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A Case Study on the Cost-Effectiveness of Drone Delivery for Blood Products in the Mountainous Regions of Lesotho

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Abstract

Mountainous terrain and poor road infrastructure in Lesotho present major logistical barriers to delivering essential medical supplies, particularly blood products, to remote health centres. Conventional road transport is frequently slow, unreliable, and costly, leading to risks of stock-outs and compromised clinical care. This case study aimed to evaluate the cost-effectiveness of a drone delivery system for blood products to remote health facilities in Lesotho's mountainous regions, compared to the existing road-based delivery model. A comparative cost-effectiveness analysis was conducted from a health system perspective. Operational and financial data were collected for both the drone delivery service and traditional road transport. Key metrics analysed were cost per delivery, delivery time, system reliability, and rates of blood product wastage. The drone delivery system demonstrated a 75% reduction in average delivery time compared to road transport. Although initial capital investment was higher, the operational cost per successful delivery proved comparable. A critical finding was the near-elimination of blood product wastage from spoilage, which was a significant problem within the road-based system. Drone delivery for blood products in this context is a cost-effective alternative to road transport. The principal advantages are substantially improved delivery speed and reliability, which enhance the availability of life-saving supplies and reduce wastage. Health authorities in similar geographically challenging settings should consider piloting drone logistics for high-value, time-sensitive medical commodities. Sustainable implementation requires investment in local technical capacity and the development of supportive regulatory frameworks. drone delivery, unmanned aerial vehicle, blood supply chain, cost-effectiveness, remote health, Lesotho, medical logistics This case study provides practical evidence from a real-world implementation to inform policy and investment decisions for strengthening medical supply chains in remote, mountainous regions of Africa.

Keywords: *cost-effectiveness analysis, drone logistics, blood product delivery, sub-Saharan Africa, health systems strengthening, remote healthcare access*

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