MICROSIMULATION

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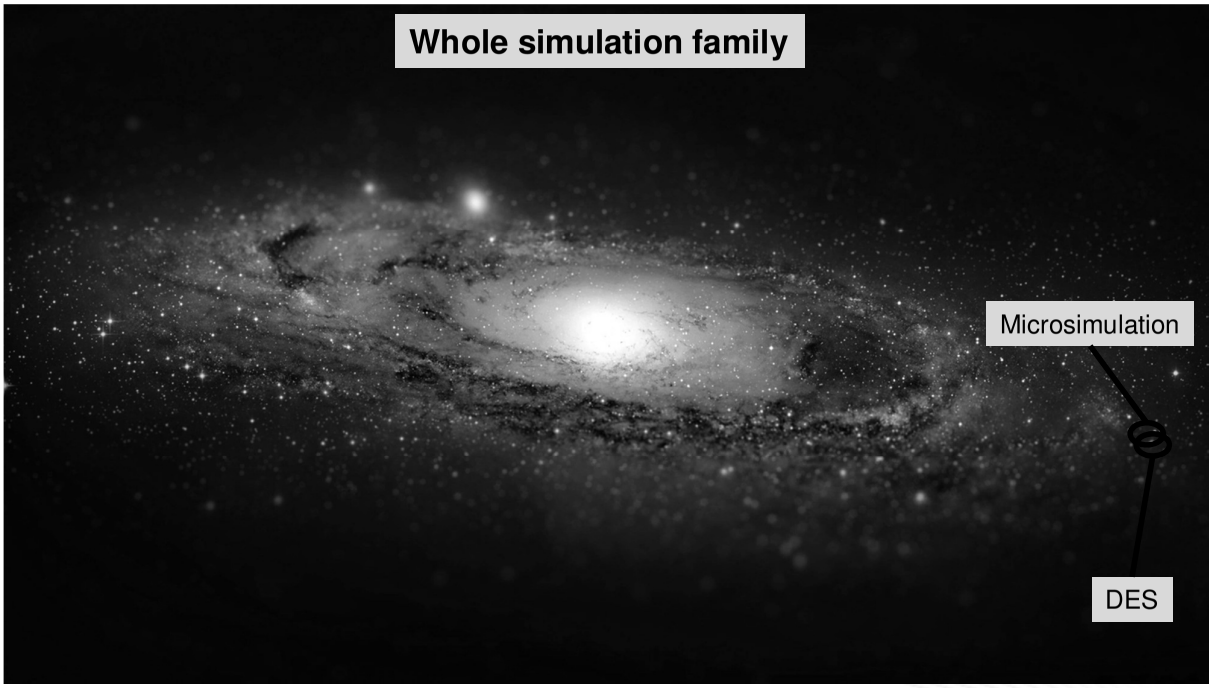
HSOR@NHG
The evidence behind your decisions

Outline

- What is Microsimulation?
- Case study sharing
  - GP bill size simulation
  - Lifetime simulation of chronic disease progression and trajectory

What do we cover?



Definition of microsimulation

"Microsimulation is a modelling technique that operates at the level of individual units such as persons, households, vehicles or firms."

- The International Microsimulation Association

Example of microsimulation

How vehicles pass the intersection?

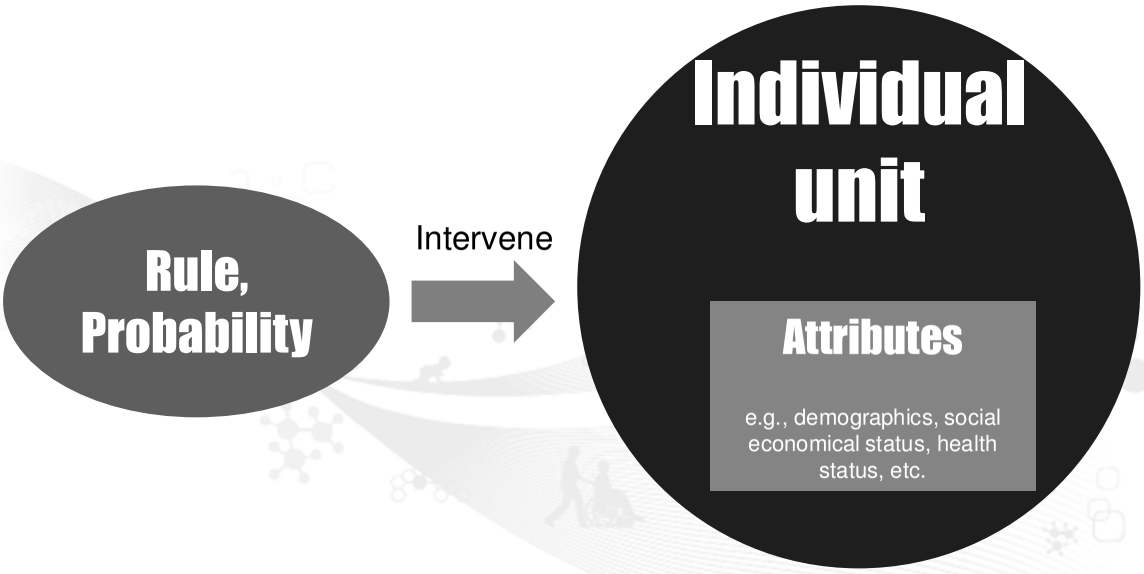
How crowd moves in a building?

Example of microsimulation

How individual reacts to health insurance reform?

How lifestyle change affects one's health status?

Microsimulation building blocks



Characteristics of microsimulation models

Deterministic	Stochastic
Static	Dynamic
Continuous	Discrete

?

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Depends

Case study 1
GP bill size simulation

Background

- One possible approach to ease the overloaded polyclinics is to transfer some polyclinic patients to suitable GP.
- One hurdle of polyclinic→GP transfer is that the out of pocket (OOP) bill size of GP is higher than polyclinic, evening after factoring in CHAS or PG subsidy.
- GPs are willing to adjust price to achieve more transfer

Objective

- Build a model to simulate how price adjustment would affect the number of transfer.

Bill size calculation of one patient

Patient ID	Type	NHGP gross cost	NHGP OOP
1	PG	$228.44	**$29.13**

Visit and prescription

Visit date	Item	Frequency	Dosage	Duration	NHGP unit price	GP unit price	GP price
30/12/2015	SIMVASTATIN <20MG>TAB	EVERY NIGHT	1	182 Days	0.12	0.9	163.8
	NIFEDIPINE 30MGLATAB	EVERY MORNING	1	182 Days	0.24	0.96	174.72
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Lab test

Visit date	Item	Gross cost
29/6/2016	Alanine Transferase	5.7
	Aspartate Transaminase	5.6
	Creatine Kinase	6.6
	Hypertensive Panel without ECG	30.8

Item	GP OOP
Consult	$20*2
Medications	$677.04
Lab test	$48.7
- subsidy	-$135*2
Total	**$495.74**

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Case study 2
Lifetime simulation of chronic disease progression and trajectory

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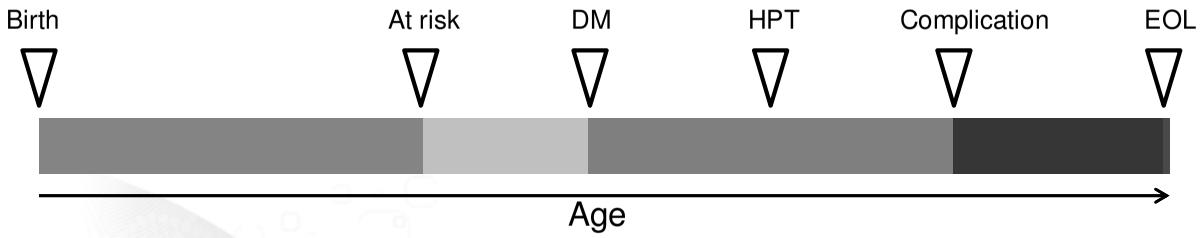
Background

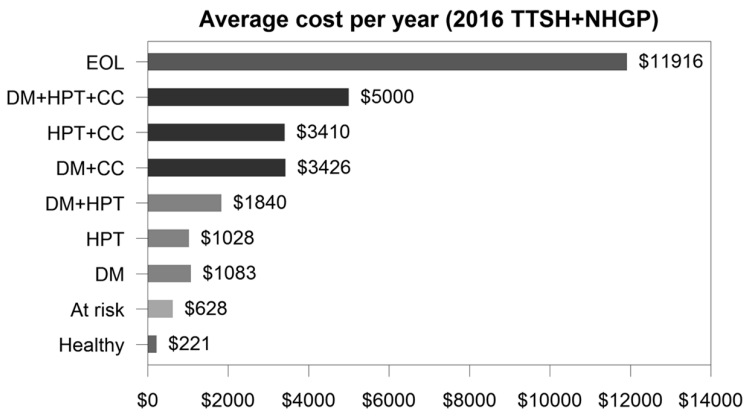
- One challenge of our healthcare system is the increasing chronic disease burden.
- Aging population is one of the reasons of increasing chronic disease prevalence.
- Different chronic conditions are interconnected and form a complex network.
- Many programs have been carried out to target one or more chronic conditions.

Objective

- Map out the network of chronic disease progression.
- Construct the complete trajectory of chronic disease progression from birth to EOL.
- Test the possible impact of hypothesized chronic disease prevention programs.

An illustration of lifetime disease trajectory of one person



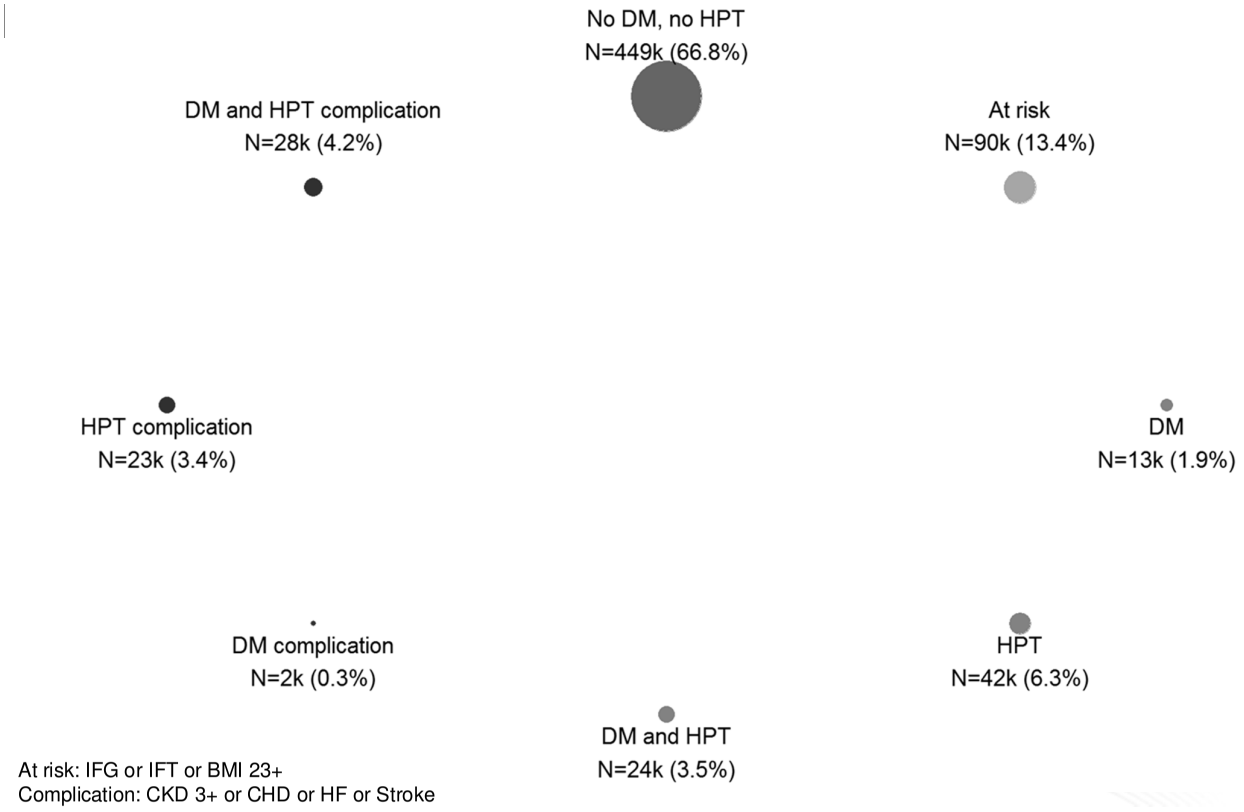


If extrapolated to national cost

$\times 1.9$

At risk: IFG, IFT or BMI 23+
Complication: CKD 3+, CHD, Stroke, or HF

One year progression of chronic disease network



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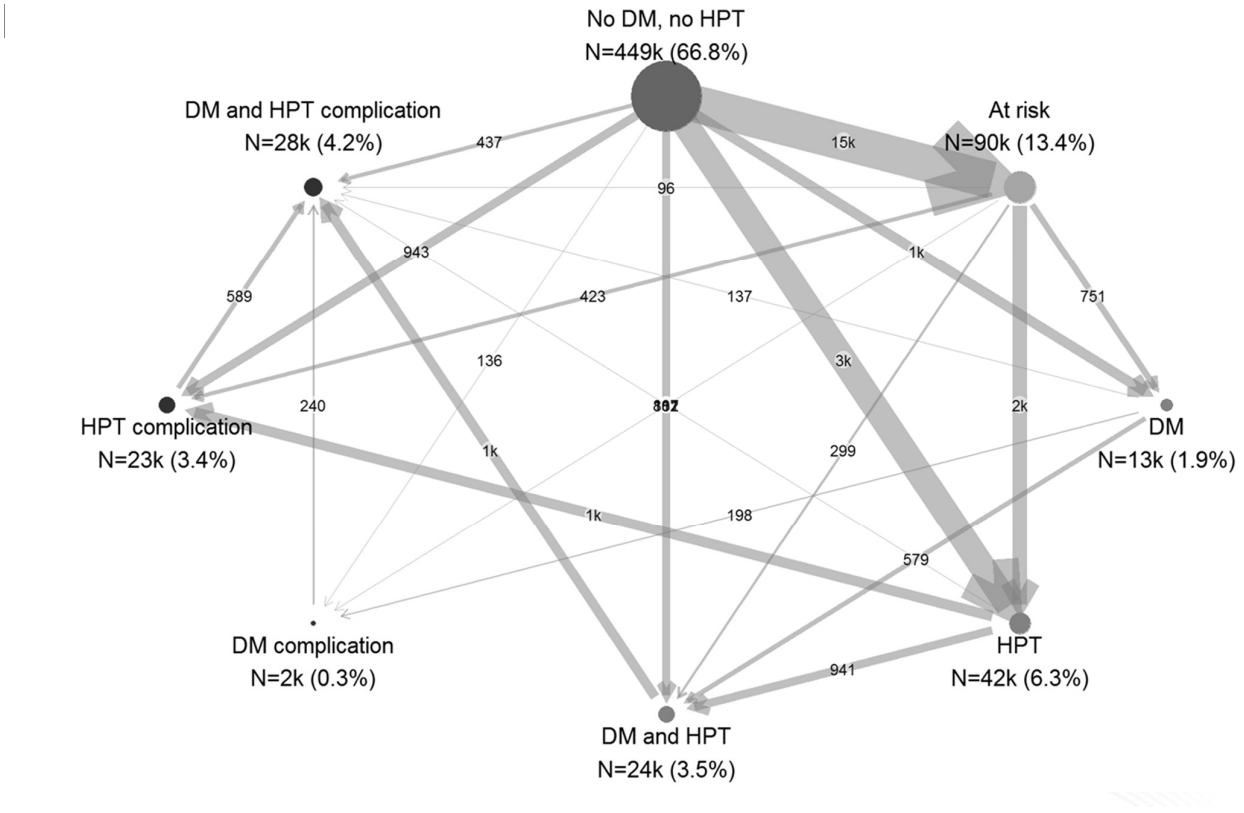
One year progression of chronic disease network



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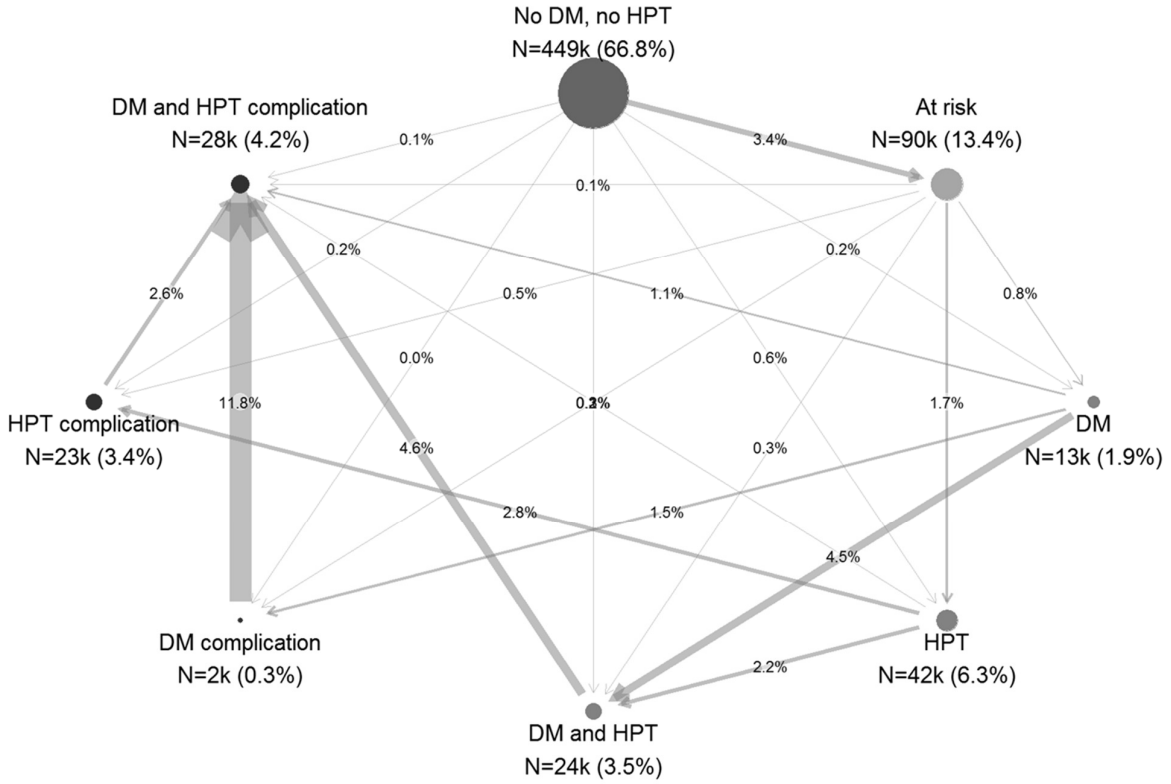
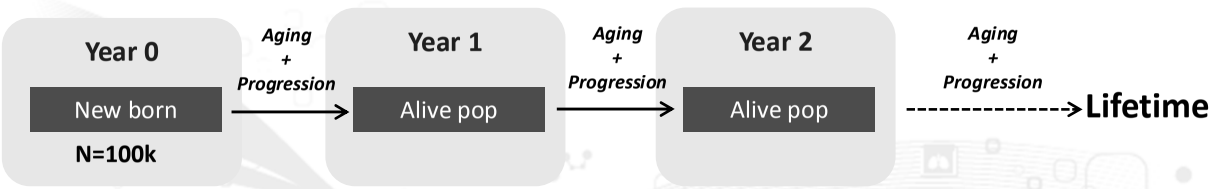
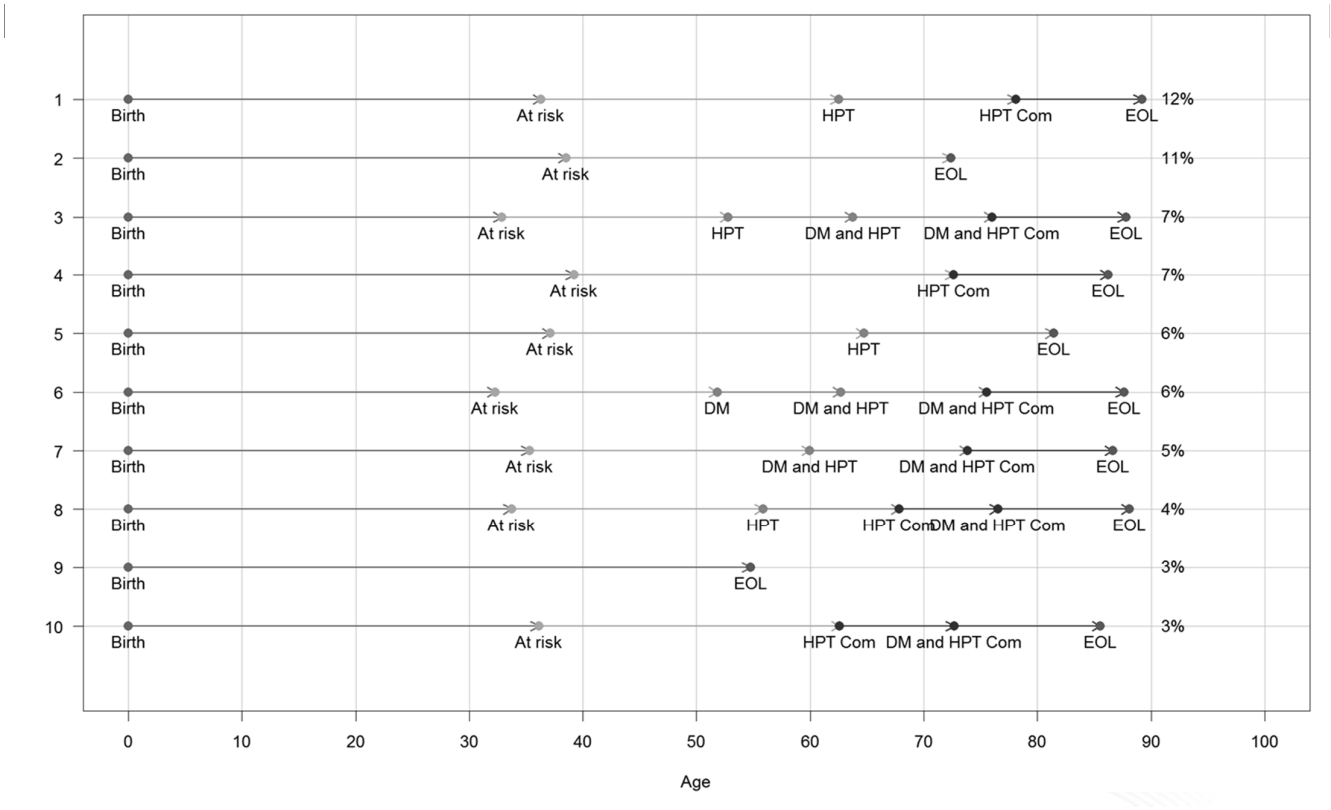


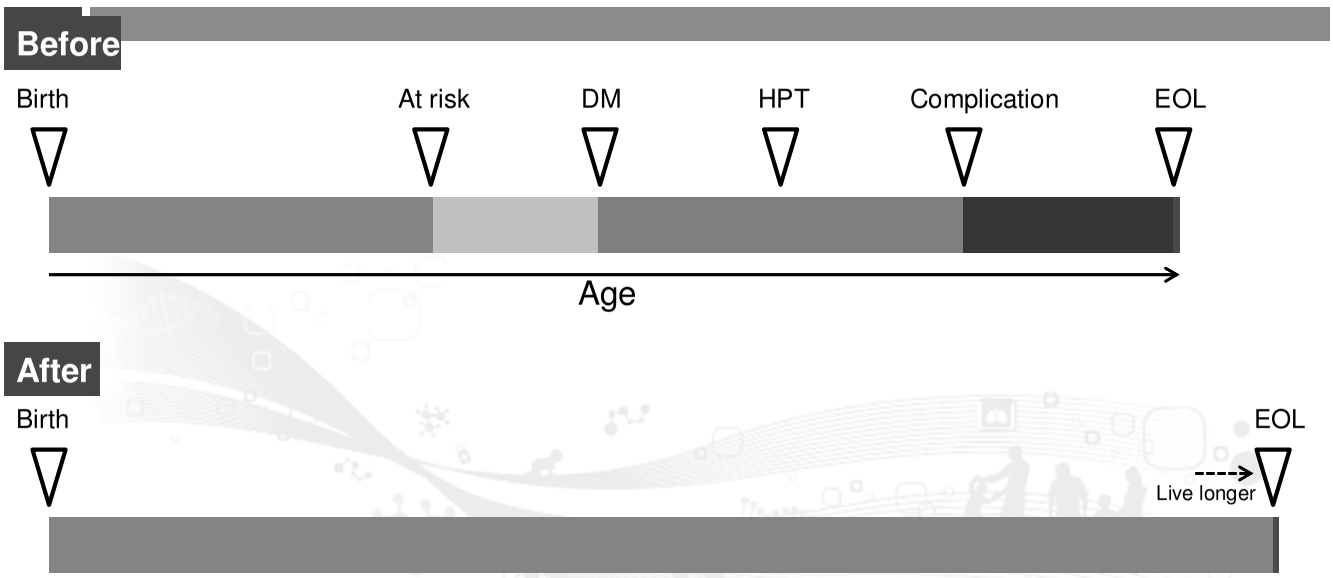
Microsimulation of a new cohort



Top 10 simulated trajectories

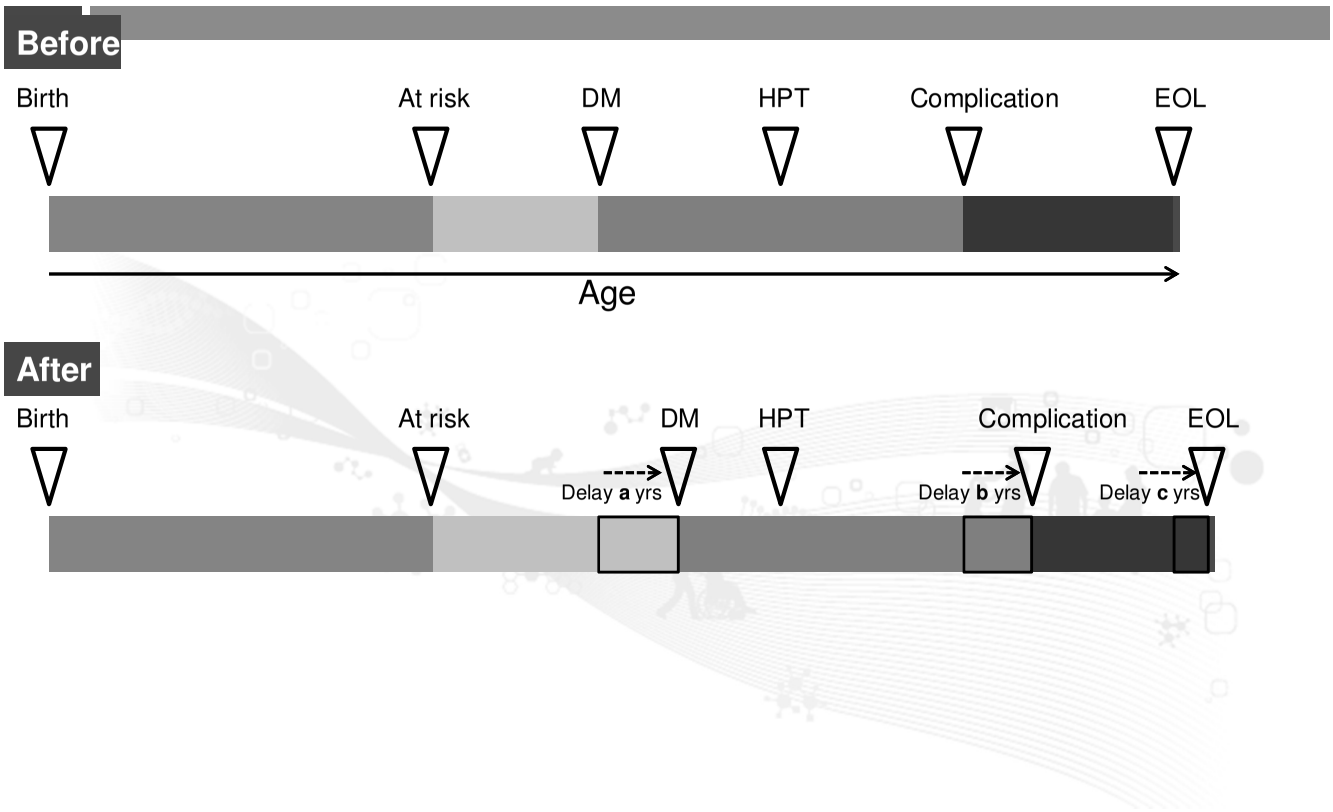


A perfect prevention program prevents any disease progression

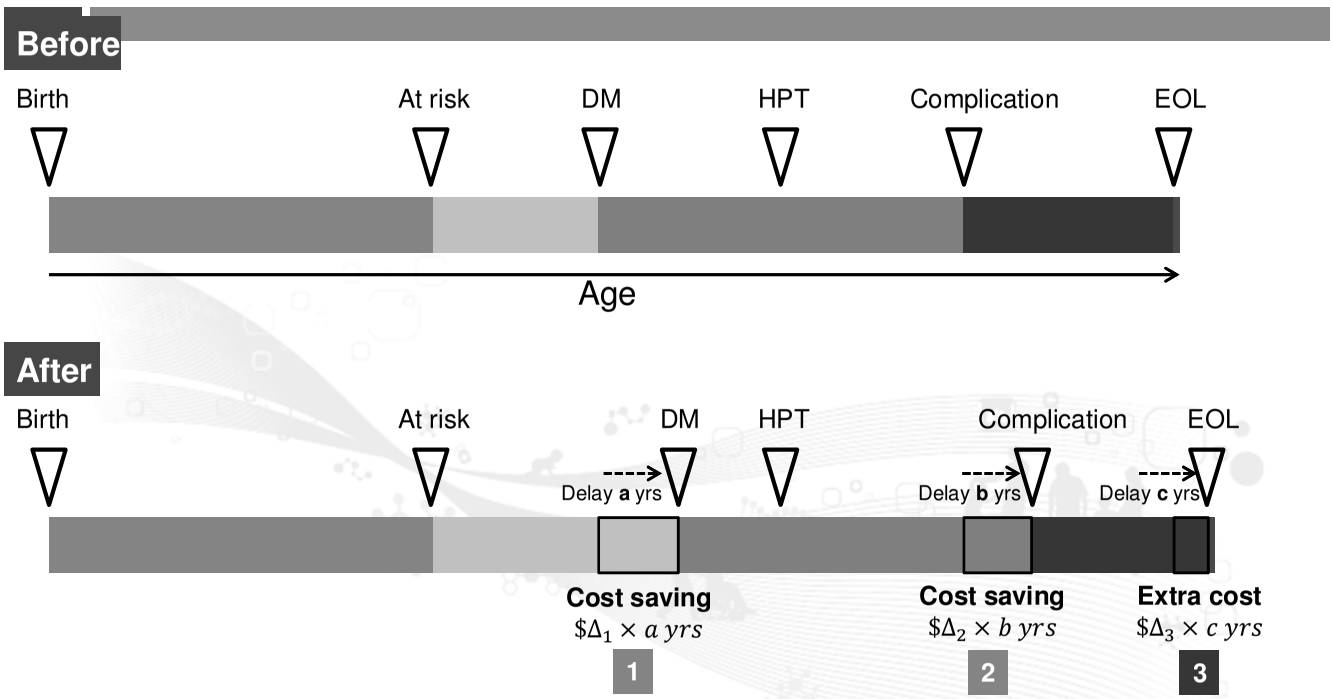


Lifetime cost would **decrease**

A diabetes prevention program



A diabetes prevention program



Increasing or decreasing lifetime cost depends on **1**,**2** and **3**

Summary

DES and Microsimulation are both simulation techniques following a bottom-up approach.

- DES focuses on the indicators of system performance, e.g., waiting time, resource utilization. It is more for resource planning and process improvement.

- Microsimulation focuses the state change within individual units. It is more for policy evaluation.