

DRAFT V8 – FOR DISCUSSION

COVID-19 Vaccine Portfolio Analysis for Risk Mitigation and Policy Development

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This note explains why the world should have a good dynamic model of the global COVID-19 vaccine portfolio, why our team has the skills to build one, what we have done so far, what we plan to do next, and kind of support we require.

The utility of a good model of the COVID-19 vaccine portfolio

Most people believe that a return to global normalcy depends on the approval and widespread use of safe and effective COVID-19 vaccines. However, experts disagree on whether or when vaccines will be approved. Similar comments apply to vaccine manufacturing and deployment. And even if there were consensus on the likelihoods, no one knows which specific vaccines will succeed or fail. Such *uncertainty* is a problem for policy development.

There has been truly remarkable work by many governments and other agencies (e.g., WHO, CEPI, BARDA) to expedite and coordinate the race for a vaccine. However, in this unprecedented effort, the world may inadvertently concentrate technical risk on certain vaccine platforms, viral antigens, or clinical trial strategies. It may also inadvertently concentrate manufacturing and deployment risk.

Therefore, we need tools to analyse and understand the global vaccine pipeline, to measure and manage risk, to sketch out the most likely scenarios, and to evaluate and communicate forecast uncertainty. This should improve portfolio management (e.g., which new candidates might minimize the risk of total failure? What manufacturing plants and distribution capacity should we start to build?). It can also guide policy (e.g., at what point would it be reasonable for a government to switch from behaving as if there will not be a suitable vaccine to behaving as if there will?).

Why we are well placed to build a portfolio model

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All three believe that

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portfolio analysis and simulation tools are superior to those in widespread use in the investment and drug industries; particularly for risk management and for evaluating and communicating uncertainty.

Progress so far on the model and portfolio analysis

23rd of April: A [technical paper](#) on the methods and rationale of portfolio analysis. We suggested the policy objective should be to minimize the risk of zero vaccines within a given time, rather than to maximise the speed of the first vaccines. We ran Monte-Carlo simulations of the global COVID-19 vaccine portfolio – albeit with simple assumptions – and computed a ~40% risk of zero approvals within 18 months. We then simulated policies to reduce the risk of zero approvals.

10th May: A [Financial Times](#) article on the logic of diversification and risk management. With many tens of candidates for the same disease, hedging the risk is more important than adding another “winner.” For example, nearly all vaccines aim to win the race by choosing the COVID-19 spike protein over other viral antigens. What if the spike protein turns out to be a bad choice? How might safety concerns with one vaccine disrupt clinical development and adoption of others? To what extent will “therapeutic nationalism” undermine the benefits of a diversified global vaccine portfolio and amplify risk at the national level?

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15th May: A questionnaire for structured interviews with vaccine experts. The questionnaire aims to elicit expert judgements on operational, safety, efficacy, and manufacturing-related risk factors; timings; and interdependencies between vaccine projects (e.g., how would one mRNA vaccine failure increase risk in other mRNA vaccines). We also have methods to convert experts' risk scores into probability of success (POS) estimates. In our experience, a two-step approach (ranking on risk factors then computing POS) works better than asking experts to estimate POS.

Immediate next steps

1. Software test: We will use preliminary risk and timing estimates from (10)(2e) and (10)(2e) to test the simulation software on the ~130 candidate global vaccine portfolio.
2. Expert interviews to parameterize the model: Structured interviews with 7 to 10 experts with experience in vaccine research, development, regulation, and manufacturing across technology platforms and pathogens. This will require 1 to 2 hours per expert. Access to suitable experts is a current constraint on progress.
3. Run model with high quality parameterisation.
4. Preliminary look at manufacturing constraints.

Planned deliverables / outputs

1. Publish the methodology including the estimates of vaccine-specific and platform-specific risk scores, POS, and timing, derived from the expert interviews.
2. Publish the results of the global COVID-19 vaccine portfolio simulation (i.e., the probability of the number and type of vaccine approvals over time). We will highlight the major sources of portfolio risk and evaluate risk mitigation strategies. We will also set out the major sources of forecast uncertainty.
3. Update and republish on a regular basis, as new information emerges on the vaccine candidates and on the development and deployment environment. Perhaps a panel of experts could be established to provide independent advice on the main model assumptions and the most useful scenario analyses.
4. Make the model available to institutions to use with their own inputs, so they can run their own portfolio simulations and scenario analyses.
5. Extend the analysis for more realistic coverage of manufacturing and vaccination campaigns.

Support required

Near term: Access to 7 to 10 experts with experience in vaccine R&D, regulation, and manufacturing across the COVID-19-relevant vaccine technologies. We are working on this and recently had some help with introductions, but it remains the rate limiting step.

Medium- to long-term: (10)(2e) are self-employed. (10)(2e) (10)(2e). So far, we have simply fitted the work around other commitments, because we think it is important. Our current informal arrangements may well get us to deliverable/output (2) above; perhaps by mid-June if we get access to suitable vaccine experts to interview. However, outputs (3) to (5) would likely require a full-time commitment from (10)(2e) and perhaps from (10)(2e) as well. It will be hard to commit to such work unless we can find funding. We are exploring options for funding from charities and government agencies. If that fails, we may seek funding from the private sector. Any funding we receive must allow us to focus on informing public policy and risk management in the COVID-19 vaccine portfolio.