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Epidemiological impact and cost-effectiveness analysis of COVID-19 vaccination in Kenya

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Introduction

Evidence on cost-effectiveness of COVID-19 vaccines is useful in estimating value for money and opportunity costs. However, there is need to balance these economic outcomes against the potential impact of vaccination. A few studies have assessed the epidemiological impact and cost-effectiveness of COVID-19 vaccines in settings where most of the population had been exposed to SARS-CoV-2 infection.

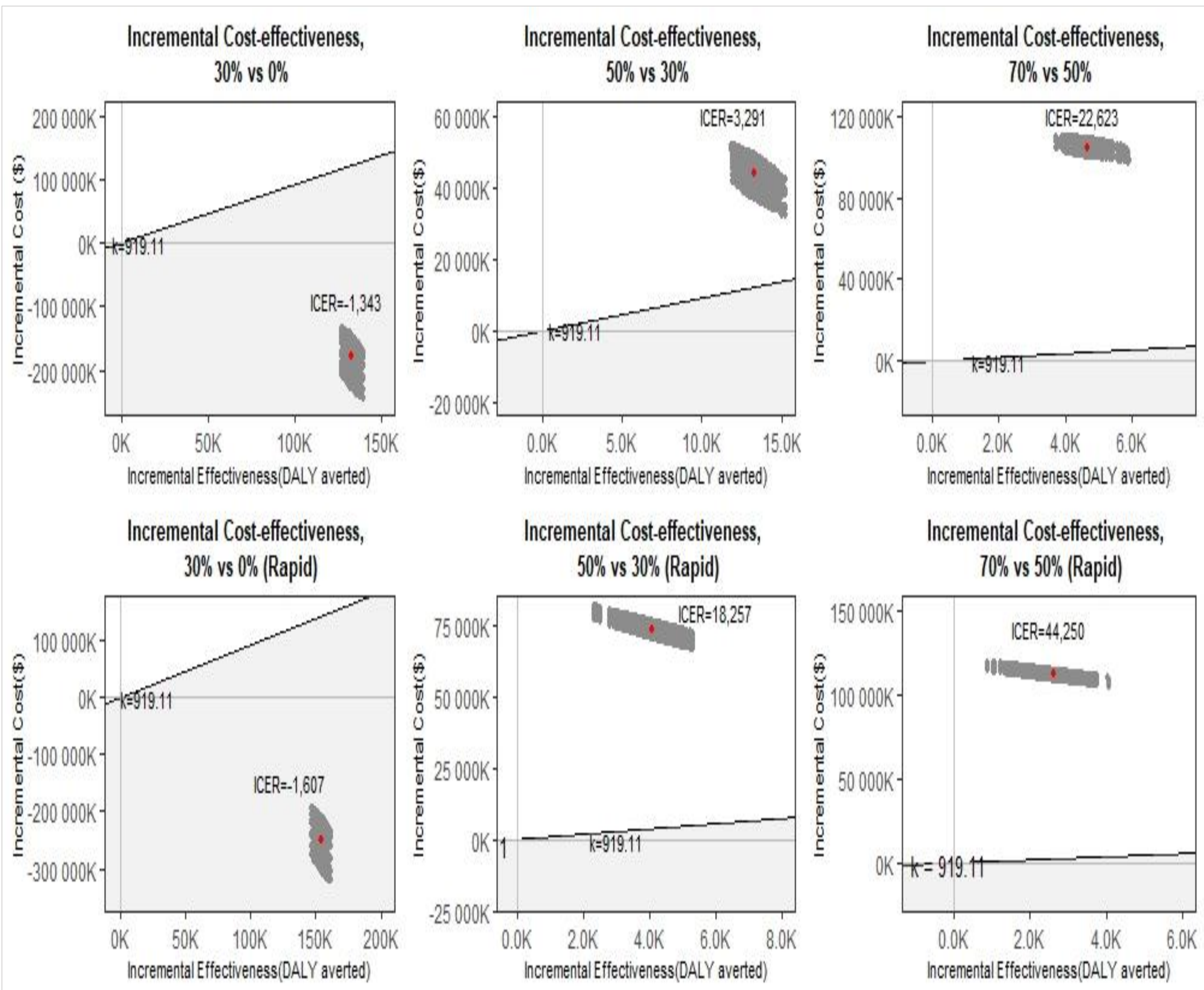
Research Objective

To evaluate the potential epidemiological impact and cost-effectiveness of different vaccine roll-out scenarios in a Kenyan population that has already acquired a high-level immunity due to prior infections.

Methodology

- We conducted a cost-effectiveness analysis of the COVID-19 vaccine in Kenya from a societal perspective over a 1.5year time frame.
- An age-structured transmission model assumed at least 80% of the population to have prior natural immunity when an immune escape variant was introduced.
- We estimate the effect of slow (18 months) or rapid (6 months) vaccine roll-out with vaccine coverage of 30%, 50% or 70% of the adult (>18 years) population prioritizing roll-out in those over 50-years (80% uptake in all scenarios).
- Cost data were obtained from primary analyses. We assumed vaccine procurement at US$7 per dose and vaccine delivery costs of US$3.90-US$6.11 per dose.
- The cost effectiveness threshold was US$919.11.

Figure 1: Probabilistic sensitivity analysis of different vaccination strategies from a societal perspective



The first row shows the vaccine scenarios comparisons under a non-rapid roll-out pace while the second row shows the rapid-roll-out results. Each grey dot represents a pair of values of incremental cost and incremental effectiveness and the red point is the mean ICER point for each vaccine comparison. The grey shaded area below the diagonal CE threshold line shows the cost-effective region.

Results

- Slow roll-out at 30% coverage largely targets those over 50 years and resulted in 54% fewer deaths (8132 (7914 to 8373)) than no vaccination and was cost-saving (ICER=US$-1343 (US$-1345 to US$-1341) per DALY averted)
- Increasing coverage to 50% and 70%, further reduced deaths by 12% (810 (757 to 872)) and 5% (282 (251-317)) but was not cost-effective, using Kenya's cost-effectiveness threshold (US$919.11)
- Rapid roll-out with 30% coverage averted 63% more deaths and was more cost-saving (ICER=US$-1607 (US$-1609 to US$-1604) per DALY averted) compared with slow roll-out at the same coverage level, but 50% and 70% coverage scenarios were not cost-effective.

Table 1: Projected clinical outcomes, costs, and the cost-effectiveness of different vaccination strategies in Kenya from a societal perspective

	Health Outcomes		Economic Outcomes		
	*Averted SARS-CoV-2 infections per 100,00	*Averted SARS-CoV-2 deaths	Total costs ($ millions),	Total DALYs (thousands)	+ICER, ($ per DALY averted) Mean (95%CI)
Non-rapid vaccination strategy (administered within 1.5years)					
No vaccination	-	-	787 (740 to 882)	247 (243 to 252)	-
30% coverage	32 (24 to 38)	8,132 (7,914 to 8,373)	614 (589 to 659)	114 (110 to 118)	-1,343 (-1,345 to -1,341) Dominant
50% coverage	4 (3 to 5)	810 (757 to 872)	658 (636 to 699)	101 (97 to 104)	3,291 (3,287 to 3,295)
70% coverage	2 (1 to 3)	282 (251 to 317)	763 (742 to 801)	96 (92 to 100)	22,623 (22,602 to 22,645)
Rapid vaccination strategy (administered within 6 months)					
No vaccination	-	-	787 (740 to 882)	247 (243 to 252)	-
30% coverage	39 (29 to 48)	9,433 (9,197 to 9,711)	545 (524 to 582)	93 (89 to 96)	-1,607 (-1,609 to -1,604) Dominant
50% coverage	1 (0.5 to 2)	250 (201 to 296)	620 (599 to 655)	88 (85 to 92)	18,257 (18,226 to 18,287)
70% coverage	0.5 (-0.05 to 1)	161 (106 to 208)	731 (713 to 765)	86 (82 to 89)	44,250 (44,126 to 44,374)

**Averted infections and deaths= This is the incremental averted infections/deaths compared to the strategy that appears in the row above. We are reporting the median (2.5th to 97.5th percentile)*

Conclusions

- Rapid deployment of vaccines during a pandemic averts more cases, hospitalizations and deaths and is more cost-effective.
- Against a context of constrained fiscal space for health and with prior exposure partially protecting much of the Kenyan population, it is likely more prudent for Kenya to target those at severe risk of disease and possibly other vulnerable populations rather than the whole population

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