It's the wrong data analysis

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Latest research

Happy birthday

Image from Stuart Miles FreeDigitalPhotos.net

Hospital food

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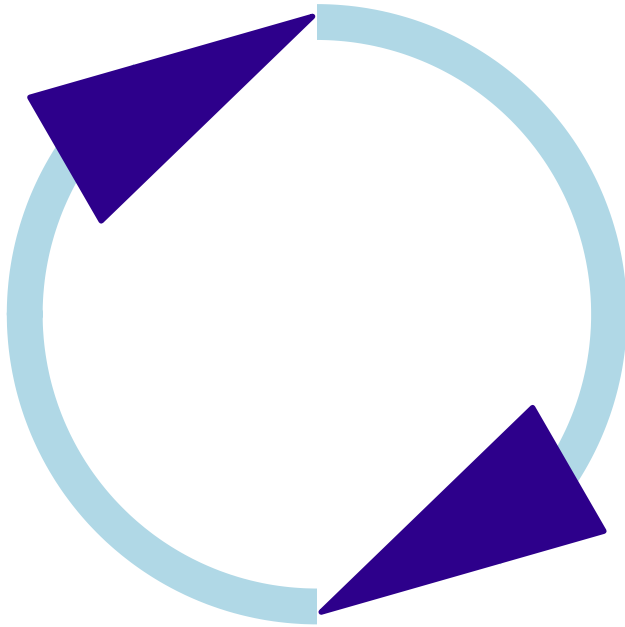
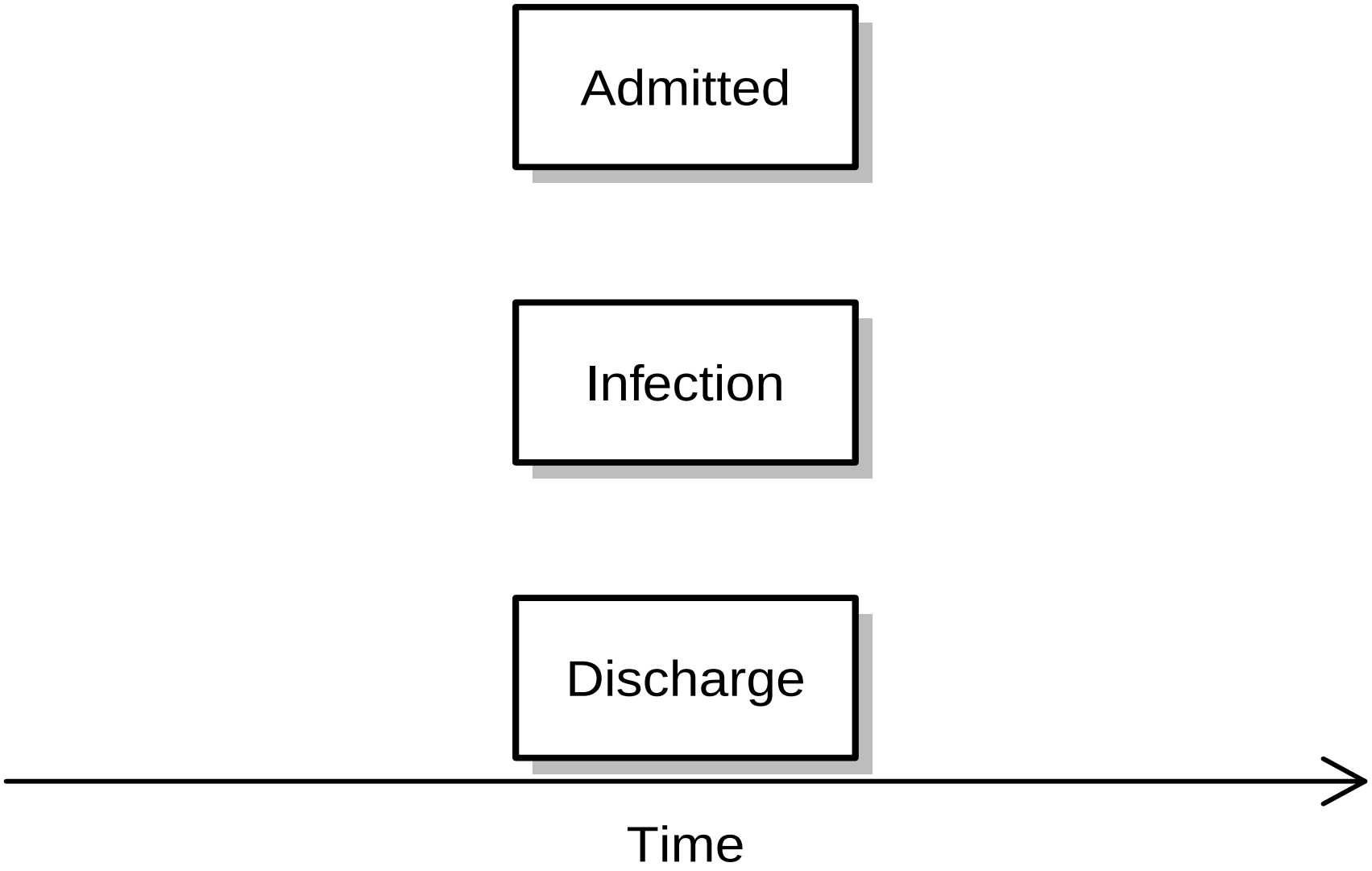
Real examples

- Patients who had the most **inter-hospital transfers** stayed twice as long
- Length of stay was 17.4 days for patients with **hospital-acquired complications** and 5.4 days for other patients
- **Nosocomial infections** multiplied length of hospital stay by 2.9



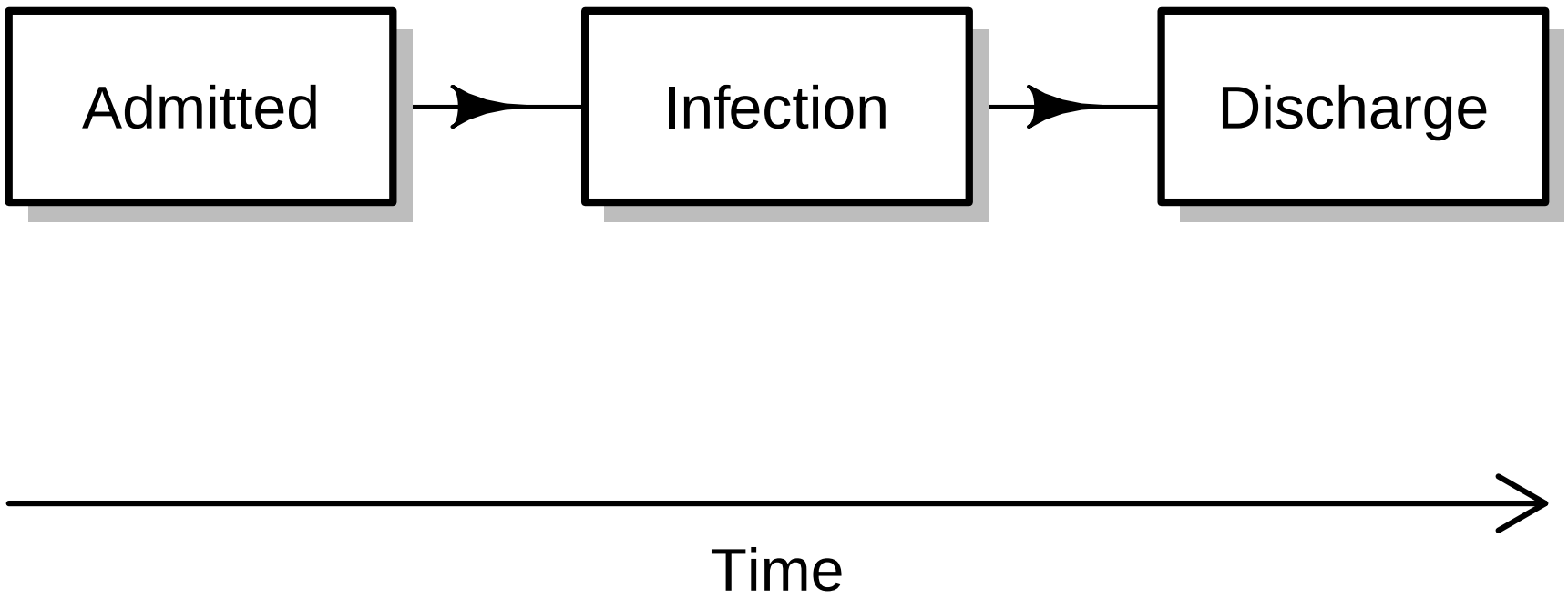
Bias of ignoring time

Cross-sectional



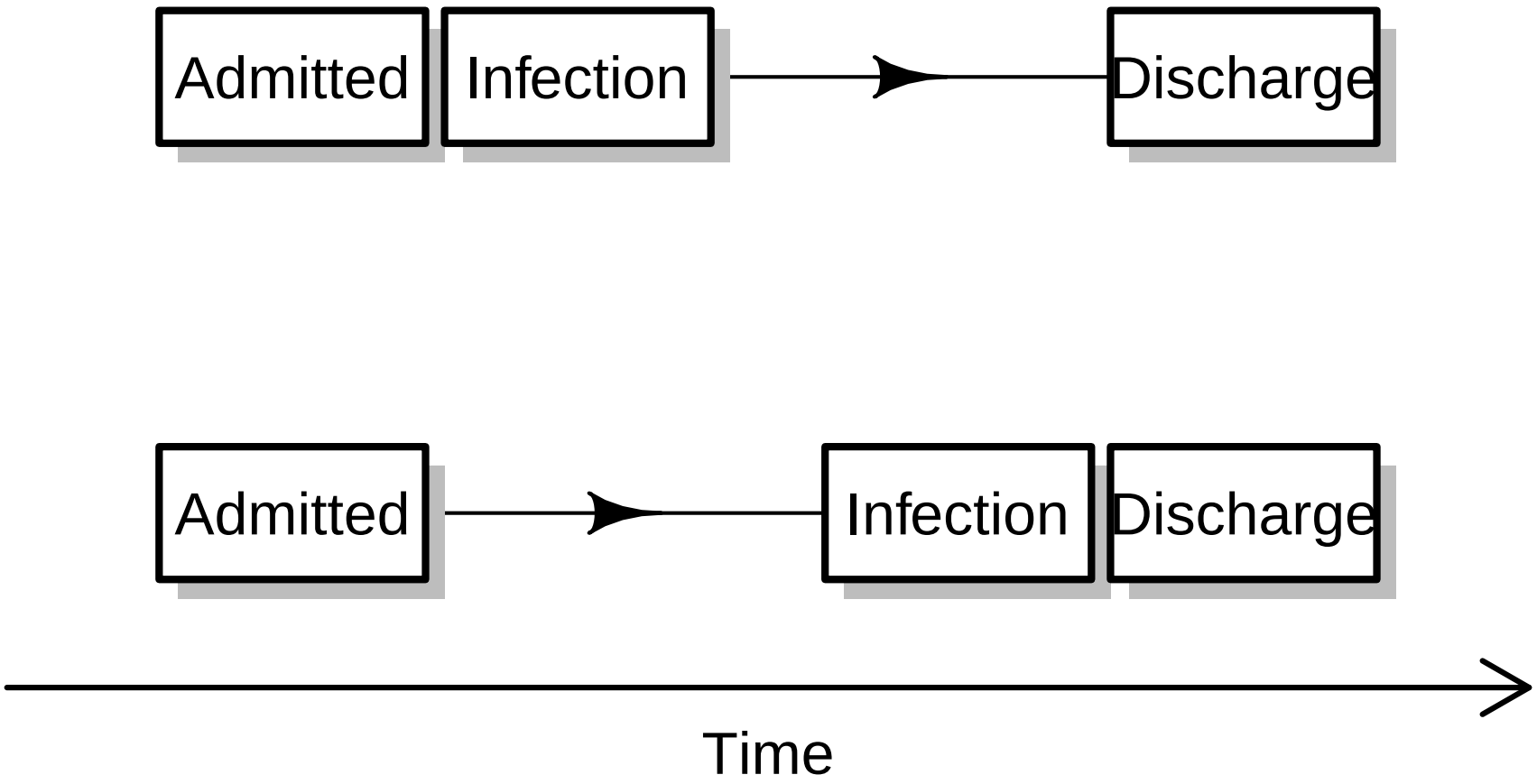
Bias of ignoring time

Time ordered



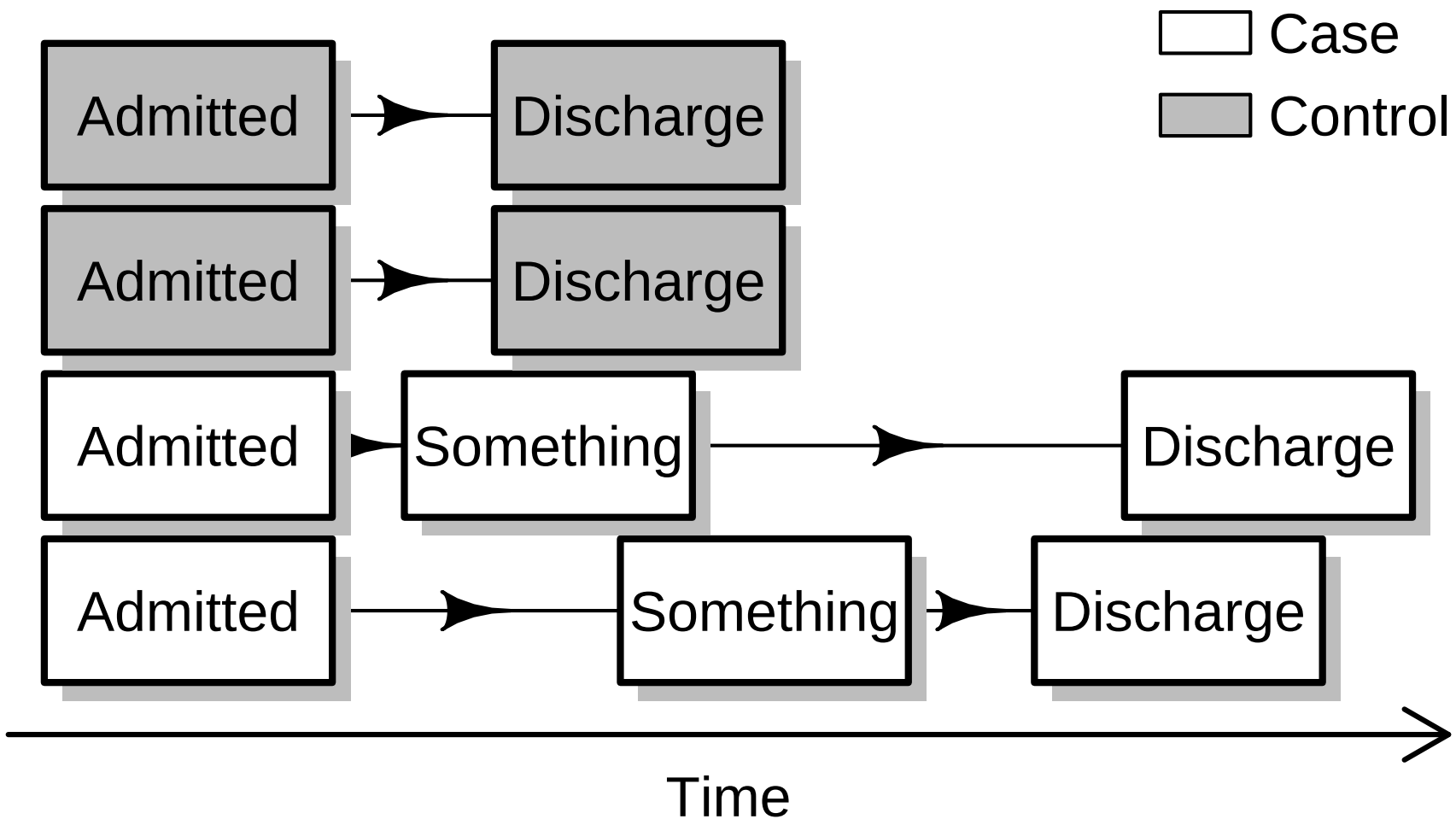
Bias of ignoring time

Same extra length of stay due to infection



Something happened

Experiment starts from the change



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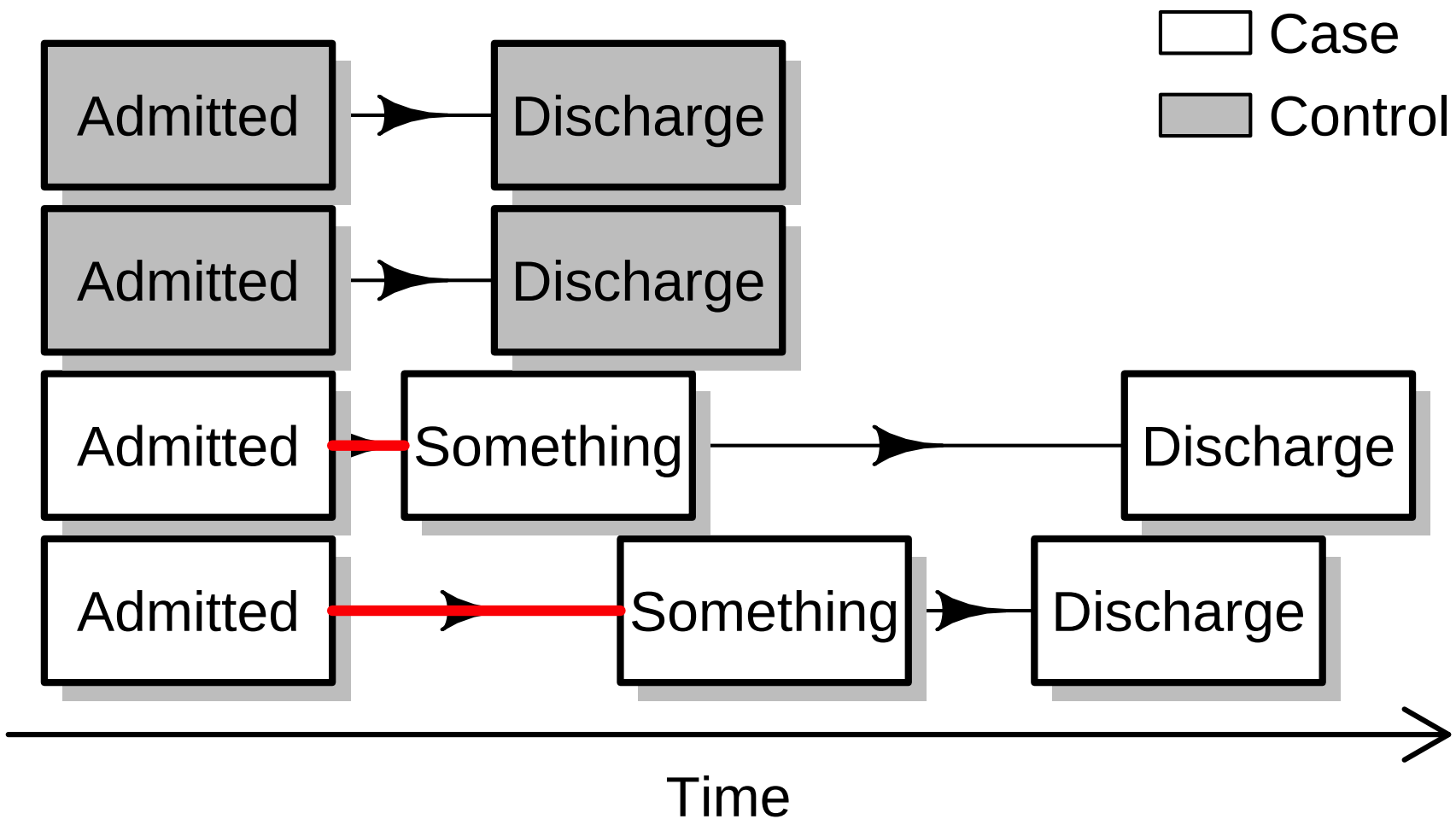

Setting up the data

New row for every change

Patient	From	To	Start	End
1	Admitted	Discharged	0	4
2	Admitted	Infected	0	3
2	Infected	Discharged	3	6
⋮	⋮	⋮	⋮	⋮

- Then use survival analysis
  - Cox regression (direct causes)
  - Cumulative risk curves (indirect causes)

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Example

Does old blood cause infections?

- Only patients with at least one transfusion
- Only red cell transfusions
- Blood age ranged from 0 to 42 days
- 147,308 patients, just 224 infections

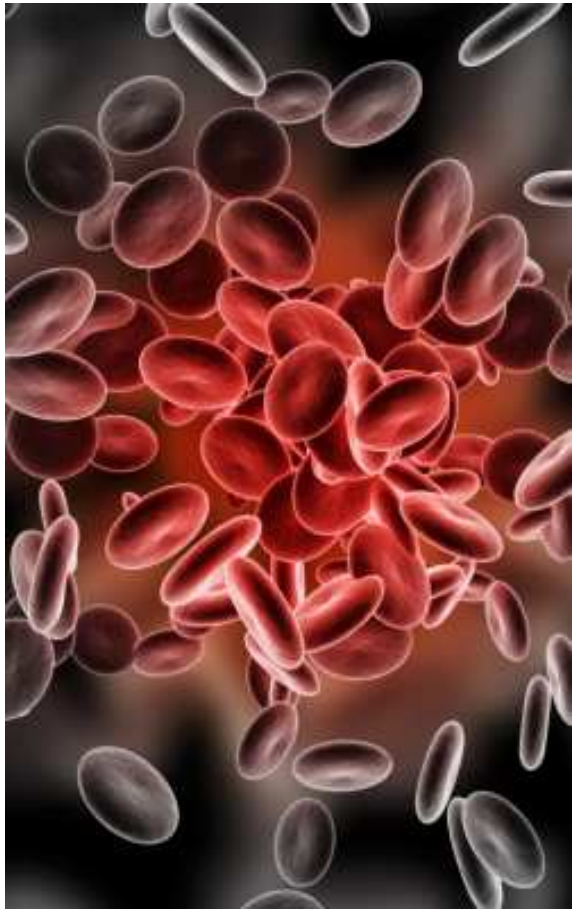
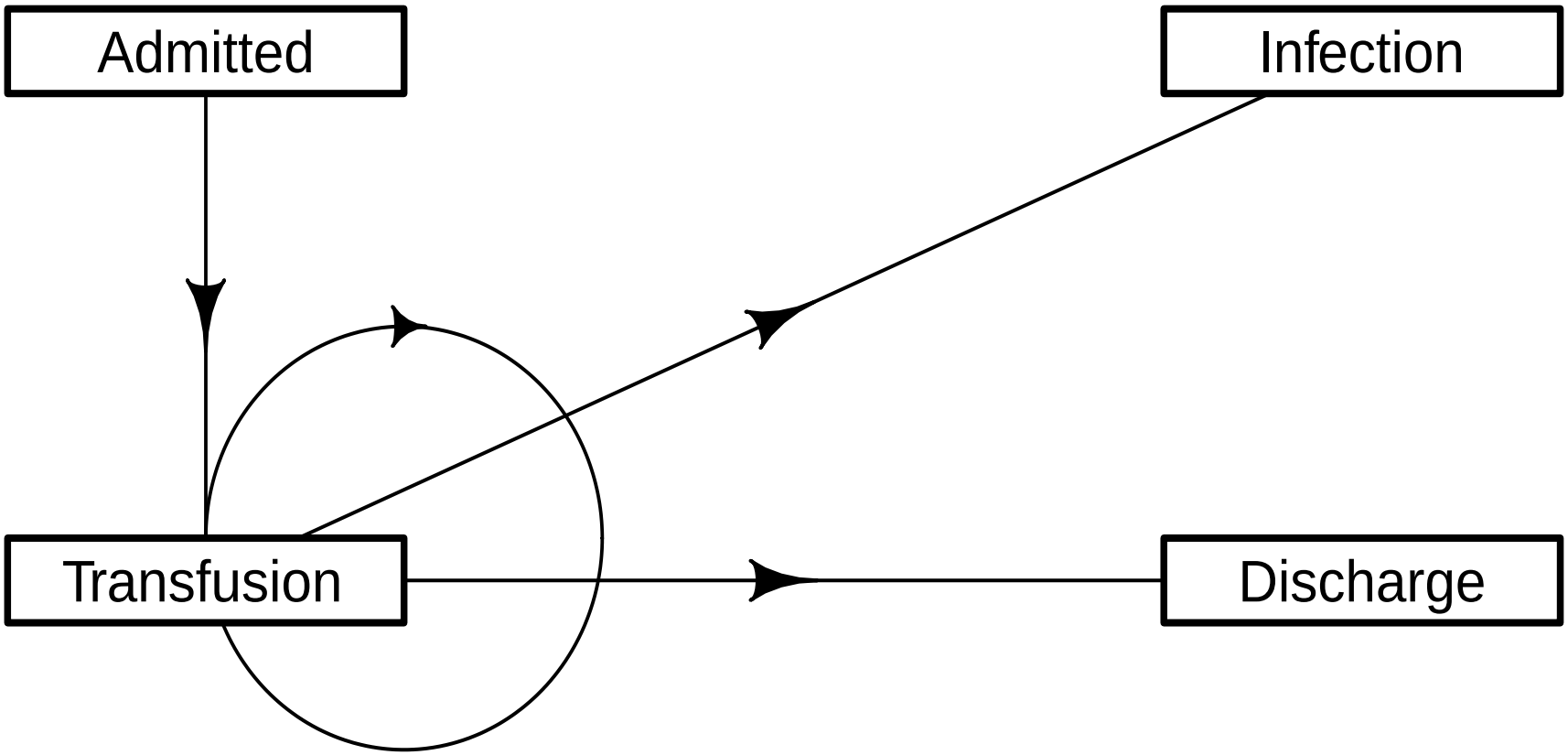
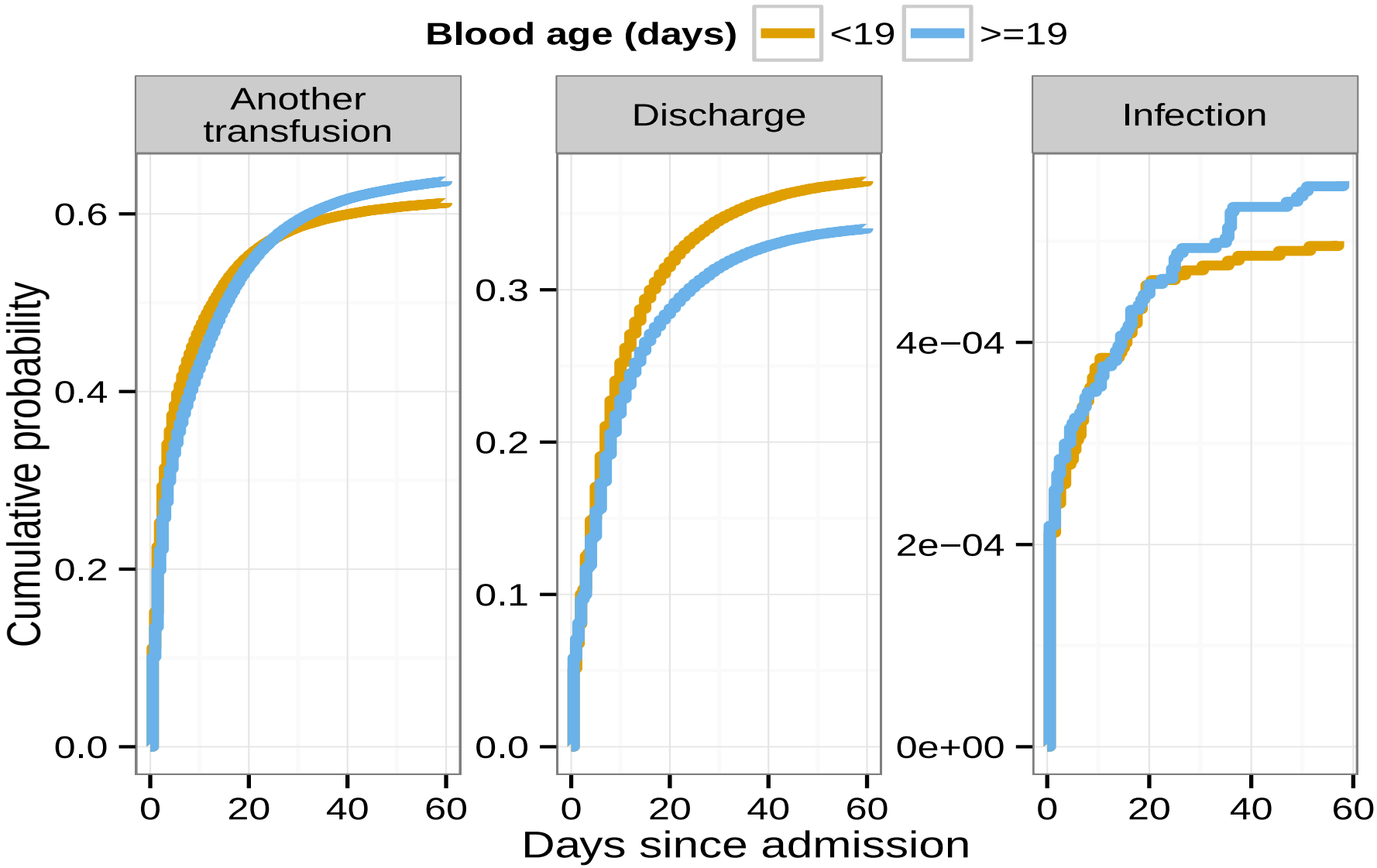


Image courtesy of rajcreationzs at FreeDigitalPhotos.net

Four states



Cumulative risks



Risks of blood age

Hazard ratios and 95 percent confidence intervals for 10 day increase in blood age

	Mean	95% CI	P-value
	Before 20 days		
Infection	0.954	0.828, 1.099	0.512
Transfusion	0.899	0.893, 0.905	< 0.001
Discharge	1.015	1.010, 1.020	< 0.001
	After 20 days		
Infection	1.173	0.926, 1.487	0.187
Transfusion	1.430	1.406, 1.455	< 0.001
Discharge	0.924	0.912, 0.937	< 0.001

Confounding and time

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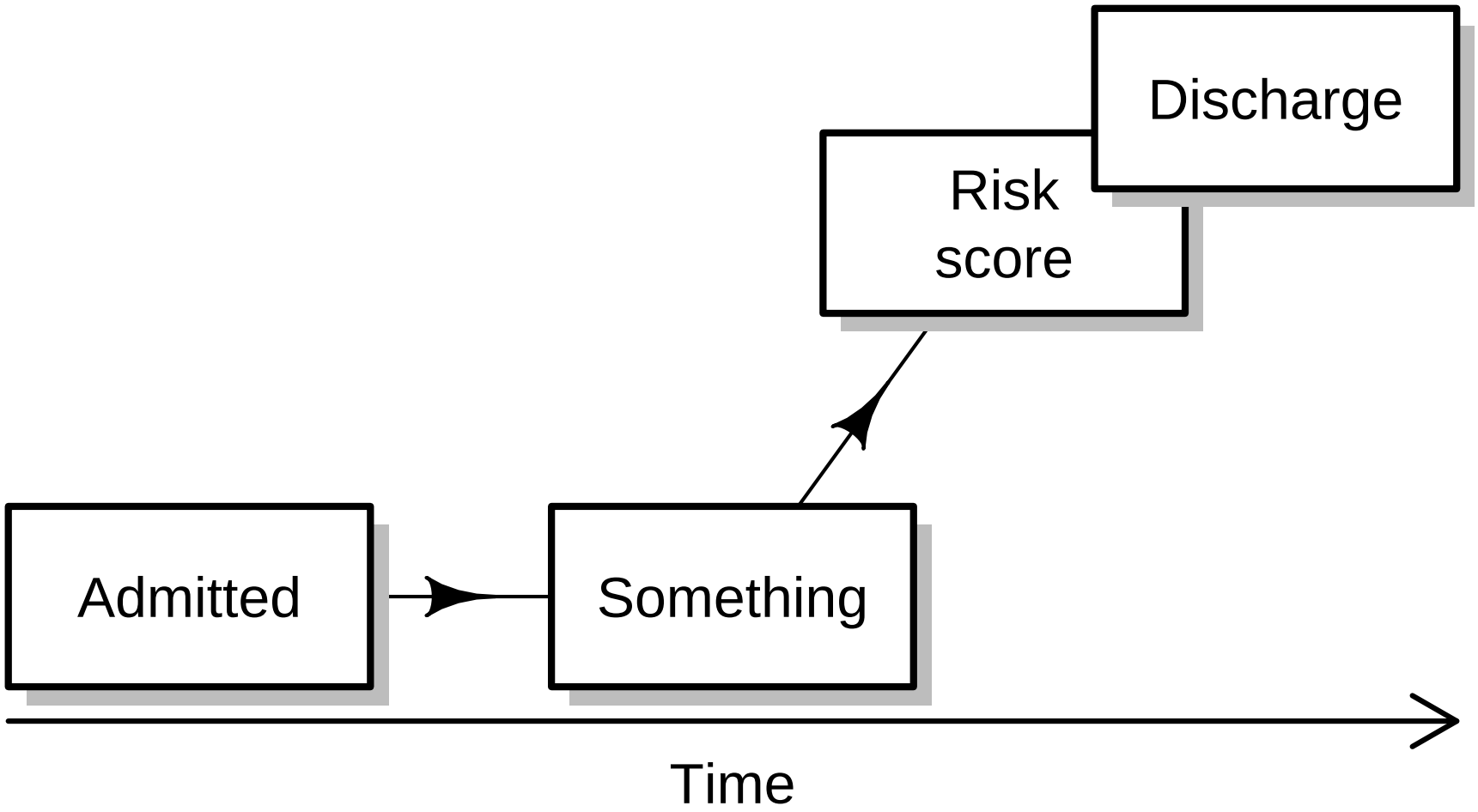
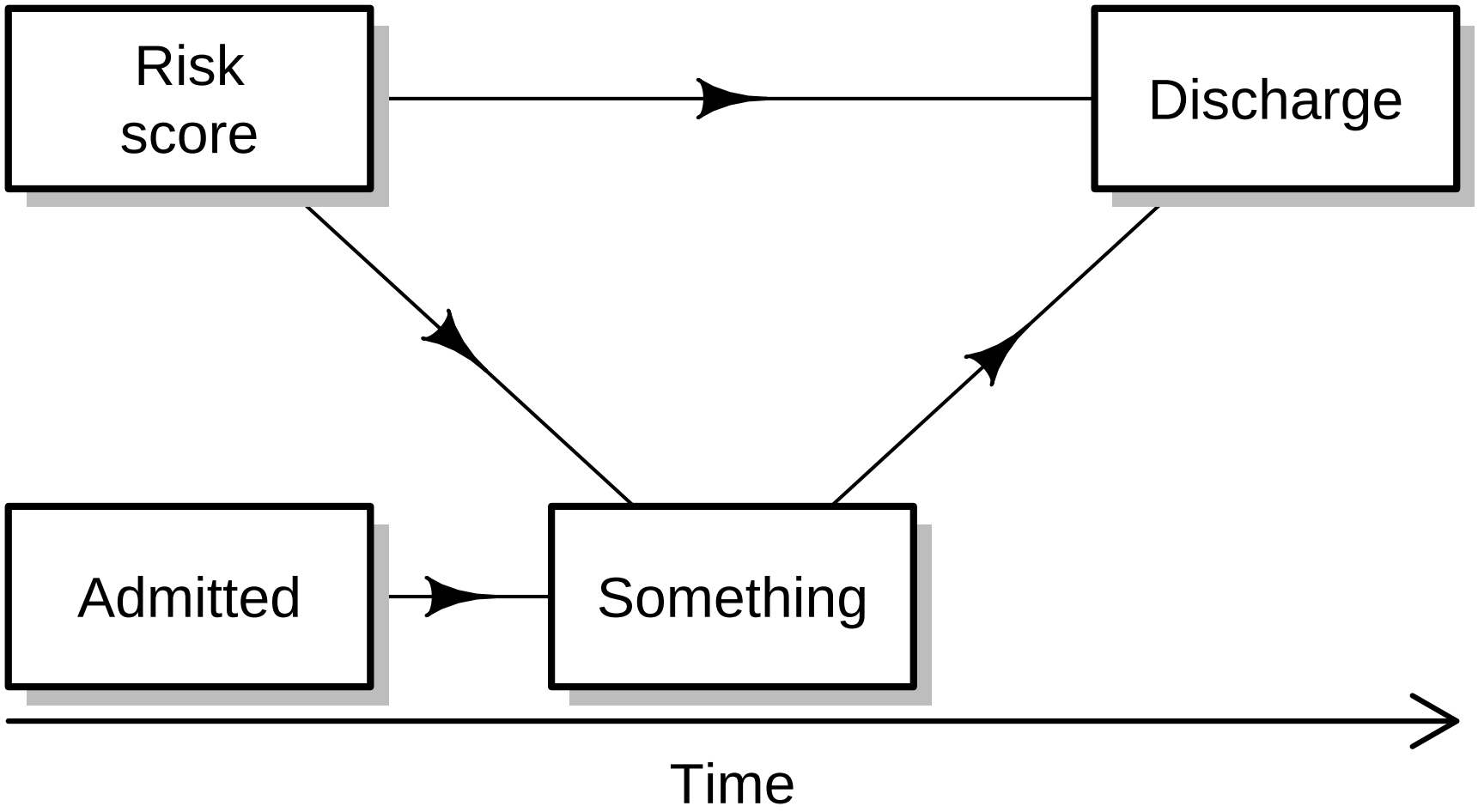
Risk score is not a confounder



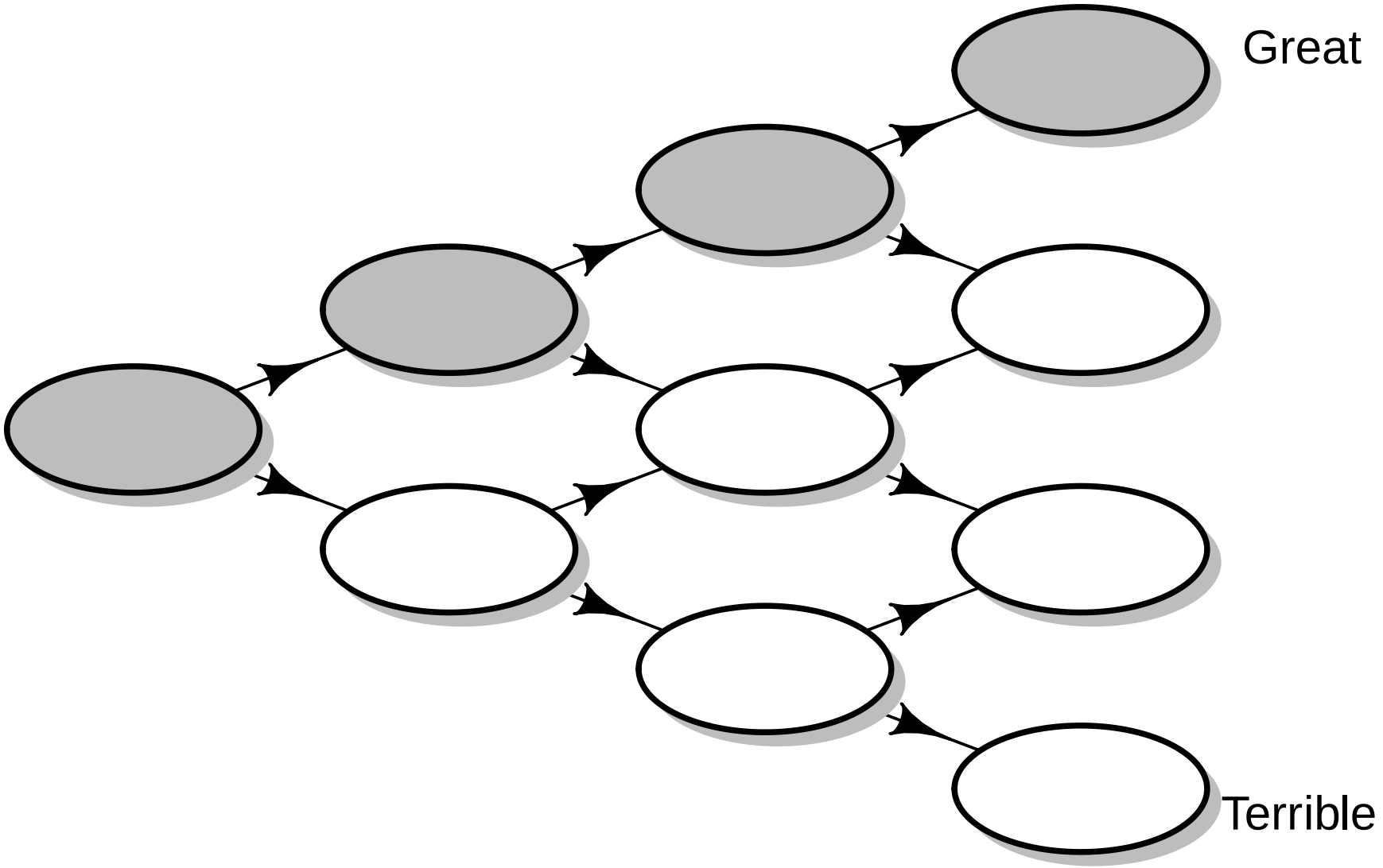
Confounding and time

Risk score is a potential confounder



Regression to the mean

Random events



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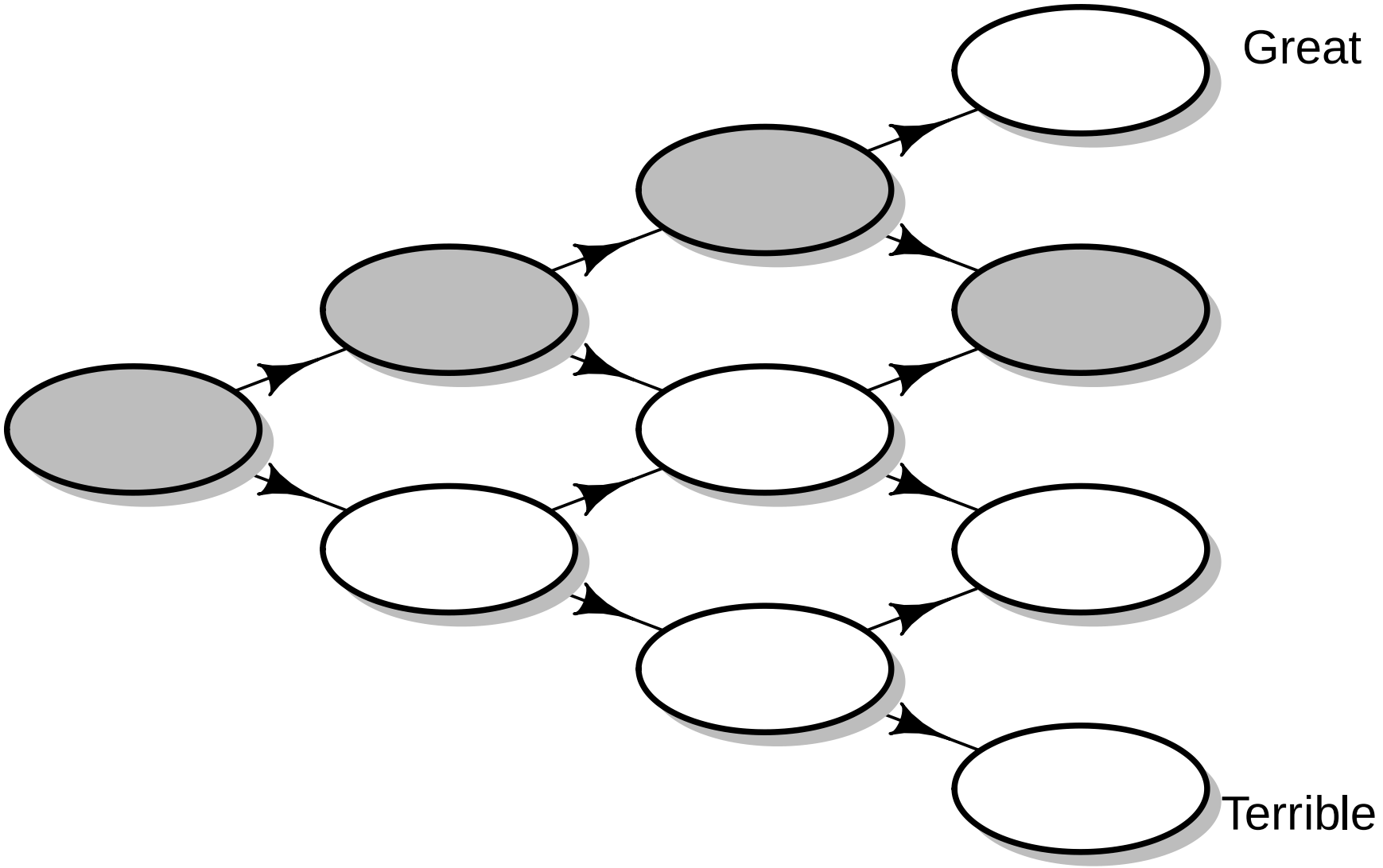

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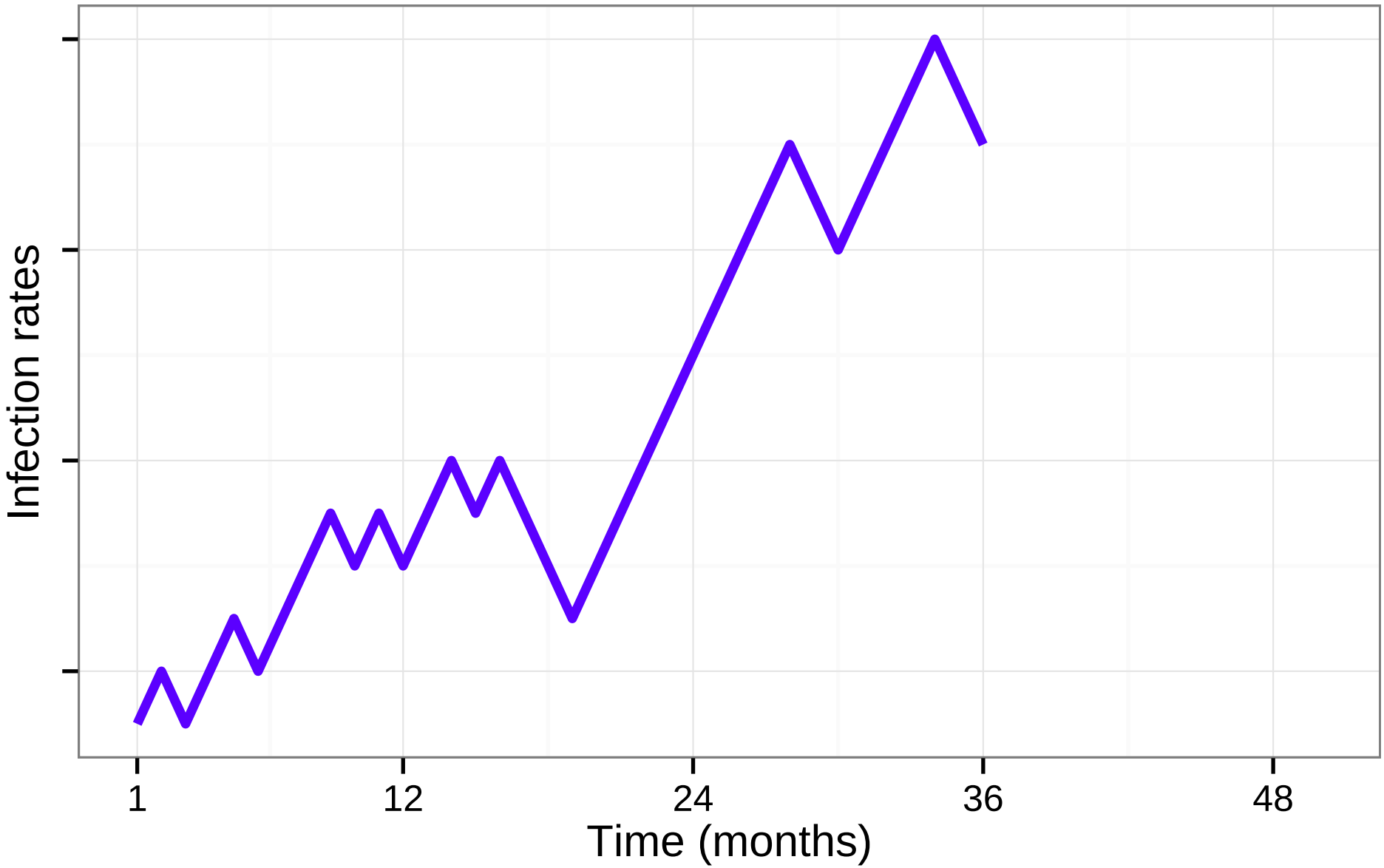

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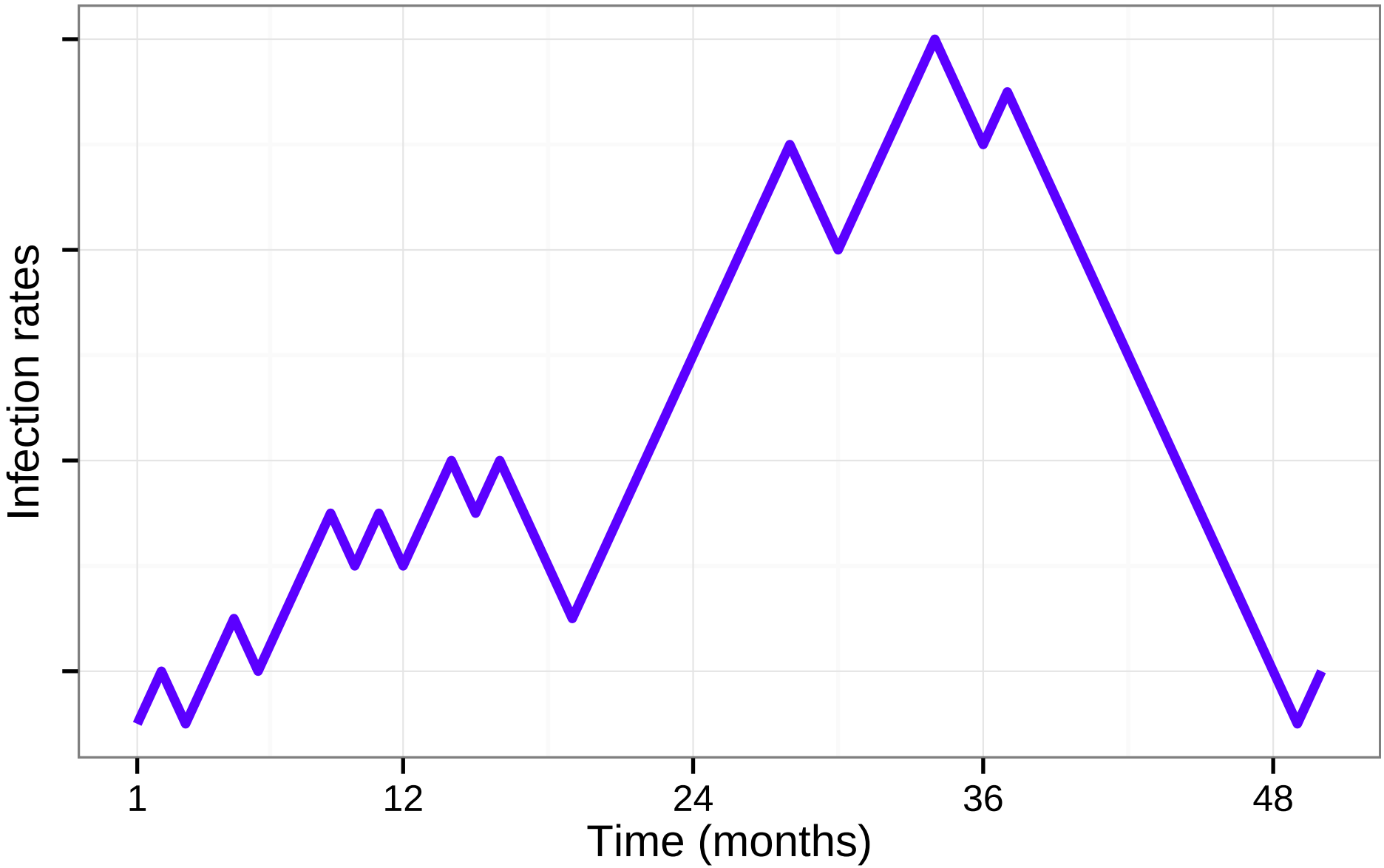

Reproducibility crisis

- Review of published re-analysis of **RCT** data
- Thirteen reanalyses (35%) led to interpretations different from that of the original article (95% CI: 20% to 53%)
- Likely much worse in **observational** data

Ebrahim et al *JAMA* **312**(10)

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