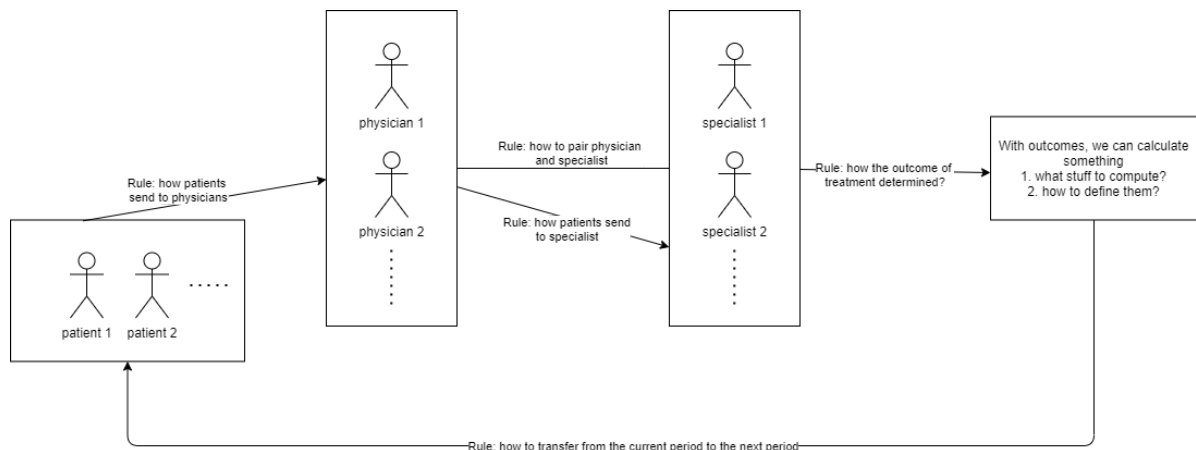# Story

Rule: how patients sent to physicians?

For each physician, there will be 4 to 6 patients allocated to. **Randomly**. When allocated to a physician, the outcome of a patient is determined (in the current period).

Rule: how to determine the quality of a specialist?

One specialist has one time-invariant quality across physicians. Such a number is drawn from a **standard uniform distribution**.

Rule: how the outcome of patients are determined?

The outcome of a patient is a standard uniform random variable. Such a number is time-variant i.e. if one patient goes to the hospital in multiple periods, then his patient outcomes are independently drawn from standard uniform distribution in each period.

Rule: how patients sent to specialist (given a physician)?

Given a physician, suppose there are x distinct specialists paired. One specialist can simultaneously serve multiple physicians.

All specialists of one physician have market shares (or probability of being chosen) whose summation is 1. It follows a uniform discrete distribution.

When one patient comes to the given physician, then he/she will be randomly allocated to one of the x specialists according to the discrete distribution. Specifically,

%TODO

Rule: how to pair physicians and specialists?

Each physician will be paired with 5 distinct specialists **uniformly** randomly. One specialist can serve multiple physicians.

Rule: how the outcome of treatments determined?

There are two kinds of outcomes: 0 for alive and 1 for dead. The outcome is a random variable and we define

$$\text{Treatment outcome} = \begin{cases} 0 & \text{if specialist quality} > \text{patient outcome} \\ 1 & \text{otherwise} \end{cases} \tag{1}$$

Rule: how to calculate the success rate for a specialist given physician?

In each period, the success rate of a specialist is defined as

$$\text{success rate}_{\text{specialist}}|\text{physician} := \frac{\text{num of alive patients}}{\text{total num of received patients}} \tag{2}$$

In one period, one specialist can have only one success rate at the place of one physician. But the specialist can have multiple success rate at the places of different physicians.

Rule: how to transfer from the current period to the next period?

- We assume that
  - The physician-specialist pairs do not change by time. One physician will always work with the same specialists once the pairs were determined
- What information to inherit? What information of this period will affect the next period?
  - Success rate this period $\implies$ market share in the next period
- How?
  - Given one specific physician, if a paired specialist has got a success rate $s_t \in [0, 1]$ and the market share of this specialist is $x_t \in [0, 1]$.