenge for Scottish transplant teams: if they get lucky, maybe they can send an organ on a commercial flight from a city like Cambridge or London up to Scotland. But often, Hoff explained, they need to charter an expensive overnight flight and then navigate rush-hour traffic in the morning in order to connect a donor organ with a recipient. Transportation delays are tied to worse outcomes for patients; cold ischemia time—the amount of time an organ spends in cold storage without blood flow—is a factor in complication and survival rates.

But what if instead of using planes and cars, organs could be sent between hospitals via drone? Inspired by research that demonstrated the feasibility of drone-based organ transport, Hoff set out on her own mission to incorporate drones into transplant logistics in the United Kingdom.

Saving Time, Money, and Lives

In Toronto, transplant teams have similar goals. Shaf Keshavjee, OC, O.Ont, MD, MSc, FRCSC, FACS, is pioneering a drone delivery program at Toronto General Hospital (TGH). In 2021, Keshavjee and his colleagues were the first team in the world to transport lungs intended for transplant via drone.



Keshavjee and team. Photo credit: University Health Network (UHN), Toronto.

Keshavjee acknowledges that there are a host of up-front logistical considerations for drone flights, but in his experience, they cost about CAD $20 per flight compared to the CAD $20,000 to CAD $40,000 he is used to spending on charter flights for organs. "There's no health care system in the world that can really afford that," he said, adding "I think that people need to know that every innovation doesn't need to cost more."

Even in situations when there is no need to charter a flight, such as if the donor and recipient are in different hospitals in the same city, there is a use case for drones, according to Keshavjee. A drone flight is likely shorter than the time it would take to travel on congested city streets, reducing the amount of time that the donor organ is subjected to ceased blood flow, he explained.

The ability to bypass inaccessible roads can also be helpful during natural disasters, as drones can also deliver blood and emergency supplies to areas with damaged infrastructure.

In a Swedish study, drones delivered automated external defibrillators directly to the location of a suspected cardiac arrest, arriving before an ambulance in 67% of cases.

Logistical Considerations

While Hoff's plans have the advantage of being able to avoid major population centers en route to Edinburgh, Keshavjee had two major considerations: (1) flying a drone in and out of commercial airspace and (2) navigating the drone through a major city with tall buildings, radio signals, and other potential interferences.

"Right now, the law in most developed countries is that you cannot fly a drone within three kilometers of an airport," he said. "So, we have an agreement with Pearson Airport by Toronto, where planes land and take off every 45 seconds."

Keshavjee and his colleagues worked with the airport to establish a drone corridor between Toronto Pearson International Airport and TGH. "When we're landing at TGH, they know what time we're landing, which way we're approaching, and where we're coming from," he said.

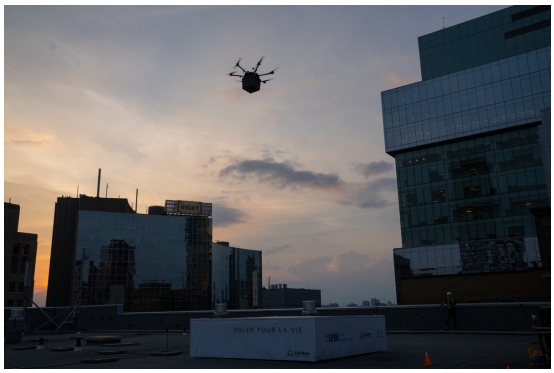


Photo credit: University Health Network (UHN), Toronto.

Just as Keshavjee never imagined his work as a transplant surgeon necessitating a meeting with air traffic controllers, he and his colleagues had to attend city council meetings to establish a "plan B" landing zone for the drones in case of emergency. The drones have automatic avoidance technology to protect the "precious cargo," Keshavjee explained, but the team needed to prepare for crash scenarios.

The organ-transporting drones are equipped with AI-enabled ballistic parachutes to facilitate a slow landing if the drone starts falling too quickly, Keshavjee said. But with drone flights being prohibited in Toronto's public parks, what would happen if the drone failed and needed to land somewhere other than TGH?

Keshavjee and his colleagues were able to make a deal with the city, and they have clearance to land in a park in case of emergency. As transplant teams find answers to logistical questions, there are opportunities to transport organs in increasingly innovative ways.

In June 2026, teams from the United Network for Organ Sharing (UNOS), NASA Langley Research Center, and LifeNet Health successfully completed a drone flight with human kidneys beyond visual line of sight.

What's Next for Drone-Based Organ Delivery

There are remaining opportunities for optimization that can help make drone-based organ delivery the way of the future, including battery life improvement for electric drones. "I think as the technology is improving, we'll get drones where batteries can be lighter and work further," Keshavjee said. "Right now, we're limited to about 400 miles with electric drones."

Even for traditional flights, there is concern for how the vibration of the aircraft affects organs during transport. Keshavjee noted that more research is needed to better understand how the vibration of a drone differs from vibrations in airplanes and helicopters.

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Despite all of this progress in drone technology and organ transplantation, Mother Nature has the final say on whether a drone will take flight. However, Keshavjee and his teammates are working to find a solution.

"Drones can only fly in good weather," he said. "They can't fly in snow and sleet because ice builds up on the blades, just like on helicopters. I've been telling our drone engineers that this is Canada: you better learn to fly in winter too."

Around the world, drone engineers and transplant surgeons are teaming up to make drones a reliable, efficient option for transporting organs, thereby reducing cold ischemia time to improve outcomes.

Keywords: organ transplant; drone; drone delivery; drone delivery of organs; logistics; drone technology; transplant surgery

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