African Security Studies (Interdisciplinary - Social/Political focus)

Drone Delivery Methods for Vaccine Distribution in Northern Ghana's Remote Villages: A Methodological Approach

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Abstract

Drone technology has shown promise in overcoming logistical challenges for vaccine distribution in remote areas. The study employs mixed-methods including pre- and post-intervention surveys to assess the impact of drones on vaccine uptake among villagers. A Bayesian hierarchical model is utilised to estimate vaccine coverage probabilities with uncertainty quantification. Drone delivery significantly increased vaccine coverage by 20% in remote villages compared to ground transport, although there was a 5% dropout rate due to technical issues and user discomfort. The methodological approach demonstrates the potential of drones for efficient vaccine distribution in underserved regions, with specific improvements in accessibility and speed. Further research should investigate long-term effects and cost-benefit analyses before implementation at scale. Vaccine delivery, drone technology, Bayesian hierarchical model, remote villages Model estimation used $\hat{\{\theta\}} = argmin\{\theta\} sumiell(yi, f\theta(\xi)) + \lambda lVert\theta rVert 2^2$, with performance evaluated using out-of-sample error.

Keywords: *Geography, Africa, Northern, Ghana, Drones, Vaccines, Transportation, Mixed-Methods, Remote, Villages, Logistics, Healthcare, Delivery, Systems, Technology, Infrastructure, Accessibility, Efficiency, Impact, Evaluation, Qualitative, Quantitative, Pre-Post, Intervention, Analysis, Models, Mapping, Integration, Adoption, Privacy, Security*

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