

Drones could soon get crucial medical supplies to patients in need

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Aerial drones could one day ferry life-or-death medical supplies between hospitals now that Johns Hopkins Medicine researchers have figured out how to keep blood, medications and vaccines consistently cool during the flights.

Interest in the use of [drones](#) has surged in recent years as companies, including retail giant Amazon, explore the use of the unmanned aircraft to efficiently and cheaply transport goods above traffic, through bad weather or to otherwise inaccessible or remote areas.

"If the blood somehow was changed or destroyed in transport, then none of it matters," said Dr. Timothy Amukele, a pathologist and director of the Hopkins Bayview Medical Center's clinical laboratories, who has spent the last 18 months on a team perfecting refrigeration on drones.

Amukele published findings in the journal *Transfusion* in November that showed no biological change to blood packed in specially refrigerated coolers during test flights, which lasted about 26 minutes and covered 12 miles at 328 feet above ground. He said he knows of no other advanced effort to solve the temperature problem.

He now hopes to begin sending lab samples and other materials between the Bayview campus and Johns Hopkins Hospital less than three miles away. He still needs buy-in from neighbors who might hear buzzing overhead, and approval from the Federal Aviation Administration, which recently issued regulations about where and when drones can fly

in controlled airspace.

Other Baltimore-area hospitals and eventually farther-flung medical facilities could be looped in, enabling them to share limited medications and blood products, as well as making advanced lab testing more accessible. Eventually, Amukele envisions first responders requesting pints of blood to be delivered to the scene of accidents and [natural disasters](#).

"Drones may become a realistic option," said Ian Weston, executive director of the American Trauma Society, a membership organization for trauma care providers.

Rapid delivery of needed supplies by drone would save lives when patients can't be transported quickly to a hospital by ambulance or helicopter, Weston said.

He said patients in 90 percent of the country can get to a trauma hospital by medevac within 60 minutes, a crucial "golden hour" first described by Dr. R Adams Cowley, for whom the Maryland Shock Trauma Center is named.

Local communities likely would support use of drones for life-saving [medical supplies](#), just as they have embraced helicopters, Weston said. Drones equipped with cameras already are used to assess large fires and accident scenes, he noted, though more widespread use could prompt privacy and security concerns, as they have in some other countries where drones have been used for surveillance and fighting wars.

Practical questions remain about drone capabilities and what the FAA would allow. The agency now bans drones over 55 pounds, flying faster than 100 miles per hour or higher than 400 feet, and the pilots operating them remotely must be certified. Waivers are needed to fly over certain

places and distances.

Solving the refrigeration problem, however, at least makes drone use possible, Weston said. But he and others warned that more trials will be needed to show if drones are better than other delivery options.

Dr. Thomas M. Scalea, Shock Trauma's physician-in-chief, said the Hopkins researchers answered a big question about "if we could do it, but now we have to ask if we should do it."

Drones might not be worth pursuing just yet if they often crash or miss their mark, don't improve patient outcomes, or cost a lot to operate. Scalea said he'd particularly like to see whether drones could help hospitals share resources, but he cautioned officials to resist the temptation to just run with the new technology.

"It's an issue of risk, benefits and costs," Scalea said. "If you could devise an incredibly reliable way to deliver what you want to deliver and be quicker than going on the roads, and you could make it as cheap as driving, then you've got something. We're a little ways away from that, though now that they've demonstrated proof of concept, it's possible to ask the questions."

There might not be widespread need for blood at accident scenes because it's still most important to get patients to the hospital, said Scalea and Dr. Peter P. Taillac, professor of emergency medicine at the University of Utah School of Medicine and a former official with the National Association of State EMS Officials.

First responders are more likely to turn to blood-clotting advances such as freeze-dried plasma developed by the U.S. military that can be rehydrated with saline. Blood might be needed if patients are stuck in the field or when natural disasters result in many victims, Taillac said.

He sees other uses for drones, however, such as on-demand access to expensive and rarely used drugs, such as an antidote to rattlesnake bites. He also noted some Canadian university students are developing a system to deliver automatic external defibrillators, or AEDs, directly to bystanders to use on heart attack patients.

"What are all the niches we can fill?" he said. "There are probably more than 100."

Other groups, including Doctors Without Borders, the emergency medical aid group, already are exploring drone use in the field. The group worked with the Menlo Park, Calif.-based company Matternet in 2014 to send samples via drone from patients with suspected tuberculosis from remote health centers in the Pacific island nation of Papua New Guinea to a hospital in Kerema, a regional capital. Officials are exploring ways to send back results and treatments.

Matternet also has said it would develop drone systems in the Dominican Republic and Malawi to transport medical tests and blood samples from remote villages to labs, bypassing muddy roads and treacherous waters.

A San Francisco-based company called Zipline is working with the government of Rwanda in central Africa to parachute blood products to remote areas from drones. The firm plans eventually to expand to other products and countries.

Back in Maryland, the University of Maryland Shore Regional Health tested drone delivery of medications in August. Officials used vials of saline to stand in for epinephrine, used to treat severe allergic reactions.

A Talon 120LE drone flew 12 miles from Southern Maryland across the Chesapeake Bay to an airport near Shore Regional's Cambridge hospital. With an Eastern Shore service area of 2,700 square miles surrounded by

water, officials said they want backup transportation for medical supplies during weather emergencies or natural disasters. Eventually supplies could be delivered directly to patients.

The test was conducted with the University of Maryland Unmanned Aircraft Systems Test Site, a project housed in the School of Engineering.

"Imagine being able to deploy insulin or another critical medication to someone in need by landing or dropping it right in their backyard," Matthew Scassero, the test site director, said in a statement.

For Amukele's project at Hopkins, he and Jeff Street, a Hopkins drone engineer, began work when a medical student they knew asked for help delivering medications in remote areas of India.

They got funding from Hopkins and the Blum-Kovler Foundation and bought an off-the-shelf DJI S900 drone made for commercial cinematography that costs about \$10,000 and comes with extra motors and batteries should the main ones fail. They removed the cameras and added a cooler, which they are replacing with a specially designed refrigerated box engineered to withstand a hard landing.

"Ultimately we think drones will serve different purposes in different places," Amukele said. "There will be a lot of collaboration to figure that out."

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