

From pulse to continuous: community-led delivery sustains rabies vaccination coverage and reduces costs in rural Tanzania

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Affiliations:

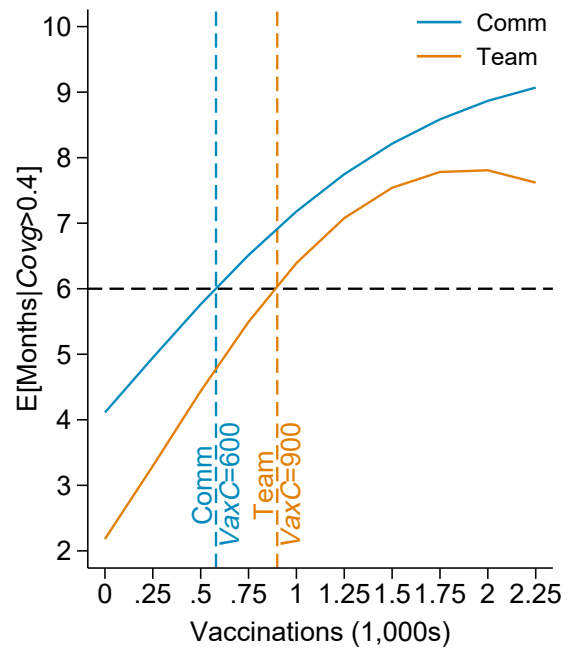
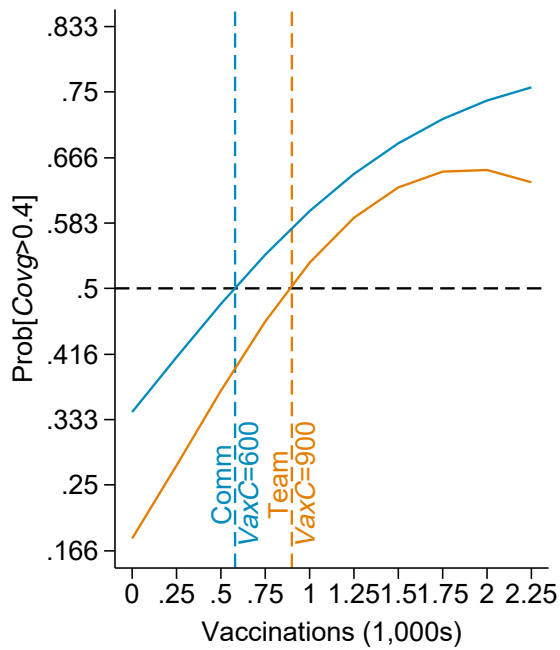
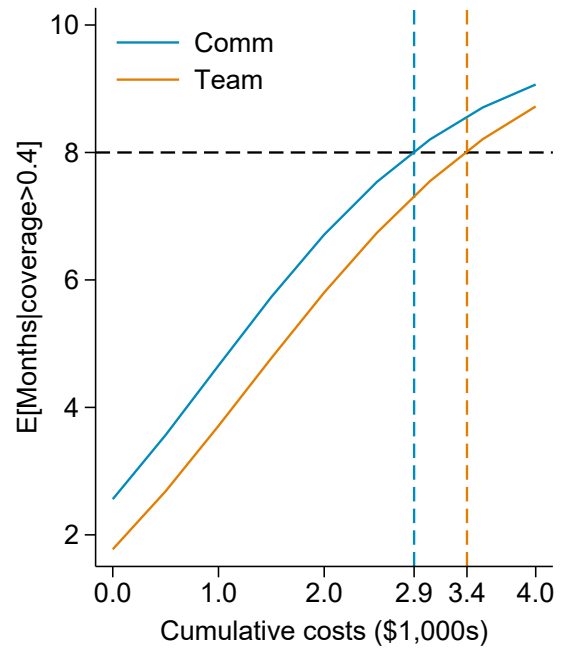
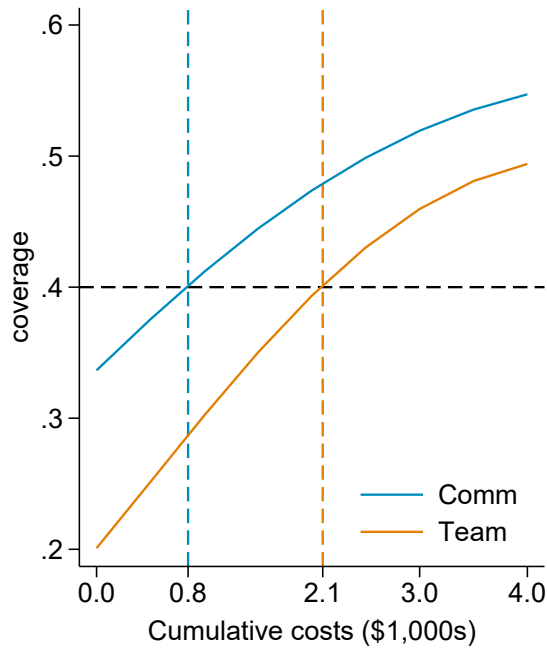
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Background: Mass dog vaccination (MDV) prevents human rabies but remains underused in sub-Saharan Africa. The conventional annual centralised pulse campaigns require high coverage to maintain herd immunity, yet costs rise sharply as coverage increases while immunity declines rapidly between campaigns due to dog population turnover. We tested whether a community-led decentralised hybrid strategy using thermotolerant vaccines could reduce costs and sustain coverage above the 40% herd immunity threshold.

Methods: We conducted a three-year cluster-randomised trial across 112 wards in Mara Region, Tanzania (2020–2023), comparing annual pulse campaigns with a community-led hybrid strategy combining village and sub-village clinics with house-to-house vaccination. Vaccination records, costs, and household surveys from 20,335 dog-owning households were analysed using regression models. Cost-effectiveness was evaluated from provider and societal perspectives.

Results: Community-led delivery vaccinated twice as many dogs per ward annually as team-led delivery, with higher mean coverage (57% vs. 48%), and longer maintenance of the 40% herd immunity threshold (7–8 versus 5–6 months per year). Annual coverage declines by 39% without additional vaccination. Despite higher fixed costs, community-led delivery had lower marginal costs (\$1.52 vs. \$1.64 per dog) with similar average cost per dog (\$2.70 vs. \$2.85), especially in rural settings (\$2.28 vs. \$2.82). The 40% coverage threshold costs \$800 per ward versus \$2,100 under team-led delivery, with an adjusted ICER of \$2.07 per dog, suggesting low incremental cost for these gains.

Conclusions: Restructuring MDV delivery to continuous delivery directly addresses the diminishing returns and coverage declines that undermine pulse campaigns.



Variable	Diff	Team-led		Comm'ty-led		Welch t-test		
		Mean	SD	Mean	SD	t	df	p-val
Vaccination Delivery ¹								
Total Rural	−0.333	1.490	0.463	1.157	0.240	-7.26	182.11	< 0.001
Total Urban	−0.009	1.277	0.378	1.267	0.335	-0.10	52.92	0.920
Household Labor ²								
Total Rural	−0.252	0.666	0.098	0.414	0.147	-16.77	250.69	< 0.001
Total Urban	−0.263	0.701	0.060	0.438	0.181	-6.908	25.95	< 0.001
Non-Vaccination Activity ³								
Total Rural	0.049	0.675	0.429	0.725	0.297	1.09	218.38	0.279
Total Urban	2.616	0.957	0.774	3.573	4.030	3.15	23.97	0.004
Total All Rural	−0.545	2.820	0.890	2.275	0.474	-6.16	184.73	< 0.001
Total All Urban	2.325	2.942	1.132	5.267	4.302	2.60	24.83	0.016

¹Vaccination Delivery = Includes consumables, personnel time & per diem, travel (fuel and rental), & storage at district & ward levels; ²Households labour = Time cost for travel to/from clinic & waiting time; ³Non-vaccination costs = DLFO oversight, community volunteer time for advertising & coordination, per diem and travel (including fuel, rental, & time costs) for training, vaccine collection, & advertising).

Costs are higher for community-led in urban wards and higher for team-led in rural wards; mean (SD) with Welch's two-sample t-test reported.