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*Long-term durability of immune responses to the BNT162b2 and mRNA-1273 vaccines based on dosage, age and sex*

The current publicly deployed lipid nanoparticle (LNP) base-modified mRNA vaccines, mRNA-1273 (Moderna) and BNT162b2 (Pfizer), are our current front-line therapeutic defence against variants of concern (VOC). Emerging data has shown that third booster dose within one year of second dose are necessary to mount an effective protection against VOC; however, the optimal timeline is not clear. In this talk I will introduce our novel within-host mathematical model for the LNP-formulated mRNA vaccines. We fit our model to 22 clinical humoral and cytokine BNT162b2 and mRNA-1273 data sets and find robust estimates for long-term within-host IgG humoral loss and inflammatory cytokine response [1]. We find that two doses of either Moderna or Pfizer leads a 99% loss of humoral immunity relative to peak immunity by eight months following the second dose. We then correlate humoral percent loss with time-dependent efficacy studies. The model-predicted inflammatory cytokine, CD8+ T-, CD4+ T-, and plasma B- cell responses levels also show significant drops from peak value over the same timeframe. Notably, eight months following the second dose was the original timeline by the U.S. Centers for Disease Control and Prevention for the third booster shot, which was later altered to 6 months post second dose; our model results agree with this proposed third-dose timeline.

(Ref [1]: C.S. Korosec et al. medRxiv 2021.10.13.21264957; doi: <https://doi.org/10.1101/2021.10.13.21264957>)