FII INSTITUTE
Future Investment Initiative Institute
Impact on Humanity

THE FUTURE OF VACCINATION DISTRIBUTION: DRONE TECHNOLOGY LEADING THE WAY

Whitepaper Series

June 2024

THE FUTURE OF VACCINATION DISTRIBUTION: DRONE TECHNOLOGY LEADING THE WAY

In a groundbreaking collaboration among Gavi, Rwanda, the UPS Foundation and Zipline, the world's first national drone delivery service was established in Rwanda in 2016.[1] This partnership has spearheaded transformative technologies, enabling California-based Zipline to extend its reach to Ghana, Kenya, Cote d'Ivoire and Nigeria, delivering over 15 million vaccines across these countries, including critical doses of mRNA, HPV and malaria vaccines.

CURRENTLY, THERE ARE VACCINATIONS AVAILABLE to safeguard against over 20 severe diseases, contributing to prolonged and healthier lifespans across all age groups. Immunization efforts presently avert between 3.5 and 5 million fatalities annually, combating diseases such as diphtheria, tetanus, pertussis, influenza, and measles.[2] Africa bears the burden of half of the globe's 5.9 million deaths among children under the age of five. Notably, pneumonia, malaria and diarrhoea collectively constitute 36% of all fatalities in this age group across the African continent.[3]

Gavi, the Vaccine Alliance, has been a leading force in ensuring equitable access to vaccines globally, contributing significantly to immunizing over half of the world's children against life-threatening diseases and averting more than 17.3 million future deaths.[4]

CHALLENGES RELATED TO LAST-MILE DELIVERY

Delivering to the last mile presents significant challenges for vaccine distribution in developing countries, often due to limitations in the supply chain infrastructure, including warehousing, storage, transportation, communication and overall logistics.[5] In Rwanda particularly, certain roads are susceptible to complete erosion during rainy seasons, resulting in many becoming impassable or entirely disappearing. This situation has hindered access to vital blood supplies for individuals in need of life-saving transfusions.[6,7] To address these challenges, Rwanda's drone delivery service was conceived with the initial goal of overcoming transportation obstacles and ensuring timely delivery of blood supplies to rural areas.

FIRST STEPS IN RWANDA

In 2016, Gavi and Zipline initiated their collaboration in Rwanda, capitalizing on the country's appetite to introduce drone vaccine delivery technology on a national scale to include a variety of medicines and life-saving interventions, facilitating efficient delivery.[8] At that time, Zipline, founded in 2013 and dating back to Romotive, a robotics toy start-up, had pivoted to drones and was still in development.

Prior to the 2016 partnership among Gavi, Zipline and Rwanda, Gavi's private sector engagement was in an exploratory phase, often facilitated by the Gavi Matching Fund, a financial mechanism that incentivizes contributions from private sector partners by matching their investments. To support Zipline's endeavors, Gavi collaborated with the UPS Foundation through a financial grant to cover essential capital expenditures for drone infrastructure, and leveraged UPS' extensive global supply chain and logistics expertise.

Gavi's bold initiative to embrace such disruptive private sector innovation has revolutionized conventional public sector supply chains in global health. The strategic partnership among Gavi, Rwanda and the UPS Foundation marked a significant milestone in this endeavor. Today, Zipline is valued at US$ 4.2 billion,

COVER: ZIPLINE PRESS IMAGE

ABOUT THE AUTHORS

BERTRAND PEDERSEN is an experienced manager in Private Sector Partnerships and Innovation at Gavi, the Vaccine Alliance. He is also in charge of INFUSE, Gavi's innovation scaling hub – a platform to identify the most promising approaches and technologies and accelerate immunization systems upgrades for the world's most in-need countries.

NADIA KOURANI serves as an analyst in the Resource Mobilization team at Gavi, The Vaccine Alliance, based in Geneva, Switzerland. She played a crucial role in overseeing the distribution of over 922 million donated Covid-19 vaccine doses to 113 recipient countries. kourani provided critical care to premature and complex neonatal cases as a registered NICU nurse at the American University of Beirut Medical Center.

→ backed by prominent investors such as Sequoia Capital and Andreessen Horowitz.[9]

EXPANDING SCOPE IN RWANDA

Zipline's partnership with the Rwandan government since 2016 has revolutionized healthcare delivery in the country. With President Paul Kagame's vision for technological advancement, Zipline's drone delivery system has transformed the on-demand logistics of blood, animal health products, human vaccines, childhood nutrition products and medical supplies, reducing delivery times and waste. Operating with a fleet of drones, Zipline serves over 517 hospitals, health facilities and health posts in Rwanda, ensuring timely delivery within 30 minutes.

Vaccination rates in Rwanda are high compared to most countries in Africa, but there are still gaps, particularly in rural border districts, and many children are significantly behind schedule. Vaccination also comes at a high economic cost to families. Currently, to fully vaccinate a child, families must travel long distances to health centers at least six times over the first 15 months of life, at an estimated cost of nearly $15 (WHO) per child. In a country with a GDP per capita of $822, this is a substantial financial burden for families and is a contributor to delayed care. The government of Rwanda has begun using Zipline to extend vaccine deliveries to health posts, 1,200 of which have been built in remote and underserved communities to provide essential primary care services within 25 minutes walking distance of every household in Rwanda. Because most health posts lack on-site cold storage, Zipline is sending just-in-time deliveries, bringing immunization services within easy reach of every family.

In its first year of vaccine deliveries to health posts, the model has yielded a 273% return on investment, saving households more than three times what the government has spent on drone logistics.

SCALING-UP ZIPLINE TO OTHER GAVI-SUPPORTING COUNTRIES

Zipline's innovative approach not only addresses critical healthcare needs, but also inspires local interest and admiration, marking a significant leap in Rwanda's journey toward becoming a technological hub in Africa.[10]

The goal of Zipline is to establish a global logistics network serving all individuals equally. With operations spanning three continents, the company has successfully delivered to numerous hospitals and businesses in Gavi-implementing countries such as Rwanda, Ghana, Nigeria, Côte d'Ivoire and Kenya, as well as in the United States and Japan.

Zipline currently serves over 4,900 healthcare facilities, reaching more than 49 million individuals. Their electric drones, or "Zips," are environmentally friendly with zero emissions, reducing carbon footprint by 97% compared to gas-powered vehicles, and boast greater efficiency than electric cars. To date, Zipline has successfully transported over 15 million vaccines

PHOTO: ZIPLINE PRESS IMAGE

across Ghana, Kenya, Rwanda, Cote d'Ivoire and Nigeria, including mRNA, HPV, and malaria vaccines.[11]

IMPACT ON VACCINE DELIVERY

The Bill & Melinda Gates Foundation funded a comprehensive evaluation conducted by Zipline in Ghana to assess its costs and impacts. The findings provide valuable insights into the effectiveness of the program in delivering commodities, and its impact on vaccine availability. According to the study, facilities served by Zipline play a significant role in routine vaccinations, as patients are 42% less likely to miss vaccination opportunities due to stockouts compared to non-Zipline facilities. Furthermore, vaccine stockouts at Zipline-served facilities are 60% shorter than those at non-Zipline facilities, indicating improved supply chain management. Additionally, Zipline-served facilities stock 10% more medical products, thereby enhancing access and equity across the health system.[12]

More recently, a study conducted by the government of Ghana in partnership with Zipline, published in the peer-reviewed Vaccine Journal, found an average 21% increase in vaccination coverage across all routine immunizations in Zipline-served regions of Ghana evaluated in this study compared to regions not served by Zipline.[13]

ZIPLINE AS TRAILBLAZER FOR GAVI'S INNOVATION INITIATIVE

This collaboration was more than just a logistical success; it demonstrated that Gavi's vision to enhance global health with disruptive, state-of-the-art technologies could be realized. Recognizing the need to champion groundbreaking ideas that have the power to reshape global health outcomes, Gavi launched INFUSE (Innovation for Uptake, Scale and Equity in Immunisation). INFUSE is an innovation scaling hub that matches investors with innovators and entrepreneurs to help scale up new ways to improve vaccination coverage in lower-income countries.

INFUSE has cultivated a community of start-up innovators overcoming vaccine delivery challenges, such as Nexleaf, Parsyl, Zenysis or Simprints. Initial →

investments in INFUSE totaled more than US$60 million, leading to more than US$200 million in follow-on funding for global health innovators.

CONCLUSION

Gavi's partnership with Zipline, Rwanda and the UPS Foundation has spearheaded groundbreaking advancements in vaccine delivery technology. Using drone technology, Zipline has overcome significant logistical challenges, revolutionizing the last-mile delivery of vaccines and essential medical supplies in developing countries like Rwanda, Ghana, Kenya and Nigeria. The impact of Zipline's drone delivery service has been remarkable, with significant improvements in vaccine availability, reduction in stockouts, and enhanced supply chain management.

Moreover, this new, innovative approach has not only addressed critical healthcare needs, but also inspired Gavi for blue-sky thinking to tackle complex healthcare challenges. This highlights the pivotal role that innovation and private sector partnerships play in shaping the future of global health delivery. ■

SOURCES

1 GAVI, THE VACCINE ALLIANCE, "GAVI NEWS," GAVI, 14 OCTOBER 2016. [ONLINE]. AVAILABLE: WWW.GAVI.ORG/NEWS

2 WHO, "VACCINES AND IMMUNIZATION," FEBRUARY 2024. [ONLINE]. AVAILABLE: WWW.WHO.INT/HEALTH-TOPICS/VACCINES-AND-IMMUNIZATION

3 UNICEF, "CHILDREN IN AFRICA," NOVEMBER 2023. [ONLINE]. AVAILABLE: HTTPS://DATA.UNICEF.ORG/WP-CONTENT/UPLOADS/2015/12/CHILDREN-IN-AFRICA-BROCHURE-NOV-23-HR_245.PDF

4 GAVI, THE VACCINE ALLIANCE, "ABOUT: GAVI," GAVI, THE VACCINE ALLIANCE, 24 NOVEMBER 2023. [ONLINE]. AVAILABLE: HTTPS://WWW.GAVI.ORG/OUR-ALLIANCE/ABOUT

5 UNICEF, "SUPPLY CHAINS SAVE LIVES: UNLOCKING ACCESS FOR CHILDREN, THEIR FAMILIES AND COMMUNITIES," DECEMBER 2023. [ONLINE]. AVAILABLE: WWW.UNICEF.ORG/SUPPLY/MEDIA/20346/FILE/SUPPLY-CHAINS-SAVE-LIVES.PDF

6 GAVI, THE VACCINE ALLIANCE, "RWANDA LAUNCHES WORLD'S FIRST NATIONAL DRONE DELIVERY SERVICE POWERED BY ZIPLINE," 14 OCTOBER 2016. [ONLINE]. AVAILABLE: WWW.GAVI.ORG/NEWS

7 O. KHAZAN, "A DRONE TO SAVE THE WORLD," THE ATLANTIC, 4 APRIL 2016

8 UNICEF, "CHILDREN IN AFRICA," NOVEMBER 2023. [ONLINE]. AVAILABLE: HTTPS://DATA.UNICEF.ORG/WP-CONTENT/UPLOADS/2015/12/CHILDREN-IN-AFRICA-BROCHURE-NOV-23-HR_245.PDF

9 FORBES, "DRONE DELIVERY STARTUP: FORBES," FORBES, 28 APRIL 2023. [ONLINE]. AVAILABLE: HTTPS://WWW.FORBES.COM/SITES/ALEXKONRAD/2023/04/28/DRONE-DELIVERY-STARTUP-ZIPLINE-BOOSTS-VALUATION-TO-4-BILLION/

10 G. G. TARUN KHANNA, "ZIPLINE: THE WORLD'S LARGEST DRONE DELIVERY NETWORK," HARVARD BUSINESS SCHOOL, 28 MARCH 2023

11 ZIPLINE, "ABOUT: FLYZIPLINE," [ONLINE]. AVAILABLE: WWW.FLYZIPLINE.COM/ABOUT

12 IDINSIGHT, "ENDLINE REPORT: ZIPLINE EVALUATION IN GHANA," 2022

13 HTTPS://WWW.SCIENCEDIRECT.COM/SCIENCE/ARTICLE/PII/S0264410X23007016

ABOUT FII INSTITUTE

FUTURE INVESTMENT INITIATIVE (FII) INSTITUTE IS a global non-profit foundation with an investment arm and one agenda: Impact on Humanity. Global, inclusive, and driven by data, we foster great minds from around the world and turn ideas into tangible solutions and actions in four critical areas: Artificial Intelligence (AI) and Robotics, Education, Healthcare and Sustainability. We are in the right place at the right time: when decision-makers, investors and an engaged generation of youth come together in aspiration, energized and ready for change.

We harness that energy into three pillars: THINK, XCHANGE, ACT. Our THINK pillar empowers the world's brightest minds to identify technological solutions to the most pressing issues facing humanity. Our XCHANGE pillar builds inclusive platforms for international dialogue, knowledge-sharing and partnership. Our ACT pillar curates and invests directly in the technologies of the future to secure sustainable real-world solutions. Join us to own, cocreate and actualize a brighter, more sustainable future for humanity. ←

FII INSTITUTE
Future Investment Initiative Institute

Contact

FII Institute: THINK
think@fii-institute.org