Optimizing Procurement of COVID-19 Vaccines in the Asia Pacific Region

(A case for a collaborative procurement mechanism)

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Global Fight against COVID-19

- The pandemic exposed inequities in the delivery and distribution of medical counter measures *(Boado-Penas et al., 2022)*
- Some regions (e.g. Latin America and the Caribbean (LAC), European Union, African Union etc.) benefited from existing regional collaborations, and health partnerships
- Many countries now investigating better ways to procure vaccines and other countermeasures during health emergencies
    - Increased emphasis on the need for international and regional collaboration *(Hotez et al., 2021; Kumraj et al., 2022; Swenson et al., 2024)*
- UN played a pivotal role, ensuring global equitable access to COVID-19 vaccines and addressing socio-economic impacts of the pandemic (COVID-19 Vaccines Global Access (COVAX) program)
    - Global Alliance for Vaccines and Immunisation (Gavi) and the Coalition for Epidemic Preparedness Innovations (CEPI) *(World Health Organization, 2024)*
    - ADB, PAHO provided regional support

COVAX Facility & Pooled Procurement Models

- The COVAX facility aimed to improve COVID-19 vaccine development and ensure their fair delivery

- The facility pledged to provide COVID-19 vaccine doses to cover between 10%-50% of the populations of participating countries *(World Health Organization, 2020)*
  - Eligible countries (all low-income countries (LIC) and lower-middle-income countries (LMIC) members) received a portion of the vaccines as COVAX donations

  - Self-financing members of COVAX were provided two alternative financing mechanisms

- Collaborative procurement is a mechanism that combines financial & other forms of purchasing authority across countries
  - Improve efficiency and create greater purchasing power
  - Exemplar: Pan American Health Organization's Revolving Fund (PAHO-RF)

During the Pandemic LAC countries benefitted from…

Established supply and distribution chains through PAHO

PAHO-RF recognized procurement agent for COVAX for the LAC region

Negotiated with vaccine providers on behalf of LAC countries

Objectives

Unlike the LAC region, the Asia and the Pacific (APAC) did not have an established collaborative regional health mechanism, which may have provided regional safeguards during the pandemic

- Analyse COVID-19 vaccine procurement (through COVAX) and coverage within APAC region. Compare to similar countries in the LAC region
- Analyse the costs & volumes associated with the procurement of COVID-19 vaccines (mainly through COVAX) for APAC and LAC countries
- Compare weighted-average prices paid by countries for different COVID-19 vaccine candidates across the two regions
- Analyse the impact of vaccine coverage on COVID-19 related public health outcomes (e.g. case fatality rate (CFR) and mortality rates) across LMIC and UMIC countries within the two regions

Would the APAC region have benefitted from a collaborative procurement system during the pandemic?

Data

WHO MI4A VACCINE REPORT	UNICEF COVID-19 DASHBOARD	OUR WORLD IN DATA
Weighted Average Price (WAP) of Vaccines based on limited number of points	Most comprehensive data on COVAX Vaccine candidates Price per dose (where available) Donated/procured Limited data on bilateral/multilateral agreements	Time series data Daily/cumulative confirmed cases Cases per million Deaths Deaths per million Admin. vac doses/100 pop Admin. booster doses/100 pop People vaccinate/ 100 (at least one dose/fully vaccinated)

Main challenge: Determining unit cost per dose for different vaccine candidates, offered to different countries at different time-points

Hierarchical Linear Mixed-Effects (HLME) Model

$$log(HO)_{it} = \beta_0 + \beta_{vc} L28.VaccineCov_{it} + \beta_{vc-int} PAHO * L28.VaccineCov_{it} + \gamma_1 X_{it} + \gamma_2 Z_i + \delta_{sub-region_i} + u_i + \varepsilon_{it}$$

$$u_i \sim N(0, \sigma_u^2) : random\ intercept\ for\ individuals$$
$$\varepsilon_{it} \sim N(0, \sigma^2) : residual\ error$$

- HO_{it} - COVID-19 related health outcomes (Daily case fatality rate (CFR) or Daily Mortality) for country i on day t (=1st March 2020 - 20th October 2023)
- $VaccineCov_{it}$ - vaccine coverage variables (cumulative population with at least 1 dose per 100 people, cumulative population fully vaccinated per 100 people and cumulative administered doses per 100 people)
- $PAHO$ – Indicator representing region (0: APAC Countries, 1: LAC countries)
- β_{vc} and β_{vc-int} - the coefficients of interest
- X_{it} - set of time-varying country-level characteristics (e.g. proportion of population aged above 65 years, proportion of population between 15-24 years, hospital beds/1000, reproduction rate and weighted average stringency index)
- Model controls for sub-region fixed effects ($\delta_{sub-region}$)

COVID-19 Related Health Outcomes

- Two main health outcomes are considered in the study: 1) daily case fatality rate (daily-CFR), & 2) daily mortality:

$$Daily\ CFR_t = \frac{Number\ of\ new\ confirmed\ deaths_t}{Number\ of\ new\ confirmed\ cases_{t-10}} \times 100$$

$$Daily\ mortality_t = \frac{Number\ of\ new\ confirmed\ deaths_t}{Total\ population} \times 1,000,000$$

- Vaccine coverage variables:
  - Cumulative number of "fully" vaccinated individuals per 100 people in the population
  - Cumulative number of people with at least 1-dose per 100 people in the population

→ **DEMAND SIDE**

  - Cumulative number of administered doses per 100 people in the population

→ **SUPPLY SIDE**

Results

		All countries[a]		LMIC		UMIC	
		(I) Log (daily CFR)	(II) Log(daily mortality)	(III) Log (daily CFR)	(IV) Log(daily mortality)	(V) Log (daily CFR)	(VI) Log(daily mortality)
(A)	L28.Fully vaccinated	-0.004	-0.013	*0.036****	-0.02	-0.003	-0.009
		[-1.08]	[-0.97]	*[3.26]*	[-1.11]	[-0.86]	[-0.70]
	L28.Fully vaccinated * LAC	**-0.014*****	-0.007	**-0.062*****	-0.009	**-0.014*****	-0.008
		[-2.87]	[-0.92]	**[-8.22]**	[-0.57]	**[-3.94]**	[-1.63]
(B)	L28.At least 1 dose	0.002	-0.006	*0.044****	-0.014	-0.001	-0.004
		[0.58]	[-0.44]	*[3.77]*	[-0.73]	[-0.24]	[-0.33]
	L28.At least 1 dose * LAC	**-0.016*****	-0.011	**-0.067*****	-0.013	**-0.013*****	**-0.012****
		[-4.34]	[-1.64]	**[-7.13]**	[-0.76]	**[-4.76]**	**[-2.53]**
(C)	L28.Administered doses	-0.001	-0.008	*0.024****	-0.016	-0.001	-0.006
		[-0.38]	[-1.11]	*[4.67]*	[-1.47]	[-0.93]	[-0.89]
	L28.Administered doses * LAC	**-0.007*****	-0.002	**-0.033*****	-0.001	**-0.006*****	-0.003
		[-3.57]	[-0.55]	**[-9.86]**	[-0.09]	**[-3.23]**	[-1.18]
	Obs.	4,883	5,098	1,340	1,407	3,543	3,691
	Groups	34	38	12	14	22	24
	Controls	Yes	Yes	Yes	Yes	Yes	Yes

*****1%, **5%, *10%. Robust standard errors. [z statistic] within brackets.** ***a.*** **Excludes all HIC and LIC countries**

Country-Level HLME Results

- Effect of vaccination is stronger and statistically significant in LAC countries
- A 1% increase in the fully vaccinated individuals/100 people leads to a 1.8% decline in daily CFR 28 days later, for LAC countries
  - This is a 1.4% higher decline than for APAC countries
- A 1% increase in the population of individuals vaccinated with at least 1 dose/100 people, leads to an additional 1.6% decline in daily CFR 28 days later, for LAC countries compared to APAC countries
- Effects of full vaccination much stronger for LIMCs in the LAC region, compared to those in the APAC region
- Higher vaccination rates in APAC countries associated with a statistically significant increase in daily CFR in LMICs
  - Results appear to suggest possible timing and surveillance effects for LMICs

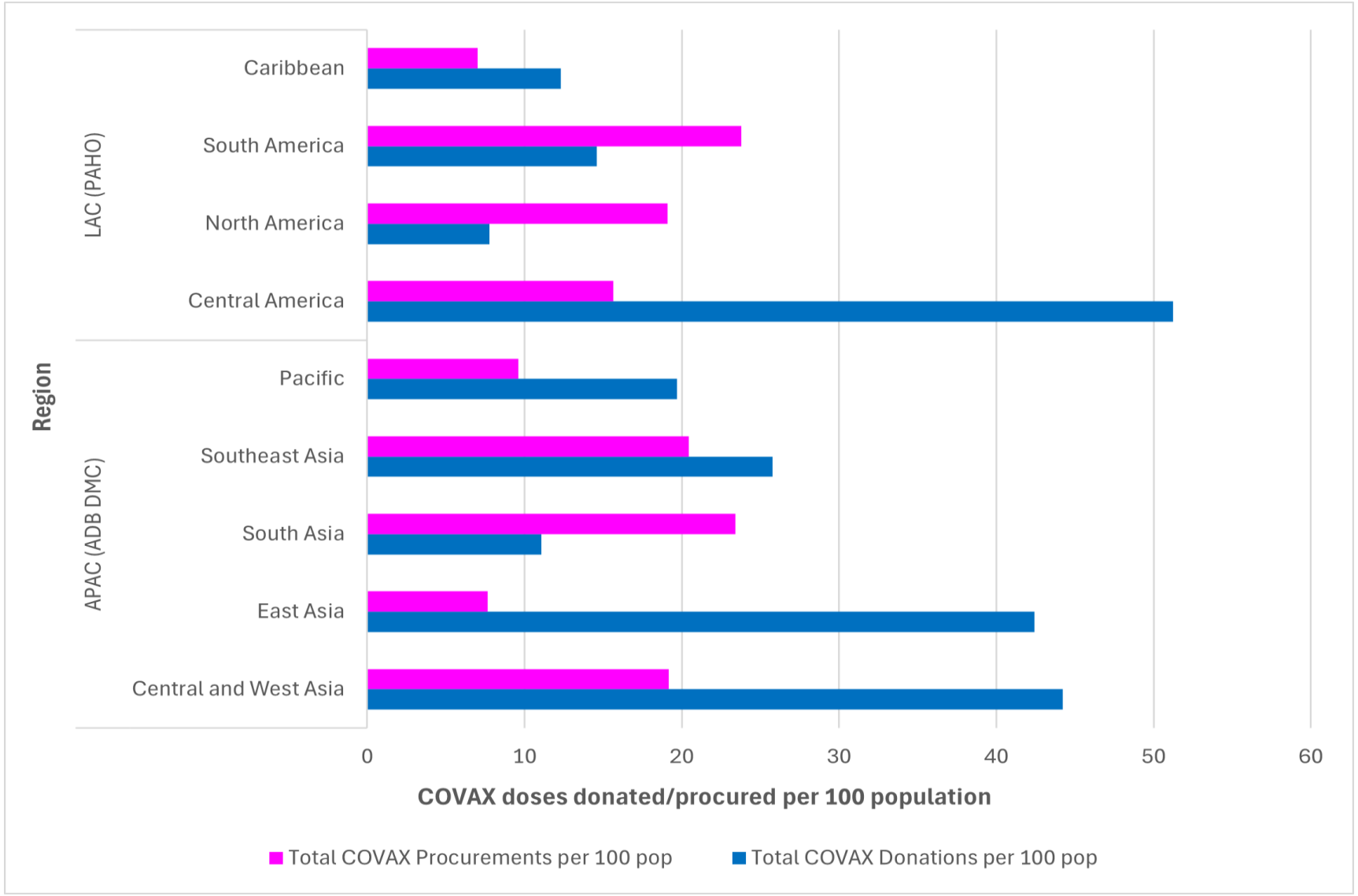
Procurement Volumes and Cost Analysis

- APAC and LAC are divided into sub-regions:
  - APAC – Central and West Asia, East Asia, South Asia, Southeast Asia, Pacific
  - LAC – Central America, North America, South America, Caribbean
- WAP per dose for sub-region i or income group k (LIC, LMIC and UMIC) was calculated using data on all contributing vaccine candidates for that sub-region/income group in the given year y = (2021, 2022 or 2023)

$$WAP_{i\ or\ k,y} = \frac{Total\ cost\ for\ COVAX\ procurement_{i\ or\ k,y}}{Total\ procured\ volume\ of\ doses\ from\ COVAX_{i\ or\ k,y}}$$

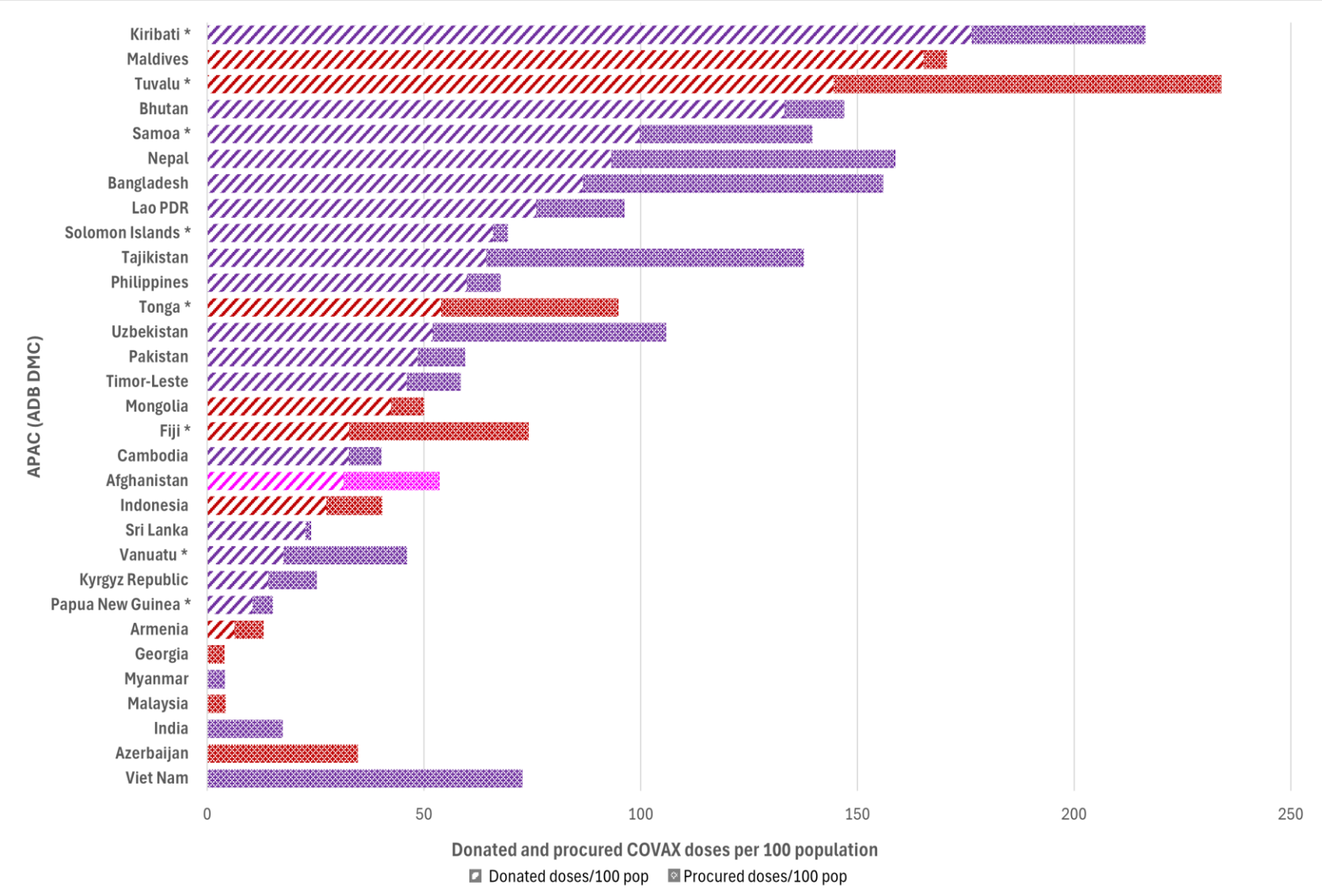
- Summary statistics indicating minimum price (and vaccine candidate), maximum price (and vaccine candidate) and weighted average price of COVID-19 vaccines calculated for each sub-region/income group
  - All vaccine candidates contributing more than 5% of the total COVAX-procured volume for each sub-region (income group) in a year considered when determining the minimum/maximum price
  - Weighted Average Price (WAP) calculation includes all procured vaccines through the COVAX facility

Procurement/Donations through COVAX



- Central America received the highest volume of COVAX donations per 100 population, across the three years.
- APAC generally received more doses as donations, relative to their populations.
- South America records the highest volume of doses procured through COVAX, per 100 population.

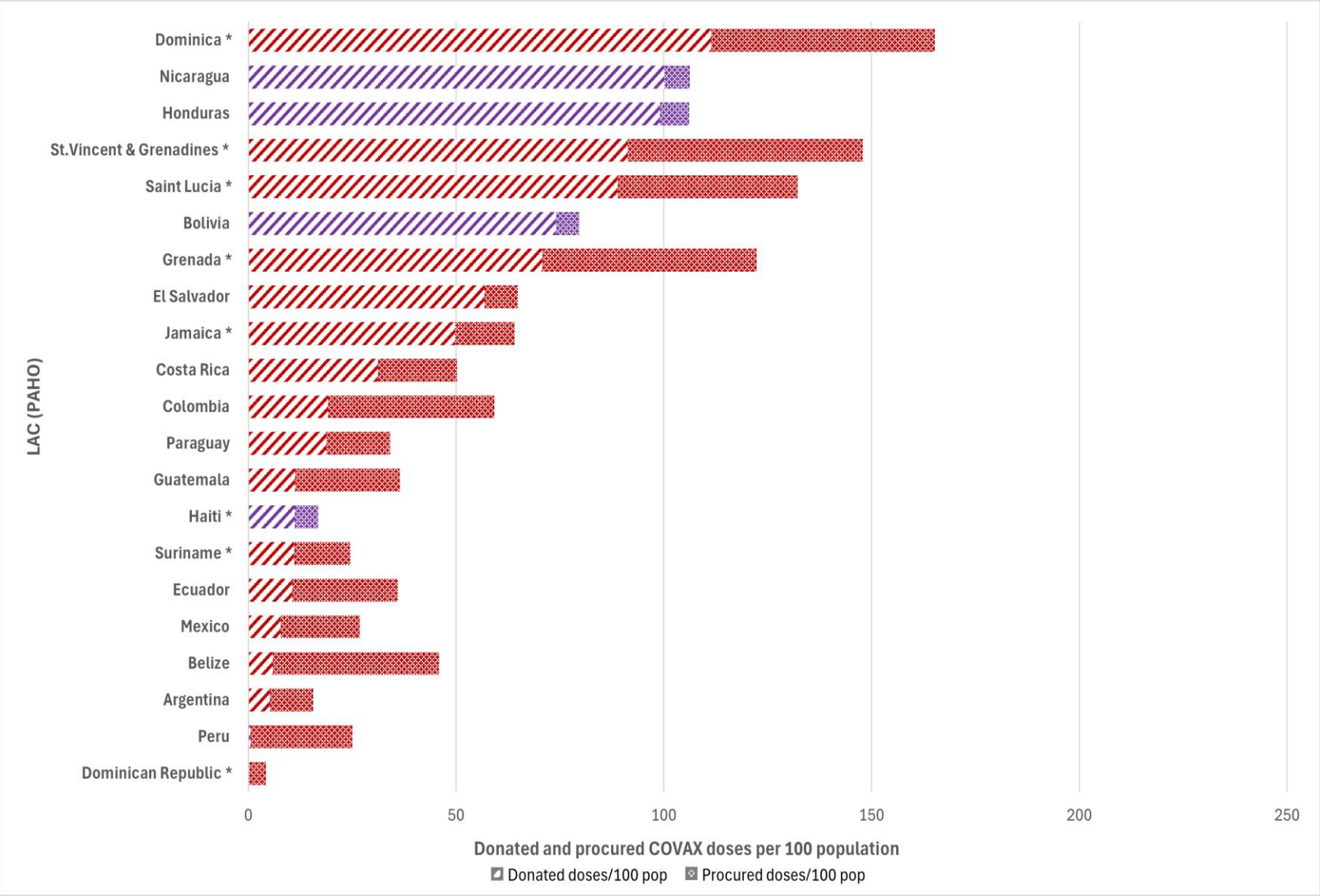
Procurement/Donations through COVAX



- Some UMICs and LMICs within the APAC region have not received donated doses through COVAX (e.g. Azerbaijan, India, Malaysia, Myanmar, Georgia and Viet Nam)
- Significant variations and disparities in donated doses received by APAC countries

* Small Island nations in the Pacific/Caribbean. Pink Bars – LICs, Purple bars – LMICs, Red Bars – UMICs

Procurement/Donations through COVAX



- LMICs received higher proportion of donated doses through COVAX
- Generally, more equitable distribution of donated vs procured doses

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Estimated Cost Savings – Example (Author calculation)

APAC Low-Income and Lower-Middle-Income Countries (2021)

Members	Income Group	Procured Volume	Procurement Cost (US $)	2021 WAP per dose for LAC (PAHO) (US $)	Procurement Cost at LAC (PAHO) WAP	Cost Savings (US $)
APAC	LIC	2,746,125	17,960,737		13,593,319	4,367,419
	LMIC	201,198,278	1,643,007,134	4.95	995,931,476	647,075,658
	UMIC	33,427,204	304,583,738	9.39	313,881,446	-9,297,708
Total Cost Savings for 2021						**642,145,369**

If the WAP applicable to LMICs and UMICs in the LAC region were applied to the LICs, LMICs and UMICs in APAC region, a cumulative cost savings of approximately ***US $ 642 million*** may have been achieved in 2021 (procurement of COVID-19 vaccines through the COVAX facility)

Conclusions

- Significant benefits & safeguards enjoyed by countries in the LAC region, particularly in the early years of the pandemic

- A strong negative effect of all three vaccine coverage metrics on the daily CFR in the LAC region
  - Relatively smaller effects for the APAC region
  - Stronger effects for LMICs in the LAC region

- Counterintuitive: Higher vaccination rates in APAC countries associated with statistically significant increase in daily CFR, in LMICs
  - Timing and surveillance effects: Possible that as vaccines rolled out, either testing expanded or case detection improved over time, increasing the denominator bias in CFR early on due to earlier undercounting of cases

- Greater cost savings, more access to low-priced COVID-19 vaccines, through the COVAX facility for LAC countries

Significant cost savings and increased bargaining power, particularly for LICs and LMICs in the APAC region, through the establishment of a collaborative procurement mechanism, similar to the PAHO-RF system.

Thank you !

- Please contact me for any further questions

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Collaborative Procurement Models

- Collaborative procurement is a mechanism that combines financial & other forms of purchasing authority across countries
    - Improve efficiency and create greater purchasing power
- Collaborative procurement offers:
    - Reliable supply of life saving medicines at affordable prices
    - Equitable access and distribution of health commodities
- Important mechanism for procuring routine essential medicines and medical countermeasures during public health emergencies
    - Exemplar: PAHO Revolving Fund (PAHO-RF) – Pan American Health Organization
    - Whilst a similar collaboration does not exist for APAC region, the Asian Development Bank (ADB) provided significant support to member countries

Pan American Health Organization (PAHO-Revolving Fund)

Latin America and the Caribbean (LAC)

35 Member states HI/UMIC/LMIC/LIC

Single price for most routine paediatric and adult vaccines

75% reduction in costs for the 13 most used vaccines

Specialized health agency of the Inter-American System

PAHO

Regional Office for the Americas of the WHO

During the Pandemic PAHO countries benefitted from…

Established supply and distribution chains

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