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Examining inequities in child vaccination coverage and cost-of-illness of vaccine preventable diseases in urban (slum and non-slum) and rural areas of Bangladesh

Understanding the influence of urban areas

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Background

Bangladesh is the 8th most populous country in the world, and there is rapid and growing urbanization

People are moving to urban areas in search of better economic prospects

It is expected that the population of its capital city Dhaka, will increase from 16 million to 27 million by 2030

Currently, one-third of the city's residents are slum dwellers

According to the national EPI coverage evaluation survey in 2019, the children in DNCC slums have lower rates of immunization – 86% compared to the national rate of 95%

Objectives

- Examine the level of inequity in vaccination coverage within the existing health system in rural, urban slum, and urban non-slum areas
- Decompose the drivers of inequity in vaccine coverage using the Vaccine Economics Research for Sustainability and Equity (VERSE) toolkit

Methodology: "Fair" and "Unfair" Factors

Fair Factors

Determinants of **need** for the service

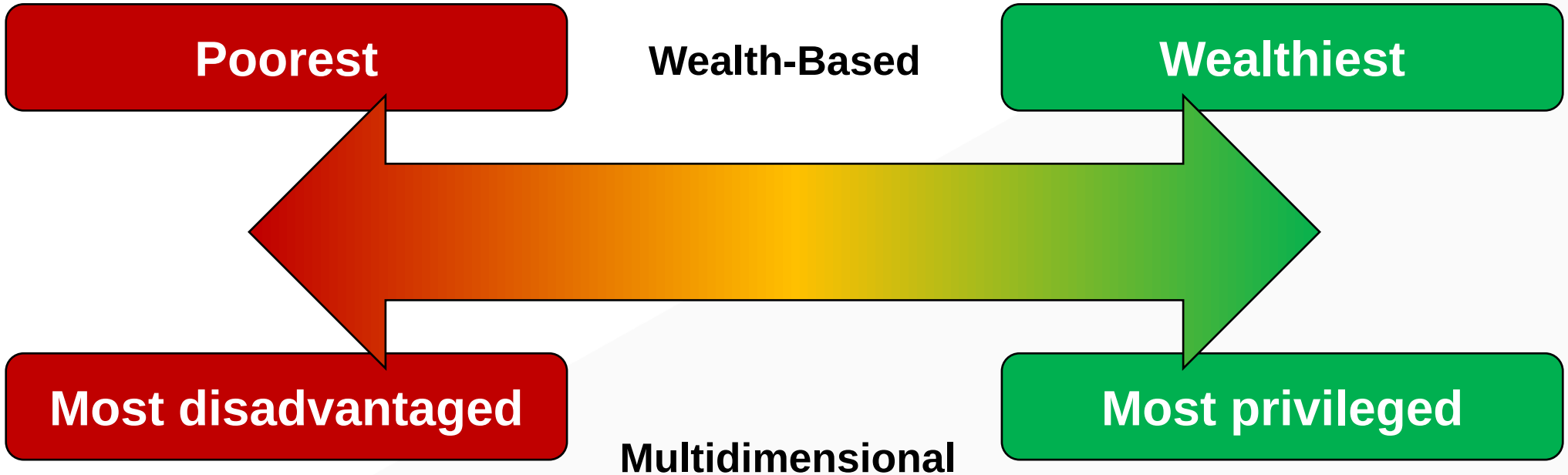
- Underage for a vaccine according to the National Immunization Schedule

Unfair Factors

After controlling for need, these characteristics should not be correlated with receiving the service under an equitable distribution

- Socio-economics status (Metric: Wealth quintile)
- Urban/Rural designation (Metric: Residential location indicator)
- Sub-national administrative region (Metric: State)
- Sex of vaccine-recipient (Metric: Sex of child)
- Maternal education level (Metric: Years of education)

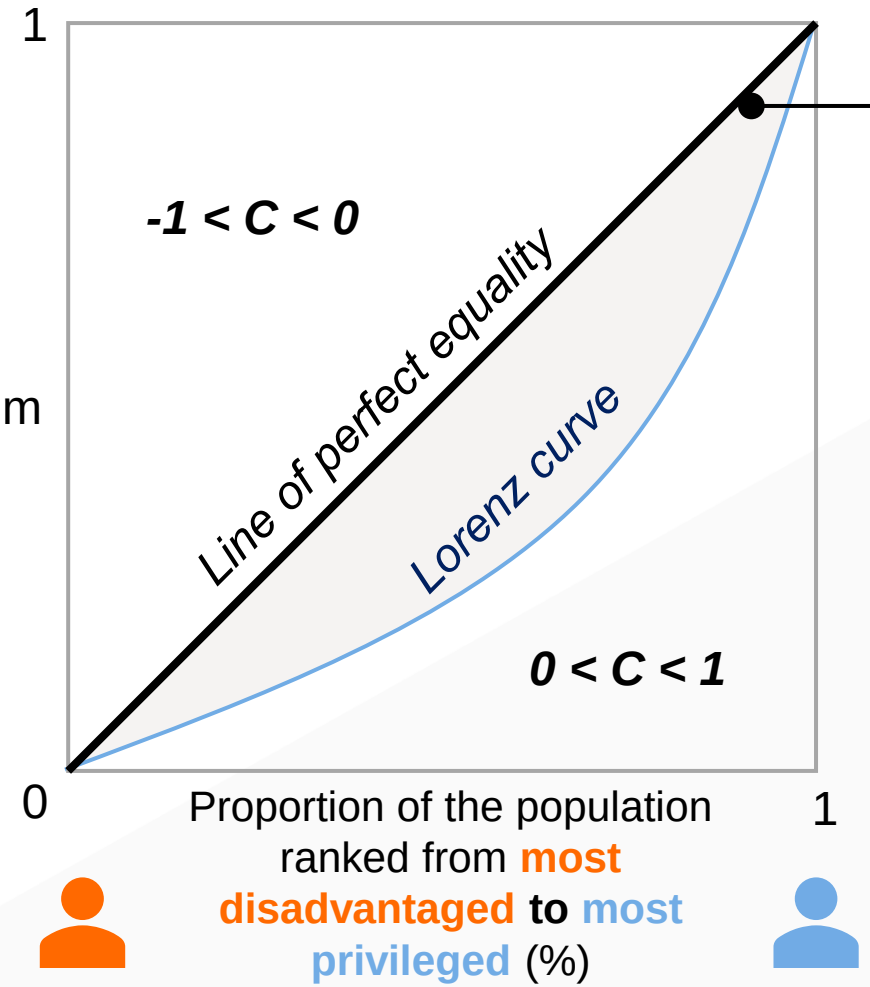
Ranking



Multidimensional

- State and settings (urban/rural)
- Maternal education
- Socioeconomic status
- Sex of the child
- Health insurance coverage

Outcome: Concentration Index



$$CI_W \approx \frac{2}{\mu_{hc}} cov(hc_{direct}, F(hc_{direct\ unfairness}))$$

Where μ_{hc} is the average healthcare coverage in the population, *cov(h,r)* the covariance between the individual level healthcare coverage (hc_{direct}) and the cumulative distribution function of direct unfairness ($F(hc_{direct\ unfairness})$).

C = 0, perfect equality

0 < C < 1, most of the healthcare coverage is **allocated to the more privileged households**

-1 < C < 0, most of it is **allocated to the more disadvantaged households**

Outcome: Absolute Equity Gap

The **Absolute Equity Gap** (AEG) is difference between health outcome attainment between the most advantaged 20% of the population and the least advantaged 20% of the population.

$$AEG = mean(outcome)_{top\ 20\%} - mean\ (outcome)_{bottom\ 20\%}$$

*A larger AEG means that the distribution of vaccines is **less** equitable between the most disadvantaged and most privileged groups.*

Data

Survey types	Study population	Sample size	Assessment
Household survey	Caregivers of 12-23 months aged children	3,357	Coverage and equity
EPI service providers' survey	EPI frontline service providers	100	

Results

Vaccination coverage 12-23 months children by study site (Card + Recall)

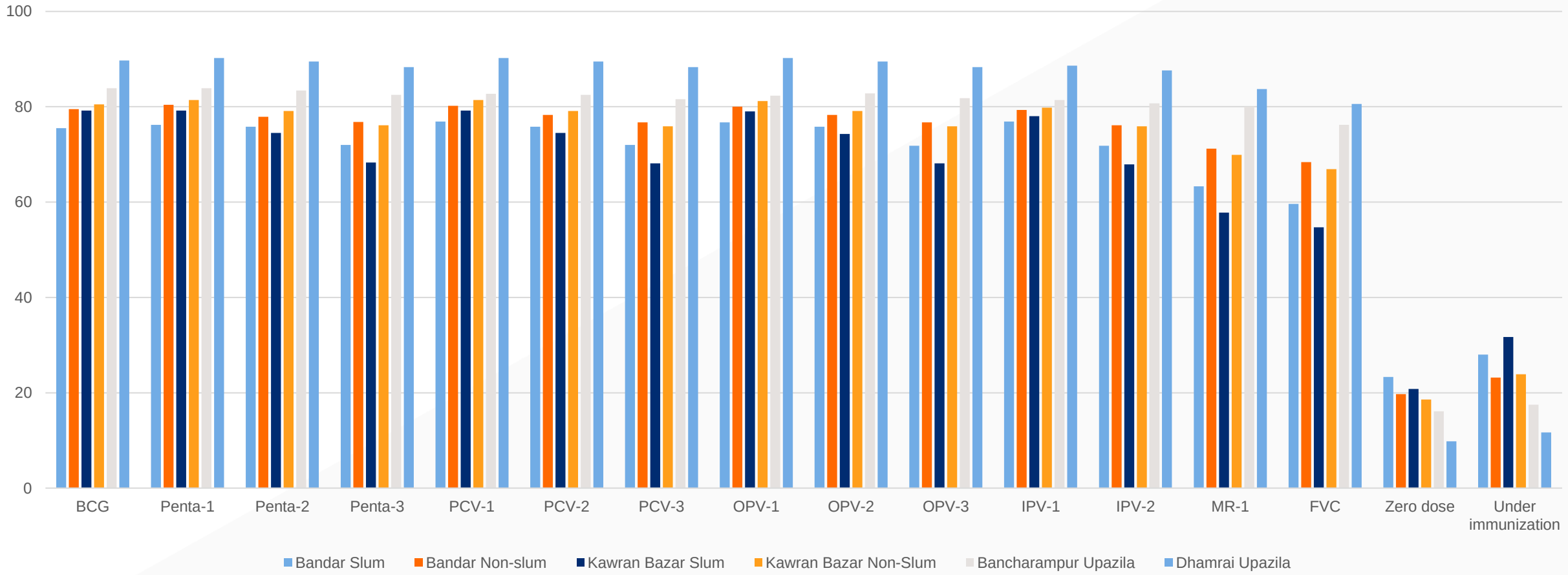
Name of Vaccine+ -	Household Location						Overall %
	Urban (City Corporation)				Rural (District)		
	Chattogram (High performing)		Dhaka North (Low performing)		Brahmanbaria (High performing)	Dhaka (Low performing)	
	Bandar		Kawran Bazar		Bancharampur Upazila	Dhamrai Upazila	
	Slum	Non-Slum	Slum	Non-slum			
	n=569	n=568	n=551	n=553	n=561	n=565	n=3,357
BCG	97·7	95·9	97·1	98·2	99·7	99·1	97·8
Penta-1	97·2	98·4	96·9	98·8	99·7	99·7	98·5
Penta-2	95·8	95·8	91·8	95·9	99·1	99·0	96·3
Penta-3	91·0	94·4	84·2	91·9	98·3	97·7	93·1
PCV-1	97·4	98·3	97·1	98·8	98·4	99·7	98·3
PCV-2	95·8	96·1	91·8	95·9	98·3	99·0	96·2
PCV-3	91·0	94·2	83·9	92·2	97·4	97·7	92·9
OPV-1	97·2	98·1	96·7	98·6	98·1	99·7	98·1
OPV-2	95·8	96·1	91·6	95·9	98·6	99·0	96·3
OPV-3	91·0	94·4	84·1	92·2	97·6	97·7	93·0
IPV-1	97·4	97·5	95·1	96·6	97·2	98·1	97·0
IPV-2	91·0	93·7	83·3	91·6	96·3	97·0	92·3
MR-1	79·0	87·9	70·8	84·60	95·3	93	85·4
FVC[1]	75·0	84·7	67·1	80·53	91·2	89·8	81·7
Zero dose[2]	2·8	1·6	3·1	1·24	0·4	0·4	1·6
Under immunization[3]	9·0	5·6	14·9	8·1	1·8	2·3	6·9

[1] FVC: A child is considered to be Fully vaccinated if s/he has received one dose of BCG, 3 doses of Pentavalent, 3 doses of OPV, and 3 doses of PCV

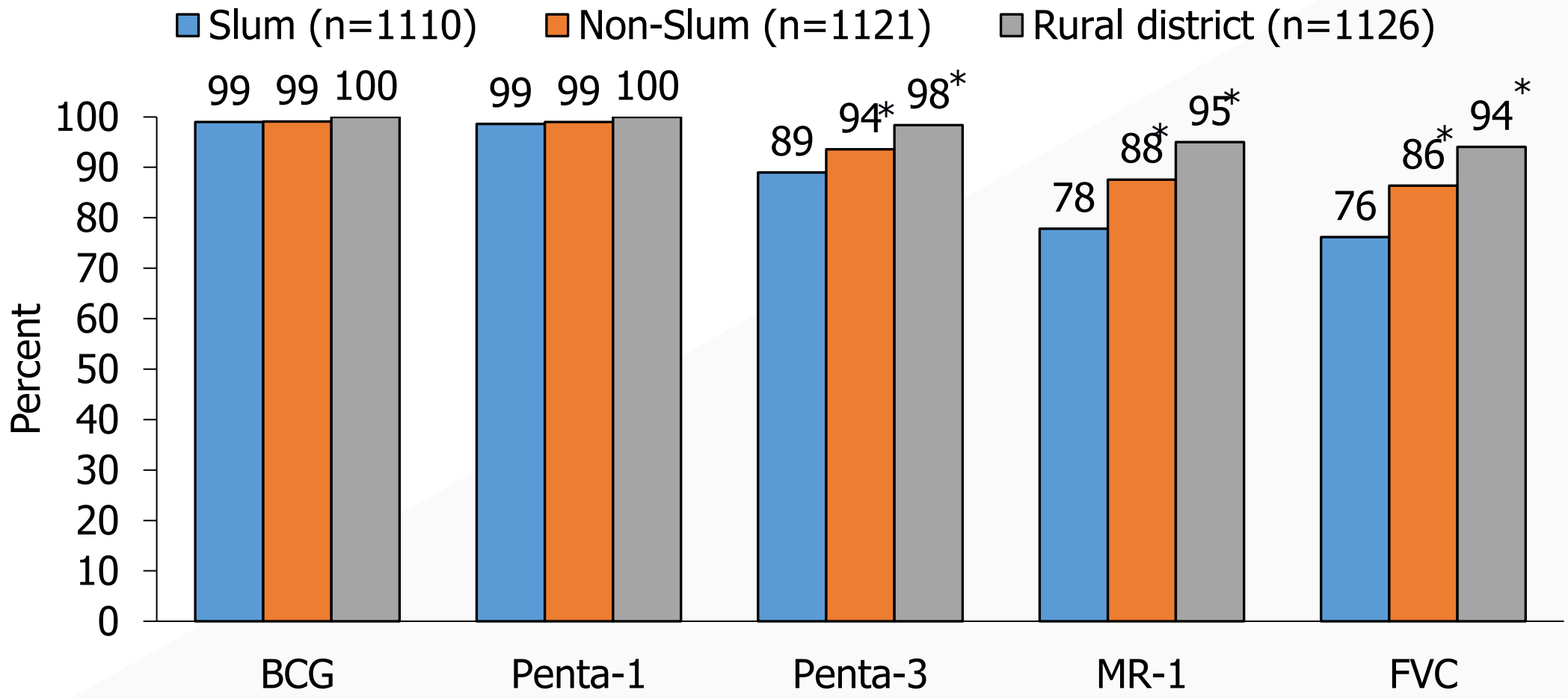
[2] Zero dose: A child is considered as Zero dose if s/he missed 1st dose of Pentavalent

[3] Under immunization: A child is considered as Under immunized if s/he missed 3rd dose of Pentavalent

Vaccine coverage for all antigens by household location (Card +Recall; N= 3357)

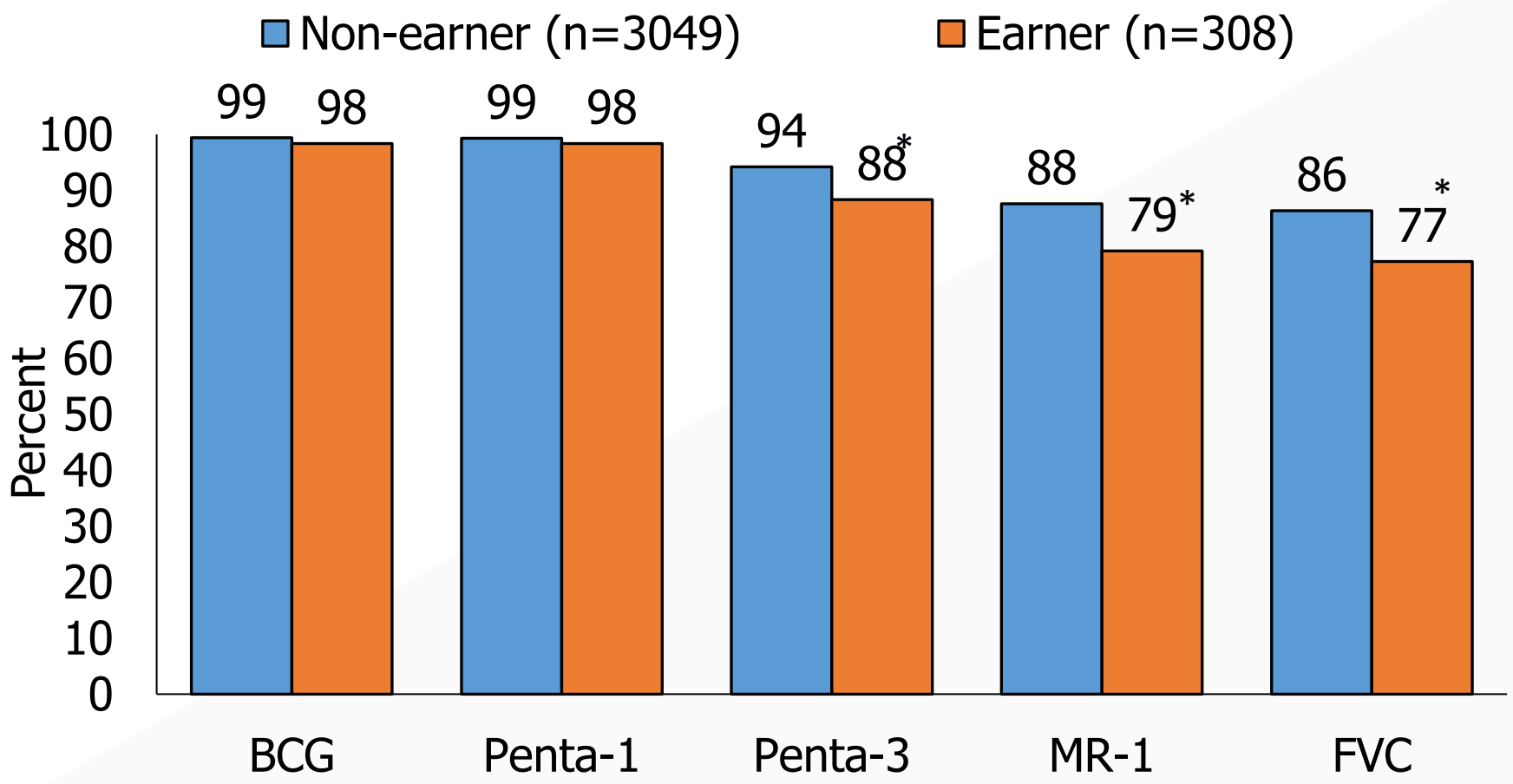


Crude vaccination coverage of children 12-23 months by study areas



* Statistically significant at 5% level of significance
Reference category: Slum

Vaccination coverage among 12-23 months children by caregivers' occupation



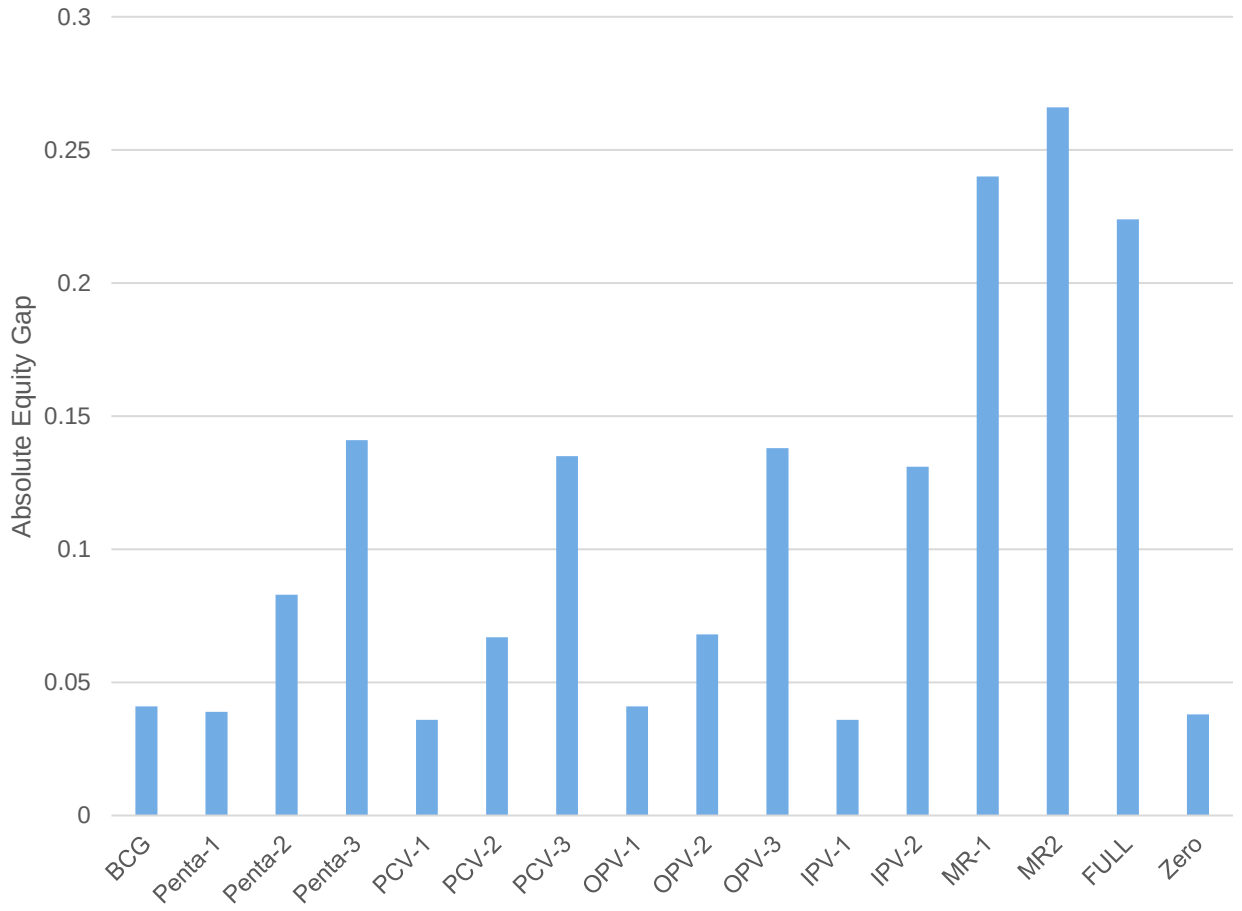
Equity Estimates using the card and recall coverage of vaccines from the household survey

Vaccine or outcome [1]	Coverage or prevalence (%)	Wagstaff composite concentration index	Absolute equity gap
BCG	97·8	0·0081	0·041
PENTA1	98·5	0·0073	0·039
PCV1	98·3	0·0064	0·036
OPV1	98·1	0·0074	0·041
IPV1	97·0	0·0075	0·036
MR1	85·4	0·058	0·24
PENTA2	96·3	0·016	0·083
PCV2	96·2	0·014	0·067
OPV2	96·3	0·015	0·068
IPV2	92·3	0·027	0·131
MR2	45·8	0·11	0·266
PENTA3	93·1	0·029	0·141
PCV3	92·9	0·028	0·135
OPV3	93·0	0·028	0·138
ZERO	1·6	0·48	0·038
FULL	81·7	0·060	0·224

[1] Full: A child is considered to be Fully vaccinated if s/he has received one dose of BCG, 3 doses of Pentavalent, 3 doses of OPV, and 3 doses of PCV

[2]Zero dose: A child is considered as Zero dose if s/he missed 1st dose of Pentavalent

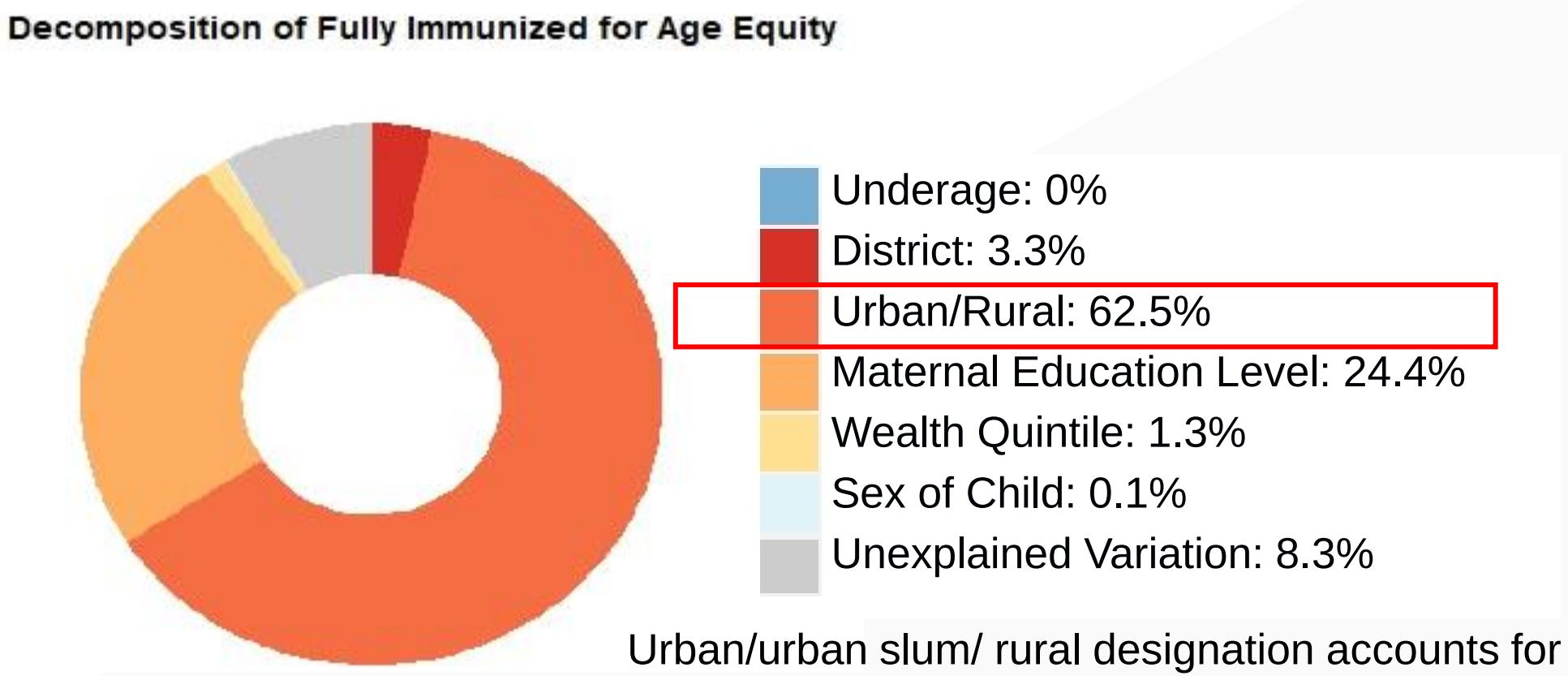
Absolute equity Gap by Vaccine Antigen



Inequity Decomposition by fair and unfair variables for all antigens

	Equity decomposition fair/unfair variables (percent)·						
Vaccine/ Antigen	Underage	Region (District)	Urban/Rural	Maternal Education	Wealth Quintile	Sex of the Child	Unexplained Variation
BCG	0	4·5	48·4	1·8	7·6	6·3	31·4
PENTA1	0	0·4	42·6	3·9	14·2	2·4	36·4
PCV1	0	6·3	23	0·4	30·6	3·1	36·6
OPV1	0	6·3	18·8	0·2	17·7	9	48
IPV1	0	1·8	13·1	0·6	12	3·5	69·1
MR1	0	3	58·8	24·3	1·7	0	12·1
PENTA2	0	1·9	48·1	17·9	2	0·4	29·6
PCV2	0	2·5	43·8	21·3	0·2	0·1	32
OPV2	0	2·9	46·2	18·1	0·4	0·2	32·2
IPV2	0	3·8	56·5	20·5	1·8	1·5	15·9
MR2	23·8	1	35·4	9·7	0·8	0·1	29·2
PENTA3	0	3	56·8	21·1	1·9	0·6	16·6
PCV3	0	3·7	56·7	21·3	1·9	0·8	15·7
OPV3	0	3·7	56·8	19·4	1·5	0·8	17·9
ZERO	1·6	0·5	57·7	4·4	17·2	2·5	16·1
FVC	0	3·3	62·5	24·4	1·3	0·1	8·3

Equity estimates using the card and recall coverage of vaccines from the household survey

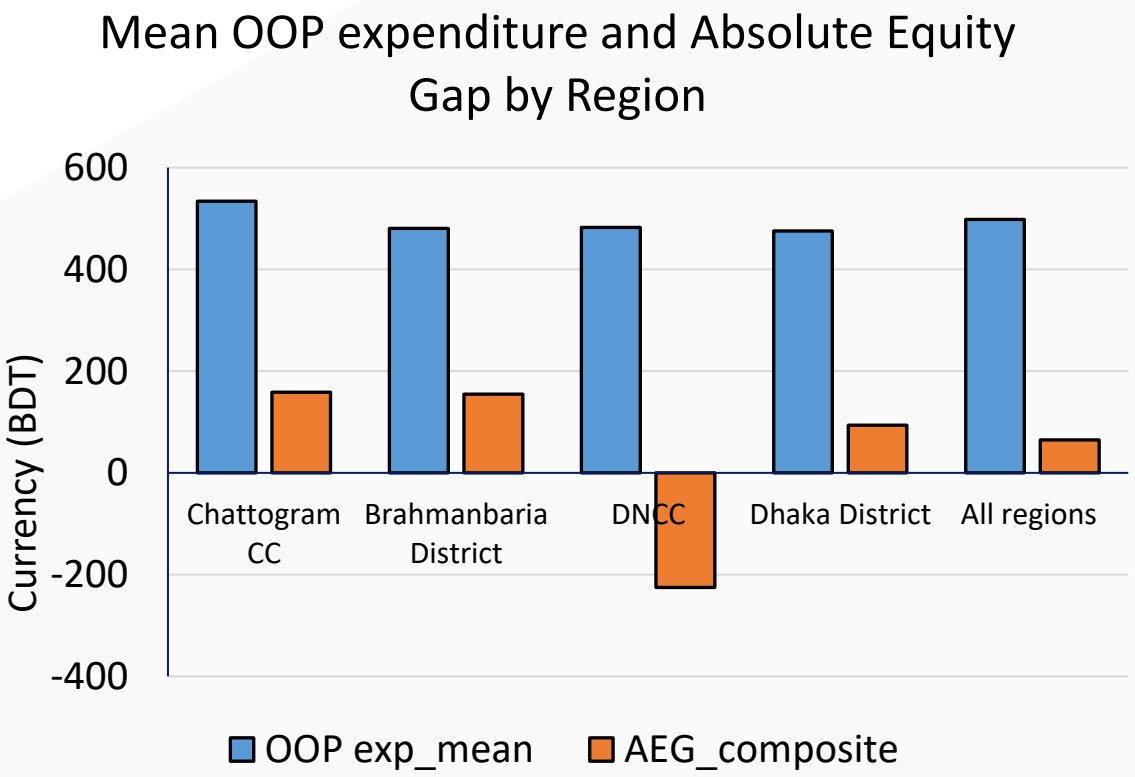


Urban/urban slum/ rural designation accounts for 62.5 of the variation in in the coverage of individuals who are fully immunized for age

Mean monthly out-of-pocket (OOP) expenditure on any pediatric condition, concertation index and absolute equity gap by study areas

Study area	OOP expenditure (mean)*	Concentration index	Absolute equity gap*
Chattogram CC	534.10	0.046	158.31
Brahmanbaria District	480.73	0.077	154.90
DNCC	482.78	-0.082	-225.59
Dhaka District	475.63	0.161	93.91
All regions	498.60	0.007	64.89

* Currency Unit is 2021 Bangladesh Taka (BDT)



Conclusion

- Inequity in vaccination coverage exists in the study areas. The coverage was lower in:
  - urban areas than rural areas, and
  - urban slums compared to non-slum areas
- Vaccination coverage significantly varied by education and earning status of caregivers
- Coverage decreased and inequity increased as doses moved beyond 1st dose for all vaccines
- The burden of out-of-pocket expenditure for pediatric care was lower among the poor in all settings besides DNCC where a disproportionately greater share of the total OOP was born by the relatively poor than the relatively rich

Thank You!

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Learn more about VERSE!

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