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VILLAGE REACH®

DRC EQUITY ACCELERATOR FUND:

Cost-Effectiveness Evaluation Report



Photo Credit: Carlo Lechea

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Abbreviations

DALY . . . . . *disability-adjusted life year*

DHIS2 . . . . . *District Health Information Software 2*

DRC . . . . . *Democratic Republic of Congo*

DPT . . . . . *diphtheria, pertussis, and tetanus*

EAF . . . . . *Equity Accelerator Fund*

Hib . . . . . *Haemophilus influenzae type b*

ICER . . . . . *incremental cost-effectiveness ratio*

NGCA . . . . . *Next Generation Supply Chain Initiative*

Penta-1 . . . . . *pentavalent vaccine first-dose*

WHO . . . . . *World Health Organization*

WHO-CHOICE . . . . . *World Health Organization Choosing Interventions that are Cost-Effective*

Executive Summary


Photo Credit: Carlo Lechea

The Democratic Republic of Congo (DRC) has one of the world's largest populations of zero-dose children—those who have never received a routine vaccine. Gavi, the Vaccine Alliance's Equity Accelerator Fund funded two complementary interventions to close this gap: the Next Generation Supply Chain Initiative (NGCA), which optimized vaccine distribution, and door-to-door visits, which brought vaccination services directly to households. This report evaluates the cost-effectiveness of these interventions, delivered as a bundled package in Tshopo and Haut-Katanga provinces from April 2024 to September 2025.

KEY FINDINGS

- **Highly cost-effective**
  The bundled package cost US$85.75 per disability-adjusted life year averted—well below DRC's gross domestic product per capita of US$806.80 (WHO-CHOICE threshold), suggesting that the intervention achieved health gains at a cost that represents good value for the health system.
- **Increased reach, at higher cost**
  Zero-dose vaccinations increased by 24% and first doses of pentavalent vaccine delivered increased by 18%. These gains came at a higher average cost per child, reflecting the additional investment required to reach children who are less likely to be vaccinated through routine fixed-site services.
- **Marginal cost of equity-focused reach**
  The incremental cost-effectiveness ratio (ICER) was US$23.77 per additional zero-dose child vaccinated.

RECOMMENDATIONS

- **Budget for the cost of reaching zero-dose children,** using the average cost per child of US$10.68 per zero-dose child vaccinated as a benchmark for future investments.
- **Plan for a transition to government financing,** prioritizing reduced recurrent transportation costs.
- **Prioritize efficiency gains at scale,** through better route planning, transportation optimization, and stronger documentation of door-to-door vaccinations to improve value for money over time.
- **Maintain NGCA and door-to-door delivery as complementary investments,** integrating both within existing primary health care services.

Background


Photo Credit: Wolf Mugos

INTRODUCTION

Equity gaps in immunization programming persist in many health systems with weak supply chains and in hard-to-reach areas. In the Democratic Republic of Congo (DRC), a substantial proportion of children are zero-dose, meaning they have received no routine vaccines at all. Geographic isolation, population mobility, weak last-mile delivery, and the limited reach of fixed-site immunization services contribute to this gap.

Past efforts to reach zero-dose children, including the Mashako Plan and Mashako Plan 2.0, faced vaccine shortages, health worker strikes, and weak monitoring. In response to these challenges, Gavi, the Vaccine Alliance's Equity Accelerator Fund (EAF) funded a set of complementary interventions to improve vaccine availability at delivery points and extend services beyond traditional, fixed-site facilities. Together, these interventions focused on increasing vaccination rates among zero-dose children by strengthening the vaccine supply chain system and expanding frontline outreach. Two interventions implemented under EAF include the Next Generation Supply Chain Initiative (Nouvelle Génération des Chaînes d'Approvisionnement, NGCA) and door-to-door visits. This report assesses the cost-effectiveness of these two interventions, delivered as a bundled package in two priority provinces, Haut-Katanga and Tshopo, from April 2024 to September 2025.



Equity gaps in immunization programming persist in many health systems with weak supply chains and in hard-to-reach areas.


Photo Credit: Wolf Mugos

SUPPLY CHAIN INTERVENTION: NEXT GENERATION SUPPLY CHAIN

NGCA was designed to optimize the vaccine supply chain and reduce stockouts through a series of operational activities: assessment, system design, technical support, planning, and distribution. By handling vaccine delivery directly, the NGCA approach relieved health workers of the burden–often a personal cost to them—of collecting vaccines themselves, freeing frontline staff to focus on service delivery, including door-to-door vaccination. In practice, NGCA worked primarily by increasing vaccine availability in health areas, which in turn improved availability during household-level vaccination activities.

NGCA consisted of the following key activities, which formed the basis for costing it:

- **Rapid assessment missions:** VillageReach conducted rapid assessments in each province to understand vaccine and supply chain issues and inform the initial redesign of the supply chain system. This activity was conducted at the start of implementation and was not expected to recur annually.
- **Supply chain design workshops:** At the start of implementation, VillageReach conducted a multi-day workshop to assess the supply chain system, design an equity-based system with stakeholders, and validate the new supply chain circuit reconfigured by local authorities in Tshopo province. This was a one-time design activity undertaken to establish the intervention and was not expected to recur annually.
- **Staff recruitment:** VillageReach recruited technical assistance staff to provide support alongside provincial health authorities.
- **Distribution planning meetings:** To coordinate delivery schedules and operational arrangements, VillageReach held planning meetings with relevant Expanded Programme on Immunization (EPI) teams.
- **Direct deliveries to health areas using the informed push approach:** VillageReach organized distribution activities through multiple routes depending on context and operational feasibility. Vaccines were distributed either directly from provincial EPI warehouses to health areas, or from provincial warehouses to central stores at the health zone level for onward distribution to health areas. The health zone is an administrative unit within a province made up of multiple health areas. The distribution route decision was informed by factors such as cold chain capacity, distance, accessibility, and security conditions. Deliveries sometimes used health area vehicles, staffed by VillageReach and the provincial EPI team along with a logistician or supply chain manager. In other cases, deliveries relied on alternative transportation, such as rented vehicles or public transportation, with VillageReach covering fuel, per diem, or rental costs to keep vaccine delivery on track.
- **Supportive supervision and data validation meetings:** Beyond improving vaccine availability, the direct distribution approach created opportunities for supportive supervision, on-the-job coaching, and improved stock management, since distribution staff interacted directly with health area teams during deliveries.

Cost data collection focused on recurrent implementation activities, excluding start-up activities such as one-time capital investments in vehicle purchases. As a result, this report focuses on the recurrent components of NGCA.

SERVICE DELIVERY INTERVENTION: DOOR-TO-DOOR VISITS

Door-to-door vaccinations were implemented to reduce missed opportunities for vaccination. A missed opportunity occurs when an eligible child visits a health area for immunization but does not receive the vaccines they are eligible for, including when vaccines are out of stock. In addition, some zero-dose and under-immunized children may not reach the health area because of barriers such as distance, transportation costs, or caregiver time constraints. Door-to-door visits addressed both barriers by bringing services directly to households, enabling health workers to vaccinate children who would otherwise be missed.

Health workers conducted weekly visits to households within 5 km (about 3.1 miles) of the facilities to identify unvaccinated children, verify vaccination status, and administer missed vaccinations. This approach complements health area services and is crucial to reaching populations that are otherwise hard to reach. This intervention consisted of the following key activities, which formed the basis for costing it:

- **Identification and verification of unvaccinated children:** Health workers used microplanning data to identify zero-dose households and communities.
- **Cold chain maintenance outside health areas:** Health workers used vaccine carriers with ice packs to keep vaccines within the required temperature range throughout door-to-door visits.
- **Travel to households:** Health workers traveled to households within 5 km of the health area by motorbike, public transportation, or on foot to conduct vaccination visits.
- **Reporting:** Health workers updated registers with vaccinations delivered and, in some cases, monitored follow-up for individual children.

The door-to-door visits introduced costs for staff time, transportation, and the equipment and supplies needed to safely deliver vaccines in the community.

OBJECTIVES AND STUDY QUESTIONS

The primary objective of this study was to assess the cost-effectiveness of the interventions—NGCA and door-to-door visits—implemented in DRC.

Secondary objectives were to:

- Assess the effectiveness of each intervention individually in reducing the number of zero-dose children.
- Estimate the direct and indirect costs of each intervention.
- Estimate the cost per additional zero-dose child immunized.
- Identify key factors influencing the cost-effectiveness of the interventions.

The primary study questions were:

1. What is the effect of the NGCA and door-to-door interventions on reducing the number of zero-dose children in Tshopo and Haut-Katanga provinces?
2. What are the costs associated with implementing these zero-dose interventions in Tshopo and Haut-Katanga provinces?
3. Are these interventions cost-effective to scale up? What costs need to be budgeted?

Methods


Photo Credit: Patrick Kahondwa

STUDY DESIGN

We used a pre/post analytical framework to assess the cost-effectiveness of the EAF interventions. This design was adopted because the interventions were implemented programmatically across selected health zones based on priority zero-dose geographies, making it infeasible to establish a control group within the sampled health zones. Identifying comparable control health zones was also challenging given the heterogeneity in geographic accessibility, population distribution, and zero-dose coverage. The pre/post design therefore offered a pragmatic approach for evaluating changes in costs and outcomes associated with the interventions.

To assess the effects of the interventions, outcomes and costs observed during the study period were compared with those observed during a six-month baseline period before implementation, using the same sampled health areas in both periods to allow comparisons within health areas over time. We originally intended to analyze each intervention alone, but routine immunization registers did not reliably distinguish door-to-door vaccination outcomes. Therefore, only NGCA was evaluated alone, with specific performance indicators compared against intervention costs. The resulting cost per performance indicator was then compared with baseline: the traditional vaccine supply chain.


Photo Credit: Patrick Kahondwa

Full detail on study location, sampling, data collection, and data cleaning is provided in Appendix 1.

DEFINING THE COUNTERFACTUAL AND INTERVENTIONS

The counterfactual for this evaluation (what would have happened in the absence of the EAF interventions) reflects the routine immunization delivery and supply chain model that was in place at baseline before the EAF interventions began. Table 1 summarizes the counterfactual and intervention models for both vaccine supply chain and vaccine service delivery.

Table 1: Counterfactual and Interventions

	Counterfactual (baseline)	Intervention (endline)
Vaccine supply chain	The traditional vaccine supply chain was the routine vaccine distribution system in place before NGCA was introduced. Under this system, commodities flowed from the provincial warehouses to the health zones based on requisition and planned deliveries, after which either: • Health zones delivered vaccines to health areas ("push" approach), or • Health areas picked up vaccines directly ("pull" approach)	NGCA: This optimized supply chain approach strengthens vaccine flow and improves last-mile readiness to vaccinate zero-dose children by providing targeted assistance in: • Quantification and forecasting • Distribution planning and distribution trips • Supervision visits to support reporting and monitor health area performance
Vaccine service delivery	Under the traditional vaccine service delivery system, caregivers brought children to a health area for vaccination through: • Traditional fixed-site sessions including vaccinations at the health area • Traditional supply chain systems • Passive identification of zero-dose children	**Bundled intervention package:** The evaluation treated EAF zero-dose interventions—door-to-door visits and NGCA—as an integrated package to assess their combined effect on zero-dose outcomes. The door-to-door visits were supported by the vaccine supplies delivered through NGCA. Health area immunization registers did not reliably distinguish vaccinations delivered through door-to-door visits from others, so the door-to-door intervention could not be evaluated on its own.

Abbreviations: EAF, Equity Accelerator Fund; NGCA, Next Generation Supply Chain Initiative.

Figure 1 summarizes the broader health system components involved in identifying and vaccinating zero-dose children.

Figure 1: Health System Components Needed to Find Zero-Dose Children
(Identify – Reach – Monitor – Measure – Advocate Framework)

IDENTIFY	**Creation of Mapping for Health Data** Here, administrative base maps are generated through a collaborative process between GIS mappers and local health teams.	**Population Estimation** Population estimation is defined as an independent source of population numbers used to help improve resource allocation/plan appropriate routine immunization strategies as part of the micro and macro-planning process.	**Micro-plan Development** Georeferenced health area and zone boundaries are developed to inform and align the management units commonly used in microplans.	**Mobility Estimates** Mobility estimates from mobile phone usage data was defined as a system for automated routine capture of mobility estimates from call data records.
REACH	**Door-to-door vaccination and all-contact vaccination to reduce missed vaccination opportunities** Door-to-door visits to houses within a 5km radius of the health facility to vaccinate children.			
REACH	**Direct distribution (informed push)** Under the Next Generation Supply Chain Initiative (in French, Nouvelle Génération des Chaînes d'Approvisionnement, or NGCA), direct deliveries are made to health facilities with the use of the Informed Push approach. Products are delivered directly from the provincial warehouse to a subset of health centers that have cold chain equipment for vaccines.			

For service delivery, immunization services were delivered primarily through fixed-site sessions in health areas or at designated fixed posts. Zero-dose children were identified passively when caregivers brought children to the health area for services; no systematic household outreach existed to actively identify and vaccinate zero-dose children. As a result, reaching zero-dose populations depended largely on caregiver demand and physical access to health areas.

For vaccine distribution, the traditional vaccine supply chain system at baseline relied on health area staff either traveling to collect vaccines from health zone stores or receiving routine deliveries from health zones. This system experienced frequent stockouts and delays, affecting the consistent availability of vaccines at service delivery points.



This system experienced frequent stockouts and delays, affecting the consistent availability of vaccines at service delivery points.

By comparing this counterfactual with the EAF interventions, the evaluation assessed intervention efficiency based on changes in key output metrics. To evaluate their impact on zero-dose outcomes, the interventions were also analyzed as a bundled package: their combined costs were compared with the number of zero-dose children vaccinated during the study period to assess the cost-effectiveness of reaching previously unvaccinated populations. Paired t-tests were used to assess whether changes in key outcomes from baseline to endline were statistically significant.

The pre/post periods are referred to as the baseline and endline periods. The baseline period was from October 2023 to March 2024, the six-month period before the EAF interventions began. The endline period was from January to June 2025, a six-month period that began after the interventions had been implemented for at least six to nine months.

COSTING APPROACH

The analysis was conducted from a health systems perspective, capturing costs incurred by actors involved in organizing and delivering the intervention, including government entities and VillageReach as the implementing partner. Both financial and economic costs were estimated.

The evaluation used a micro-costing approach for the intervention components and system levels included in the analysis, at both baseline and endline. Costs were collected at subnational levels, primarily the health area level.

The costing analysis covered a six-month baseline period (October 2023 to March 2024) and a six-month intervention period (January to June 2025). The study included both financial costs (direct program expenditures) and economic costs (including the value of health worker time).

Health worker time was valued using reported salary levels. Cold chain equipment costs were annualized over the equipment's expected useful life using straight-line depreciation and prorated for the study period. All costs are reported in 2025 US dollars (US$).

For NGCA, a targeted micro-costing approach identified, measured, and valued the resource inputs for the traditional and optimized supply chain systems, drawing on the USAID | DELIVER PROJECT method for supply chain costing (McCord, Tien, & Sarley, 2013). For the bundled intervention package, we combined the costs of door-to-door visits, NGCA activities, and routine fixed-site service delivery to capture the full endline service delivery model, since door-to-door visits complemented rather than replaced fixed-site vaccination services. Full cost-category breakdowns for both interventions are provided in Appendix 1.

The outcome metric for NGCA was the number of pentavalent vaccine first doses (Penta-1) delivered during the study period. The outcome metric for the bundled intervention package was the number of zero-dose children vaccinated during the study period. Incremental costs and outcomes were estimated as the difference between endline and baseline values for each metric.

COST-EFFECTIVENESS THRESHOLD ANALYSIS

The average cost per outcome and the incremental cost-effectiveness ratio (ICER) were calculated for the interventions. The ICER is calculated as the ratio of incremental costs to the incremental number of children vaccinated and the incremental quantity of doses delivered.

To contextualize the cost-effectiveness of the bundled intervention package, we assessed it against a cost-effectiveness threshold based on DRC's estimated gross domestic product (GDP) per capita (World Bank, 2025), and following the approach originally proposed by the World Health Organization (WHO) Commission on Macroeconomics and Health and later formalized by WHO-CHOICE (Tan-Torres Edejer et al., 2003). Under this approach, an intervention is considered highly cost-effective if the cost per disability-adjusted life year (DALY) averted is below 1× GDP per capita (US$806.80), and cost-effective if below 3× GDP per capita (US$2,420.40).

We note that this threshold approach is no longer considered current best practice; WHO has since recommended country-specific, opportunity cost thresholds instead (Bertram et al., 2016). We applied this GDP-based approach here as a reasonable substitute in the absence of an established DRC opportunity cost threshold.

We derived coverage rates using the number of zero-dose children vaccinated at baseline and endline, divided by the target population. Subnational population data for Tshopo and Haut-Katanga—sourced from the Humanitarian Data Exchange subnational population data (UN Office for the Coordination of Humanitarian Affairs, 2024)—were combined into a single projection to scale national demographic parameters to the study area, applying one combined coverage rate to their combined total population. The Lives Saved Tool (LiST) modeled deaths averted attributable to the DPT and Haemophilus influenzae type b (Hib) components of the pentavalent vaccine (Johns Hopkins Bloomberg School of Public Health/Avenir Health, 2026). We converted these to DALYs averted using DALY-to-death ratios derived from 2023 estimates for children under five in DRC from the Global Burden of Disease (GBD) database (GBD Collaborative Network, 2025). DPT deaths were used as a proxy for pertussis deaths, and meningitis deaths were used as a proxy for Hib deaths. Diphtheria, tetanus, and hepatitis B mortality impacts were not captured by this method.

Findings


Photo Credit: Carlo Lechea

NGCA

During the study period, NGCA direct distribution activities were conducted through multiple delivery routes, including direct deliveries from the province to health areas and deliveries routed through the health zone for onward distribution to health areas. Expenses incurred included transportation logistics, fuel, vehicle rental where required, and per diem support for VillageReach staff supporting distribution. VillageReach also provided supportive supervision visits to health areas.

Figure 2 shows a breakdown of costs by supply chain function. Total supply chain costs increased from US$97,285 at baseline to US$191,391 at endline, representing an incremental cost increase of US$94,106 attributable to the NGCA intervention. These additional costs reflect the investments in transportation, storage, and management required to optimize NGCA's direct distribution approach. Percentage change was calculated relative to baseline values.

Transportation costs represented the largest share of total supply chain costs at both baseline and endline, accounting for 53% and 54%, respectively. Storage costs decreased as a share of total costs, from 42% at baseline to 17% at endline, while management costs increased from 5% to 28%. This increase in management costs reflects additional coordination, supervision, and technical assistance inputs required to operationalize the NGCA distribution model.

The average cost per Penta-1 dose delivered increased from US$1.67 at baseline to US$2.77 at endline. While the NGCA intervention increased total supply chain costs, it also increased vaccine throughput, reflected in the higher number of Penta-1 doses delivered.

The ICER for NGCA was estimated at US$8.84 per additional Penta-1 dose delivered, calculated as the incremental supply chain cost (US$94,106) divided by the incremental increase in Penta-1 doses delivered (10,649). This metric reflects the additional cost of delivering one more Penta-1 dose under the NGCA-supported supply chain relative to the traditional system. Table 2 summarizes the total costs, number of Penta-1 doses delivered, and cost per dose for NGCA at baseline and endline.

Figure 2: Breakdown of Costs by Supply Chain Function

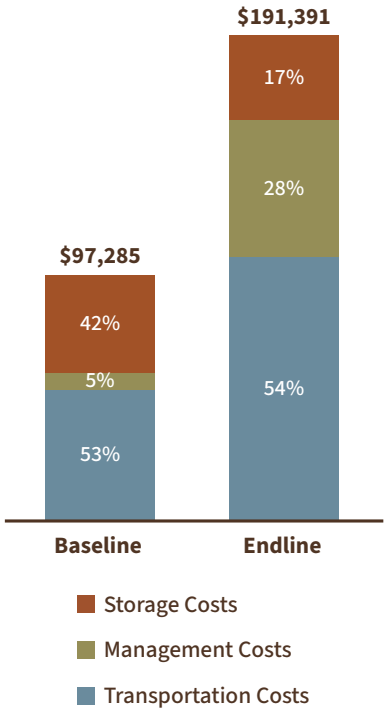


Table 2: Costs and Outcome Estimates for NGCA

Evaluation metric	Baseline (counterfactual)	Endline (intervention)	Percentage change
Total costs, US$	97,285	191,391	97%
Number of Penta-1 doses delivered	58,359	69,008	18%
Cost per Penta-1 dose delivered, US$	1.67	2.77	66%

The substantial increase in total supply chain costs reflects the additional investments required to implement the NGCA direct distribution model, including transportation and logistics, supervision, and technical assistance. Although the number of Penta-1 doses delivered increased by 18%, the cost per dose delivered increased by 66%. Such cost increases are common during the early stages of supply chain optimization, when some recurrent investments are higher and may decline as the system matures.

The incremental cost per dose reflects the cost of improving vaccine availability at health areas and enabling health workers to vaccinate previously zero-dose children. It does not attribute changes in vaccination outcomes solely to NGCA; rather, it measures the cost of improvements in supply chain efficiency.

BUNDLED INTERVENTION PACKAGE

INTERVENTION COSTS

At endline, door-to-door delivery costs totaled US$28,490, comprising health worker time (US$18,932) and transportation (US$9,558). At baseline, fixed-site delivery costs totaled US$60,424, comprising staff costs (US$46,361) and cold chain equipment costs (US$14,063).

We did not collect fixed-site costs at endline because equipment, staffing structures, and routine service delivery activities were not expected to change during the study period. We therefore assumed that fixed-site costs remained constant and focused endline data collection on costs introduced by door-to-door delivery. If the intensity of fixed-site services changed during the study period, however, incremental costs may have been under- or overestimated.

Table 3 presents the baseline, endline, and incremental economic costs of the bundled intervention package. Incremental costs were calculated as the difference between endline and baseline costs for each intervention component.

The total cost of the bundled intervention package increased from US$157,709 at baseline to US$280,305 at endline. The traditional supply chain system was the main cost driver at baseline (62%), as was NGCA at endline (68%). In both periods, transportation costs accounted for the largest share of supply chain costs.

Table 3: Economic Costs of the Bundled Intervention Package

Intervention cost category	Baseline, US$	Endline, US$	Increment, US$	Proportion of activity costs in the total intervention cost	
				Baseline, %	Endline, %
Vaccine supply chain	97,285 (traditional supply chain)	191,391 (NGCA)	94,106	61.7	68.3
Vaccine service delivery	60,424 (fixed-site only)	88,914 (door-to-door and fixed-site)	28,490	38.3	31.7
Total	**157,709**	**280,305**	**122,596**	**100%**	**100%**

The financial costs per intervention are presented in Table 4. Total financial costs increased from US$47,113 at baseline to US$141,614 at endline. At baseline, all financial costs were associated with the traditional supply chain, with no financial costs incurred for service delivery. At endline, both NGCA and door-to-door service delivery contributed to financial costs, with NGCA accounting for the larger share. As a proportion of total intervention costs, financial costs increased from 30% at baseline to 51% at endline. This increase was largely driven by transportation costs related to vaccine distribution and supervision trips.

Table 4: Financial Costs per Intervention

Financial costs	Baseline, US$	Endline, US$	Proportion of activity financial costs in the total intervention costs	
			Baseline, %	Endline, %
Vaccine supply chain	47,113	132,056	30	47
Vaccine service delivery	0	9,558	0	3.4
Total	**47,113**	**141,614**	**30**	**51**

EFFECTIVENESS DATA: NUMBER OF ZERO-DOSE CHILDREN VACCINATED

The number of zero-dose children vaccinated at baseline and endline for each health area is presented in Appendix 2. We also calculated the incremental number of zero-dose children vaccinated to assess changes from baseline to endline.

Primary data on the number of zero-dose children vaccinated through door-to-door visits were considered unreliable and may have overstated the number vaccinated. Therefore, the analysis used secondary data reported through DHIS2 on the number of zero-dose children vaccinated during the study period.

More zero-dose children were vaccinated in urban health areas (Table 5) than in rural health areas. Compared with the baseline, an additional 5,157 zero-dose children were vaccinated at endline ($p < .001$), representing a 24% increase. The mean number of zero-dose children vaccinated per health area at endline was 438, with higher counts observed in urban health zones. Incremental vaccination counts were positive in most health areas (Appendix 2).

Table 5: Number of Zero-Dose Children Vaccinated by Settlement Type

Settlement type	**Zero-dose** (baseline)	**Zero-dose** (endline)
Rural	10,393	12,148
Urban	10,706	14,108

Table 6 below presents a synthesis of cumulated outcomes data from the outcomes table in Appendix 2.

Table 6: Cumulative Outcome Data

Outcomes	Baseline	Endline	Increment
Penta-1 doses delivered	58,359	69,008	10,649
Total zero-dose children vaccinated	21,099	26,256	5,157

The average cost per outcome and ICER for the bundled intervention package is presented in Table 7. The ICER was calculated as the ratio of incremental costs to the incremental number of zero-dose children vaccinated.

From baseline to endline, the average cost per zero-dose child vaccinated increased from US$7.47 to US$10.68. This measure represents the average cost of vaccinating one zero-dose child under each intervention package. The ICER was US$23.77, representing the additional cost required to vaccinate one additional zero-dose child at endline relative to the baseline approach.

Table 7: Average Cost per Outcome and Incremental Cost-Effectiveness Ratio (ICER)

Average cost per outcome	Baseline	Endline	ICER
Cost per Penta-1 dose delivered, US$	1.67	2.77	8.84
Cost per zero-dose child vaccinated, US$	7.47	10.68	23.77

Using LiST, the estimated changes in vaccination coverage across Tshopo and Haut-Katanga were projected to avert 1,429.7 DALYs, primarily through reductions in mortality from DPT and Hib. The resulting cost per DALY averted was US$85.75. Table 8 shows the deaths averted, DALY-to-death ratios, and DALYs averted by vaccine component.

Table 8: DALY Estimation Inputs and Outputs

Vaccine component	Deaths averteda	DALY-to-death ratiob	DALYs averted
Diphtheria, pertussis, and tetanus	11	89.38	983.2
Haemophilus influenzae type b	5	89.29	446.5
Total			**1,429.7**

[a] Deaths averted data are from the Lives Saved Tool (LiST), a module of Spectrum. Johns Hopkins Bloomberg School of Public Health/Avenir Health. b DALY-to-death ratio data (for children under five in DRC) are from the Global Burden of Disease Collaborative Network. (2025). Global Burden of Disease Study 2023 (GBD 2023) Results. Institute for Health Metrics and Evaluation.

Cost-effectiveness threshold metrics are summarized in Table 9.

Table 9: DALYs Averted and Cost-Effectiveness Threshold Metrics

Metric	Value
Number of DALYs averted	1,429.7
Total incremental cost, US$	122,596
Cost per DALY averted, US$	85.75
1× DRC GDP per capita threshold, US$	806.80
3× DRC GDP per capita threshold, US$	2,420.40

The bundled intervention package had a cost of US$85.75 per DALY averted, which is below the threshold of 1× GDP per capita. Under this threshold, the intervention would be considered **highly cost-effective**.

Discussion



Photo Credit: Carlo Lechea

INTERPRETATION OF KEY FINDINGS

This economic evaluation examined the costs and effects of a bundled, high-impact intervention package designed to reduce the prevalence of zero-dose children in DRC. The package combined NGCA and door-to-door vaccination, demonstrating a measurable increase in both Penta-1 doses delivered and the number of zero-dose children vaccinated compared with the baseline approaches. However, these gains were accompanied by substantial increases in both financial and total intervention costs. The resulting ICER was approximately US$23.77 per additional zero-dose child vaccinated and US$8.84 per additional Penta-1 dose delivered.

The ICER represents the additional cost of vaccinating one additional zero-dose child at endline compared with the baseline service delivery approach. In this context, the ICER reflects the cost of extending immunization services beyond passive, fixed-site delivery to actively identify and reach children in hard-to-reach communities.

These costs are expected to be higher because zero-dose children are often concentrated in geographically remote communities or areas with limited access to vaccination services, where reaching them requires additional logistical, transportation, and operational investments. Despite these higher costs, the intervention package is highly cost-effective according to the established WHO-CHOICE benchmark.

The bundled EAF package demonstrates that improving equity in immunization coverage requires dedicated financing and targeted investments. Distribution and transportation activities for both NGCA and door-to-door delivery were the primary drivers of these additional costs. Overall, the ICER reflects the marginal cost of supplementing routine health-area service delivery with active strategies to identify and vaccinate zero-dose children.



These gains were accompanied by substantial increases in both financial and total intervention costs.

The resulting ICER was approximately **US$23.77** per additional zero-dose child vaccinated and **US$8.84** per additional Penta-1 dose delivered.

- **The intervention package is highly cost-effective:** Using a cost-effectiveness threshold of 1× to 3× the DRC's GDP per capita, the bundled intervention package was highly cost-effective. Its cost of US$85.75 per DALY averted was approximately 11% of the DRC's GDP per capita and fell well below the 1× GDP-per-capita threshold. Under the WHO-CHOICE GDP–based threshold approach, these findings suggest that the health gains were achieved at a cost that represents good value relative to the country's economic capacity.
- **The package increased reach at a higher cost:** Over the six-month period, the intervention package vaccinated an additional 5,157 zero-dose children—a 24% increase from baseline—and delivered 10,649 additional Penta-1 doses, an 18% increase. These findings suggest that integrated, geographically informed outreach can increase vaccination among children in remote communities and areas with limited access to routine vaccination services. However, this increased reach required additional resources. The average cost per zero-dose child vaccinated increased from US$7.47 at baseline to US$10.68 at endline, reflecting the costs of actively identifying and vaccinating children who were unlikely to access services at health areas. Transportation costs associated with vaccine distribution and supervision trips were a major cost driver. Although the traditional supply chain has a lower cost per dose delivered, it relies on health area staff collecting vaccines from health zones and may lead to stockouts and delays. NGCA requires additional distribution trips and technical assistance but can improve vaccine availability at health areas.
- **Transportation drove costs:** At endline, transportation accounted for 41% of the intervention package's total costs, the largest share of any cost category. Door-to-door vaccination required health worker time, transportation, and logistical support to reach children in their communities. NGCA introduced additional coordination, forecasting, storage, and distribution activities necessary to improve vaccine availability at health areas. These functions complemented door-to-door delivery: NGCA strengthened supply chain reliability and helped reduce stockouts, thereby improving health area readiness to provide vaccination services, while door-to-door visits translated that readiness into increased vaccination uptake and reach among zero-dose children.
- **Sustainability may improve over time:** Although the intervention package was resource-intensive, its longer-term sustainability may be more favorable than its initial costs suggest. A substantial share of endline costs reflected technical assistance costs under NGCA. As capacity is institutionalized within the Ministry of Health, reliance on external technical support is expected to decline, potentially reducing recurrent supervision and support costs. The optimized NGCA distribution model may also yield operational efficiency gains through improved forecasting accuracy and fewer stockouts. Thus, although the bundled package requires deliberate short-term financing, its system-strengthening components could reduce marginal costs over time.
- **Effects of individual components could not be separated:** A key limitation of this evaluation was the inability to disaggregate the effects of the individual intervention components. Because of data constraints, we could not estimate the separate contribution of NGCA and door-to-door vaccination to changes in vaccination outcomes, including the number of children vaccinated through door-to-door visits specifically. This limitation has implications for scalability. Although the bundled package was effective, health planners may need to prioritize or adapt individual components according to local delivery constraints, population needs, and cost structures.

CONTEXTUALIZATION WITH EXISTING LITERATURE

The findings align with evidence from other low- and middle-income countries. The ICER of US$23.77 per additional zero-dose child vaccinated is within the range reported for integrated outreach interventions in comparable settings. For example, an integrated outreach intervention in Pakistan reported a cost of US$47.13 per zero-dose child reached (ThinkWell, 2025), and a review by Munk et al. (2019) reported costs ranging from US$0.66 to US$161.95 per child vaccinated. Direct comparisons should be interpreted cautiously, however, because costing methodologies, health system structures, and target populations differ across studies.

An evaluation of India's Intensified Mission Indradhanush reported a cost of US$327.63 per DALY averted, using an India GDP-based threshold (Clarke-Deelder et al., 2024). However, this estimate is not directly comparable with our study findings because of differences in country context, DALY estimation methods, and price years.

LIMITATIONS

- **Attribution:** Data constraints did not allow for attribution of outcomes to individual intervention components. Routine data systems did not distinguish vaccinations delivered through door-to-door visits and fixed-site sessions. Geo-referenced microplanning was implemented as part of the intervention package to support the identification of zero-dose children; however, cost data for this component were unavailable. As a result, the analysis may underestimate the total cost of the bundled intervention package, and observed outcomes may partially reflect the contribution of this uncosted component.
- **Threshold methodology:** The WHO-CHOICE GDP multiple threshold used in this analysis is no longer considered best practice. An opportunity cost threshold was not available for DRC at the time of the analysis.
- **DALY estimation:** We could estimate health effects for only two of the five diseases the pentavalent vaccine protects against. DPT deaths were used as a proxy for pertussis deaths, and meningitis deaths were used as a proxy for Hib deaths. LiST does not provide separate estimates for deaths from diphtheria or tetanus.
- **Time frame:** The evaluation covers a limited period. Longer-term effects on vaccination coverage, equity, and health system efficiency are unknown.
- **Data quality:** Reliance on routine health management information system data for zero-dose child counts may have introduced reporting inaccuracies or underestimation. The inability to independently abstract zero-dose child counts from health areas also introduces uncertainty into the effectiveness estimates.
- **Generalizability:** These findings are specific to the DRC context and may not be directly applicable to other countries or regions.


Photo Credit: Marcel Baingbo

Recommendations


Photo Credit: Carlo Lechea

This evaluation highlights several important recommendations for donors and policymakers.

FOR DONORS

- **Continue funding the bundled approach:** The package's cost of US$85.75 per DALY averted is well below DRC's GDP per capita of US$806.80. Under the WHO-CHOICE GDP-based benchmark, this suggests the intervention achieved health gains at a cost that represents good value for the health system.
- **Budget for the added cost of reaching zero-dose children:** The bundled package increased the number of zero-dose children vaccinated by 24% and Penta-1 doses delivered by 18%, although at a higher average cost per child. This additional cost reflects the investment required to reach children who are less likely to be vaccinated through routine fixed-site services. Use the average cost per child of US$10.68 as a benchmark for future investments in supply chain and service delivery approaches to actively reach children missed by routine services and the ICER of US$23.77 per additional zero-dose child vaccinated as a decision tool for comparing against alternative investments in supply chain and service delivery.
- **Plan for a transition to government-financed operations:** Sustaining and expanding the equity gains achieved through the bundled package will require transitioning from implementing-partner support to an operating model that the government can finance. Reducing recurrent transportation costs will be particularly important. Integration with existing immunization and primary health care services may help distribute costs across multiple services while maintaining a focus on reaching zero-dose children.

FOR POLICYMAKERS

- **Prioritize efficiency gains as the program scales:** Improve route planning, optimize transportation, strengthen documentation of door-to-door vaccinations, and integrate with other primary health care services to improve value for money over time.
- **Maintain NGCA and door-to-door delivery as complementary investments:** NGCA improves vaccine availability and health system readiness, while door-to-door delivery translates this readiness into vaccination uptake among children missed by routine services. Integrating both approaches within existing primary health care services may strengthen their effectiveness and sustainability.

Conclusion



Photo Credit: Carlo Lechea

The bundled intervention package was an effective, though resource-intensive, strategy for reaching zero-dose children in DRC. Although the EAF interventions had a higher average cost per child vaccinated than the baseline approach, the package extended immunization services to children who had previously been missed by routine fixed-site delivery.

Future implementation should focus on improving the efficiency of the most costly components: transportation, which accounted for 41% of endline costs. Further research should assess the cost-effectiveness of individual intervention components, the long-term sustainability of the package, and its effects on equity to inform future investments in reaching zero-dose children.

Evaluations would also benefit from reporting tools that allow health areas to record vaccinations delivered through door-to-door visits at the point of service. Such data would enable disaggregated cost-effectiveness analysis and clearer estimates of the independent contribution of door-to-door delivery.

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Appendix 1: Detailed Methods



Photo Credit: Patrick Kahondwa

This appendix presents the full study location, sampling, data collection, data cleaning, and detailed costing methodology summarized in the Methods section.

STUDY LOCATION

The study was conducted in Tshopo and Haut-Katanga provinces of the Democratic Republic of Congo (DRC). Primary data were collected from 60 health areas across 10 health zones in these provinces. Table 1-1 lists the interventions, implementing partners, and provinces where each intervention was implemented.

Table 1-1: Interventions and Implementation Locations

Intervention	Implementing partners	Location	
		Haut-Katanga	Tshopo
Direct distribution of vaccination inputs with NGCA	United Nations Children's Fund, VillageReach		X
Door-to-door vaccination and all-contact vaccination to reduce missed opportunities	Central African Growth Fund; Ministry of Public Health, Hygiene, and Prevention; World Health Organization	X	X

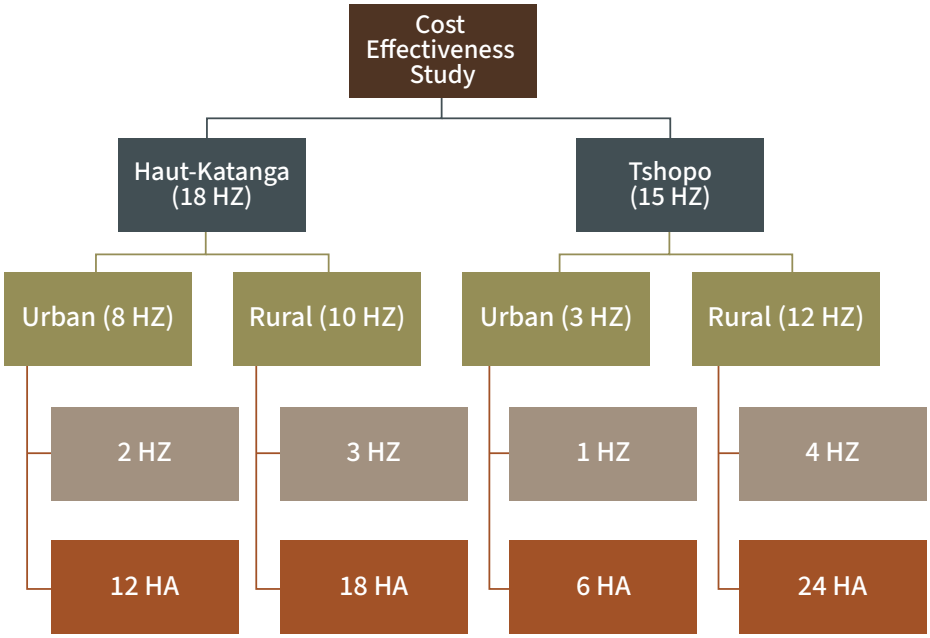
Abbreviation: NGCA, Next Generation Supply Chain Initiative.

SAMPLING AND SAMPLE SIZE

We adopted a stratified random sampling approach to select health zones and health areas for the study. Stratification was based on geographic context (urban and rural) to ensure representation of different service delivery environments, following the current policy for health zone type categorization. Within each stratum, 30% of health zones and health areas were randomly selected for inclusion.

The 30% sampling proportion was selected to balance representativeness and operational feasibility by capturing a representative range of service delivery contexts across the study provinces while remaining sufficient to reflect variability in immunization service delivery and supply chain performance. This yielded a sample size of 60 health areas across 10 health zones in the two provinces (Figure 1-1).

Figure 1-1: Representation of the Sampling of Health Zones and Health Areas



Abbreviations: HA, health area; HZ, health zone.

SELECTION OF HEALTH ZONES AND HEALTH AREAS

Using the Android application "Randomizer," we conducted simple random sampling to select 30% of the total health zones within each stratum, then 30% of the total health areas from the selected health zones.

See Appendix 2 for a full list of the areas in the sample set.

DATA COLLECTION

VillageReach collected data at baseline (October 2023 to March 2024) and endline (January to June 2025) in Tshopo and Haut-Katanga provinces, across the sampled health areas (Appendix 2). We used a mixed methods approach, combining both primary data collection through structured questionnaires administered during interviews, with secondary data abstraction from routine administrative systems. All interviews were conducted in person: baseline interviews were conducted between October 2024 to November 2024, and endline interviews between October 2025 and November 2025. The VillageReach DRC monitoring and evaluation team led, trained, and supervised data collectors.

Ethical approval was obtained from the Kinshasa School of Public Health Ethical Review Committee, and all respondents provided written informed consent. Primary data collection tools, including structured cost questionnaires administered at the health area level, were digitized and deployed using KoboCollect.

We obtained cost data from several sources:

- Health worker interviews to estimate time allocation and other costs associated with supply chain functions and door-to-door visits
- VillageReach financial records, including financial ledgers
- Excel-based labor-allocation surveys administered to the technical assistance team

Vaccination outcomes were extracted from the national health information system (DHIS2). These data included health-area-level reports of pentavalent vaccine first doses (Penta-1) administered, the number of zero-dose children vaccinated, and vaccination counts at baseline and endline.

DATA CLEANING AND VALIDATION

Data cleaning procedures included cross-checking the completeness of health area reporting for the baseline and endline periods and aggregating health area reports to calculate cumulative totals for each period. Health areas reporting negative changes between baseline and endline were retained in the analysis because these changes reflected fluctuations in service delivery.

A zero-dose child was defined as a child, 12 to 23 months of age, who had not previously received any routine vaccinations and who received Penta-1 during the reporting period.

Cost data were reviewed for completeness and internal consistency before analysis. Health worker time devoted to service delivery and supply chain activities was valued using reported salary levels. Volunteer contributions were excluded from the costing analysis because reliable estimates of time use were unavailable. Cold chain equipment costs were annualized using straight-line depreciation over the equipment's expected useful life.

Costs were aggregated across the sampled health areas for the baseline and endline periods. For the endline analysis, VillageReach costs for distribution, supervision, and technical support were added to health system costs.

DETAILED COSTING APPROACH

NEXT GENERATION SUPPLY CHAIN INITIATIVE COST CATEGORIES

A targeted micro-costing approach was used to identify, measure, and value the resource inputs expected to differ between the traditional and optimized supply chain systems. Because provincial and health zone costs were assumed to be similar at baseline and endline, primary cost data collection focused on the health area level, where the main differences in resource use were expected, including reduced trips by health areas to pick up vaccine orders from the health zone. Endline costs additionally included detailed costing of activities supported by VillageReach.

Using the pre/post evaluation approach, we compared the optimized NGCA supply chain to the traditional supply chain system. We assumed that health system costs at the provincial and health zone levels were similar at baseline and endline, with the major input being the parts of the supply chain supported by VillageReach, and that the main cost differential would appear at the health area level. We therefore collected primary data on supply chain costs at the health area level at both baseline and endline. Baseline costs reflect the traditional supply chain system; endline costs reflect the improved system, including VillageReach's technical assistance in supporting quantification and forecasting, distribution planning, workshop costs, and supervision visits, as well as embedded technical support within the Ministry of Health in Tshopo. To estimate endline costs, we reviewed secondary data and VillageReach's financial records to identify expenses incurred in supporting supply chain activities.

The costing approach drew on the USAID | DELIVER PROJECT method for supply chain costing (McCord, Tien, & Sarley, 2013), applied here to cost distribution and supporting activities. Costs are reported using a functional breakdown for cost categories (management, storage, and transportation) but exclude procurement costs. Table 1-2 lists the NGCA cost categories and inputs for baseline and endline.

We included only costs directly related to distributing routine immunization commodities. For example, if a health worker spent two days in a month picking up vaccines and supplies, only that proportion of the salary (2 days out of 22 working days in the month) was included in the final costs. If a trip was only half devoted to vaccine distribution, only half of that proportion was included. The same principle applied to all cost-bearing activities.

Table 1-2: NGCA Cost Categories and Cost Inputs

Cost categories	Description	Baseline cost inputs	Endline cost inputs
Management	Costs related to administering the supply chain, including operational costs such as supervision and training, as well as management labor and expenses for health workers located in the health area.	• Health worker time at the health area to support essential supply chain management functions, including supervision, forecasting, and quantification.	• Health worker time at the health area to support essential supply chain management functions, including supervision, forecasting, and quantification. • VillageReach staff time spent on quantification and forecasting.
Storage	Costs related to equipment, labor, and storage activities.	• Labor for storage activities (e.g., packing). • Cold chain equipment costs.	• Labor for storage activities (e.g., packing). • Cold chain equipment costs.
Transportation	Costs related to commodity distribution, including labor (e.g., health area staff time for collecting commodities), fuel, vehicle depreciation, and related expenses.	• Health worker time (labor costs) to pick up vaccines. • Transportation costs, including vehicle-related costs and public transportation costs.	• Health worker time (labor costs) to pick up vaccines. • Transportation costs, including vehicle-related costs and public transportation costs. • VillageReach staff time to support vaccine distribution. • VillageReach vehicle and fuel costs for distribution trips.

BUNDLED PACKAGE COST CATEGORIES

The two Equity Accelerator Fund (EAF) zero-dose interventions were evaluated as a bundled package, given their interdependencies and data constraints, to assess their combined effect on zero-dose outcomes.

Door-to-door visits were originally intended to be evaluated as a standalone intervention. However, routine immunization registers did not reliably distinguish vaccinations delivered through door-to-door visits, and as a result, vaccination outcomes could not be attributed to door-to-door visits alone. In addition, door-to-door visits relied on vaccine availability, which NGCA helped optimize. Improvements in vaccine flow likely contributed to the vaccination outcomes observed during the study period.

We still conducted a standalone analysis of NGCA (methodology presented earlier) to show cost drivers and efficiency levels achieved by NGCA alone.

To estimate the costs of the bundled intervention package, we combined the costs of door-to-door visits, NGCA activities, and routine fixed-site service delivery to capture the full endline service delivery model. Door-to-door visits complemented, rather than replaced, fixed-site vaccination services. For this reason, bundled-package costs include both delivery approaches.

Table 1-3 presents the cost categories for fixed-site and door-to-door delivery, highlighting the main inputs and cost drivers for both activities. These included health worker time, cold chain equipment used for outreach, and transportation and logistics support funded through the EAF grant. Costs were collected at the health area level. Vaccine costs were excluded from the evaluation.

Table 1-3: Door-to-Door Cost Categories and Cost Inputs

Cost category	Cost inputs	
	Fixed-site service delivery (baseline)	**Door-to-door service delivery (endline)**
Personnel costs	Health worker time spent at fixed-site sessions for vaccination and reporting	Health worker time spent conducting door-to-door visits for vaccination and reporting
Cold chain equipment costs	Cold chain equipment costs	Cold chain equipment costs
Transportation costs	Not applicable	Transportation costs for movement within communities during door-to-door visits

To estimate personnel costs for door-to-door visits, health worker time was costed using their reported hours for door-to-door visits, multiplied by the number of sessions during the study period. We also included a monthly health area-level allocation of US$27 in the cost estimation, as specified in the intervention design. However, disbursement records could not be verified.

Appendix 2: Total Outcome Data


Photo Credit: Carlo Lechea

This appendix shows the total number of zero-dose children vaccinated at baseline and endline for each health zone and health area, along with the incremental change between the two periods.

Table 2-1. Number of Zero-Dose Children Vaccinated at Baseline and Endline by Health Area

Health zone	Health area	Settlement type	Total number of zero-dose children vaccinated (baseline)	Total number of zero-dose children vaccinated (endline)	Incremental number of zero-dose children vaccinated	Total number of Penta-1 doses delivered (baseline)	Total number of Penta-1 doses delivered (endline)	Incremental number of Penta-1 doses delivered
Banalia	Alolo	Rural	165	180	15	500	640	140
Banalia	Baloma	Rural	137	175	38	370	605	235
Banalia	Bopepe	Rural	178	238	60	420	790	370
Banalia	Kole	Rural	148	219	71	440	640	200
Banalia	Mosanda	Rural	144	260	116	470	820	350
Banalia	StElisabeth	Rural	180	178	-2	580	1,175	595
Basoko	Ambambe	Rural	229	463	234	516	1,422	906
Basoko	BanduCité	Rural	343	372	29	1,020	980	-40
Basoko	BanduCol-lectivite	Rural	216	284	68	610	1,005	395
Basoko	Lokutu	Rural	287	353	66	650	820	170
Basoko	Mambandu	Rural	185	216	31	610	885	275
Basoko	Toyokana	Rural	226	340	114	832	1,030	198
MakisoKi-sangani	Boyoma	Urbain	776	1,062	286	2,800	2,020	-780
MakisoKi-sangani	Libota	Urbain	474	898	424	1,475	1,740	265
MakisoKi-sangani	MacMillan	Urbain	200	610	410	638	1,685	1048
MakisoKi-sangani	Mandombe	Urbain	314	688	374	930	2,030	1,100

MakisoKi-sangani	Neema	Urbain	713	1,337	624	1,960	2,010	50
MakisoKi-sangani	Paix	Urbain	527	690	163	1,605	2,065	460
Yakusu	LotokilaEtat	Urbain	208	245	37	600	910	310
Yakusu	Yaboya	Rural	144	209	65	450	650	200
Yakusu	Yalokombe	Urbain	187	190	3	610	875	265
Yakusu	Yalotcha	Rural	149	180	31	460	660	200
Yakusu	Yanonge	Rural	187	265	78	1,465	880	-585
Yakusu	Yaoseko	Urbain	180	311	131	720	990	270
Yaleko	Itokola	Rural	131	171	40	385	740	355
Yaleko	Lisuma	Rural	95	148	53	390	485	95
Yaleko	Losanganya	Rural	156	206	50	450	730	280
Yaleko	Yakoko	Rural	531	338	-193	640	980	340
Yaleko	Yambela	Rural	168	190	22	316	795	479
Yaleko	Yatolema	Rural	336	325	-11	1,020	1,515	495
Kafubu	Adra31	Rural	268	221	-47	465	270	-195
Kafubu	Kafubu	Rural	182	344	162	90	810	720
Kafubu	Kikanda	Rural	365	317	-48	1,440	870	-570
Kafubu	Kikwanda	Rural	269	222	-47	300	177	-123
Kafubu	Kiwele	Rural	181	103	-78	360	850	490
Kafubu	Sambwa	Rural	227	213	-14	760	600	-160
Kapolowe	kapolowe-Gare	Rural	522	574	52	1,225	1,280	55
Kapolowe	Katanga	Rural	494	588	94	1,240	1,500	260
Kapolowe	Kibangu	Rural	310	346	36	980	980	0
Kapolowe	Koni	Rural	446	527	81	1,330	1,525	195
Kapolowe	Kyembe2	Rural	387	547	160	1,125	970	-155
Kapolowe	Ndakata	Rural	391	651	260	745	1,825	1,080
Kikula	Kampemba	Urbain	574	641	67	3,095	2,265	-830
Kikula	Kanona	Urbain	215	278	63	685	1,001	316
Kikula	Kapenda	Urbain	559	721	162	1,660	1,861	201

Kikula	Kibadi	Urbain	503	583	80	1,735	1,720	-16
Kikula	Kyubo	Urbain	475	537	62	2,420	1,561	-860
Kikula	Musumba	Urbain	702	951	249	1,259	1,573	315
Kipushi	GCM	Urbain	415	331	-84	985	1,020	35
Kipushi	Kawama	Rural	497	684	187	1,185	1,165	-20
Kipushi	Kinsevere	Rural	521	520	-1	1,198	1,195	-3
Kipushi	Lumata	Rural	451	392	-59	855	721	-134
Kipushi	Mabaya	Rural	204	209	5	790	420	-370
Kipushi	Mimbulu	Rural	343	380	37	1,355	1,113	-242
Kisanga	JamaaYetu	Urbain	1,117	1,213	96	2,520	2,738	218
Kisanga	Kasungami2	Urbain	330	511	181	615	955	340
Kisanga	Kiboko	Urbain	461	447	-14	640	883	243
Kisanga	Mutuale	Urbain	538	561	23	1,052	1,116	65
Kisanga	Peage	Urbain	464	533	69	1,204	1,397	193
Kisanga	Somika	Urbain	774	770	-4	1,115	2,077	962
TOTAL			**21,099**	**26,256**	**5,157**	**58,359**	**69,008**	**10,649**