

# Modellierung Omikron-Welle

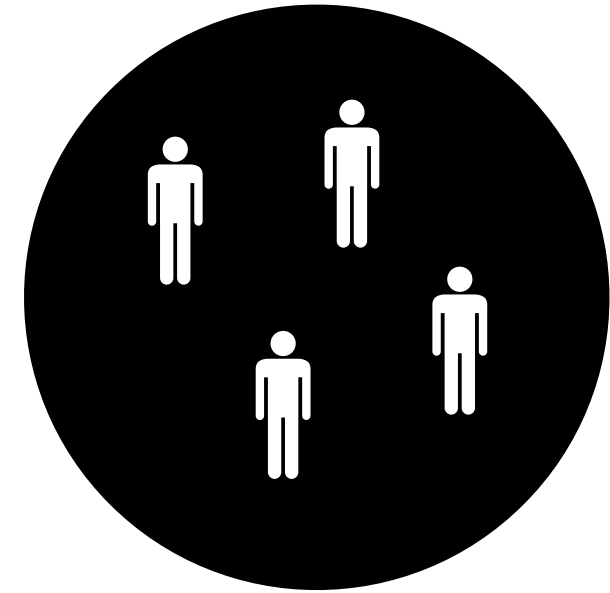
P4 in Kollab. mit FG33 *et al.*

Ben Maier, 2021-01-14, [maierb@rki.de](mailto:maierb@rki.de)

# Modellstruktur

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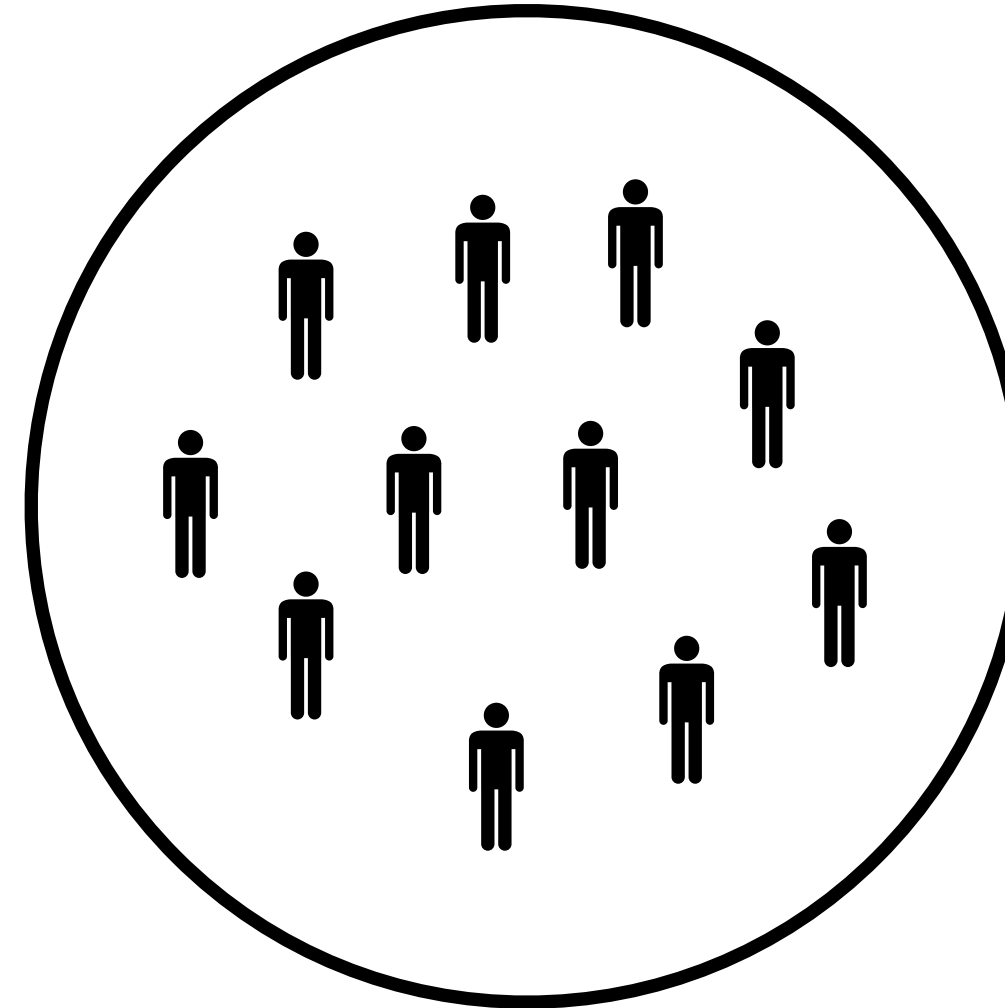
Ungeimpfte



Vollst. 1. Impfsérie

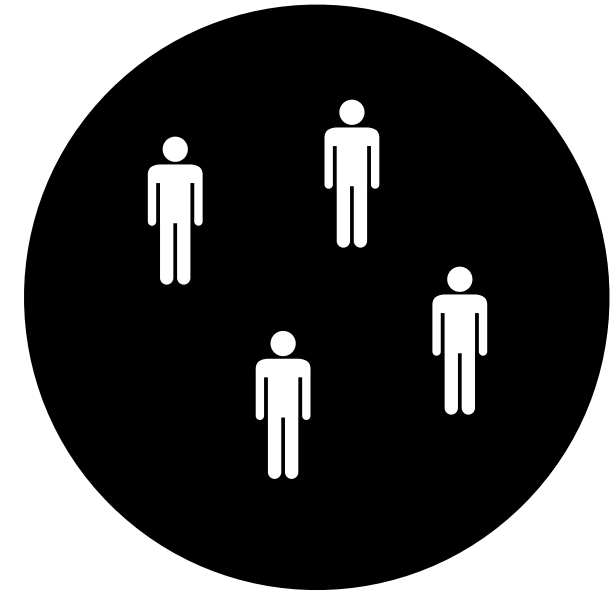


Geimpfte



# Modellstruktur

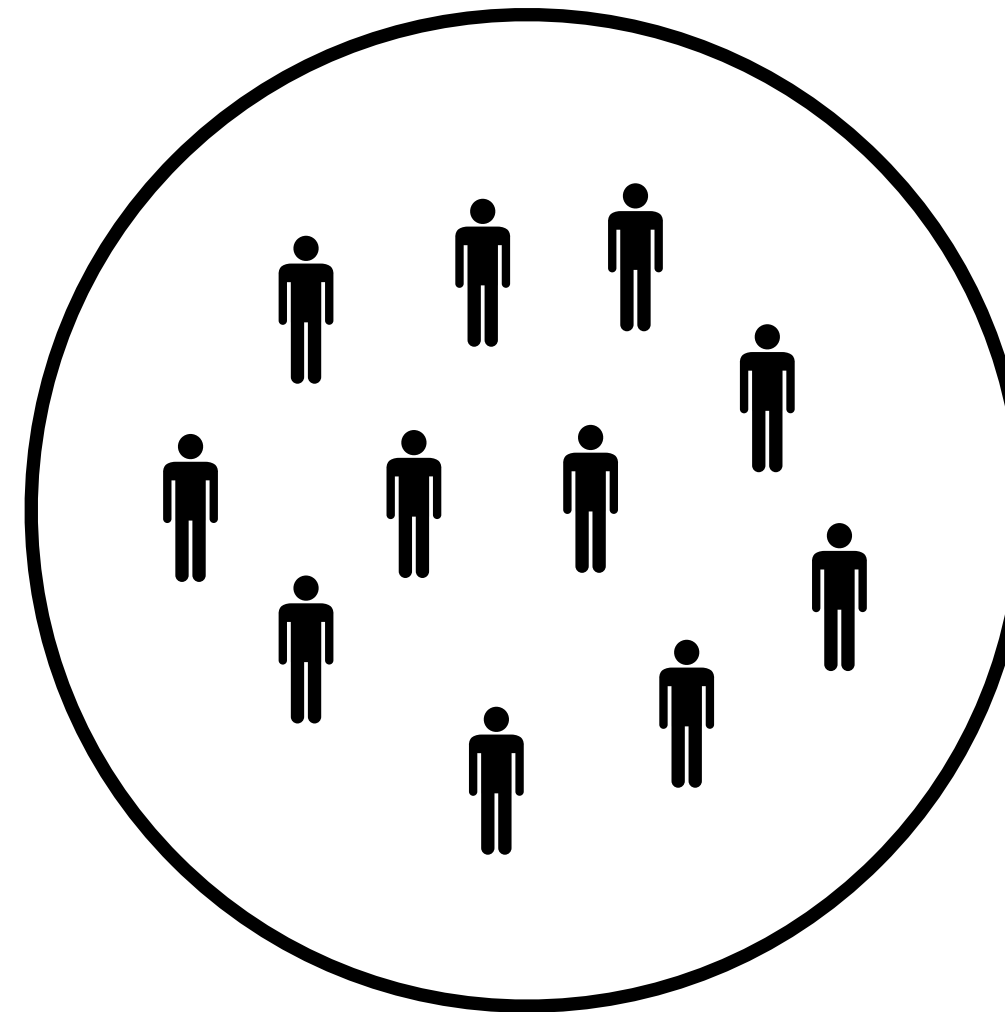
Ungeimpfte



Vollst. 1. Impfserie



Geimpfte

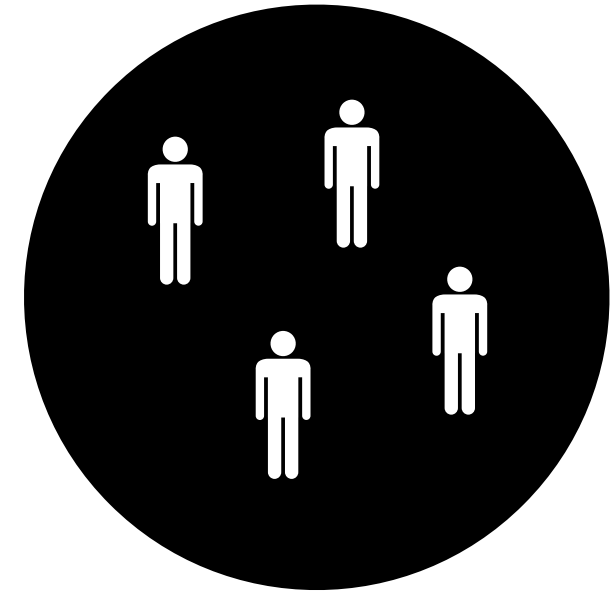


Impfschutz  
vaccine efficacy (VE)

nicht vorhanden

# Modellstruktur

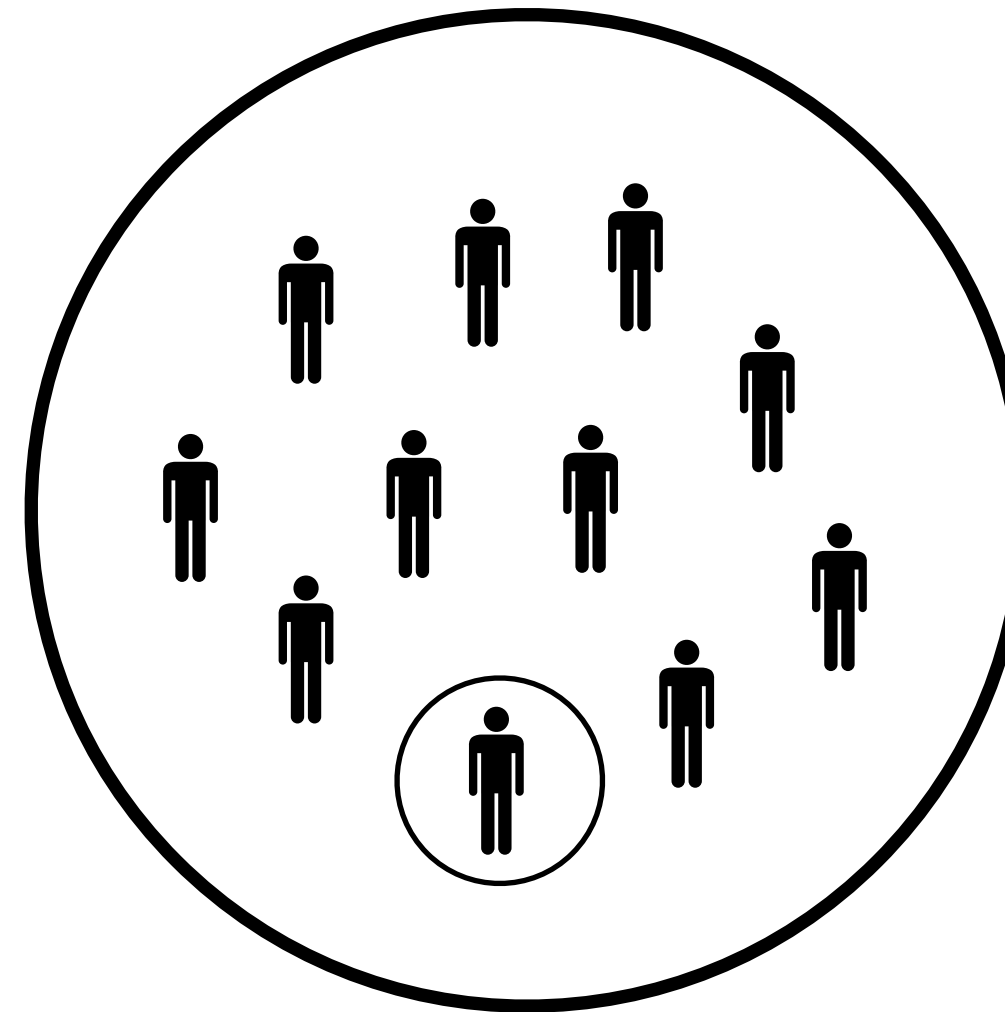
Ungeimpfte



Vollst. 1. Impfserie

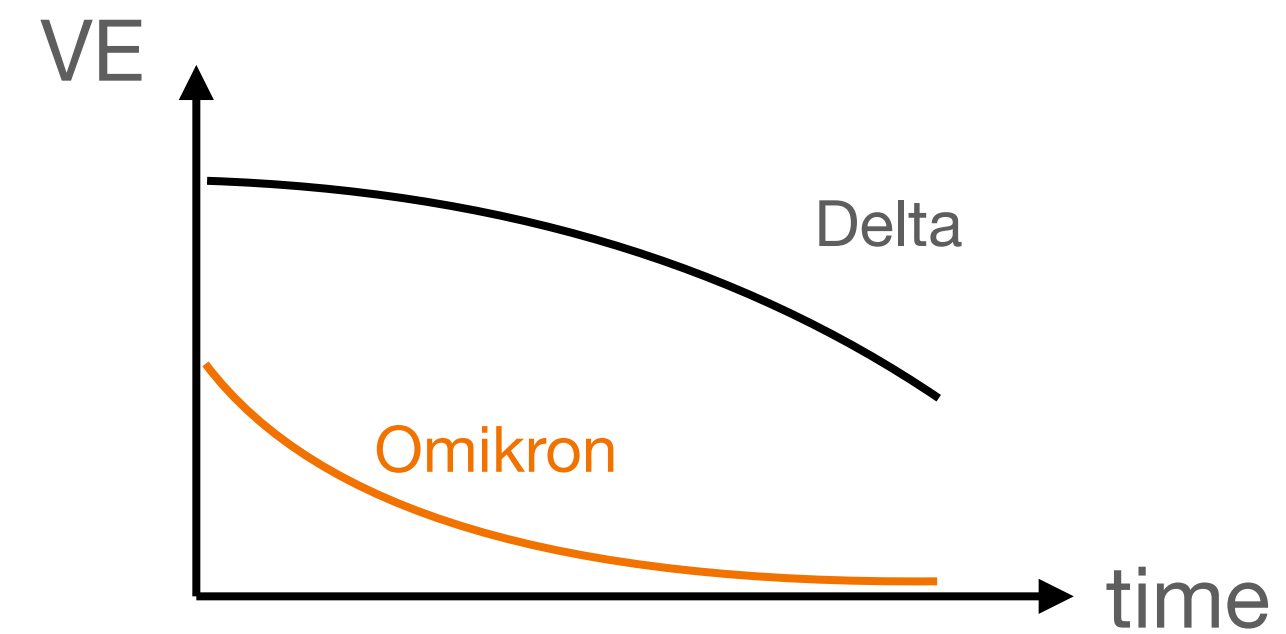


Geimpfte



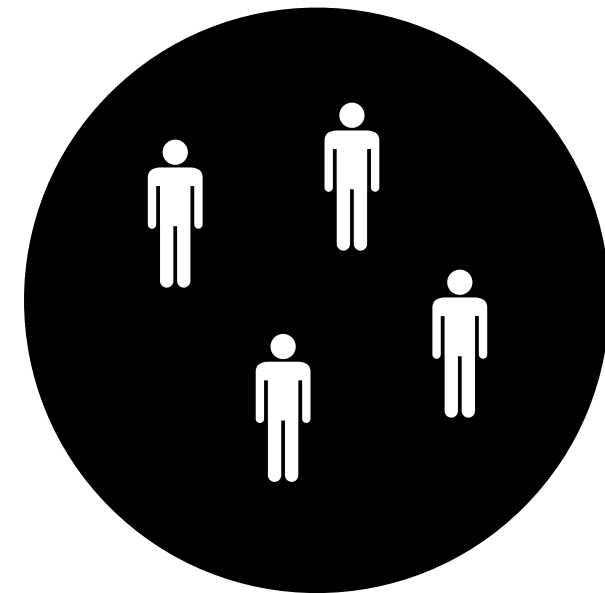
Impfschutz  
vaccine efficacy (VE)

nicht vorhanden



# Modellstruktur

Ungeimpfte



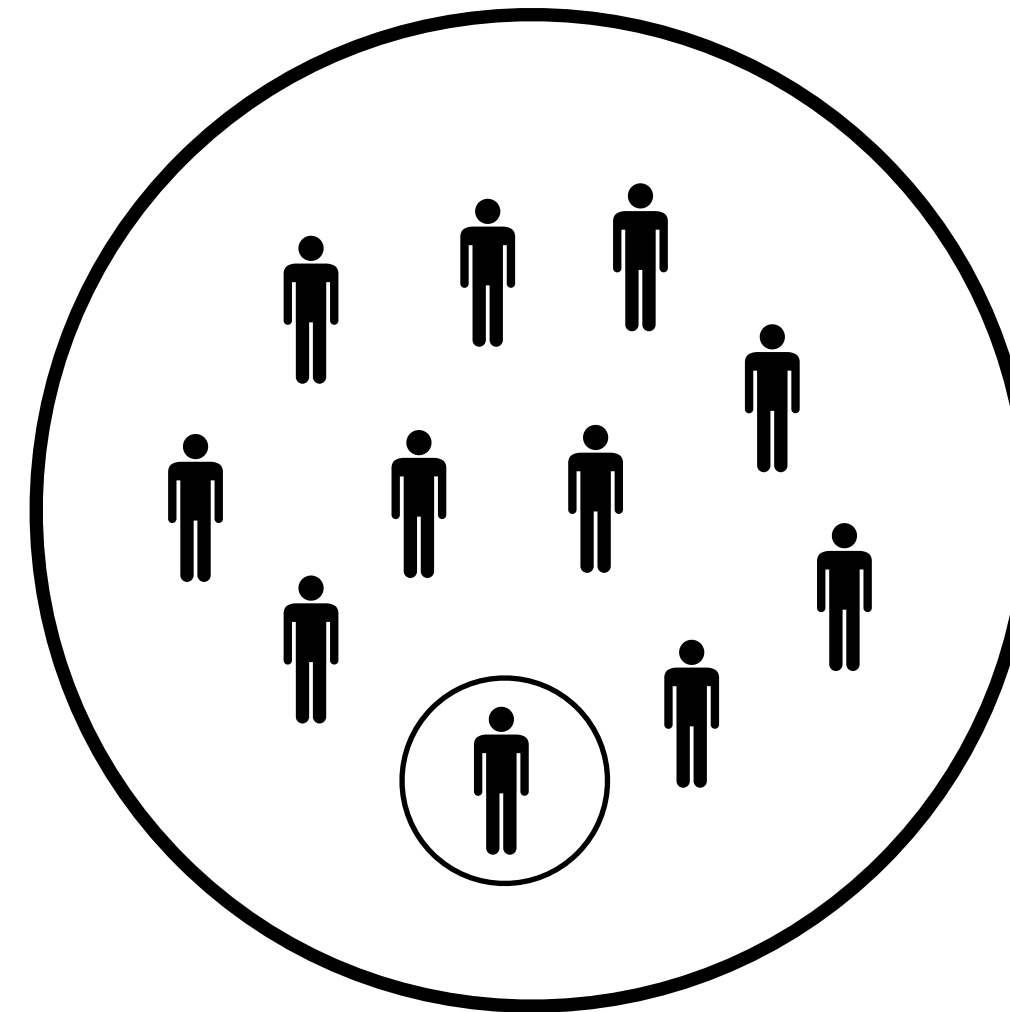
Gesamtzahl:  
zeitabhängig

nicht vorhanden

Vollst. 1. Impfserie



Geimpfte

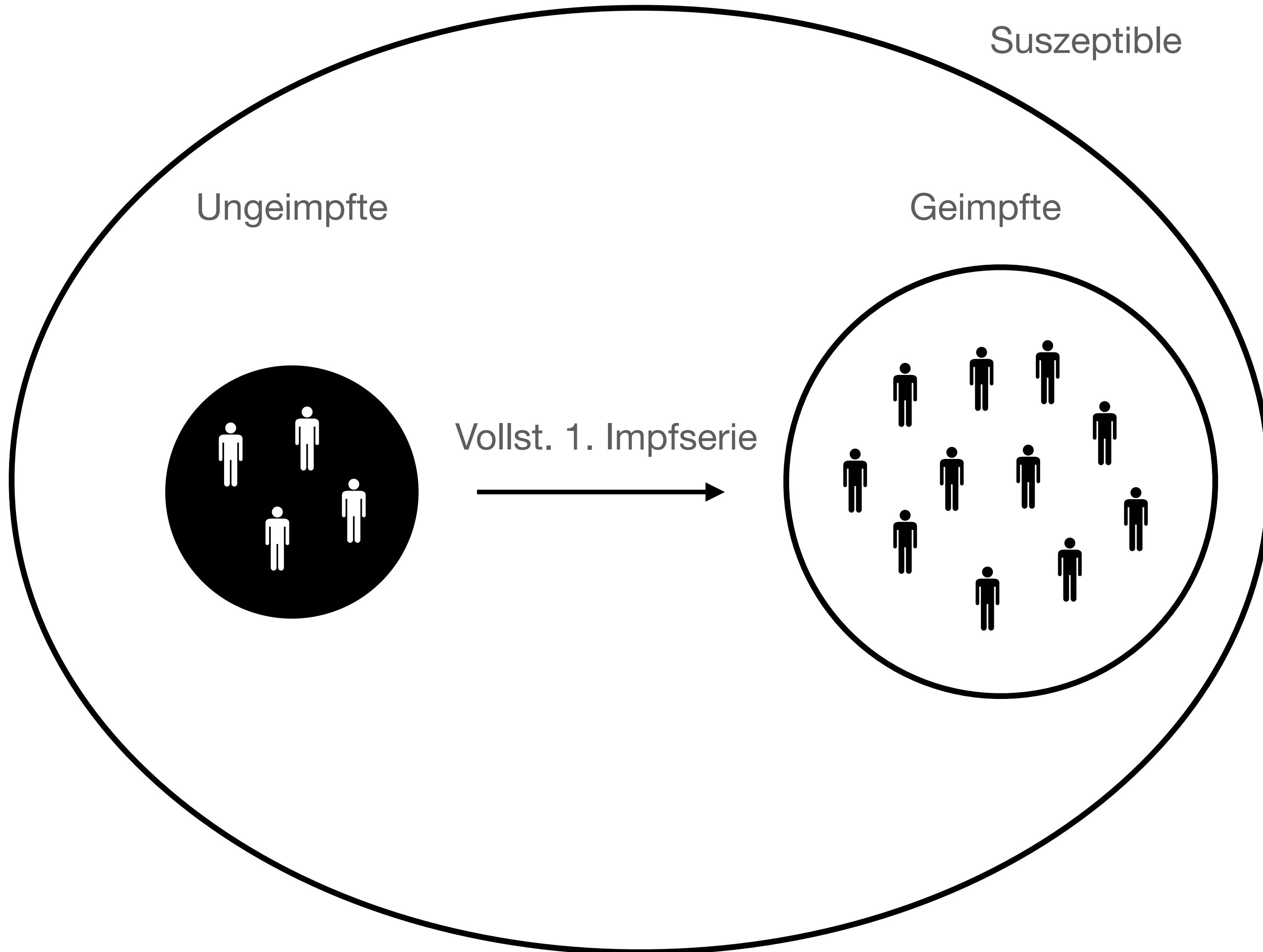


Gesamtzahl:  
zeitabhängig

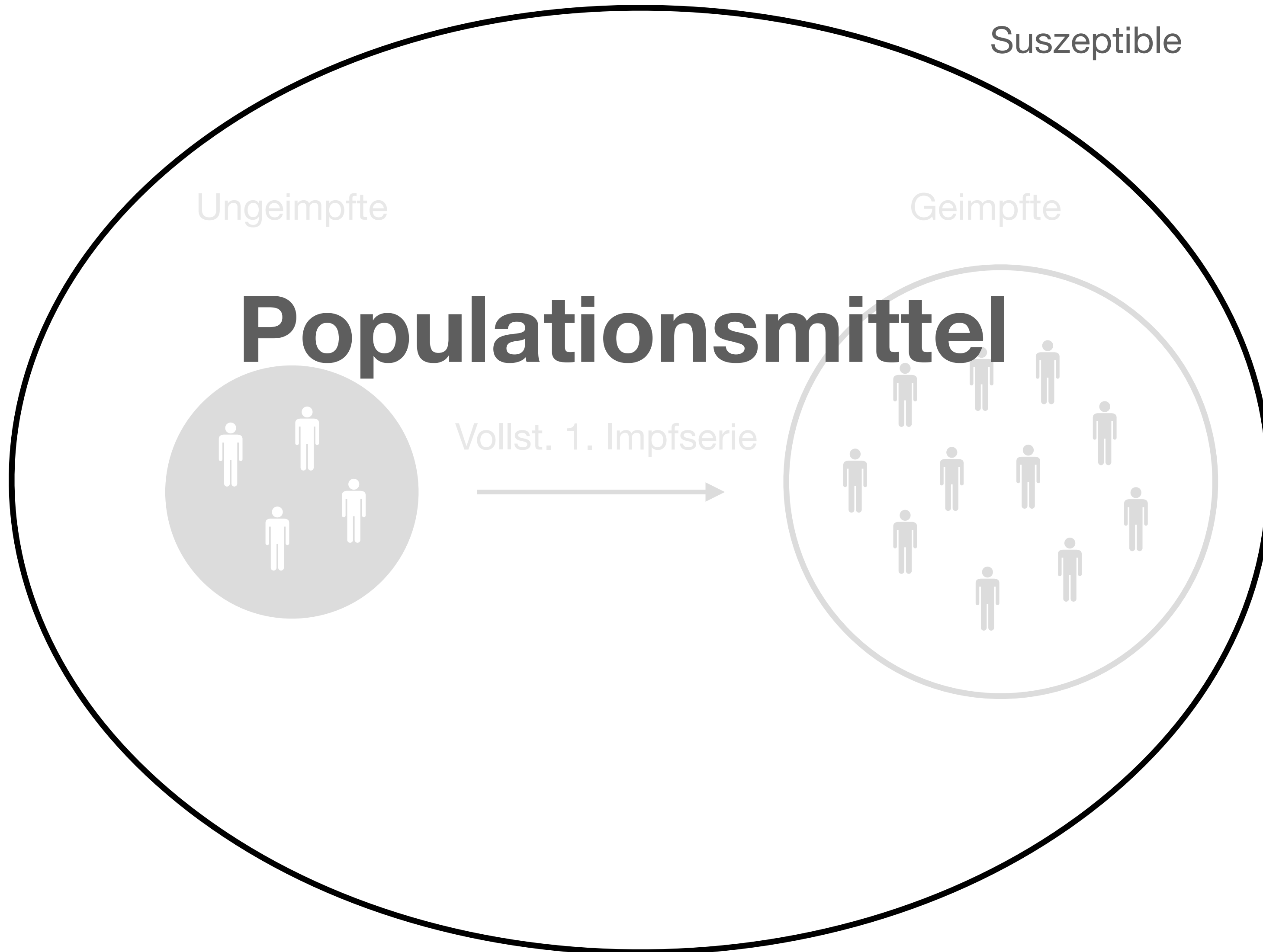
zeitabhängiger Mittelwert

Impfschutz  
vaccine efficacy (VE)

# Modellstruktur

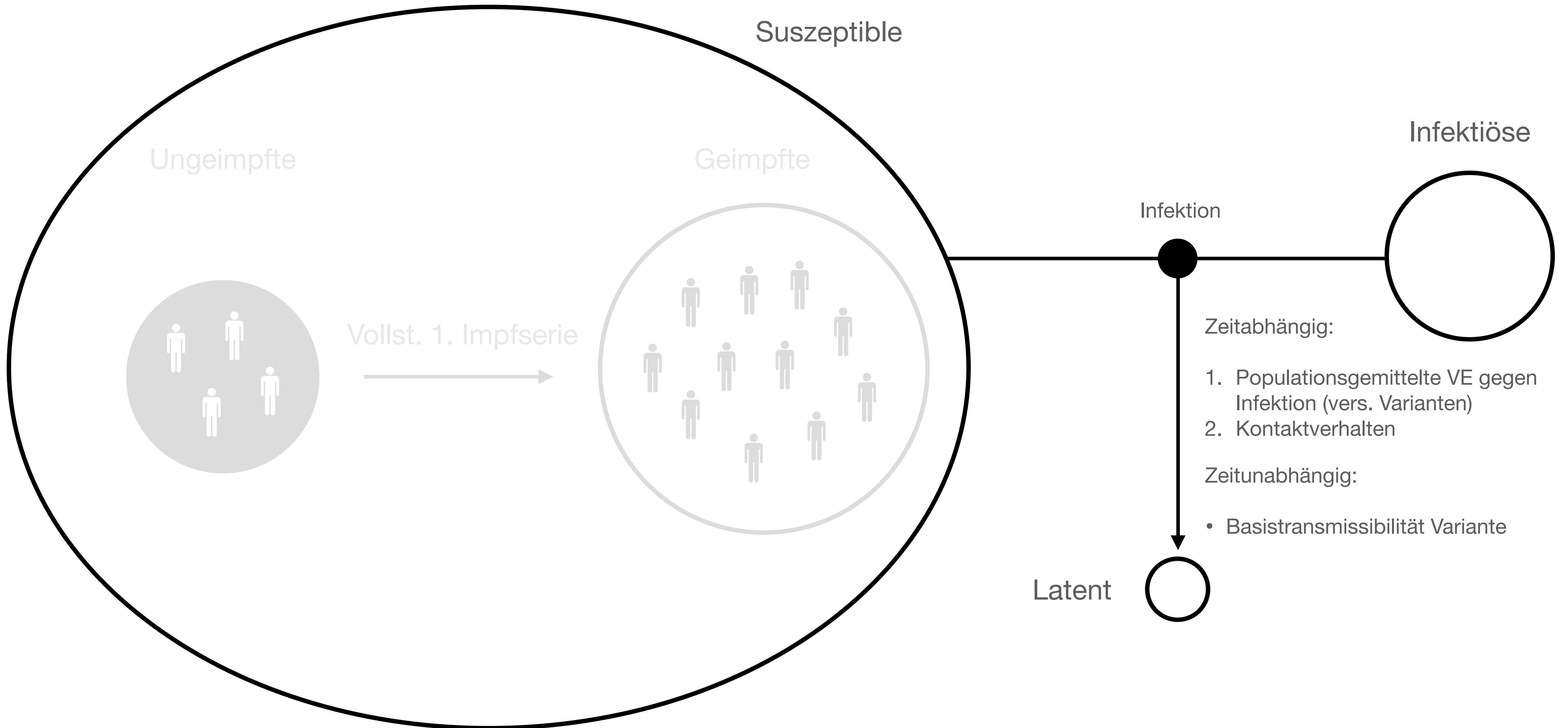


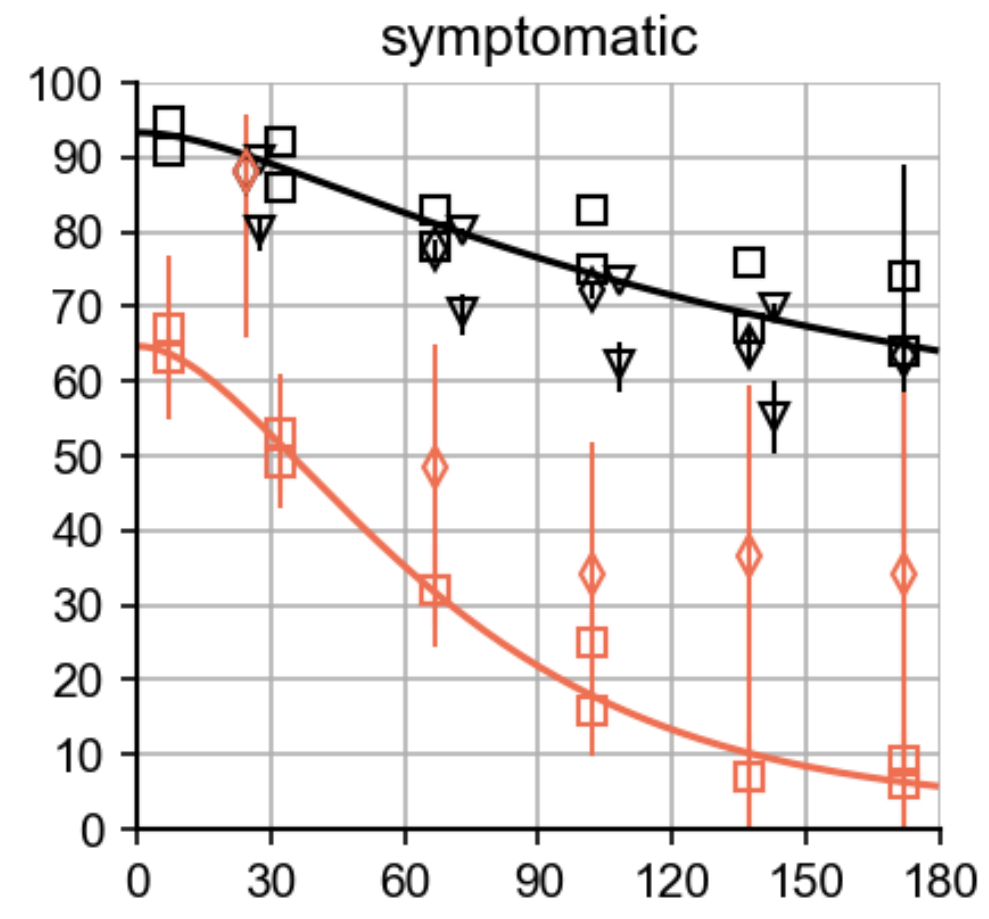
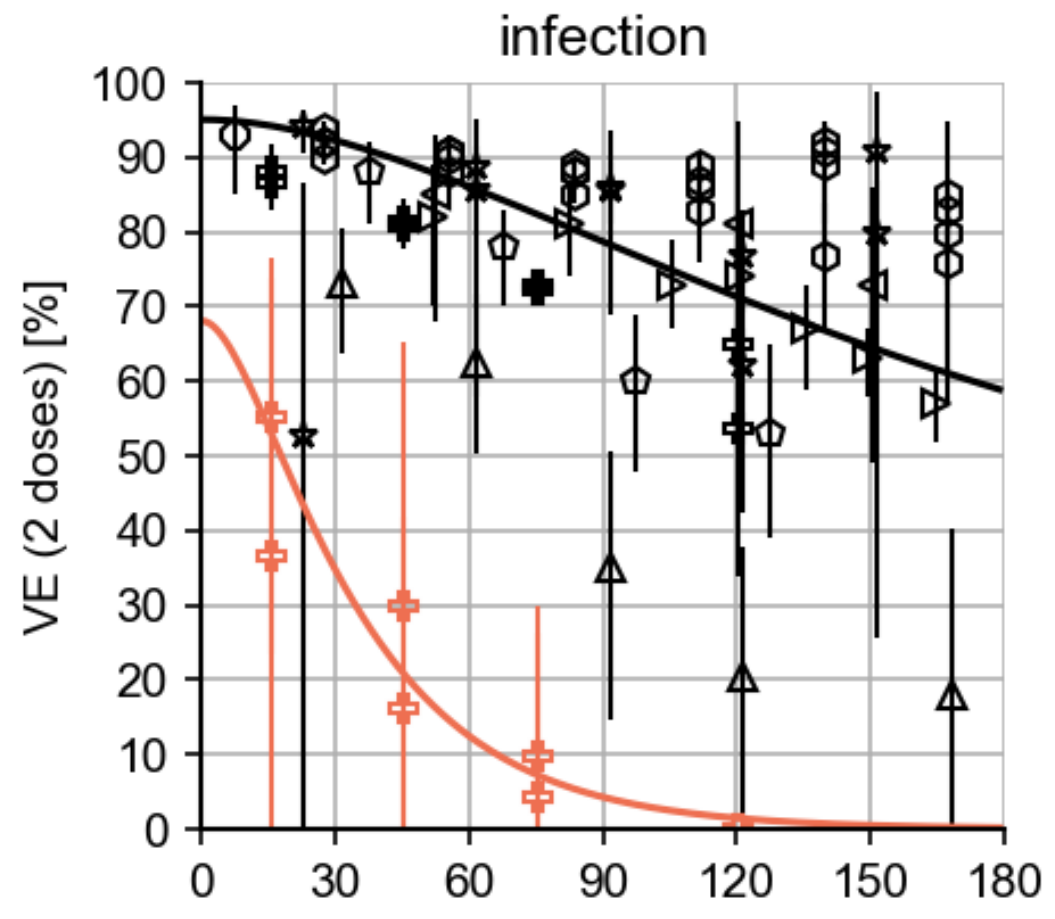
# Modellstruktur





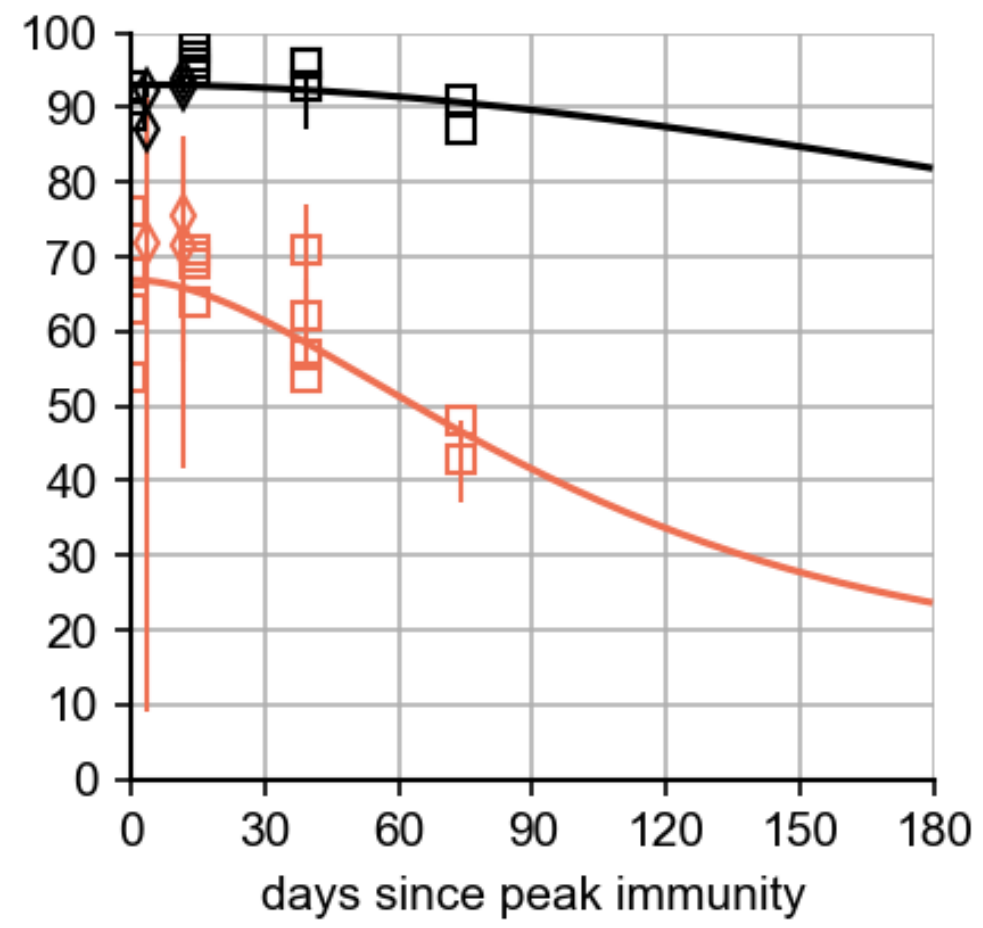
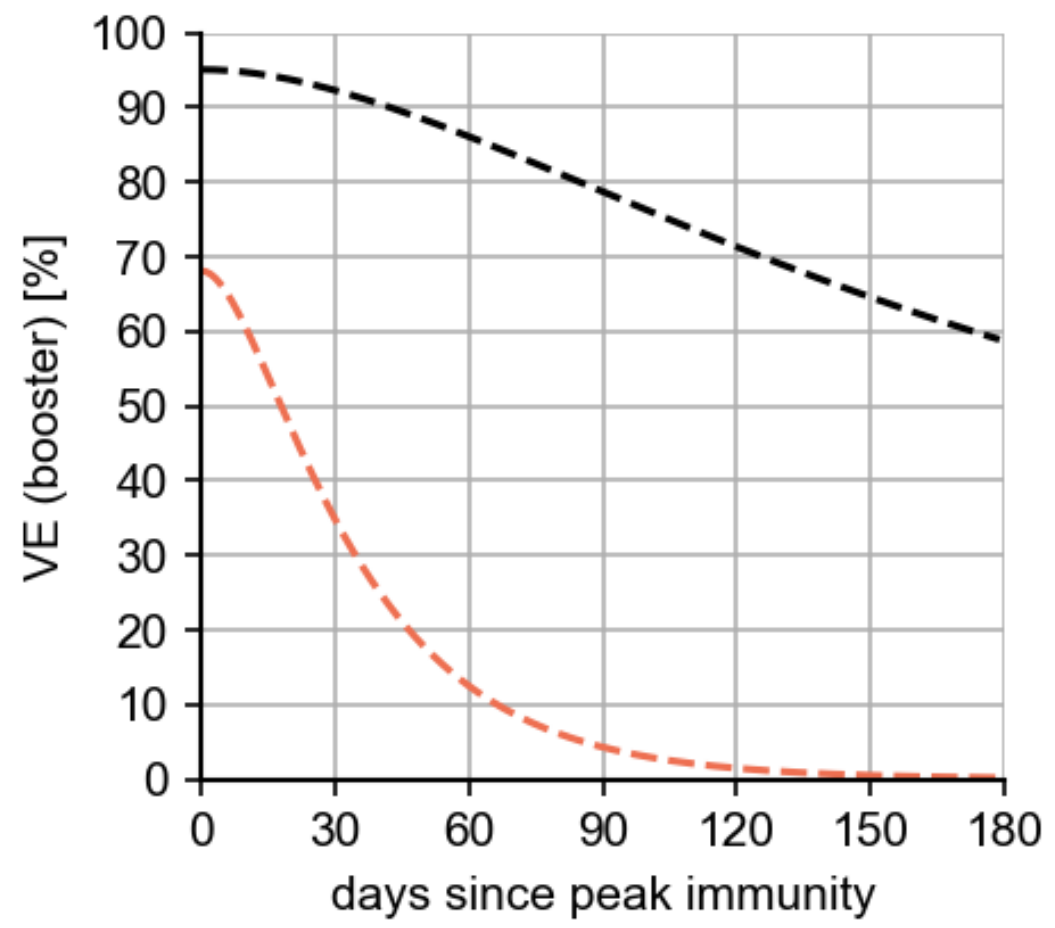
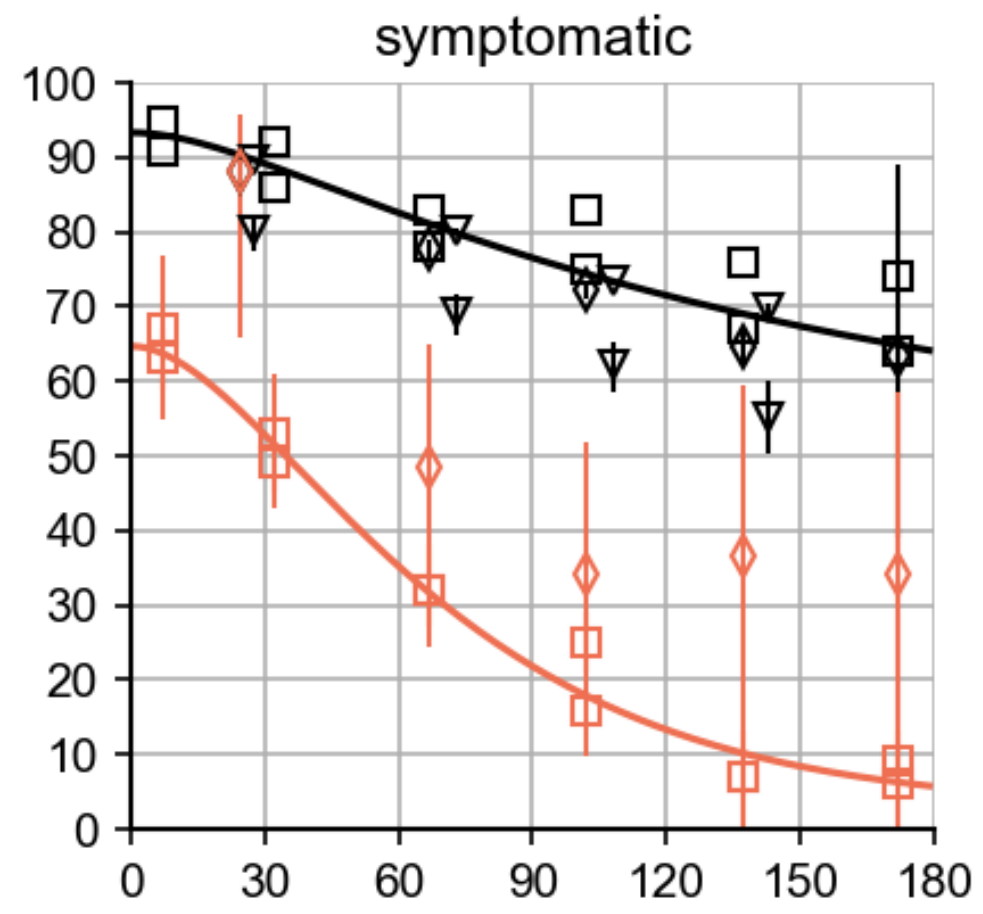
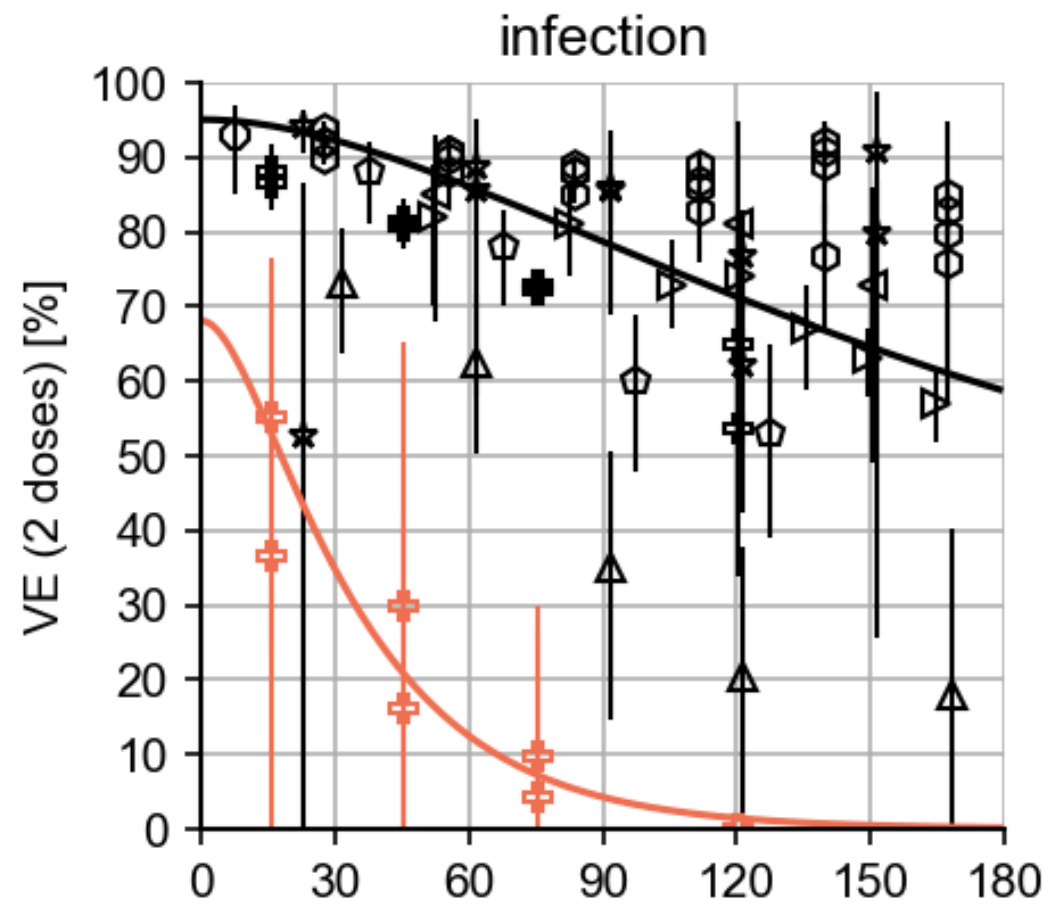
# Modellstruktur





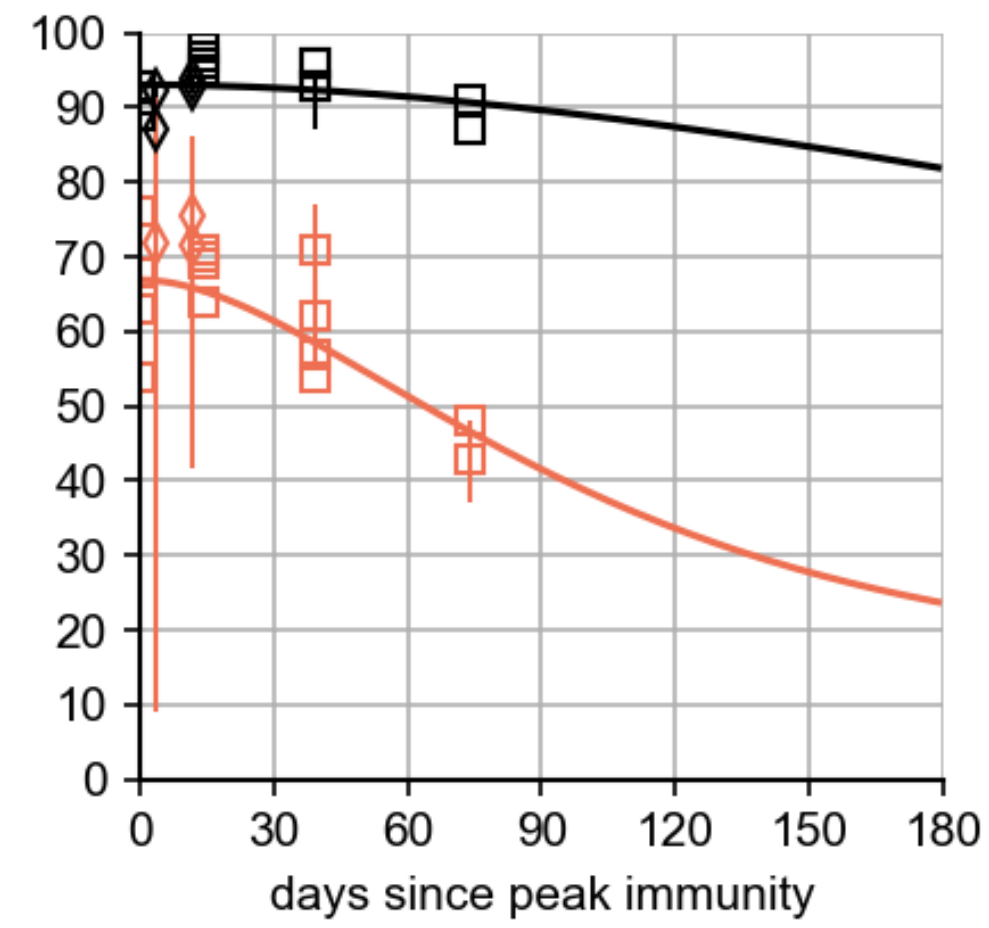
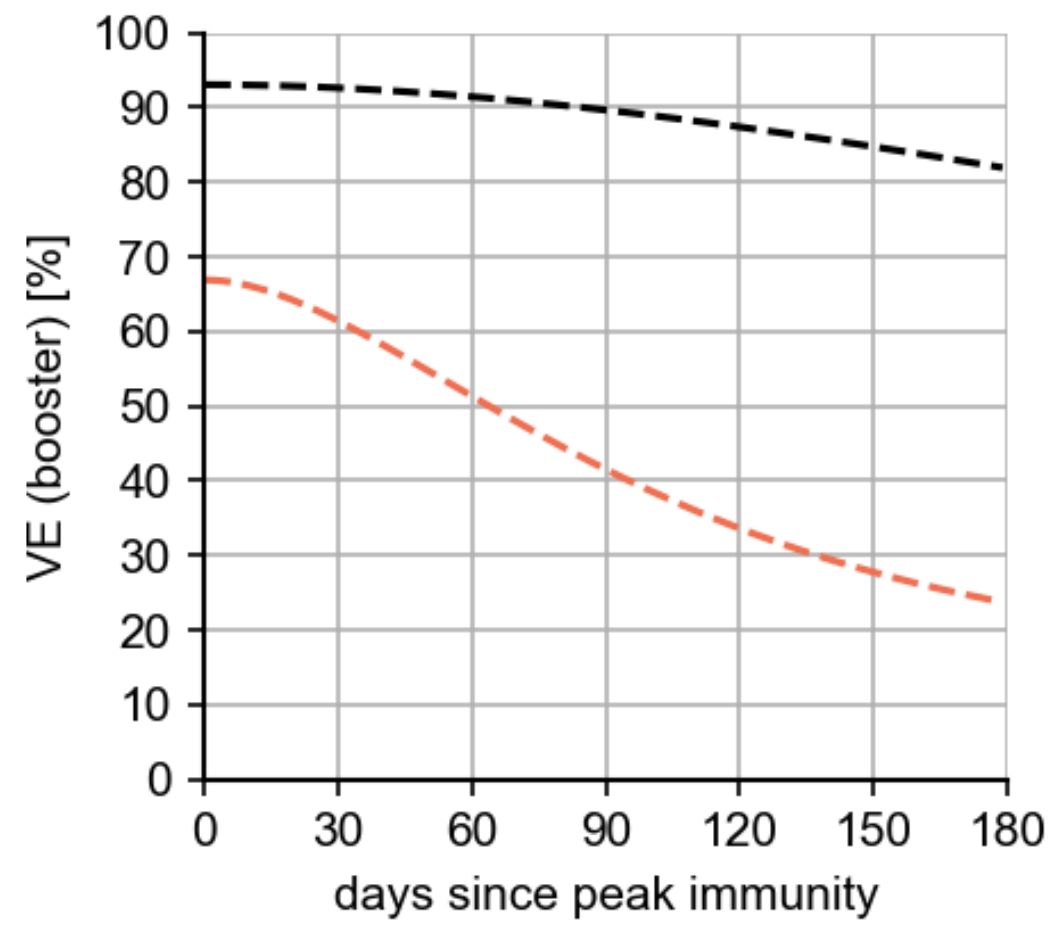
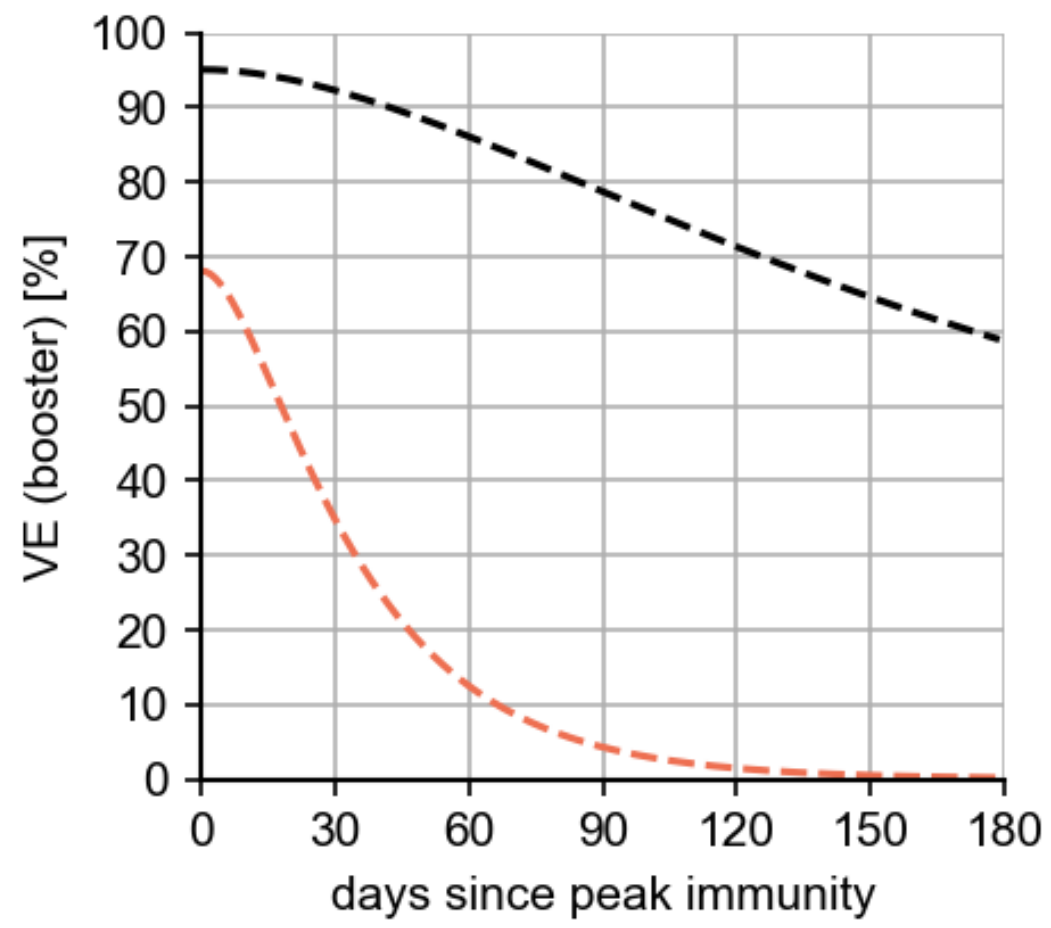
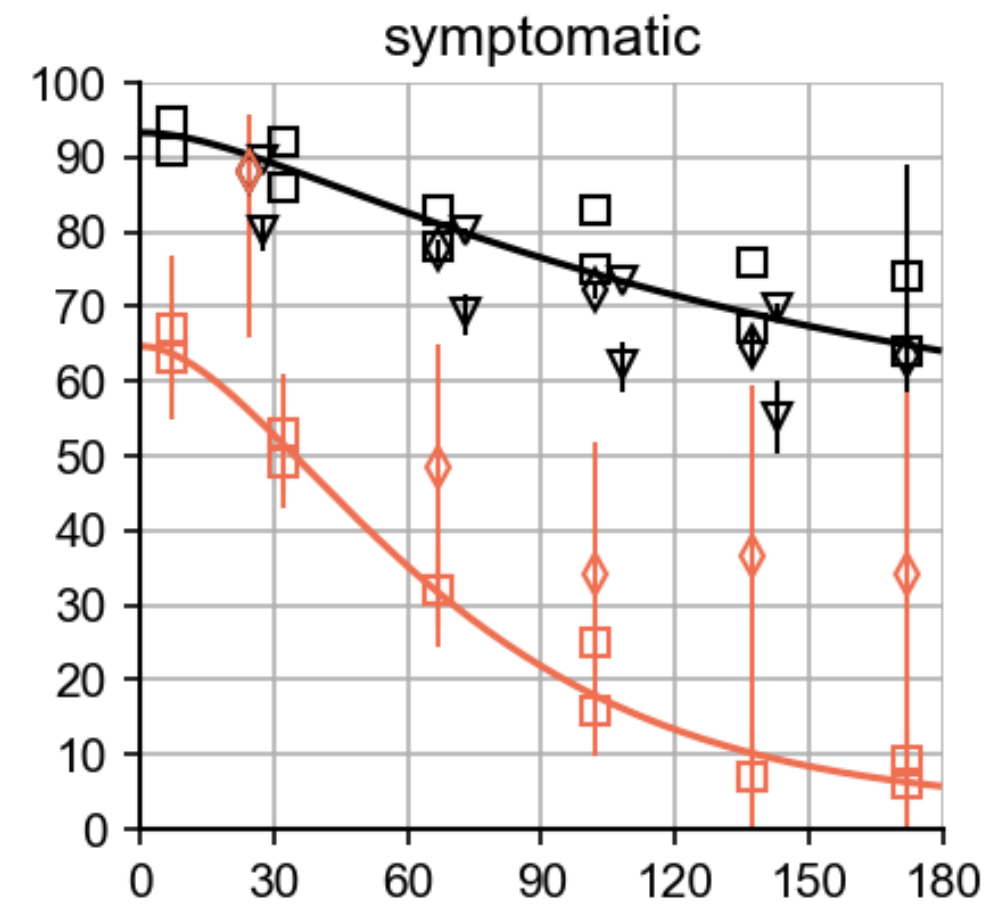
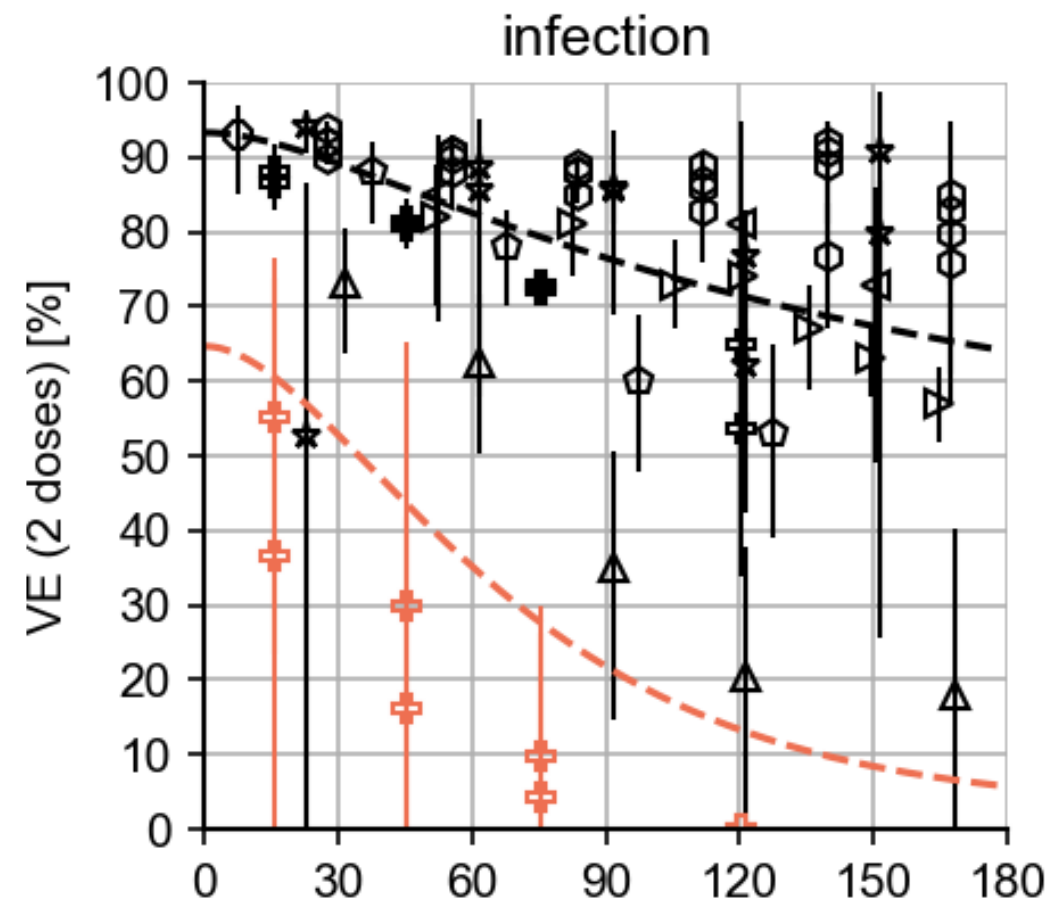
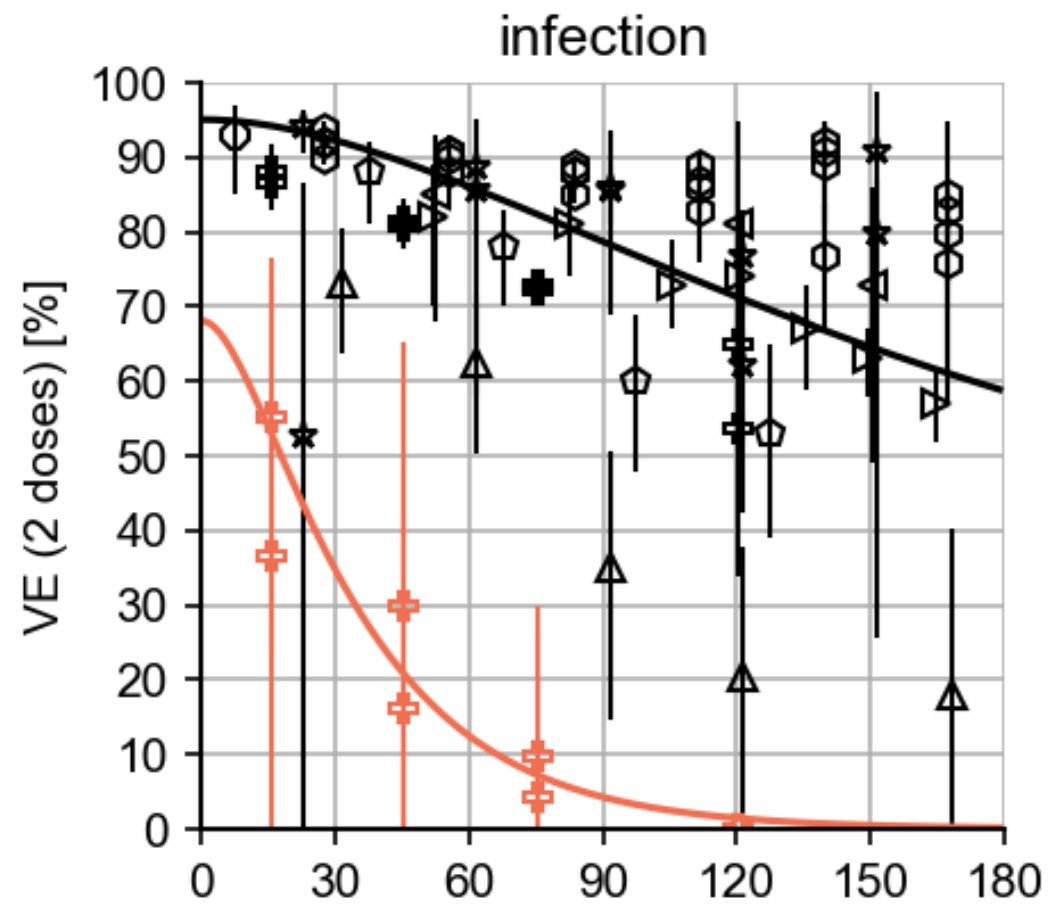
- ⊞ hansen\_dk\_dec\_21
- ★ feikin\_bruxvoort\_nov\_21
- △ feikin\_chemaitelly\_nov\_21
- feikin\_skowronski\_nov\_21
- ◁ harder\_fowlkes\_oct\_2021
- harder\_tartof\_oct\_21
- ▷ feikin\_goldberg\_nov\_21
- ◊ feikin\_tartof\_nov\_21
- ◇ andrews\_uk\_dec\_21
- ▽ feikin\_andrews\_nov\_21
- UKHSA\_update\_dec\_21
- degier\_netherlands\_sep\_21

# Pessimistische Annahme

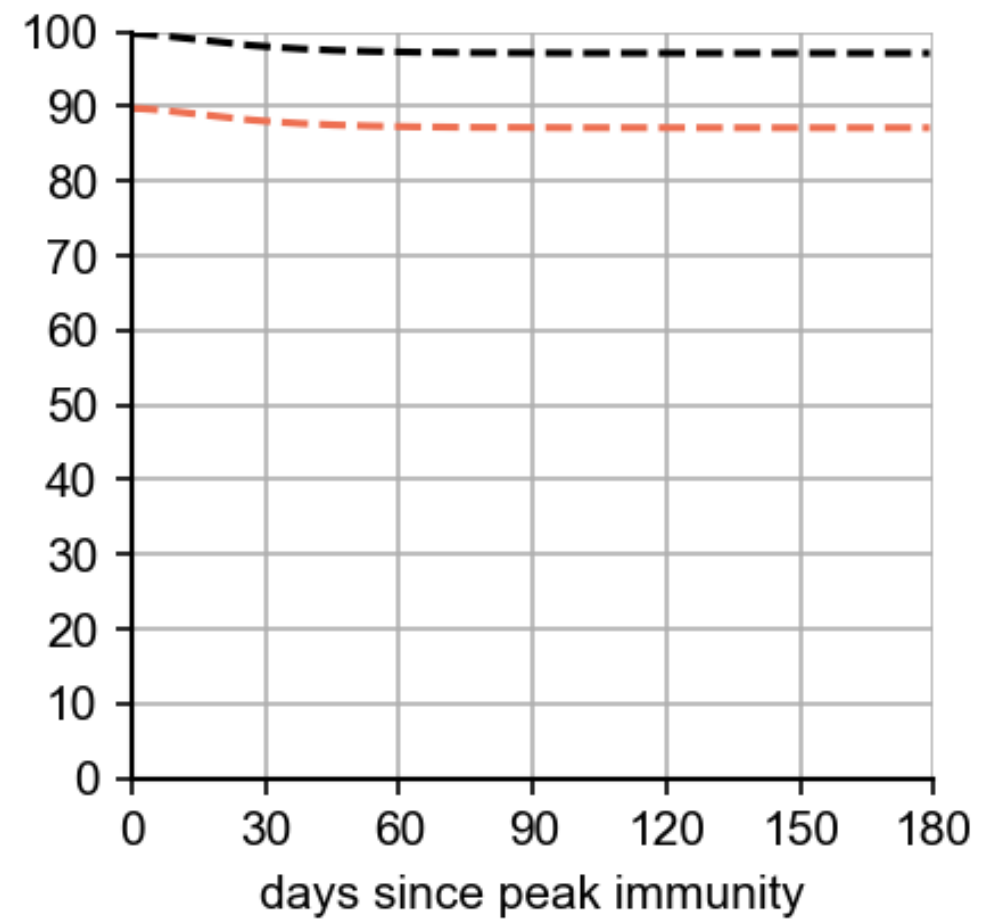
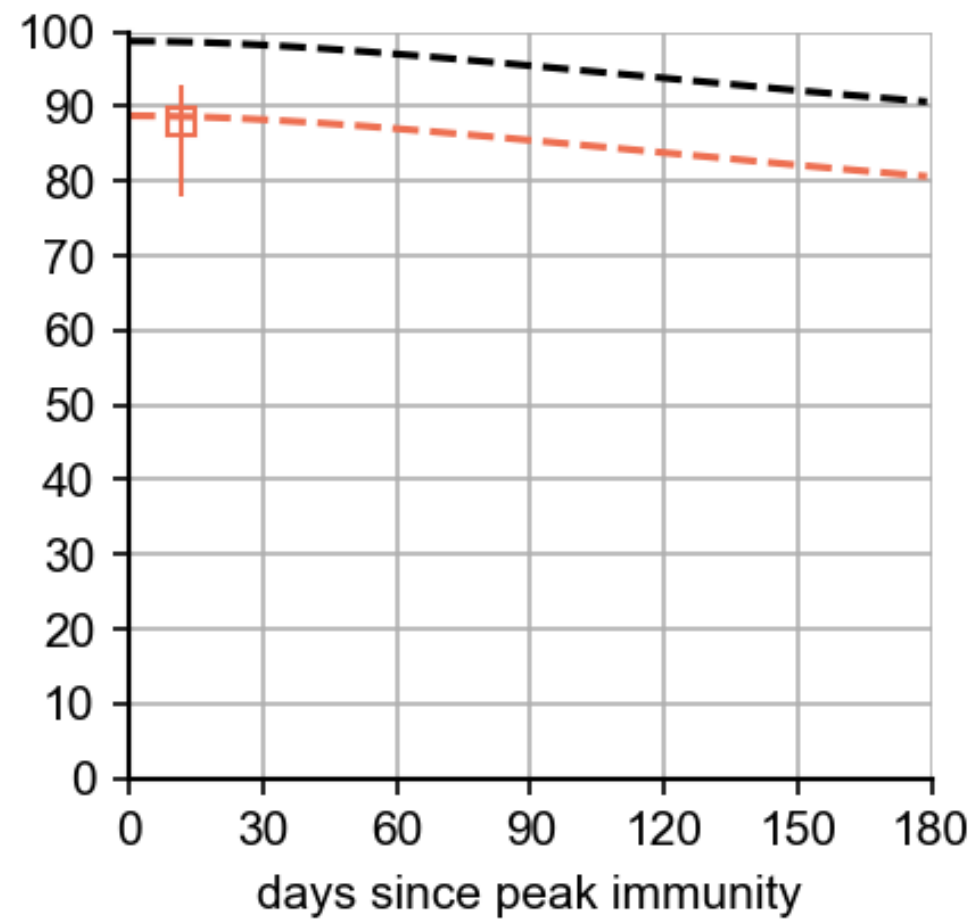
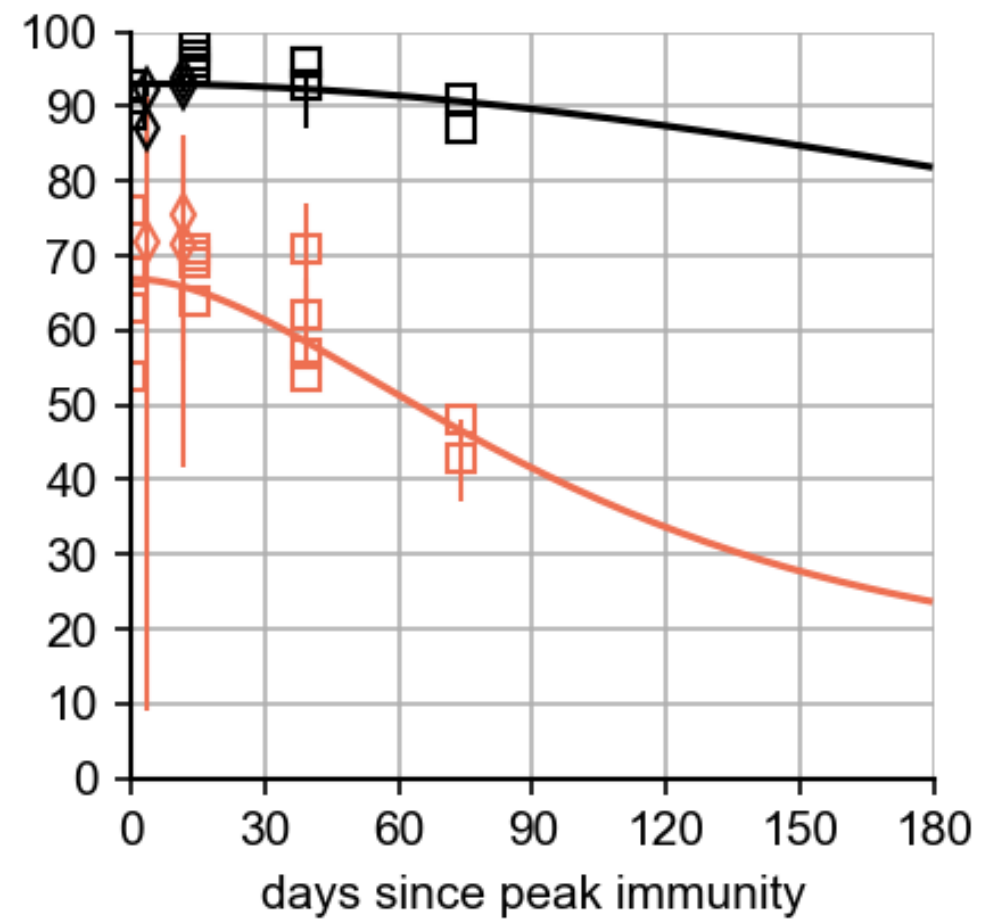
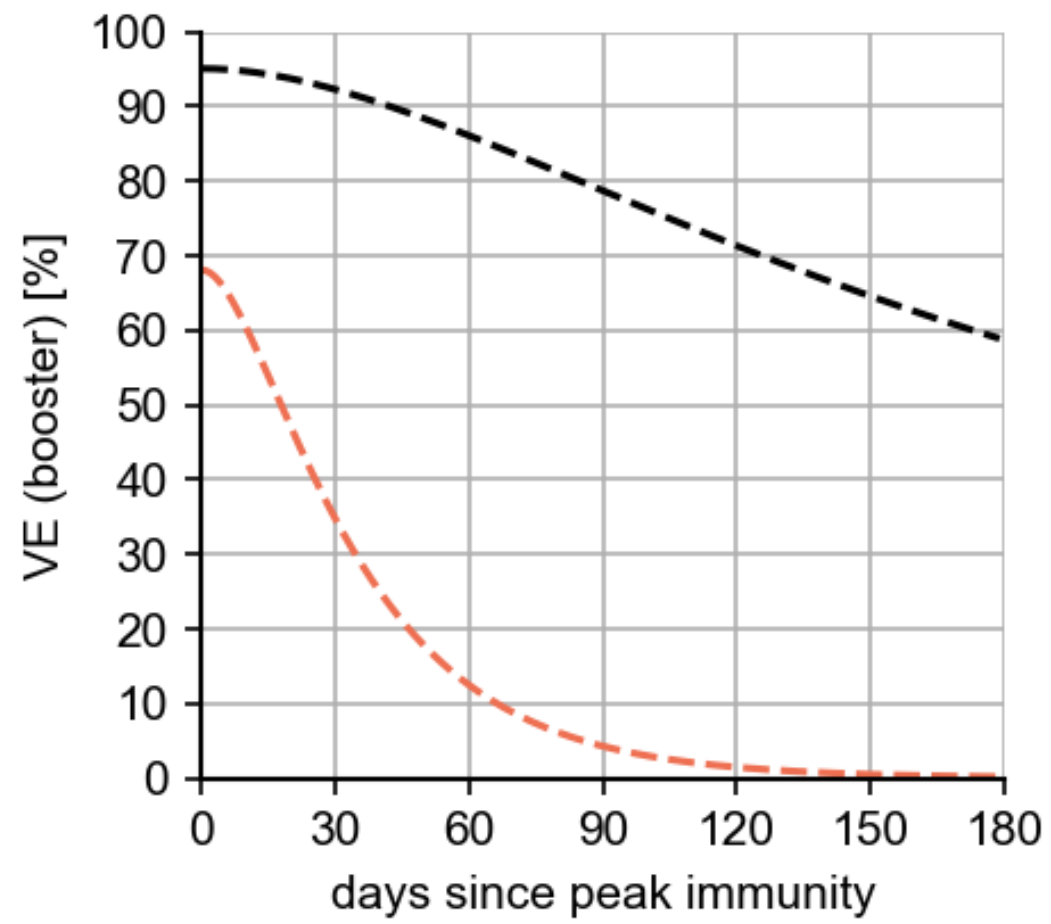
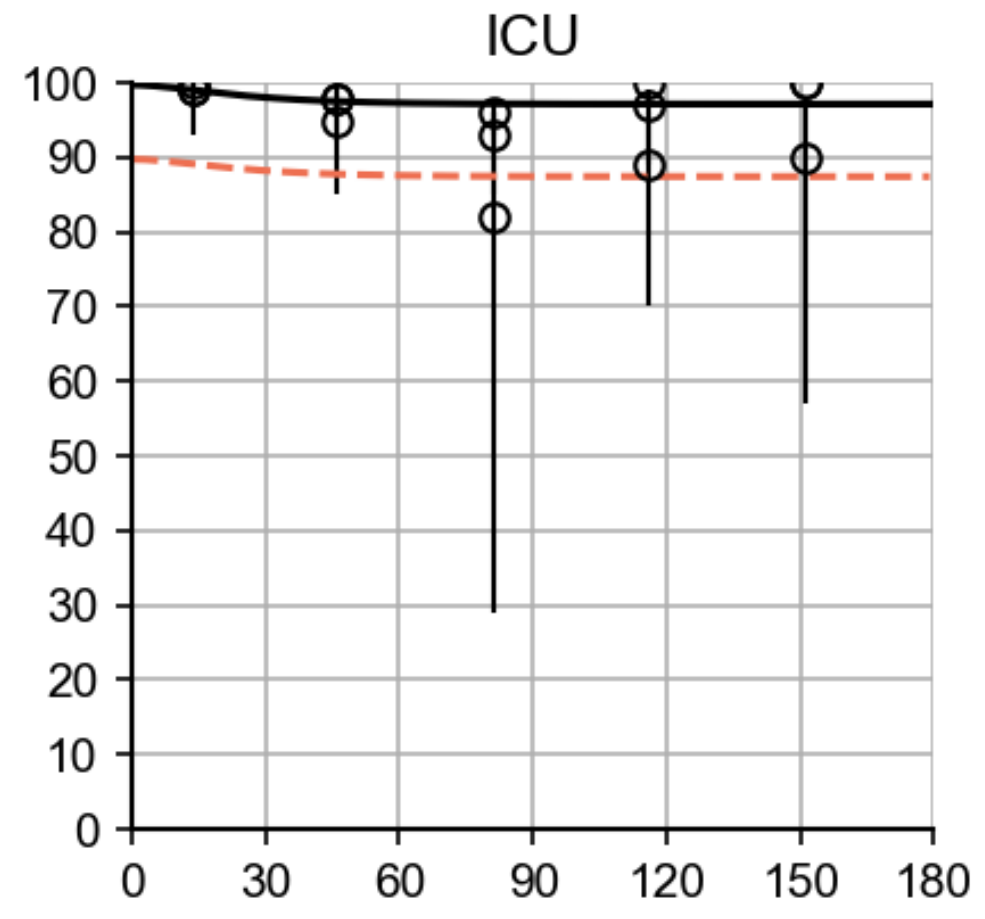
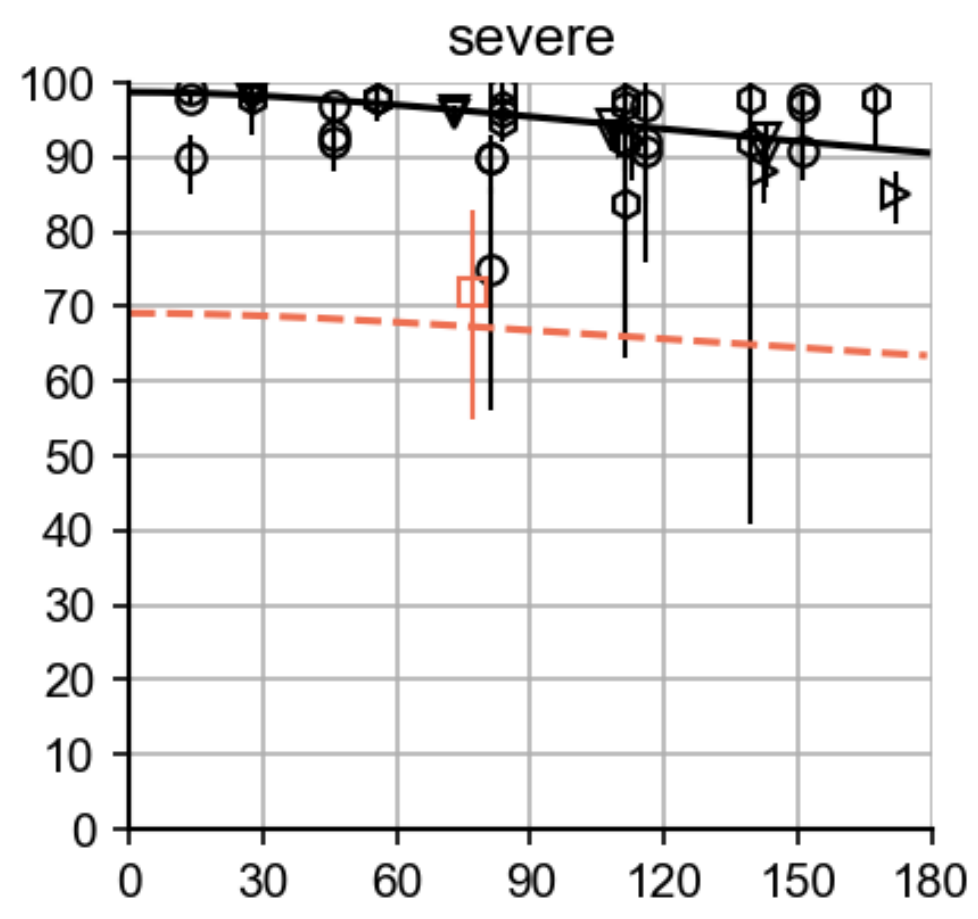
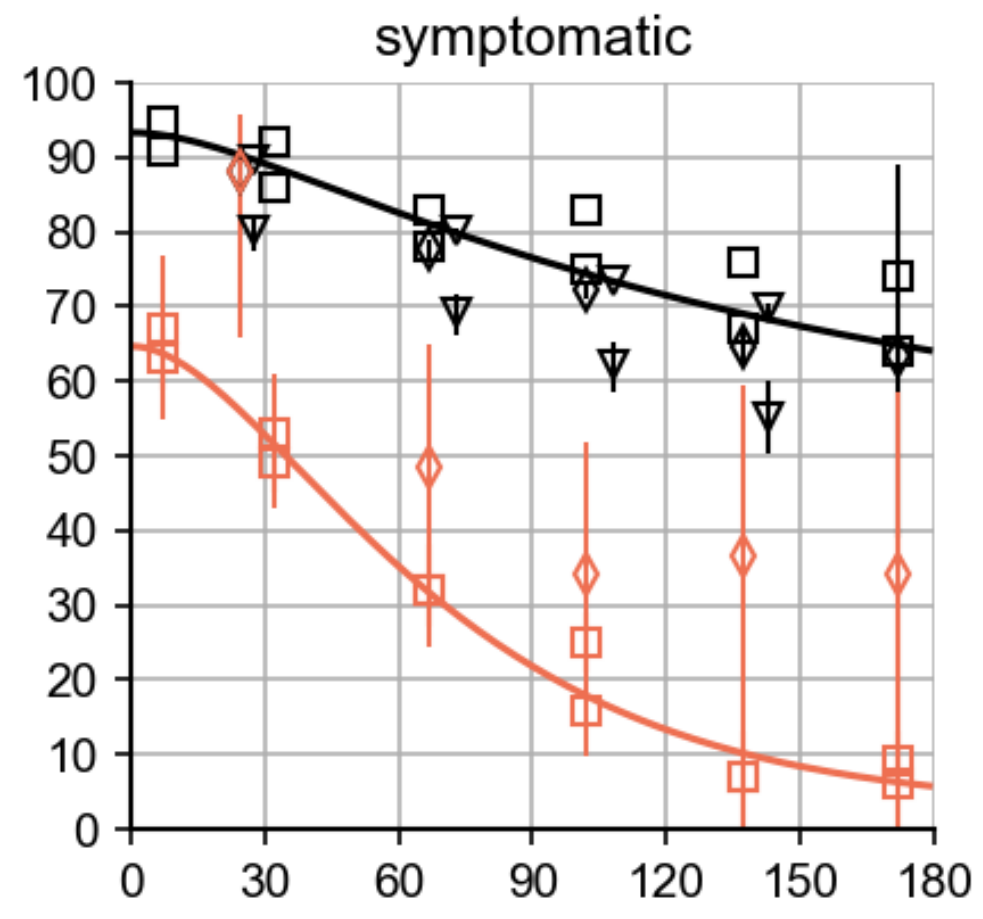
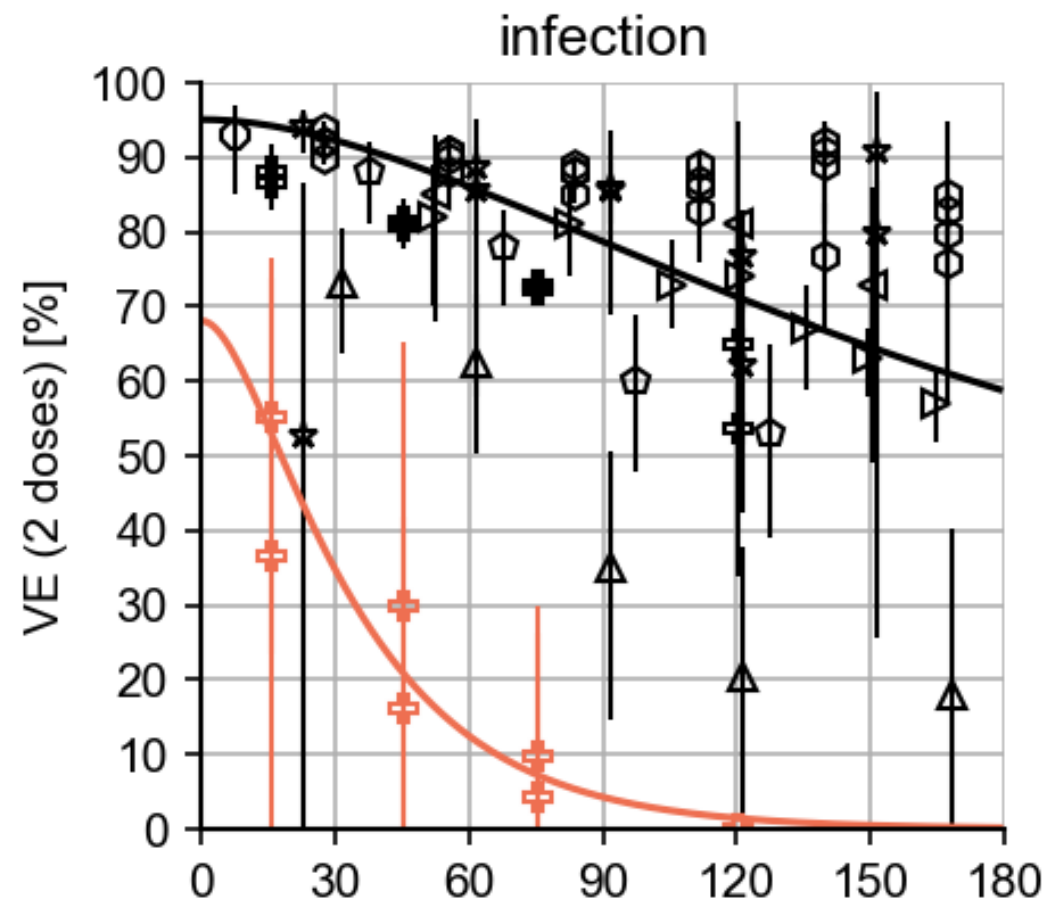


### Pessimistische Annahme

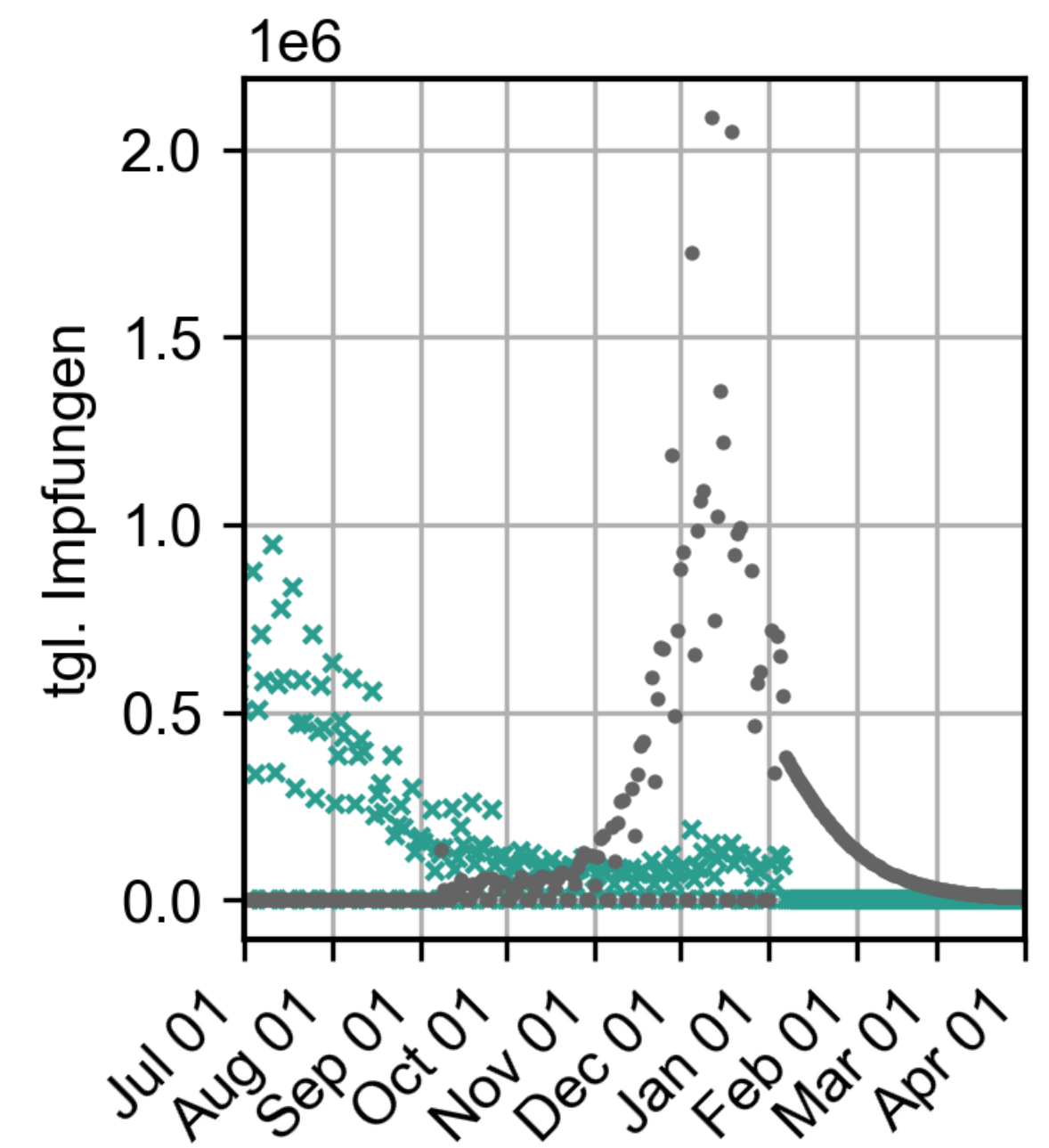
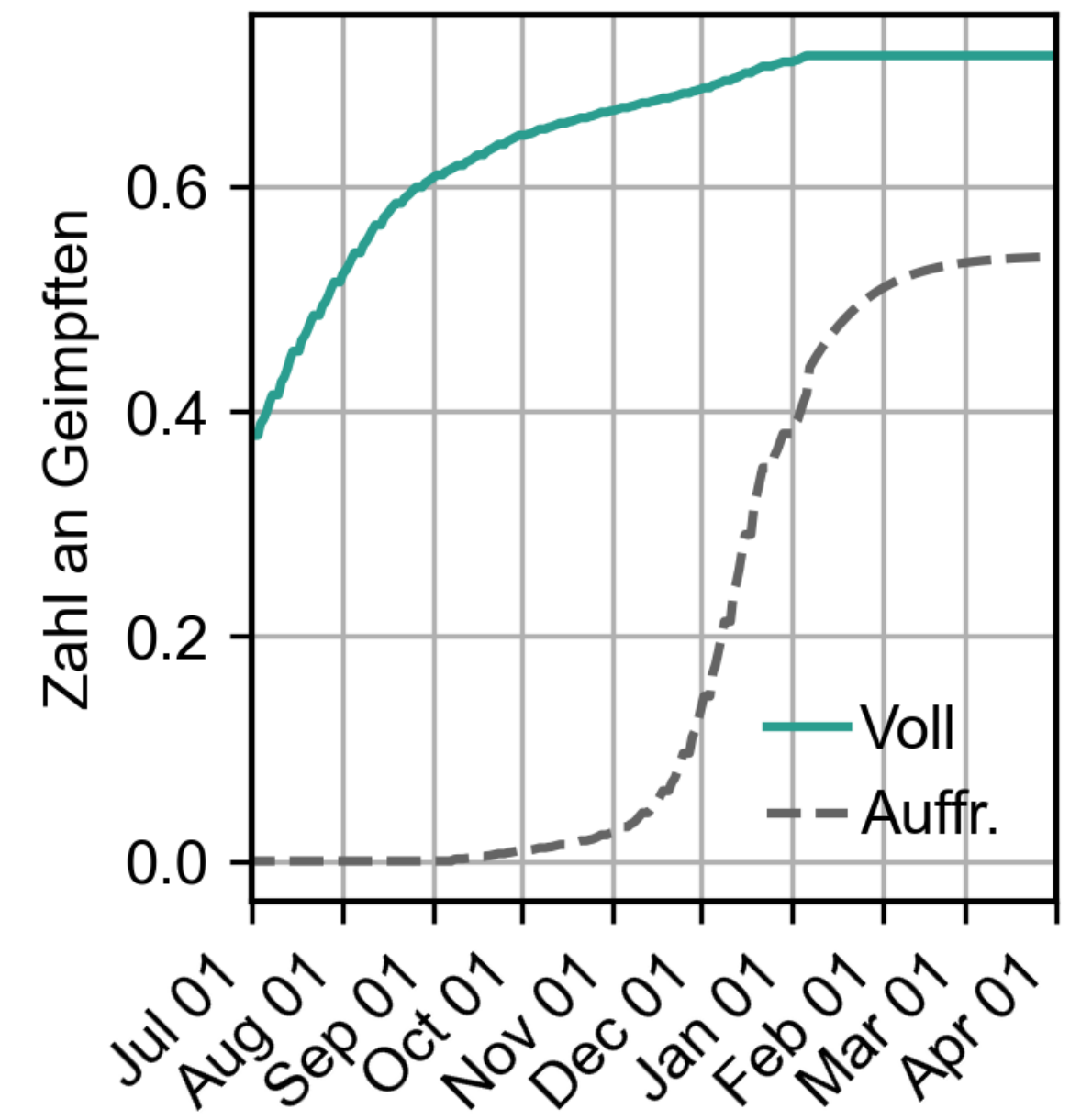
### Optimistische Annahme



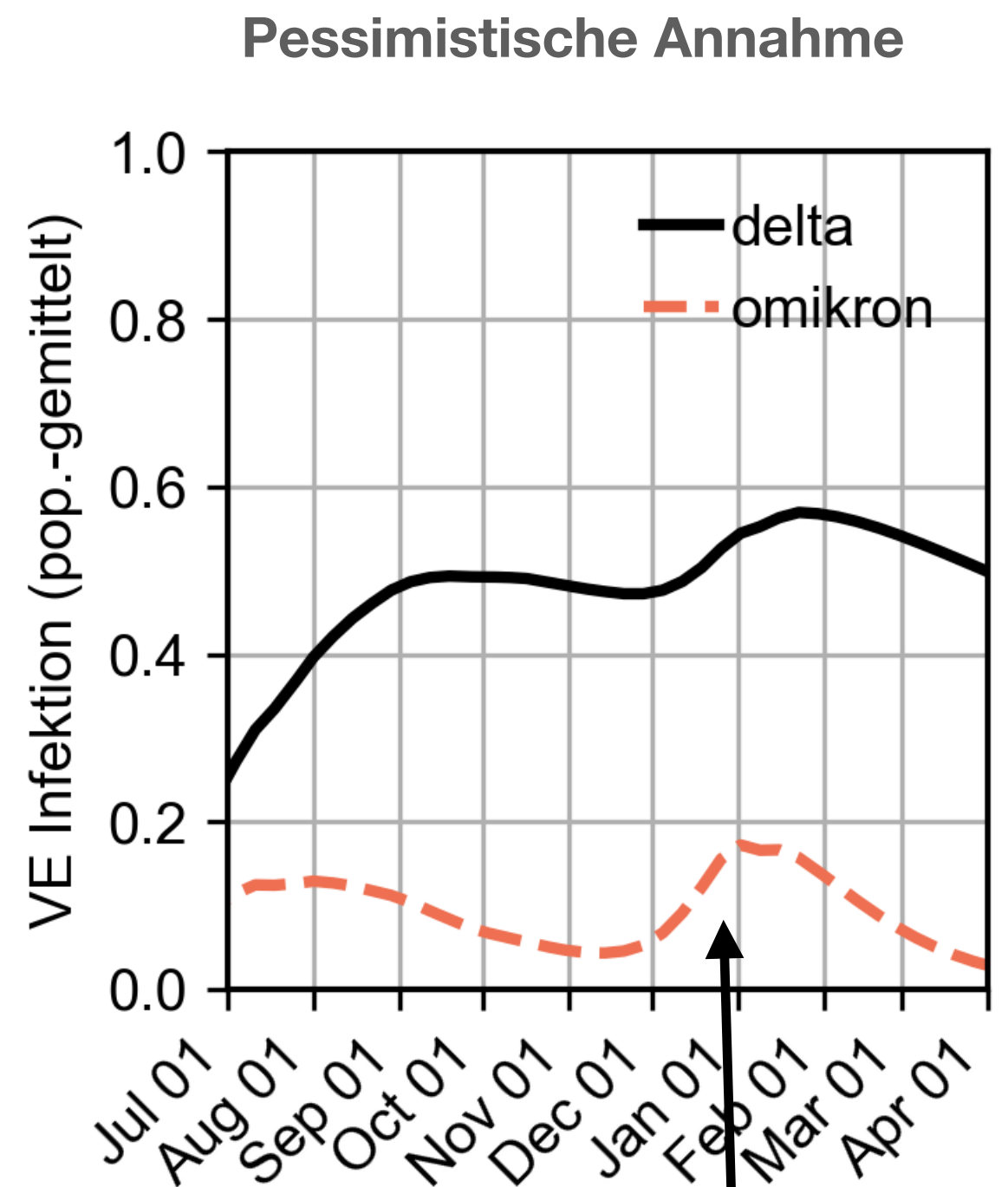
# Pessimistische Annahme



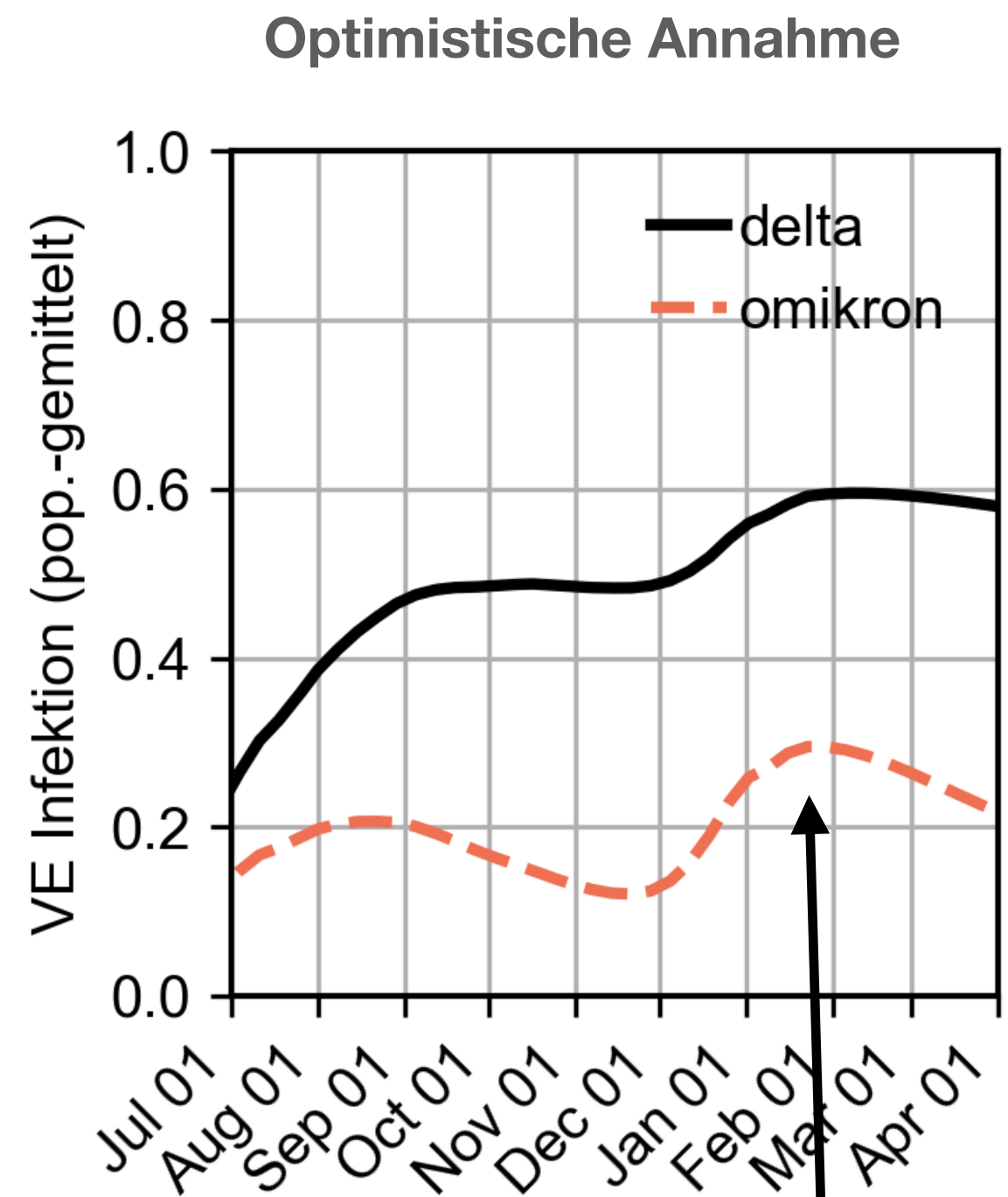
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- ★ feikin\_bruxvoort\_nov\_21
- △ feikin\_chemaitelly\_nov\_21
- feikin\_skowronski\_nov\_21
- ◁ harder\_fowlkes\_oct\_2021
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- UKHSA\_update\_dec\_21
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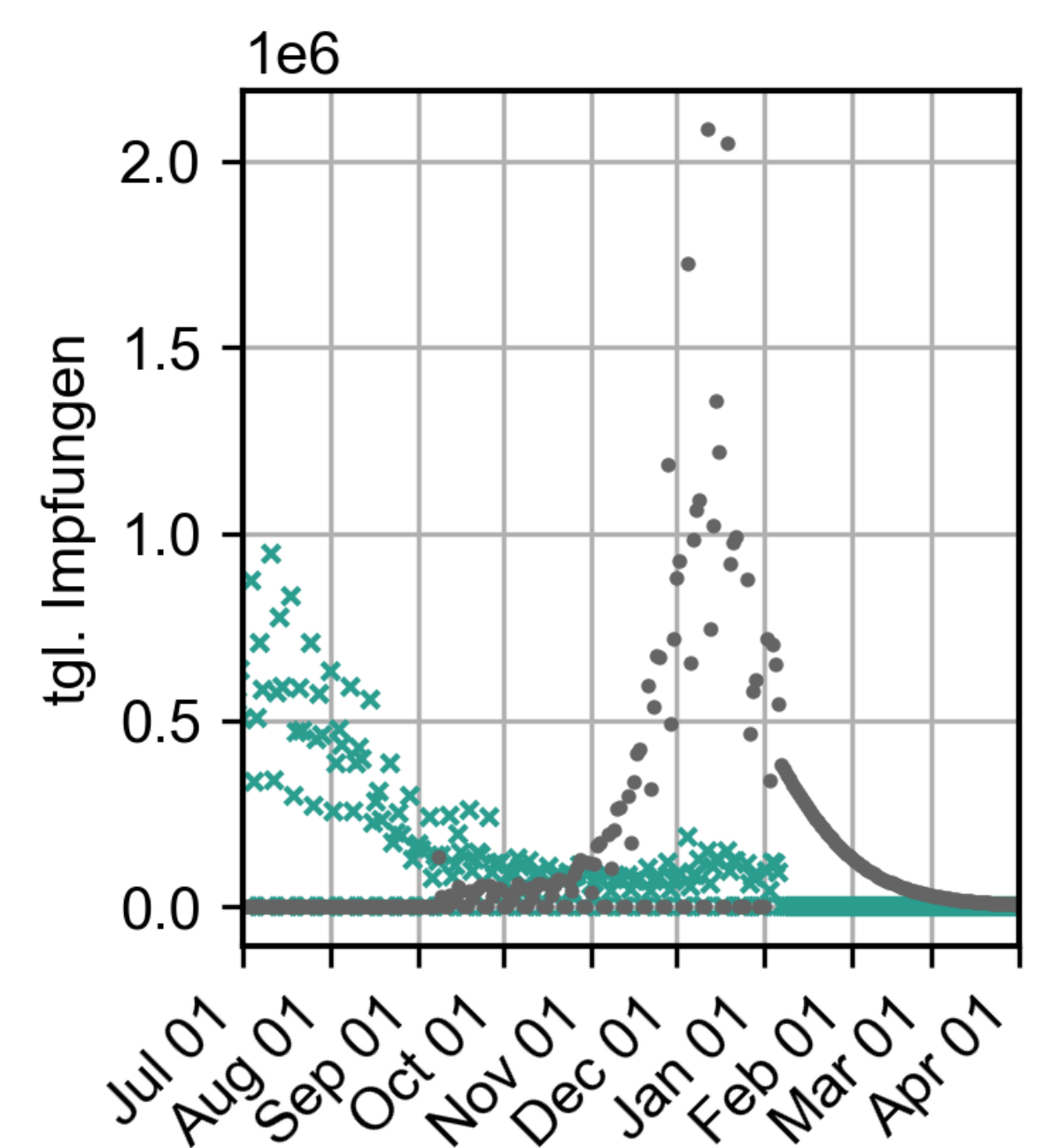
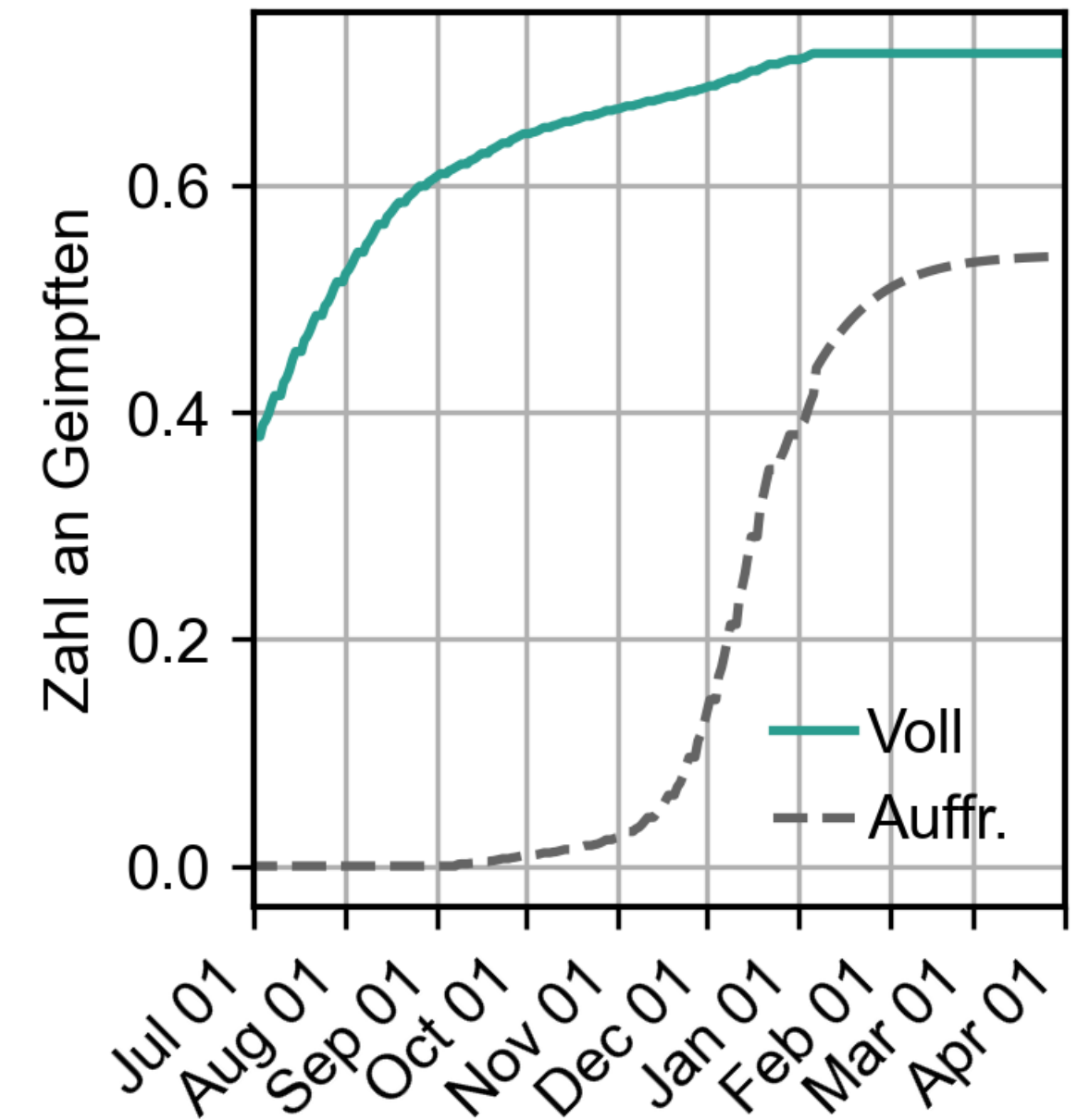




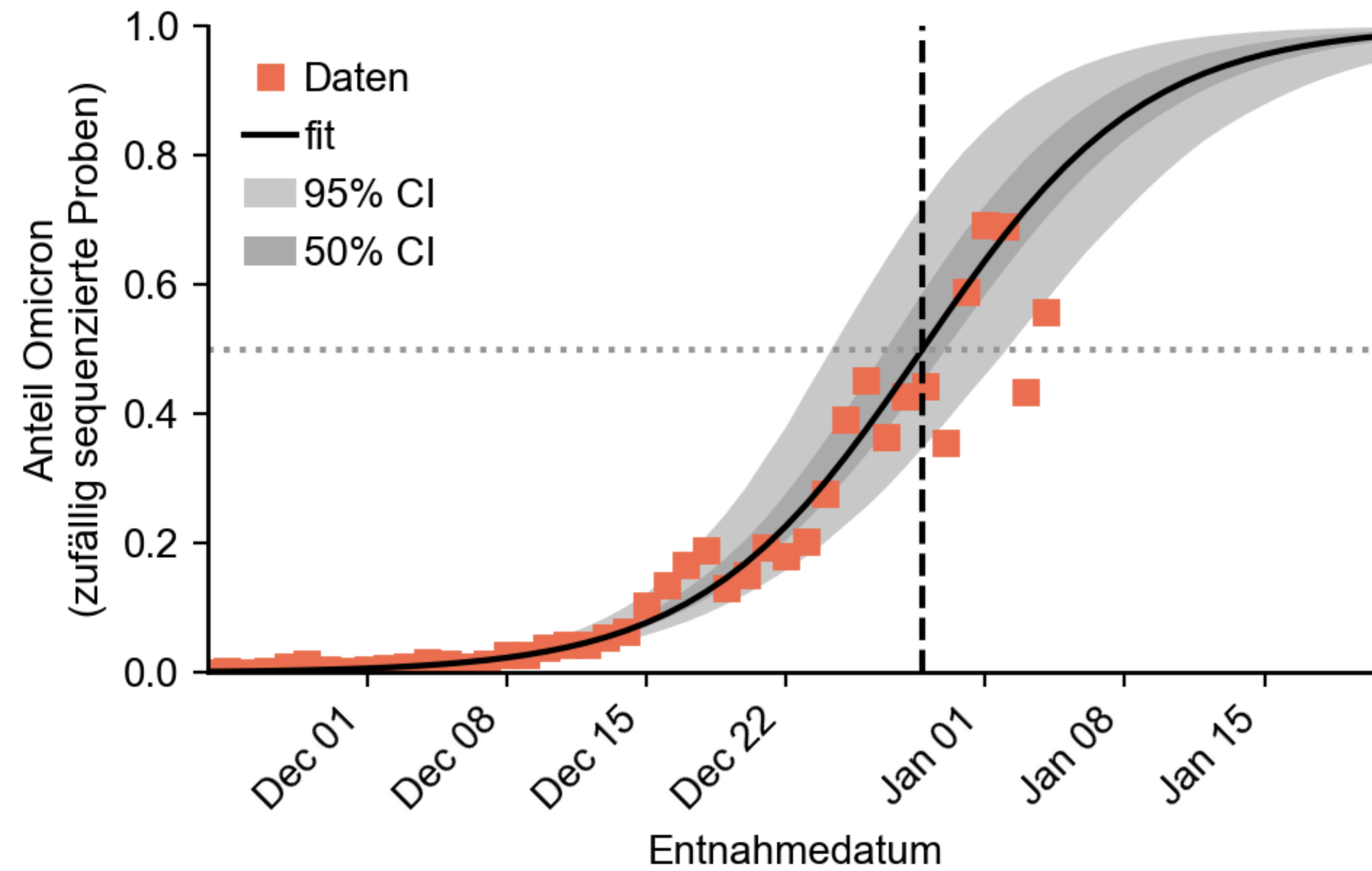
Booster hat kaum Effekt



Booster hat leichten Effekt

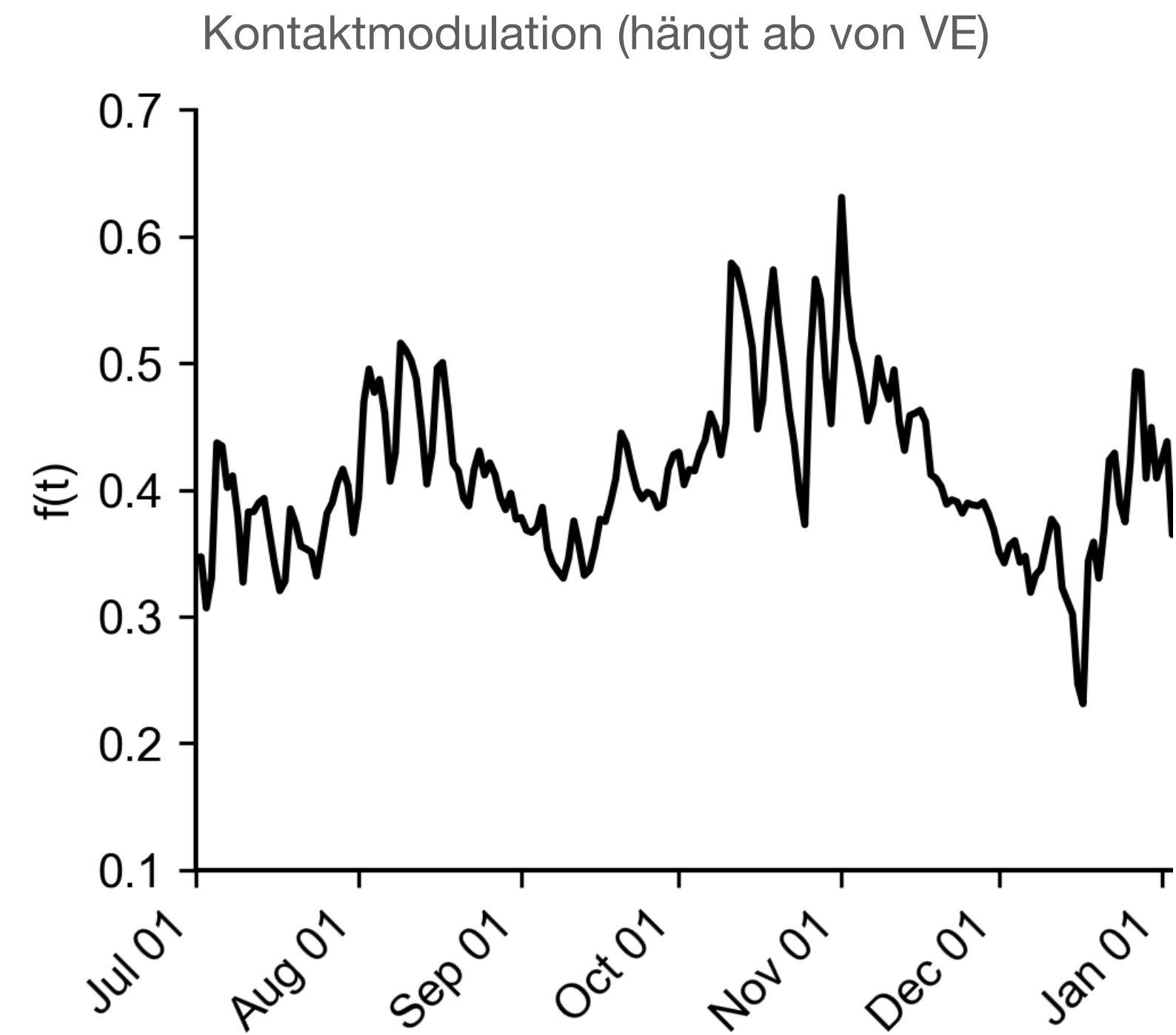
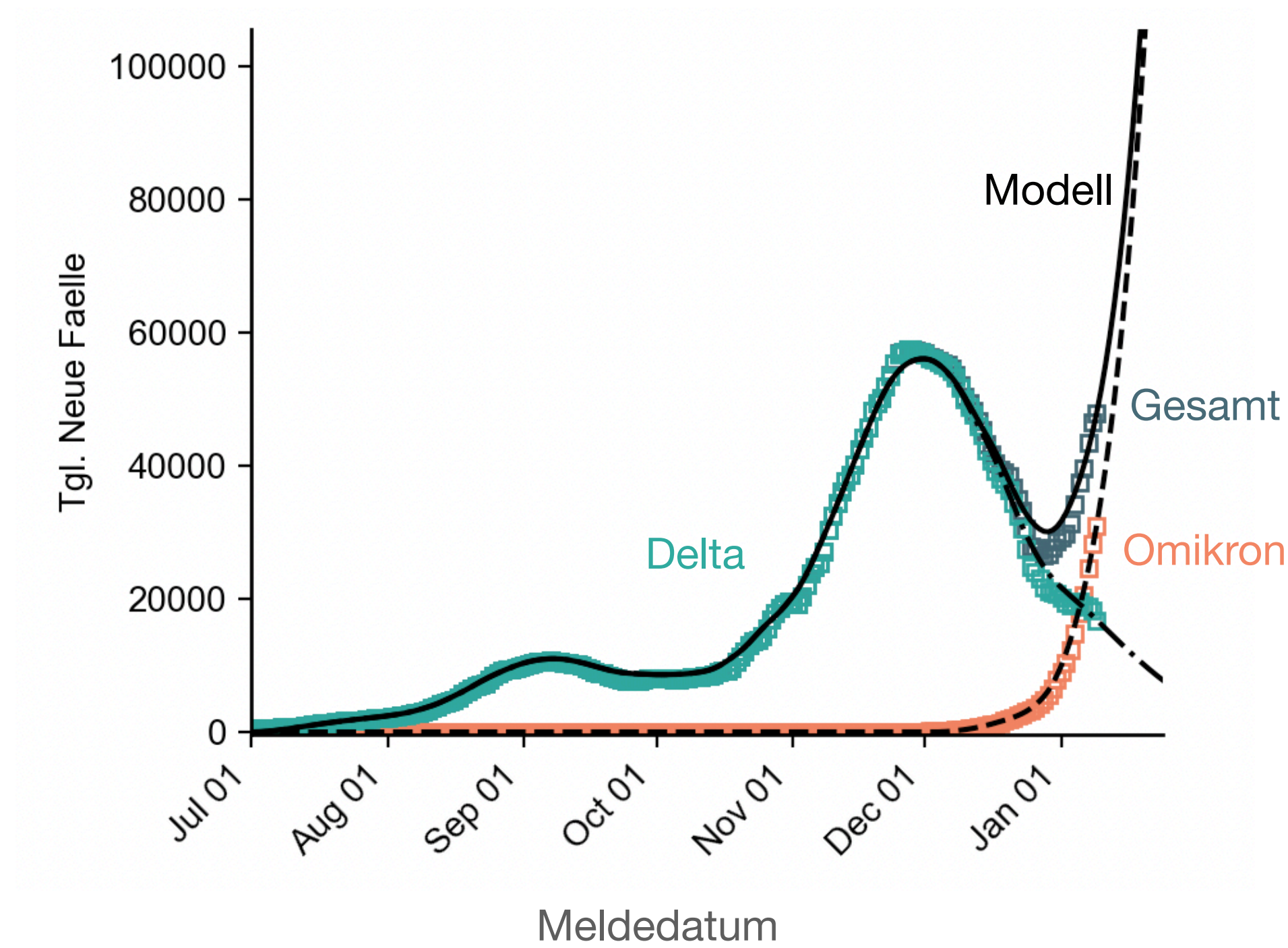


# Model Calibration

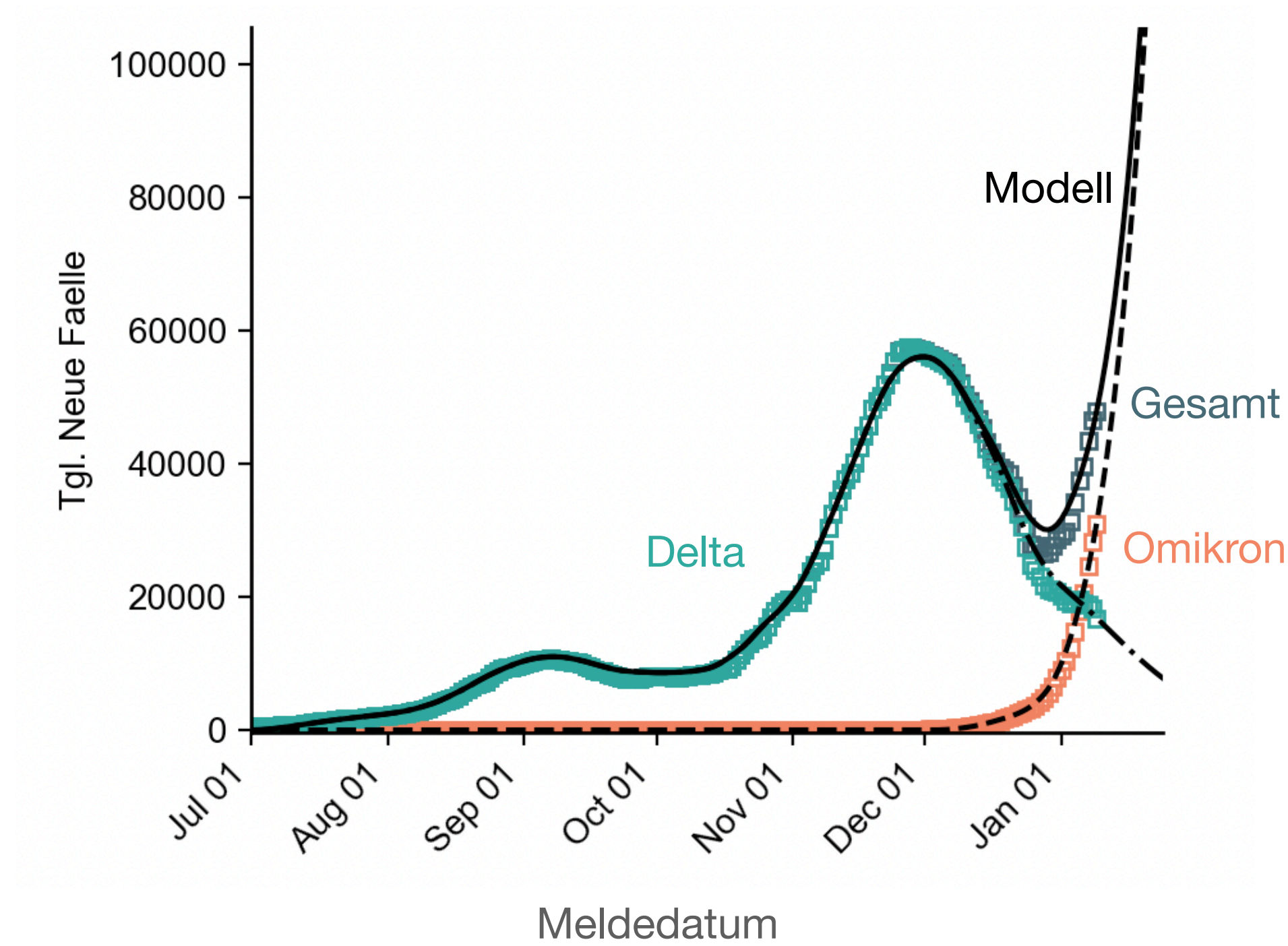




# Model Calibration

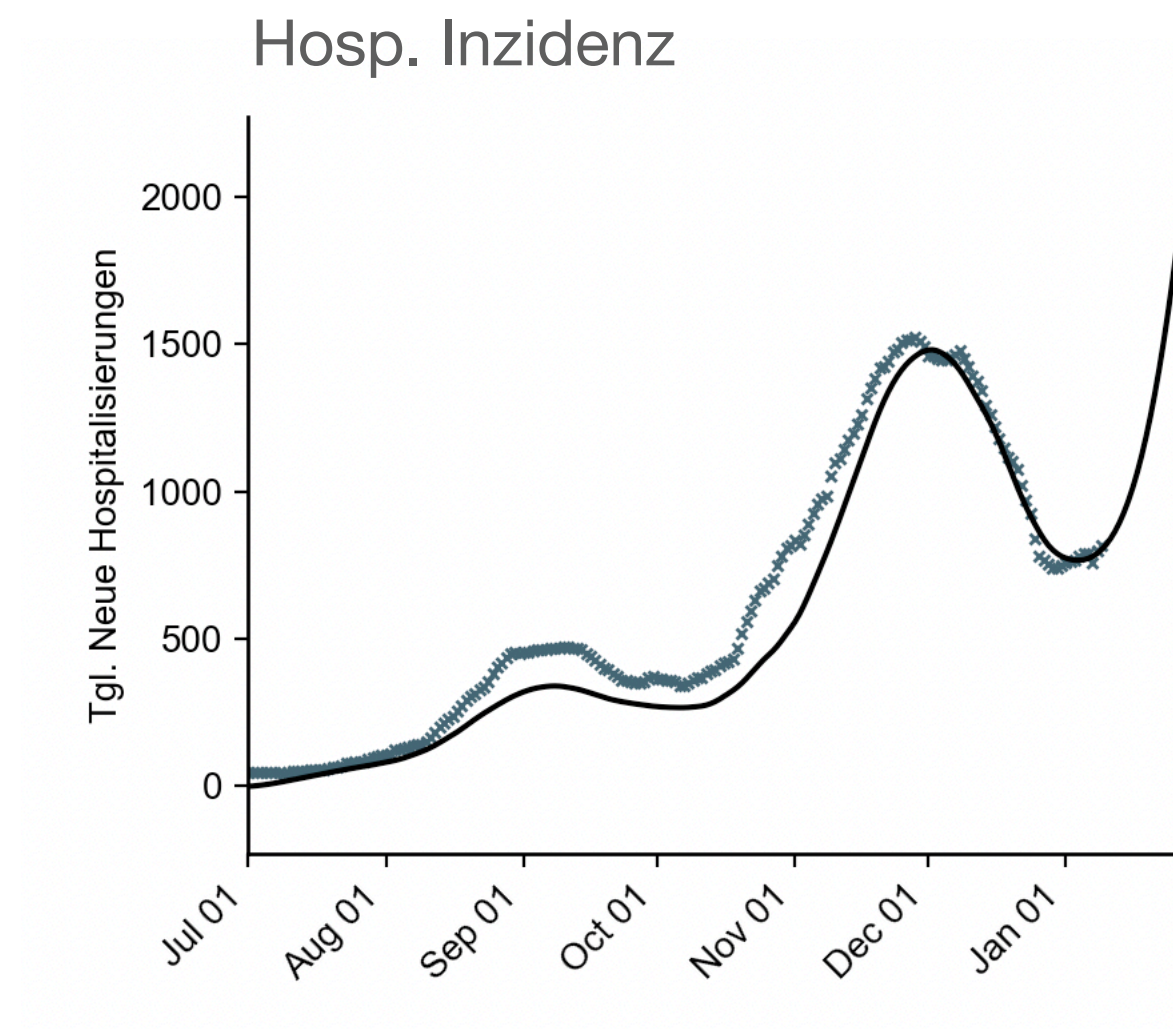


# Model Calibration

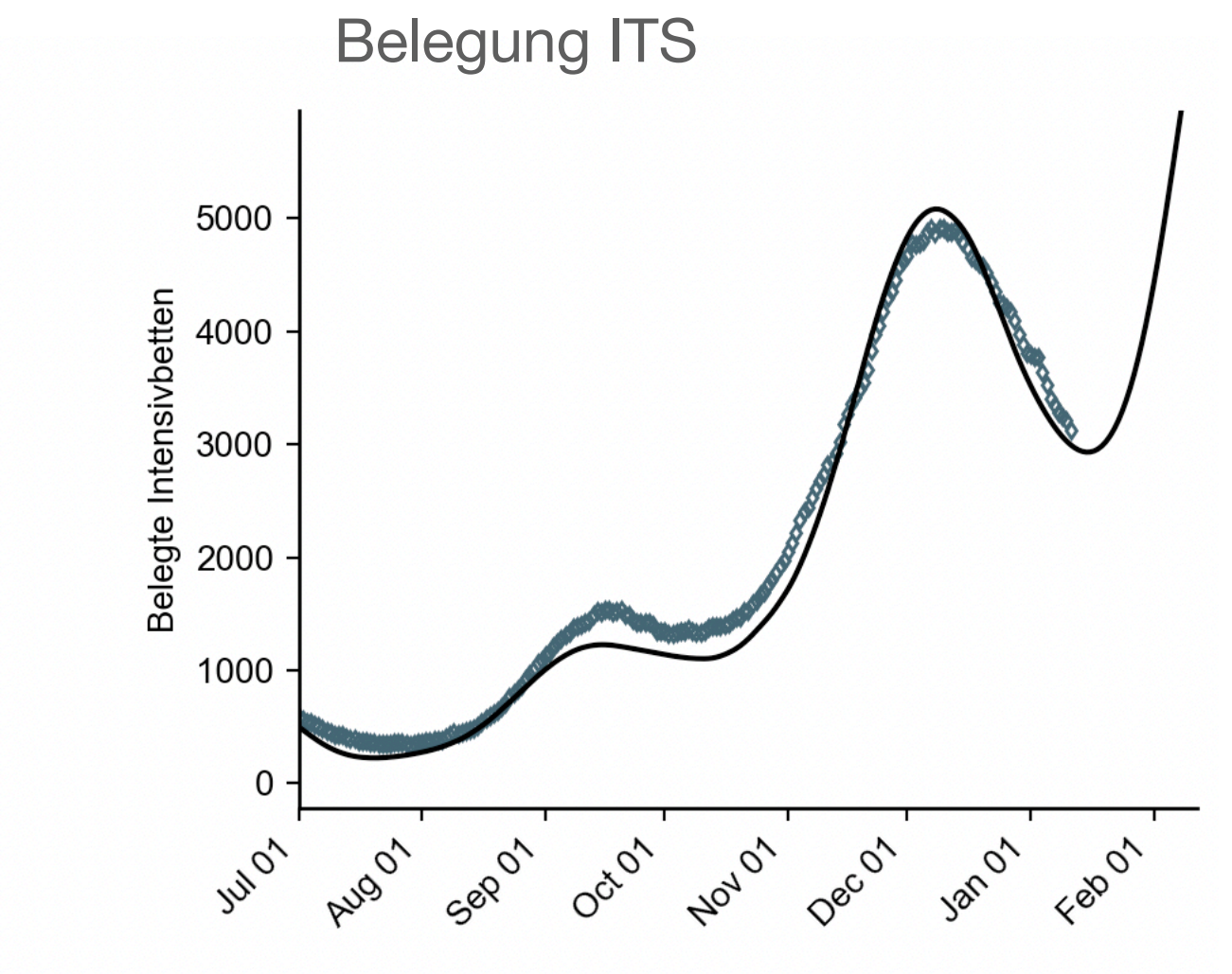


Basisszenario:

Hospitalisierungsrate Omikron: -50%  
ITS-rate Omikron: -50%



Fallhospitalisierungsrate: 1.9%



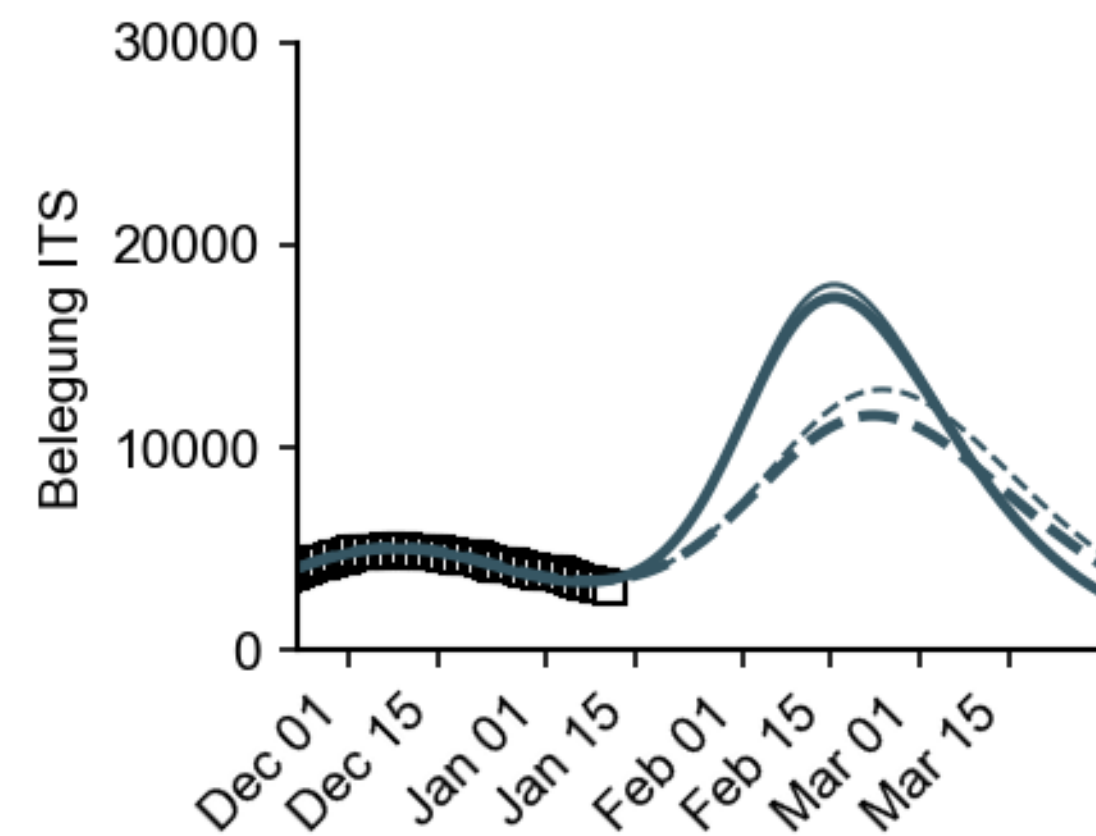
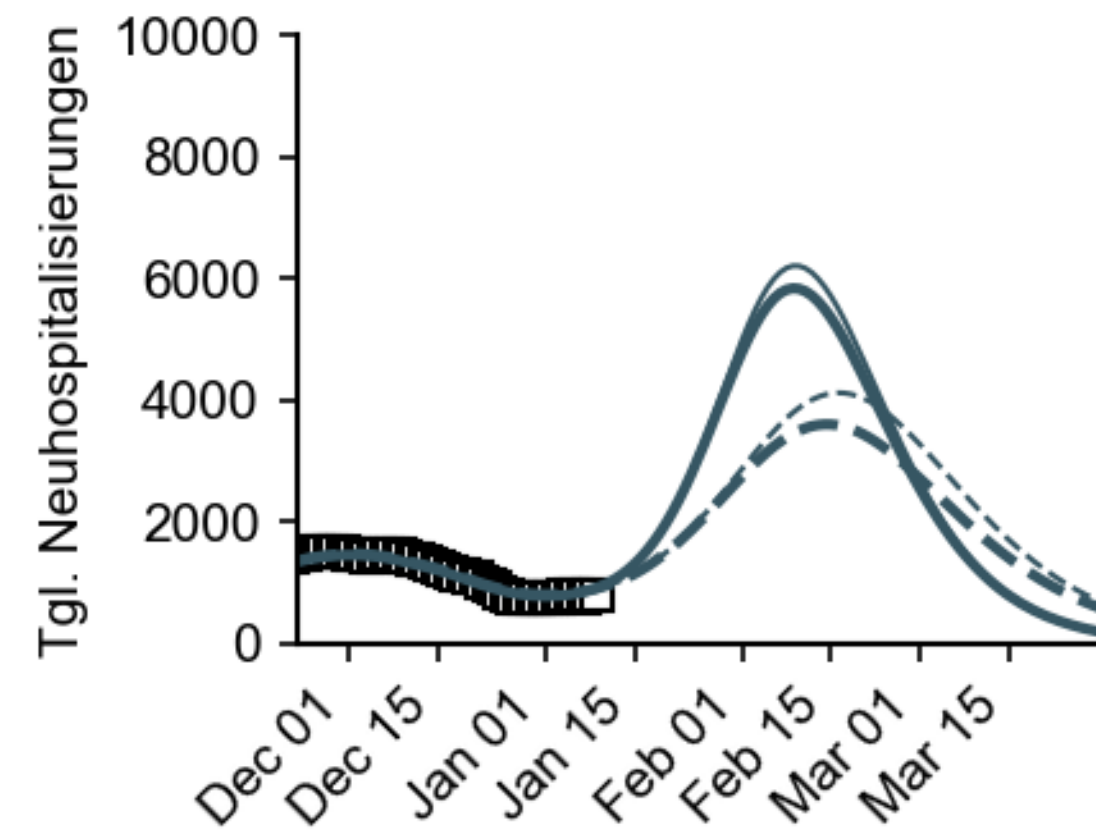
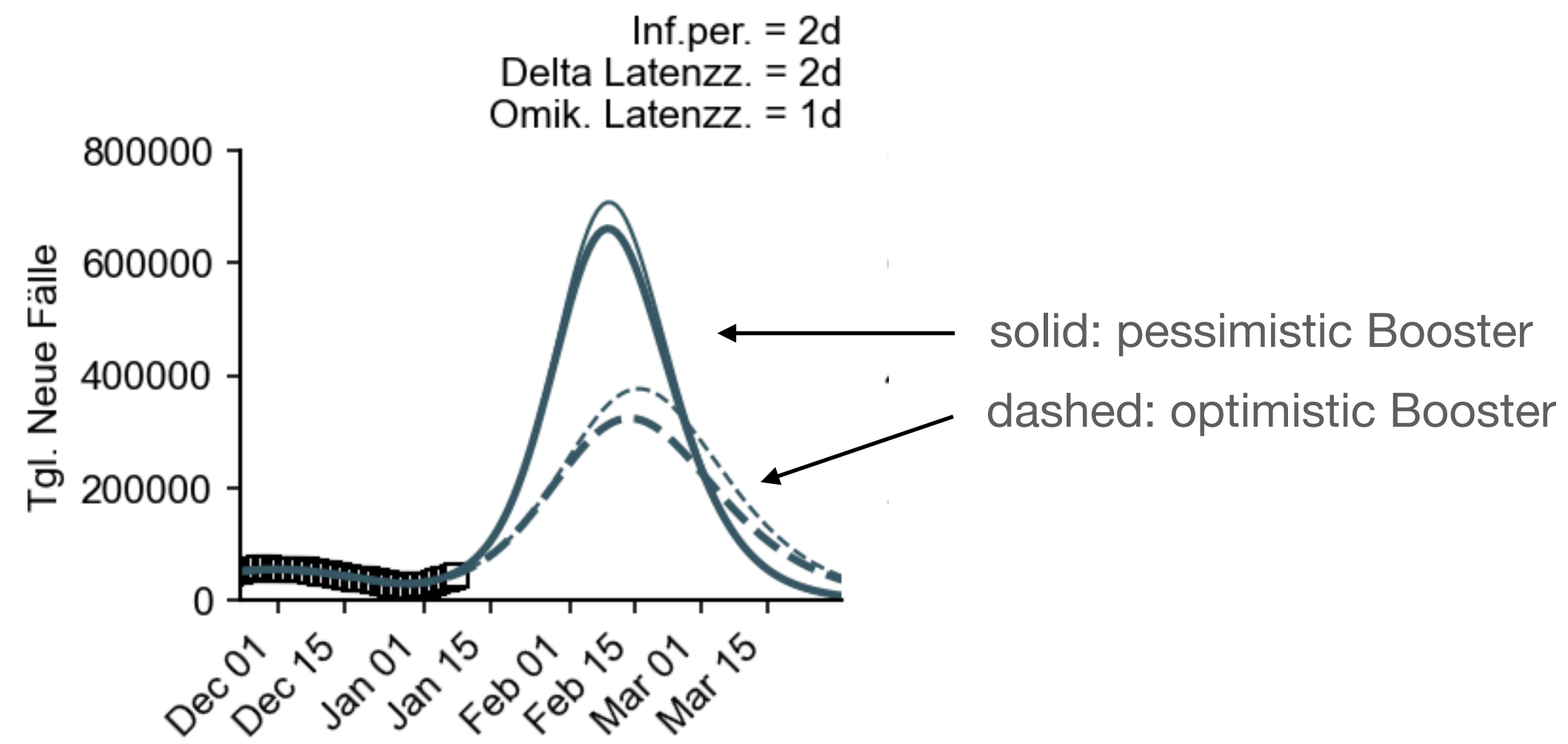
Fall-ITS-Rate: 0.6%



# Modelllimitationen

- populationsgemittelte Modelle überschätzen Peak-Höhe bei großen Ausbrüchen (~ 10%)
- populationsgemittelt -> Heterogenitäten in Populationen werden nicht beachtet
- Keine "Notbremse": Keine automatische Kontaktreduktion bei hohen Inzidenzen/ITS-Auslastungen
- Unsicherheit in Dunkelziffer: höhere Dunkelziffer = Kleinere Peaks
- Unsicherheit in Immunität von Genesenen: Hohe Immunität = Kleinere Peaks
- Unsicherheit in Zahl von Genesenen: Unklar, wie viele geimpft
- Möglicherweise VE gegen Infektion mit Delta überschätzt
  - -> weniger Wachstum durch escape -> höhere Transmissibilität Omikron
  - -> höhere Peaks

# Ergebnisse

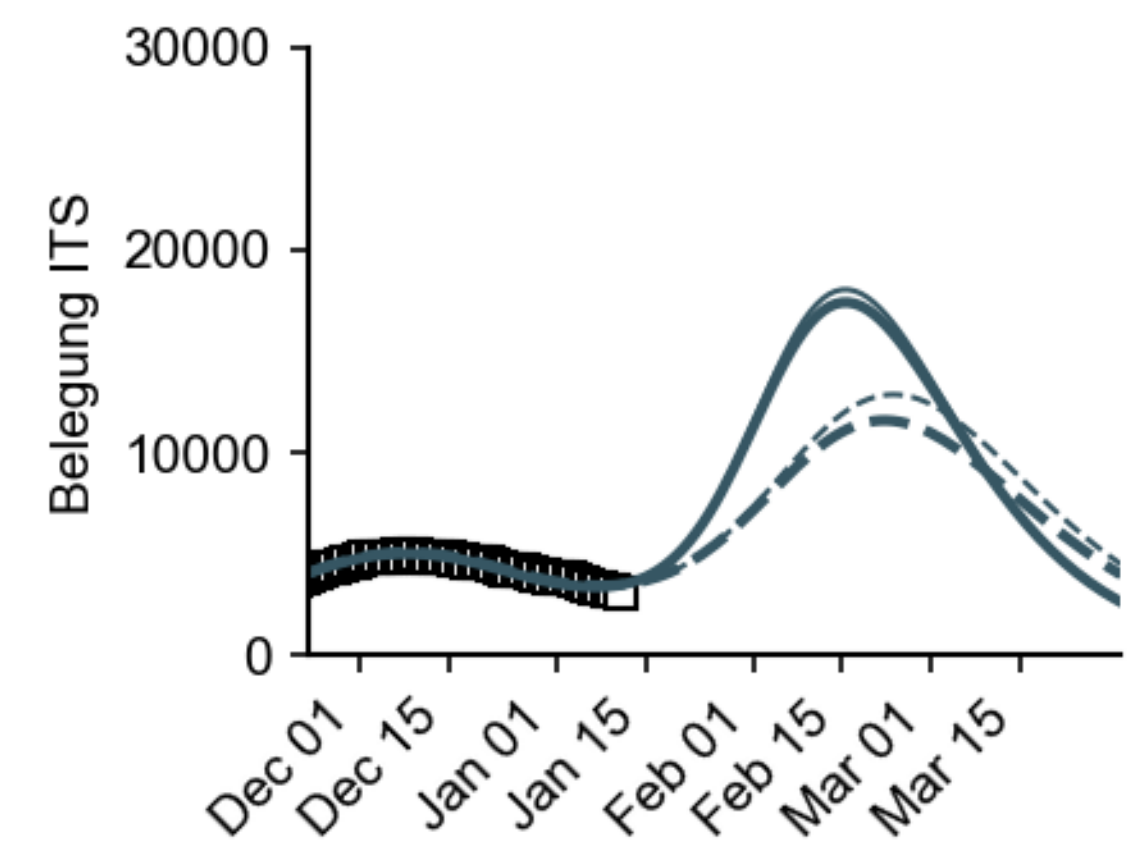
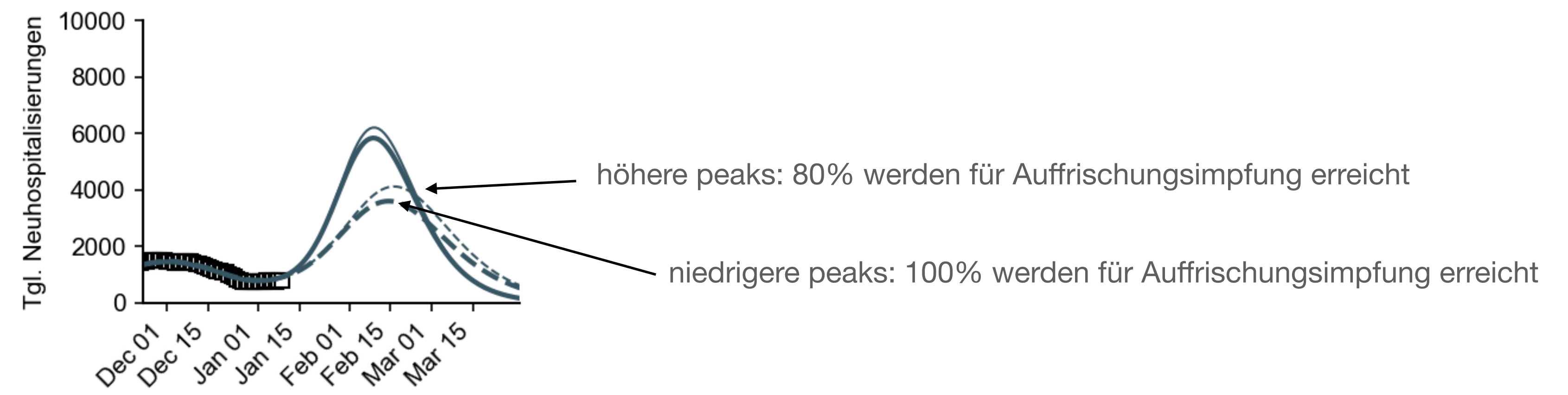
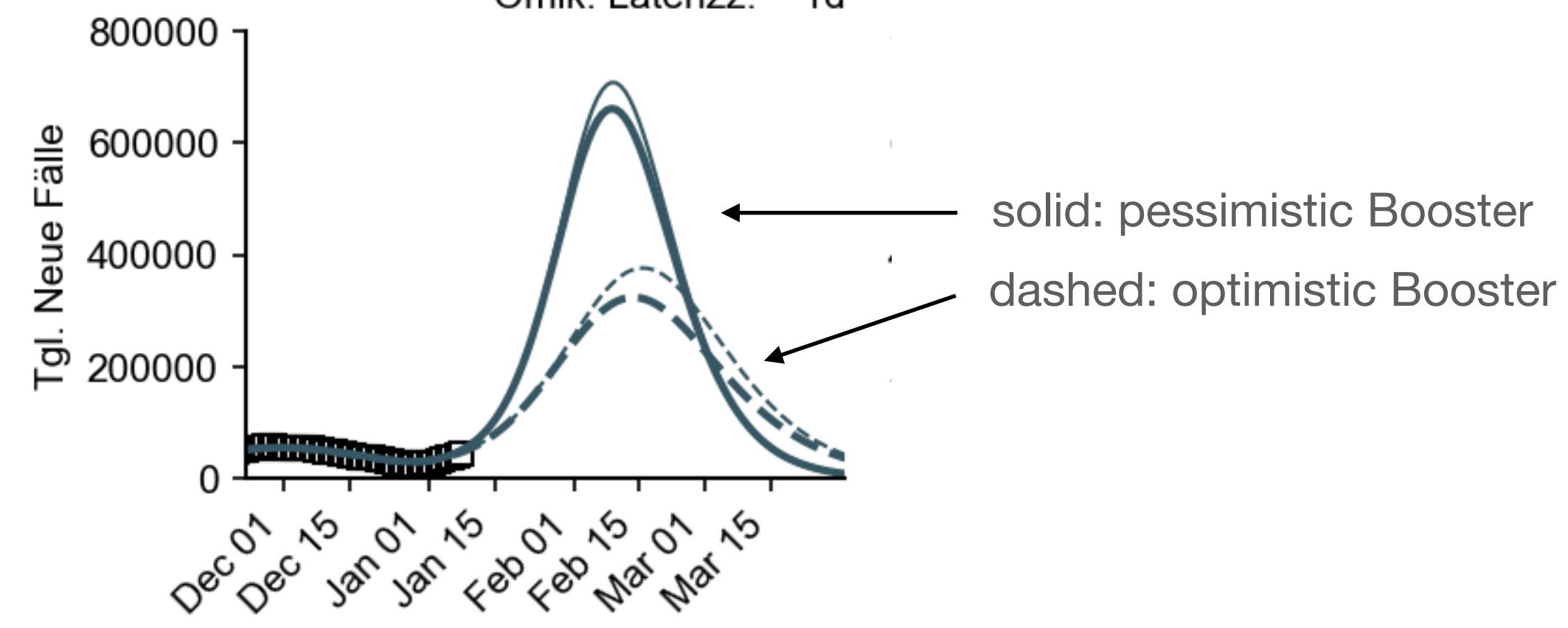


Basisszenario:

Hospitalisierungsrate Omikron: -50%

ITS-rate Omikron: -50%

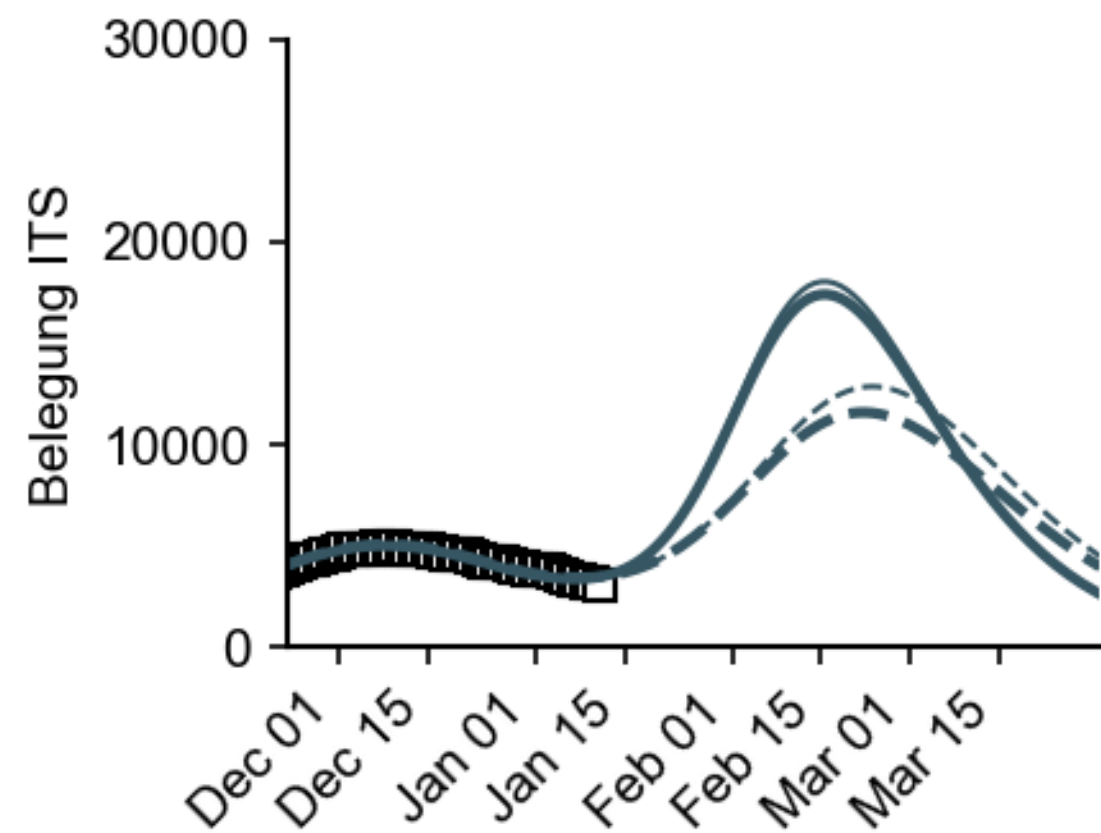
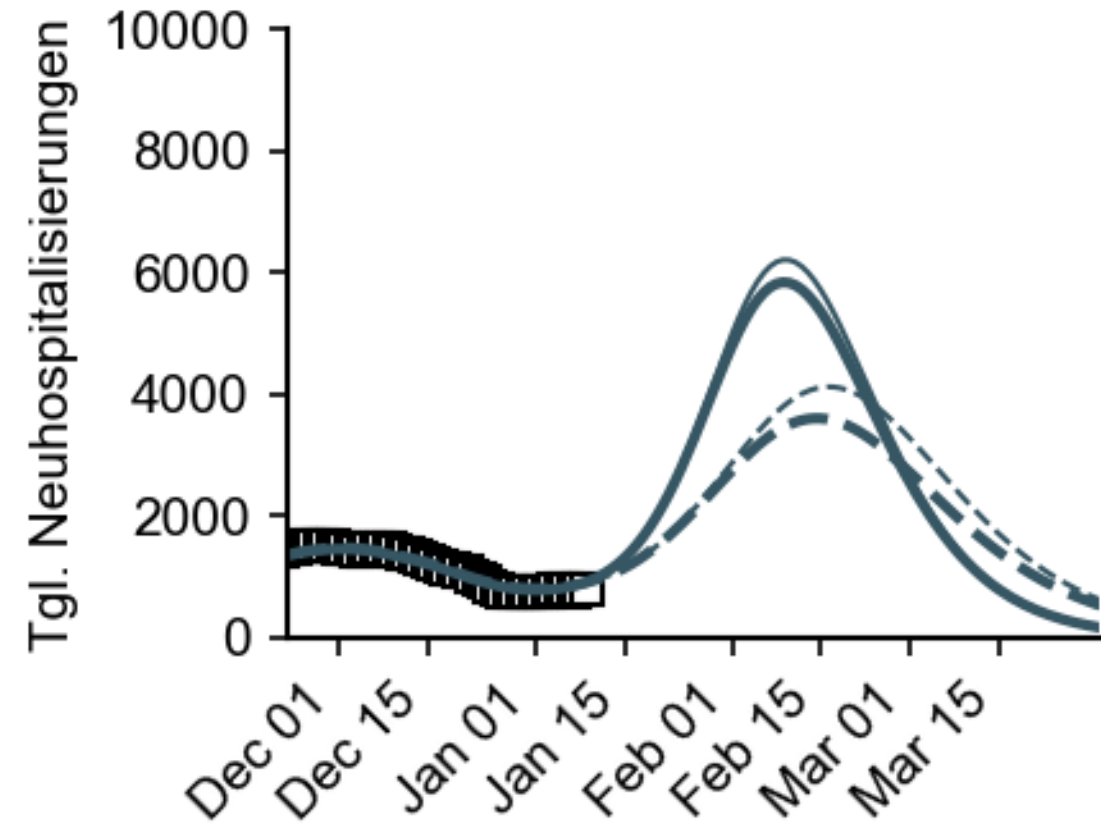
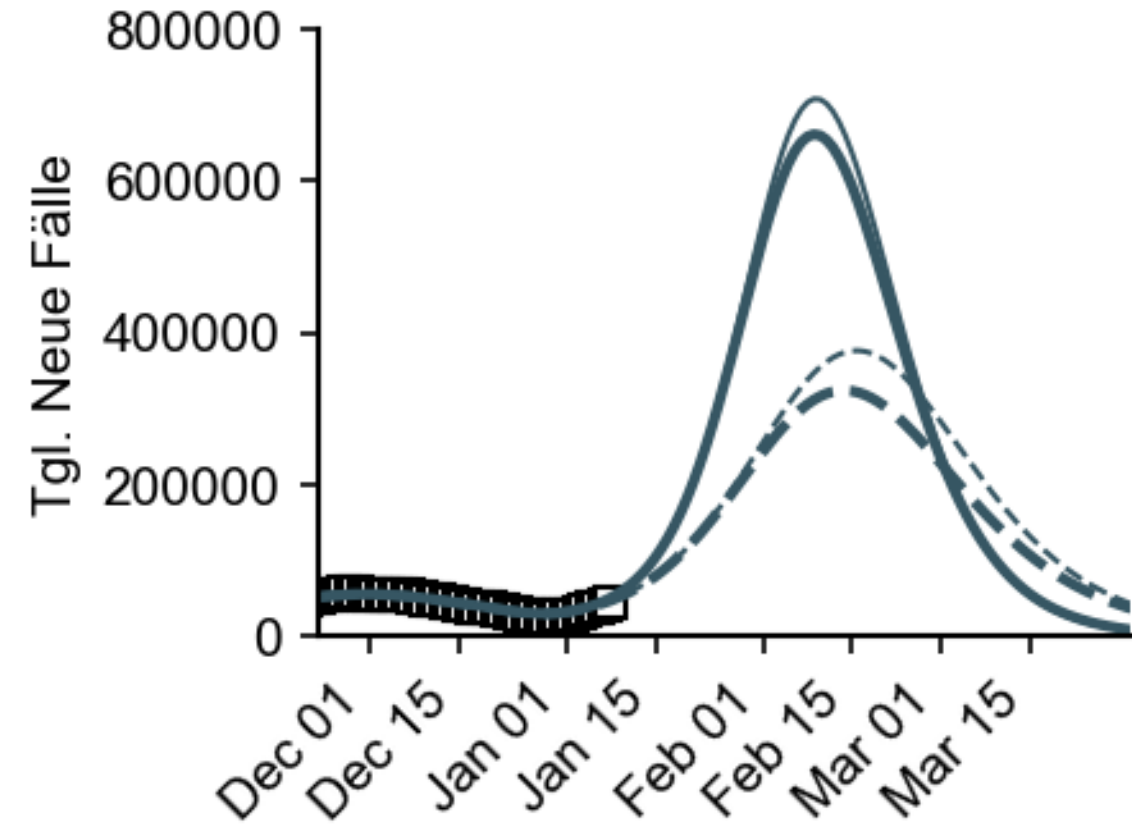
Inf.per. = 2d  
Delta Latenz. = 2d  
Omik. Latenz. = 1d



Basisszenario:  
Hospitalisierungsrate Omikron: -50%  
ITS-rate Omikron: -50%

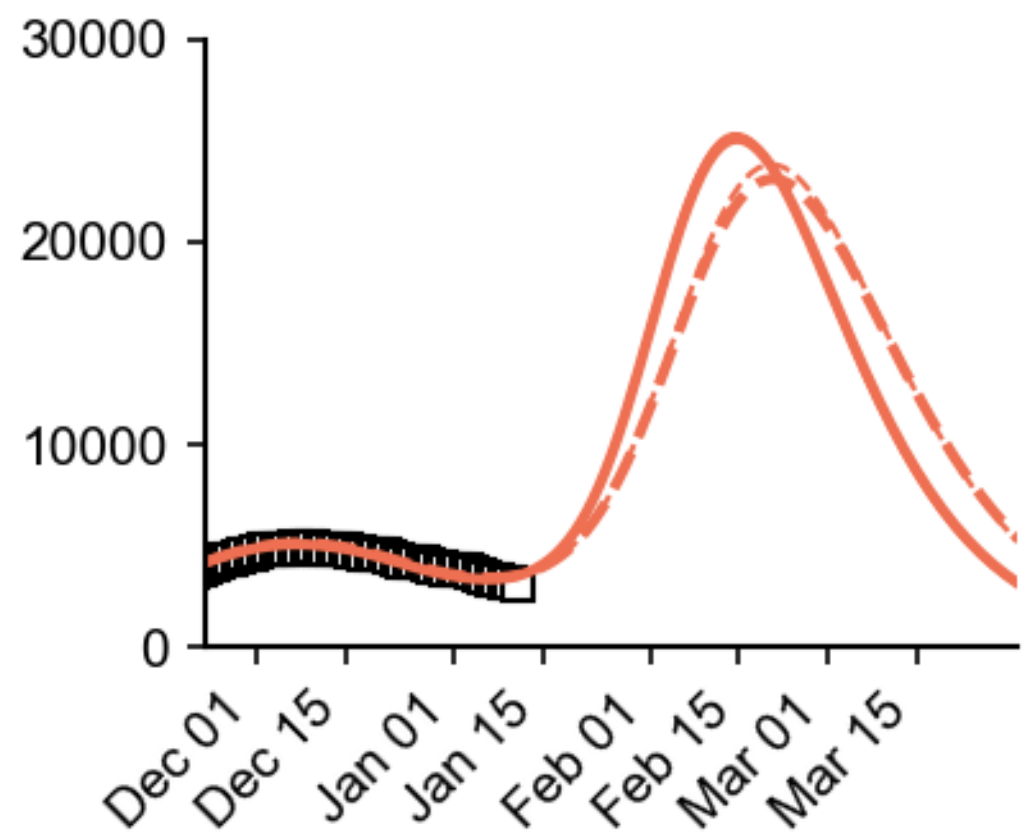
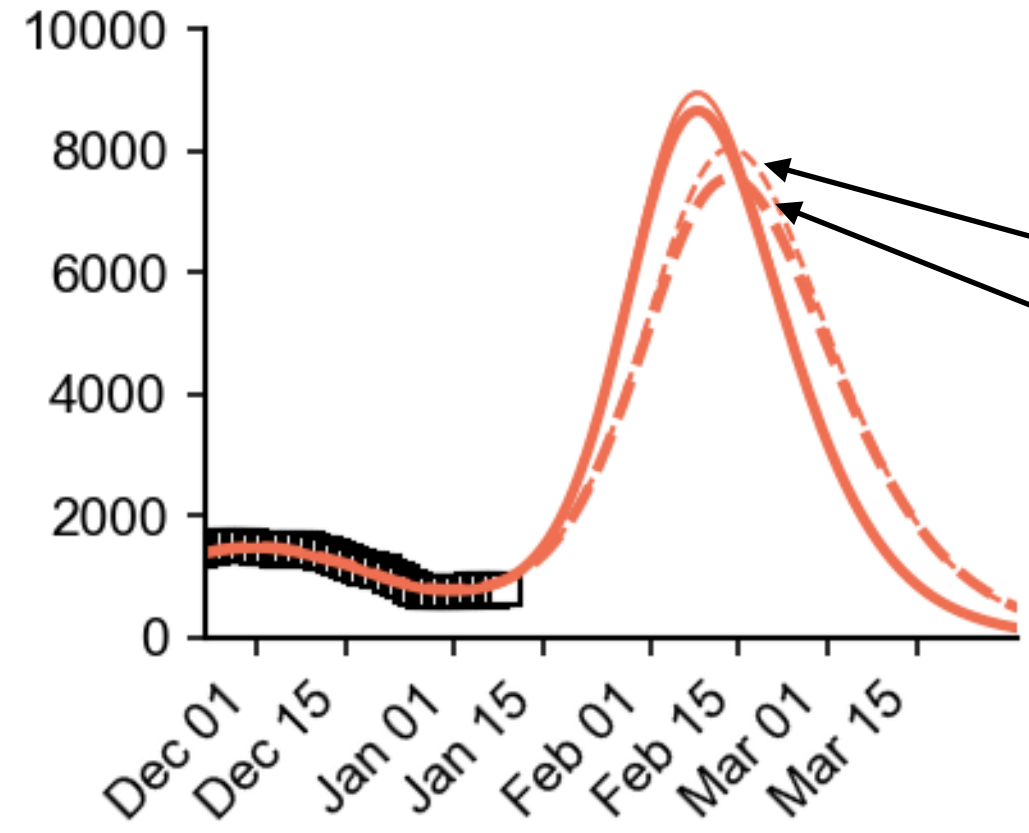
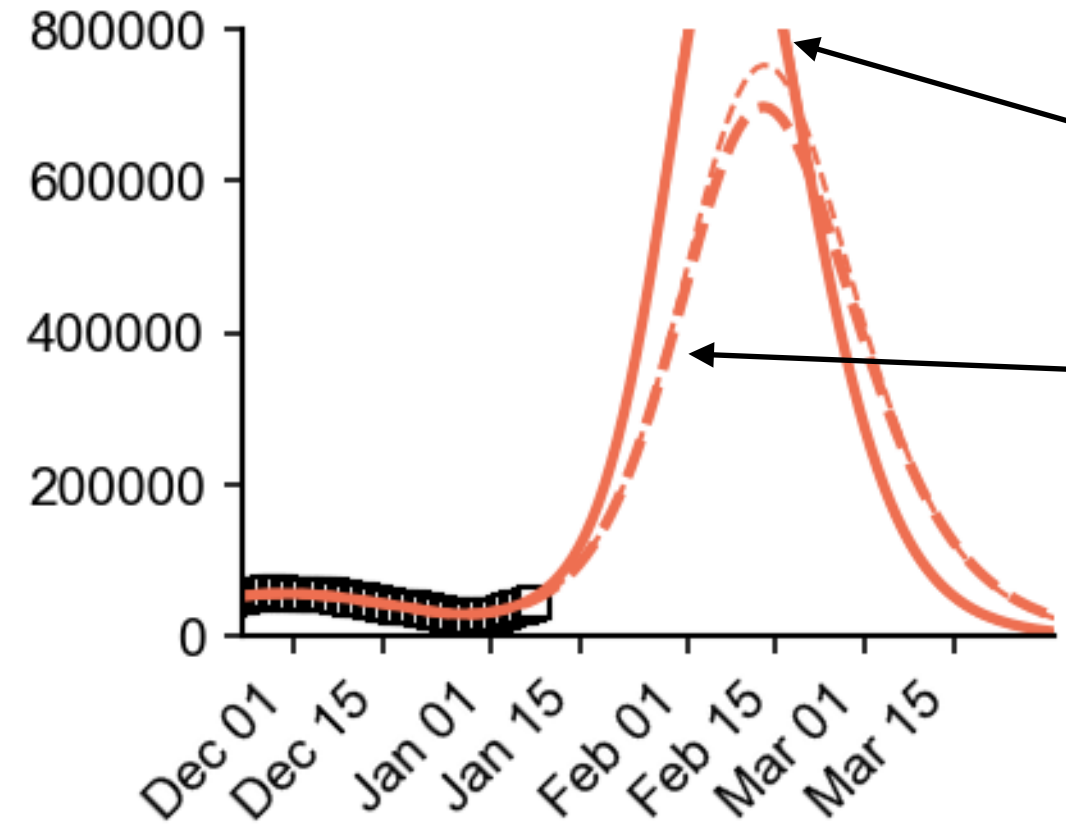
Gen.zeit D: 4d  
Gen.zeit O: 3d

Inf.per. = 2d  
Delta Latenz. = 2d  
Omik. Latenz. = 1d



Inf.per. = 3d  
Delta Latenz. = 2d  
Omik. Latenz. = 2d

Gen.zeit D: 5d  
Gen.zeit O: 5d



solid: pessimistic Booster

dashed: optimistic Booster

höhere peaks: 80% werden für  
Auffrischungsimpfung erreicht

niedrigere peaks: 100% werden für  
Auffrischungsimpfung erreicht

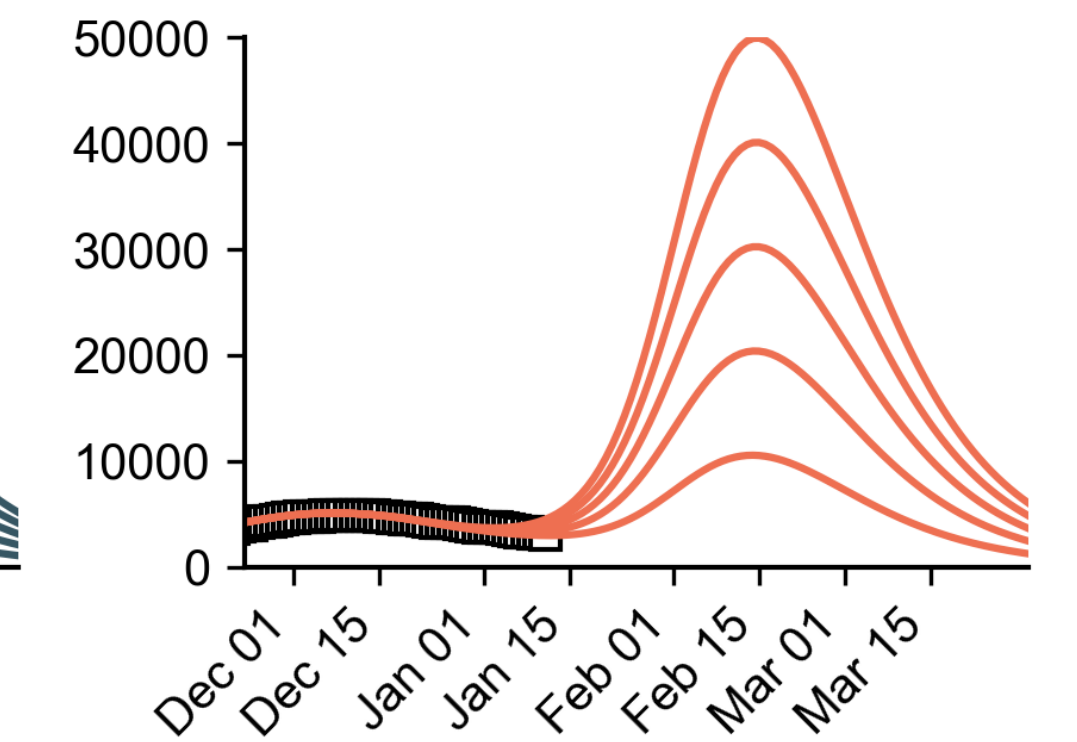
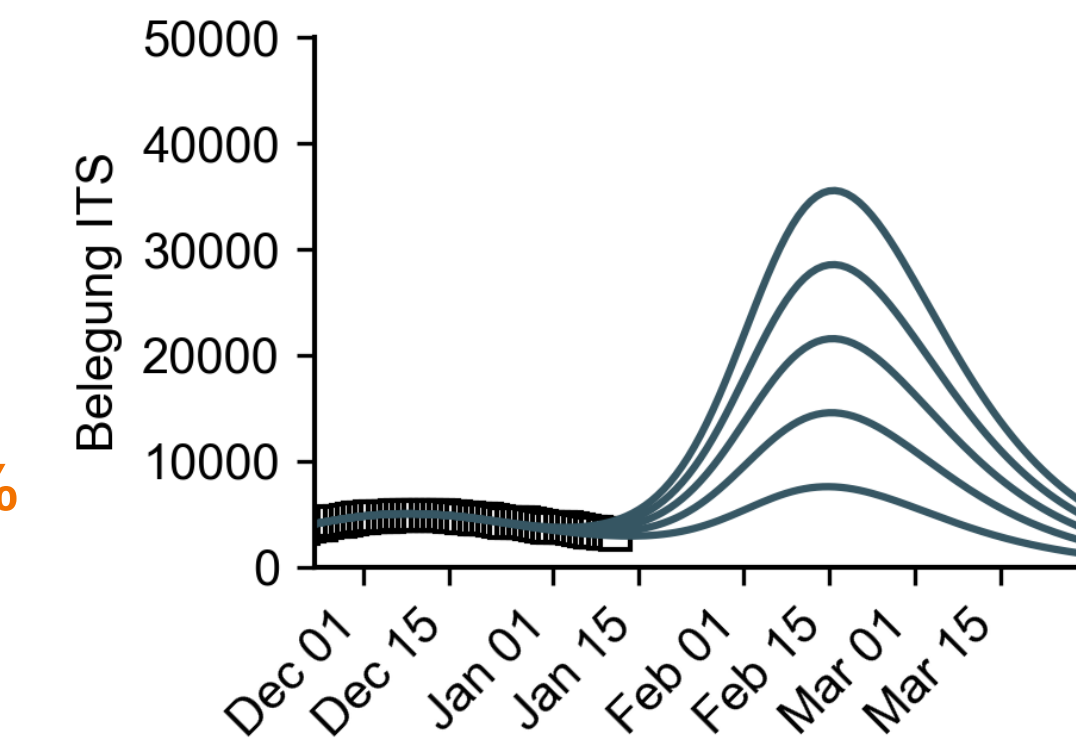
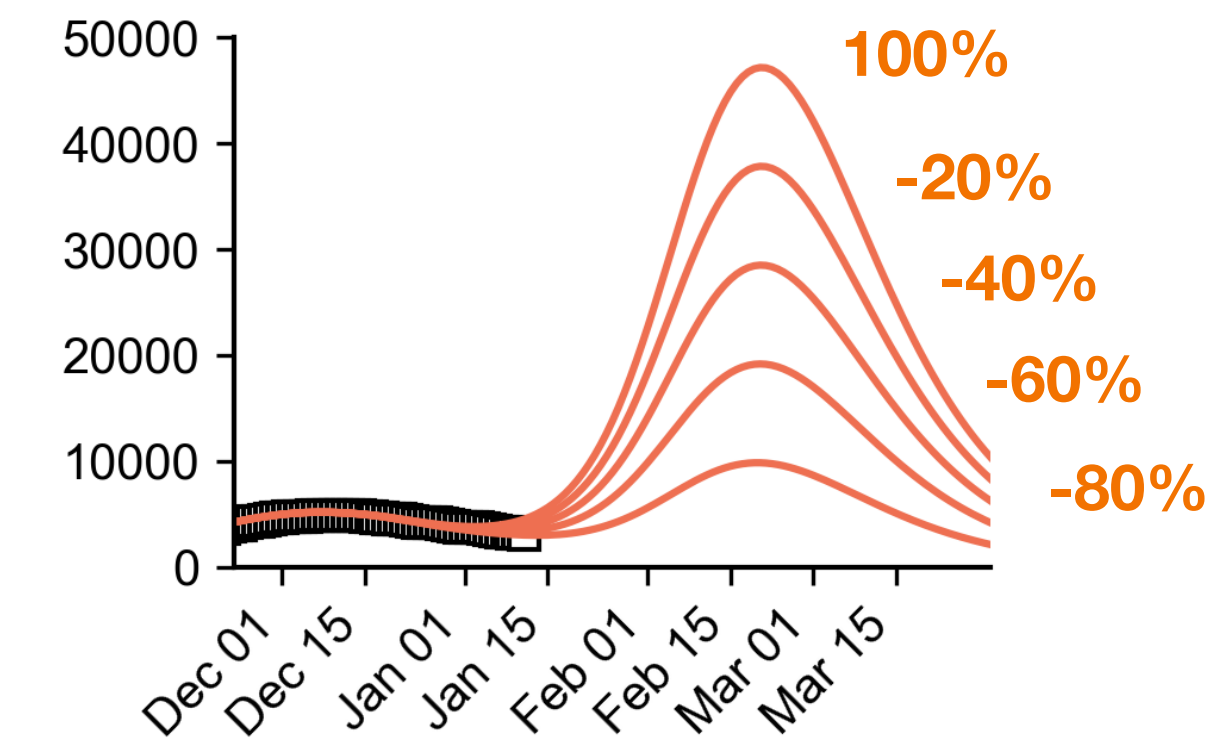
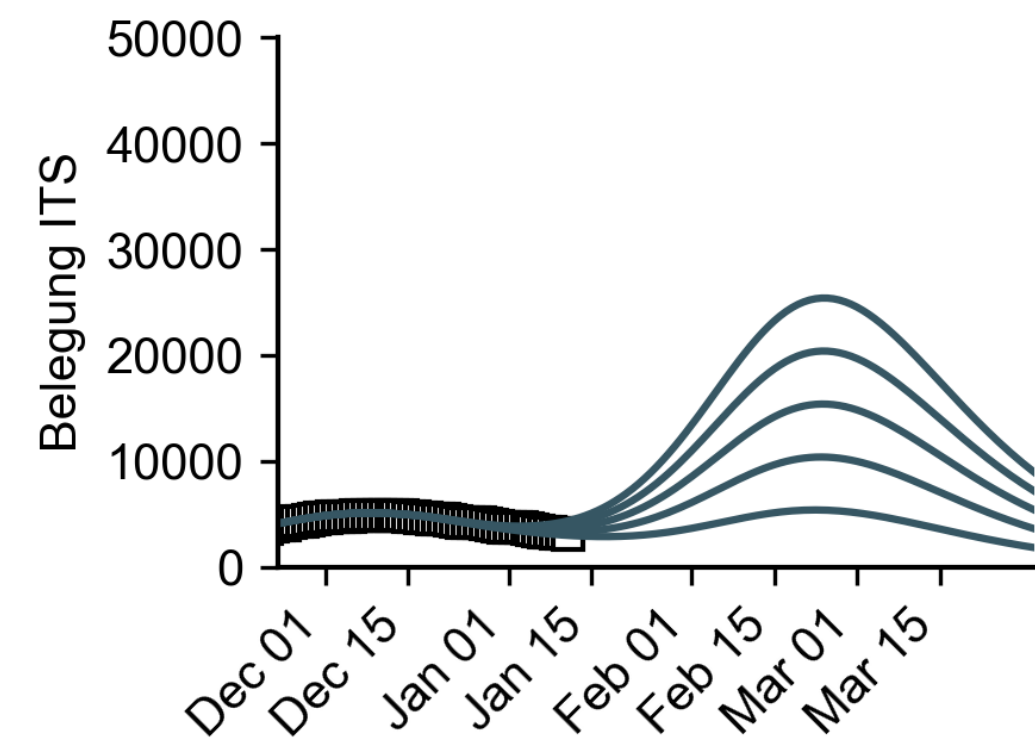
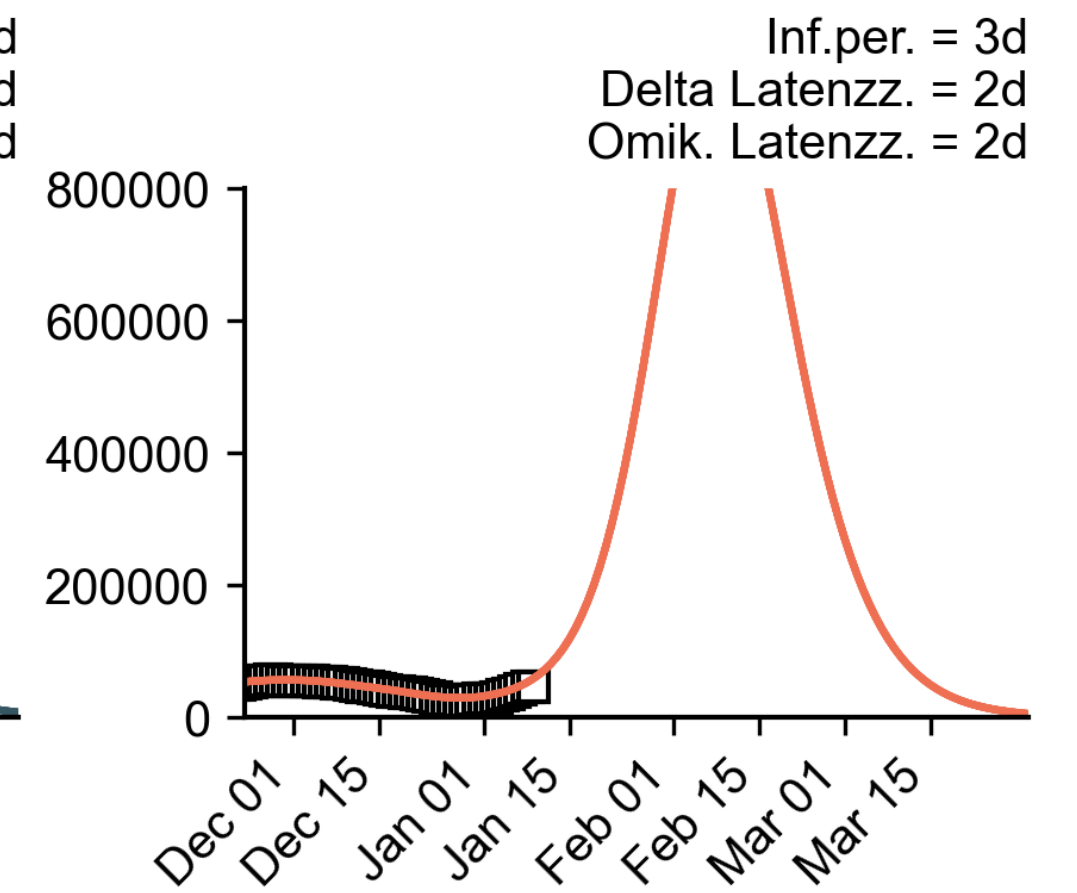
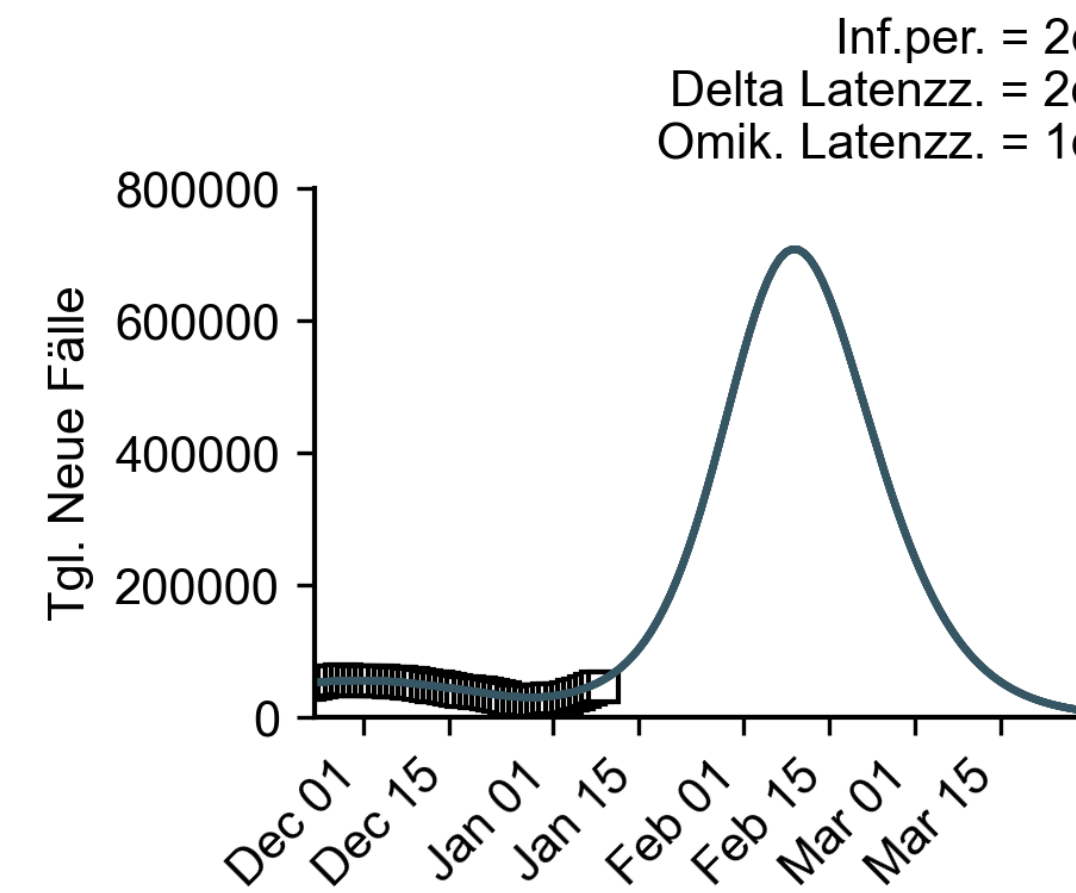
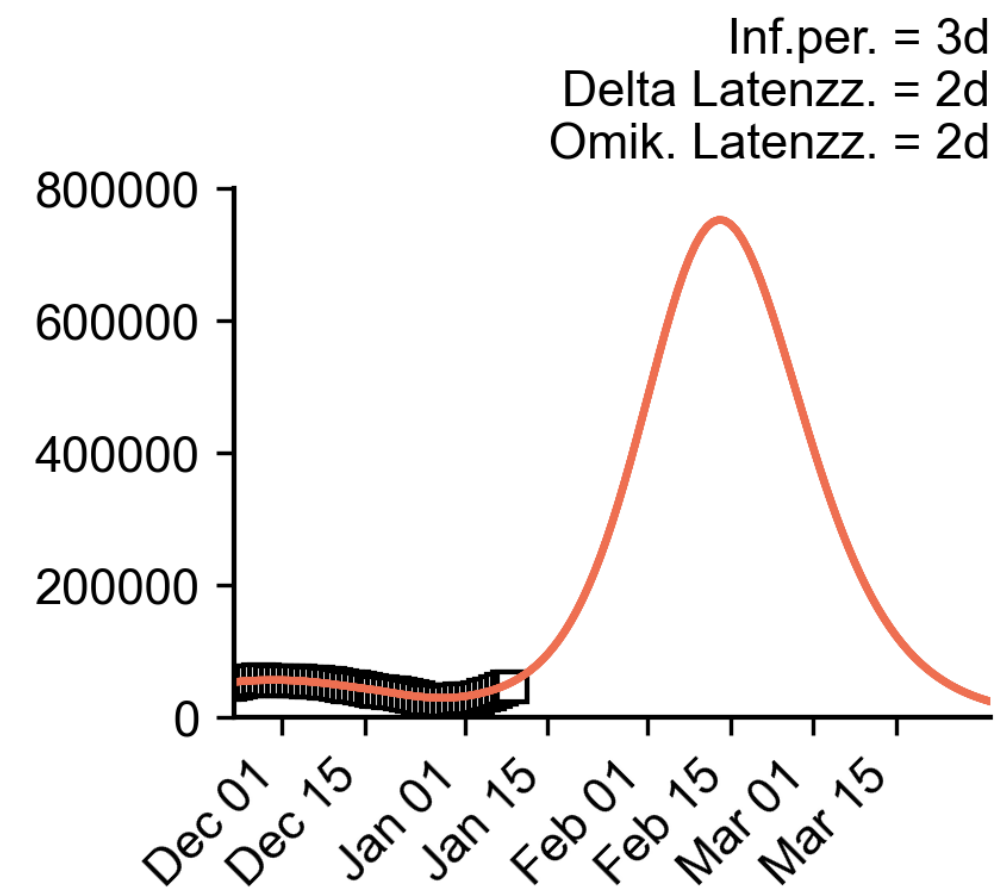
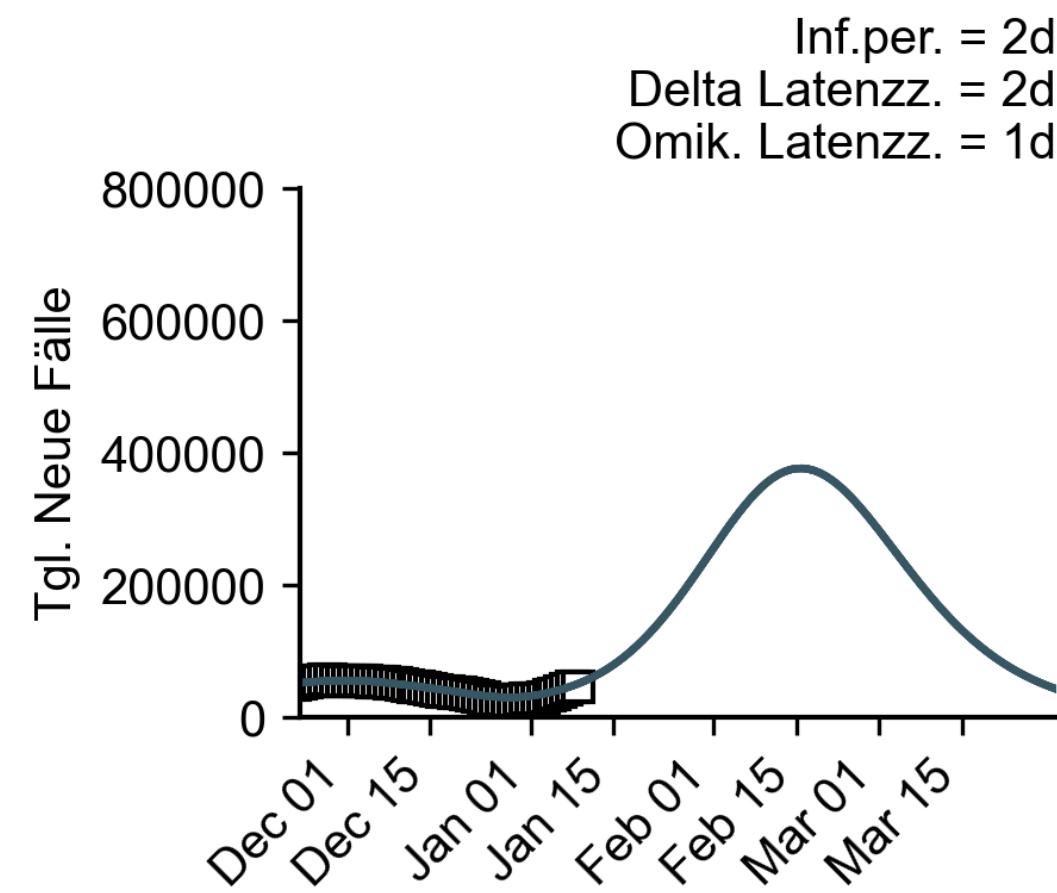
Basisszenario:

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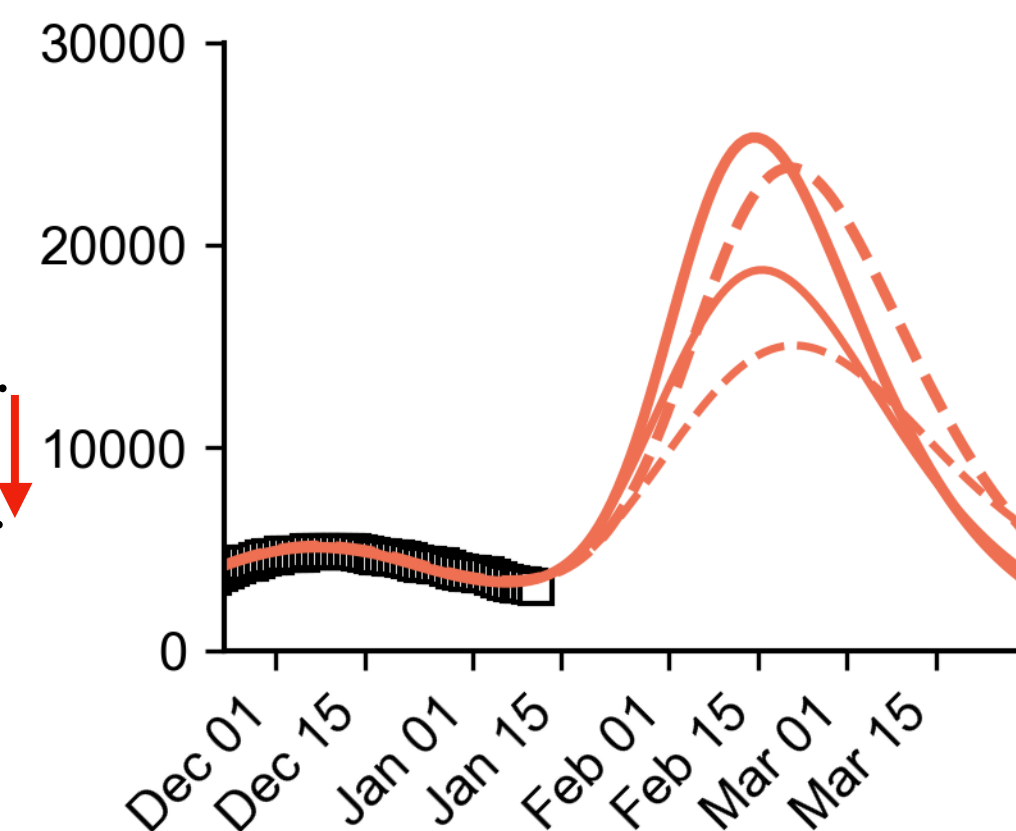
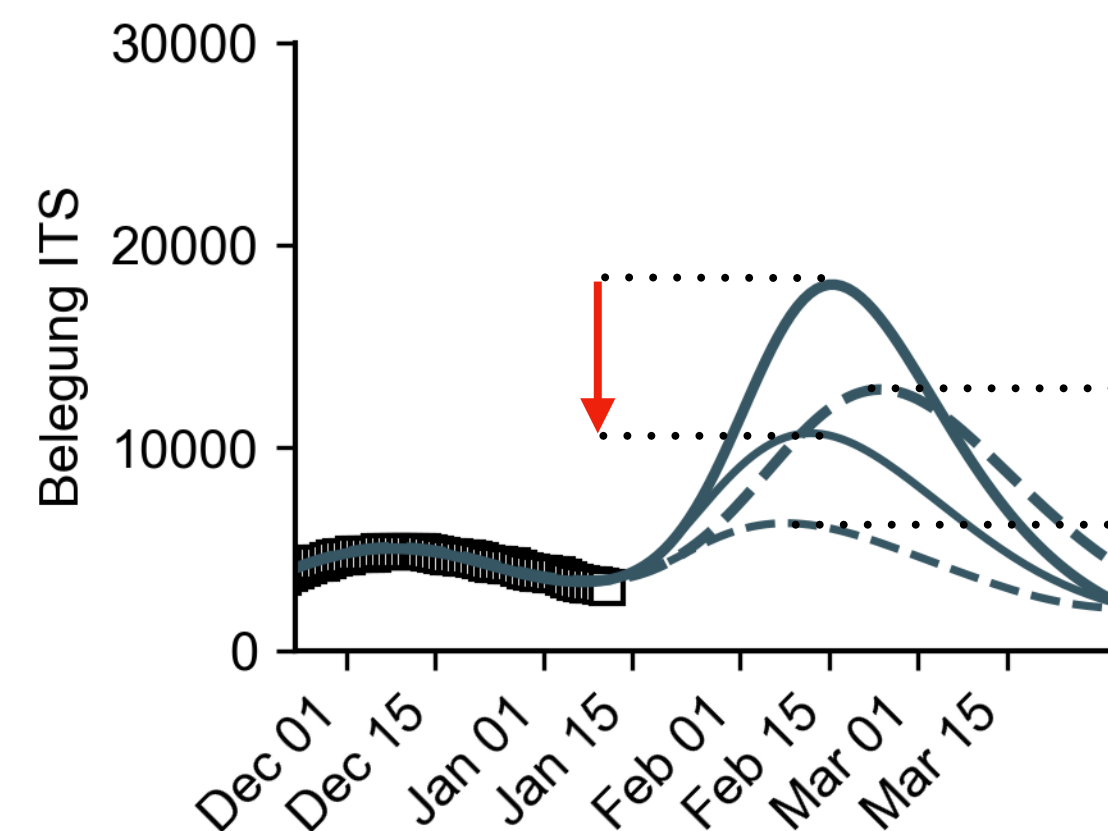
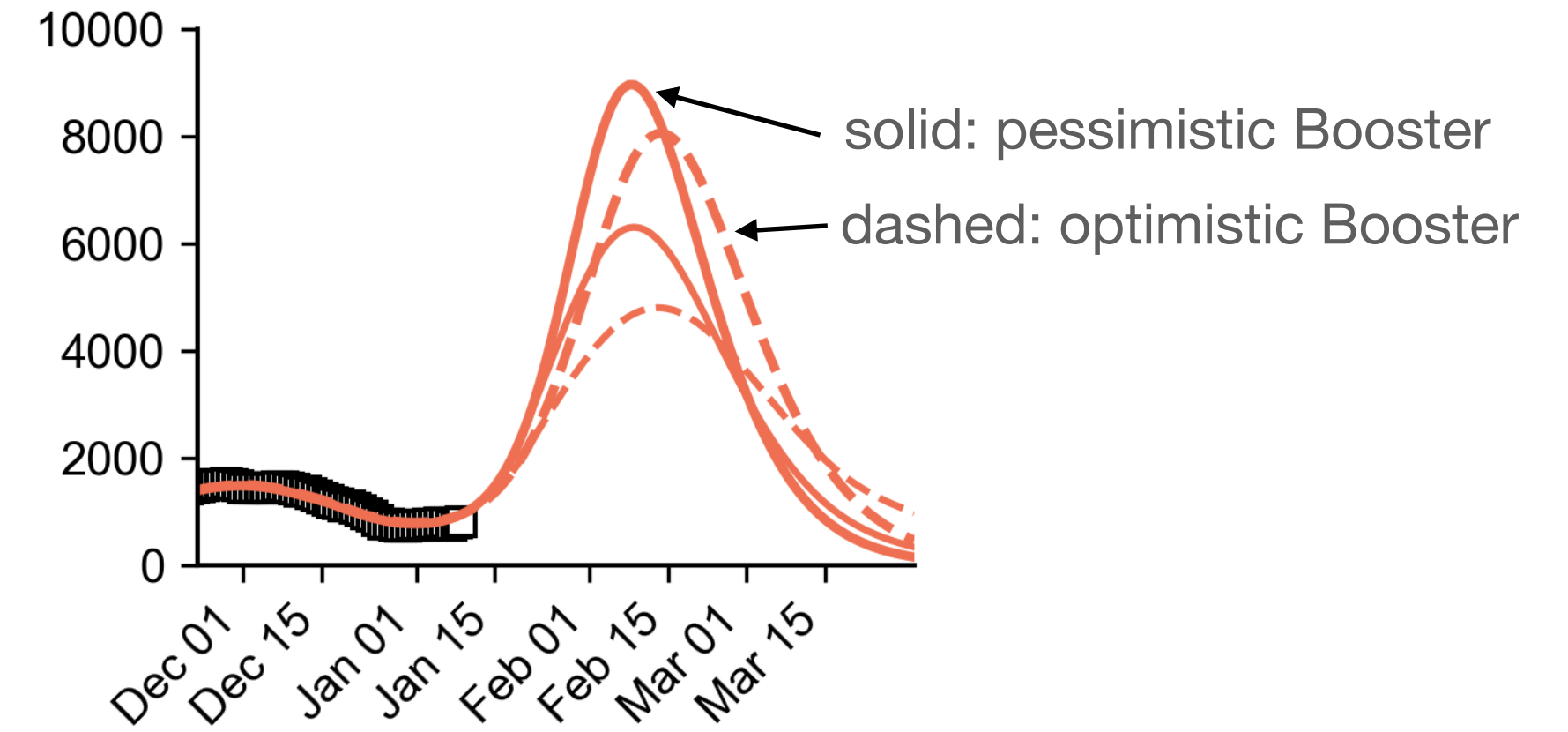
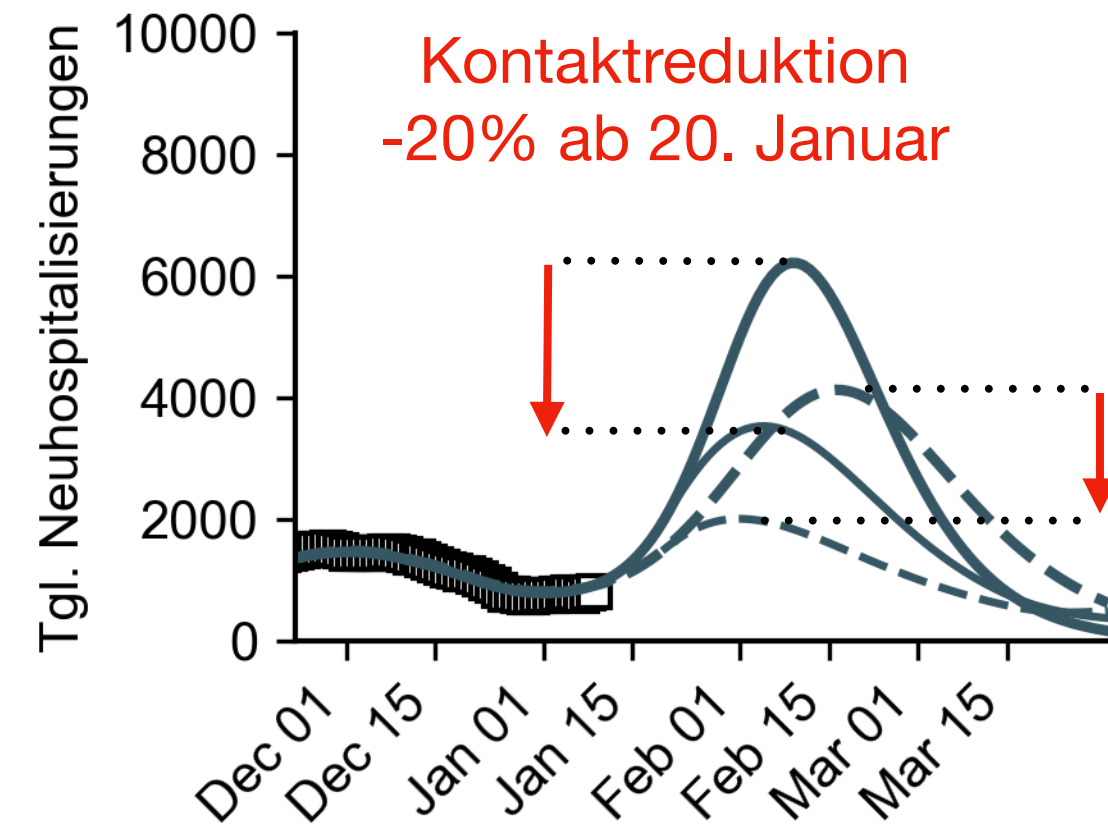
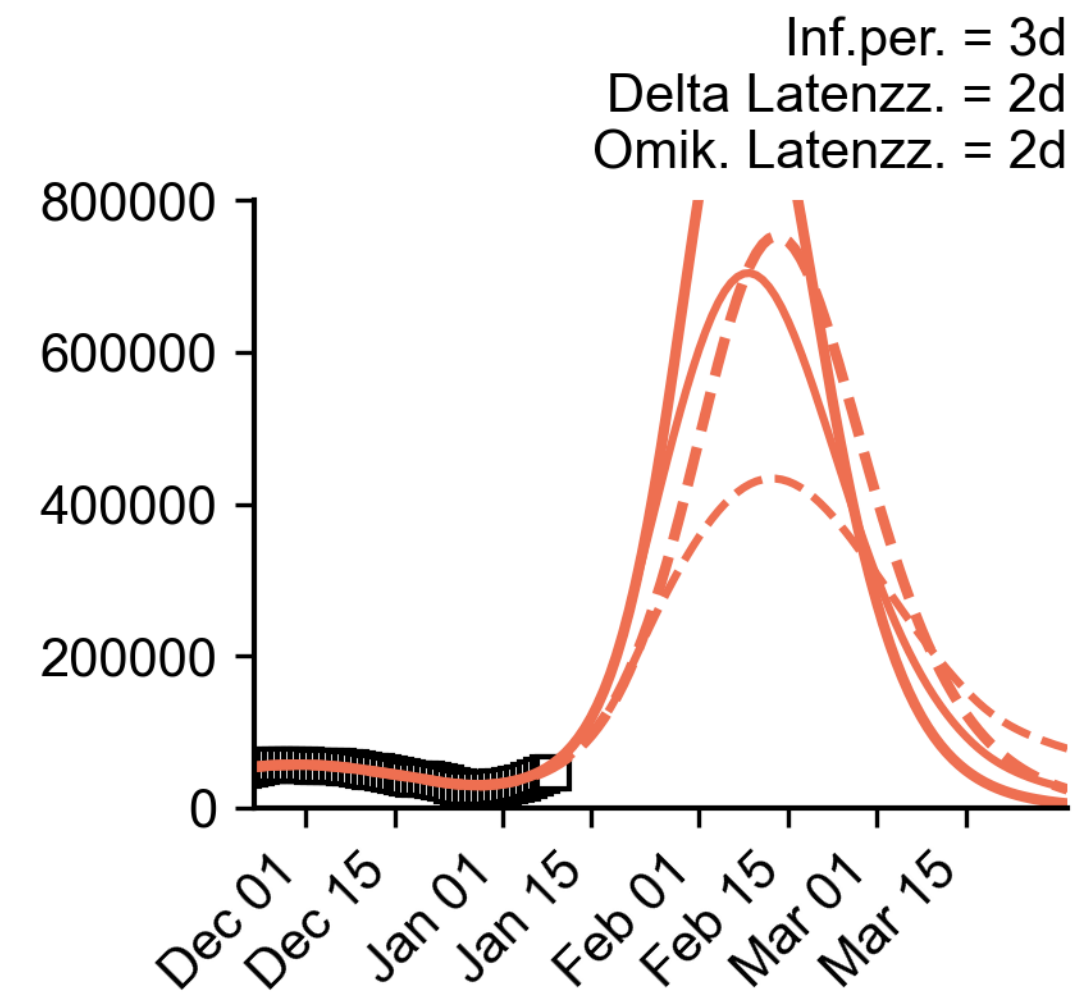
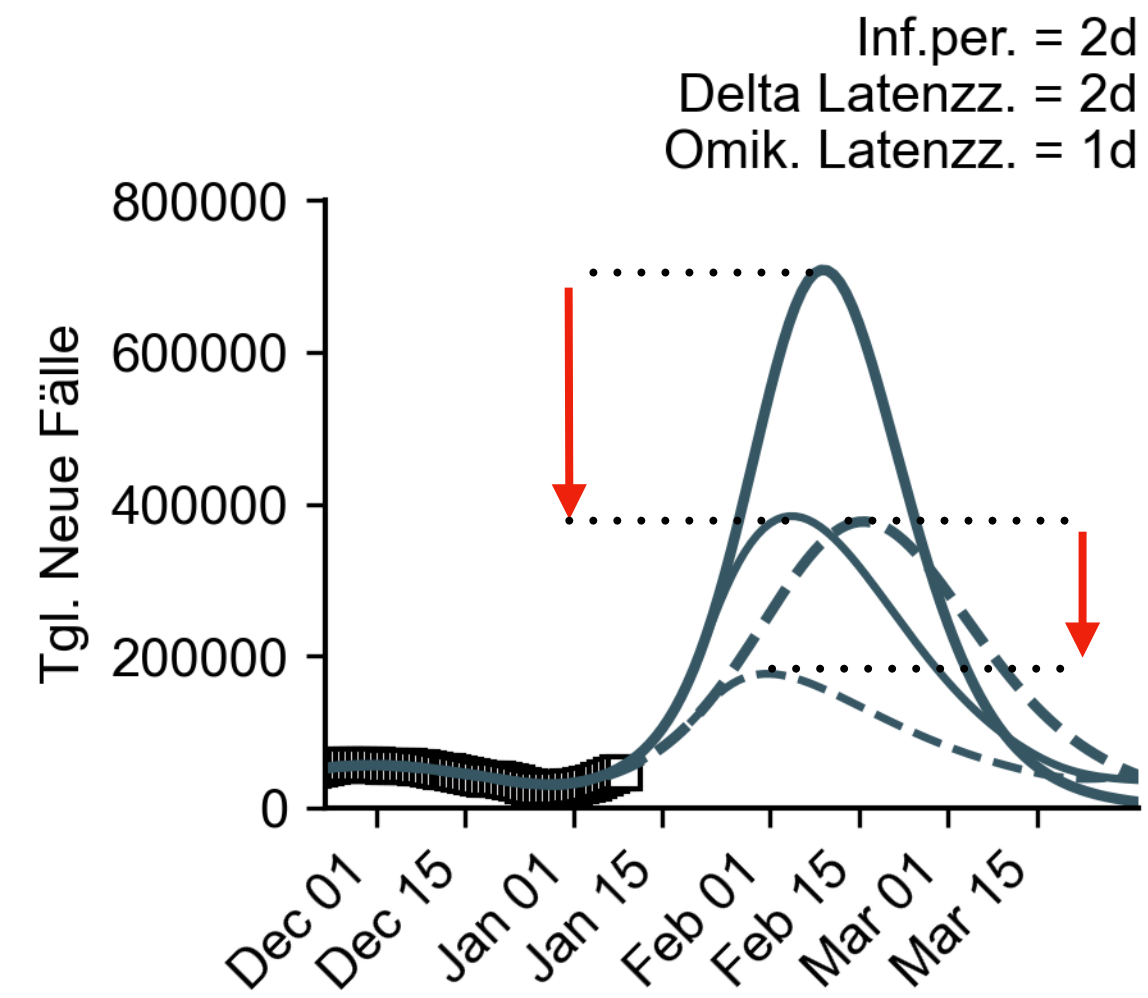
# Reduktion in Schwere ggü. Delta

## Optimistische Boosterwirkung





# Kontaktreduktionen



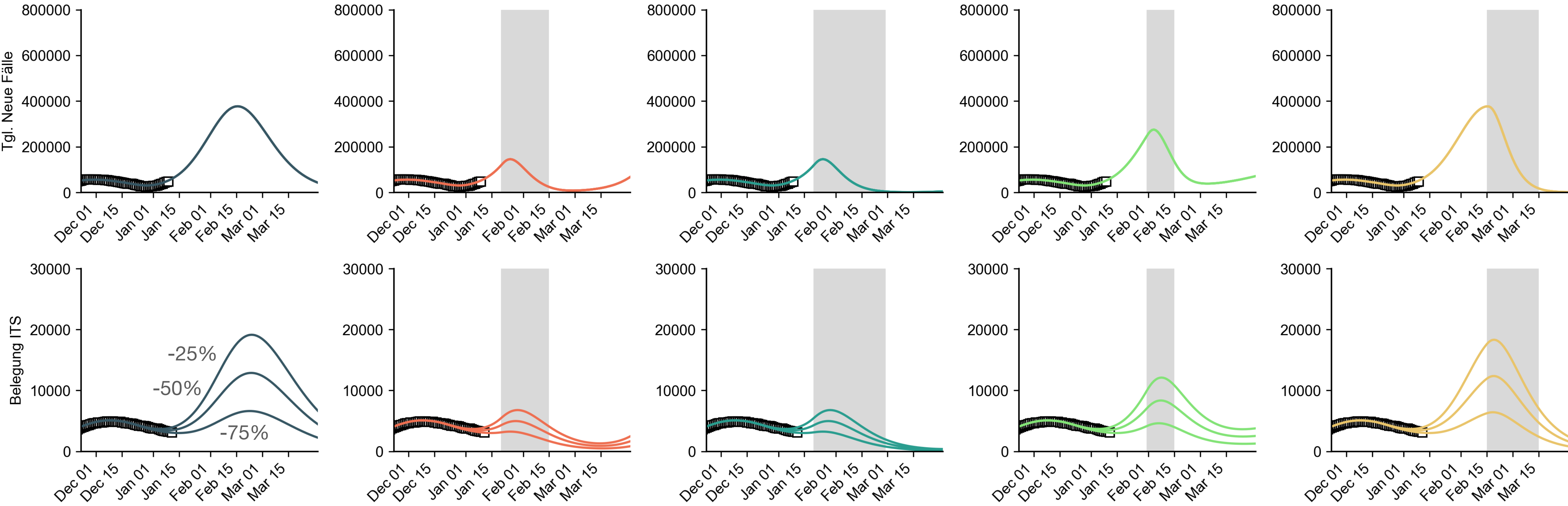
Basisszenario:

Hospitalisierungsrate Omikron: -50%

ITS-rate Omikron: -50%

# Starke NPIs (-50% ggü. Dezember)

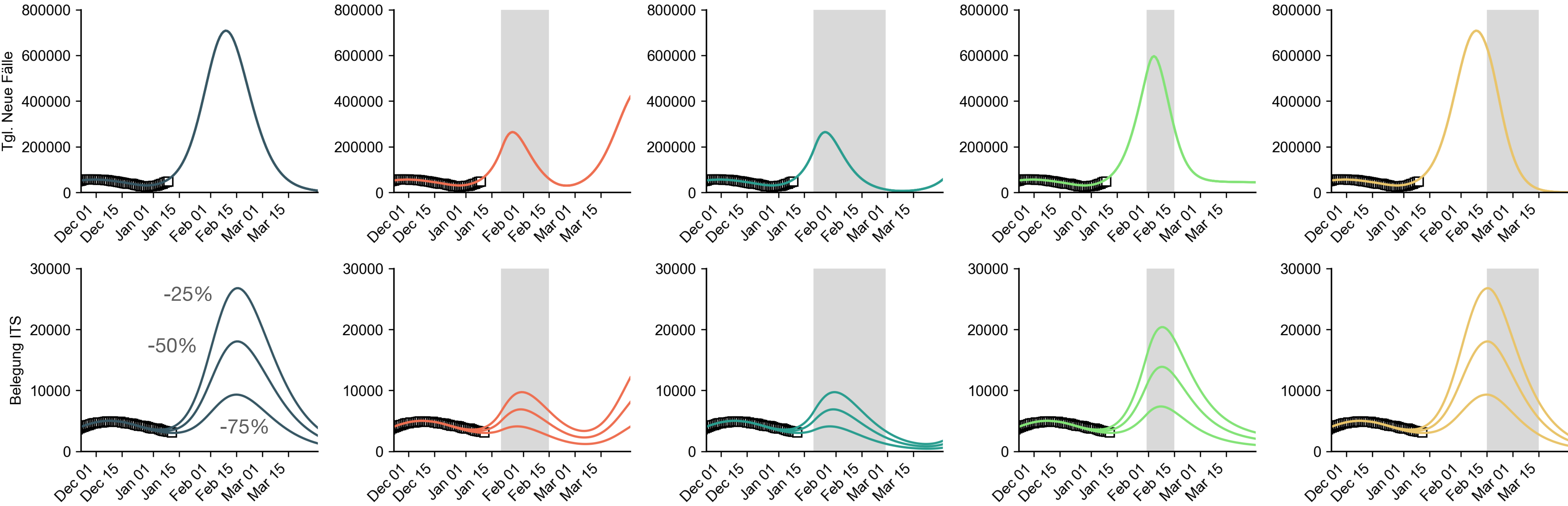
Boosterwirkung: Optimistisch  
Generationszeit: Optimistisch





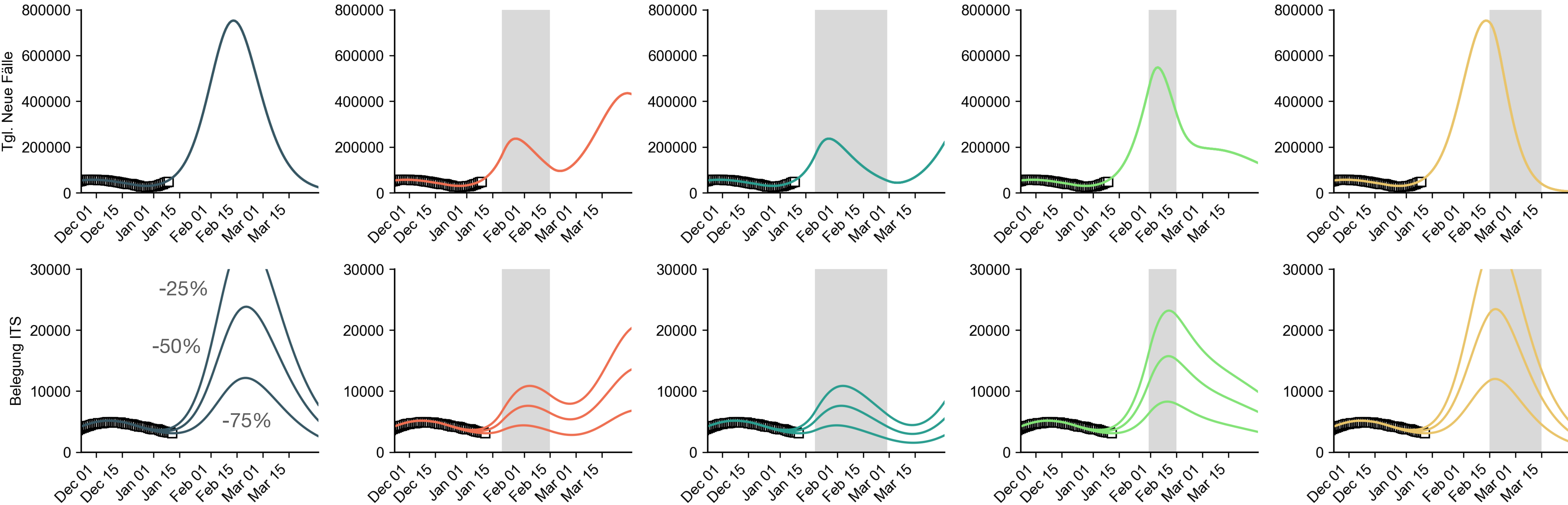
# Starke NPIs (-50% ggü. Dezember)

Boosterwirkung: Pessimistisch  
Generationszeit: Optimistisch



# Starke NPIs (-50% ggü. Dezember)

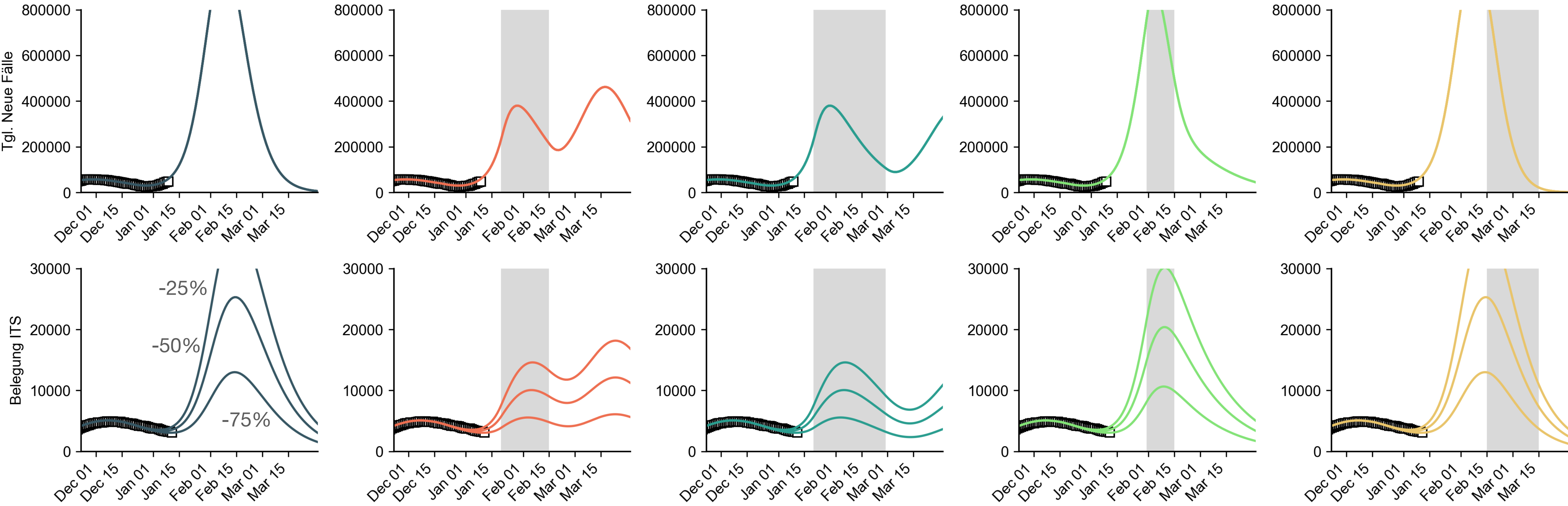
Boosterwirkung: Optimistisch  
Generationszeit: Pessimistisch





# Starke NPIs (-50% ggü. Dezember)

Boosterwirkung: Pessimistisch  
Generationszeit: Pessimistisch



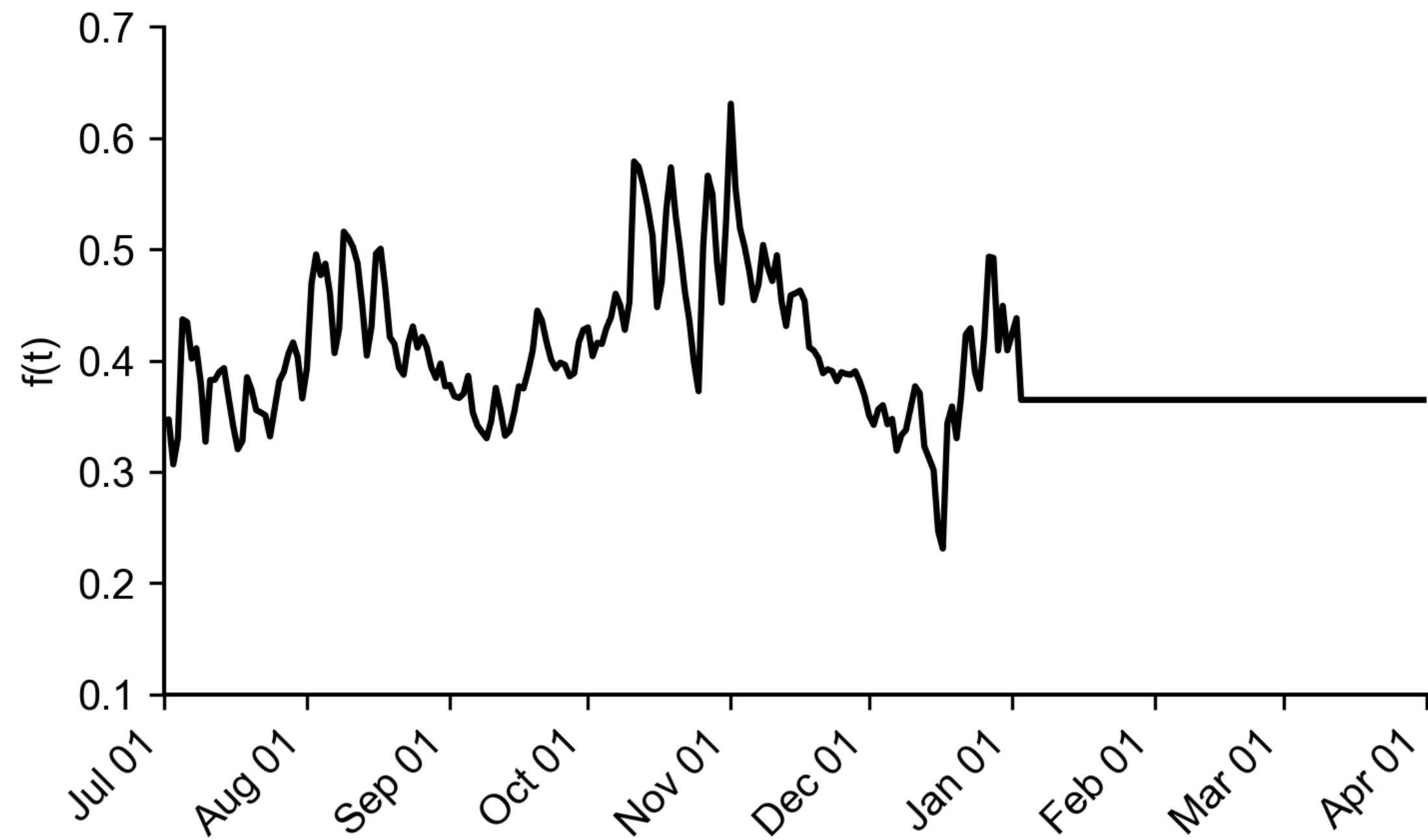
# Fazit

- Größenordnung 80-90%-ige Reduktion in der Schwere der Erkrankung von Omikron nötig, um ITS nicht zu überlasten
- Modell reagiert sensitiv auf Annahmen zur Generationszeit, zur Boosterwirkung
- Modell reagiert nicht sensitiv auf Gesamtzahl der Auffrischungsimpfung (80%-100% der vollständig Geimpften)
- leichte bis strikte Kontaktbeschränkungen können kurzfristig zur Entlastung beitragen, doch ggf. auch zu einem Rebound-Effekt führen

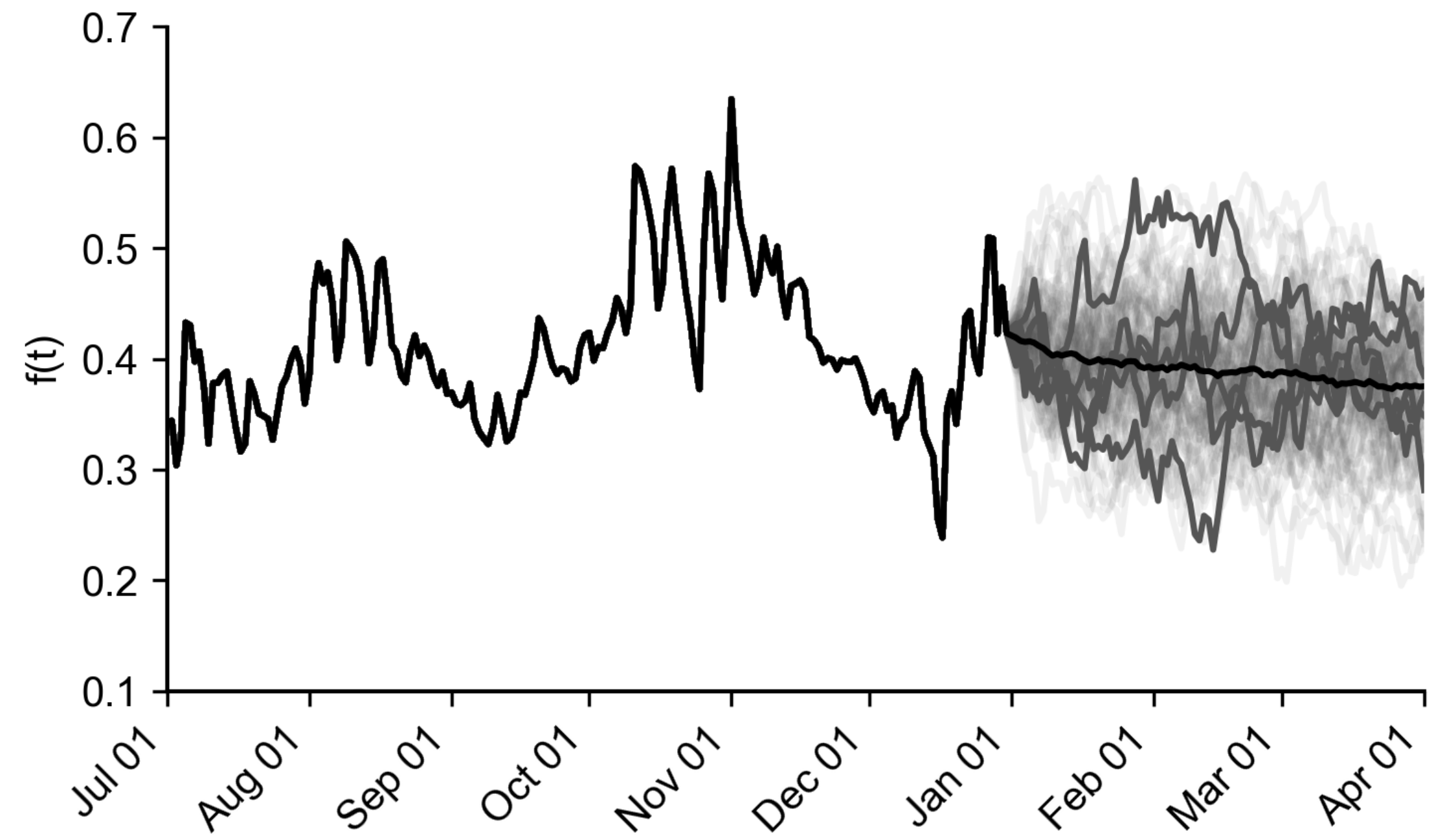
# Appendix

# Stochastische Kontaktmodulation

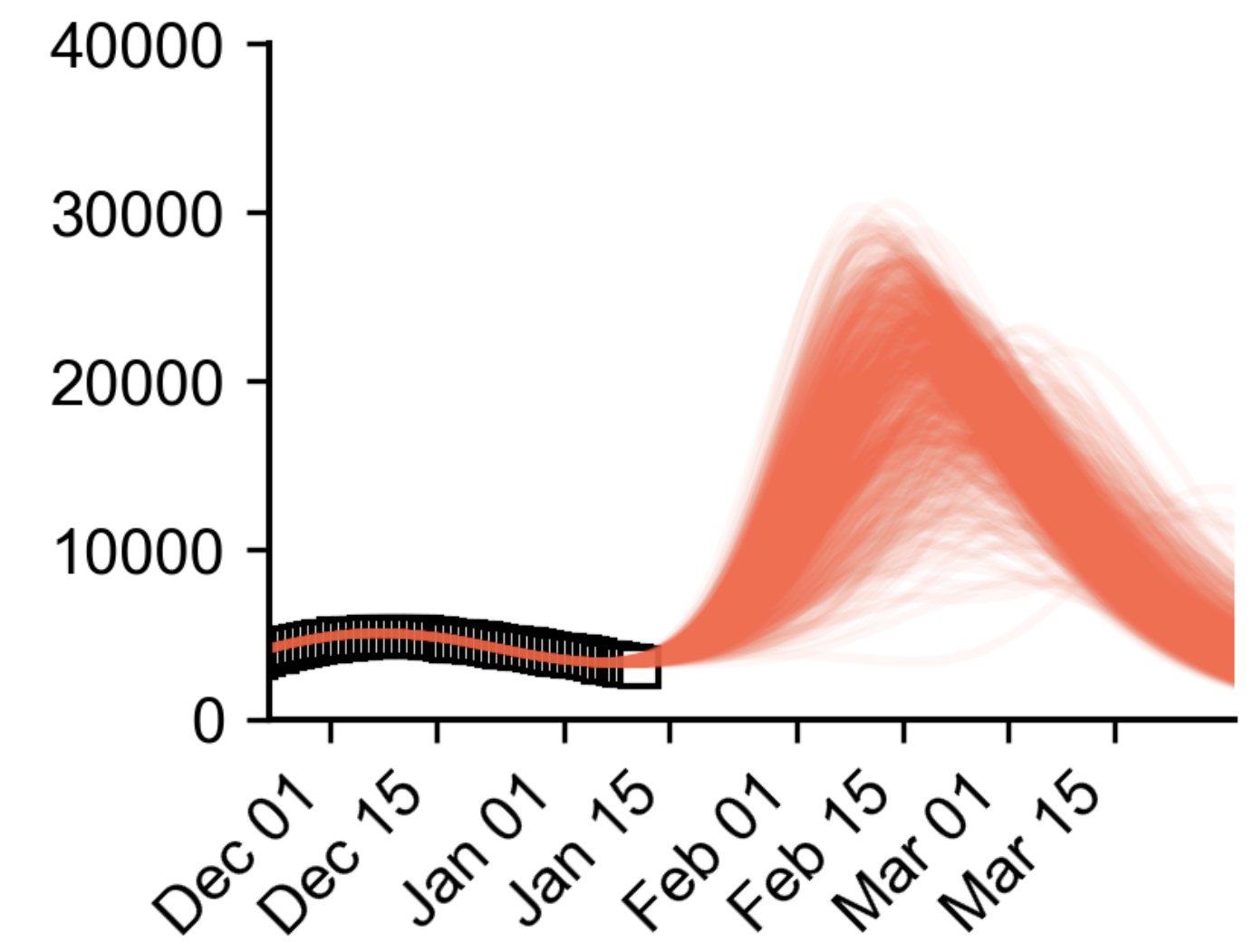
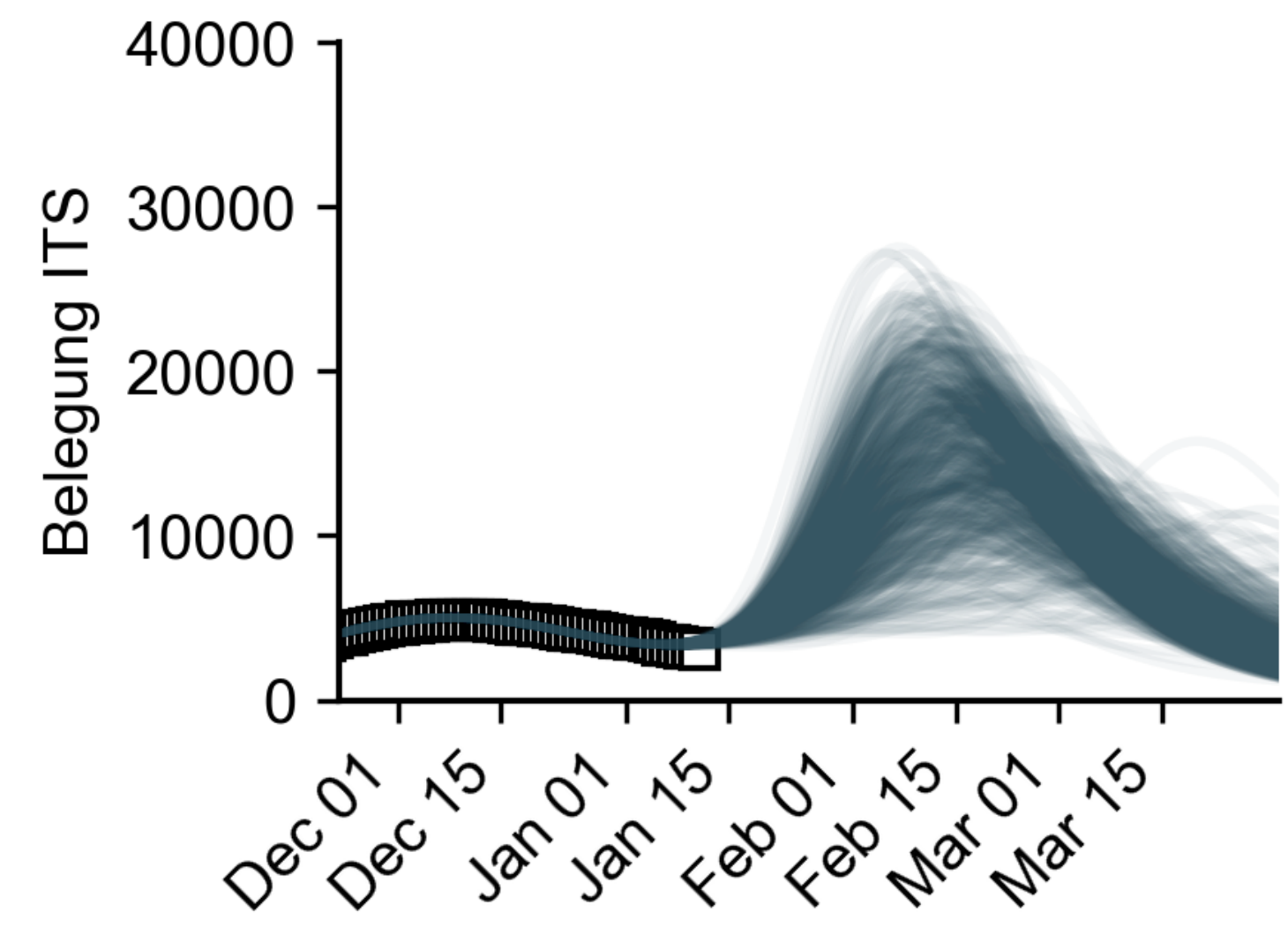
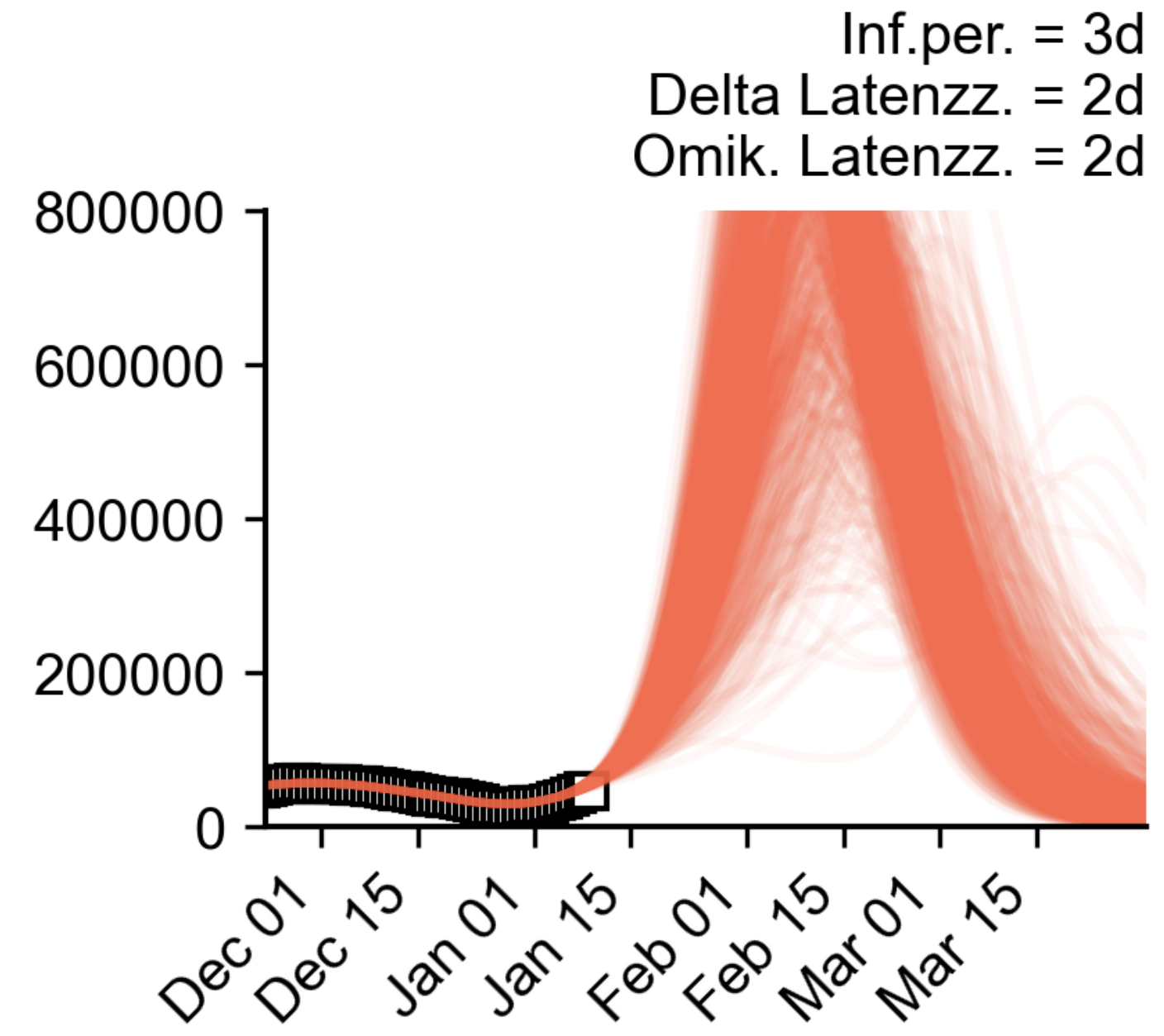
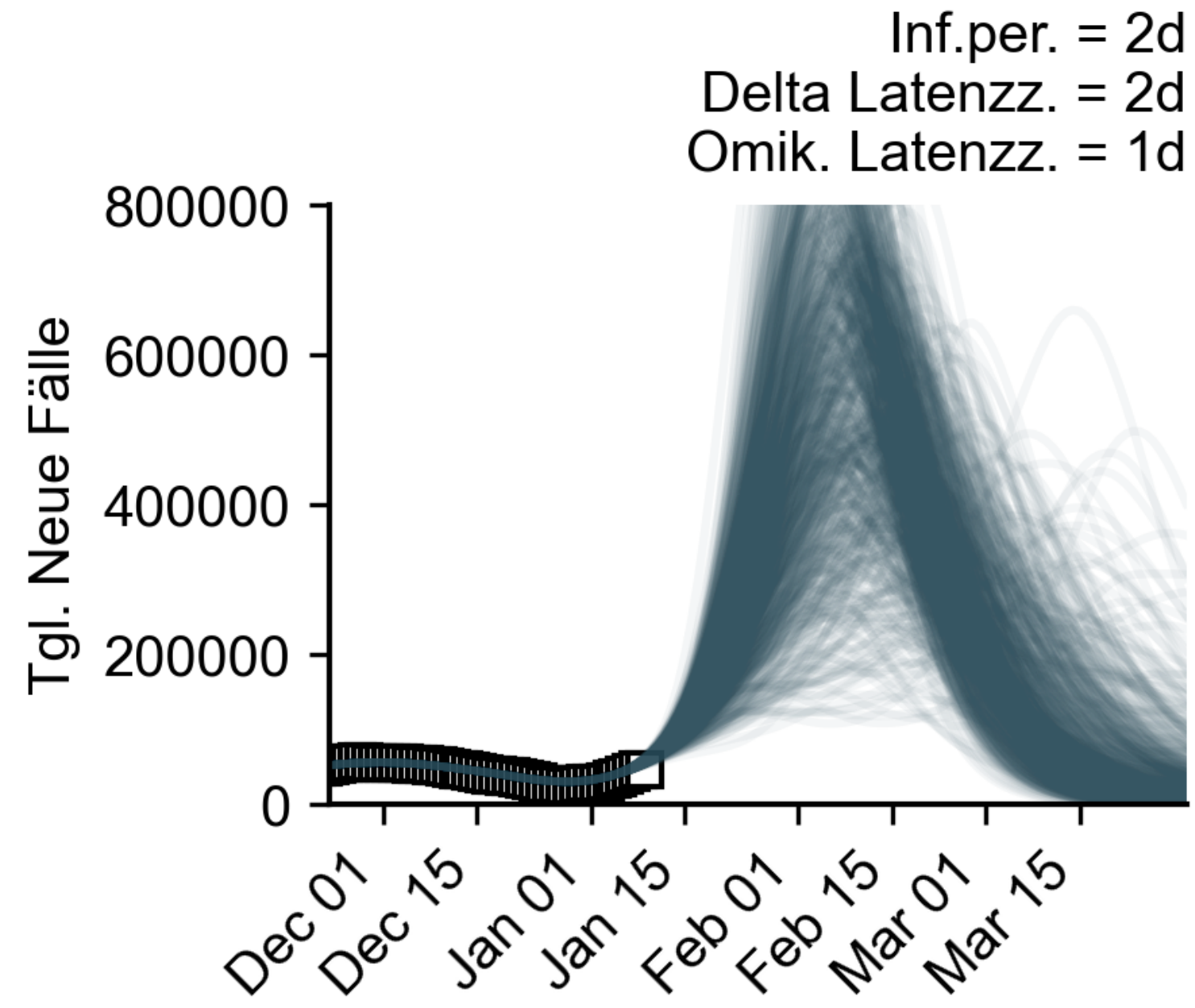
Bisher



Stochastischer Prozess





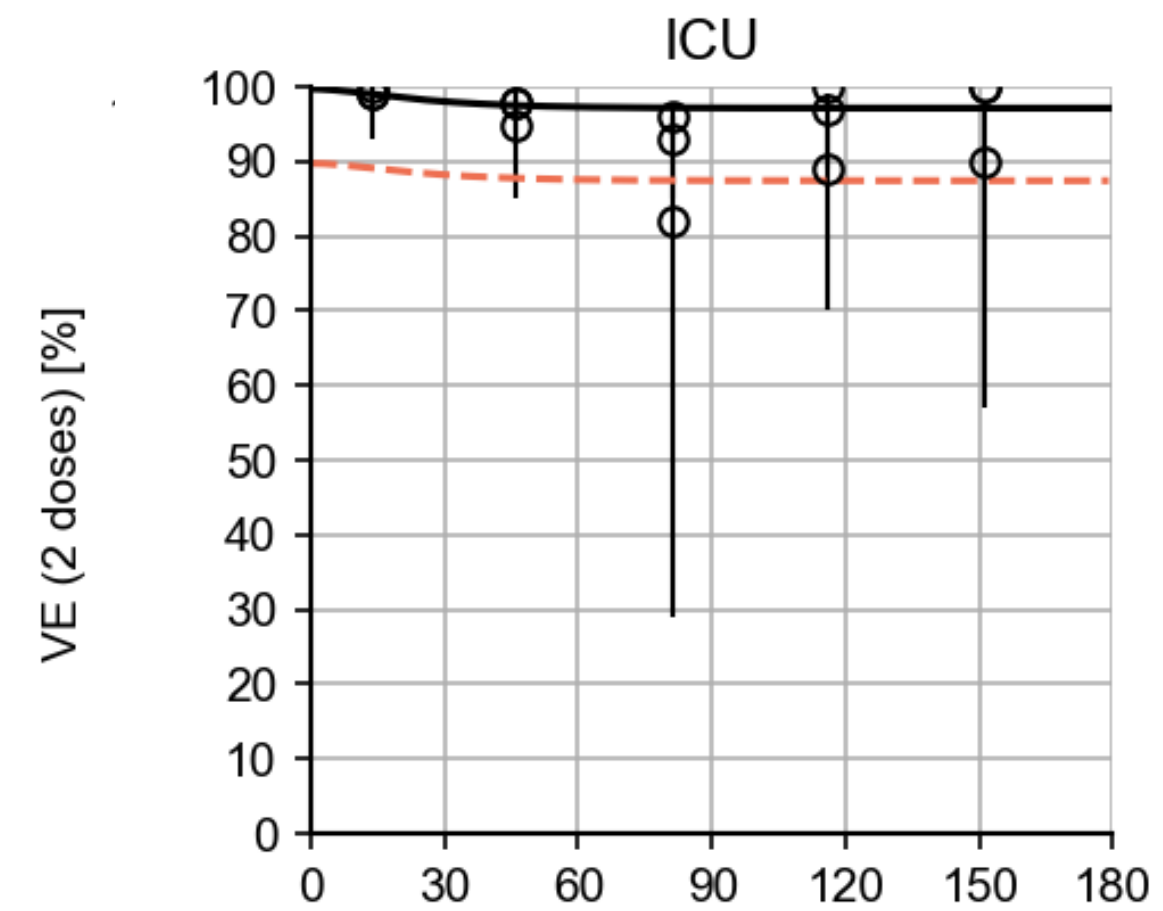


Basisszenario:

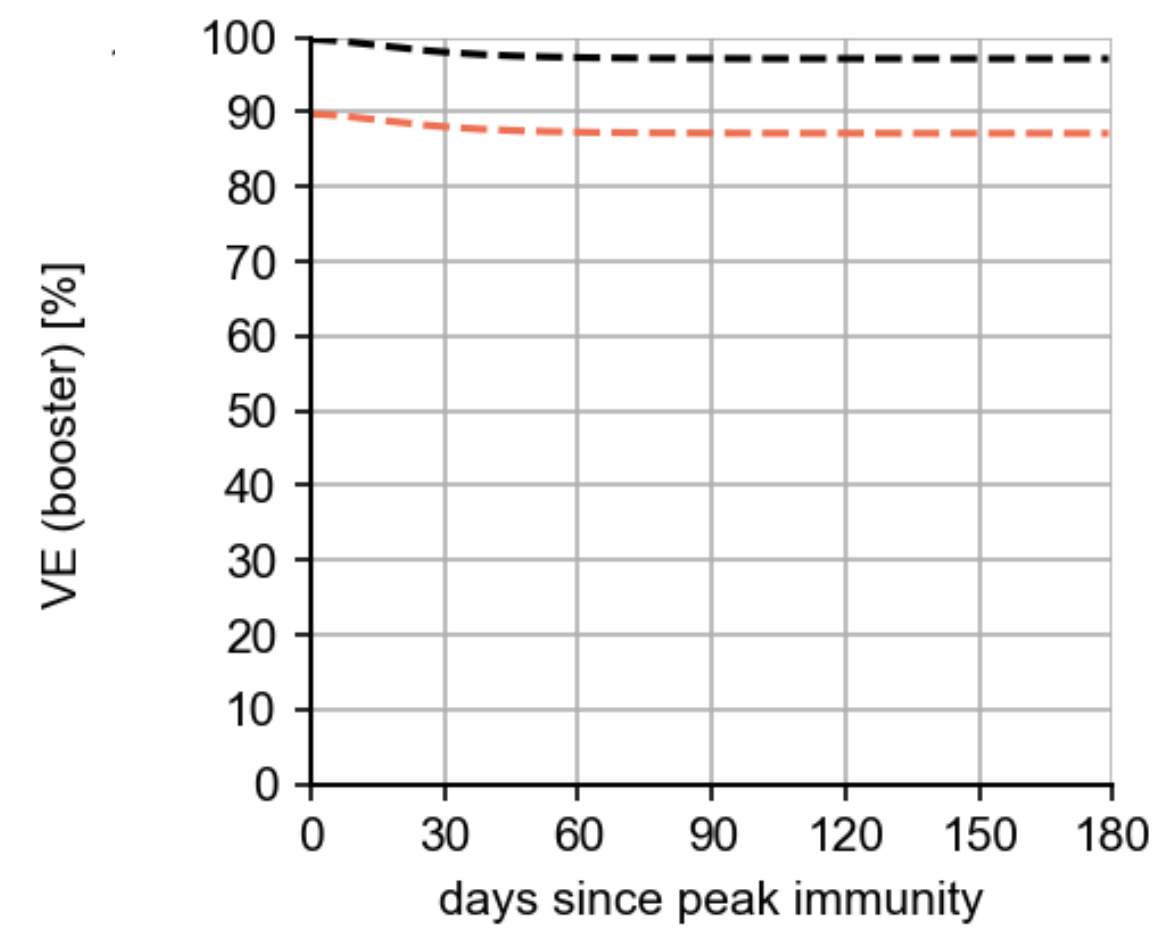
ITS-rate Omikron: -50%

# Sensitivität: VE gegen ICU

Basis



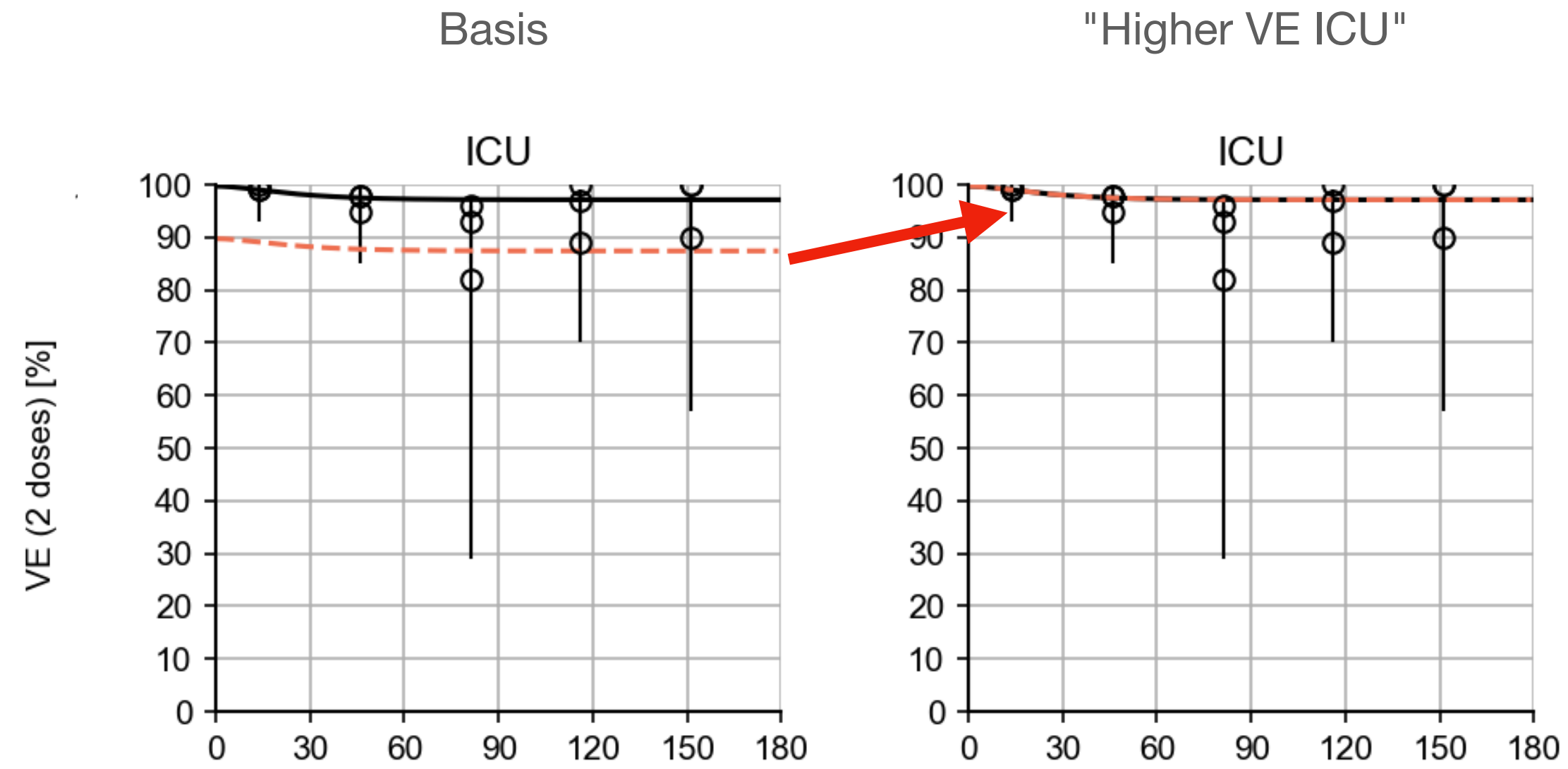
2 Dosen



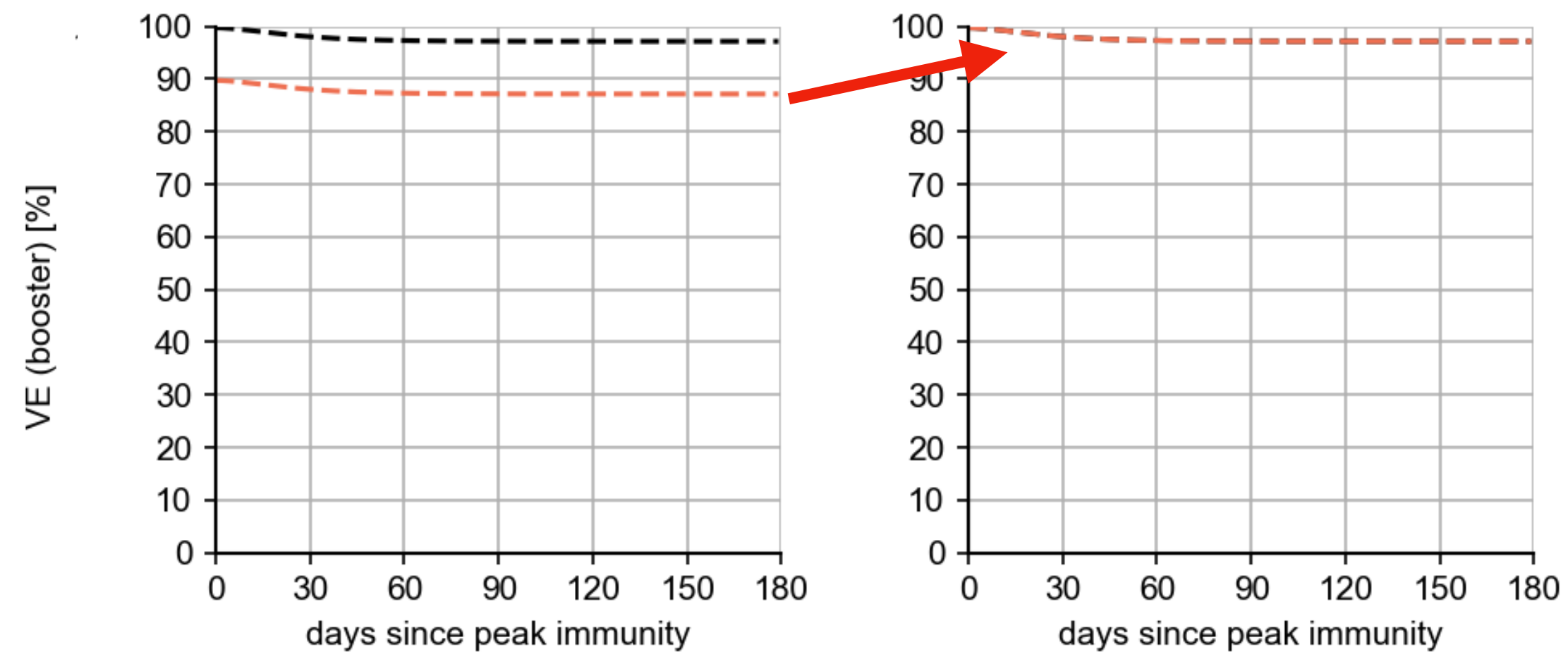
Booster

# Sensitivität: VE gegen ICU

2 Dosen

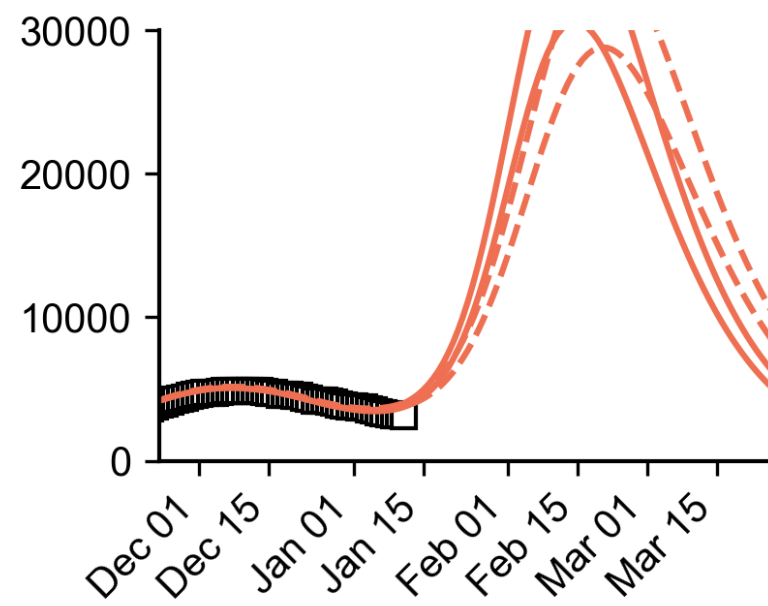
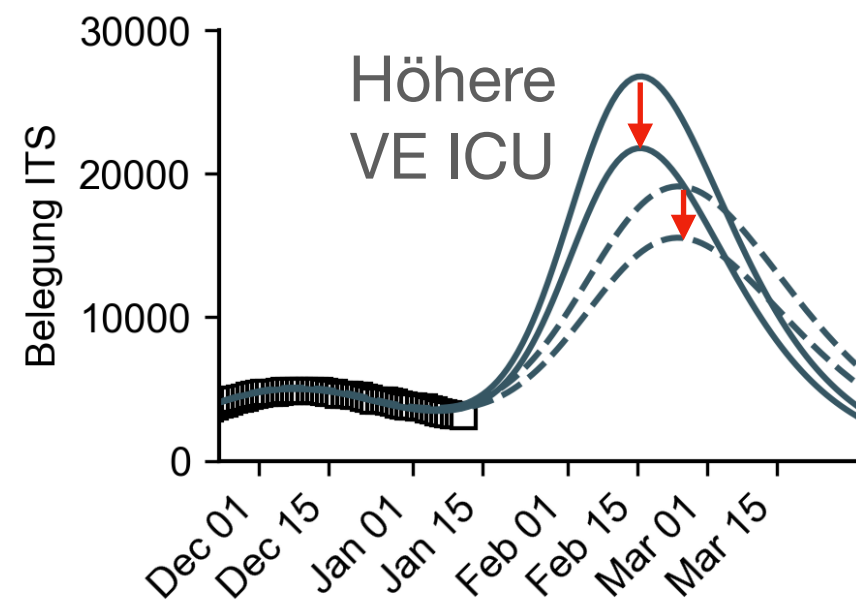
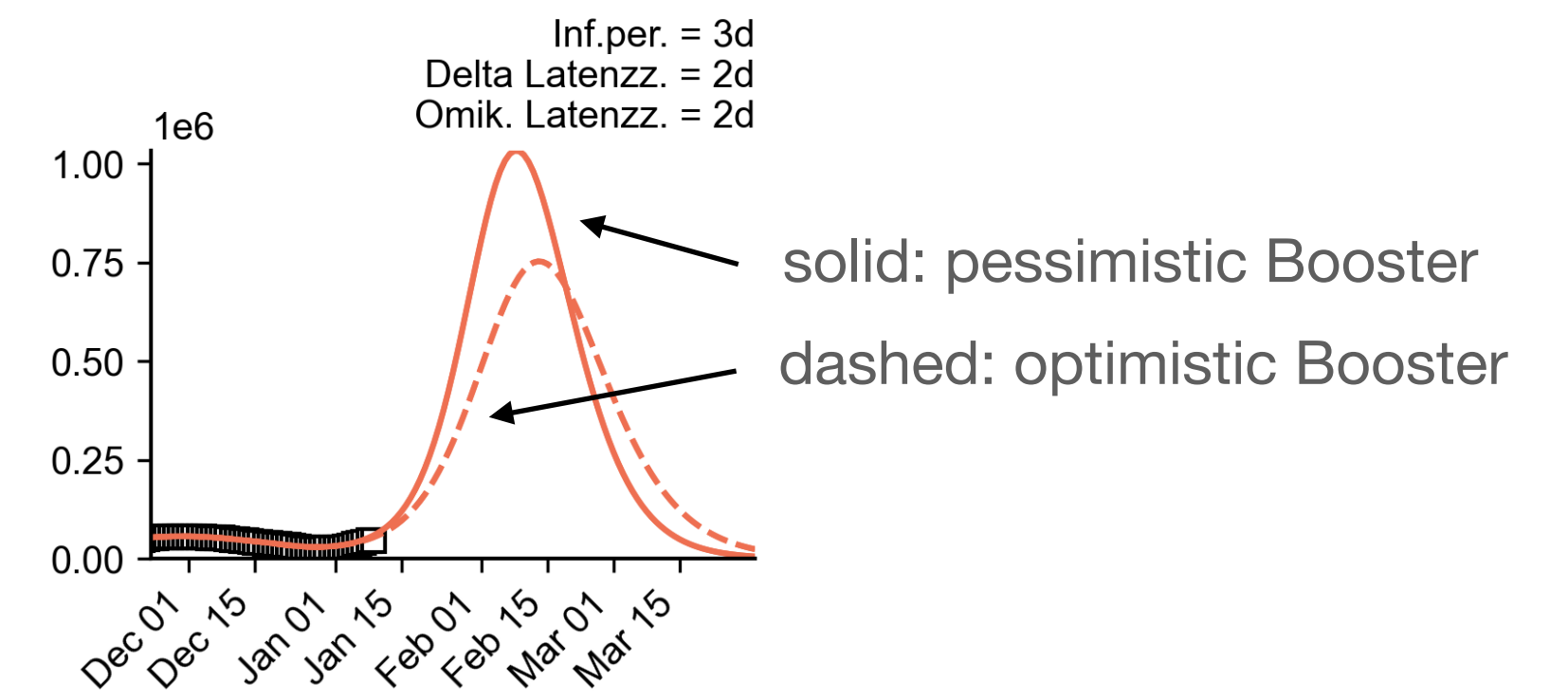
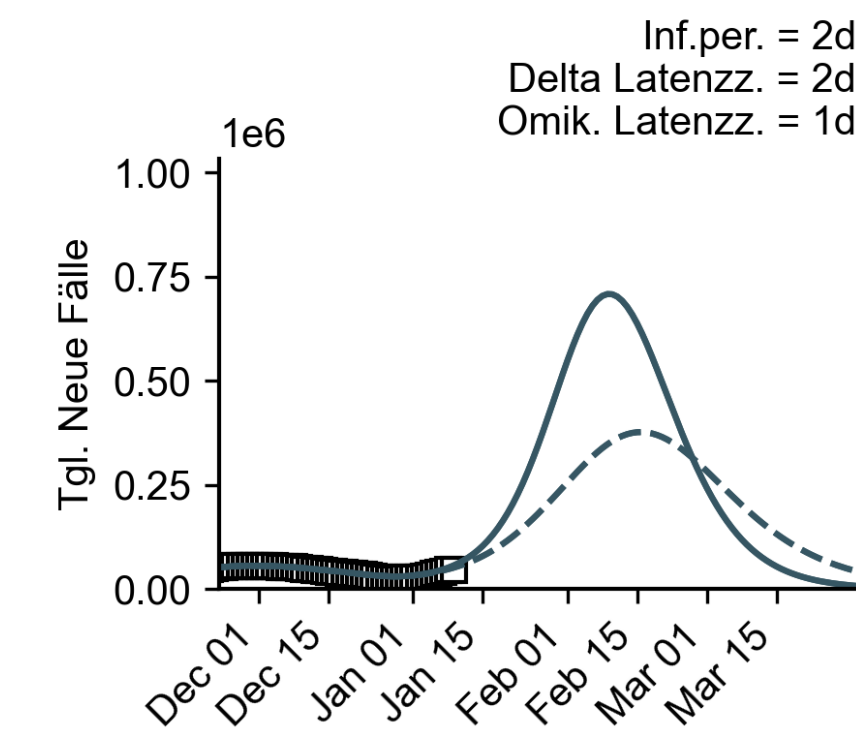


Booster



# Sensitivität: VE gegen ICU

Reduktion in  
Wahrscheinlichkeit ICU  
Omikron ggü. Delta: -25%





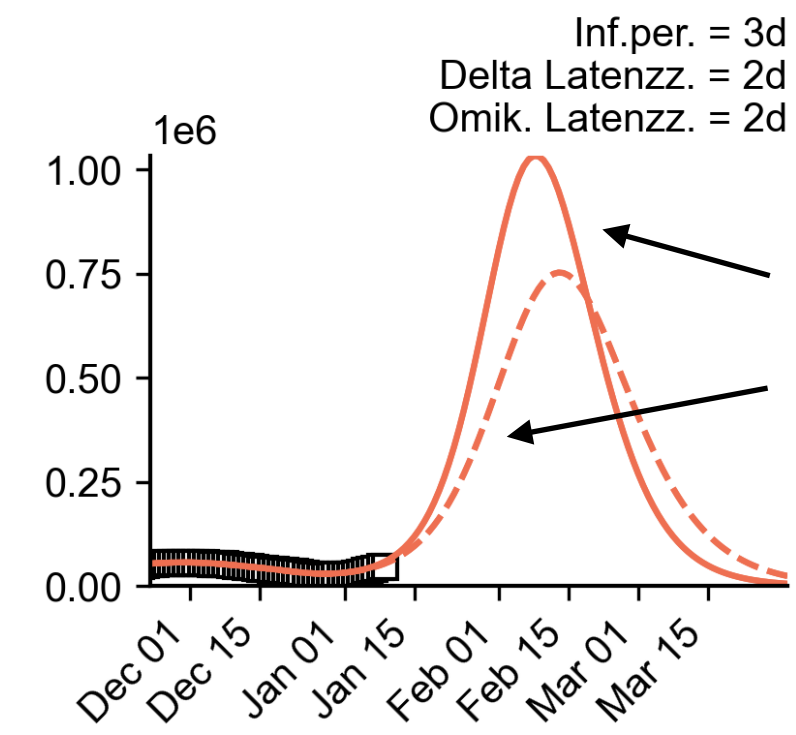
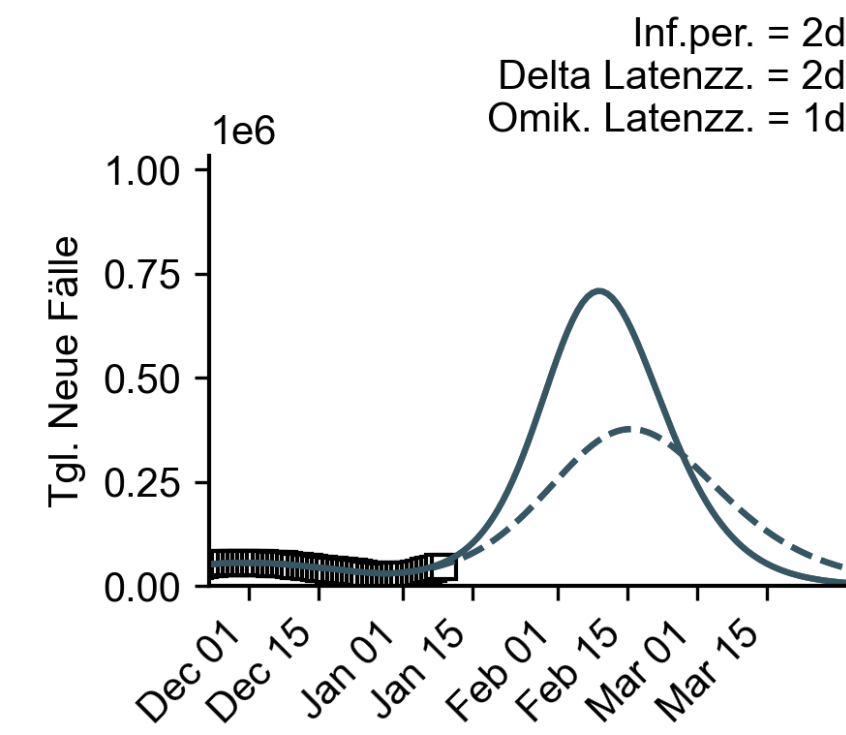
# Sensitivität: VE gegen ICU

Reduktion in  
Wahrscheinlichkeit ICU  
Omikron ggü. Delta:

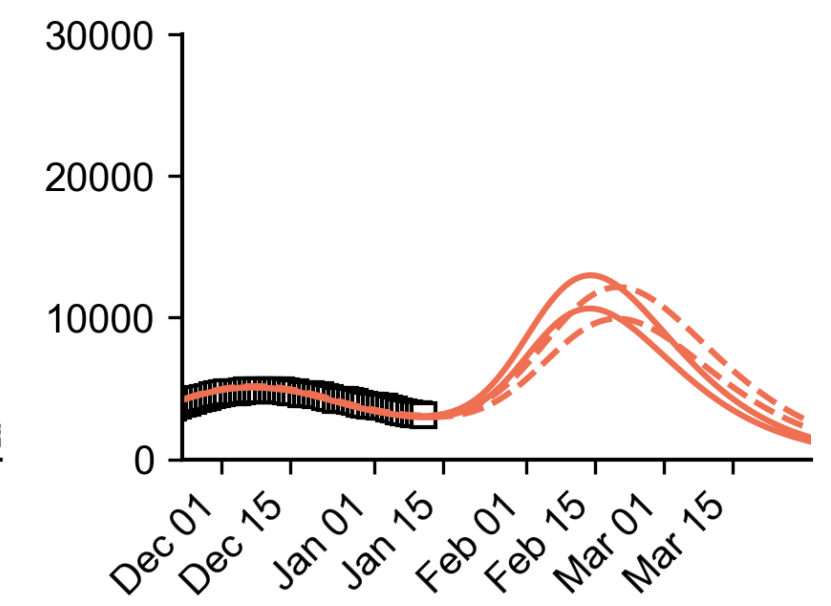
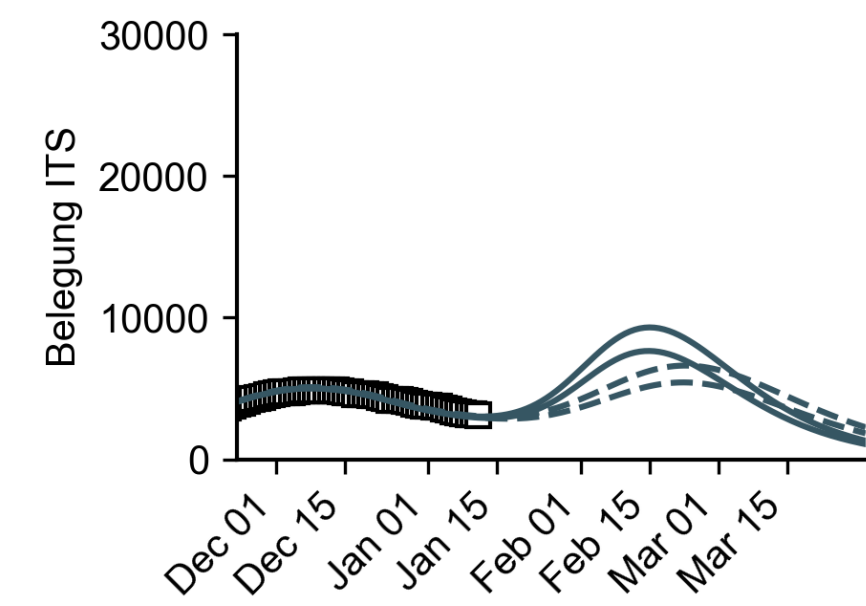
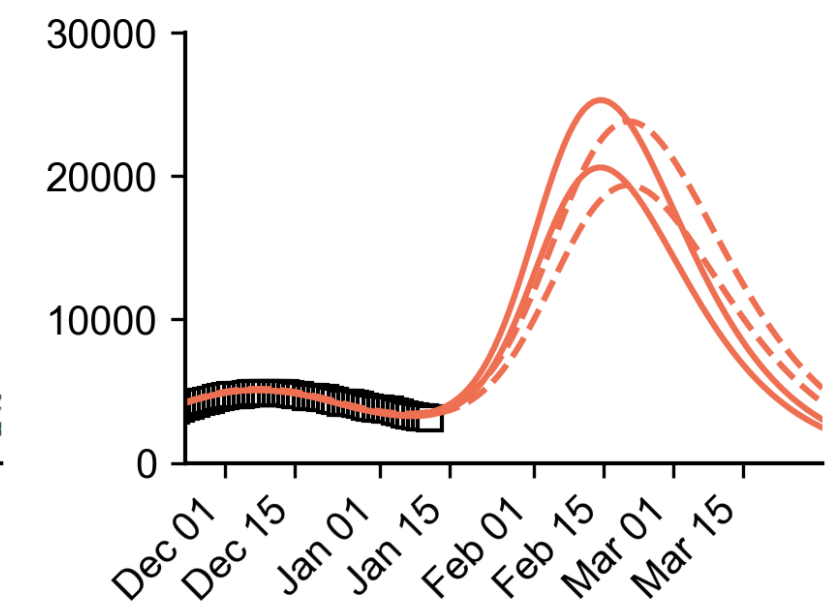
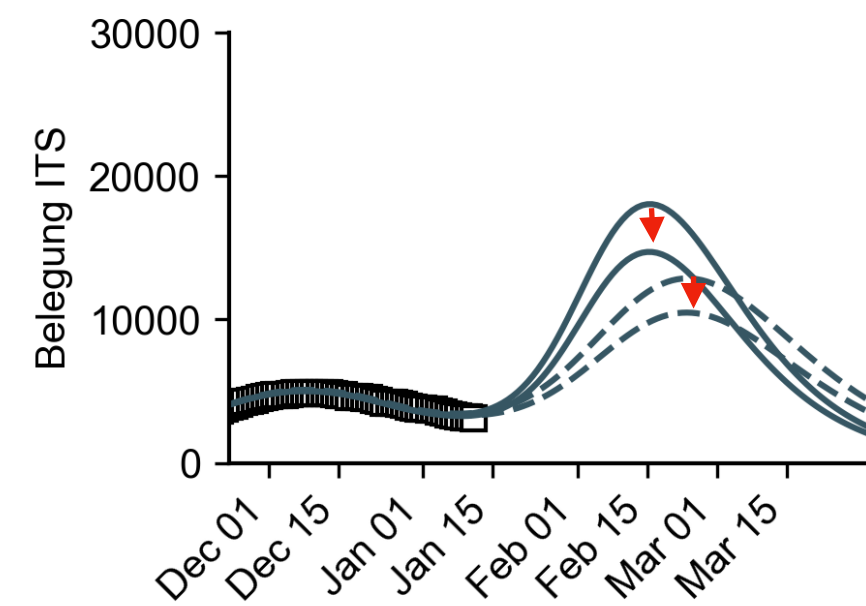
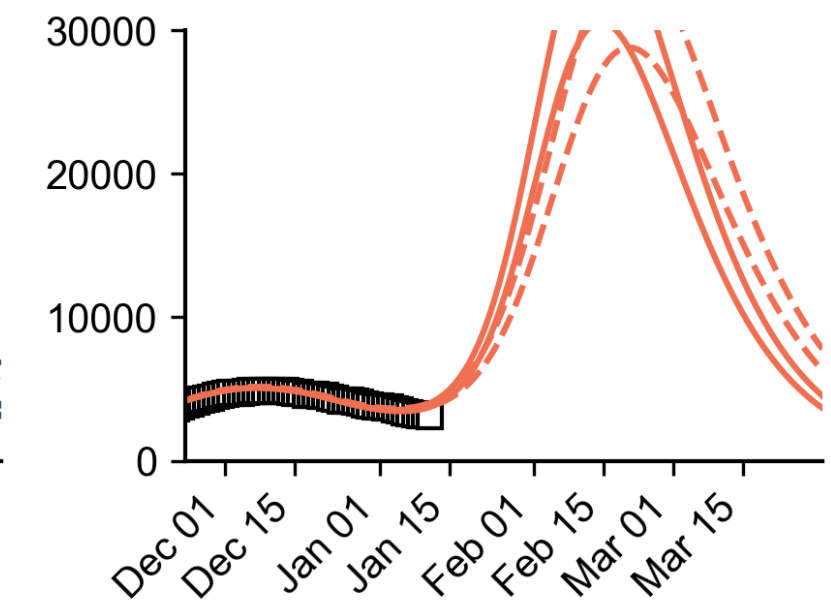
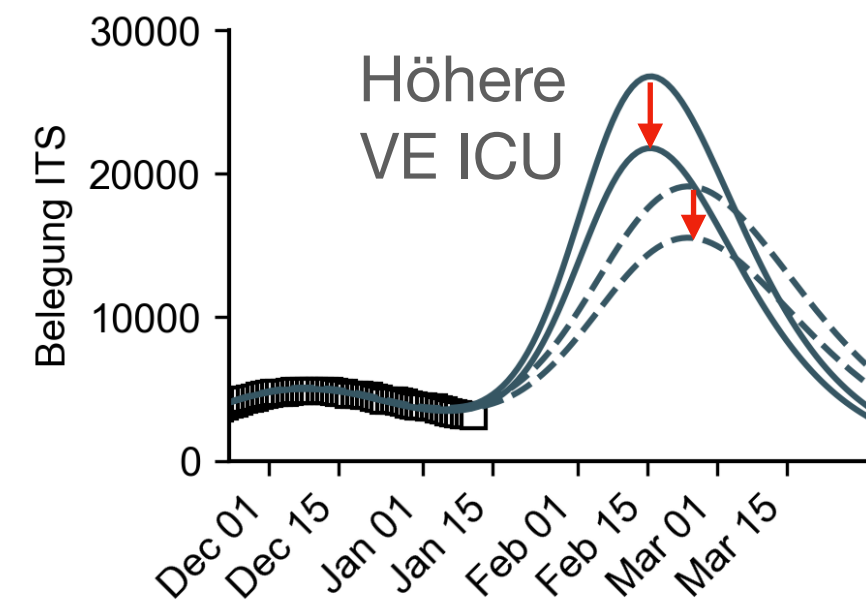
-25%

-50%

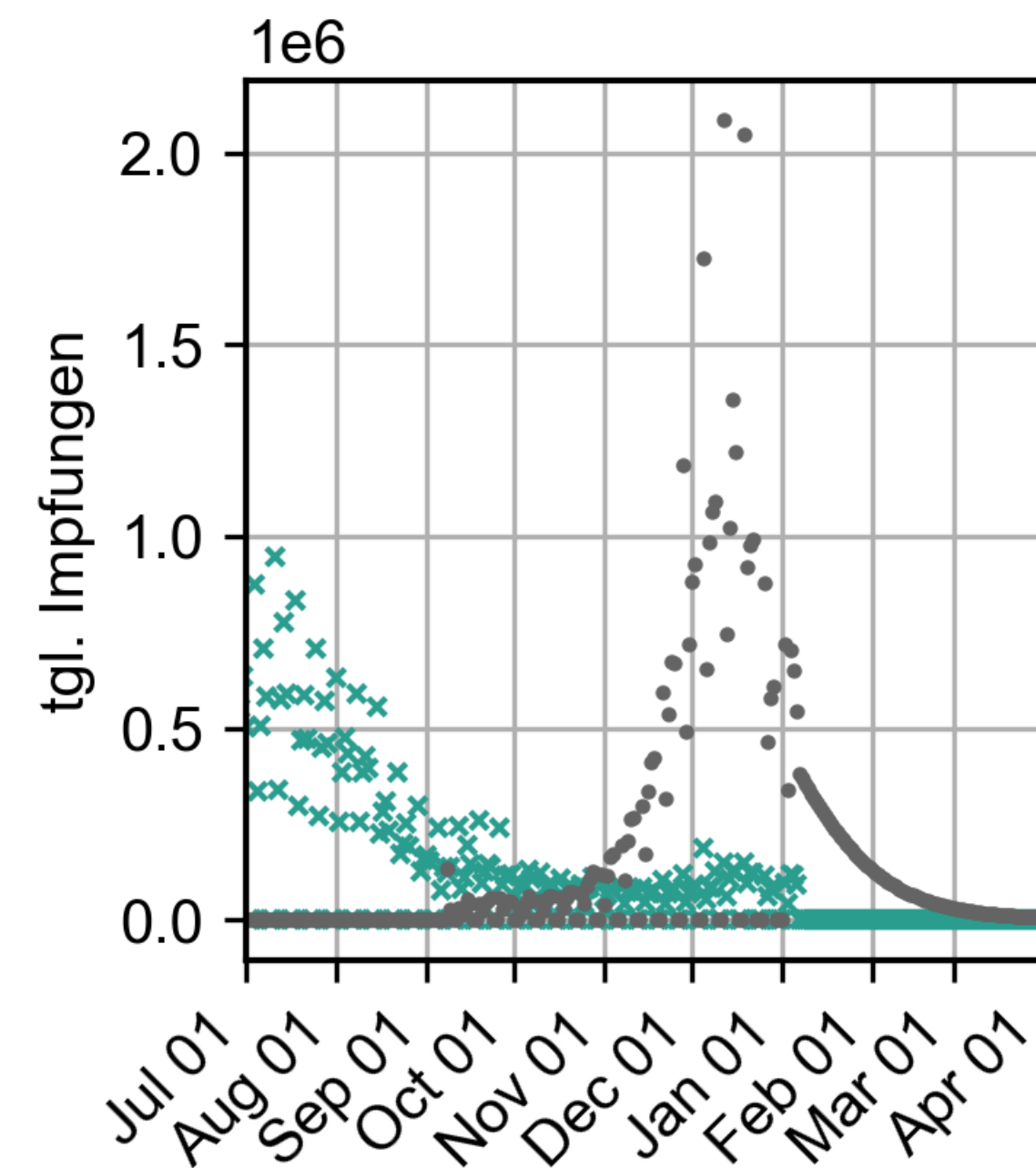
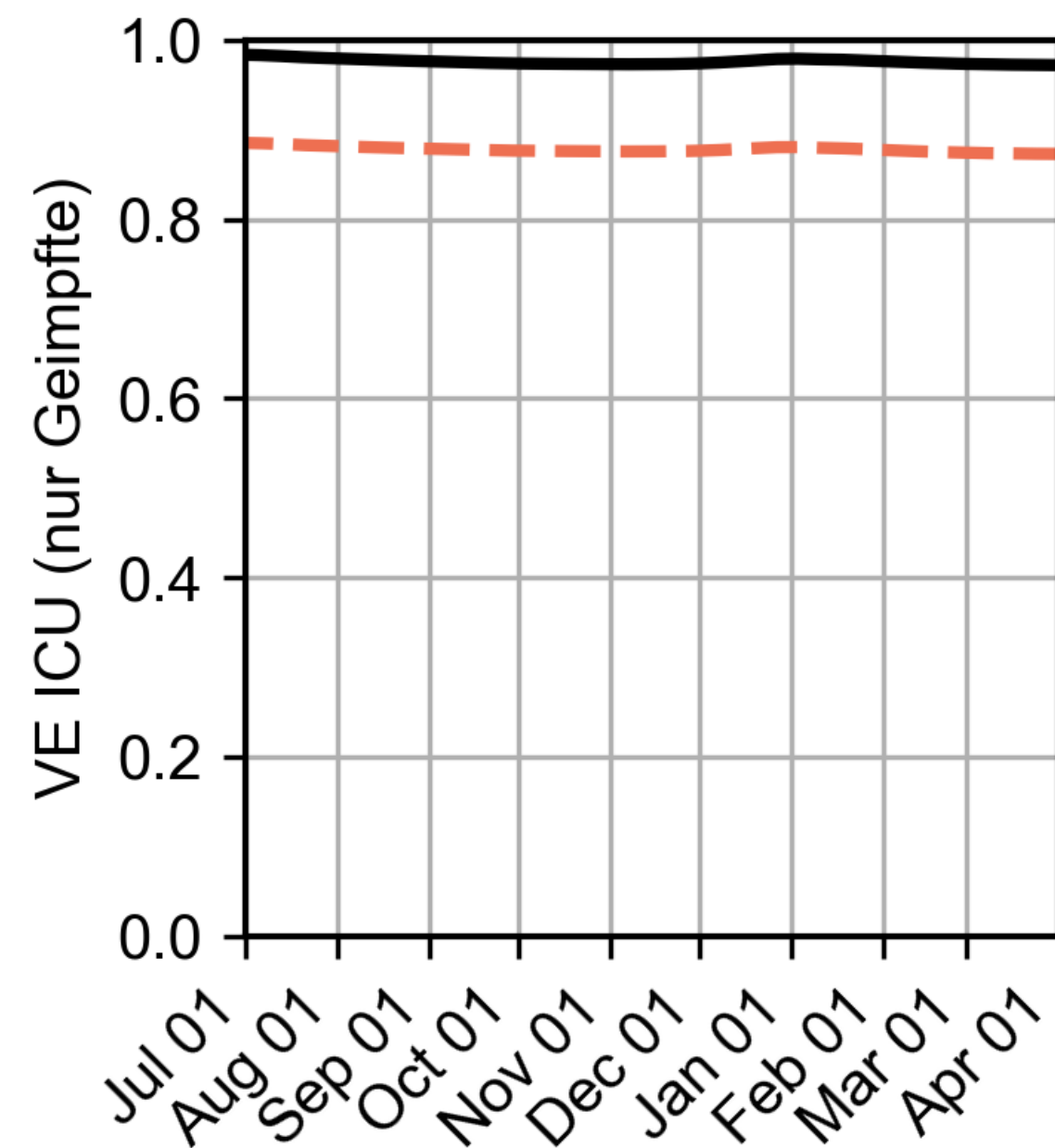
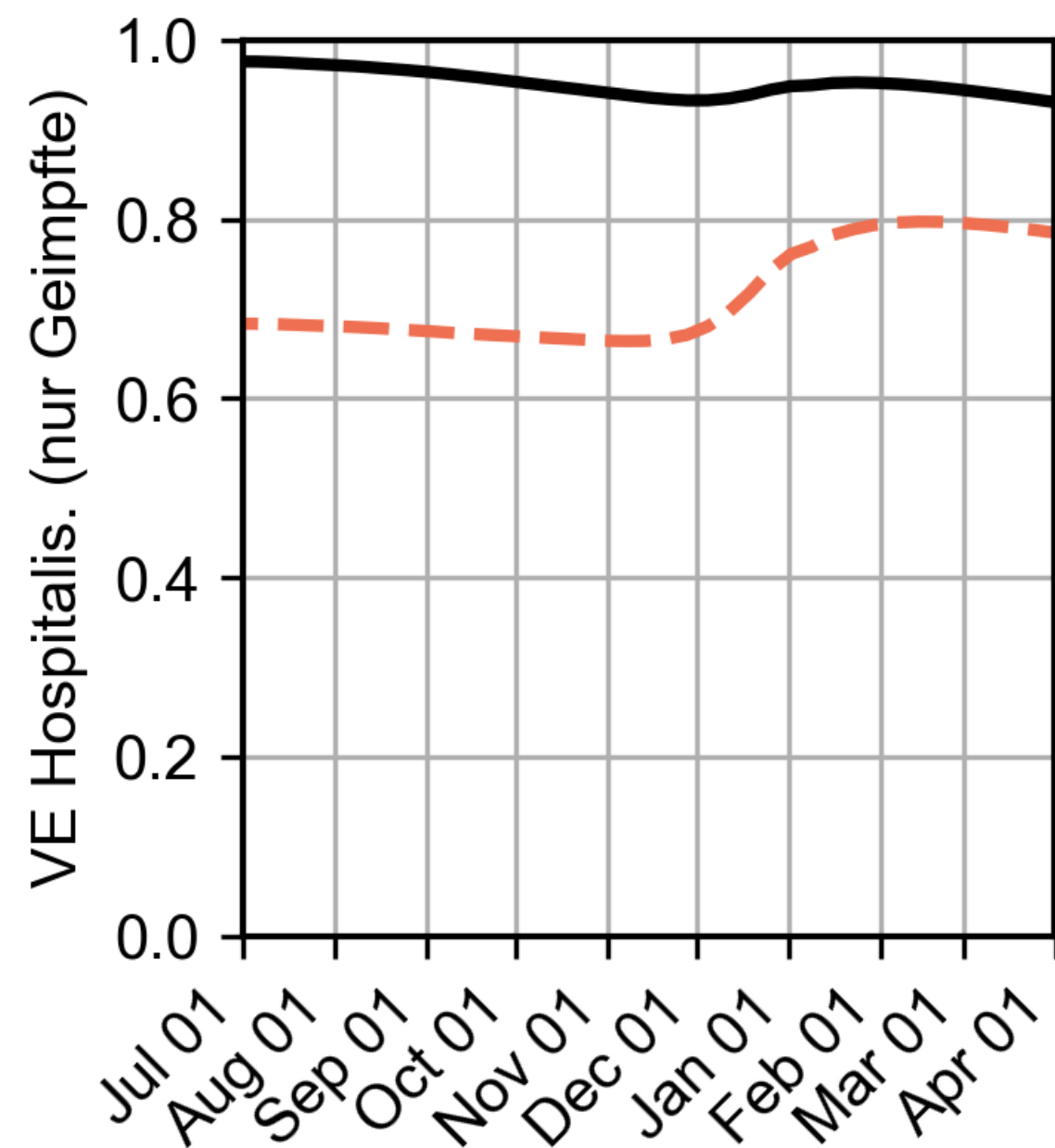
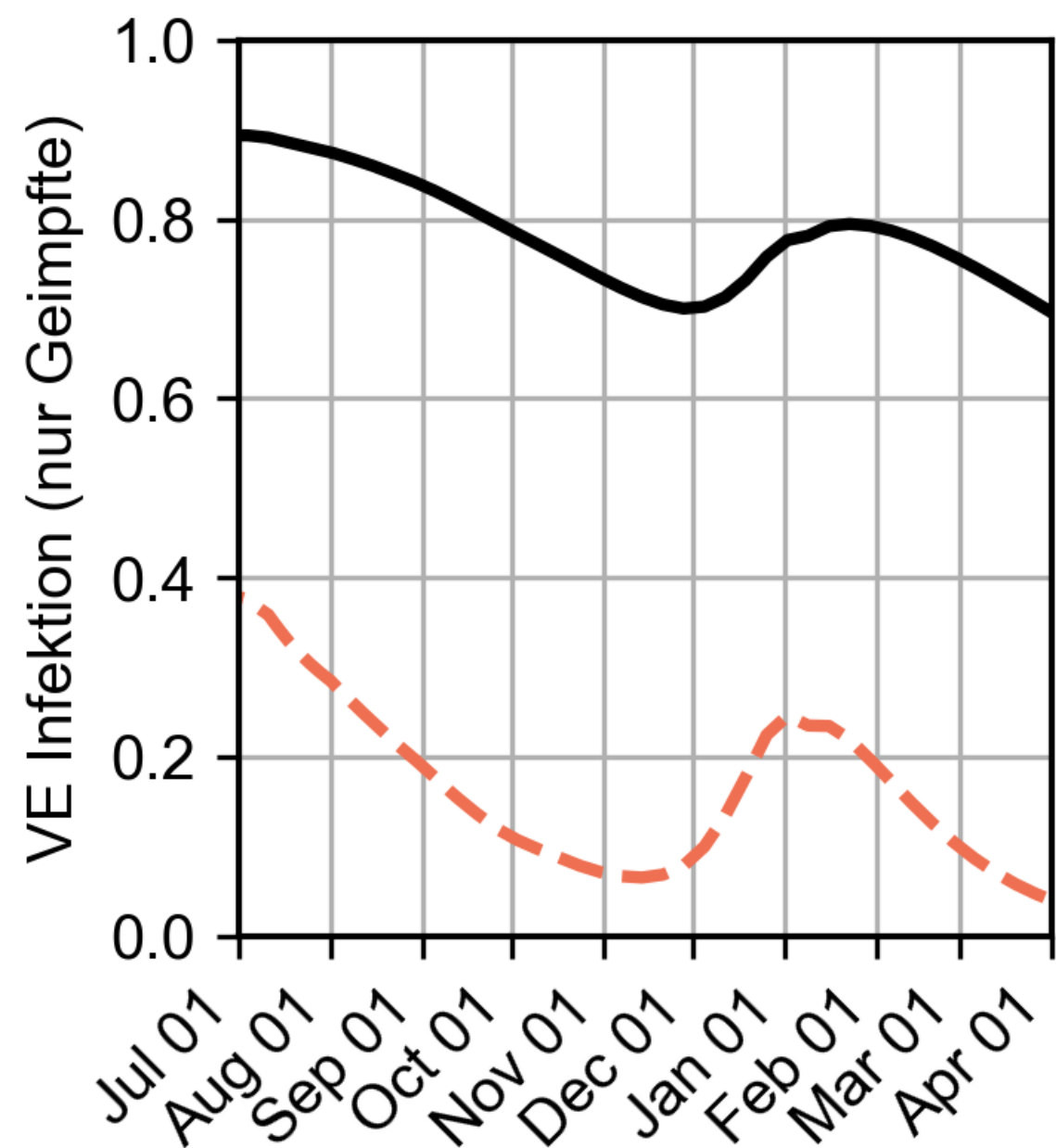
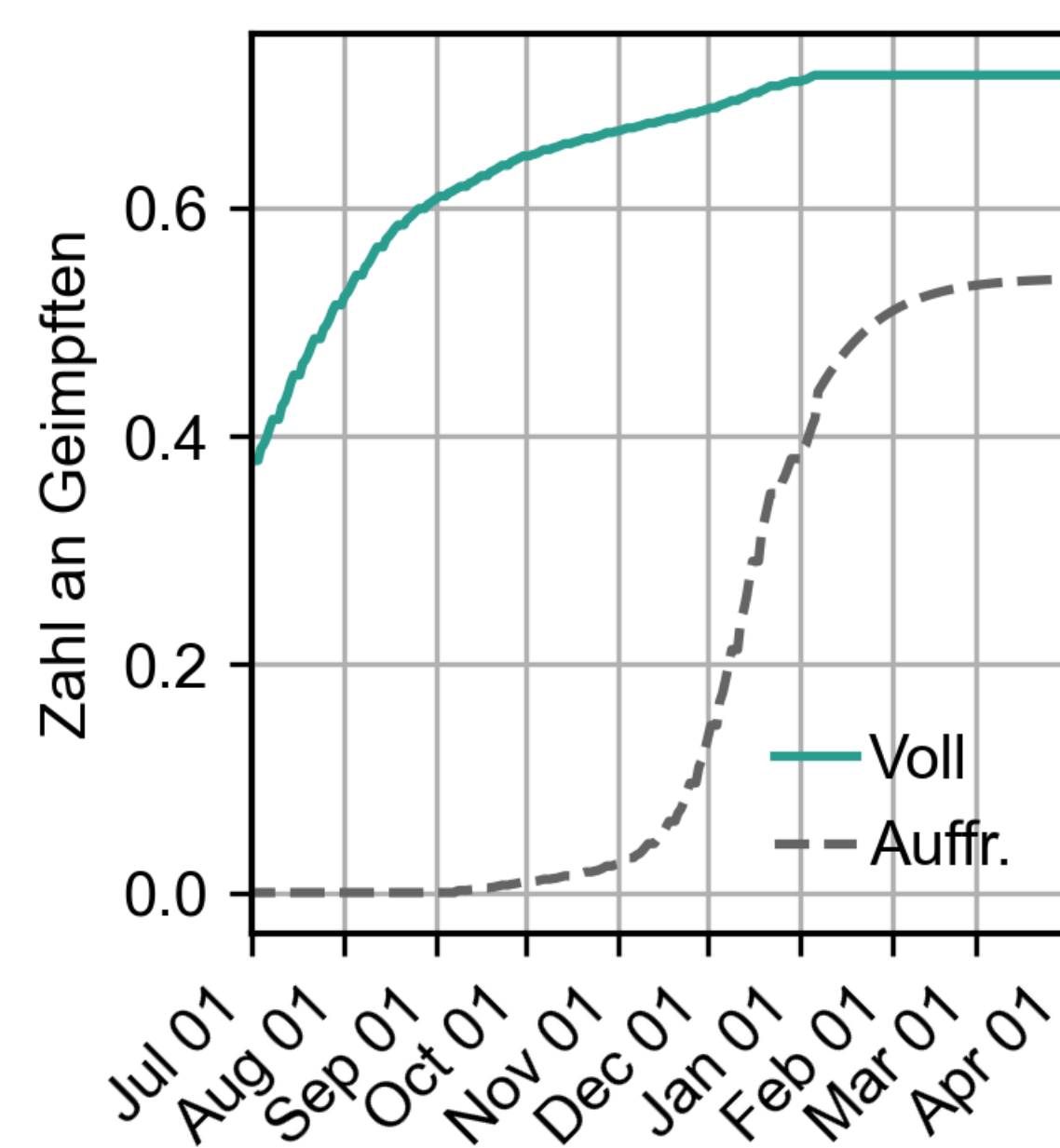
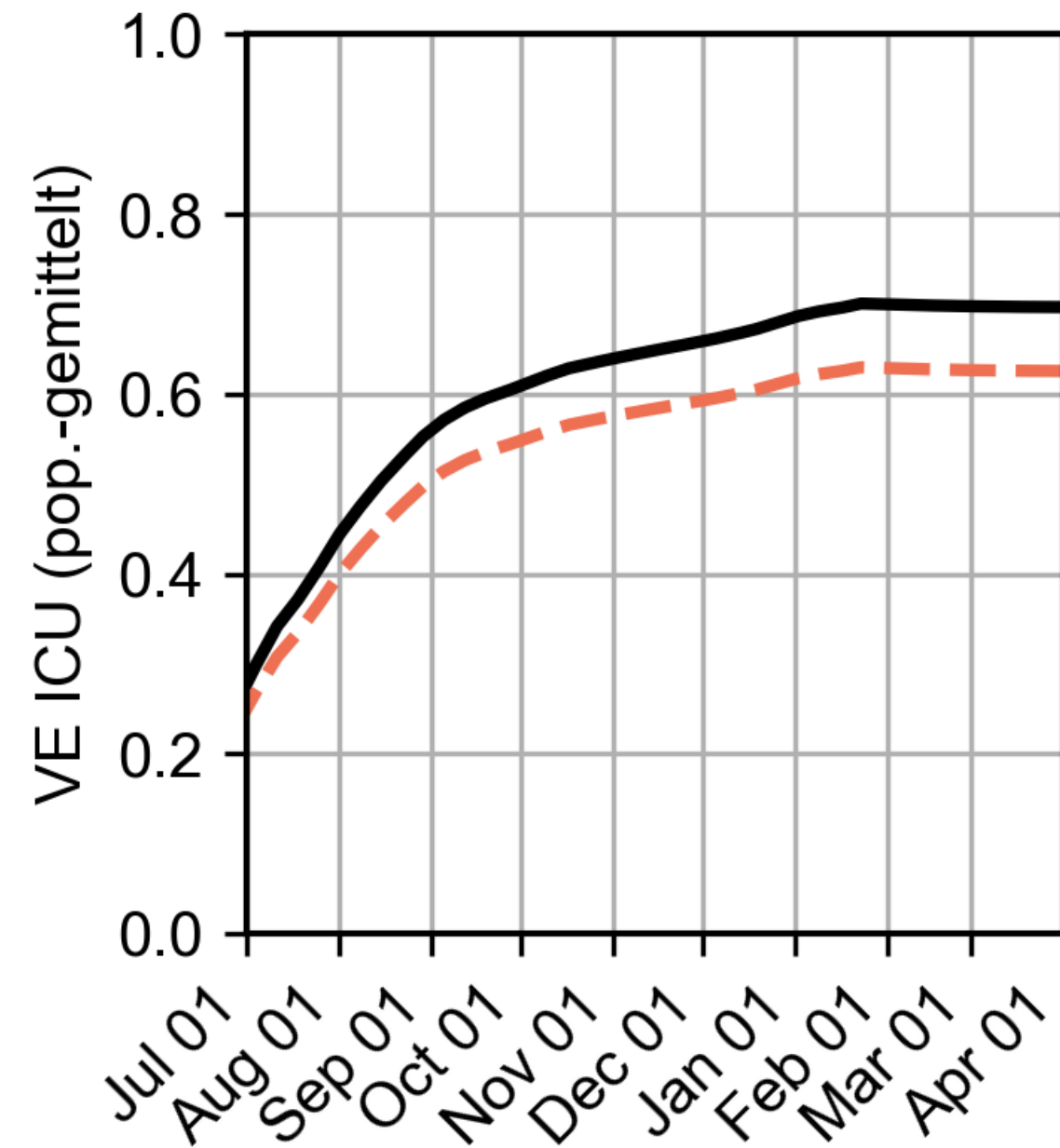
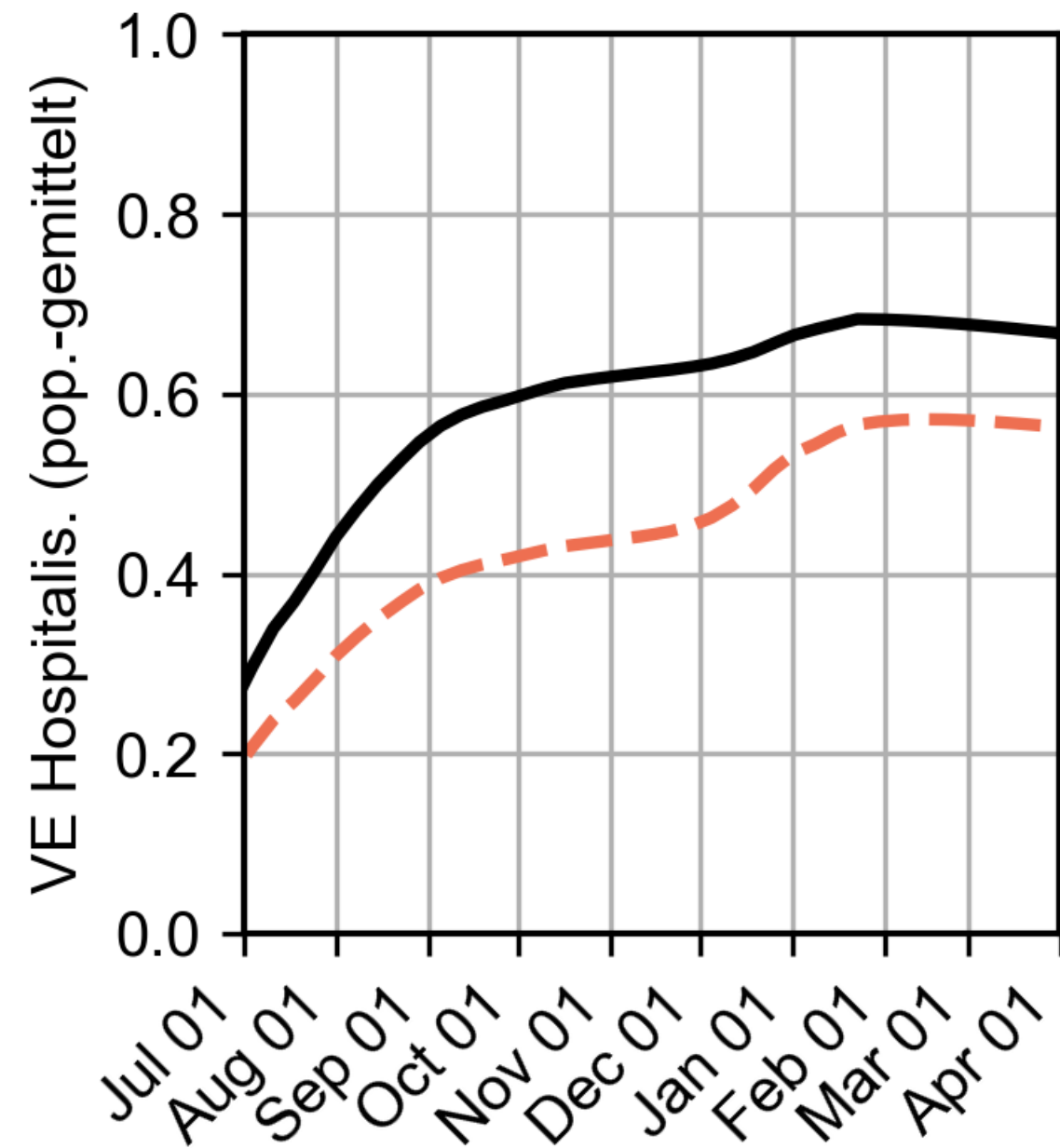
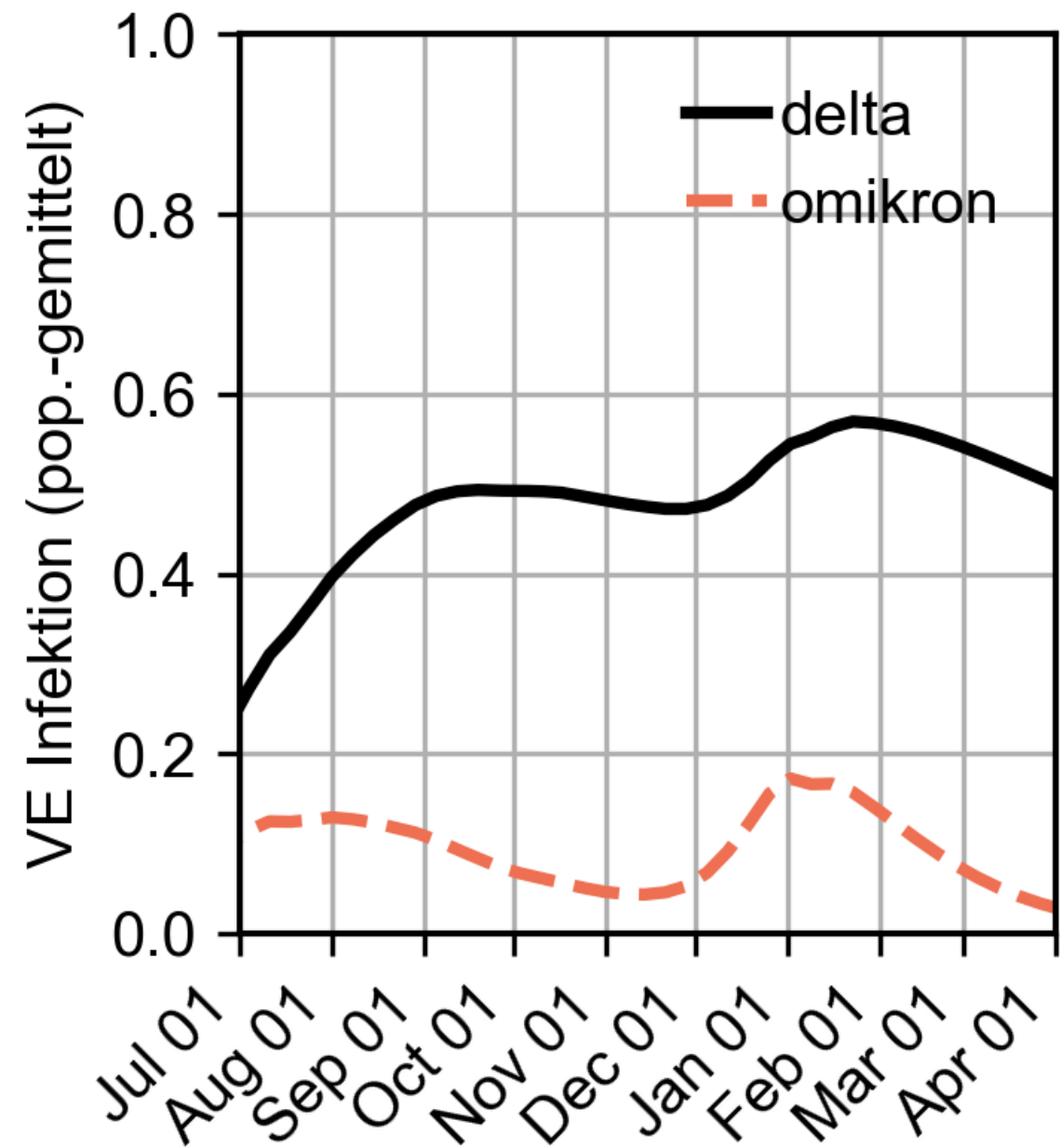
-75%



solid: pessimistic Booster  
dashed: optimistic Booster

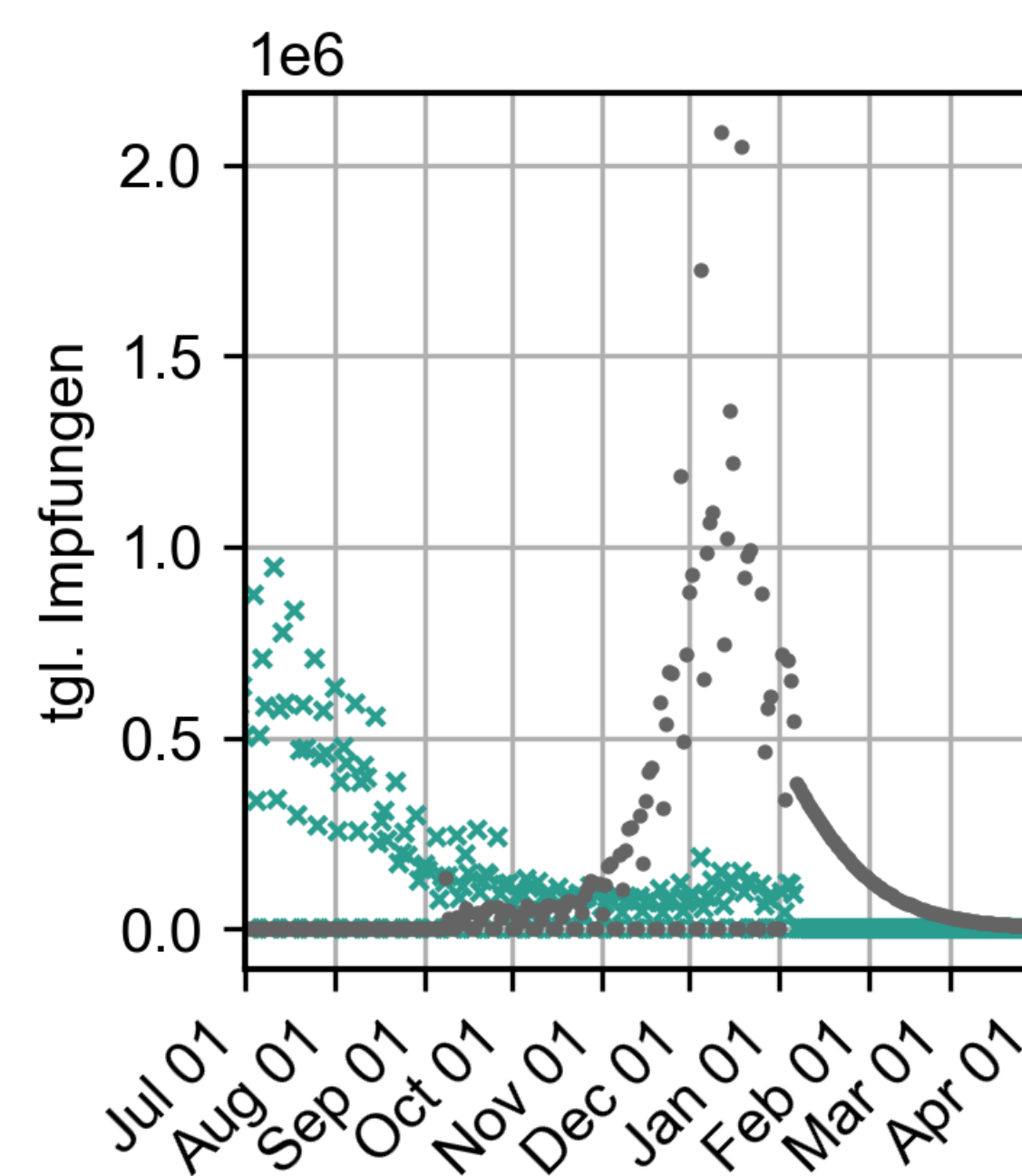
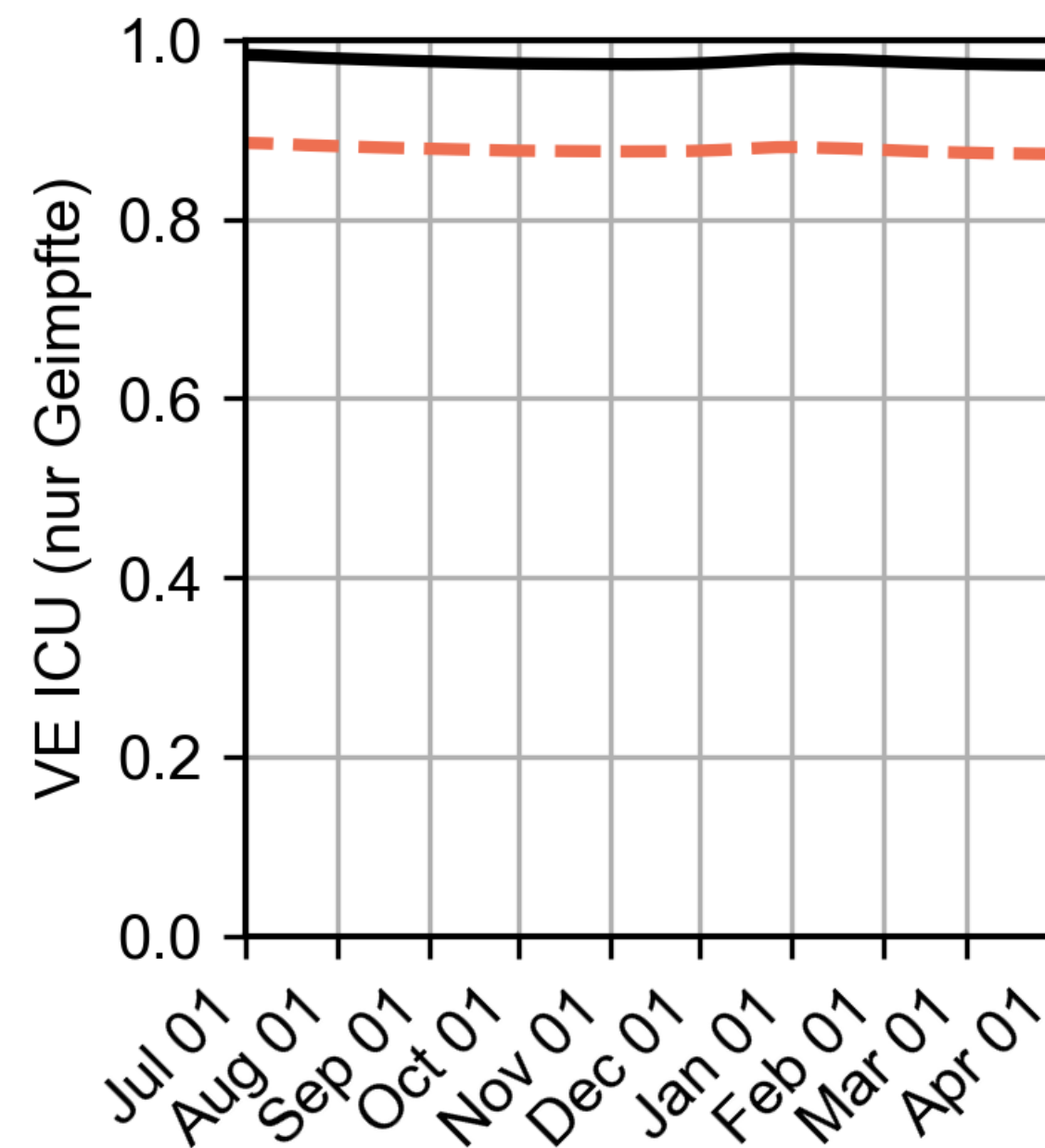
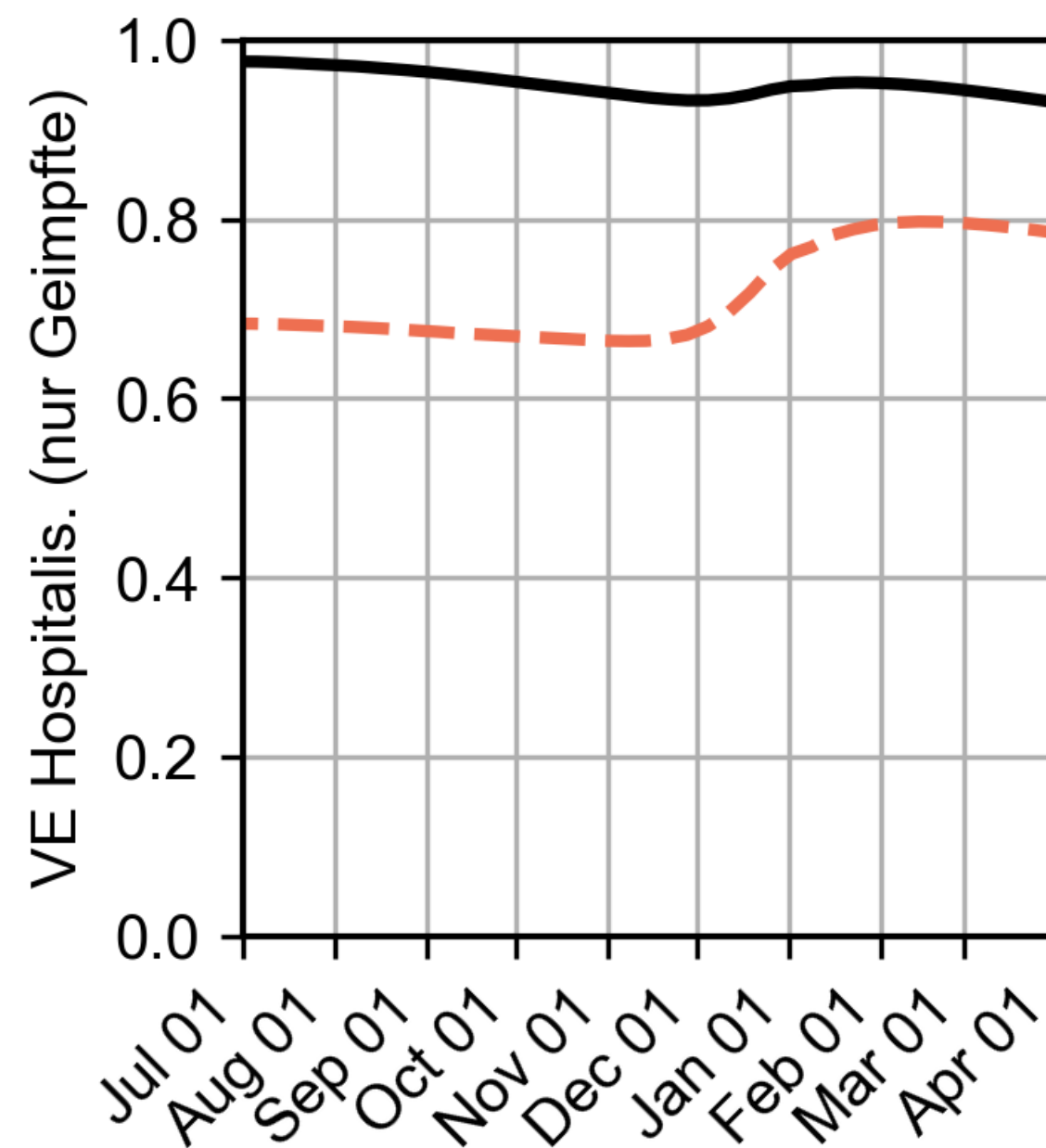
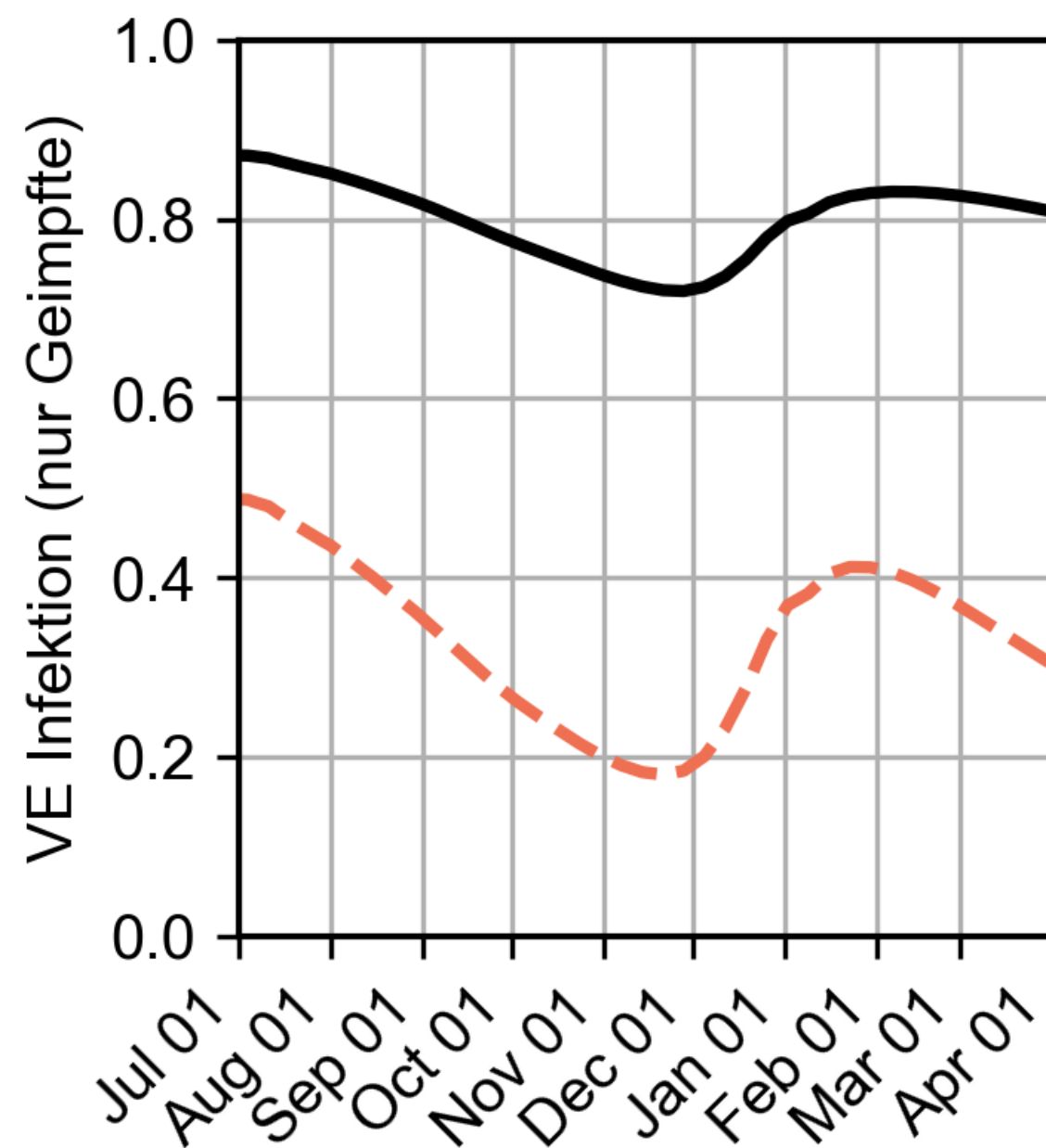
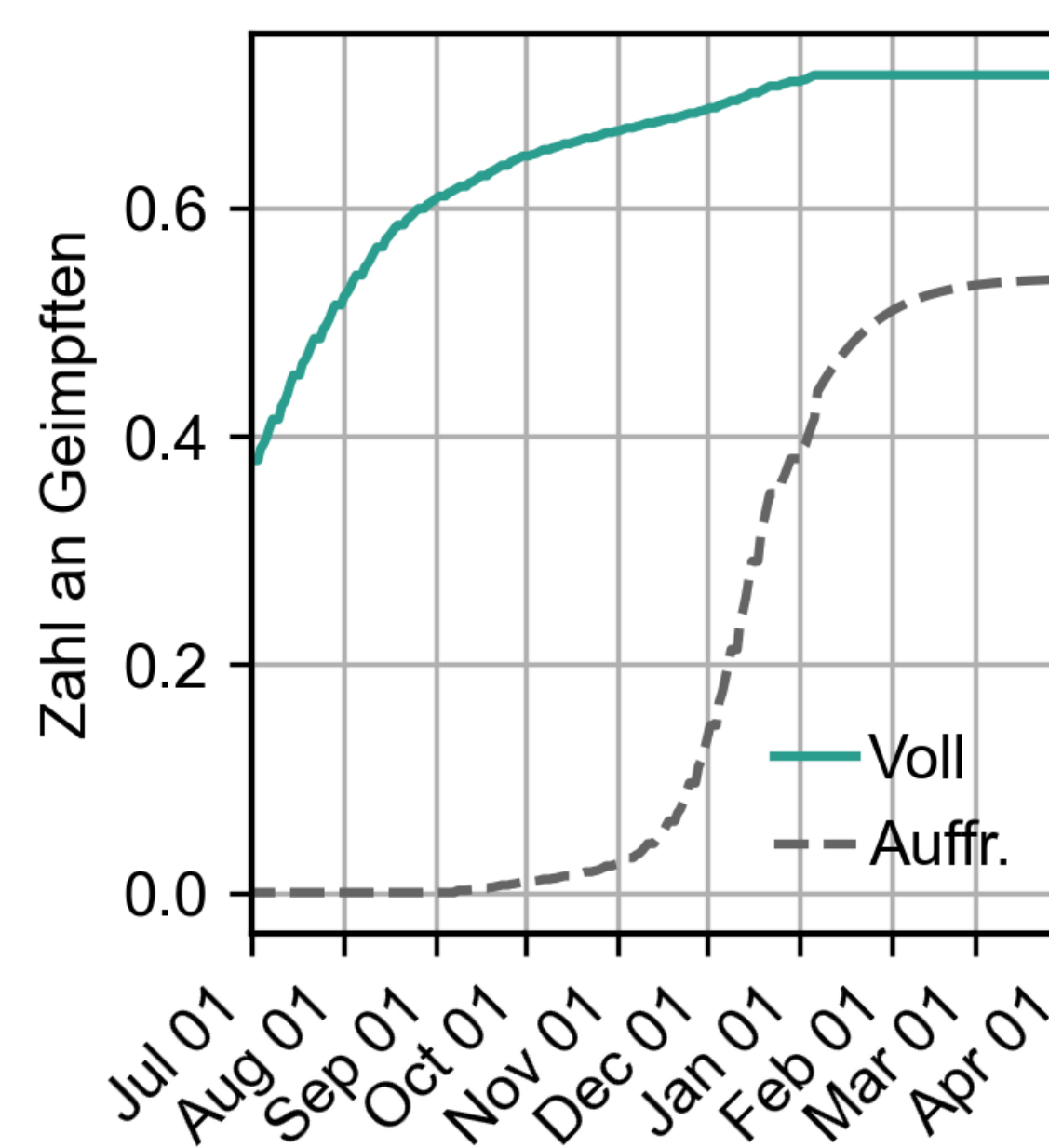
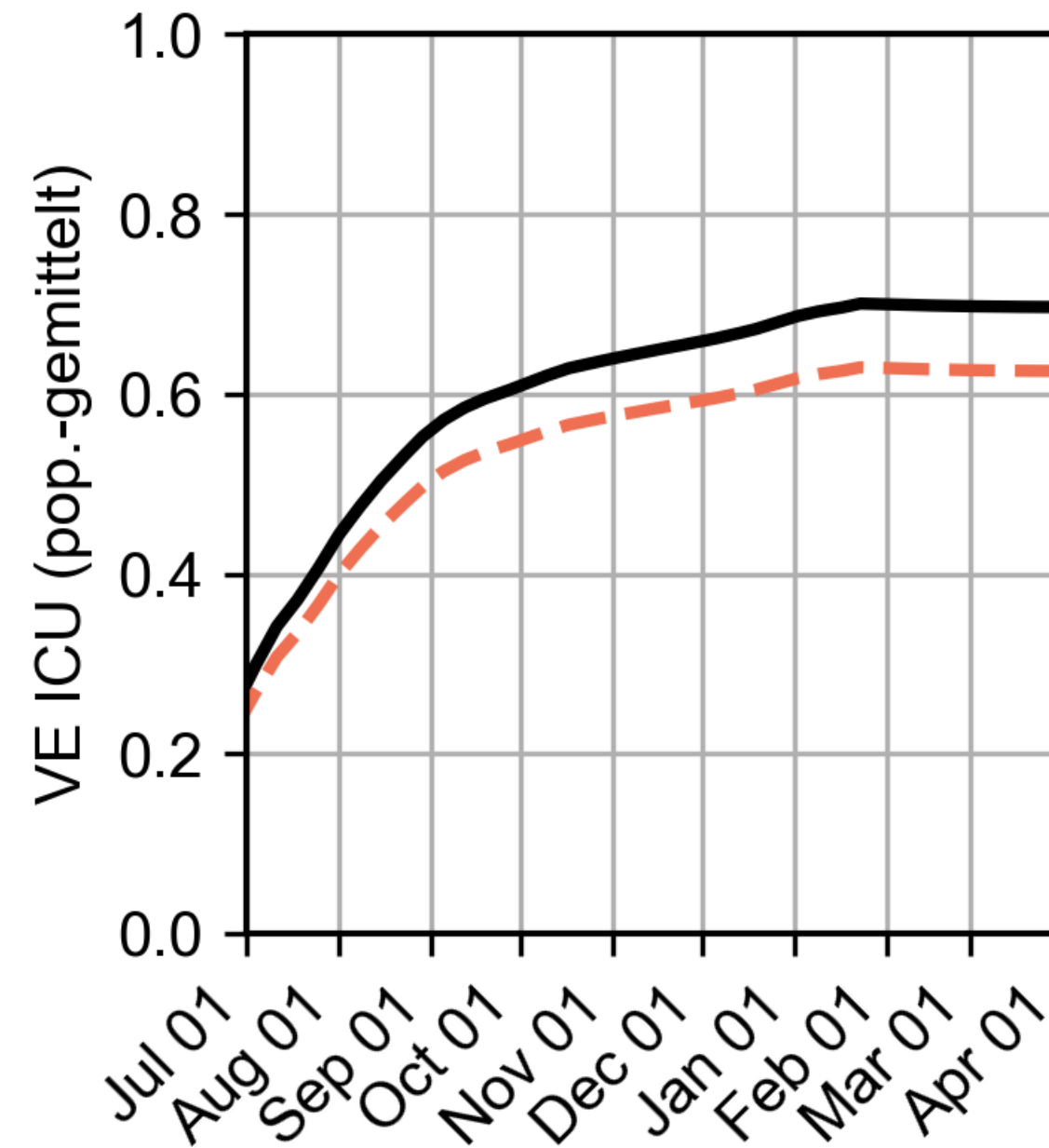
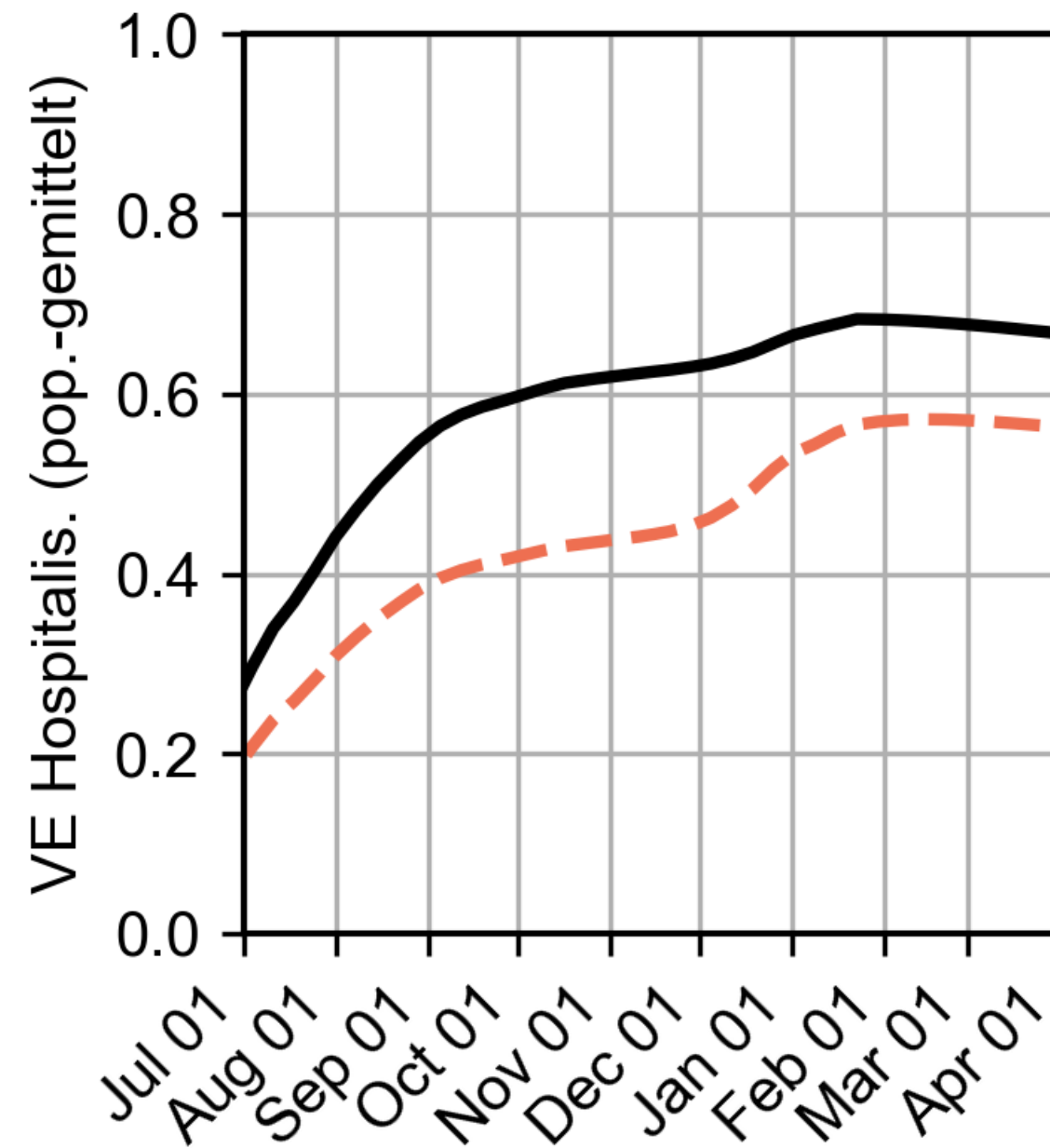
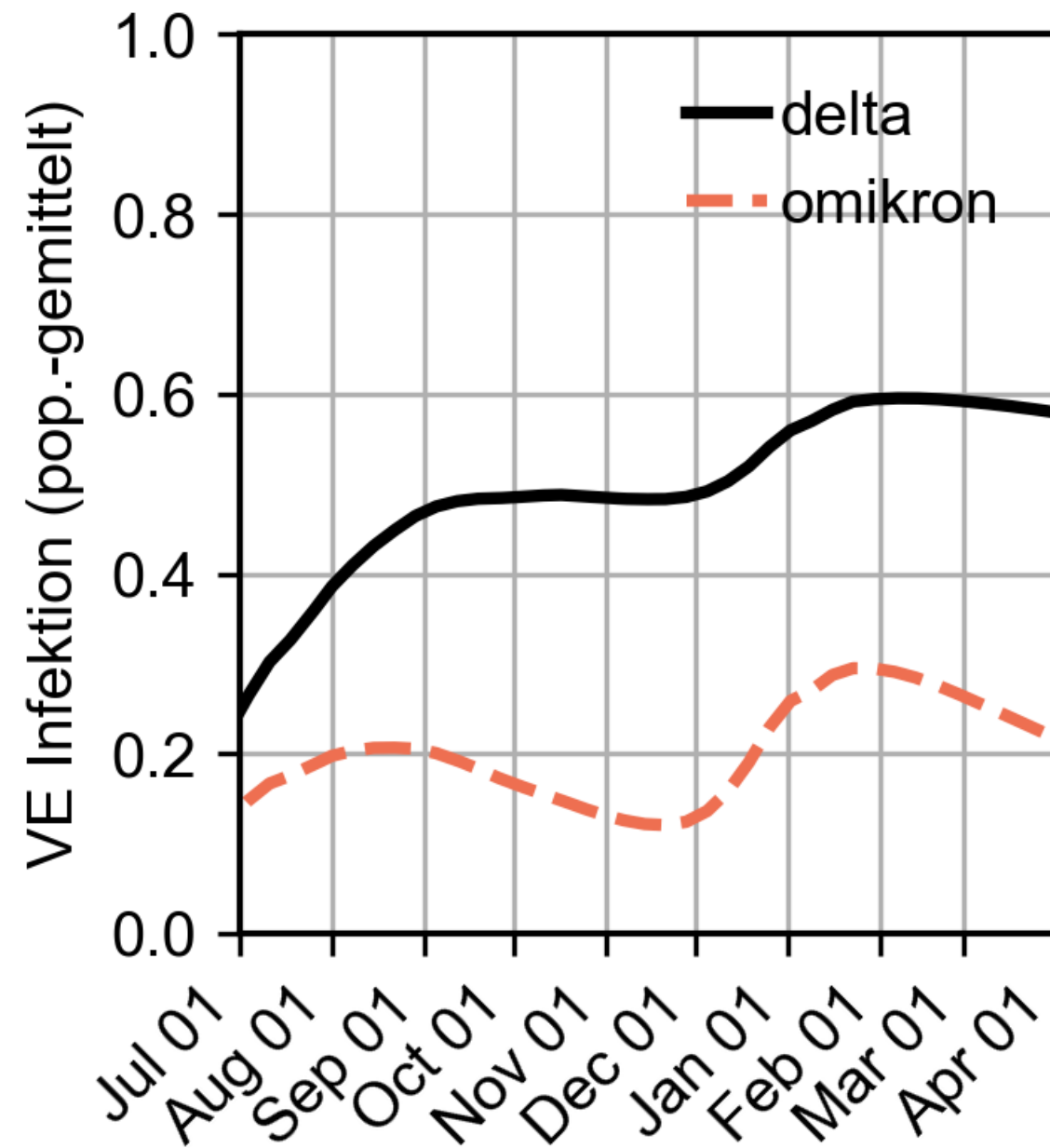


medium\_rate\_medium\_reach\_infectionVEfromdata\_escape





medium\_rate\_medium\_reach\_infectionVEfromsymptomatic\_escape



medium\_rate\_high\_reach\_infectionVEfromsymptomatic\_escape

