Justification

Aerial logistics have demonstrated a transformative impact on vaccine uptake. Research shows that drone-based logistics can reduce vaccine stockouts by over 30%, significantly decrease missed opportunities for vaccination, and increase immunization coverage by up to 37.5 percentage points in served areas. Moreover, aerial logistics have proven to be highly cost-effective as an intervention to increase vaccine uptake, often outperforming other well-established immunization strategies in terms of cost per additional immunized child.

To date, these successes have been achieved primarily by integrating drones into existing supply chain infrastructures, supporting deliveries to health facilities where routine immunization typically occurs. While this approach has fulfilled its intended purpose and demonstrated considerable impact, it leaves vast potential for further innovation untapped. Aerial logistics could play a pivotal role in enhancing underutilized or emerging vaccination models—many of which have struggled to reach scale due to conflicting or insufficient supporting evidence. Additionally, drones could unlock entirely new vaccine delivery paradigms that are impractical or infeasible with ground-based logistics. For instance, aerial logistics could enable:

- Seamless distribution to health posts and lower-complexity health facilities: Drones can ensure uninterrupted vaccine supply to facilities not traditionally involved in immunization programs, significantly boosting access and uptake.
- Direct delivery to community health workers (CHWs): By serving as sole distributors or supplementing existing systems, drones could resolve persistent stockout issues that hinder CHW efficiency and effectiveness.
- New access points for vaccination: Aerial logistics can facilitate the creation of reliable, cost-effective vaccination sites in underserved regions through on-demand delivery, bypassing traditional cold chain infrastructure challenges.
- Bundled service delivery: By combining vaccine delivery with other essential health interventions, drones can incentivize families to seek comprehensive care for their children, improving immunization rates and overall health outcomes.

Pioneering advancements in this space is not without challenges. Governmental reluctance to experiment with less-visible components of the supply chain and the absence of real-time data in traditional models frequently impede bold, systemic changes. Innovation heightens risk, favoring the status quo even when it does not serve public health goals well (or well enough). Evidence shows that aerial logistics offer a unique dual advantage: they alleviate supply chain inefficiencies while generating actionable real-time data, which supports rigorous cost-effectiveness analyses and operational impact assessments, providing a robust foundation for informed decision-making.

This scoping project is essential to guide future investments and interventions, addressing a critical question: What version of centralized, on-demand logistics delivers the greatest and most cost-effective improvements in vaccine uptake and public health outcomes?

Objective and expected output

At the conclusion of this scoping phase, our goal is to deliver a comprehensive portfolio of proposed studies that investigate how on-demand aerial logistics can maximize vaccine uptake by identifying the most effective delivery models. These studies will explore opportunities to pilot scalable solutions with future funding. The scope will encompass a range of potential interventions, including: Drones as sole distributors of vaccines to health posts, reducing supply interruptions; Direct deliveries to CHWs to address stockouts and improve vaccine availability in underserved areas; Creation of new, on-demand vaccination access points, independent of traditional infrastructure; and Bundled service delivery models that combine vaccines with other essential interventions. The aim is to deepen our understanding of which aerial logistics models most effectively enhance immunization rates and deliver value for money, particularly among underserved populations. The final output will include:

1. **Leveraging Expertise in Aerial Logistics**
   - Overview of Zipline's expertise in immunization logistics and lessons from past work.
   - Comparative insights from other logistical innovations to inform future proposals.
2. **Designing and Testing Targeted Interventions**
   - Development of treatment groups to test multiple delivery models, including CHW-driven and facility-focused approaches.
   - Identification of deployment regions across different contexts, potentially spanning different countries where Zipline operates.
   - Prioritization of populations in remote, conflict-affected, or zero-dose areas to maximize public health impact.
   - Feasibility assessment for using randomized controlled trials (RCTs) to evaluate effectiveness.
   - Exploration of delivering other critical health commodities alongside vaccines to enhance cost-effectiveness and health outcomes.
3. **Baseline and Projected Impacts on Immunization Coverage**
   - Analysis of current vaccination coverage for critical vaccines (e.g., BCG, DPT1-3, PCV1-3, rota1-3, MCV1).
   - Estimation of coverage increases and cost per vaccinated child, enabled by various aerial logistics models.
   - Evaluation of how aerial logistics address systemic barriers like stockouts, care-seeking behavior, and community trust.
4. **Monitoring and Evaluation (M&E) Framework**
   - Methods for collecting baseline and follow-up data on vaccination rates and program performance.
   - Integration of real-time vaccine inventory tracking using Zipline's logistics systems to ensure accuracy and transparency.
5. **Operational Feasibility and Policy Integration**

- Analysis of challenges and enabling factors for integrating aerial logistics into national immunization supply chains.
- Recommendations to bridge policy gaps, mitigate risks, and reduce delays in deployment.
- Strategies to align drone-based interventions with existing health system innovation priorities.

Scope of work

Desk-based research and stakeholder consultation: Review existing literature and engage with key stakeholders in countries where Zipline operates. This includes government officials (e.g., ministries of health, immunization program leads), health facility staff, CHW coordinators, and community representatives, to review:

- **Program history and government support**
  Identify countries with established or pilot programs using CHWs, health facilities, or alternative models for vaccine delivery. Assess outcomes of these programs to understand what worked (and why), challenges encountered, and lessons learned. Evaluate government openness to adopting aerial logistics in emerging immunization efforts, and identify policies that enable or hinder drone integration into these programs.
- **Roles of delivery models and contexts**
  Examine the roles of CHWs, health posts, and other delivery systems, including their training, geographic reach (e.g., rural, urban, or conflict-affected areas), and alignment with vaccine distribution needs. Highlight gaps in capacity and service delivery that could be addressed by aerial logistics.
- **Logistical challenges and opportunities**
  Assess the storage, cold chain, transport, and stock management systems at health posts and CHW levels. Identify bottlenecks, vaccine wastage, and stockout risks within these systems. Explore how aerial logistics can address these challenges, streamline supply chains, and enhance real-time decision-making through better data visibility.

Preliminary technical discussions on research design: Engage with leading research institutions (e.g., KEMRI, University of Ghana) to design robust methodologies for evaluating the impact of various aerial logistics models. This includes identifying potential pilot sites, refining data collection tools, and ensuring methods align with best practices for immunization research.
Regular alignment with GiveWell: Conduct periodic check-ins with GiveWell to ensure proposed studies and interventions align with their immunization objectives and evaluation criteria. Incorporate feedback to refine research proposals and enhance their relevance and impact.

Criteria for prioritizing research/evaluation ideas

Portfolio contribution and scalability: Focus on interventions that strengthen the overall immunization portfolio by generating insights applicable across diverse contexts and demonstrating potential for scalability to other settings.

Prioritizing scalable, high-potential interventions: Focus on interventions that have shown significant promise at small scale but have not been widely scaled, primarily due to logistical or data challenges. Addressing these barriers can unlock broader impact and inform scaling strategies.
Focus on zero-dose children and hard-to-reach populations: Prioritize interventions that target zero-dose and under-immunized children under 2 years old while addressing broader benefits for children aged 2-5, aligning with national "Zero-Dose Catch-Up" policies, and emphasize strategies that improve equity by bringing vaccines closer to communities with limited access to health facilities.
Focus on cost-effectiveness: Focus on interventions that reach the greatest *number* of children under 2 years of age, and the greatest *share* of children under 2 within the lowest vaccination coverage areas, at the lowest possible cost.

Estimated Timeline

Months 1-2: Desk-based research and stakeholder consultations: Conduct desk research and consult with stakeholders to gather insights on program history, CHW roles, vaccine delivery models, and logistical challenges. Include analysis of small-scale, high-potential interventions hindered by logistical or data barriers.
Month 3: Preliminary analysis and evaluation: Analyze collected data to identify key trends, gaps, and opportunities for aerial logistics. Summarize findings on program history, delivery roles (CHW and others), logistical bottlenecks, and scalable interventions. Establish research hypotheses and criteria for prioritizing interventions.
Month 3-4: Midpoint evaluation with GiveWell: Zipline will share a brief written update on progress including what ideas we are working on and why we have prioritized them. This will be an opportunity to reflect with GiveWell on the potential project ideas and incorporate feedback ahead of the intervention design stage.
Months 4-5: Intervention design and technical discussions with evaluators: Define contexts where aerial logistics are likely to have the greatest impact. Develop a portfolio of interventions tailored to these contexts, detailing standards of care for each model. Collaborate with research institutions to refine methodologies and ensure robust evaluation designs.
Month 6: Finalize outputs: Prepare a detailed project proposal, including budget, staffing, and an implementation timeline. Deliver a prioritized list of proposals for further study or pilot programs, emphasizing scalability and alignment with immunization objectives. Zipline will submit the proposal(s) to GiveWell for feedback and discussion.

Budget

Staffing
Zipline Impact Lead: 139 hours ($14,595)
Zipline Health Economist: 117 hours ($10,530)
Zipline Country Managers: 96 hours ($11,520)

Zipline Support Staff: 75 hours ($3,375)

Travel for stakeholder engagement

International flights: $6,000

Domestic flights/transport: $3,000

Hotels: $3,000

Fees for data/tool licensing and access to subscription-based articles: $2,600

Total Budget: $54,620