Longitudinal trajectories of influenza immune response after repeat vaccination

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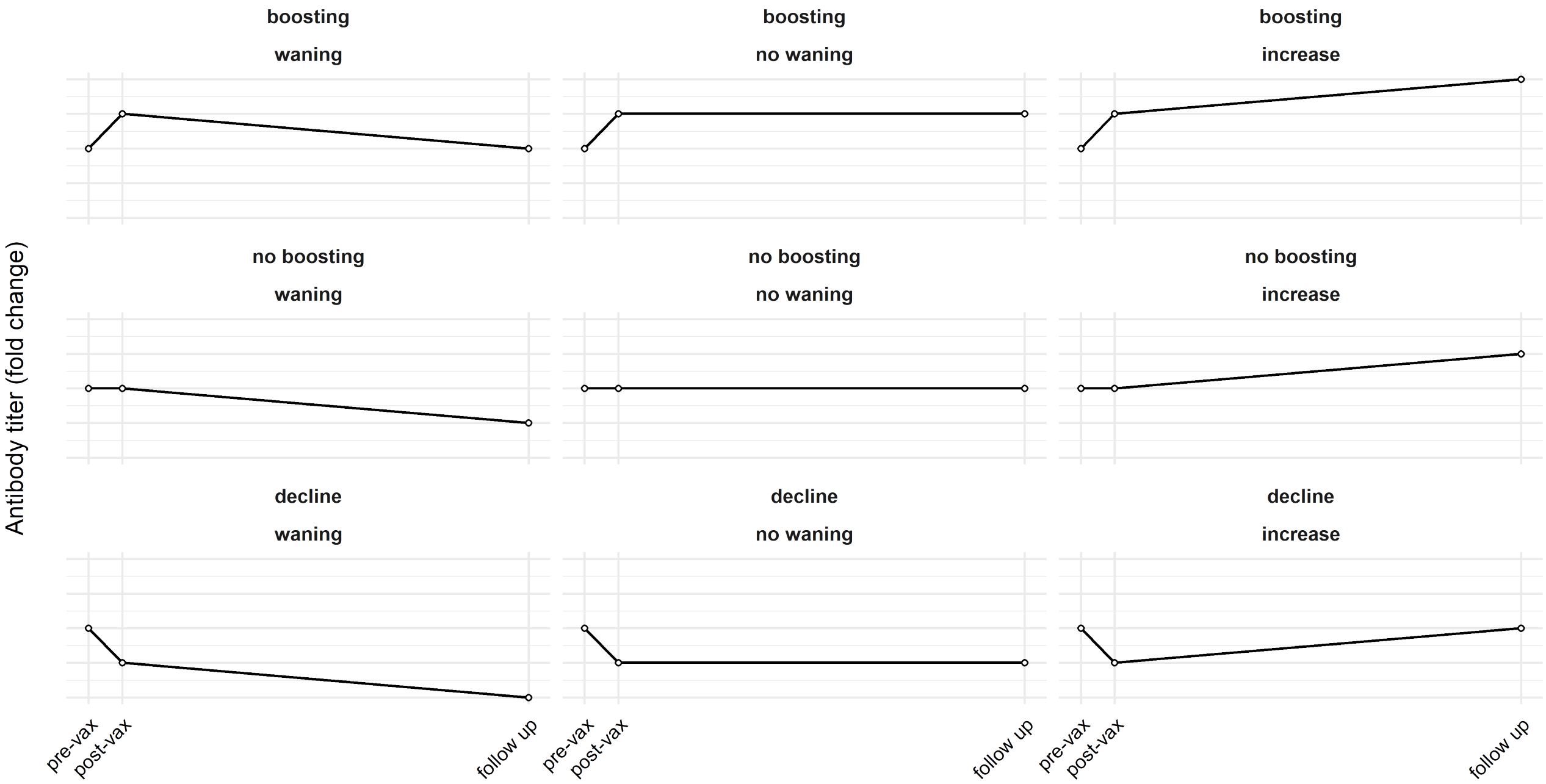
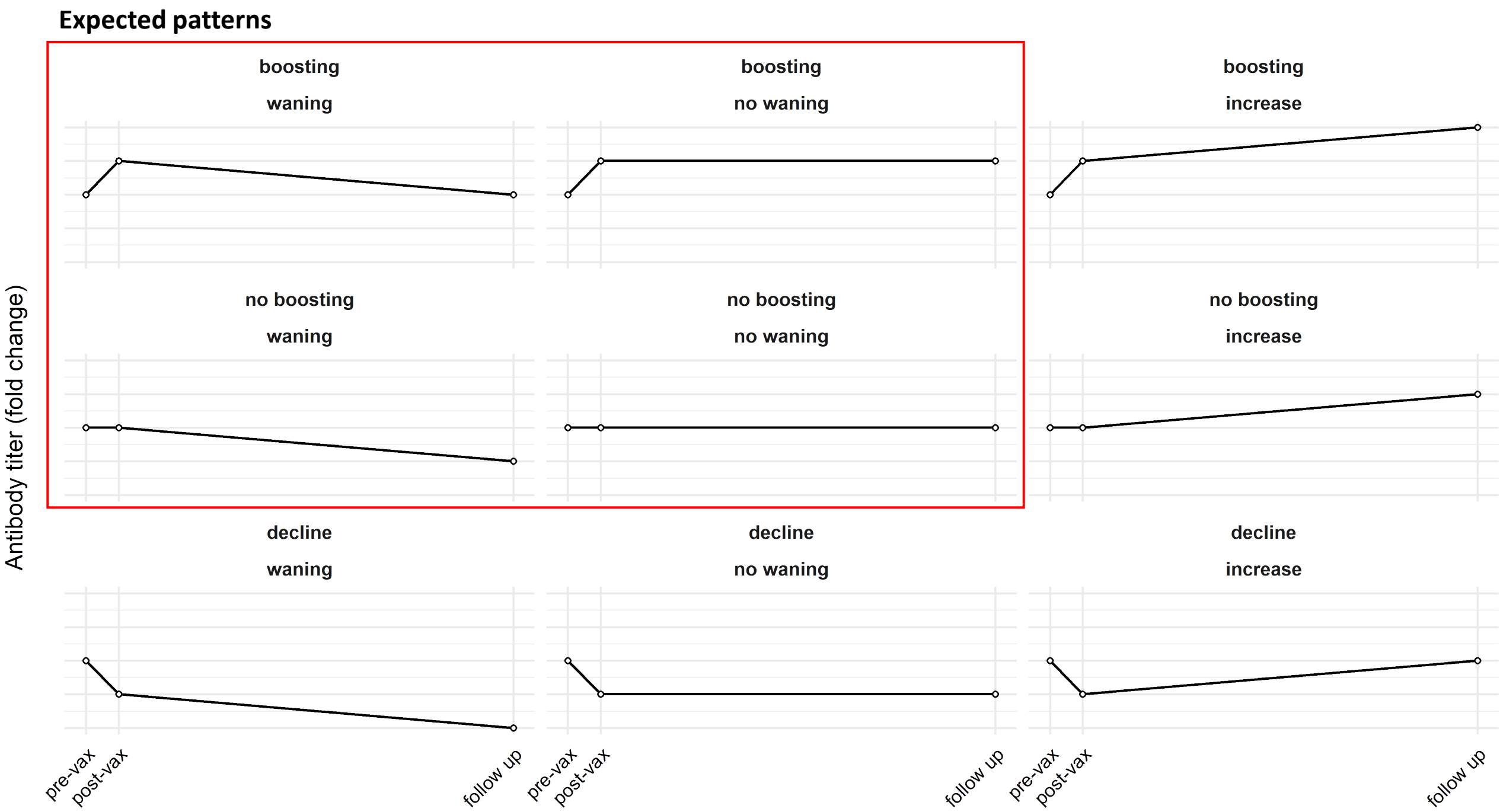
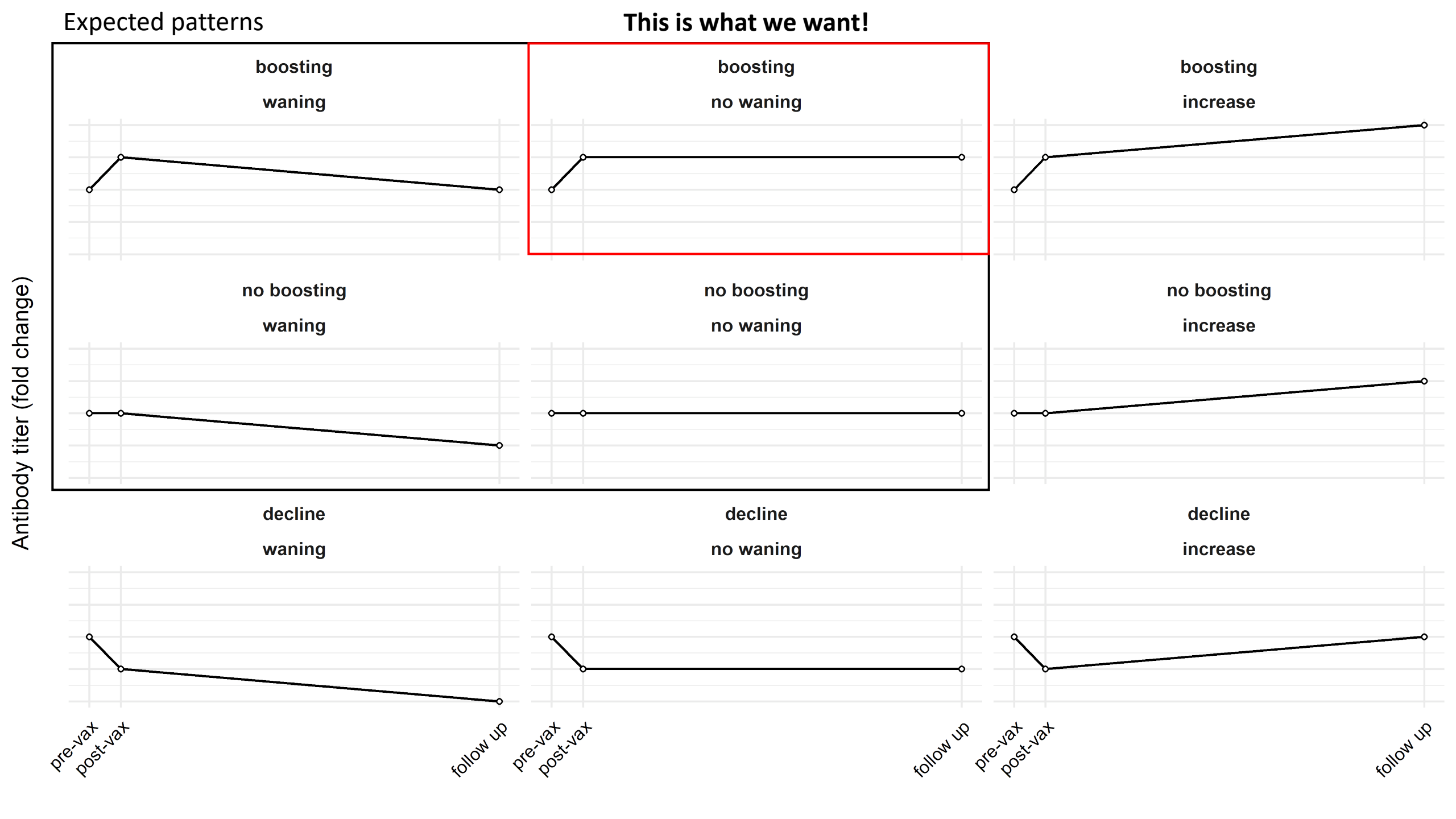
What could trajectories look like?




Expected patterns
boosting
waning
boosting
no waning
boosting
increase
no boosting
waning
no boosting
no waning
no boosting
increase
decline
waning
decline
no waning
decline
increase
Antibody titer (fold change)
pre-vax
post-vax
follow up
pre-vax
post-vax
follow up
pre-vax
post-vax
follow up


Expected patterns
This is what we want!
boosting
waning
boosting
no waning
boosting
increase
no boosting
waning
no boosting
no waning
no boosting
increase
decline
waning
decline
no waning
decline
increase
Antibody titer (fold change)
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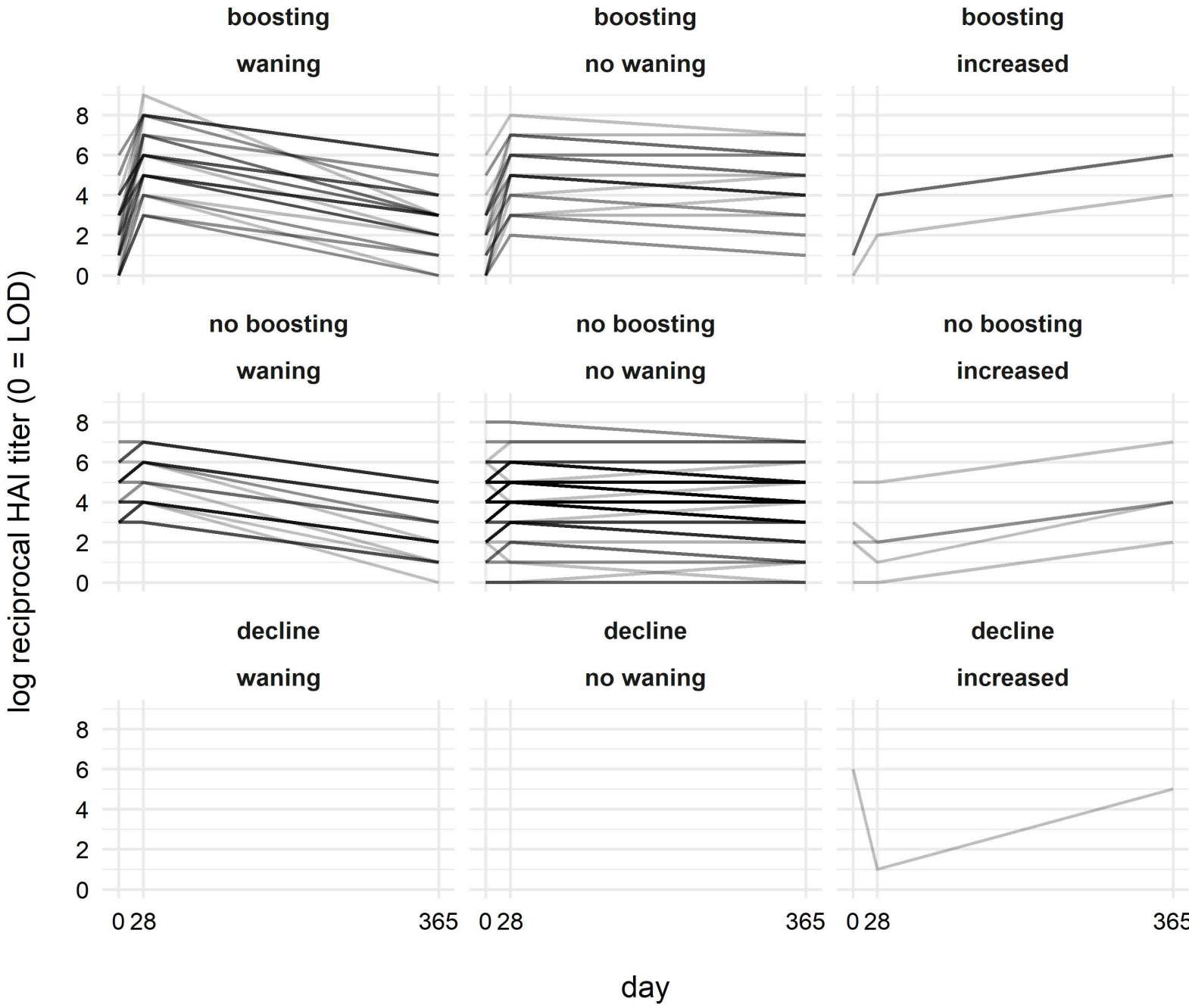
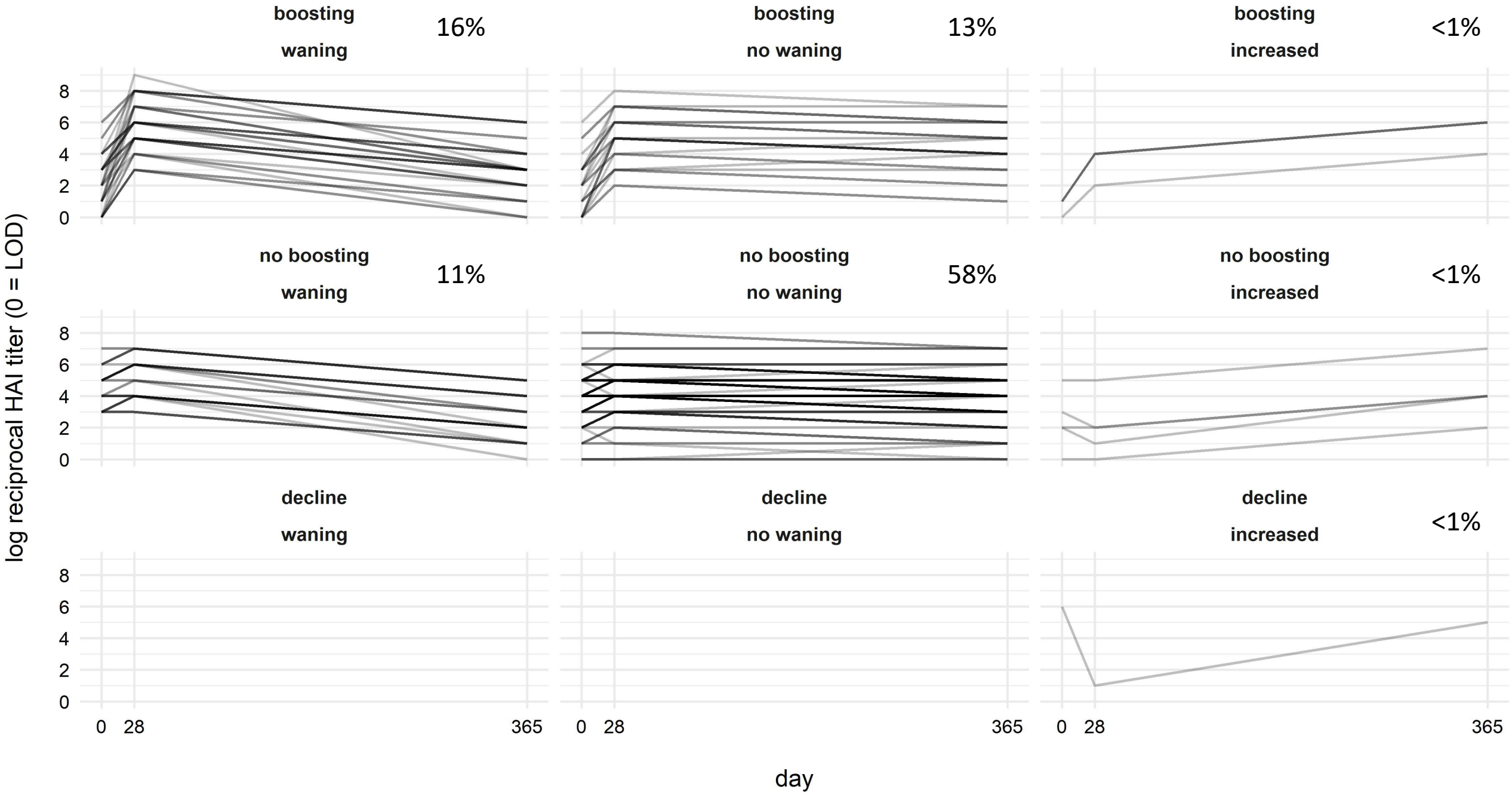
post-vax
follow up

When we consider boosting/waning as at least a 4-fold change, we see all patterns in real data.

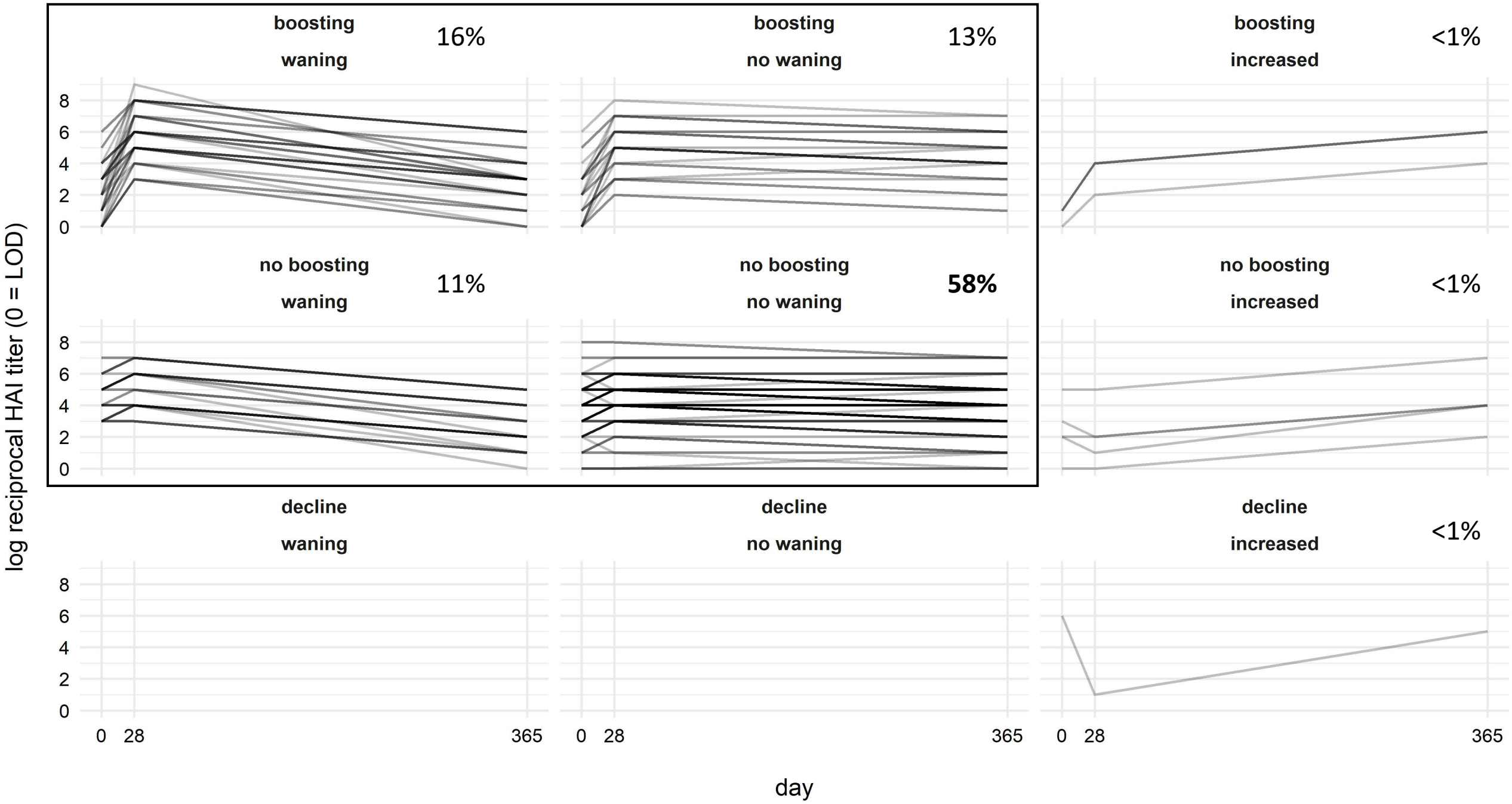
- Data are from an ongoing cohort study of flu vaccination by Ted Ross' group at UGA. (Started 2016.)
- Participants give serum samples before vaccination and approx. 28 days after. Some repeated in consecutive years, so we can use these prevaccination titers as a "follow-up" measurement.
- Serum samples are tested against a panel of current and historical influenza samples.
- Figure shows: 200 randomly sampled HAI titer against B-Phuket-2013 strain (total sample size for this strain = 640 trajectories) across all five years of the study.



Most trajectories fall into the expected categories—others could be measurement error or biological.



No 4-fold change was, by far, the most common outcome across all strains and seasons.



Future research

- Quantify patterns with formal statistical analyses.
- Are there noticeable patterns when we stratify trajectories by host factors, like sex or age?
- How do patterns of homologous and heterologous trajectories differ? **We have an entire panel of heterologous strains we can check!**

Example of stratification:

Pattern	Age >= 65	Age < 65	Overall
boosting waning	3%	17%	16%
boosting no waning	8%	14%	13%
no boosting waning	29%	10%	11%
no boosting no waning	60%	58 %	58%
other 5 patterns	0%	1%	2%

For trajectories of B-Phuket-2013 response (n = 640 representing 376 unique individuals).