

Comparison 6: Emergency Department - Follow-up Treatment

Casualties from accidents are admitted to an emergency department for dressing of wounds. Broken limbs are put in plaster. After a few days a follow-up examination must be performed to monitor the healing process. If necessary, additional treatment will be administered.

Follow-up treatment in the emergency department of a hospital is the discrete process to be investigated in this comparison.

The emergency department comprises the following facilities for follow-up treatment:

- Registration (one person): casualties are assigned to casualty wards 1 or 2; the necessity of further treatment is established.
- Waiting area (people waiting to enter casualty wards 1 and 2).
- Two casualty wards (CW1, CW2; with two doctors each but CW2 staffed only by inexperienced doctors for attention to simple cases).
- X-ray room with two X-ray units (but all people waiting in one single queue).
- A room where plaster casts are applied or removed (one person).

Patients start arriving at 7.30 a.m. and queue for registration. Doctors start work at 8.00 a.m. They attend to four types of patients:

- 1) Patients requiring X-raying. Patients are first examined in the casualty ward, then sent to the X-ray room. Before they leave their X-ray photographs are examined once again in the casualty ward.
- 2) Removal of plaster casts. Patients enter a casualty ward, are sent to the plastering room, then leave the department.
- 3) Plaster casts requiring X-raying and renewal. Patients enter the casualty ward, are sent to the X-ray room and given new plaster casts. After checking of the new plasters by X-raying again patients are readmitted to the casualty ward. They then leave the department.
- 4) Changing wound dressings. Patients are admitted to a casualty ward, then leave the department.

The statistical parameters are as follows:

- The time between arrivals of patients is distributed exponentially with parameter 0.3 minutes.
- The percent distribution of patients over the four groups described above is as follows:
1: 35%, 2: 20%, 3: 5%, 4: 40%.
- 60% of patients waiting for admission to a casualty ward are admitted to ward CW1, 40% to CW2. The parameters of the single treatment points show a triangular distribu-

tion (minimum value / mode = most likely value / maximum value):

Registration:	0.2 / 0.5 / 1.0 (min)
CW1:	1.5 / 3.2 / 5.0 (min)
CW2:	2.8 / 4.1 / 6.3 (min)
X-ray:	2.0 / 2.8 / 4.1 (min)
Plaster:	3.0 / 3.8 / 4.7 (min)

- Patients wait in queues before every treatment point (only one queue for X-raying!).

The following experiments should be performed:

- a) Determine average overall treatment time for 250 patients and classify these patients by types 1) to 4).
- b) Assume that a doctor from CW1 (experienced) replaces one of the inexperienced doctors in CW2 as soon as the queue for CW2 is in excess of 20 patients. Note that the working time of the doctor from CW2 now working in CW1 is increased by 20% due to the more complex cases he/she has to deal with. As soon as queue for CW2 is down to five people the inexperienced doctor still working in CW1 is returned to CW2. Perform Task a) on this assumption.
- c) Try to minimize the standard deviation of overall treatment time by introducing a priority ranking. One option: patients entering one of the treatment points for the second time (type 1 patients, type 3 patients) rank higher in priority than all other patients. Other priority rankings are of course also conceivable.

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