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Costs of seasonal influenza vaccine delivery in a pediatric demonstration project for children aged 6–23 months — Nakuru and Mombasa Counties, Kenya, 2019–2021☆

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Disclaimer

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.vaccine.2023.12.029.

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Abstract

Background: During November 2019–October 2021, a pediatric influenza vaccination demonstration project was conducted in four sub-counties in Kenya. The demonstration piloted two different delivery strategies: year-round vaccination and a four-month vaccination campaign. Our objective was to compare the costs of both delivery strategies.

Methods: Cost data were collected using standardized questionnaires and extracted from government and project accounting records. We reported total costs and costs per vaccine dose administered by delivery strategy from the Kenyan government perspective in 2021 US$. Costs were separated into financial costs (monetary expenditures) and economic costs (financial costs plus the value of existing resources). We also separated costs by administrative level (national, regional, county, sub-county, and health facility) and program activity (advocacy and social mobilization; training; distribution, storage, and waste management; service delivery; monitoring; and supervision).

Results: The total estimated cost of the pediatric influenza demonstration project was US$ 225,269 (financial) and US$ 326,691 (economic) for the year-round delivery strategy (30,397 vaccine doses administered), compared with US$ 214,753 (financial) and US$ 242,385 (economic) for the campaign strategy (25,404 doses administered). Vaccine purchase represented the largest proportion of costs for both strategies. Excluding vaccine purchase, the cost per dose administered was US$ 1.58 (financial) and US$ 5.84 (economic) for the year-round strategy and US$ 2.89 (financial) and US$ 4.56 (economic) for the campaign strategy.

Conclusions: The financial cost per dose was 83% higher for the campaign strategy than the year-round strategy due to larger expenditures for advocacy and social mobilization, training, and hiring of surge staff for service delivery. However, the economic cost per dose was more comparable for both strategies (year-round 22% higher than campaign), balanced by higher costs of operating equipment and monitoring activities for the year-round strategy. These delivery cost data provide real-world evidence to inform pediatric influenza vaccine introduction in Kenya.

Keywords

Influenza vaccine; Vaccination; Pediatric; Economics; Expenditures

1. Introduction

In Kenya, influenza causes a substantial burden of respiratory illness among young children [1]; illnesses result in an estimated 17,129–27,659 hospitalizations per year among children under the age of 5 years [2], and influenza-associated outpatient visits and hospitalizations among this age group represent an estimated annual economic burden of 5.13–11.78 million US Dollars (US$) [3]. In 2016, the Kenya National Immunization Technical Advisory Group

(KENITAG) issued a recommendation for the introduction of seasonal influenza vaccination among children aged 6–23 months, provisional on evidence from a vaccine demonstration project [4]. As there are usually multiple seasons of increased influenza activity annually in Kenya [5], the demonstration project compared a year-round vaccination strategy with a seasonal campaign-mode vaccination strategy. Policy-relevant data sought through the demonstration project included the impact of the vaccination program on the local healthcare workforce, impact on other health services, vaccine coverage, operational needs, and the costs of implementing the vaccination program for children aged 6–23 months. These data would then be used to inform deliberations about the most appropriate strategy for influenza vaccine delivery: year-round delivery or a seasonal campaign.

In this analysis, we assessed the costs of the pediatric influenza demonstration project for the two vaccine delivery strategies, with the aim to provide decision-makers with evidence to inform the introduction of a future national influenza vaccination program for young children in Kenya.

2. Methods

The pediatric influenza vaccine demonstration project ran from November 2019 through October 2021 in four sub-counties of Kenya: Nakuru North and Njoro sub-counties (Nakuru County) and Jomvu and Likoni sub-counties (Mombasa County); full details of the project are described in Dawa et. al. [6]. These counties participate in national influenza sentinel surveillance and were selected to represent distinct demographic and socio-cultural settings within Kenya. Nakuru County, in the Rift Valley region of Kenya, has a population of 2.2 million persons across 7509.5 km^2, approximately half of whom reside in rural areas and practice farming, whereas Mombasa County is in the coastal region of Kenya and has a population of 1.2 million persons across 212.5 km^2, all of whom reside in urban areas [6,7]. Two sub-counties (one from each county) were assigned to each of the two vaccine delivery strategies: year-round vaccination (Njoro and Jomvu sub-counties) and campaign vaccination (Nakuru North and Likoni sub-counties); the sub-counties were purposively selected based on ease of access and geographic distance within each county (to avoid population overlap). The year-round strategy was implemented for two years from 2019 to 2021 (November 2019–October 2021 in Njoro; December 2019–October 2021 in Jomvu); the seasonal campaigns were originally planned to occur in mid-2020 upon availability of the Southern Hemisphere influenza vaccine formulation, but due to disruptions from the COVID-19 pandemic, they occurred over four months in 2021 (Nakuru North = June–September 2021; Likoni = July–October 2021).

We calculated the costs of the pediatric influenza vaccination demonstration project from a government perspective, which includes costs to the Kenyan government (all levels, from national through to health facilities within the sub-county), from any financing source, and excludes costs incurred by patients and other payers. We calculated financial costs and economic costs; financial costs were monetary expenditures that were incurred to implement the demonstration project, and economic costs were financial costs plus the value of existing government resources used for the demonstration project (e.g., existing equipment, facilities, and personnel time for existing staff) (Table 1).

2.1. Data collection and sampling

Data collection occurred from February 2020 through October 2021. We collected retrospective data on costs incurred at the following administrative levels: national (from the National Vaccines Immunization Program [NVIP] and Kenya Medical Supplies Authority [KEMSA]), regional (KEMSA regional stores), county, sub-county, and health facility (Fig. 1). At the national, regional, county, and sub-county levels, we collected data on costs incurred from all participating units; no sampling was performed. Any costs that were shared between both strategies (e.g., shared costs at the national and county levels for ASM and training) were fully included for both strategies as they would be incurred regardless of the strategy adopted. At the health facility level, we purposively sampled a subset of government-owned facilities, which were selected to be representative of all participating government health facilities based on level of care provision; this included 14 (48%) of 29 total government facilities that participated in the year-round strategy and 11 (69%) of 16 facilities that participated in the campaign strategy (Supplemental Table S1). At the health facility level, costs to private and faith-based facilities were not included because costing was conducted from the government perspective. However, shared costs to support government facilities and private/faith-based facilities were included at the national, regional, county, and sub-county levels (i.e., for shared program activities of advocacy and social mobilization [ASM], training, monitoring, and supervision).

Data were collected via standardized questionnaires administered to staff across administrative levels, as well as data extraction from national, subnational, and project-specific accounting records. Data collection tools were adapted from the World Health Organization's "Guidelines for estimating costs of introducing new vaccines into the national immunization system" [8].

2.2. Cost analysis

We organized cost inputs into six categories corresponding to the following vaccination program activities: (1) advocacy and social mobilization (ASM); (2) training; (3) distribution, storage, and waste management; (4) service delivery; (5) monitoring; and (6) supervision (Table 1). Each input included multiple cost elements, such as personnel allowances, transportation, meeting/training costs, equipment, and supplies/materials; full details are described in the Table 1 and in the Supplemental Methods. We divided shared costs among the activities represented; for example, if ASM and training activities were combined in one trip, the travel costs incurred by staff were equally divided among ASM and training. Similarly, the staff per diem costs were apportioned according to the number of days spent dedicated to each activity. When costs were not specific to the influenza vaccine demonstration project, we used time and usage allocation interviews to estimate the proportion of facility work or equipment usage dedicated to demonstration project activities by asking facility staff to give estimates. We verified these estimates in discussions with national and county-level staff.

Prefilled single dose syringes of both trivalent inactivated influenza vaccine (TIV) and quadrivalent inactivated influenza vaccine (QIV) were used for the demonstration project due to changes in manufacturer availability, and the price-per-dose ranged from US$ 2.90

(TIV) to US$ 5.76 (QIV). We calculated the costs of vaccine purchased for each delivery strategy using a purchase price of 621 Kenyan shillings (KSh; equivalent to US$ 5.76 in 2021) per dose purchased. Based on demonstration findings, we used a vaccine wastage factor of 1.006, representative of vaccine wastage across both strategies to estimate vaccine wastage, resulting in a price of US$ 5.83 per dose administered.

We calculated total financial and economic costs by delivery strategy, administrative level, and program activity. Campaign delivery strategy costs were presented for a four-month period, compared with a 12-month period for the year-round strategy (representing the annual duration of vaccine administration, respectively). For cost inputs for which only annualized costs could be estimated (e.g., yearly price of storage space allocated to influenza vaccine and supplies), the 4-month costs of the campaign strategy were computed by dividing the annualized costs by three. For health facility-level data, we weighted costs from sampled government-run facilities to allow for inference to unsampled facilities; the sample weights were calculated based on the health facility level of care provision and proportion of facilities sampled (Supplemental Table S1).

We used the weighted total cost to calculate a unit cost per vaccine dose administered, both including and excluding the cost of vaccine purchase. For these cost-per-dose calculations, we used the total number of doses administered in the first year of the year-round strategy (November/December 2019 through November/December 2020) and the four months of the campaign strategy (June/July 2021 through September/October 2021) as the denominator [6]; for costs incurred at the health-facility level, this included only the number of doses administered in government health facilities. We converted all costs from their original currency (KSh, British pound sterlings [GBP], Euros, or US$) to 2021 US$ for analysis using conversion rates of 107.85 KSh = 0.723 GBP = 0.841 Euros = 1 US$ (2021 mid-year rate based on Central Bank of Kenya foreign exchange rates [9]). All data were collated and analyzed in Microsoft Excel.

2.2. Ethical approval

Administrative approval to conduct the demonstration project was received from the Kenyan Ministry of Health and the Nakuru and Mombasa County health departments. This activity was reviewed by the US Centers for Disease Control and Prevention (CDC) and was conducted consistent with applicable federal law and CDC policy (See e.g., 45C.F.R. part 46, 21C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq).

3. Results

3.1. Total costs

Among two sub-counties that used a year-round vaccine delivery strategy for the pediatric influenza vaccine demonstration project in Kenya, the total financial cost was US$ 225,269 and economic cost was US$ 326,691 (Table 2). The largest proportion of costs were incurred at the national level (US$ 190,240 [84 %] financial; US$ 197,234 [60 %] economic), the majority of which were the cost of vaccine purchase (US$ 177,145; 93% of national-level

financial costs). A total of 30,397 vaccine doses were administered via the year-round strategy.

Among two sub-counties that used a 4-month campaign delivery strategy for the pediatric influenza vaccine demonstration project, the total financial cost was US$ 214,753 and economic cost was US$ 242,385 (Table 2). Again, the largest proportion of costs were incurred at the national level (US$ 167,824 [78%] financial; US$ 168,217 [69%] economic), the majority of which were the cost of vaccine purchase (US$ 148,047; 88% of national-level financial costs). A total of 25,404 vaccine doses were administered via the campaign strategy.

Higher financial costs were incurred at the health facility level for the campaign strategy (US$ 26,605 [12%]) compared with the year-round strategy (US$ 17,307 [8%]) (Table 2); the largest contributor to health facility-level financial costs for the campaign strategy was service delivery, which included the hiring of 14 surge staff for vaccine administration (Supplemental Tables S2–S3).

3.2. Cost per dose administered

The cost of vaccine purchase was the greatest contributor to both financial and economic costs-per-dose, with a unit cost of US$ 5.83 per dose administered (Table 3). Excluding the cost of vaccine purchase, the cost per dose administered was US$ 1.58 (financial) and US$ 5.84 (economic) for the year-round strategy and US$ 2.89 (financial) and US$ 4.56 (economic) for the campaign strategy. This represented a financial cost difference of 82.8% (i.e., financial cost per dose of the campaign strategy was 1.8 times higher than that of the year-round strategy) and economic cost difference of −21.9% (i.e., the economic cost per dose of the year-round strategy was 1.2 times higher than that of the campaign strategy). Including the cost of vaccine purchase, the cost per dose administered was US$ 7.41 (financial) and US$ 11.66 (economic) for the year-round strategy and US$ 8.72 (financial) and US$ 10.39 (economic) for the campaign strategy.

After vaccine purchase costs, the program activities of ASM and training represented the next largest proportions of financial costs at 9% (US$ 0.70 per dose) and 7% (US$ 0.53 per dose), respectively, for the year-round strategy and 12% (US$ 0.98 per dose) and 10% (US$ 0.87 per dose), respectively, for the campaign strategy (Table 3). Additionally, after vaccine purchase costs, service delivery accounted for the largest share of economic costs for both strategies, representing 21% (US $ 2.98 per dose) for the year-round strategy and 14% (US$ 2.12) for the campaign strategy. The only other cost input for which there was a > 5% difference in cost contribution across the two strategies was distribution, storage, and waste management at the health facility level (Table 3; Supplemental Table S4), which represented 6% of economic costs for the year-round strategy, compared with 1% for the four-month campaign strategy. These increased economic costs largely consisted of the operational costs of equipment at the facilities (e.g., cold chain equipment) for the year-round strategy (Supplemental Table S2).

4. Discussion

To date, program costing data on influenza vaccine introduction in low- and middle-income countries (LMICs) are limited, particularly those that specifically evaluate delivery costs for pediatric influenza vaccination [10]. Our costing evaluation found that the total financial cost-per-dose, excluding vaccine purchase, was nearly two times (83%) higher for the campaign strategy (US $ 2.89 per dose) than the year-round strategy (US$ 1.58 per dose) during this demonstration project. Campaign strategy costs were largely driven by financial expenditures for more intensive advocacy and social mobilization activities, increased training costs, and hiring of surge staff to conduct the campaign, whereas the year-round strategy used more personnel time from existing staff sub-counties, thereby incurring lesser financial costs. The total economic cost-per-dose, excluding vaccine purchase, was more comparable for both strategies, with the year-round strategy (US $ 5.84 per dose) 22% higher than the campaign strategy (US $ 4.56 per dose); costs were largely balanced by greater operational costs (e.g., cold chain equipment) that extended over a full year for the year-round strategy with only slightly more children vaccinated, compared with a four-month period for the campaign.

As in prior influenza delivery costing studies for other target groups in LMICs [11–13], we found that vaccine purchase was the greatest contributor to total costs. Procurement costs represented 37% of economic costs of influenza vaccination for all target groups in South Africa [11], 44% of economic costs for health worker vaccination in Albania [12], and 82% of economic costs for maternal vaccination in Malawi [13], compared with 54% of economic costs for the year-round strategy and 61% of economic costs for the campaign strategy in our evaluation. As previously described, while we set the price of all vaccines purchased to US$ 5.76 (US$ 5.83 inclusive of wastage), both trivalent inactivated influenza vaccine (TIV) and quadrivalent inactivated influenza vaccine (QIV) were used for the demonstration project, with a price-per-dose that ranged from US$ 2.90 (TIV) to US$ 5.76 (QIV). This wide range in vaccine prices underscores the importance of access to affordable influenza vaccines in LMICs such as Kenya. An economic evaluation among young children in Kenya did not identify a cost-effective strategy for influenza vaccination, driven in part by the cost of vaccine (modeled at US$ 3.00 per dose) [14]. As documented in other vaccine introduction initiatives, [15], sustainable financing and procurement policies will be critical to enable successful influenza vaccine introduction in Kenya.

Consistent with a prior evaluation of vaccine supply chain and service delivery costs for routine immunization in Kenya [15], which found that human resource costs accounted for the largest share of costs, we identified service delivery as the second largest contributor (following vaccine purchase) to economic costs for both vaccine delivery strategies. While the year-round strategy largely incurred costs from time dedicated by existing vaccination staff at the health facilities, the campaign strategy required a substantial financial cost for surge staff to deliver vaccines within a short timeframe. Continued evaluation and budgeting of service delivery costs will be important to ensure the success of pediatric vaccination rollout, particularly given existing staffing constraints within health facilities in Kenya [16].

These findings are subject to several notable limitations. First, this was a small-scale demonstration project with only two participating sub-counties per delivery strategy, so we could not provide a statistical measure of uncertainty and determine whether the costs for each strategy were statistically different from one another. However, we attempted to address variability in costs across sub-counties by weighting data by level of care provision to represent all participating government facilities. Relatedly, characteristics of the counties, such as size and population demographics, varied and might have affected evaluation of costs (e.g., the larger size of Nakuru county and its sub-counties might have resulted in greater transport costs), although we attempted to minimize this variability by assigning one sub-county from each county to each strategy. Second, we did not have full data for all opportunity costs incurred, likely underestimating economic costs for both strategies. For example, we were not able to cost personnel time for government employees at levels higher than at the facility level, thus underestimating the economic costs for supervision activities. Due to the perspective employed (government perspective), we did not include costs to private and faith-based facilities, though these incurred additional costs for vaccination. Third, we asked health facility staff to estimate the percentage allocation of a resource input or activity to influenza vaccination; however, these retrospective estimations are subjective [17] and may underestimate or overestimate costs depending upon staff perceptions. Additionally, use of surge staff for influenza vaccination could have incurred opportunity costs to other public health efforts, which were not captured within the scope of this analysis. Fourth, we used the same wastage factor (1.006) for both strategies because calculation of strategy-specific estimates was limited by operational challenges encountered at the start of the demonstration project [6]; however, in reality, wastage might differ by delivery strategy, particularly if multi-dose vaccine vials are procured for national rollout.

Fifth, the values we obtained for cost per dose were greatly influenced by the number of vaccine doses administered; if more doses had been administered during the project period, the cost per dose would have been lower. During the demonstration project, some factors such as community acceptance of the vaccine and resulting vaccine uptake were not uniform across sub-counties and could have influenced the comparison of strategies [6]: one sub-county (Likoni) achieved lower coverage during the demonstration project, largely due to community vaccine hesitancy, which affected calculations of the cost per dose. Furthermore, the demonstration project occurred during the COVID-19 pandemic, which could have resulted in lower influenza vaccine uptake and increased other costs for supply procurement, personnel time, and other cost inputs. Finally, costs incurred during the demonstration project might not be fully generalizable to pediatric influenza vaccination rollout on a national scale in Kenya. We did not delineate introduction and recurrent costs for this analysis, and thus the cost-per-dose may decrease over a multi-year timeframe. Additional efforts to extrapolate and characterize national costs over a longer projected period are underway. Future analyses could also use more recently developed tools such as the WHO Seasonal Influenza Immunization Costing Tool [18] or other costing tools for campaign and routine immunization delivery [19].

Ultimately, these cost data could have future use in projecting national costs of pediatric vaccine rollout, or as inputs for further economic evaluations, continuing to contribute to the evidence base for pediatric influenza vaccination in Kenya. Evaluation of vaccine coverage

during the demonstration project indicated that both strategies achieved similar coverage (59.1% first-dose coverage for the year-round strategy in its first year, and 63.2% coverage for the campaign strategy) [6]. Considering that the economic cost per dose administered was also comparable across strategies, these results should be weighed holistically with other gathered data and qualitative implementation experiences [20] to inform the decision as to which strategy is preferable for vaccine introduction.

5. Conclusions

Our vaccine delivery costing study provides policymakers with direct evidence to aid decisions on vaccine introduction, plan budgets and financing strategies for rollout, and identify efficiencies in service delivery [21]. In addition, the cost data provided in this study can be key inputs for additional economic evaluations, such as cost-effectiveness studies [22], which provide further evidence for vaccine policy development [23].

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Data availability

Data will be made available on request.

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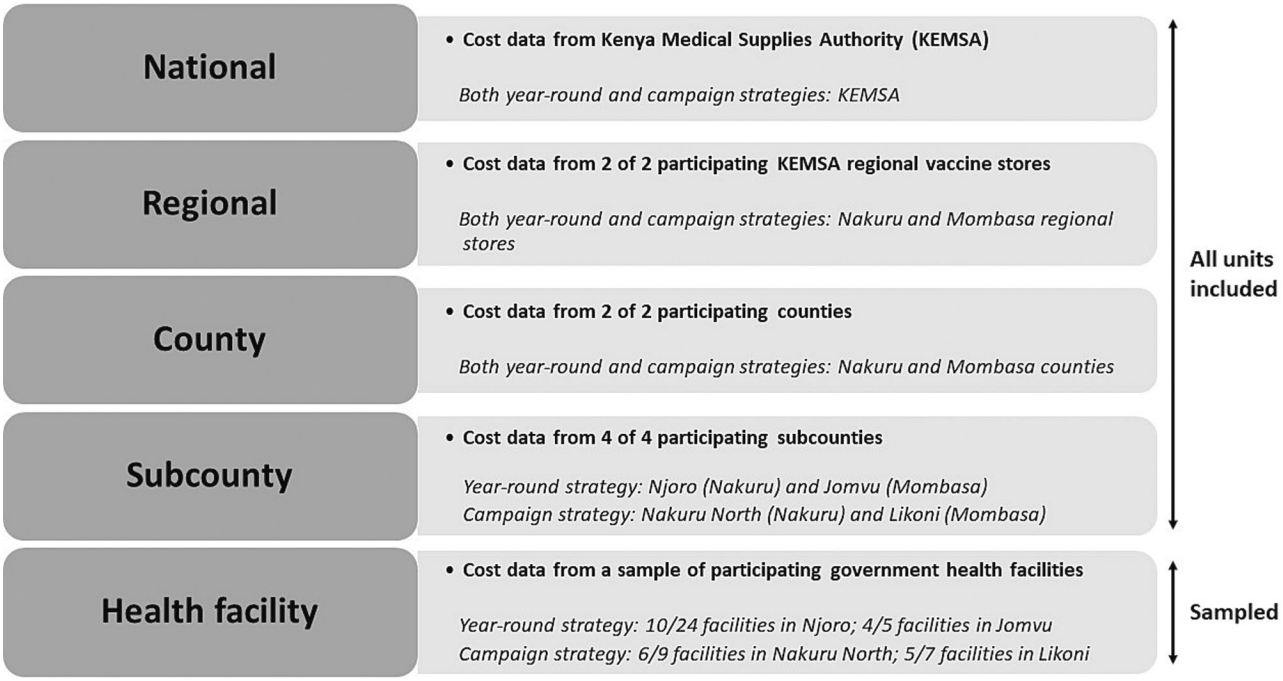

Fig. 1.

Data collection strategy by administrative level for the pediatric influenza vaccine demonstration project – Nakuru and Mombasa Counties, Kenya, 2019–2021.

Table 1

Costs assessed for both year-round and campaign strategies for the pediatric influenza vaccine demonstration project - Nakuru and Mombasa Counties, Kenya, 2019–2021.

Cost input	Method of data collection[1]	Administrative level(s) assessed	Costs elements included	Year-round strategy		Campaign strategy	
				Financial costs[2]	Economic costs[2]	Financial costs[2]	Economic costs[2]
Cost of vaccine	Data abstraction	National	Price of vaccine (prefilled syringes), accounting for wastage	✓	✓	✓	✓
Advocacy and social mobilization	Standard questionnaire; data abstraction	National; County; Sub-county;Health facility	Personnel allowances	✓	✓	✓	✓
			Transportation	✓	✓	✓	✓
			Meeting/training costs	✓	✓	✓	✓
			Advocacy materials	✓	✓	✓	✓
Training	Data abstraction	National; County; Sub-county;Health facility	Personnel allowances	✓	✓	✓	✓
			Transportation	✓	✓	✓	✓
			Meeting/training costs	✓	✓	✓	✓
			Training materials	✓	✓	✓	✓
Distribution, storage, and waste management	Standard questionnaire	National; Regional; Sub-county;Health facility	Vaccine distribution[3]	✓	✓	✓	✓
			Storage		✓		✓
			Waste disposal (burning chamber)		✓		✓
			Cold chain equipment and maintenance/operation		✓		✓
Service delivery	Standard questionnaire	Health facility	Personnel time and pay[4]		✓	✓	✓
			Overhead (electricity, water)		✓		✓
			Vaccine administration space		✓		✓
Monitoring	Standard questionnaire	Regional; County; Sub-county	Personnel time		✓		✓
Supervision	Data abstraction	Health facility	Personnel allowances	✓	✓	✓	✓
			Transportation	✓	✓	✓	✓
			Meeting/training costs	✓	✓	✓	✓

[1] Data collection included standardized questionnaires administered to staff across administrative levels, as well as data abstraction from demonstration project accounting records.

[2] Financial costs are incremental monetary expenditures made by the Kenyan Ministry of Health for the influenza demonstration project; economic costs include all financial costs as well as the value of existing government resources used for the demonstration project (e.g., existing equipment, facilities, and personnel time for existing staff).

[3] Because influenza vaccine was not yet included in the routine immunization program, financial transport costs were incurred to distribute vaccine from regional stores to health facilities in both the year-round and campaign delivery strategies.

[4] Only existing personnel were used for delivery of influenza vaccine in the year-round delivery strategy; however, surge personnel were hired for the campaign strategy, resulting in financial costs from personnel salaries.

Table 2

Total costs of the pediatric influenza vaccine demonstration project, by administrative level and delivery strategy - Nakuru and Mombasa Counties, Kenya, 2019–2021.

	Year-round strategy (annual cost)				**Campaign strategy (4-month cost)**			
	Financial cost		***Economic cost***		***Financial cost***		***Economic cost***	
Administrative level	**Total cost**	**%**	**Total cost**	**%**	**Total cost**	**%**	**Total cost**	**%**
National	190,240	84 %	197,234	60 %	167,824	78 %	168,217	69 %
Cost of vaccine	*177,145*	*93 %*	*177,145*	*90 %*	*148,047*	*88 %*	*148,047*	*88 %*
Other national costs	*13,094*	*7 %*	*20,089*	*10 %*	*19,776*	*12 %*	*20,169*	*12 %*
Regional	556	0 %	2,747	1 %	232	0 %	1156	0 %
County	2,326	1 %	3,355	1 %	2,236	1 %	2,579	1 %
Sub-county	14,840	7 %	17,520	5 %	17,856	8 %	18,392	8 %
Health facility[1]	17,307	8 %	105,835	32 %	26,605	12 %	52,041	21 %
TOTAL (excluding cost of vaccine)	**48,124**		**149,546**		**66,705**		**94,337**	
TOTAL (including cost of vaccine)	**225,269**		**326,691**		**214,753**		**242,385**	
	Total doses administered				*Total doses administered*			
	30,397				25,404			

All costs presented in U.S. Dollars (US$); 1 US$ =107.85 Kenyan shillings (2021).

Totals might not sum exactly to components due to rounding.

[1]Weighted estimates to account for unsampled government-owned health facilities.

Table 3

Costs of the pediatric influenza vaccine demonstration project by program activity and delivery strategy - Nakuru and Mombasa Counties, Kenya, 2019–2021.

	Year-round strategy (annual cost)						Campaign strategy (4-month cost)					
	Financial cost			*Economic cost*			*Financial cost*			*Economic cost*		
Program activity	**Total cost**	**%**	**Cost per dose administered**	**Total cost**	**%**	**Cost per dose administered**	**Total cost**	**%**	**Cost per dose administered**	**Total cost**	**%**	**Cost per dose administered**
Cost of vaccine[1]	177,145	79 %	5.83	177,145	54 %	5.83	148,047	69 %	5.83	148,047	61 %	5.83
Advocacy and social mobilization	21,267	9 %	0.70	21,267	7 %	0.70	24,873	12 %	0.98	24,873	10 %	0.98
Training	16,235	7 %	0.53	21,585	7 %	0.71	22,030	10 %	0.87	22,030	9 %	0.87
Distribution, storage, and waste management[2]												
Health facility level	0	-	-	19,817	6 %	0.86	0	-	-	3,058	1 %	0.19
Above health facility level	3,830	2 %	0.13	5,662	2 %	0.19	2,333	1 %	0.09	3,530	1 %	0.14
Service delivery[2]	0	-	-	68,712	21 %	2.98	11,775	5 %	0.73	34,154	14 %	2.12
Monitoring	0	-	-	5,711	2 %	0.19	0	-	-	998	0 %	0.04
Supervision	6,793	3 %	0.22	6,793	2 %	0.22	5,695	3 %	0.22	5,695	2 %	0.22
TOTAL (excluding cost of vaccine)	**48,124**		**1.58**	**149,546**		**5.84**	**66,705**		**2.89**	**94,337**		**4.56**
TOTAL (including cost of vaccine)	**225,269**		**7.41**	**326,691**		**11.66**	**214,753**		**8.72**	**242,385**		**10.39**
	Total doses administered						*Total doses administered*					
	30,397						25,404					

All costs presented in U.S. Dollars (US$); 1 US$=107.85 Kenyan shillings (2021).

Totals might not sum exactly to components due to rounding.

[1] While vaccine was purchased at an average price of 621 Kenyan shillings (equivalent to US$ 5.76 in 2021) per dose, the calculated cost of vaccine accounts for a median vaccine wastage factor of 1.006 over the demonstration project.

[2] Per-dose costs for distribution, storage, and waste management costs (health facility level) and service delivery were calculated using only the number of doses administered in government-owned facilities (23,092 doses for year-round strategy; 16,103 doses for campaign strategy).