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A Meta-Analysis of the Cost-Effectiveness of Drone-Delivered Blood Products for Obstetric Haemorrhage in Remote Districts of Sierra Leone,

Kadiatu Bangura[1]

[1] Department of Clinical Research, Ernest Bai Koroma University of Science and Technology

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Correspondence: kbangura@hotmail.com

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Author notes

Kadiatu Bangura is affiliated with Department of Clinical Research, Ernest Bai Koroma University of Science and Technology and focuses on Medicine research in Africa.

Abstract

Obstetric haemorrhage is a leading cause of maternal mortality in Sierra Leone. Outcomes are particularly poor in remote northern districts due to severe logistical challenges in delivering time-sensitive blood products. Unmanned aerial vehicles (drones) present a potential solution, but a consolidated analysis of their economic viability in this specific context is lacking. This meta-analysis aimed to synthesise existing economic evaluations to determine the cost-effectiveness of using drone networks for the delivery of blood products for emergency obstetric care in hard-to-reach areas of Sierra Leone. A systematic review and meta-analysis was conducted. Electronic databases were searched for full economic evaluations comparing drone-delivered blood products to standard road-based transport. Incremental cost-effectiveness ratios (ICERs) were pooled using a random-effects model. The quality of included studies was assessed using the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist. Five studies met the inclusion criteria. The pooled analysis indicated that drone delivery was a cost-effective intervention, with a dominant or highly favourable ICER in most scenarios. Cost-effectiveness was highly sensitive to the scale of operations, with a threshold of approximately 50 deliveries per month per drone required to achieve cost savings compared to land transport. Drone delivery of blood products for obstetric haemorrhage in remote Sierra Leonean districts is likely to be a cost-effective strategy. This economic viability supports investment in the technology as part of a comprehensive emergency obstetric care system. Policy makers should consider piloting scaled-up drone networks for blood delivery, integrated within existing health infrastructure. Further operational research is needed to optimise delivery routes, maintenance models, and cold chain management specific to the Sierra Leonean context. unmanned aerial vehicles, maternal health, postpartum haemorrhage, health economics, Sierra Leone, cost-benefit analysis This meta-analysis provides a consolidated evidence base on the cost-effectiveness of drone-based blood delivery for obstetric emergencies in Sierra Leone, informing health policy and resource allocation for maternal health services in remote settings.

Keywords: *Maternal mortality, Cost-effectiveness analysis, Haemorrhage, Sub-Saharan Africa, Health systems, Emergency medical services, Blood transfusion*

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