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Vaccine Allocation Priorities Using Disease Surveillance and Economic Data

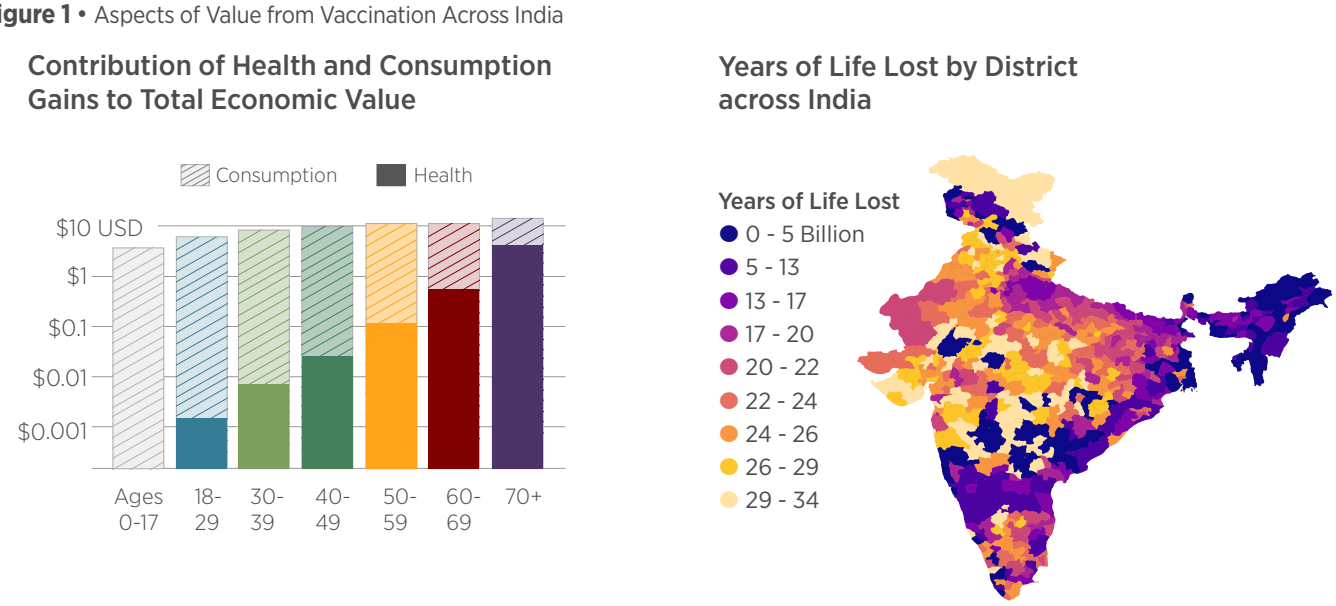
Based on BFI Working Paper 2022-14, "Vaccine Allocation Priorities Using Disease Surveillance and Economic Data," by Anup Malani, UChicago Law School; Satej Soman, University of California, Berkeley; Sabareesh Ramachandran, University of California, San Diego; Alice Chen, University of Southern California; and Darius Lakdawalla, University of Southern California

It may be less cost-effective to vaccinate—and thus to procure doses for—only a subset of a population in countries where the rate of vaccination is low, because infection will spread to more people, reducing the incremental value of vaccination; that is, the social value of vaccination and the optimum number of doses to purchase rise with the rate of vaccination.

The COVID-19 pandemic has infected over 250 million and killed at least 5 million worldwide. Nearly two years into the crisis, many countries, such as India, have experienced second waves with infection levels greater than the initial wave, and now face a potential third wave from the Omicron variant that is larger still. Despite widespread availability in some countries, many others still face shortages, raising an important question: What vaccine allocation plan maximizes the health and economic benefits from vaccination?

Prior analyses of optimal vaccine allocation typically begin with a model of disease, then simulate or forecast the effect of various vaccine allocation plans, and finally compare plans based on certain metrics. The authors cite numerous studies that incorporate various features, from prioritization of elderly populations, to accounting for deaths averted and years of life saved, among other factors. This research builds on those prior evaluations of vaccine allocation in three important respects: it includes novel epidemiological data from

Figure 1 • Aspects of Value from Vaccination Across India



Notes: The bar chart shows a decomposition of aggregate total economic value at levels of age bins into components associated with improved survival probability and with improved consumption. Total economic value is calculated using per capita present value of willingness-to-pay for gains in longevity from a random assignment vaccination policy assuming 50% of the population is vaccinated annually with a 70% effective vaccine. The map shows years of life lost per district assuming a random assignment vaccination policy and 50% vaccination rate.

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a low-to-middle income country, India; it incorporates a robust economic valuation of vaccination plans based on willingness to pay for longevity; and---more importantly---it employs a model for social demand for vaccination that can guide governments' vaccine procurement decisions.

Among other findings, this work reveals the following:

- Allocation matters. In countries such as India, with large populations and vaccine shortages, it matters who gets the vaccine first. Mortality-rate based prioritization may save a million more lives and 10 million more life-years.

- The social value of vaccination and the optimum number of doses to purchase rise with the rate of vaccination. It may be cost-effective to vaccinate—and thus to procure doses for—only a subset of the population if the rate of vaccination is low because vaccination campaigns are in a race against the epidemic. Slower vaccination means more people obtain immunity from infection, reducing the incremental protection from---and thus the social value of---vaccination.

- However, if the cost of speeding up vaccination is the inability to prioritize, it may be prudent in countries like India, for example, to choose a slower but mortality-rate prioritized vaccination plan. Vaccinating just 25% of the population in a year using mortality-rate prioritization saves more lives and life-years than vaccinating even 100% of the population in 6 months using random allocation. Protecting a small number of the elderly eliminates much of the remaining mortality risk from COVID-19 in India.

- A substantial portion of the social value from vaccination comes from improvement in consumption when vaccination reduces cases and permits greater economic activity.

This paper presents tools that can provide actionable policy advice, with estimates to help governments select optimal vaccination plans on a range of metrics. Importantly, these metrics consider economic factors that influence politicians, even though they may not be what the public health community recommends. Most importantly, these estimates recommend how many doses would be cost effective for governments to procure at different levels of vaccine efficacy and price.

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