Cost Efficiency Analysis of Drone-Based Last Mile Vaccine Delivery to Remote Island Health Facilities in Buvuma District, Uganda

Emmanuel Okiror Okello, MPH

Epidemiologist (EPI), Uganda

THE REPUBLIC OF UGANDA
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Last Mile Vaccine Delivery in Uganda

- **Last mile vaccine delivery**
  - Final stage in vaccine supply chain
  - Most challenging and costly
- **Multimodal**
  - Refrigerated trucks, motorcycles
- **Challenges**
  - Difficult terrains
  - Maintaining the cold chain
  - Infrastructure gaps
  - Funding gaps

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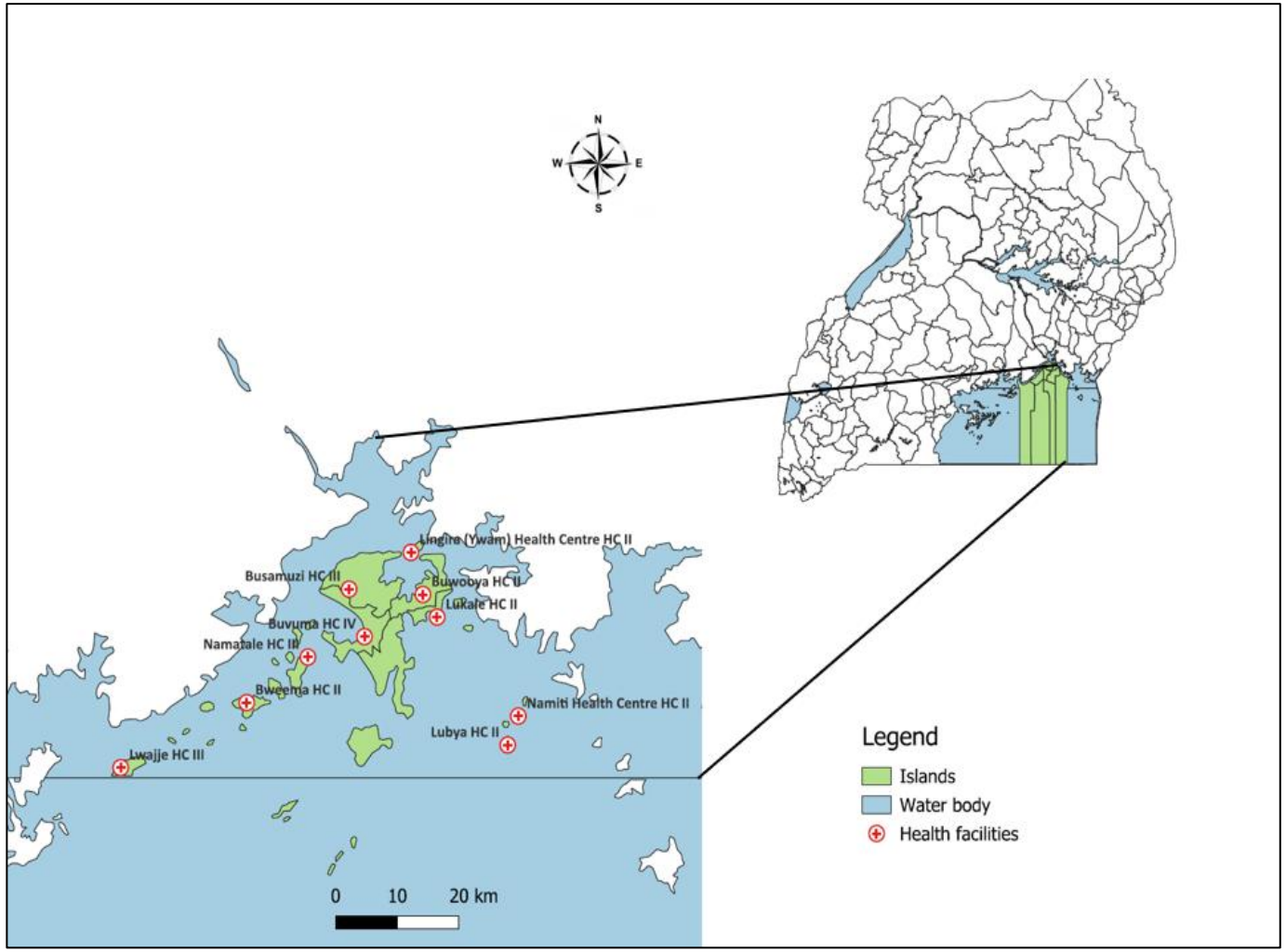
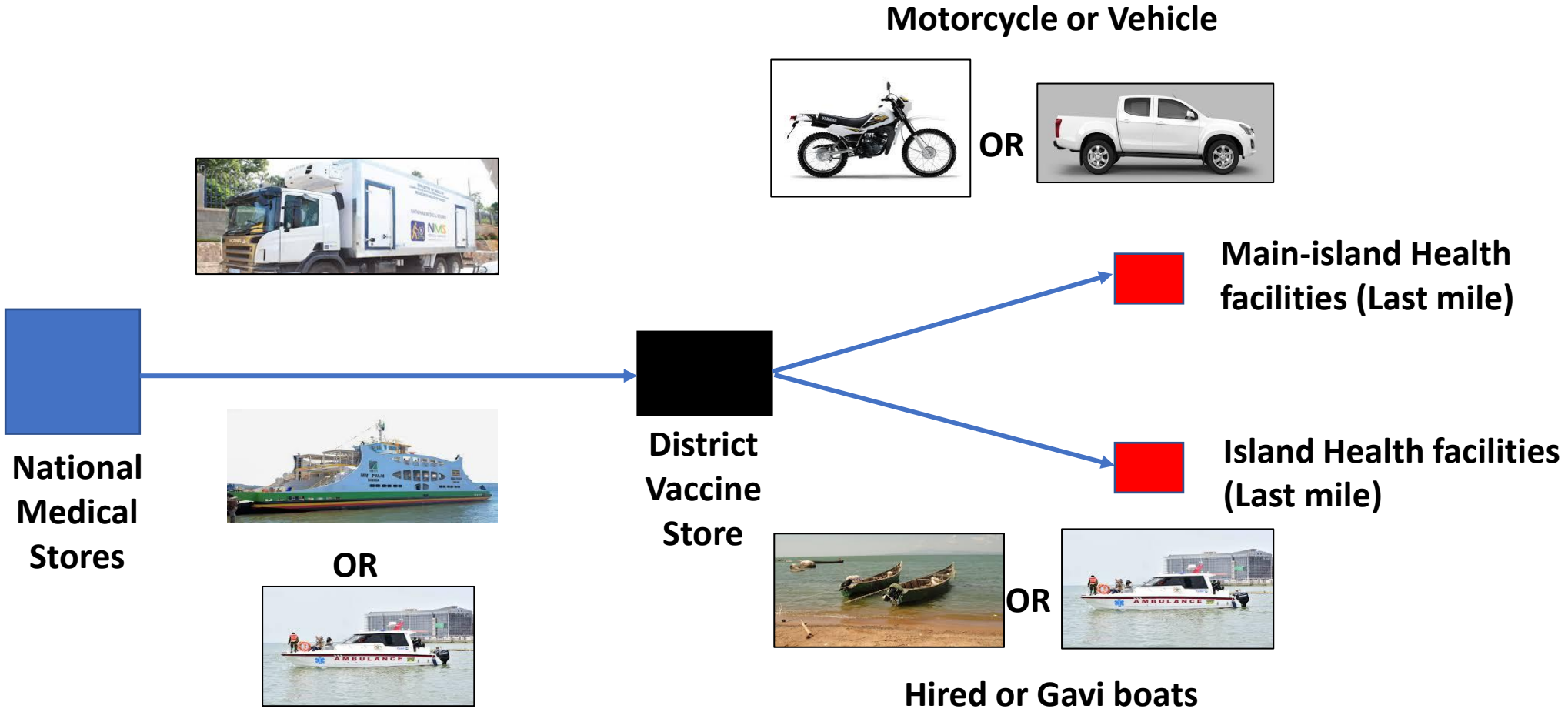
Buvuma District

- **52 inhabitable islands**
  - 9 administrative units
  - 13 health facilities
- **Logistical challenges**
  - Delayed last mile delivery
  - Constant stockouts
- **Poor performance**
  - DPT1-3 dropout rate of 32%
  - Approximately 6,000 zero dose children



Last Mile Delivery in Buvuma (Traditional)



Proposed Drone Delivery

Road + Ferry/Boat

National Medical Stores

District Vaccine Store

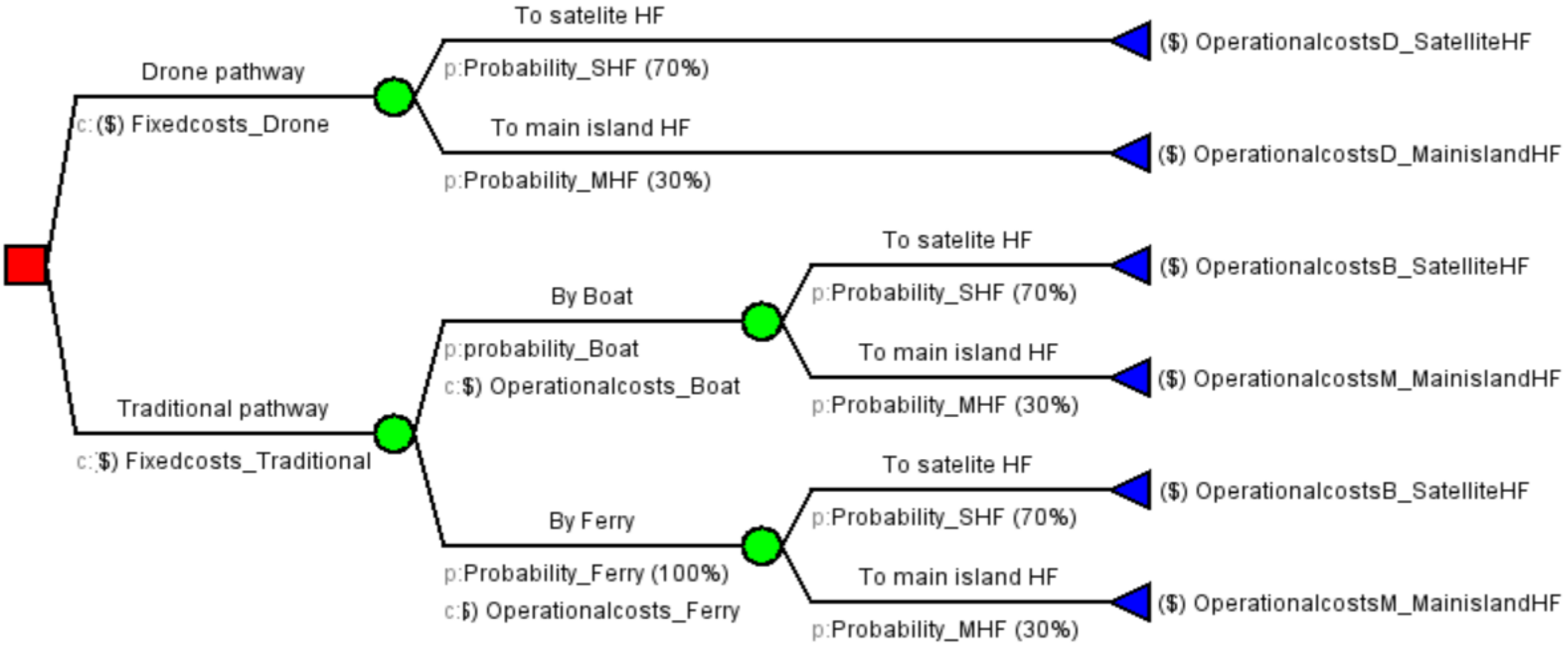
Main-island Health facilities (Last mile)

Island Health facilities (Last mile)

Objectives and Outcomes

- **Objectives**
  - To compare the cost efficiency of drone delivery to the traditional multimodal transport method in last mile delivery of vaccines in Buvuma District, Uganda
- **Outcomes**
  - Costs per vaccine delivered last mile
- **Perspective**
  - Government (Health sector)

Model Analysis

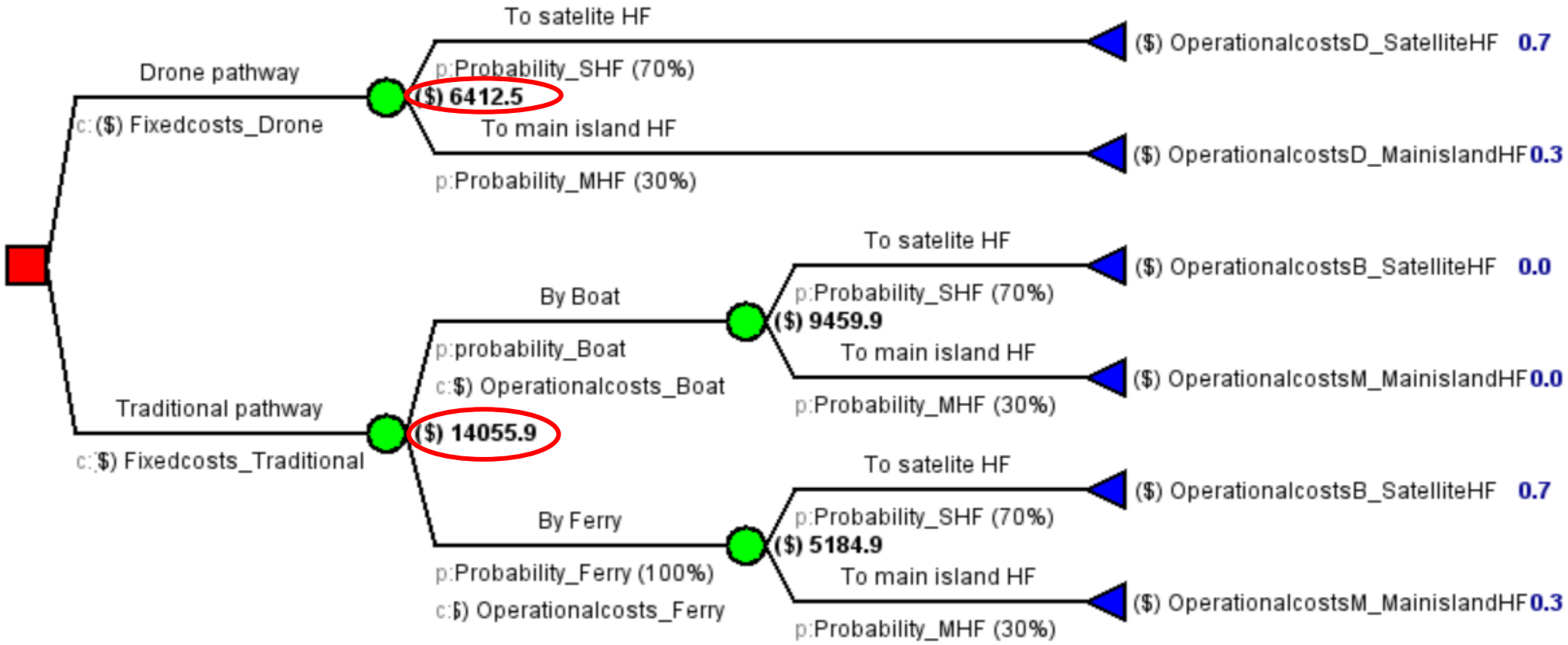


Cost Components and Sensitivity Analysis

- **Cost components**
  - Fixed + variable operational costs
  - Amortized to daily or quarter costs
- **Sensitivity analysis**
  - One-way sensitivity analysis
  - Tornado diagram

Name	Expression
Fixedcosts_Drone	2700
Fixedcosts_Traditional	8871
Probability_SHF	0.7
Probability_MHF	0.3
probability_Boat	0
Operationalcosts_Boat	5535
Probability_Ferry	1
Operationalcosts_Ferry	1260
Operationalcosts_MainislandHF	168
OperationalcostsD_SatelliteHF	4455
OperationalcostsD_MainislandHF	1980
OperationalcostsB_SatelliteHF	5535
OperationalcostsM_MainislandHF	168

Total Costs & Saving



- **Total Savings=14,055.9-6,412.5=$7,643.4**

Cost Per Vaccine Delivered & Saving

- **Cost per child =** Total Cost/Number of vaccines delivered

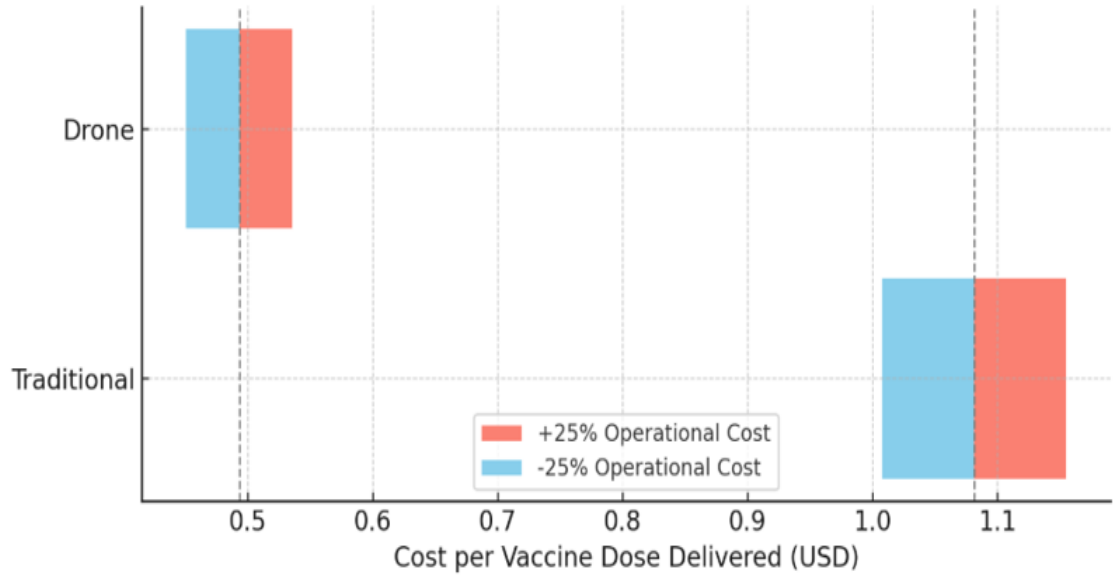
- **Traditional=**$\frac{14,055.9}{13,000}$**=$1.08 per dose**

- **Drone=**$\frac{6,412.5}{13,000}$**=$0.49 per dose**

- **Cost Saving per dose=**1.08-0.49**=$0.59**

Sensitivity Analysis

Strategy	Low Estimate	Base Case	High Estimate
Traditional	$1.01	$1.08	$1.16
Drone	$0.45	$0.49	$0.54



- **Drone delivery remained more cost-effective across all operational cost scenarios**

Study Limitations

- **Relied on modelled data**
  - Limits generalizability
- **Short analytic time horizon**
  - Not accounting for long term impact
  - Scalability & sustainability uncertain
- **Potential underestimation of indirect costs**
  - Non-monetized indirect savings

Conclusion and Recommendations

- **Conclusion**
  - Drone-based vaccine delivery offered a 54% reduction in costs
- **Recommendations**
  - Integrate drone technology into Uganda's immunization supply chain
  - Further studies
    - Expand analysis to include health outcomes
    - Assess environmental impacts
    - Longer analytical time horizons

Acknowledgement

- **Ministry of Health, Uganda**
- **Makerere University School of Public Health**
- **US Centers for Disease Control and Prevention**
- **Buvuma District Local Government**
- **GAVI**

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