

Simple Health Clinic HCCM

Problem description

In a simple model of a health clinic, patients arrive, wait to receive treatment, receive treatment, and leave.

Common questions asked by clinic management are: "How long do our patients wait before being seen? How long are they at the clinic? How big does my waiting room need to be? ".

In this case study we are going to consider a simple health clinic model in which patients arrive every 20 mins on average. Once the doctor is ready to see them they take 2 minutes getting to the doctor's office and treatment takes between 5 and 30 minutes, with the usual treatment time of 10 minutes and the average treatment time of 15 minutes.

Objectives

The goal of this simulation study is to analyse the effects of different arrival and service distributions on the average time patients spend:

1. waiting for treatment; and
2. in the clinic;

and the average length of the patient queue (which informs waiting room size).

Output

Table 1 Output parameters

Time spend waiting for treatment	Time from Patient arrives in clinic to Doctor sees patient
Total time spend in clinic	Time from Patient arrives in clinic to Outside
Number of patients in waiting room	The number of patients waiting before Doctor sees patient

Input

Table 2 Input parameters

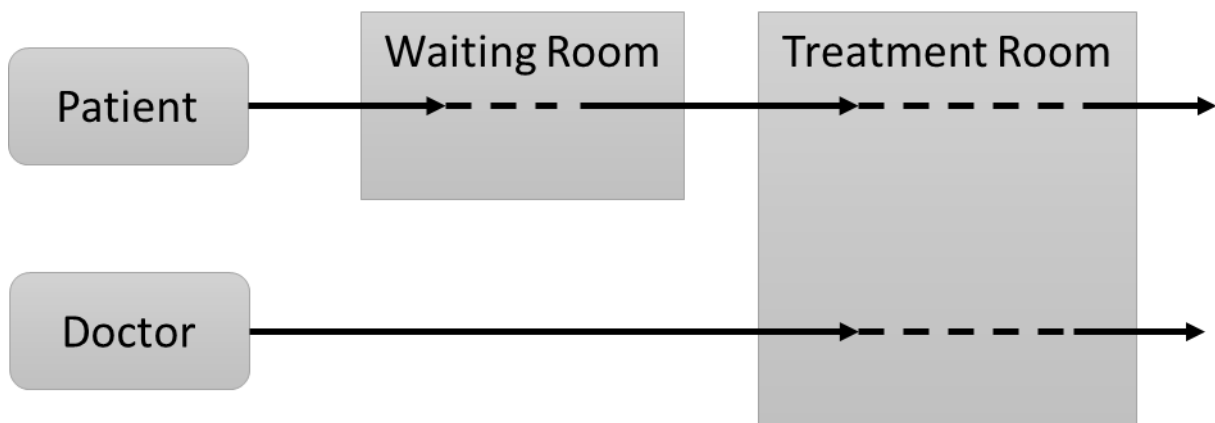
Interarrival Times	The time between arrival of patients with its distribution
Treatment Times	The time the patient spends at Doctor sees patient with its distribution
Waiting room capacity	The maximum number of patients in the waiting room

Entity list

Table 3 Entity list

No.	Entity	Active/ Passive	Attributes	Unit	Value
1	Treatment Room	Passive			
2	Waiting Room	Passive	Patient_Waiting Patient_State	Number String	Max = .. [Arrive, Wait, Treat, Leave]
3	Patient	Active	Patient_Waiting_Time Patient_Total_Time	min min	
4	Doctor	Active	Doctor_Shift Doctor_Available Doctor_State	Binary-number Binary-number String	No shift= 0 Shift = 1 Unavailable = 0 Available = 1 [Idle, Working]

Table 4 Structural view of the Health Clinic problem



Active entities individual behavior

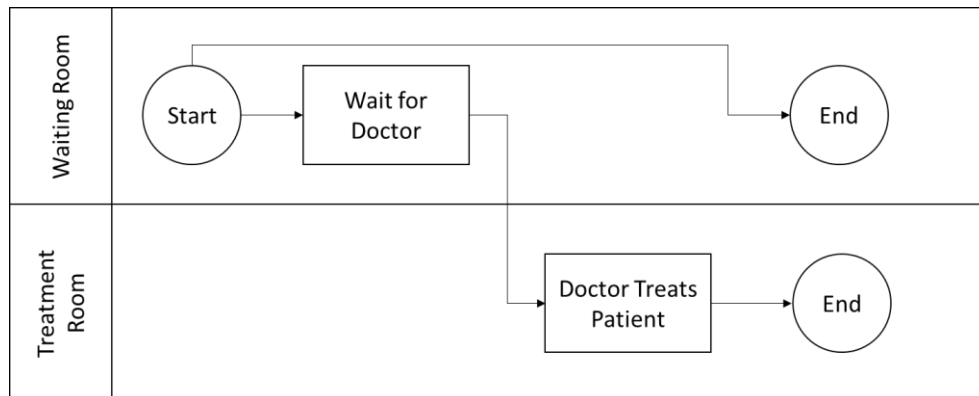


Figure 1 Behavioral view for Patient

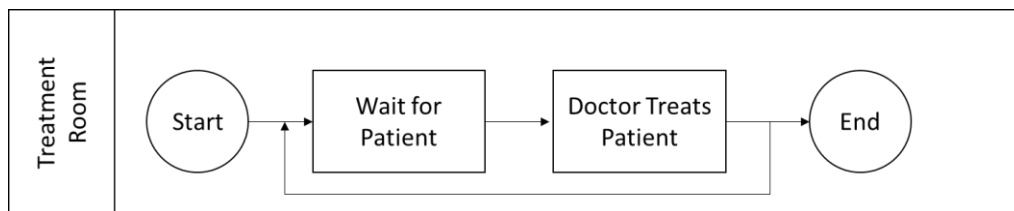


Figure 2 Behavioral view for Doctor

Activities definition

Patient Waiting	
Participating entities	Patient, WaitingRoom
Code	A01
Start type	Request
End type	Request
Start state changes	A01_Start_Time = time Patient_Waiting += 1 Patient_State = "Wait"
End state changes	Patient_Waiting_Time = time-A01_Start_Time Patient_Waiting -= 1 Patient_State = ""
Attributes	
Start Request	Patient enters WaitingRoom
End Request	Patient enters TreatmentRoom
A01_Start_Time	Time activity starts
Control units	Patient Control

Doctor at Treatment Room	
Participating entities	Doctor, Treatment Room
Code	A02
Start type	Scheduled Request
End type	Request
Start state changes	Doctor_Available = 1 Doctor_State = "Idle"
End state changes	Doctor_Available = 0 Doctor_State = ""
Attributes	
Start Request	Doctor enters TreatmentRoom
End Request	Doctor leaves TreatmentRoom
Control units	Employee Control

Doctor has Shift	
Participating entities	Doctor
Code	A03
Start type	Scheduled
End type	Scheduled
Start state changes	Doctor_Shift = 1
End state changes	Doctor_Shift = 0
Attributes	
Start Request	Doctor starts shift
End Request	Doctor ends shift
Schedule	Doctor Roster
Control units	Clinic Control

Doctor Treats Patient	
Participating entities	Patient, Doctor, Treatment Room
Code	A04
Start type	Request
End type	Scheduled
Start state changes	A04_Start_Time = time Patient_State = "Treat" Doctor_Available = 0 Doctor_State = "Working"
End state changes	Patient_Total_Time = Patient_Waiting_Time + time-A04_Start_Time Patient_State = "" Doctor_Available = 1 Doctor_State = "Idle"
Attributes	
Start Request	Doctor Starts Treatment Patient
End Scheduled Request	Doctor Ends Treatment Patient
Scheduled Time	Treatment Time
A04_Start_Time	Time activity starts
Control units	Patient Control

Control Units Definition

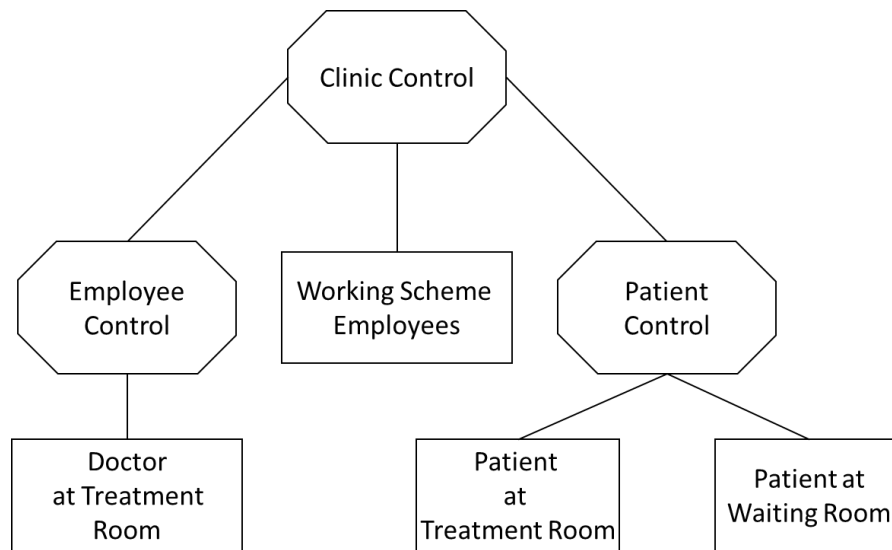


Figure 3 Control view for the Health Clinic problem

Control Units Definition		
Name	Entities	Attributes
Clinic Control	Doctor	Doctor_Shift
Employee Control	Doctor Treatment Room	Doctor_Available Doctor_State
Patient Control	Patient Waiting Room Treatment Room	Patient_Waiting Patient_Waiting_Time Patient_Total_Time Patient_State

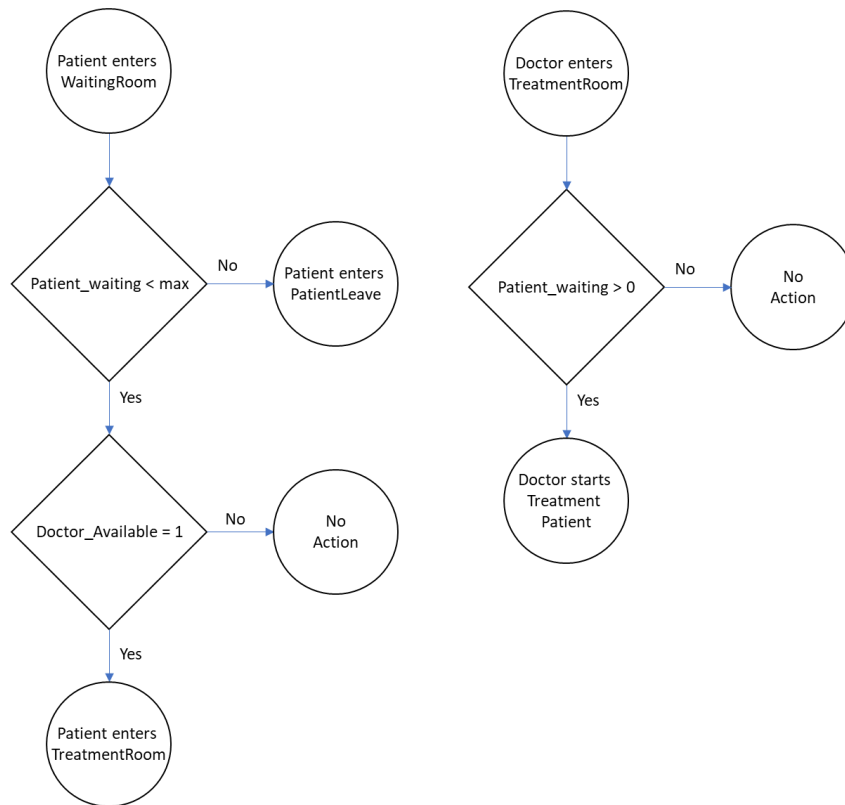


Figure 4 Control Policies

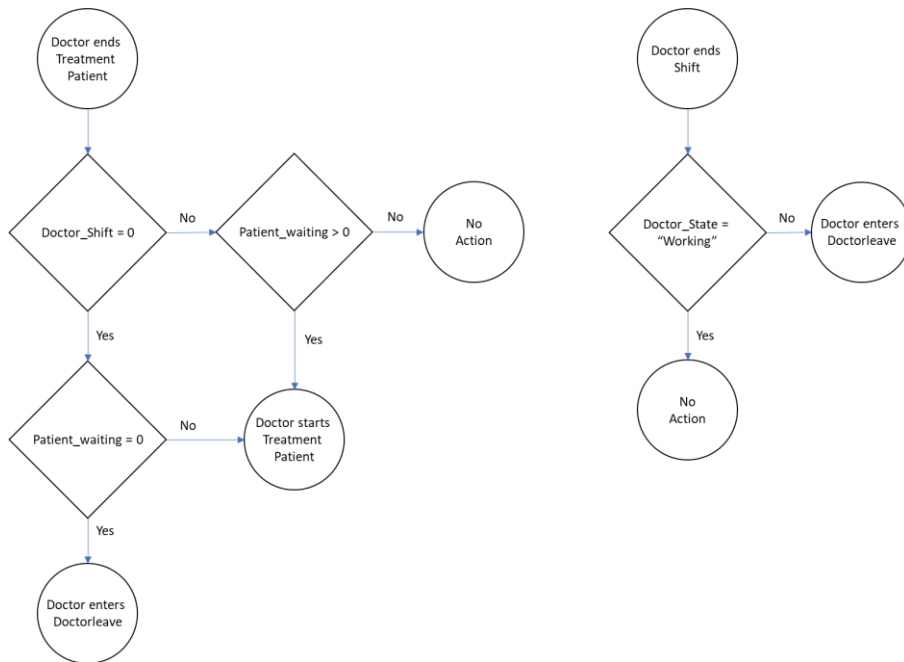


Figure 5 Control Policies