The costs of using drones to transport vaccines to hard-to-reach areas in DRC: Drones for Health DRC Economic Evaluation Results

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Our Vision
A world where everyone has the health care needed to thrive.

Our Mission
To transform health care delivery to reach everyone.

Our Impact
In 2021, VillageReach with partners:

• Helped increase access to quality health care for 58 million people in sub-Saharan Africa.

• Supported 380,000 health workers’ ability to deliver products and quality health services to the most under-reached.

• Assisted in the delivery of health products to 2,500 health facilities.

Pathways to primary health care
VillageReach builds tech-enabled pathways to PHC services increasing access for the under-reached.

Products to people
VillageReach makes health products available when and where they are needed.

Drive sustained impact
VillageReach works with governments and private sector to drive sustained impact at scale.
VillageReach’s Drones for Health Program in the Democratic Republic of the Congo
Drones for Health (D4H) in DR Congo

**Location:** Equateur Province (103,902 km²)

**Scope:** Began in Dec 2020, now supplying 40 health facilities via 24 landing sites

- Bi-directional drone network is one of the largest in the world: 37,445 km²
- Drone hub ~30 min by road from provincial warehouse
- BVLOS flights of 15-60 min, landing at the remote facilities
- Drone battery change (stopover) for longer distances (> 115 km)
DRC Routine Drone Transport: Primarily 20 Immunization Products & Lab Samples

**Monthly & on demand transportation for 40 communities:**
1. Exclusive drone transportation for immunization products
2. Lab samples & reports
3. Emergency orders of other products

**Outsourcing drone transportation to Swoop Aero:**
- Bi-directional, electric, VTOL drones
- 3 kg & 5.4 L capacity
- 90-115 km/hr, 115km range
- Satellite connectivity and visual targets for areas without mobile access
- Fully local drone team
Phase 2 Equateur drone program: Results

30 Dec 2020 – 30 June 2023

4,911 flights in 403 days
1,824 product deliveries both ways

2,196 flight hours
221,342 km flown (2-6 drones)

40 health facilities
supplied with immunization products
via 24 drone-landing sites

1,841 kg (volume of 7,227 L) delivered
vaccines + lab samples, reports + medicines, PPE

130,633 people directly benefitting
from products flown by drone, including:

• 75,937 children < 1 year,
• 25,578 pregnant women,
• 29,100 people of all ages,
• 18 (community) health workers

343,398 vaccine doses*
118,787 diluents + 184,954 syringes + 18,034 adaptors

418 lab samples
85 test results (5 positive)
311 reports + 4 product order forms
15,328 vaccination cards + 100 tally sheets
485 PPEs for COVID-19
14 blisters + 16 vials of medicines
102 collection kits + 23 other products

* Additional products moved by road

In addition to supplying the full monthly quantities of Routine Immunization products needed in 40 communities, drones delivered yellow fever vaccines on-demand during a mass vaccination campaign & picked-up samples during Ebola outbreak.
Our Approach to Evaluate our Solution

Performance evaluation

UNIVERSITÉ DE KINSHASA
KSPH
Kinshasa School of Public Health

VillageReach

IDinsight

Economic evaluation

OPS MEND

VillageReach

Robust holistic evidence
Performance Evaluation Results
Results: Higher EPI product availability & faster transport, but vaccinations depend on many other factors

<table>
<thead>
<tr>
<th>KEY INDICATORS</th>
<th>Baseline Apr – Sep 2020</th>
<th>Endline Jan – Jun 2022</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard-to-reach health facilities (drone landing sites)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccine availability (last 3 months)</td>
<td>65%</td>
<td>98%</td>
<td></td>
</tr>
<tr>
<td>% facilities with stockouts (last 3 months)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentavalent</td>
<td>6%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Measles</td>
<td>12%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Yellow fever</td>
<td>18%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>% facilities taking 2+ days to get vaccines</td>
<td>65%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>% of vaccination sessions conducted according to plan</td>
<td>85%</td>
<td>85%</td>
<td></td>
</tr>
<tr>
<td>Vaccine coverage</td>
<td>94.2%</td>
<td>92.3%</td>
<td></td>
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</tbody>
</table>

Key challenge: 6-month health worker strike (Aug 2021-Jan 2022) meant fewer vaccinations happening, even though products were available.
Economic Evaluation Results
Economic evaluation methodology

1. **Start-up costs**
   - Secondary analysis of VillageReach financial records to identify costs of introducing the D4H intervention uncaptured in iSC costing

2. **iSC Costing**
   - Adapted USAID | DELIVER activity-based supply chain costing methodology of the D4H network pre and post intervention

3. **Cost-effectiveness Analysis (CEA)**
   - Cost-effectiveness analysis conducted utilizing a multi-component performance metric, weighted based off DRC stakeholder preferences
Most start-up costs were found to be recurring, but will be reduced after initial start-up.

<table>
<thead>
<tr>
<th>Cost Categories</th>
<th>Cost type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One time</td>
</tr>
<tr>
<td>Advocacy &amp; stakeholder engagement</td>
<td>✔️</td>
</tr>
<tr>
<td>Community sensitization</td>
<td>✔️</td>
</tr>
<tr>
<td>Site selection</td>
<td>✔️</td>
</tr>
<tr>
<td>Network design</td>
<td>✔️</td>
</tr>
<tr>
<td>Regulatory management</td>
<td></td>
</tr>
<tr>
<td>Infrastructure investments</td>
<td>✔️</td>
</tr>
<tr>
<td>Asset Shipping &amp; Importation</td>
<td>✔️</td>
</tr>
<tr>
<td>Recruitment</td>
<td>✔️</td>
</tr>
<tr>
<td>Training</td>
<td>✔️</td>
</tr>
<tr>
<td>Data systems &amp; management</td>
<td>✔️</td>
</tr>
<tr>
<td>Project management</td>
<td>✔️</td>
</tr>
<tr>
<td>Evaluations</td>
<td>✔️</td>
</tr>
</tbody>
</table>
Start-up costs were highest during pre-implementation, but steady state costs are more reflective of future recurring costs.

<table>
<thead>
<tr>
<th></th>
<th>Pre-implementation</th>
<th>Scale-up</th>
<th>Steady state</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>12 months</td>
<td>Jan 2021 – Jan 2022</td>
<td>Feb 2022 – June 2022</td>
</tr>
<tr>
<td>Excluding evaluation</td>
<td>$13,375</td>
<td>$11,460</td>
<td>$9,172</td>
</tr>
<tr>
<td>Including evaluation</td>
<td>$16,010</td>
<td>$17,726</td>
<td>$22,208</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-31%</td>
<td></td>
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</tbody>
</table>
Total iSC cost increased but drone transportation introduced cost savings at the Zones (Districts) and Health Centers

<table>
<thead>
<tr>
<th>Cost and Performance Summary</th>
<th>Annual Transportation Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td><strong>Endline</strong></td>
</tr>
<tr>
<td>Total annual cost</td>
<td>$150,368</td>
</tr>
<tr>
<td>Cost/dose</td>
<td>$0.58</td>
</tr>
<tr>
<td>Vx availability</td>
<td>65%</td>
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Total iSC cost increased but drone transportation introduced cost savings at the Zones (Districts) and Health Centers

### Cost and Performance Summary

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<th>Baseline</th>
<th>Endline</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total annual cost</strong></td>
<td>$150,368</td>
<td>$481,982</td>
<td></td>
</tr>
<tr>
<td><strong>Cost/dose</strong></td>
<td>$0.58</td>
<td>$1.84</td>
<td></td>
</tr>
<tr>
<td><strong>Vx availability</strong></td>
<td>65%</td>
<td>98%</td>
<td></td>
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### Annual Transportation Costs

- **Zone (District)**
  - Baseline: $5,446
  - Endline: $1,651
  - Trend: $3,795
  - **-70%**

- **Health Center**
  - Baseline: $19,650
  - Endline: $36,174
  - Trend: $16,524
  - **-46%**

- **n=18** for Zone (District) and **n=39** for Health Center
The current drone iSC configuration (endline) has higher total effectiveness score but higher cost, equating to baseline being more cost-effective.

<table>
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<tr>
<th>Metrics</th>
<th>Baseline 2020</th>
<th>Endline 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$0.58</td>
<td>$1.84</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>21%</td>
<td>48%</td>
</tr>
<tr>
<td>Cost-Effectiveness</td>
<td>7.16</td>
<td>10.04</td>
</tr>
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</table>
If operational bottlenecks causing low asset utilization are addressed, it can provide us the flexibility to optimize the supply chain design to reduce cost, with a high potential for future cost-effectiveness.

<table>
<thead>
<tr>
<th>Metrics</th>
<th>Baseline 2020</th>
<th>Endline 2022</th>
<th>Improved Endline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Cost per dose</td>
<td>$.58</td>
<td>$1.84</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>Multi-metric score (%)</td>
<td>21%</td>
<td>48%</td>
</tr>
<tr>
<td>Cost-Effectiveness</td>
<td>Cost ($K) per % of effectiveness</td>
<td>7.16</td>
<td>10.04</td>
</tr>
</tbody>
</table>
Reaching cost-effectiveness through new market development strategies

**CURRENT STATUS**

Drone logistics are **not financially sustainable** for public health markets

- **Public health**
- **Customers funding** start-up costs (MoH or donors)
- **Single customer** paying for all recurring costs
- **One-pricing strategy** for customers

- **Small scale** leading to high unit costs
- **No economies of scale**

**NEW STRATEGY**

**Cost-competitive & sustainable pricing for**
the public health market

- **Public & Private** health, agriculture, logistics, postal, maritime, disaster response, etc.
- **Multiple customers** to spread recurring costs amongst
- **Market-driven pricing strategy** for cost-sensitive customer

**Levers to unlock affordable drone logistics** for the health sector in low and middle-income countries

- **Drone service providers fund** start-up costs in new markets
- **Market-driven pricing strategy** for cost-sensitive customer

**Sector Focus**

- **Network Scale**
- **Business Model**
Interpretation & Conclusion

- Eliminated stockouts and ensured more consistent availability of vaccines in remote facilities
- Decreased duration of transport
- More vaccination sessions conducted
- Drones are well accepted by health workers, community members and community leaders
- Possible to achieve results in very remote areas with no communication
- Drone performance expected to continue to improve
- System not optimized for cost but large potential for reductions
Thank you