

Risk group turnover in STI/HIV epidemics

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Disclosures

None.

Acknowledgements



Heterogeneity & Turnover in Risk

► Core Group Theory (Risk Heterogeneity):

- Core group is sometimes necessary / sufficient to sustain an epidemic
- Increase R_0
- Decrease endemic prevalence

► Turnover:

- Movement of individuals between risk groups (in / out of the core)
- AKA: “episodic risk”, “migration”
- Rarely modelled

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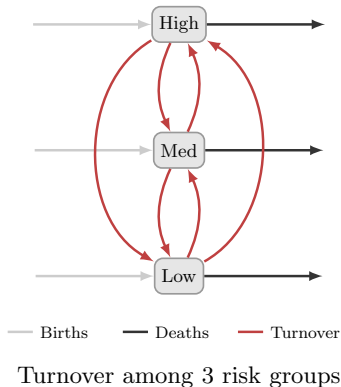
Influence of Turnover in STI Epidemic Models

Research Questions:

Influence of turnover on:

- Equilibrium incidence & prevalence by risk group
- TPAF* of core group

*TPAF: “transmission population attributable fraction”:
Proportion of cumulative new infections averted
if transmission from that group is stopped



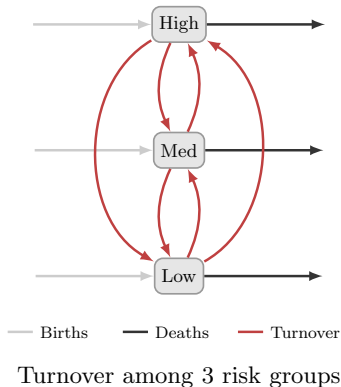
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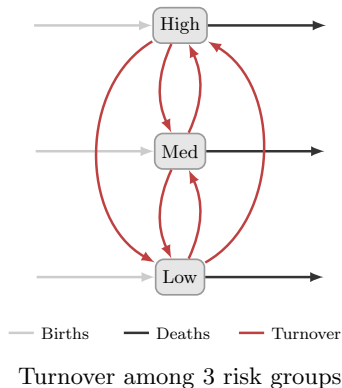
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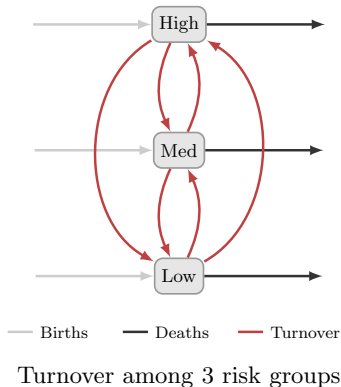
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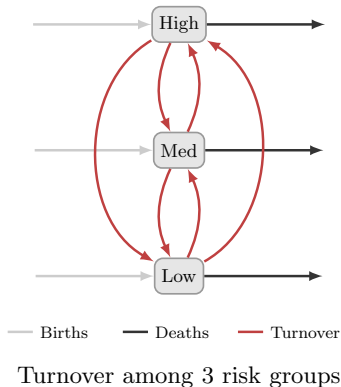
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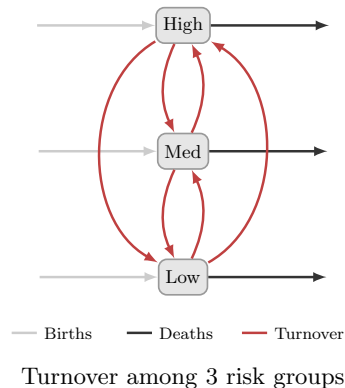
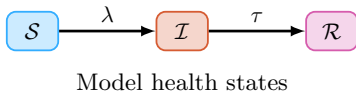
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Illustrative Model of STI Transmission

- ▶ 1-sex SIR model
- ▶ 3 risk groups
- ▶ proportional mixing
- ▶ turnover rates ensure group sizes don't change
- ▶ no disease-attributable mortality



Experiments: Influence of Turnover on Model Outputs

1. Equilibrium outputs:

- ▶ **Vary:** Turnover magnitude
- ▶ **Compare:** a) prevalence, b) incidence (by risk group, at equilibrium)

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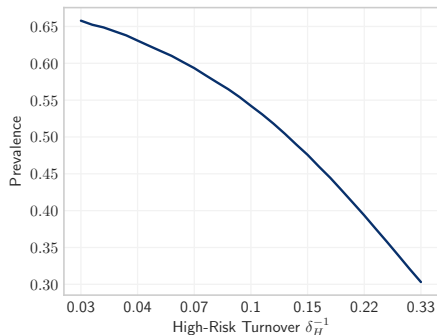
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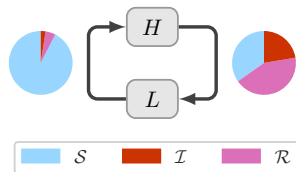
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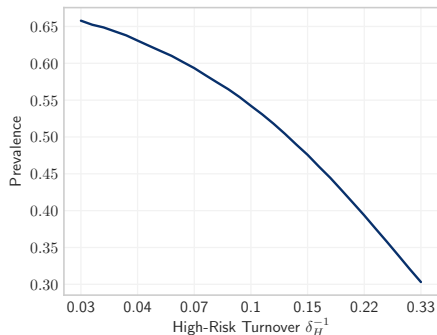
Core group prevalence vs turnover

Turnover causes a net movement of infected: high \rightarrow low risk

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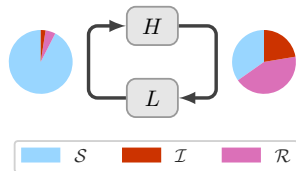
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Risk concentration



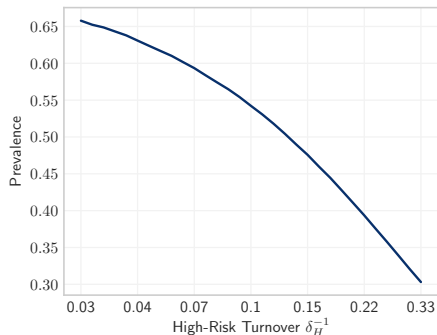
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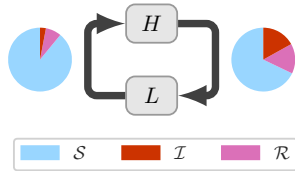
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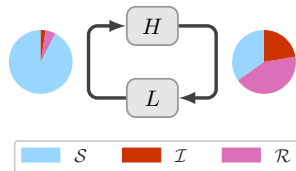
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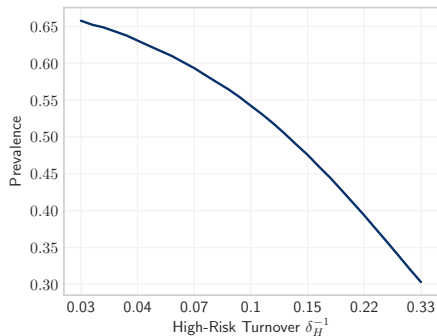
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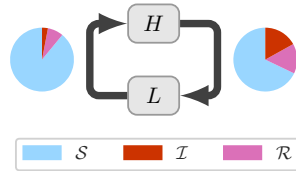
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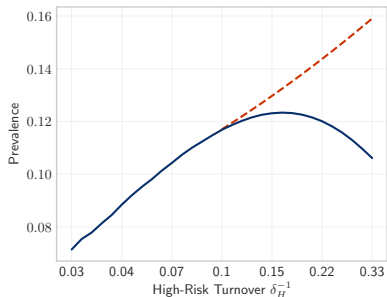
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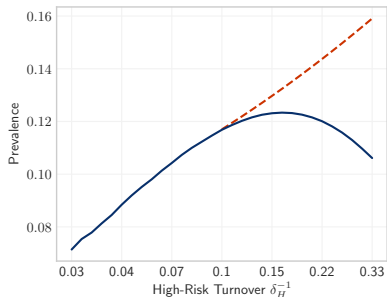


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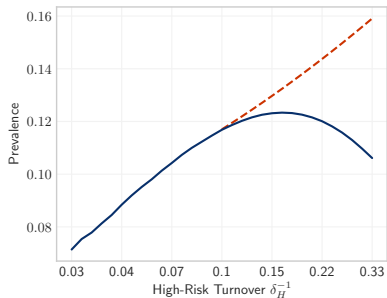


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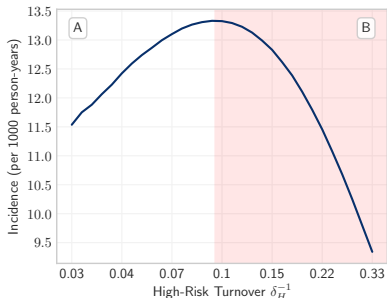
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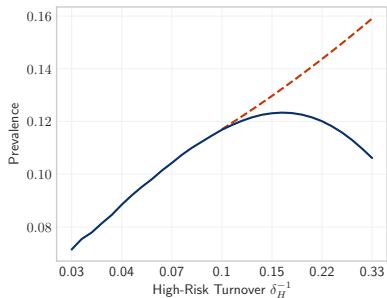


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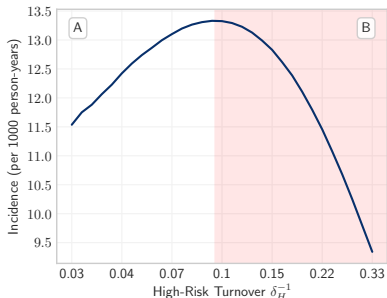
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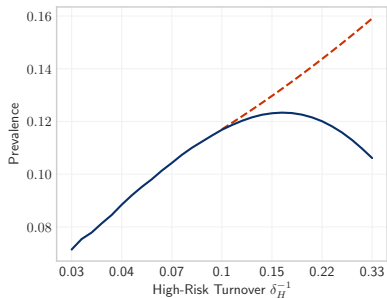
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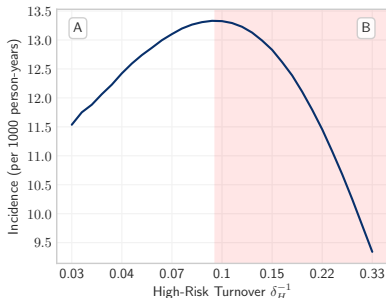
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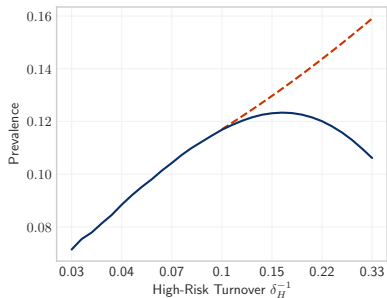
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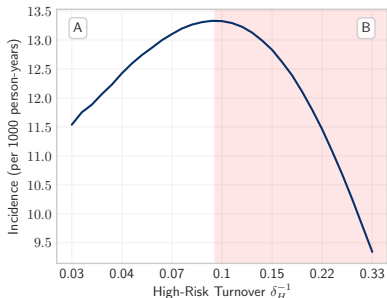
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Turnover makes it harder to observe a high prevalence ratio

		Before Fitting		After Fitting	
		No turnover	Turnover	No turnover	Turnover
Contact rate	Core	25.0	25.0	15.8	16.9
	Low risk	1.0	1.0	2.49	0.28
	Ratio	25	25	6.3	60
Prevalence	Core	66%	42%	25%	25%
	Low risk	7%	12%	5%	5%
	Ratio	9.4	3.5	5.0	5.0

To observe the same prevalence ratio:

Risk heterogeneity must be higher with turnover than without
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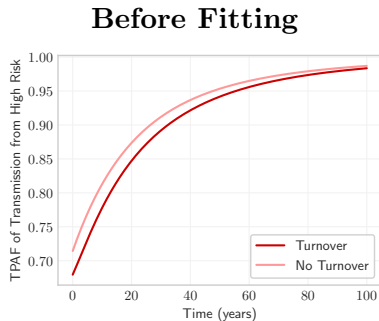
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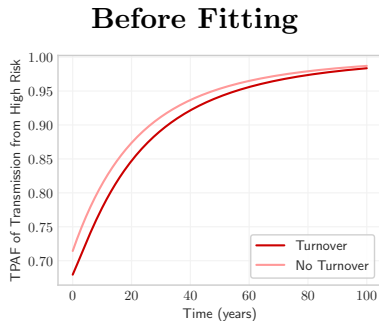
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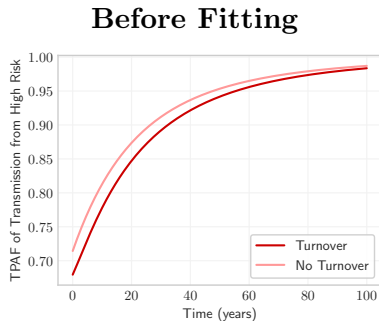
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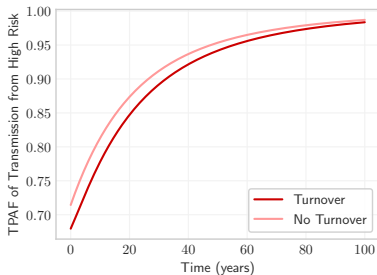
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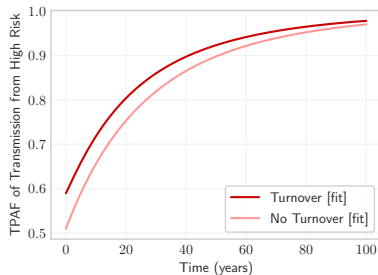
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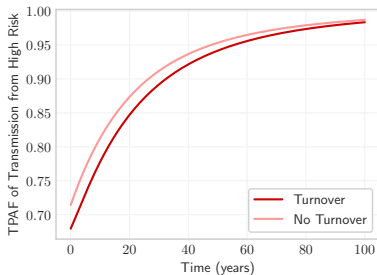
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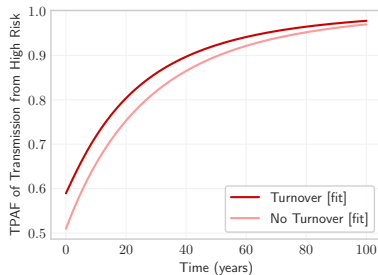
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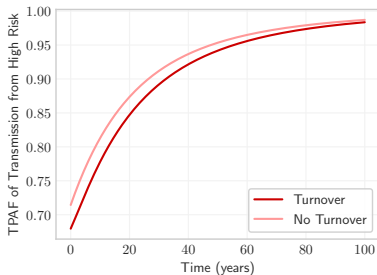


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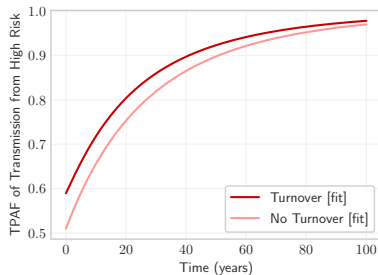
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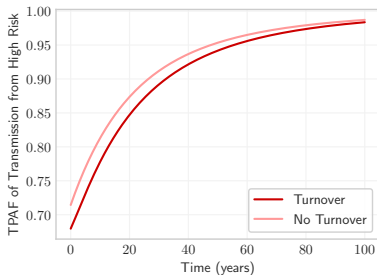


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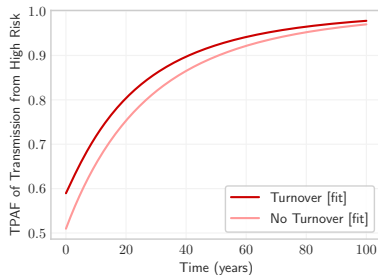
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① Turnover influences equilibrium prevalence & incidence

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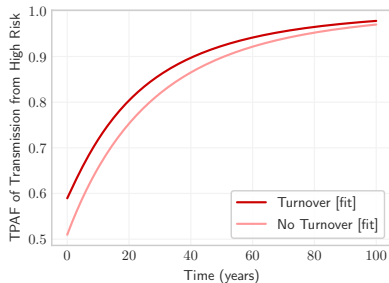
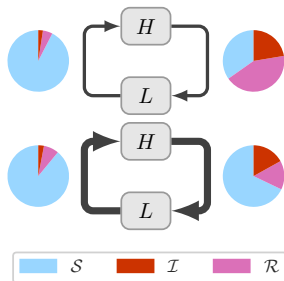
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