Extended Health Clinic HCCM

Problem description

This case study extends the Simple Health Clinic – Scheduled Appointments model. The extensions are:

1. Walk-up patients are triaged before receiving treatment;
2. After being triaged, some walk-up patients need to have a test performed before seeing a doctor;
3. Appointment patients arrive at their appointment times +/- a few minutes;
4. The arrival rate of walk-up patients varies over the day.

Objectives

The goal of this simulation study is to analyse 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). This analysis will include a comparison of the walk-up vs scheduled patients.

Output

Waitingtime Walk-up Patients	Time Walk-up Patient waits for triage + Time Walk-up Patient waits for Test + Time Walk-up Patient waits for treatment
Waitingtime Scheduled Patients	Time Scheduled Patient arrival to clinic till Scheduled Patient sees Doctor
Time spend in clinic by Walk-up Patients	Time from Walk-up Patient arrives in clinic to Outside
Time spend in clinic by Scheduled Patients	Time from Scheduled Patient arrives in clinic to Outside
Number of Walk-up Patients in waiting room	The number of Walk-up Patients waiting before Doctor sees patient
Number of Scheduled Patients in waiting room	The number of Scheduled Patients waiting before Doctor sees patient

Input

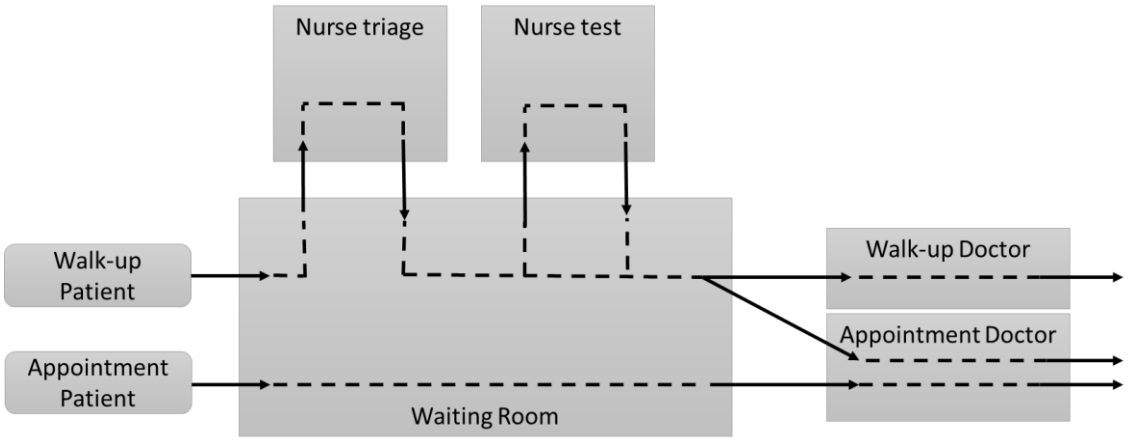
Interarrival Times Walk-up Patients	The time between arrival of Walk-up Patients with its distribution
Appointment Times Scheduled Patients	The time Scheduled Patients arrive at the clinic
Treatment Time Nurse Triage	The time the Walk-up Patient spends at Nurse Triage with its distribution
Treatment Time Nurse Test	The time the Walk-up Patient spends at Nurse Test with its distribution
Treatment Time Walk-up Doctor	The time the Walk-up Patient spends at Walk-up Doctor sees patient with its distribution

Treatment Time Appointment Doctor	The time the Scheduled Patient spends at Appointment Doctor sees patient with its distribution
Waiting room capacity	The maximum number of patients in the waiting room
Patient_Needs_Test	The probability that a Walk-up patient needs to go to Nurse Test.

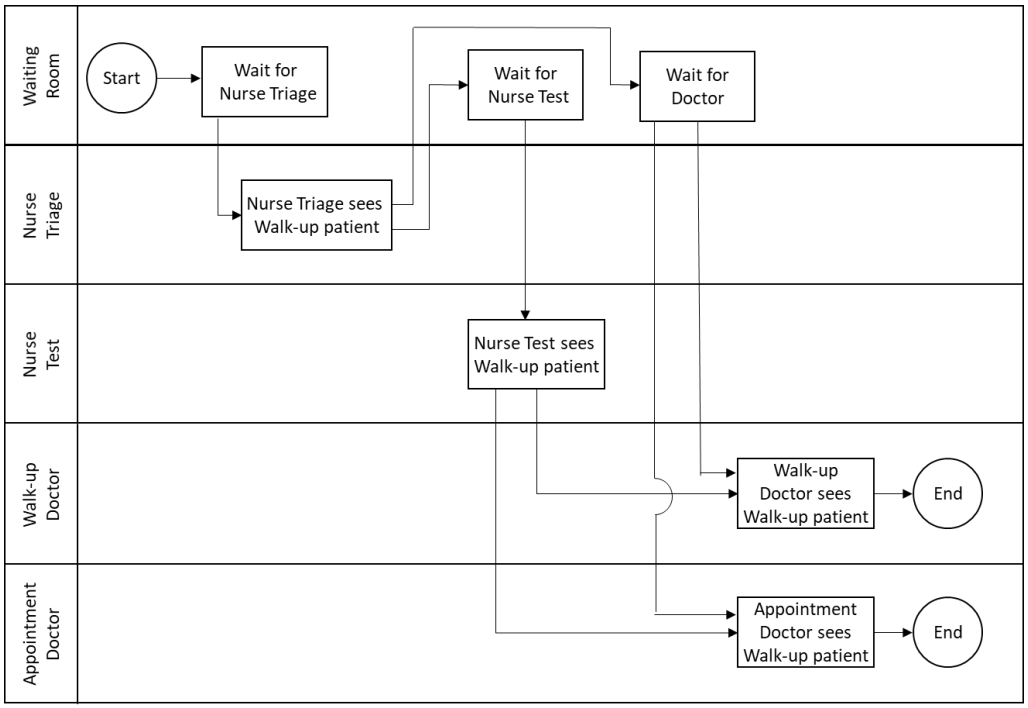
Entity list

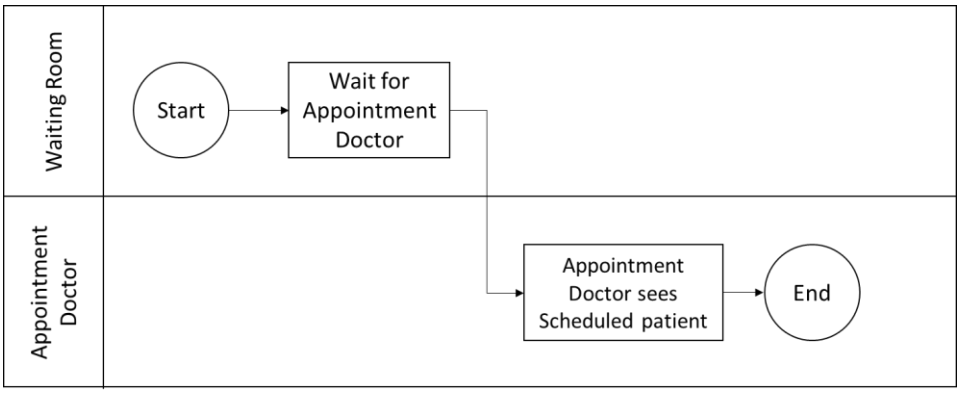
No.	**Entity**	**Active/ Passive**	**Attributes**	**Unit**	**Value**
1	**Nurse Triage**	Passive	Nurse_Triage_Occupied	Binary-number	Unoccupied = 0 Occupied = 1
2	**Nurse Test**	Passive	Nurse_Test_Occupied	Binary-number	Unoccupied = 0 Occupied = 1
3	**Walk-up Doctor**	Passive	WalkUp_Doctor_Occupied	Binary-number	Unoccupied = 0 Occupied = 1
4	**Appointment Doctor**	Passive	Appointment_Doctor_Occupied	Binary-number	Unoccupied = 0 Occupied = 1
5	**Waiting Room**	Passive	WalkUp_Patient_Waiting_Triage WalkUp_Patient_Waiting_Test WalkUp_Patient_Waiting_Treatment Scheduled_Patient_Waiting_Treatment	Number	Max (WalkUp_Patient_Waiting_Triage +WalkUp_Patient_Waiting_Test+ WalkUp_Patient_Waiting_Treatment+ Scheduled_Patient_Waiting_Treatment) = …
6	**Walk-up Patient**	Active	WalkUp_Patient_Waiting_Time_Triage WalkUp_Patient_Waiting_Time_Test WalkUp_Patient_Waiting_time_Treatment WalkUp_Patient_Time_Triage WalkUp_Patient_ Time _Test WalkUp_Patient_ Time _Treatment WalkUp_Patient_Cycle_Time PrTest	min min Number	 (0 – 1)

7	**Scheduled Patient**	Active	Scheduled_Patient_Waiting_Time_Treatment Scheduled_Patient_Cycle_Time	min min	



Active entities individual behavior





Activities definition

Walk-up Patient arrival and waiting for Nurse Triage	
Participating entities	Walk-up Patient, Waiting Room
Code	A01
Start type	Scheduled
End type	Request
Start state changes	A01_Start_Time = time WalkUp_Patient_Waiting_Triage += 1
End state changes	WalkUp_Patient_Waiting_Time_Triage = time-A01_Start_Time WalkUp_Patient_Waiting_Triage -= 1
Attributes	
Request	Nurse Triage sees Walk-up patient
A01_Start_Time	Time activity starts
Control units	Clinic Control

Nurse Triage sees Walk-up patient	
Participating entities	Walk-up Patient, Nurse Triage
Code	A02
Start type	Request
End type	Scheduled
Start state changes	A02_Start_Time = time Nurse_Triage_Occupied = 1
End state changes	WalkUp_Patient_Time_Triage = time-A02_Start_Time Nurse_Triage_Occupied = 0 Pr(Patient_Needs_Test = 1) = PrTest Pr(Patient_Needs_Test = 0) = 1-PrTest
Attributes	
Request	Nurse Triage sees Walk-up Patient
Duration	Treatment time Nurse Triage
A02_Start_Time	Time activity starts
Control units	Clinic Control

Walk-up Patient waiting for Nurse Test	
Participating entities	Walk-up Patient, Waiting Room
Code	A03
Start type	Scheduled
End type	Request
Start state changes	A03_Start_Time = time WalkUp_Patient_Waiting_Test += 1
End state changes	WalkUp_Patient_Waiting_Time_Test = time-A03_Start_Time WalkUp_Patient_Waiting_Test -= 1
Attributes	
Request	Nurse Test sees Walk-up patient
A03_Start_Time	Time activity starts
Control units	Clinic Control

Nurse Test sees Walk-up patient	
Participating entities	Walk-up Patient, Nurse Test
Code	A04
Start type	Request
End type	Scheduled
Start state changes	A04_Start_Time = time Nurse_Test_Occupied = 1
End state changes	WalkUp_Patient_Time_Test = time-A04_Start_Time Nurse_Test_Occupied = 0
Attributes	
Request	Nurse Test sees Walk-up patient
Duration	Treatment time Nurse Test
A04_Start_Time	Time activity starts
Control units	Clinic Control

Walk-up Patient waiting for Treatment	
Participating entities	Walk-up Patient, Waiting Room
Code	A05
Start type	Scheduled
End type	Request
Start state changes	A05_Start_Time = time WalkUp_Patient_Waiting_Treatment += 1
End state changes	WalkUp_Patient_Waiting_Time_Treatment = time-A05_Start_Time WalkUp_Patient_Waiting_Treatment -= 1
Attributes	
Request	Walk-up Doctor sees Walk-up patient || Appointment Doctor sees Walk-up patient
A01_Start_Time	Time activity starts

Control units	Clinic Control

Walk-up Doctor sees Walk-up patient	
Participating entities	Walk-up Patient, Walk-up Doctor
Code	A06
Start type	Request
End type	Scheduled
Start state changes	A06_Start_Time = time WalkUp_Doctor_Occupied = 1
End state changes	WalkUp_Patient_Cycle_Time = WalkUp_Patient_Waiting_Time_Triage + Walkup_Patient_Time_Triage + WalkUp_Patient_Waiting_Time_Test + Walkup_Patient_Time_Test + WalkUp_Patient_Waiting_Time_Treatment + time-A06_Start_Time WalkUp Doctor_Occupied = 0
Attributes	
Request	Walk-up Doctor sees Walk-up patient
Duration	Treatment time Walk-up Doctor
A06_Start_Time	Time activity starts
Control units	Clinic Control

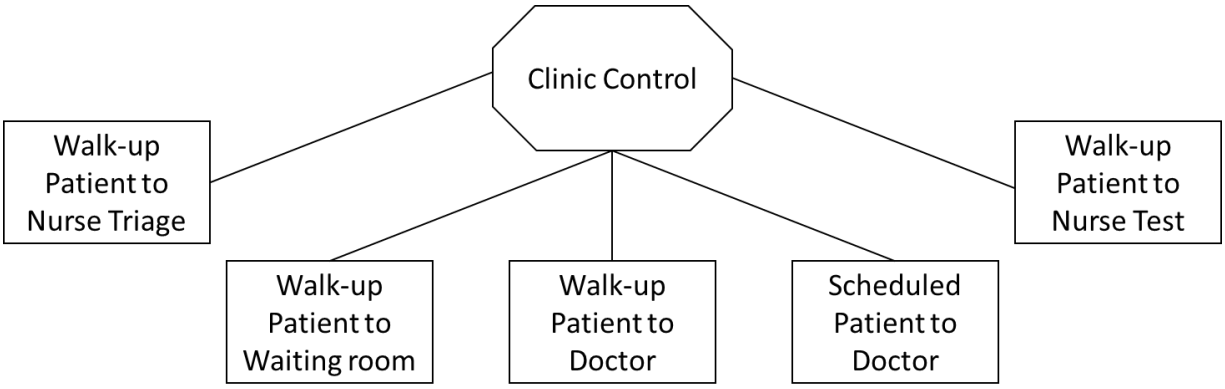
Appointment Doctor sees Walk-up patient	
Participating entities	Walk-up Patient, Appointment Doctor
Code	A07
Start type	Request
End type	Scheduled
Start state changes	A07_Start_Time = time Appointment_Doctor_Occupied = 1
End state changes	WalkUp_Patient_Cycle_Time = WalkUp_Patient_Waiting_Time_Triage + Walkup_Patient_Time_Triage + WalkUp_Patient_Waiting_Time_Test + Walkup_Patient_Time_Test + WalkUp_Patient_Waiting_Time_Treatment + time-A07_Start_Time

	Appointment Doctor_Occupied = 0
Attributes	
Request	Appointment Doctor sees Walk-up patient
Duration	Treatment time Appointment Doctor
A07_Start_Time	Time activity starts
Control units	Clinic Control

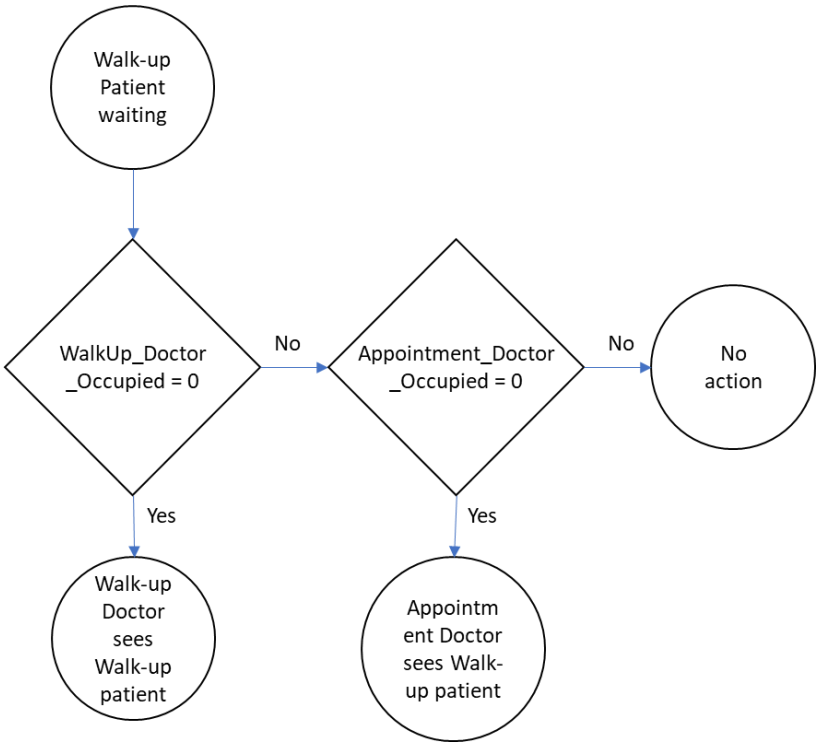
Scheduled Patient arrival and waiting	
Participating entities	Scheduled Patient, Waiting Room
Code	A08
Start type	Scheduled
End type	Request
Start state changes	A08_Start_Time = time Scheduled_Patient_Waiting_Treatment += 1
End state changes	Scheduled_Patient_Waiting_Time_Treatment = time-A08_Start_Time Scheduled_Patient_Waiting_Treatment -= 1
Attributes	
Request	Appointment Doctor sees Scheduled patient
A08_Start_Time	Time activity starts
Control units	Clinic Control

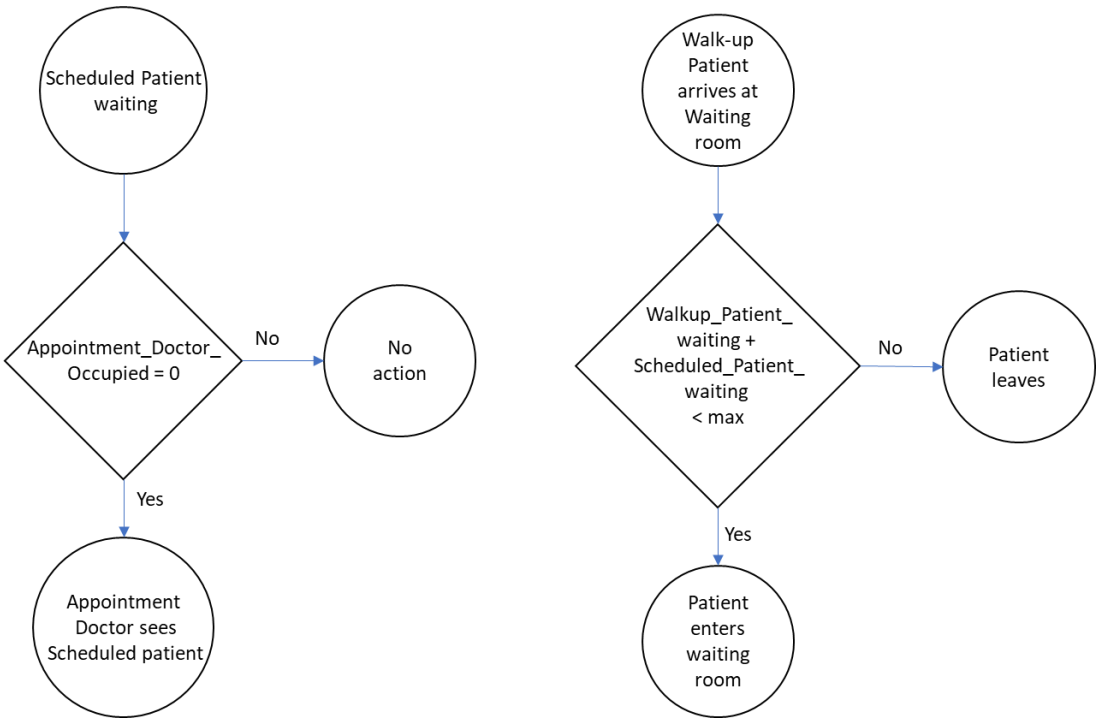
Appointment Doctor sees Scheduled patient	
Participating entities	Scheduled Patient, Appointment Doctor
Code	A09
Start type	Request
End type	Scheduled
Start state changes	A09_Start_Time = time Appointment_Doctor_Occupied = 1
End state changes	Scheduled_Patient_Cycle_Time = Scheduled_Patient_Waiting_Time + time-A09_Start_Time Appointment Doctor_Occupied = 0
Attributes	
Request	Appointment Doctor sees Scheduled patient
Duration	Treatment time Appointment Doctor
A09_Start_Time	Time activity starts
Control units	Clinic Control

Control Units Definition



Control Units Definition		
Name	Entities	Attributes
Clinic Control	**Walk-up Doctor**	WalkUp_Doctor_Occupied
	Appointment Doctor	Appointment_Doctor_Occupied
	Walk-up Patient	WalkUp_Patient_Waiting_Time_Triage
		WalkUp_Patient_Time_Triage
		WalkUp_Patient_Waiting_Time_Test
		WalkUp_Patient_Time_Test
		WalkUp_Patient_Waiting_Time_Treatment
		WalkUp_Patient_Cycle_Time
	Scheduled Patient	Scheduled_Patient_Waiting_Time
		Scheduled_Patient_Cycle_Time
	Waiting Room	WalkUp_Patient_Waiting_Triage
		WalkUp_Patient_Waiting_Test
		WalkUp_Patient_Waiting_Treatment
		Scheduled_Patient_Waiting
	Nurse Triage	Nurse_Triage_Occupied
	Nurse_Test	Nurse_Test_Occupied





Assumptions and Simplifications

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