

Press release

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ESMT Berlin study: Fractional-dose vaccines can save millions during shortages

New research shows that using smaller, fractional doses of vaccines can significantly reduce infections during epidemics, especially when vaccine supply, delivery, or administration capacity is limited. The study provides the first analytical framework for determining when and how many vaccine doses should be fractionated to most effectively reduce infections and maximize public health impact.

The paper, “When Should Fractional-dose Vaccines be Used?” by [Francis de Véricourt](#), professor of management science and founding academic director of the [DEEP - Institute for Deep Tech Innovation](#) at ESMT Berlin, [Jérémy Gallien](#) (London Business School), and [Naireet Ghosh](#) (London Business School), has been accepted in the peer-reviewed journal [Manufacturing & Service Operations Management](#). It combines epidemiology and operations research to evaluate vaccination strategies under real-world constraints. Using an epidemic simulation model integrated with an optimal control framework, the authors identify vaccination policies that minimize infections while accounting for limited stockpiles, delivery delays, and administration capacity.

Their findings show that fractional-dose vaccines, those using less antigen per shot, can substantially reduce infections even when they are somewhat less effective than full doses. They are most valuable when vaccine stockpiles are scarce or delivery is slow, such as early in a pandemic or in low-resource settings, because smaller doses allow more people to be vaccinated faster. By contrast, when supply is ample or vaccination capacity is limited, full doses remain the better option. The optimal mix depends on both the efficacy gap between doses and the logistical constraints faced by health authorities.

In two real-world case studies – the 2004–05 influenza season in the United States and Nigeria’s COVID-19 vaccination campaign – the researchers illustrate the potential scale of the effect. In the U.S. flu shortage, using fractional instead of full doses could have averted 64% more infections, or around 32 million additional cases. In Nigeria, where vaccine supply rates were the main bottleneck, the optimal fractional-dose strategy could have increased infections averted by 131%, preventing roughly 11 million more cases. The results show that fractional dosing can save millions when vaccines are scarce, but should be avoided once supply and delivery capacities are sufficient.

“Fractional-dose vaccines can expand the reach of limited supplies,” says Francis de Véricourt. “Our work gives policymakers a clear framework to decide when smaller doses avert more infections and protect more people, especially when time and supply are scarce. Future health crises will require learning while acting, and our model can be extended to guide adaptive vaccination policies as new data emerge.”

The study demonstrates that simplified strategies, such as using a single vaccine dosage throughout a campaign, can still achieve most of the benefits of the optimal, more complex policies. However, the

researchers caution that the most effective approach depends strongly on local constraints such as manufacturing speed and distribution infrastructure.

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