Analyses of Costs and Financing of the Routine Immunization Program and New Vaccine Introduction in the Republic of Moldova

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Final study results
28 November, 2013

This study was conducted as part of a multi-country analysis of the costing and financing of routine immunization and new vaccines (EPIC) supported by the Bill & Melinda Gates Foundation. The methods were derived from a Common Approach developed for this exercise

Country Context

Population: 3,559,500

Area: 33,846 km²

GDP P/C(PPP): $3,415 (2012)

Health Spending (2011)

THE-% GDP: 11.7%

GGHE-%THE: 45.8%

P/C THE (PPP): $350

Introduction
Organization of immunization services-Facility Taxonomy

- **FMC** - Family Medicine Centres serve a population ranging from 40,000 to 80,000 inhabitants

- **HC** - Health Centres usually established for 4,500 inhabitants

- **OFD –** Office of a Family Doctor serve between 900-3,000 inhabitants

- **HO -** Health Offices serve up to 900 residents

In all primary health care facilities immunization is delivered as a fixed strategy, no outreach activities are being carried out

Methods: Selection of facilities:

Multi-stage stratified random sampling

I stage: selection of districts

- Districts were stratified into three groups by number of total doses delivered in 2011 (Low, medium and high doses administered)

- In each stratum two districts were chosen by a <u>simple random sampling approach</u>

In total 6 districts out of 37 : 2 with low doses, 2 medium and 2 high doses

Methods: Selection of facilities:

II stage: selection of facilities

- Proportions of urban/peri-urban and rural facilities from the total number of facilities in the sampled districts were estimated

- These proportions were applied to calculate the number of rural and urban/peri-urban facilities to be included in the sample

- One peri-urban facility was chosen in each sampled district and three urban facilities were randomly selected in the capital city

- If more than one peri-urban facility existed in a district, simple random sampling approach was used

- Rural facilities were selected using systematic random sampling

In total 50 PHC facilities: 8 urban/peri-urban and 42 rural facilities
5 FMCs, 10 HCs, 23 OFDs and 12 HOs

Methods: Summary of facility selection

District	URBAN		RURAL	
	Sampled facilities	Total Facilities in District	Sampled facilities	Total Facilities in District
Briceni	1	2	7	31
Calarasi	1	1	8	35
Chisinau	3	26	2	9
Leova	1	2	7	32
Ungheni	1	2	17	70
Vulcanesti	1	1	1	4
Total	**8**	**34**	**42**	**181**

Methods: Data collection

- **Duration:** October 3rd 2012 to January 14th 2013

- Structured questionnaires

- Questionnaires were field-tested and adjustments incorporated

- **Data collection methods:**
  - Key informant interviews
  - Facility observation
  - Record review

EPI Costing

Cost analysis

- Costs were calculated retrospectively for 2011

- Ingredient costing approach

- Financial and Economic costs
  - **Financial cost** -capital costs were annualized using straight line depreciation method
  - **Economic cost-** capital costs were annualized using a 3% discount rate

- Country specific useful life years for different capital items were applied

Cost analysis

Different cost allocation methods:

- **Labour cost-** percentage of staff time spent on immunization in a given facility

- **Cost of vehicles and vehicle maintenance costs** - proportion of km travelled for routine immunization out of total km travelled in 2011

- **Building costs** - proportion of square meters designated for routine immunization (where vaccines are administered, stored) out of total facility space.

Cost analysis

Unit costs:

- *Total Unit Cost* **(TUC)-** includes salaries for shared labour

- *Unit Costs* **(UC) -**without salaries

  - **Cost per dose delivered**

  - **Cost per FIC**

    - FIC-child < 1, who received DTP 3 doses
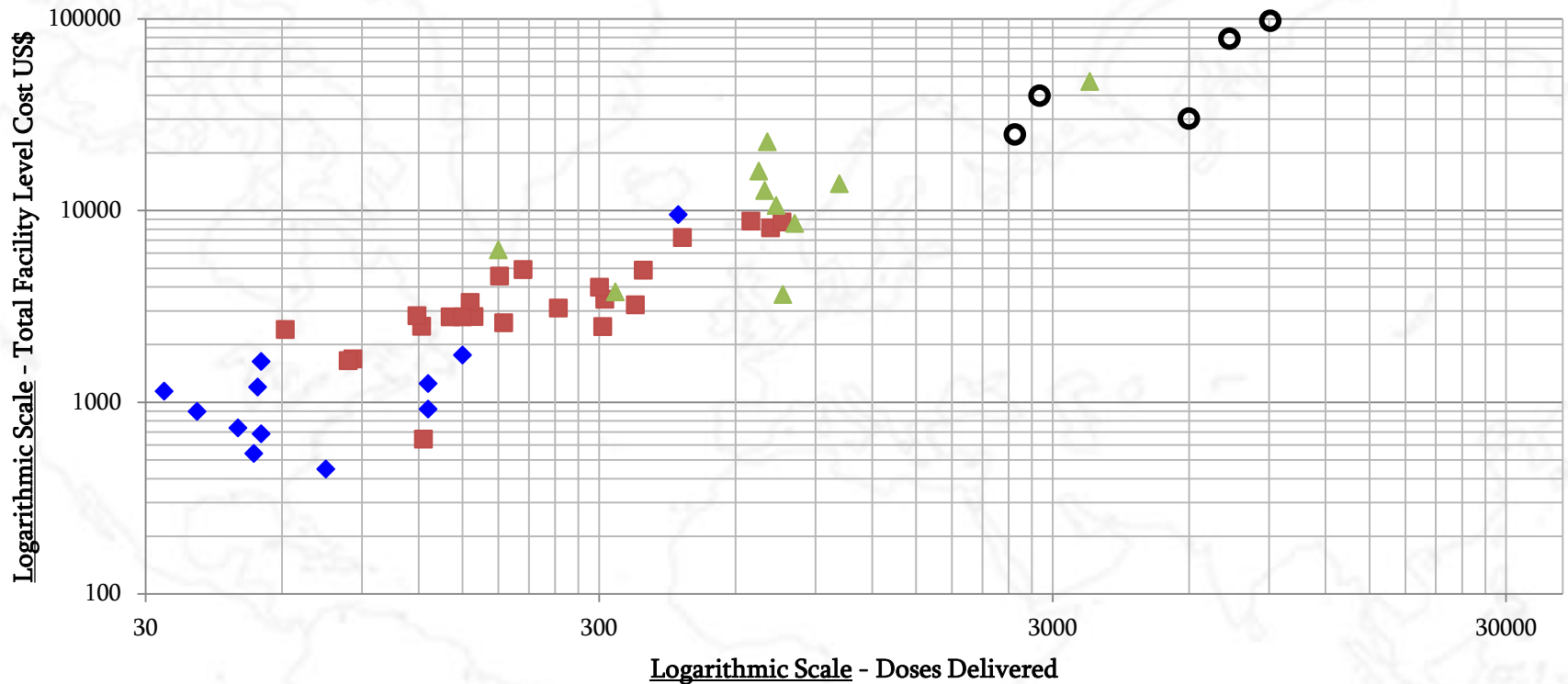
  - **Cost per Infant**

Results
Total facility costs and their variation

# Total economic cost by facility measured by number of doses delivered

Legend: ◆ HO ■ OFD ▲ HC ○ FMC

Y-axis: Logarithmic Scale - Total Facility Level Cost US$ (100, 1000, 10000, 100000)

X-axis: Logarithmic Scale - Doses Delivered (30, 300, 3000, 30000)

- The total facility level immunization costs varied between 449$US and 97,572 $US mean - 10,532 $US and median- 3,372 $US
- Strong positive linear correlation between the total facility cost and scale of the facility

Total economic costs by facility type and average DTP3 coverage (%)
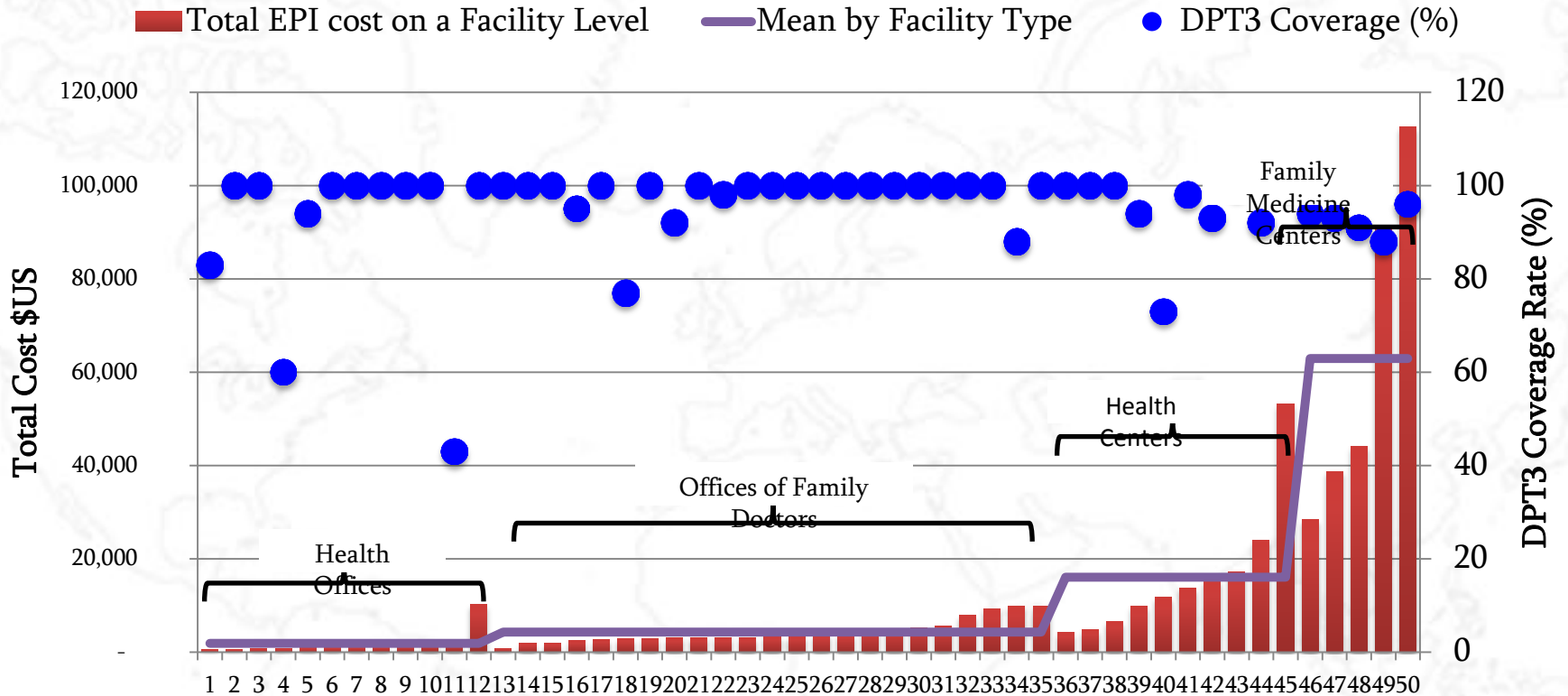
- **Total facility cost varied by facility type, size of the facility and number of infants**
- **Total facility level costs grew from HOs that are the smallest to FMCs that are the largest**
- **HCs and OFDs achieve the highest DTP3 coverage rate , HOs has poorest performance**

Facility staffing and communities where facilities operate

Facility type	# of infants in catchment area	Population in catchment area	Staffing
FMCs	430 (95%CI: 372-487)	32,616	Doctors and Nurses
HCs	47 (95%CI: 39-54)	3,737	Doctors and Nurses
OFDs	17 (95%CI: 16.1 – 18.3)	1,555	Doctors and Nurses
HOs	7 (95%CI: 6.7-7.9)	535	Only nurses

Results
Unit cost structure

Unit Cost Structure by facility type

Chart legend:
- Other capital costs
- Cold chain equipment
- Building
- Other recurrent
- Printing
- Utilities and communications
- Vaccines
- Salaried Labor

Data values shown in bars:

Category	FMC	HC	OFD	HO
Building	0.19	0.77	2.27	4.61
Vaccines	13.46	7.68	8.2	7.71
Salaried Labor	70.48	73.25	68.11	54.42
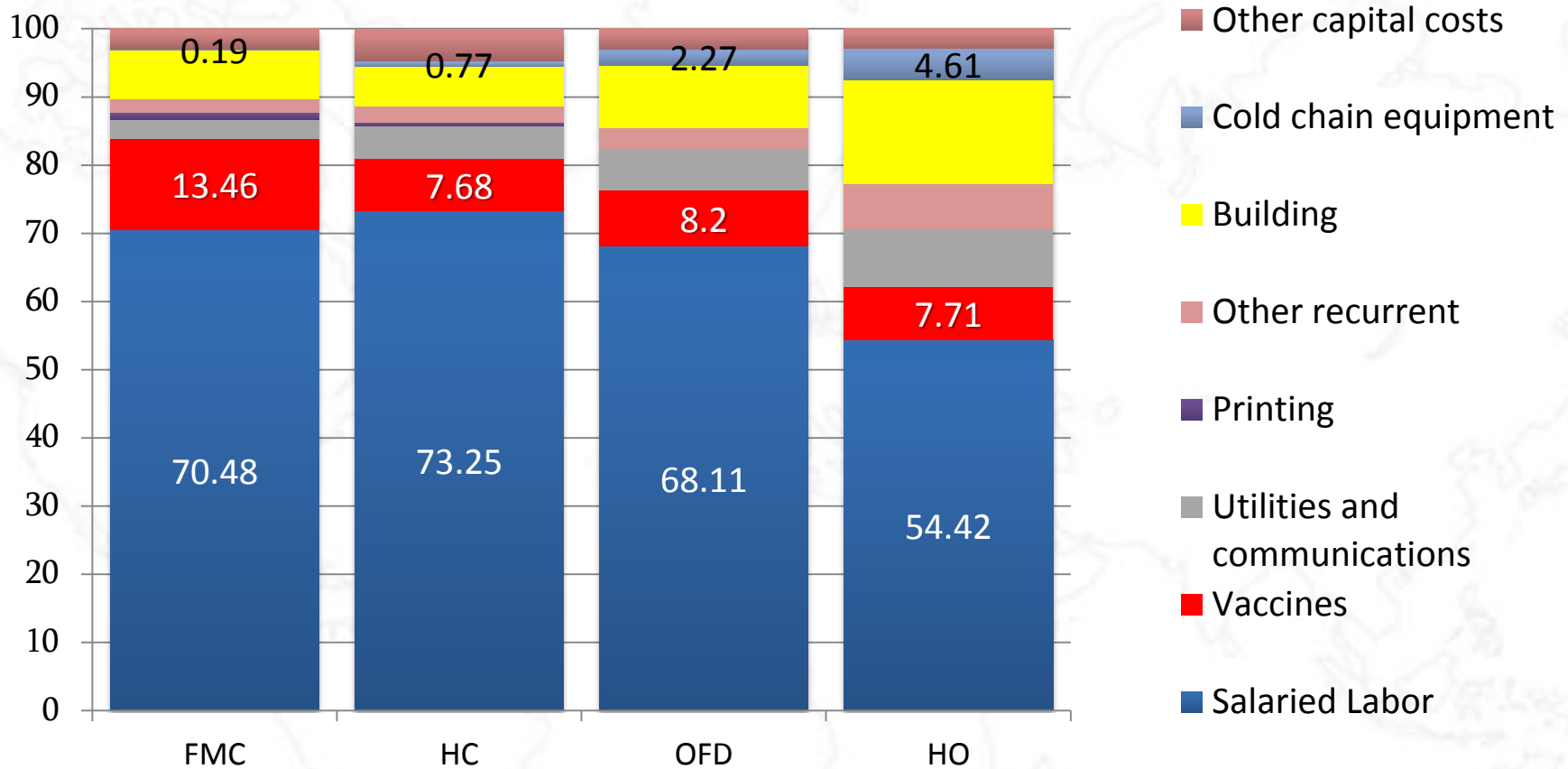
Labour cost is a main cost driver-immunization is labour intensive in Moldova

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Results
Unit Cost Structure by facility type and intensity

	Recurrent cost	Capital cost
HO	77.2	22.8
OFD	85.4	14.6
HC	88.7	11.3
FMC	89.7	10.3

Facility Type — 70% 80% 90% 100%

	Capital cost	Recurrent cost
High	9.3	90.7
Medium	12.3	87.7
Low	23.1	76.9

Facility scale — 100% 95% 90% 85% 80% 75% 70%
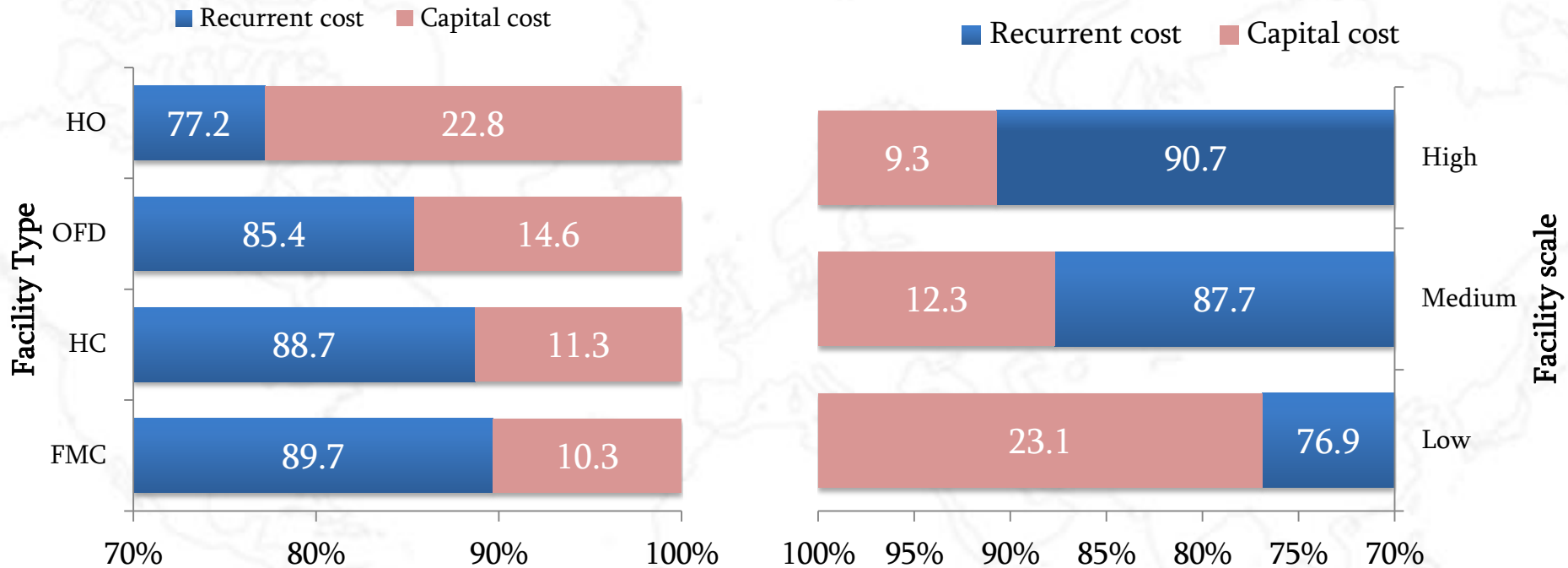
- Share of recurrent and capital costs vary across type of providers and by immunization intensity
- Share of capital costs in a unit cost of FMCs is lowest and highest in HOs, lowest in high intensity facilities and highest in low intensity facilities
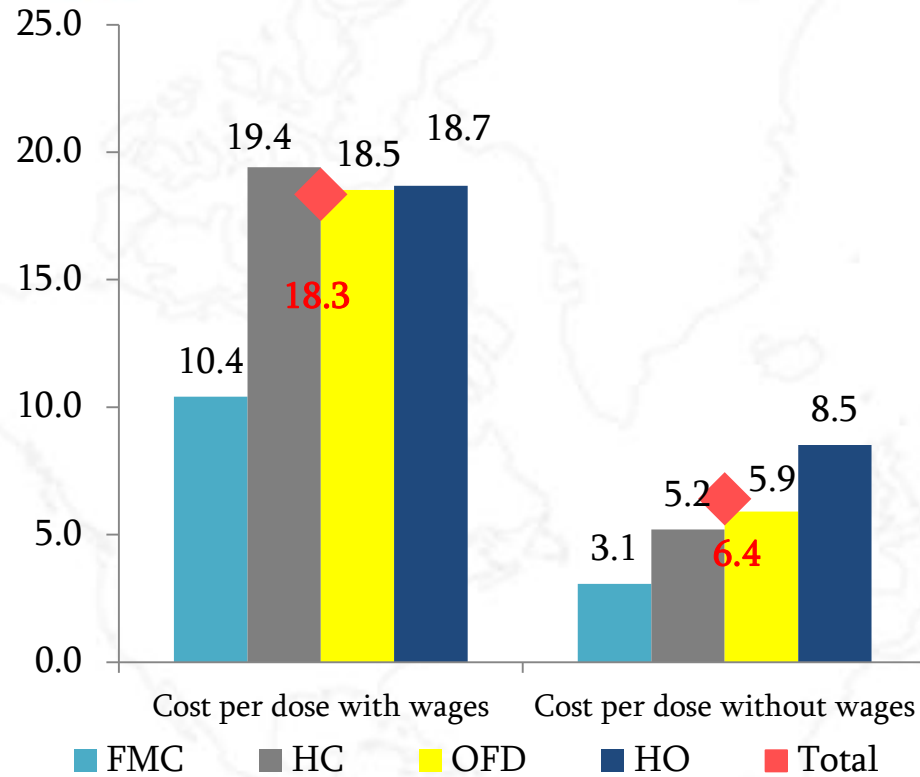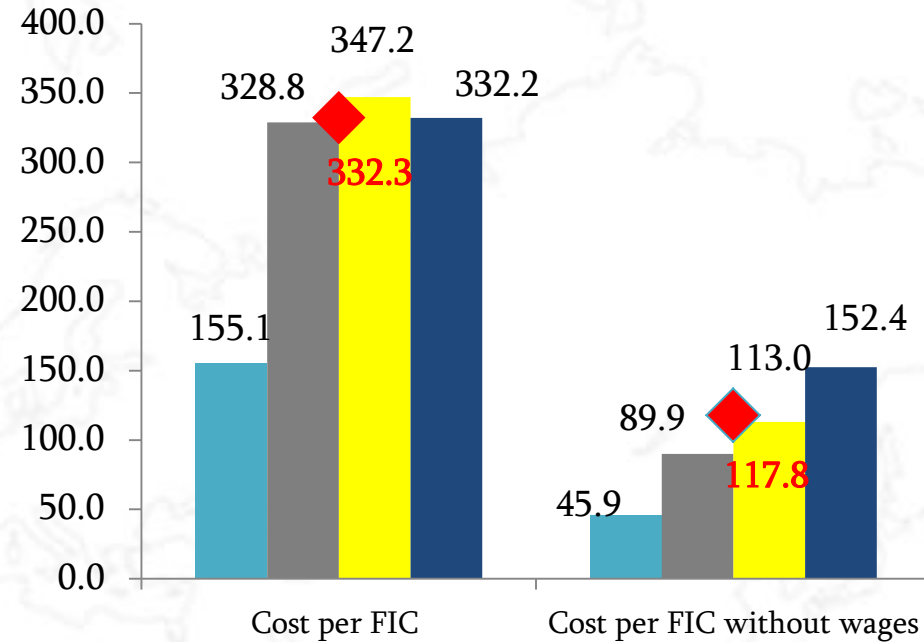
Results
# Unit costs and their variation

Cost per dose by facility type

Cost per FIC by facility type

- Unit costs increase when facility size declines- statistically significant only when shared labour costs are removed
- Mean costs in HCs and OFDs are in the same range and almost two times higher compared to unit costs in FMCs.
- Contribution of labour costs in the unit cost declines in smaller facilities

Cost per dose by location
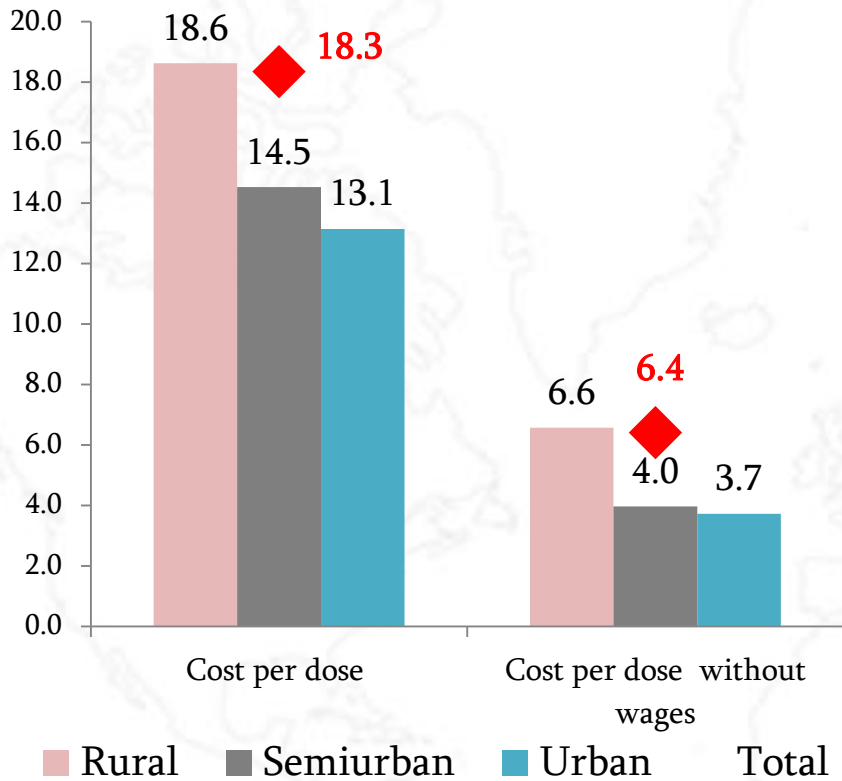
Cost per FIC by location
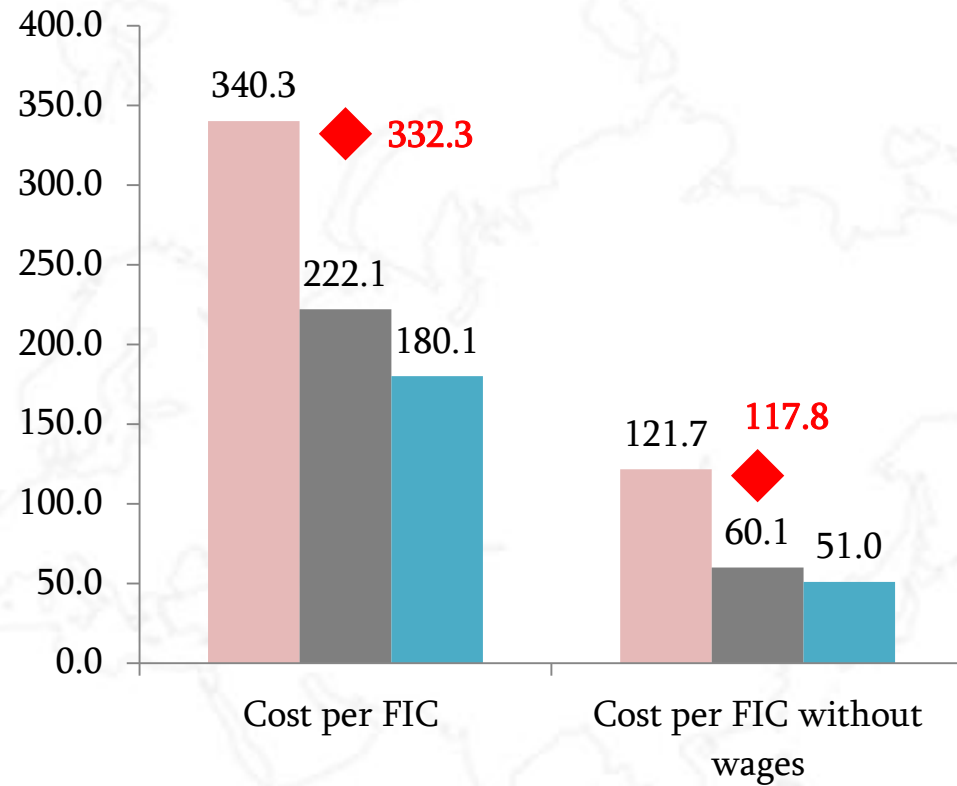
- **Unit costs decline from rural to urban facilities but differences are not statistically significant**

Cost/dose by facility scale $2011

Cost/FIC by facility scale$2011

Left chart — Cost/dose by facility scale $2011:
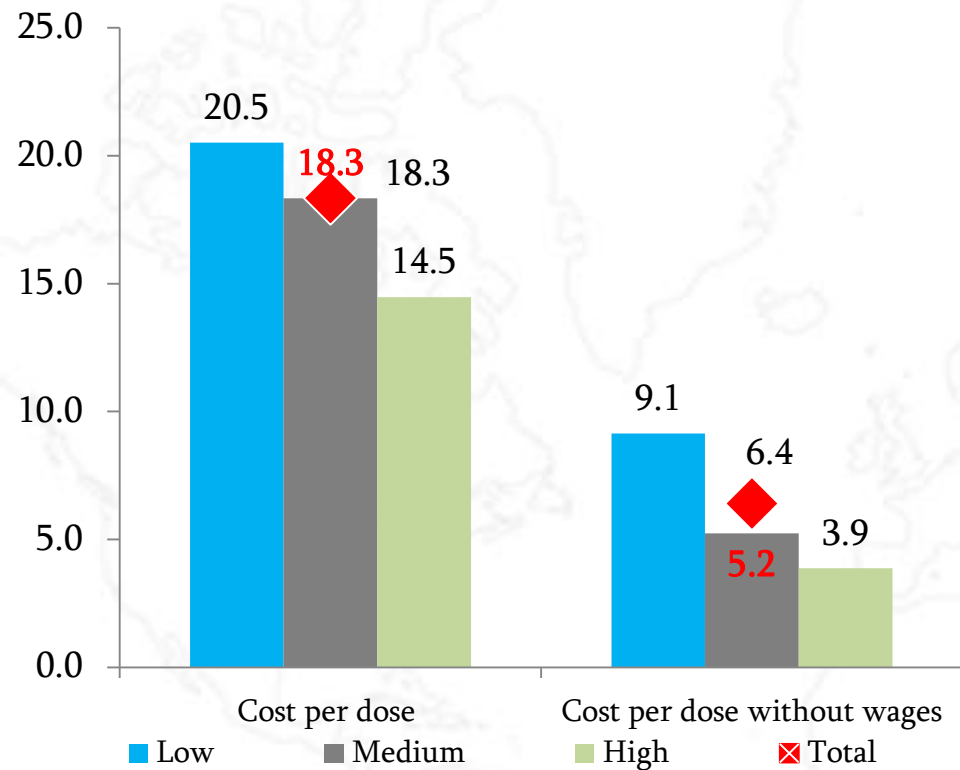
Cost per dose:
- Low: 20.5
- Medium: 18.3
- High: 14.5
- Total: 18.3

Cost per dose without wages:
- Low: 9.1
- Medium: 5.2
- High: 3.9
- Total: 6.4

Right chart — Cost/FIC by facility scale$2011:

Cost per FIC:
- Low: 357.5
- Medium: 359.7
- High: 231.2
- Total: 332.3

Cost per FIC without wages:
- Low: 167.3
- Medium: 101.7
- High: 61.6
- Total: 117.8

Legend: Low, Medium, High, Total
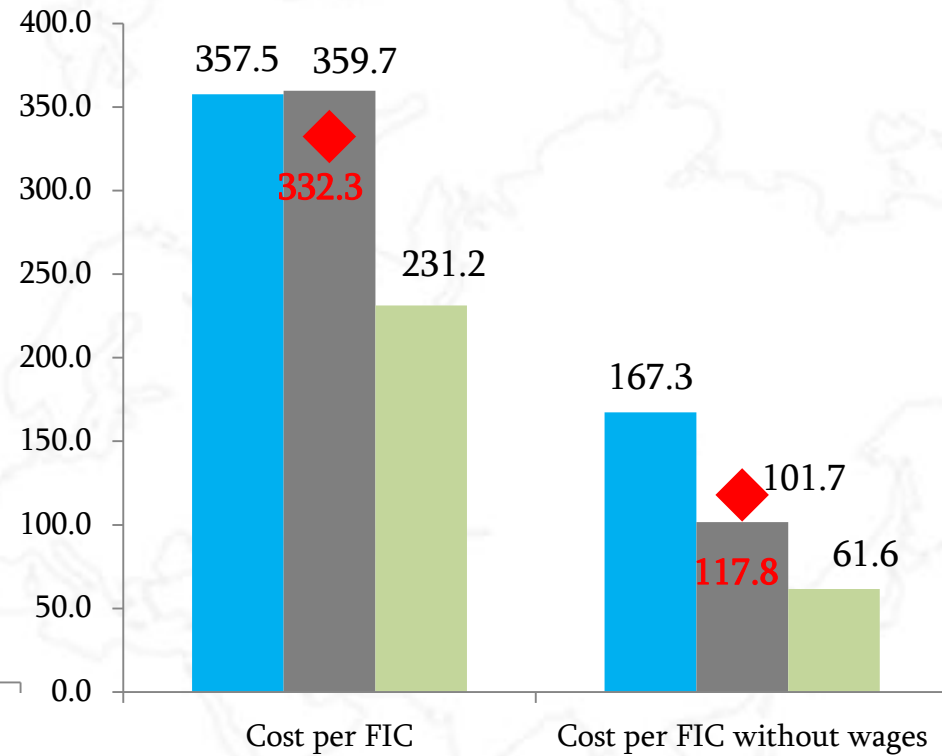
- The higher the scale the lower unit costs.
- When shared labour cost are considered difference in unit costs between facilities with low and medium scale is marginal.
- When shared personnel costs are removed difference increases and becomes statistically significant (at 99% level)

Facility Unit costs without shared labor costs by facility scale

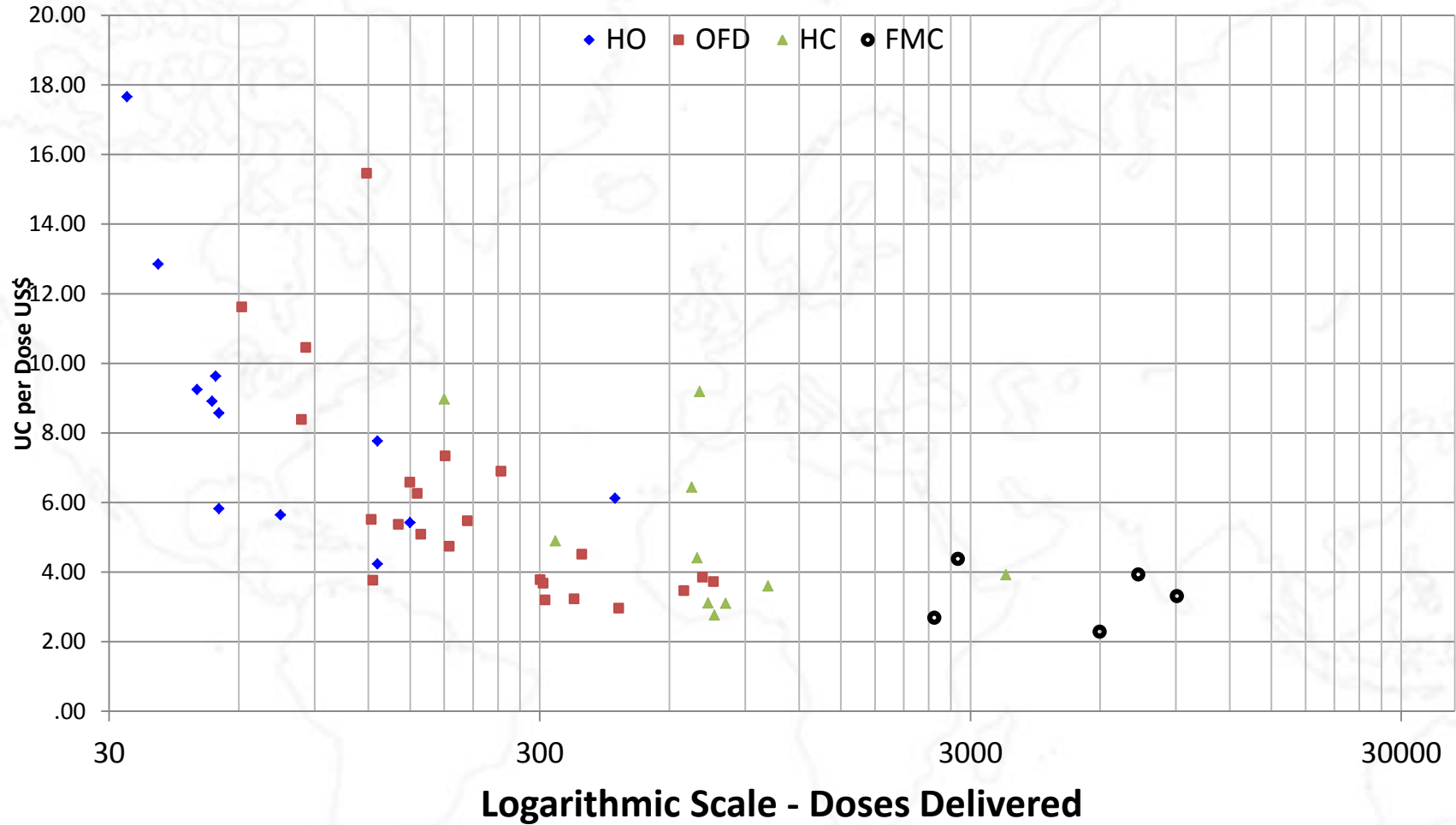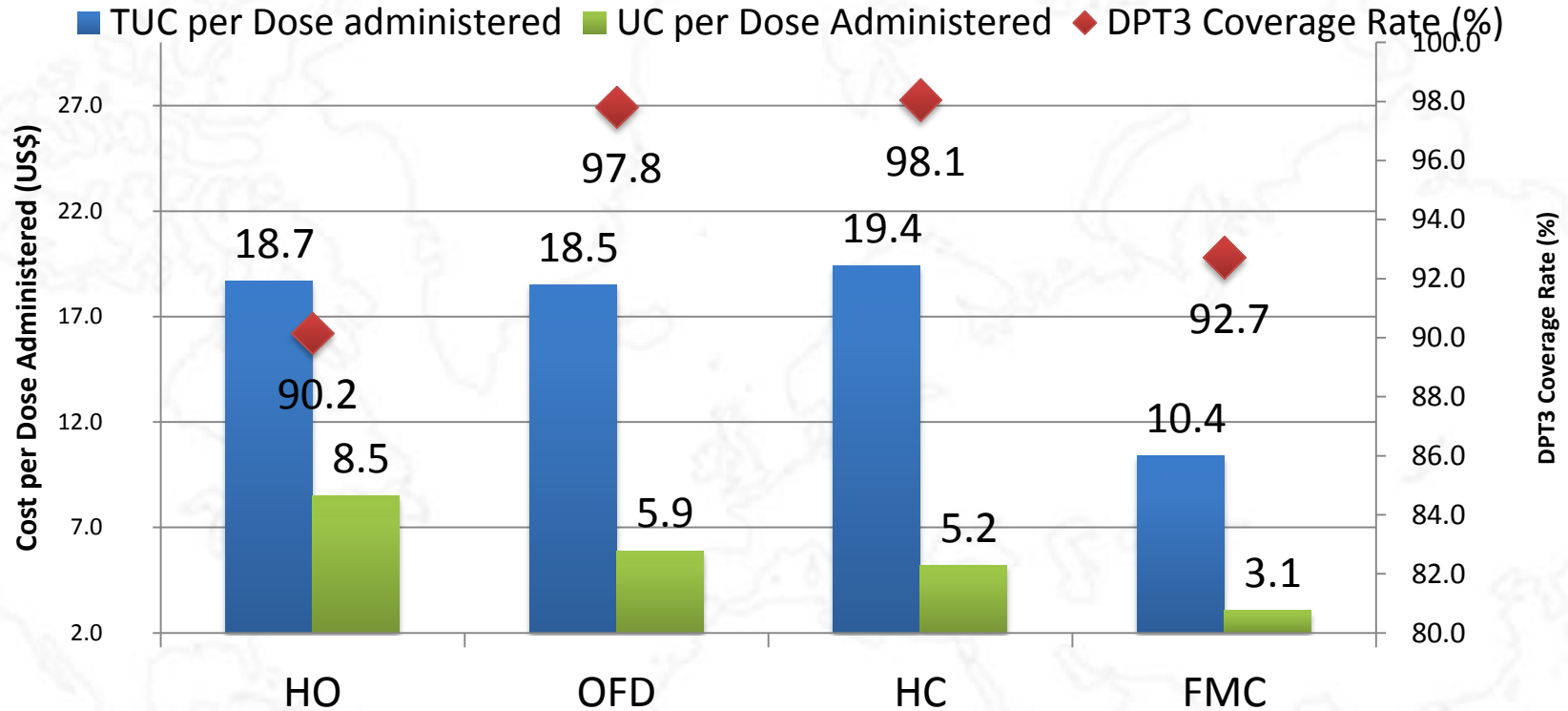© Curatio International Foundation

Unit Costs and Immunization Program Performance

Legend: TUC per Dose administered, UC per Dose Administered, DPT3 Coverage Rate (%)

Chart data:

Facility	TUC per Dose administered	UC per Dose Administered	DPT3 Coverage Rate (%)
HO	18.7	8.5	90.2
OFD	18.5	5.9	97.8
HC	19.4	5.2	98.1
FMC	10.4	3.1	92.7

Y-axis (left): Cost per Dose Administered (US$)
Y-axis (right): DPT3 Coverage Rate (%)

TUC- unit cost with shared labor cost; UC – unit cost without shared labor cost

- HCs spend highest amount per dose but also achieve highest coverage rates
- HOs spend comparable amount per dose with OFDs and HCs, but have lowest DTP3 coverage
- FMCs deliver immunization at a lowest cost per dose, but coverage is relatively low

COST AGGREGATION

Cost Element	Economic Costs	Financial Costs	Difference
Average facility cost without vaccines and injection supplies	$ 6,160	$ 5,906	$ 254
Total number of facilities in the country	1318	1318	
Total facility level immunization program cost without vaccines and injection supplies	$ 8,119,394	$ 7,784,266	$ 335,128
Average district cost without vaccines and injection supplies	$ 14,497	$ 13,360	$ 1,137
Total number of districts	37	37	
Total district cost without vaccines and injection supplies	$ 536,404	$ 494,335	$ 42,069
National cost without vaccines and injection supplies	$ 142,063	$ 132,489	$ 9,574
Cost of vaccines and injection supplies	$ 1,058,706	$ 1,058,706	-
Total National level immunization economic cost with vaccines and injection supplies	$ 9,856,567	$ 9,469,796	$ 386,771

Main Conclusions and Policy Implications

Main conclusions

- Labour inputs are significant cost drivers of a unit costs and consequently to the total cost of the immunization program

- Unit costs are related to the size and scale of the facility
  - Unit costs decline
    - From rural to urban facilities, but not significant
    - From smallest to largest facilities
    - From low scale facilities to high scale/Facilities with a grater scale are able to deliver services more efficiently

- Smaller facilities seem to utilize capital less effectively compared to and bigger facilities delivering immunization services on a greater scale

Main conclusions

- Facility characteristics have influence on facility performance measured by achieved DTP 3 coverage

  - Small size of catchment population allows <u>HCs and OFDs to better identify, plan and follow-up infants and achieve higher coverage rates</u>

  - Due to large size of catchment population <u>FMCs may face challenges in finding and immunizing children</u>

How to increase effectiveness?

Context: Moldova is focusing on increasing health system efficiency through various means, including infrastructure optimization

Based on our study findings reducing staff time spent on immunization could help increase efficiency of the program

- Delegating certain immunization related tasks from doctors to nurses

- Reducing time spend on management and/or record-keeping functions➔ **design and include immunization modules in new e-health system that is being developed**

How to increase coverage?

✓ **Place more** importance **on FMCs rather than HOs**

- Increasing coverage in HOs will be **more costly** and **marginal impact on the overall program performance will be minimal** due to low number of children covered by these facilities and also low number of underperforming facilities

- Improving performance of FMCs will be **less costly** due to lowest cost per dose and per FIC **and overall impact on the national program performance is expected to be greater**

What is important to consider when designing new policies?

- **Context:** Moldova is considering reforms after graduating from the GAVI. Namely, it may decentralize vaccine procurement responsibilities due to mandates imposed in the national legislation/regulation.

- **Based on our findings:** centralized model of immunization service delivery, when national level controls the prices/costs of centrally provided or regulated inputs seems most effective

- Decentralization in vaccine purchase and delivery may increase overall EPI costs significantly

Financial flow analysis
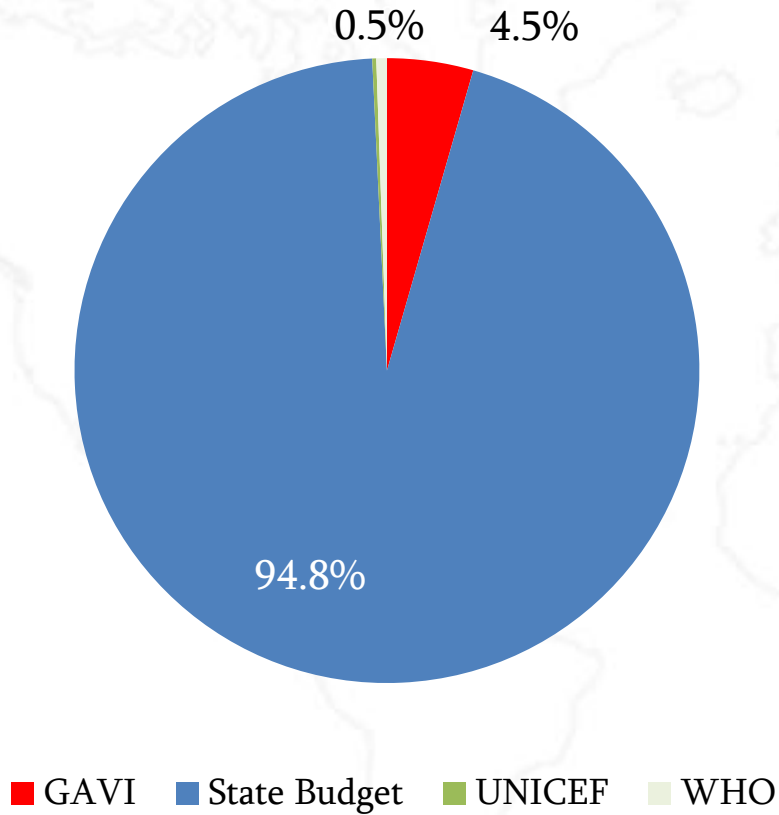
Sources of Funds → Republican Budget | GAVI | Private Corporations & Population | UNICEF,WHO

Financing Schemes → Ministry of Health | National Drug Agency | National Health Insurance Company | UNICEF & WHO
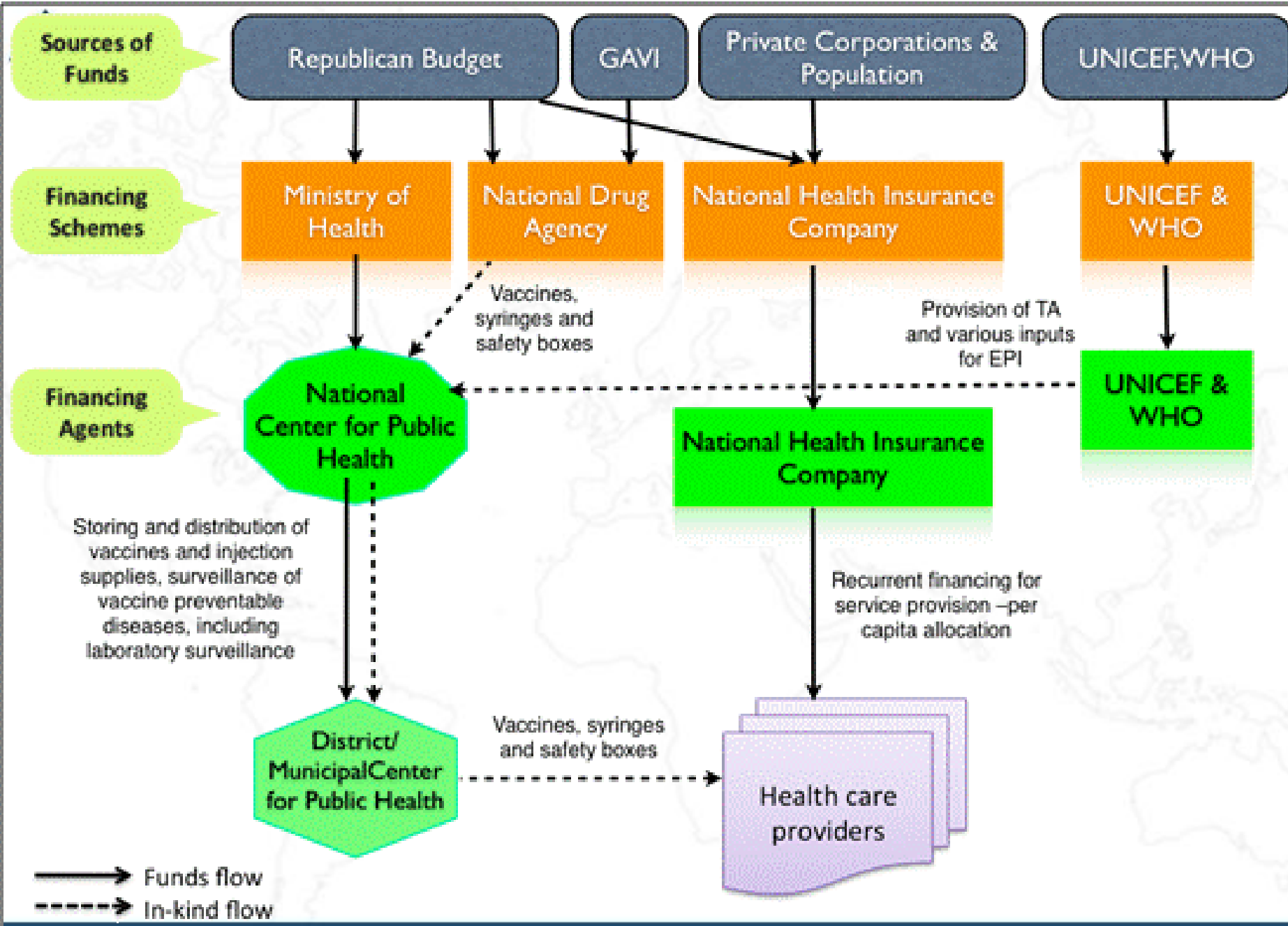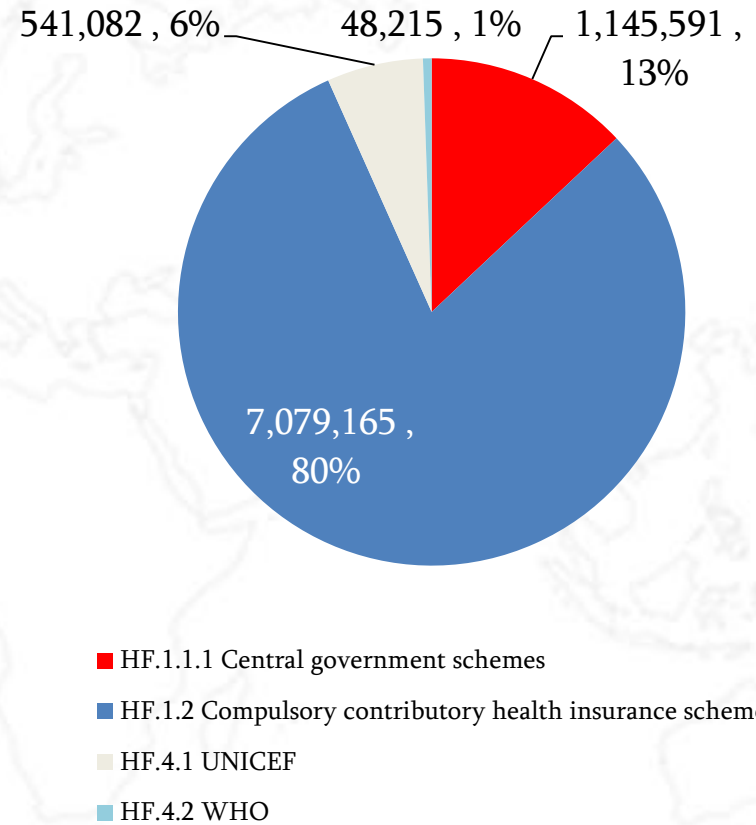
Financing Agents → National Center for Public Health | National Health Insurance Company | UNICEF & WHO

Vaccines, syringes and safety boxes

Provision of TA and various inputs for EPI

Storing and distribution of vaccines and injection supplies, surveillance of vaccine preventable diseases, including laboratory surveillance

Recurrent financing for service provision – per capita allocation

District/MunicipalCenter for Public Health

Vaccines, syringes and safety boxes

Health care providers

→ Funds flow

----▶ In-kind flow

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Sources of Funds

0.5% 4.5%

94.8%

■ GAVI ■ State Budget ■ UNICEF ■ WHO

Financing Schemes

541,082 , 6%   48,215 , 1%   1,145,591 , 13%

7,079,165 , 80%

■ HF.1.1.1 Central government schemes

■ HF.1.2 Compulsory contributory health insurance schemes
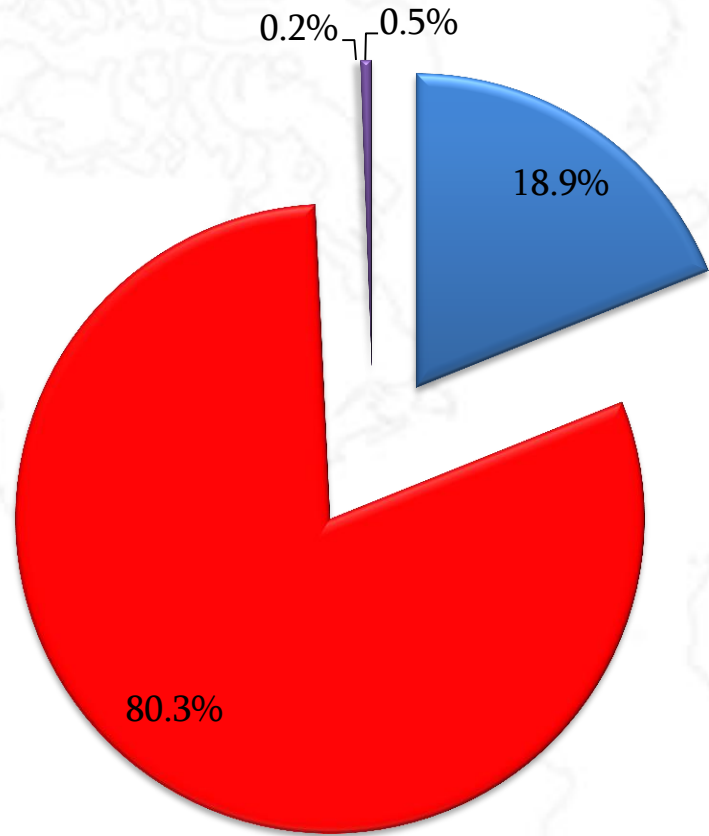
■ HF.4.1 UNICEF

■ HF.4.2 WHO

Financing Agents

0.2% 0.5%

18.9%

80.3%

- National Surveillance Agency & Medical Store
- National Medical Insurance Company
- UNICEF
- WHO

Providers of Services

5.2% 0.2% 0.5%

6.5%

33.5%

23.3%

30.9%

- Center of Family Doctors
- Office of Family Doctors
- Health Center
- Health Office
- Providers of preventive care
- UNICEF

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Providers of Services by Financing Agents
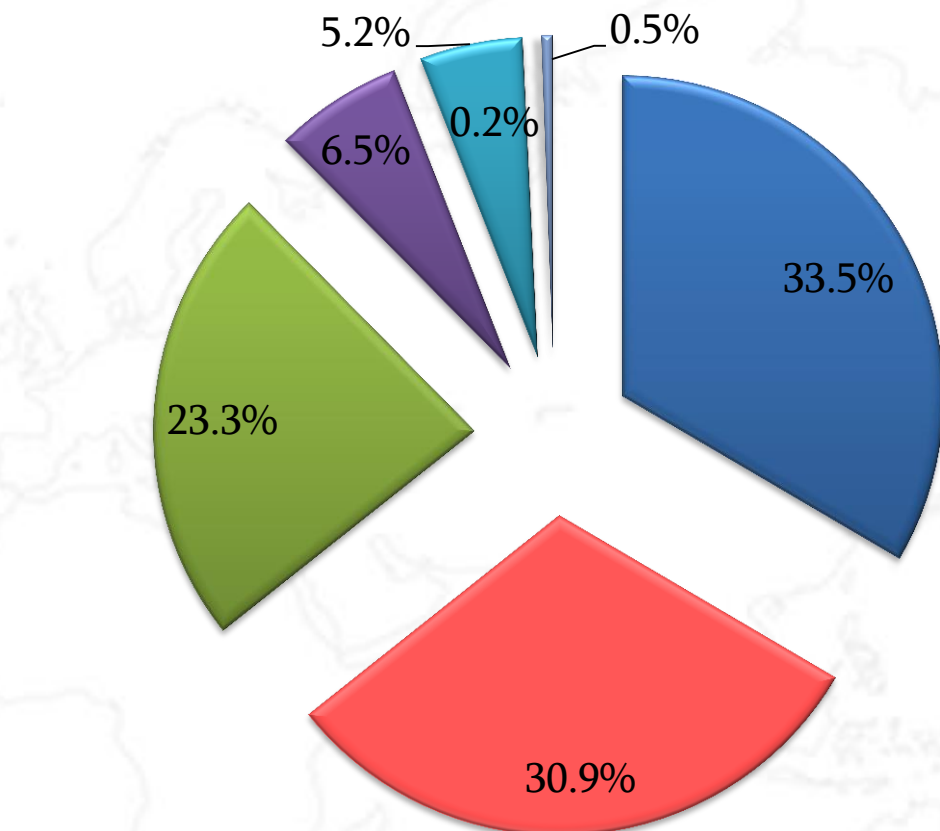
Legend:
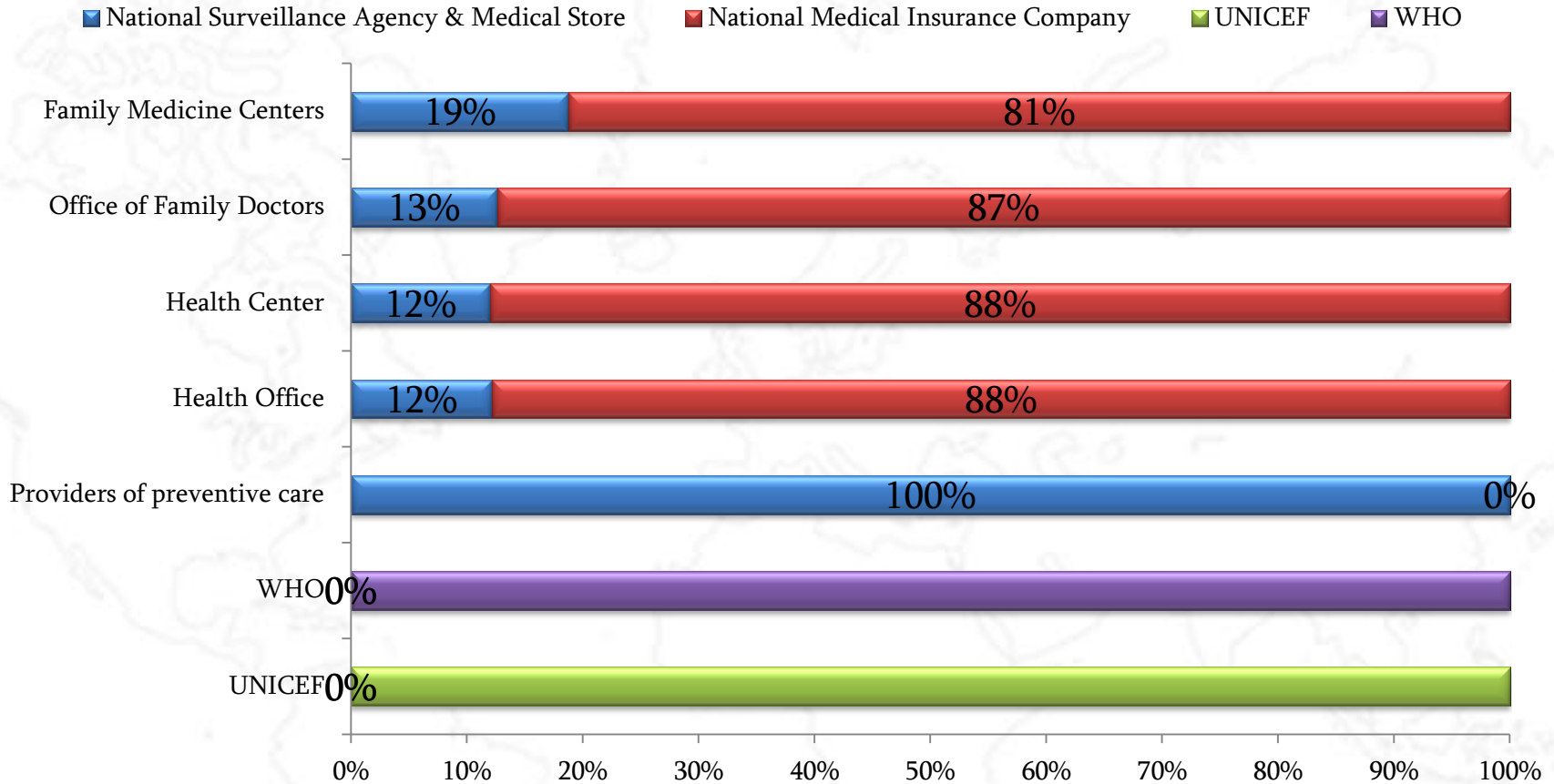- National Surveillance Agency & Medical Store
- National Medical Insurance Company
- UNICEF
- WHO

Provider	National Surveillance Agency & Medical Store	National Medical Insurance Company	UNICEF	WHO
Family Medicine Centers	19%	81%		
Office of Family Doctors	13%	87%		
Health Center	12%	88%		
Health Office	12%	88%		
Providers of preventive care	100%	0%		
WHO	0%			100%
UNICEF	0%		100%	

X-axis: 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%

Major financier of a PHC care provider was CNAM, which provided 81-88% of the funds used for the immunization services.

Providers of Services by Functions
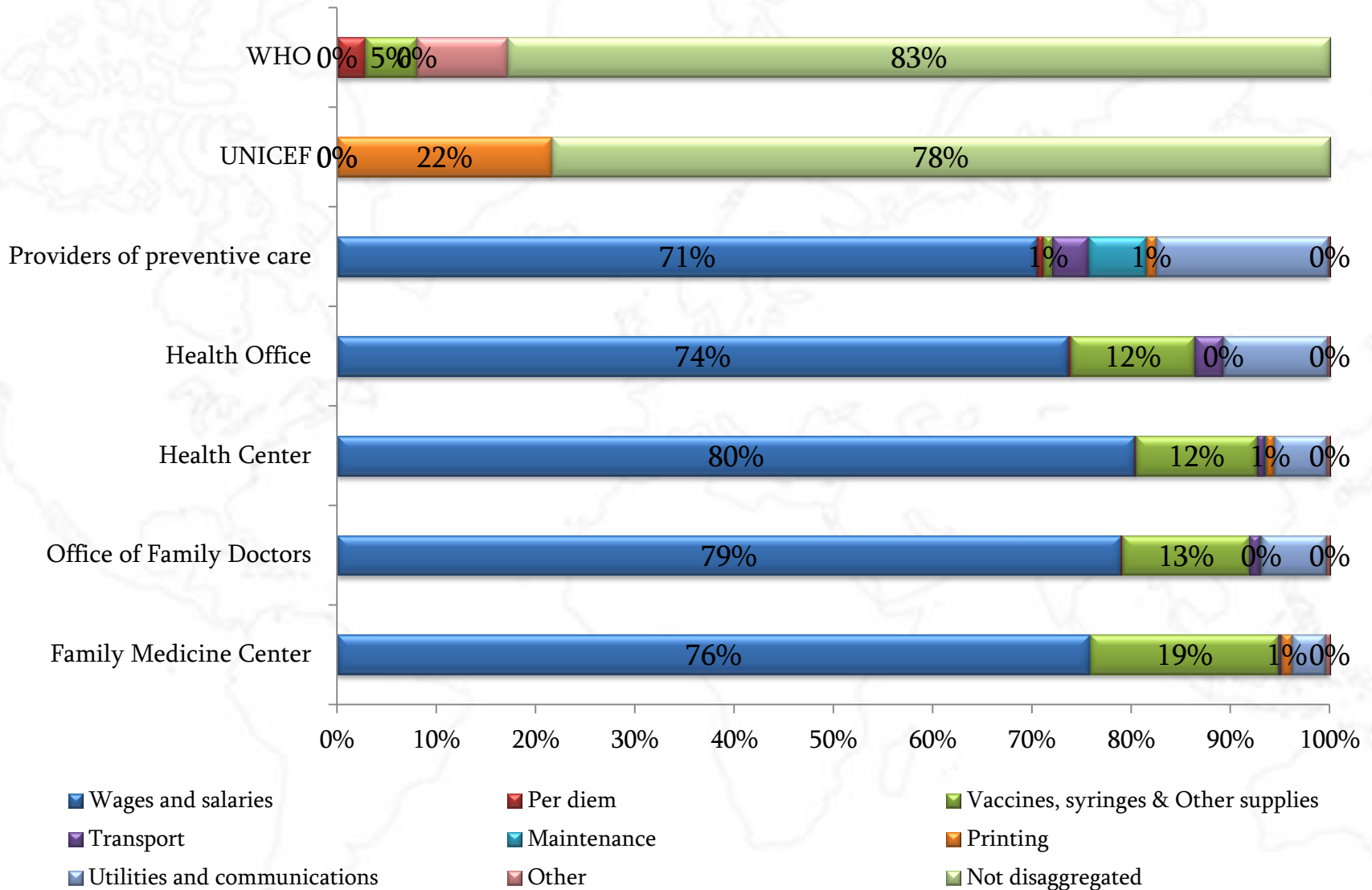

Provider	Percentages
WHO	0% 0% 88%
UNICEF	22% 0% 78%
Providers of preventive care	1% 4% 20% 0%
Health Office	11% 51% 14% 0%
Health Center	12% 39% 20% 0%
Office of Family Doctors	14% 47% 17% 0%
Family Medicine Center	14% 42% 20% 0%

Legend:
- Social mobilization, advocacy
- Facility-based routine immunization service delivery
- Training
- Vaccine collection, storage and distribution
- Cold chain maintenance
- Program management
- Supervision
- Other routine immunization programme activity

Providers of Services by Inputs

Legend:
- Wages and salaries
- Per diem
- Vaccines, syringes & Other supplies
- Transport
- Maintenance
- Printing
- Utilities and communications
- Other
- Not disaggregated

Cost Determinants and Productivity

Research Questions and methodology

Estimation strategy considers two steps.

1st. Step: Determinants of main production indicators/outputs: **Fully Immunized Child (FIC),** and **total number of doses administered on a facility level**?

$$Q_i = \alpha_1 \ln A_i + \alpha_2 \ln L_i + \alpha_3 \ln K_i - \alpha_4 \ln W_i$$

where: *Q is the output indicator (FIC, number of doses administered) for facility "i",*

L and K are multiplicative vectors of production factors, with participation α1, α2)

A is the scale of infants present in the catchment area.

wastage rate (-W), which weighted the productivity of each factor.

Semilog implementation reflect data characteristics and facilitates the use of ordinary least square estimation techniques, and allows identification of production semi-elasticities with respect to each input indicator(s).

Research Questions and methodology

2nd Step: *What determines the cost of immunization services?*

Dependent variable: *Economic Cost for Fully Immunized Child-* at a facility level - as well as at district and national levels.

$$ln\, CQ_i = ln\, FIC_i + \alpha_1\, ln\, w_i + ln\, r_i + ln\, P_i$$

Where: *CQ is the vector of cost specification for facility i,*
FIC is the scale factor,
L & K are vectors for labor-related & infrastructure-related inputs characteristics,
P represents demand-side and quality shifter variables (education, wastage rates, facility characteristics.

Traditional hypotheses:

* presence of economies of scale in the provision of immunization

* verify labor intensive bias of vaccination services.

* identify relevance of family participation (education, income, formal health coverage) in immunization costs.

* Differences in cost determinants at facility, district and national level.

Conclusions

- Relevance of HHRR in the success of vaccination coverage (FIC and total doses administered) in comparison to facility infrastructure.

- Research support the importance of population scale in allowing cost savings at the same level of production.

- Differences in performance by production factors across facility types do not necessarily involve uneven productivity, but gaps within different context, such as scale of the center, and population location.

- Econometric analysis does not identify strong equity and efficiency issues across providers, although more in-depth qualitative research is suggested.

Conclusions

- Community related (demand-side) variables are particularly relevant to reach a successful immunization plan, particularly when outreach activities are not part of the usual coverage strategy

-

- Prices do not show to be relevant cost shifters at the facility level, associated to the centralized process of contracting and purchasing

- Analysis identifies three different factors affecting immunization outputs:
  - operative capacity at the facility level,
  - managerial efficiency of vaccines,
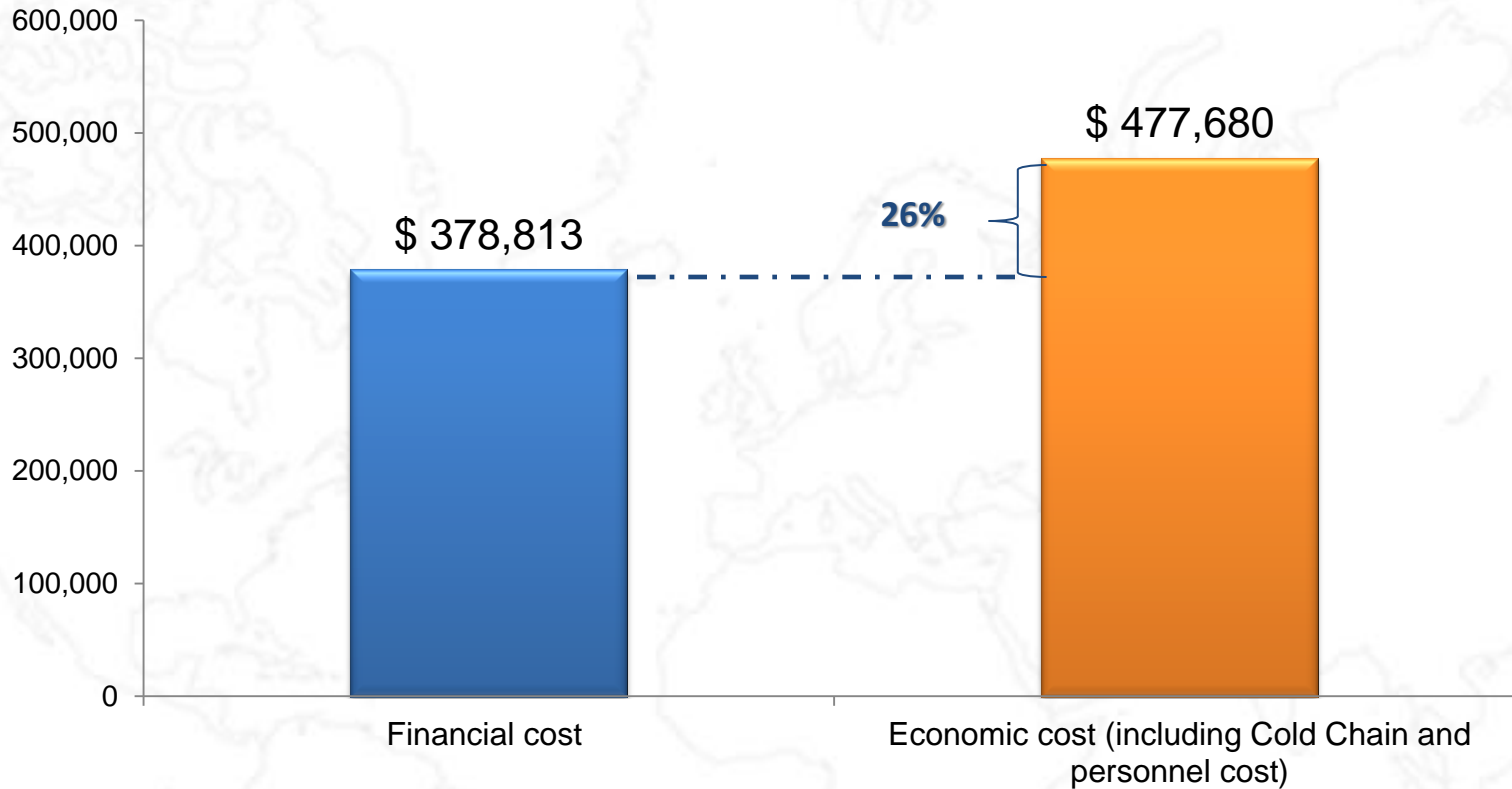 - population scale.

NUVI COST

Total Incremental Rota virus Vaccine Introduction Cost

| Dimension	Financial cost ($US 2012)	Cash Flow ($US 2012)	Economic cost (without Cold Chain)	Economic cost (including Cold Chain)
Average facility cost without vaccines	3.1	4.8	43.6	56.1
Average Rota vaccine cost per facility	193.4	193.4	193.4	193.4
Shared staff salary costs per facility			38.9	38.9
Average Cold Chain Costs per Facility				12.6
Total number of facilities	1318	1318	1318	1318
Total facility level cost without vaccines	4,080	6,269	108,707	141,810
Total facility level cost with vaccines	258,981	261,170	363,608	396,711
Mean district cost without vaccines	43.6	66.4	108.1	232.0
Number of districts	37	37	37	37
Total district cost without vaccines	1,613	2,458	3,998	8,584
National level cost without vaccines	118,219	142,660	87,550	72,385
Total National Rota Introduction Cost	378,813	406,288	455,156	477,680

Financial and Economic Cost of New Vaccine Introduction

Bar chart:
- Financial cost: $ 378,813
- Economic cost (including Cold Chain and personnel cost): $ 477,680
- Difference: 26%

- **Additional financial costs for Rota introduction are marginal (378, 813 $ USD) due to available spare capacity of cold chain and human resources on a PHC**

- **If more NEW vaccines will be introduced , Moldova will face additional costs (26% more) to fund cold chain and probably salaries.**

Cost Drivers for the NUVI cost
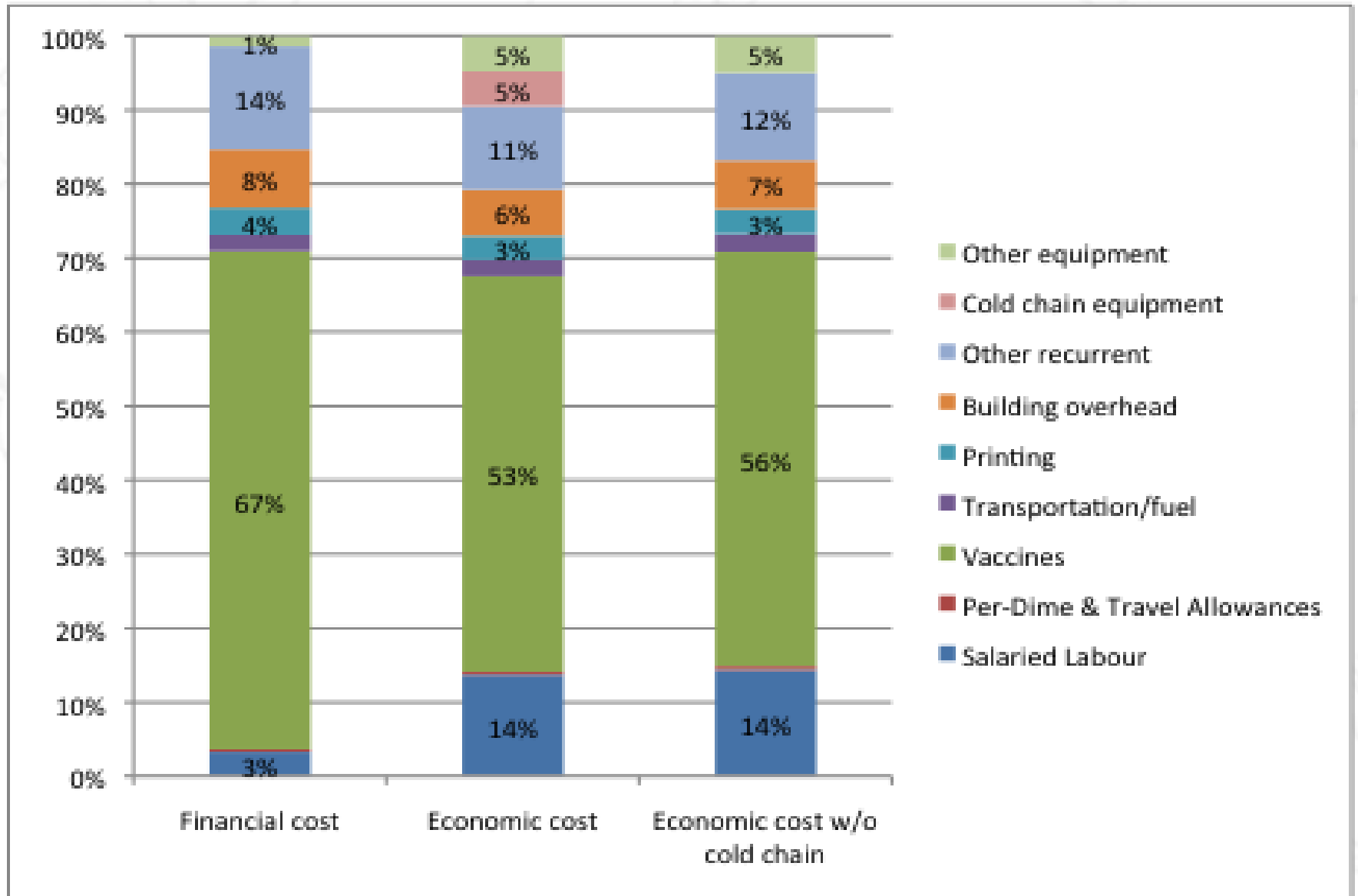
National Level Unit Costs

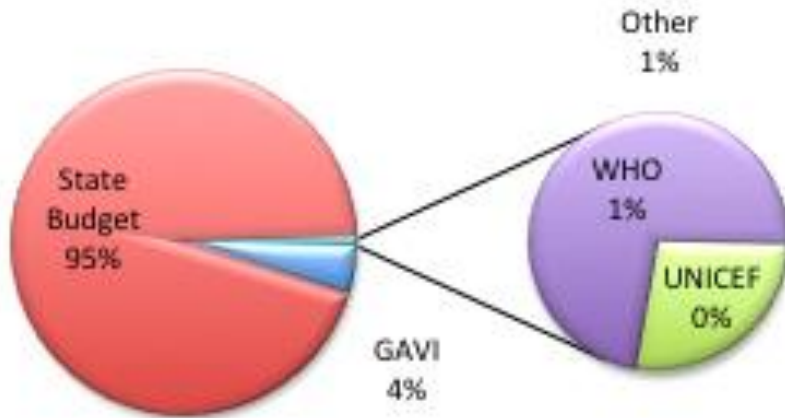| National level unit costs	Financial cost $US Mean (95% CI)	Economic cost $US Mean (95% CI)
Unit costs without vaccines		
Cost per dose delivered	1.76 (1.70 : 1.82)	4.29 (3.71 : 4.87)
Cost per infant	3.52 (3.40 : 3.63)	8.76 (7.48 : 10.04)
Unit costs including vaccines		
Cost per dose delivered	4.95 (4.82 : 5.08)	7.48 (6.89 : 8.07)
Cost per infant	9.96 (9.81 : 10.10)	15.20 (13.90 : 16.50)

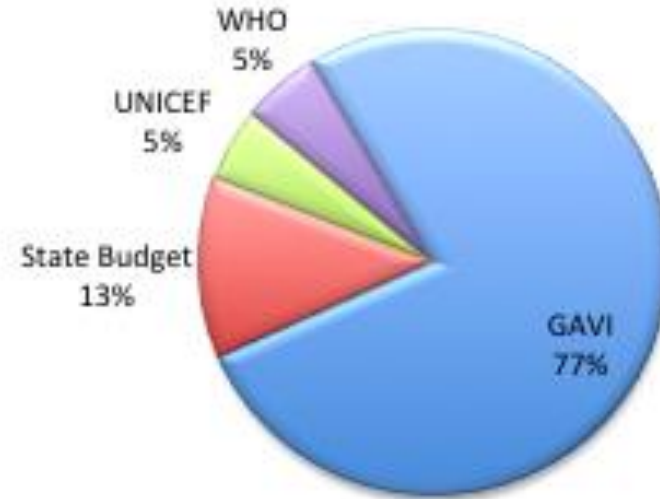# Price influence on financial costs per infant (sensitivity analysis)

Price Change	Price per dose of Rotarix	Cost per Infant (Rotarix)	Price per dose of PCV-13	Cost per Infant (PCV-13)	Incremental cost per Infant (Rotarix + PCV-13)	Percent Change relative to 2011 Prices per Infant
Baseline price	2.5	9.9	7	32.6	42.5	13.4%
1$ increase in price	3.5	12.5	8	36.5	49.0	15.5%
2$ increase in price	4.5	15.1	9	40.4	55.5	17.5%
3$ increase in price	5.5	17.7	10	44.3	62.1	19.6%
4$ increase in price	6.5	20.3	11	48.2	68.6	21.7%
5$ increase in price	7.5	22.9	12	52.2	75.1	23.7%
6$ increase in price	8.5	25.5	13	56.1	81.6	25.8%
Double of the baseline price	4.9	16.3	14	60.0	76.2	24.1%

Funding the Routine Immunization and NUVI

Funding Sources for Routine EPI

- State Budget 95%
- GAVI 4%
- Other 1%
  - WHO 1%
  - UNICEF 0%

Funding Sources for NUVI

- GAVI 77%
- State Budget 13%
- WHO 5%
- UNICEF 5%

- Reliance of the RI on external funding is marginal, however

- When labor costs are removed, the role of external funded increases up to 20%

- 87% of the Rota introduction is funded by donors

Major Conclusions

1. incremental financial cost per infant (without vaccine) was estimated at 3.52$ is 4.4 times higher than 80 cents established per infant under GAVI vaccine introduction grant policies

2. NUVI costs in Moldova were low because the country had spare cold chain capacity on the national and district level and was able to meet increased vaccine volume needs without additional investments

3. The largest driver of new vaccine introduction is cost of vaccine - 95%. Therefore, any reduction in suppliers' prices resulting from positive market dynamics will be beneficial for new vaccine introduction.

4. It is estimated that every dollar increase in vaccine price may result in 2.1% increase of immunization costs and doubling the vaccine price will demand almost 24.1% more from the national budget
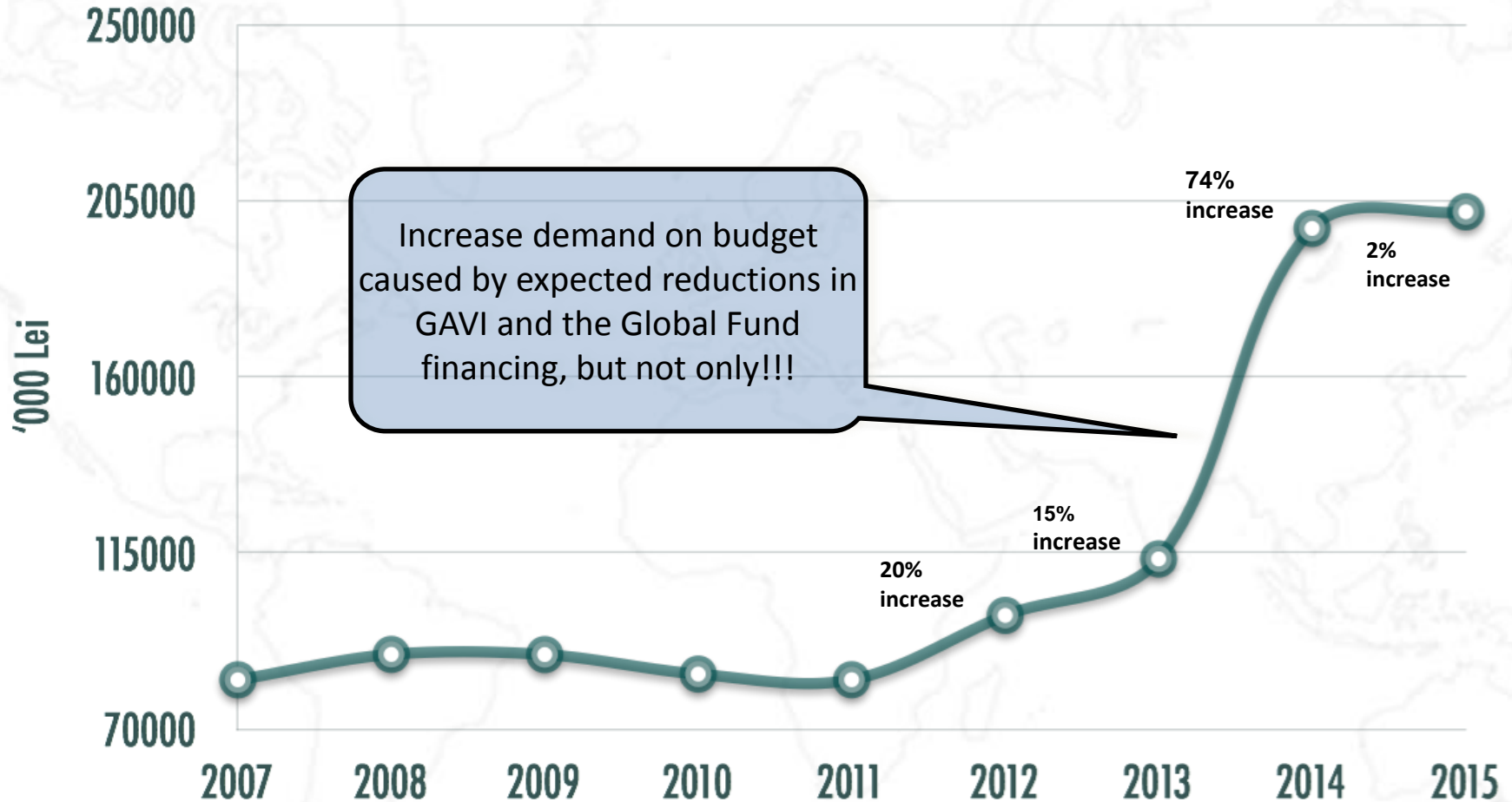
Sustainability Issues/ what is important to consider when graduating from GAVI?

- While GAVI graduation for Moldova seems affordable, the challenges emerge when broader context is taken into account

- Moldova **concurrently graduates** from the GAVI and the Global Fund, which further increases the pressure on the national budget for public health programs

Expected Pressures on the Public Health Budget

Increase demand on budget caused by expected reductions in GAVI and the Global Fund financing, but not only!!!

74% increase

2% increase

15% increase

20% increase

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Conclusions

- Total immunization program costs amounts to only 1.27% of the total national health expenditure or 2.4% of recurrent public financing for health. In such a fiscal context graduating from GAVI seems affordable.

- However, while single donor graduation could seems affordable, such decisions have to also account for graduating from other donors.

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THANK YOU