Healthcare Drones on Reservations: Opportunities, Challenges, and Implications

Abstract

In this paper on the opportunities, challenges, and implications of healthcare drones on reservations, we tried to assess the legal, ethical, and social ramifications if using drones to deliver medications on tribal lands.

We conducted a structured literature review including scientific journals, government regulations from the Federal Aviation Administration, the Government Accountability Office report, the Federal Trade Commission recommendations, the National Academies report, and the publication of the National Health Institute. We also collected data from an interview with an airline pilot and medical doctor. Afterwards, we conducted qualitative thematic analyses. The results of our analyses were concerns about privacy.

We used the Policy Science Framework [1], the set of Principles of Privacy by Design [2], and the Geo-design Framework [3] to identify potential unintended consequences and make policy recommendations. We recommended commissioning a technology assessment of likely outcomes if the 6-point plan is implemented. The technology assessment will evaluate the implications of the policy recommendations and articulate the opportunities and challenges that each policy option presents.

Keywords: Drones, medications, reservations, concerns, regulations.

Bio

Lionel is a Public Interest Technologist and Geographical Information System enthusiast.

His work experience includes serving the United Nations specialized agency for international civil aviation, where he contributed to ICAO work programmes related to aviation safety as well as air navigation capacity and efficiency at the intersection of the regulatory activities of ICAO and those in the airline and airport industries at IATA and ACI.

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1. Introduction

In the Journal of Responsible Innovation, Ribeiro et al present a complementary dilemma to Collingridge's dilemma of social control of technology. The dilemma implies that our capacity to shape the trajectories of technological change (for the better) is radically diminished with time (Collingridge, 1980). To avoid the irreversible consequences of science, technology, and innovation; Ribeiro et al suggest that a better alignment between the goals of science, technology, and innovation and those of diverse publics can be achieved through societal alignment [4]. By societal alignment, we mean the integrative, ongoing, iterative, and synergistic alignment between the goal of technology development and public interest articulation.

The Federal Aviation Administration (FAA) already has a drone approval process in place. Many states, local and tribal government agencies have implemented Health Insurance Portability and Accountability Act (HIPAA) Privacy Rules [5] for several years. The innovative approach of medication delivery using drones is a new technology that can provide a solution to a healthcare provider accessibility problem for people living on reservations- here we call them residents. The use of healthcare drones on reservations presents opportunities but also has some challenges. This mode of medication delivery has implications that need to be assessed and understood so that mechanisms can be established to disseminate and implement best practices.

To that end, we conducted a structured literature review to describe a pathway for the responsible use of healthcare drones on reservations. The review included scientific journals, government regulations from the FAA, the Government Accountability Office report, the Federal Trade Commission recommendations, the National Academies report, and the publication of the National Health Institute. We also collected data from an interview with an airline pilot and medical doctor. Afterward, we conducted qualitative thematic analyses. From our analyses, the major findings were privacy concerns. For residents, concerns were to see their personal and health data compromised. For the pilot, concerns were to invade people's privacy and see their drones destroyed. By law, drone pilots are granted licenses to operate for work and have the right to operate for fun after being registered by the FAA. Therefore, there is a need for policies that regulate the use of healthcare drones on reservations and a framework that protects healthcare drone operators.

As a problem statement, we will try to answer the following question: How might we better protect people's privacy if the Sells Indian Hospital uses drones to deliver medications to members of the Tohono O'odham Nation Reservation? The purpose of this research proposal is to identify potential unintended consequences and make policy recommendations. We will use [1], [2], [3].

As a socio-technical solution, we want to generate interest in finding a societal alignment in healthcare drone use. We will map what needs to happen to enable the responsible use of drones to deliver medications to remote parts of American Indian Reservations. That is, the nontechnical obstacles that would require approvals at the federal, tribal, and local government (county and state); and map which organizations, institutions, and governments have jurisdiction.

2. Technology description

We envision a scenario where the Center Hospital in Phoenix would start delivering medications to patients living in remote parts of the surrounding Tohono O'odham Nation Reservation. The routes to residents are difficult and time-consuming to reach by car, so the Center clinic in Sells (Sells Indian Hospital) is considering having a drone operator fly medications to the patients.

Proposed concept of drone-aided healthcare delivery and pickup service in rural area

Source: Kim, S.J et al (Drone-Aided Healthcare Services for Patients with Chronic Diseases in Rural Areas, 2017)

To do that, the corporate drone operator needs to:

1. Engage with the Federal Aviation Administration to determine which types of operations can be performed in the designated portion of the airspace;
2. Determine what flight rules apply in the designated portion of the airspace;

3. Engage with the state, local and tribal governments to determine the conditions for a drone delivery technology to operate;
4. Determine what regulations apply regarding the delivery of medications on the reservation;
5. Engage with residents to build capacity and empower patients;
6. Start making deliveries per applicable privacy rules.

As drones are emerging technologies, the privacy around their usage in the delivery of medications merits assessment because ample opportunities for unintended consequences will almost surely arise. As drones will be flying around their homes, residents are worried about the recordings that drones may be making and the potential future use of the stored data. As drones will be delivering medications, patients are afraid of the potential misuse of their personal and health data such as protected health information sharing to third parties without permission whether voluntarily or involuntarily. If drones conform to a high standard of privacy protections, the riskier it will be when used to deliver illicit drugs to unauthorized users.

Within the scope of this initial assessment, we assume that flight safety aspects are addressed. Therefore, the assessment will be limited to legal, ethical, and social ramifications.

3. Expert and Stakeholder Engagement

During this initial assessment, we requested information from Dr. John Shufeldt. He is an adjunct professor at the Arizona State University, an airline pilot and emergency department medical director at Sells Hospital in Arizona. He provided substantial feedback on public engagement initiatives that would support the successful implementation of this technology.

We interviewed Ryan Harrisson, a commercial and hobbyist drone pilot, to get his perspective on this topic.

After the expert and stakeholder engagement, we identified the following strategies: public outreach, pilot program, and trial on drone delivery of uncontrolled substances. These engagement strategies would help local pharmacies, healthcare providers and tribal authorities understand the value proposition of the technology.

We then organized an online discussion on public engagement strategies to gather feedback from a lay audience (ASU students) and explore how the identified public engagement strategies would best support the implementation of the healthcare drone delivery technology on the Tohono O'odham Nation Reservation.

From these engagements, we recommend that the inclusion of specific stakeholders would help develop a more robust technology. In the upstream: US Senator of Arizona. In the midstream: UAS software application manufacturers, UAS hardware component manufacturers, UAS manufacturers, Corporate UAS operators, and Citizen UAS Operators. In the downstream: Arizona Self-Driving Vehicle Oversight Committee, Citizen UAS Operators, Tohono O'odham Department of Health and Human Services, Tribal Health, Tribal members.

[3] highlights that geodesign is an effective planning approach for an indigenous community as it incorporates, in the engagement, the four primary indigenous values: local sovereignty, the sacredness of the land, relatedness to the environment, and local oral and experiential knowledge.

The geodesign framework could be applied in the public outreach, pilot program, and trial process. It would help bring different stakeholder perspectives into the development of planning outcomes informed by geographic context and using the Geographical Information System. The combination of anticipatory and participatory [6] geodesign approaches would empower members of the reservation.

4. Opportunities and Challenges

In terms of opportunities, the literature reveals that a model has been developed to determine the location and number of centers to cover all patients while eliminating redundant and infeasible candidate sites. Another model determines the optimal number of drones in each center, considering all schedules in a given area [7]. Second, we discovered two new designs for a drone healthcare delivery network. One design minimizes the total weighted delivery time: road plus air. The other design minimizes the maximum weighted time to deliver to all demand points in all demand clusters [8]. Third, we found an ethical framework that could serve as a guide to engineers [9].

On the 27th of April 2021, James L. Grimsley testified before the House Committee on Transportation and Infrastructure, Subcommittee on Aviation, and presented the economic and social benefits of drone technology for tribal communities [10], which includes addressing delays in medical response in rural areas.

However, some challenges must be addressed to realize these societal benefits. The first challenges are related to airspace regulation and HIPAA compliance. Second, drone delivery could provoke legal challenges if privacy is invaded. Third, banning facial recognition does raise some ethical considerations; but any technology for delivering medications will need to have highly reliable end-user identification such as two-factor authentication. Because of the risk of diversion, drones could be used to deliver illicit drugs to unauthorized users.

5. Policy options

Policy options for using drones to deliver medications on reservations and addressing privacy concerns:

- Propose legislation to conduct technology assessment with an emphasis on legal, ethical, and privacy aspects in the integration of healthcare drones into the National Airspace System;
- Propose the FAA to prevent drone service providers from using Artificial Intelligence (AI) on personal data and ban unauthorized use of facial recognition;
- Propose drone manufacturers to implement Privacy by Design principles.

These policy options have implications at the Federal, State, and Tribal levels. The federal law would establish the requirements for airspace regulation, enforce HIPAA privacy rules and establish the coordination mechanism for the safe integration of this technology. The state law would establish an oversight mechanism for effective compliance with applicable state laws. The tribal law would establish an implementation strategy. As tribal authorities may reclaim sovereignty [11] over the airspace below 400ft, they would be able to authorize the implementation of this technology on the reservation. Alternatively, tribal authorities could block this technology if public safety and privacy protections are not guaranteed. Therefore, we reiterate that engagement strategies must demonstrate the value proposition of this technology.

6. Organizations, institutions, governments with jurisdiction

Federal Aviation Administration

Source: https://www.faa.gov/

The Federal Aviation Administration certifies healthcare drones, may regulate the portion of the airspace, and approves healthcare drones operations.

az.gov STATE OF ARIZONA

Source: https://az.gov/

ADOT Arizona Self-Driving Vehicle Oversight Committee

Source: https://azdot.gov/home

In the State of Arizona, Executive Order 2015-09 outlines Arizona's process for the safe development and testing of autonomous and connected vehicle technologies. The order establishes within the Office of the Governor the Arizona Self Driving Vehicle Oversight Committee [12]. The mandate of this committee may include the healthcare drone delivery technology. The enforcement of this order can provide a basis for work at the aeronautics division of the Arizona Department of Transportation on the drone aspect of the technology. This enforcement can also provide a basis for work at the Arizona Department of Health Services on the healthcare aspect of the technology.

ARIZONA DEPARTMENT OF HEALTH SERVICES
Health and Wellness for All Arizonans

Source: https://www.azdhs.gov/

Source: http://www.tonation-nsn.gov/

Indian Health Service
The Federal Health Program for American Indians and Alaska Natives

Source: https://www.ihs.gov/

The tribal government and the Indian Health Service will be the main actors in authorizing the testing of this healthcare drone delivery technology. We reiterate that the tribal laws would establish an implementation strategy. This aspect opens opportunities for further analyses of tribal studies.

Source: https://www.dea.gov/

After the approval to test the delivery of medications on the reservation using drones is granted, the Drug Enforcement Administration will be authorized to enforce its laws to combat illicit drug trafficking and distribution on the Tohono O'odham Nation Reservation.

Source: http://www.tonhc.org/facilities/sells-hospital/

After permission to deploy the healthcare drone delivery technology is received from tribal authorities, the Sells Hospital will be the testing center of the delivery technology. The Sells Hospital would be the ultimate organization to give clearance to the drone operator to deliver medications to their patients.

7. Conclusion

The topic developed in this paper is of utmost interest to governmental regulatory agencies, innovators in the private sector, and concerned citizens whether or not active drone users or healthcare professionals. This technological innovation in healthcare drones is where we are heading in the coming years. So, finding a societal alignment could help limit the unintended consequences. It remains important to keep in mind that to deliver medications on reservation drone operator needs to:

1. Engage with the Federal Aviation Administration to determine which types of operations can be performed in the designated portion of the airspace;
2. Determine what flight rules apply in the designated portion of the airspace;
3. Engage with the state, local and tribal governments to determine the conditions for a drone delivery technology to operate;
4. Determine what regulations apply regarding the delivery of medications on the reservation;
5. Engage with residents to build capacity and empower patients;
6. Start making deliveries per applicable privacy rules.

Therefore for a successful implementation of the 6-point plan above, a technology assessment of likely outcomes should be commissioned to evaluate the implications of the policy recommendations and articulate the opportunities and challenges that each policy option presents. A participatory assessment would be appropriate.

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Appendix

Interview with Dr. John Shufeldt

Meta Information

Interviewer	PIT Group 5: Rob Alexander, Lionel Gamath-Goubili
Interviewee	Dr. John Shufeldt, **https://isearch.asu.edu/profile/581754**
Date	2021-09-08
Location	14614 N. Kierland Blvd. Suite 120 Scottsdale, AZ 85254
Purpose	This interview was performed for the Fall 2021 PIT 502 course at ASU for a project on privacy related to drones delivering critical services. The intent was to get the perspective of an airline pilot and emergency medical doctor.

Coding Key

[FAA][hospital][drones][reservation][medications][phones]

Audio files:

https://otter.ai/u/S038fPtwHV22uLwkqGQXxBWgtdA

https://otter.ai/u/ws3hwdXy8lm7MFj7C3l8GQGXiCM