Drone-Based Telemedicine: A Brave but Necessary New World

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We are fortunate to be living in a time of technological revolution. The availability and convenience of smart phones and tablets and the resulting instant access to social media, facilitating interpersonal communication and connectedness, are unprecedented. During postdisaster observations of the 2013 EF-4 tornado in Hattiesburg, the authors discovered that many people used Twitter to communicate that they or others were in immediate distress and needed assistance. However, the resources to help people were not immediately available.[1-5] In many large-scale disasters, demand exceeds supply of resources. But have we as health care providers truly leveraged these technological enhancements for the benefit of our patients?

A recent report[6] found that physicians are slow to embrace technology and that hospitals and other sites of health care delivery are often lagging in areas of technological advancement, often as a result of barriers with cost and administration preference. Although the power of communicating through Twitter and other social media after the tornado was remarkable, deeper questions surfaced. Can we do more for a community in the midst of a disaster? Can we leverage existing technologies to put eyes on the scene and to provide medical interventions faster to people in distress?

An innovative solution came to mind that required us to repurpose 2 technologies in a disaster response or medical emergency. The first was to repurpose an unmanned aerial vehicle, more commonly known as a *drone*, to carry a medical kit to someone in a disaster area. The second was to integrate telemedicine through a medical kit to deliver life-saving medical care to those in need while visualizing the situation. The key to successfully achieving our goal was integrating the 2 technologies into a single solution to provide a synergistic effect to treat patients and reduce morbidity and mortality.

Drones exist for search and rescue and for the transport of automated external defibrillators; however, we recognized that greater medical capabilities were needed. Questions regarding repurposing these technologies were reviewed, including inherent limitations of Federal Aviation Administration regulations, existing drone capability, and safety.[7] It became apparent that these issues would not prohibit our ability to proceed in our attempt to connect these components. After careful review of multiple drone options, we selected the DJI S1000+, which is traditionally used for photography, and modified it for the delivery of a telemedical kit. The telemedical kit can be used for a variety of medical emergencies, including cardiac events, traumatic injuries, infectious disease outbreaks, and chemical exposures. We envision that the kits would be maintained by local emergency responder jurisdictions.

The project, Healthcare Integrated Rescue Operation (HiRO), has culminated in a working prototype, which is still in the quality, safety, and testing stage. A video available on YouTube (https://www.youtube.com/watch?v=3w0wqqO2v1U) shows the drone being used during a simulated cardiac emergency in a rural area. The drone in the video is equipped with a safety feature that allows the telemedical kit to be remotely deployed. The telemedical care package can be rapidly remodularized to adapt to the demands of any disaster or crisis.

Drone-based telemedicine has the potential to enhance the safety of first responders and volunteers. The innovation can be used to assess the likelihood of an infectious disease outbreak or to determine the risks to responders from a myriad of potential risk factors at the scene. Drone-based telemedicine can be particularly useful for responding to a suspected hazardous materials accident or a terrorist event. The drones can be sent into the "hotzone," with sensor-enabled technology to detect hazardous emissions and to expe-

dite the immediate delivery of life-saving antidotes or vaccines.

The technology can drastically reduce the transport time for emergency medical services in rural communities and the wilderness, particularly if the drones are strategically prepositioned for deployment. Drone-based telemedicine provides an immense opportunity to provide medical support in cases of challenging terrains and natural obstacles until first responders arrive. It can also be used in coastal areas for response to boating or other offshore emergencies.

Although we have a working prototype, ensuring quality and safety of the drone is of paramount importance. As such, we are instituting a variety of assessments to ensure that health care professional and operator concerns are met and aligned with the needs of the community. This process and ongoing dialogue will improve the quality of the product and its acceptance for use by the emergency management and emergency medical services communities.

Strategically, we envision a fleet of prepositioned drones, via GPS mapping, throughout the country but especially in disaster-prone areas. They can also be essential components of mobile disaster teams. These drones would be deployed at a moment's notice for a variety of concerns directly through existing 911 systems and potential future communication systems.

The technological revolution has brought us many conveniences in our day-to-day lives, some more vitally useful than others. We believe that drone-based telemedicine is an innovative tool that has the potential to transform our response to global disasters, medical emergencies in rural and wilderness regions, and other medical and disaster-related emergencies in the United States and around the world. Technology will continue to evolve. However, we must take advantage of the technology available today. It is time to innovate! (doi:10.7556/jaoa.2015.143)

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Correction

The *JAOA* regrets several errors that appeared in the following article:

Yorkgitis BK, Zhang J, Rappold JF. Non-vitamin K antagonist oral anticoagulants: the clinician's new challenge. *J Am Osteopath Assoc*. 2015;115(10):612-621. doi:10.7556/jaoa.2015.122.

In *Table 2*, the column headings should be Dabigatran, Rivaroxaban, Apixaban, Edoxaban.

These changes will be made to the electronic versions of the article online. (doi:10.7556/jaoa.2015.144)