Poster EP032

Acceptability and cost-effectiveness of blood sample transport by drone for HIV-testing of infants exposed to HIV in the city of Conakry, Guinea (ANRS 12407 AIRPOP)

Maxime Inghels[1], Gabrièle Laborde-Balen[2], Oumou Hawa Diallo[3], Paul Mee[1], Mohamed Cissé[4], Alice Montoyo[5], Abbas Diakité[6], Frank Tanser[1], Youssouf Koita[7], Guillaume Breton[8].

[1]Lincoln International Institute for Rural Health, University of Lincoln, United Kingdom; [2]TransVIHMI, University of Montpellier, INSERM, IRD, France; [3]Solthis, Conakry, Guinea; [4]Service de Dermatologie, CHU Donka, Conakry, Guinea; [5] ONG ALIMA, Paris, France; [6] Cellule Nationale de Lutte contre le VIH SIDA (CNLS), Conakry, Guinea; [7]Programme National de Lutte contre le VIH SIDA et les Hépatites (PNLSH), Conakry, Guinea; [8]Solthis, Paris, France

BACKGROUND

Early infant diagnosis (EID) of HIV is essential because of the high mortality of HIV-infected infants during the first months of their lives. In Conakry timely EID is difficult as traffic congestion prevents the rapid transport of blood samples to the central laboratory (figure 1). We investigated (i) the cost-effectiveness of transporting EID blood samples by drone and (ii) the acceptability of EID blood samples by drone.

Figure 1: traffic jam in Conakry (left) and health centers and central laboratory (Hospital Donka) mapping

METHODS

Objectif (i): We conducted a cost-effectiveness comparative analysis between EID blood samples transportation by UAV compared to motorcycle using Monte Carlo simulations. Incremental cost-effectiveness ratio (ICER) per life-year gained was computed with local annual GDP per capita (US$1,194) set as the threshold. Simulation models included parameters such as consultation timing (e.g. time of arrival), motorcycle and UAV characteristics, weather and conditions (Table 1). Data sources included field surveys, literature reviews, Google Maps, Meteoblue (weather data), DroneVolt (a drone manufacturer) and IeDEA West Africa data (survival data). Sensitivity analyses were conducted.

Table 1. Main technical assumptions for the cost-effectiveness simulation model

Parameters	Value	[min-max]	Distribution	Sources
Healthcare				
Mother-to-child transmission rate at 6 weeks	17,5%		Point estimate	PNLSH
HIV-exposed infant receiving PCR test at 6 weeks	64,4%	[47,5 – 81,2]	Random point estimate	Wettstein et al. *AIDS* 2012
Arrival time of mothers at the health centre	9h00	[7h00 – 16h30]	Beta PERT	Field survey
Waiting time at health centre (min)	133,8	SD: 66.2	Normal	Literature review
Time required to perform a PCR test (min)	105	[90 –120]	Random point estimate	Field observations with GeneXpert®
Work departure time of healthcare workers	16h30		Point estimate	Field observations
Mothers able to wait until healthcare workers leave	39,0%	[15,3 – 69,0]	Random point estimate	Field survey
Maximum waiting times for mothers (min)	160	[3 –600]	Beta PERT	Field survey
Number of days needed to return for the test results if not collected the same day	33	[0 –365]	Logarithm	Literature review
ART initiation acceptance rates	92,3%		Point estimate	Bianchi et al. *Lancet HIV* 2019
Average age at ART initiation among children after one year	4.7	[1.0 – 21.7]	Exponential	IeDEA data
Drone				
Drone price	$23,126		Point estimate	Drone Volt
Operational horizontal speed (km/h)	72		Point estimate	Drone Volt
Operational vertical speed (km/h)	14,4		Point estimate	Drone Volt
Flight altitude required (meters)	80		Point estimate	Field observations
Autonomy (min)	35		Point estimate	Drone Volt
Preparation times—e.g. deployment (min)	10		Point estimate	Field observations
Weather inoperability	2.1%		Point estimate	Meteoblue
Drone loss rates	0%		Point estimate	Drone Volt
Motorcycle				
Motorcycle Price	$3,238		Point estimate	CFAO motors
Lifespan (per km)	55,000	[30k – 70k]	Beta PERT	Ochieng et al. *Lancet Glob Health* 2020
Breakdown rate (per 10,000km)	0.6		Point estimate	
Accident rate (per 100,000km)	2.08		Point estimate	
Weather inoperability	0.2%		Point estimate	Meteoblue

CFAO: Corporation For Africa & Overseas; IeDEA; International epidemiology Databases to Evaluate AIDS; PCR: polymerase chain reaction ; PNLSH: Programme National de Lutte contre le VIH/Sida et les hepatites virales; SD: standard deviation.

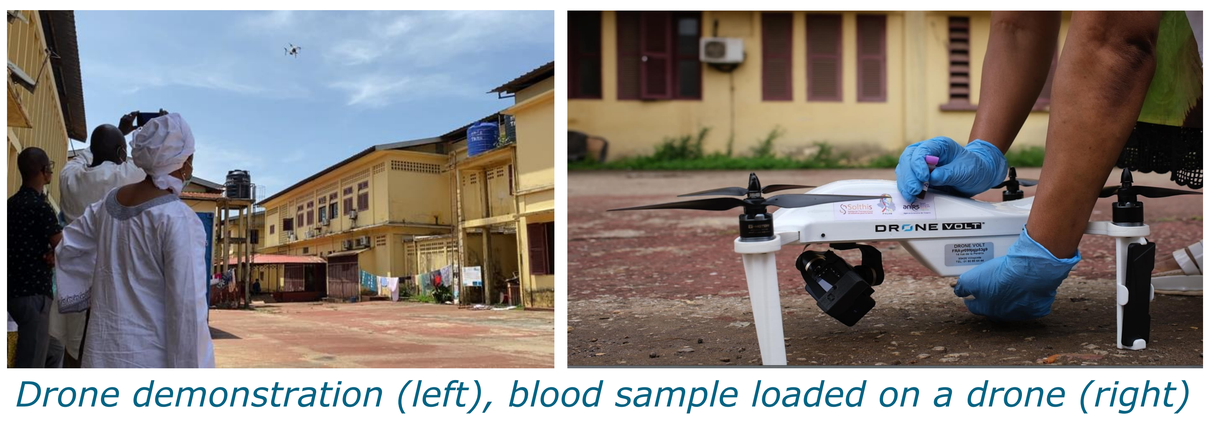
Objectif (ii): Interviews were conducted with 65 stakeholders including postpartum women, local residents and policy makers. The drones were demonstrated to these individuals.

RESULTS

(i) Over a 5-year program and 318 HIV-exposed infants seen in consultation on average every year, the UAV transport strategy was able to save 24·1 life-years [90% PI: 15·3 –63·4]. The UAV strategy costs an additional of $37·4 [33·6 –42·0] per infant tested compared to the motorcycle one. Based on the current UAV purchase price of $23,126, the ICER of $2,497 per life-year gained was above the cost-effectiveness threshold. The ICER would fall below the threshold if the price were reduced to $8,737. The ICER is primarily sensitive to weather-related downtime, number of HIV-exposed infants and travel time saved by UAV.

(ii) Perception among the general population was overall positive with some fear reported of blood contamination if the drone fall or its misuse of drones for terrorist attacks.

Post-partum women perceived that the use of drones could reduce the time to receive EID results. Health policy makers shred the view that drones could improve care decentralization and allow for the transportation of other health products.



Drone demonstration (left), blood sample loaded on a drone (right)

DISCUSSION & CONCLUSION

The transportation of EID blood samples by drone could be highly acceptable and could save more lifes than motorbike transportation. To be cost-effective in Guinea, the purchase price of the drone should be less than $8,737 which is highly likely to occur considering the recent development of low-cost drones and the rapid improvement of drone technologies. Thus, transportation by drone could be very soon represent an alternative to improve the care of HIV-exposed infants and reduce their mortality in Guinea. Drone transportation could be cost-effective in upper-middle-income cities with important traffic congestion and low rate of EID.

Further details:
Dr Maxime Inghels, Research Fellow in Global Health
Lincoln International Institute for Rural Health (LIIRH)
Email: MInghels@lincoln.ac.uk
Tel: +44 (0) 1522 88 6208

Presented at AIDS 2022 – The 24th International AIDS Conference

AIDS 2022
29 July – 2 August