



**Simio 2021 December
Student Competition**

Simio Clinic and Urgent Care



Overview

The Simio Clinic and Urgent Care (SCUC) is an institution that provides a variety of medical services including wellness check-ups, minor trauma aid, lab testing, and orthopedic care. The facility is prepared for both scheduled appointments and unplanned arrivals. Patients are regularly slated for primary care appointments, but the SCUC also treats unscheduled people in need of medical attention. Unscheduled patients cannot wait days or weeks for an appointment, so the SCUC staff will assess their condition and if possible, treat them at that time or send them to a hospital for emergency care.

The SCUC administration is planning to expand its network and add a new facility. They are requesting a team to assist in preparing for the construction and opening of the new center. The administration wants to determine staffing levels and schedules to hire employees for the new location. They are also seeking guidance regarding the number and position of rooms for the layout. To acquire this information the team must review historical activity logs to account for patient arrival patterns, treatment times, and patient demographics.

The SCUC would like the team to provide staffing models assessing the tradeoffs between patient satisfaction and cost of operation. Patient satisfaction is gauged by metrics such as the time patients spend in the facility and how many patients leave the facility without being treated. The administration would like to sustain reasonable patient satisfaction levels but avoid overstaffing and empty treatment rooms which increase operating costs. Additionally, the administration is considering investing in new equipment but first would like to determine how it would affect key metrics.

Facility and Employees

This new urgent care center will be open 7 days a week starting at 7am. The facility closes to new patients at 9pm but remains open until all patients have been seen. Consequently, staff members in all departments are scheduled to stay until 10PM. Past 10PM, only employees required for patients currently in the building are required to work overtime. Any employees that are required to work beyond their scheduled shift will receive overtime pay. Overtime pay is 150% of the staff member's standard rate. Staffing rules require 9-hour shift patterns with a 60-minute mid-shift break for all employees. Table 1 shows the schedule patterns that are currently followed.

Table 1: Typical shift schedule for staff.

Shift Type	Working Periods
Early	7am – Noon, 1pm – 5pm
Late	Noon – 4pm, 5pm -10pm

The facility will be staffed by one or more of each of the following medical professionals: nurses, general physicians, receptionists, imaging technicians, orthopedic physicians, orthopedic technicians, and lab technicians. Table 2 provides the hourly rate for each employee.

Table 2: The hourly cost for each type of employee.

Caregiver	Cost per Hour
Receptionist	\$13
Nurse	\$35
Orthopedic Technician	\$25
Imaging Technician	\$21
Physician	\$90
Orthopedic Physician	\$110
Lab Technician	\$20

The facility will be comprised of a registration area, waiting room, triage area, and rooms that can be used for exams, imaging, lab tests, and procedures. Rooms and stations in the SCUC facilities require specialized machinery and equipment, which have large maintenance and utility costs. The equipment in each type of room/station varies, so each room/station accrues different costs. When the facility is opened each day, all the equipment is powered on and it will remain on until the facility is closed at the end of the day. While the equipment is powered on, each room incurs a cost at a constant hourly rate. Table 3 provides the hourly rate of cost per room/station.

Table 3: The hourly cost for each type of room or station.

Room/Station	Cost per Hour
Triage Station	\$11
Exam Room	\$17
Procedure Room	\$30
Imaging Room	\$45

After each room/station has been used, the room/station must be cleaned and set up for the next patient. In an exam room or at the triage station, this is done by a nurse. In the imaging room, these tasks are managed by an imaging technician. In the procedure room, the clean-up tasks are dependent on the patient that was last using the room. If the patient was treated for an orthopedic diagnosis, an orthopedic technician completes these tasks. In all other cases, a nurse oversees post procedure cleanup.

Patient Information

At the SCUC, patients are scheduled for one of three types of appointments. One type of appointment is for a standard checkup/exam such as physicals, vaccinations, or treatment follow-ups. The two other types of appointments are either for lab work or an x-ray and casting. All other patients at the SCUC are unscheduled patients. All new arrivals will first visit the registration desk, where they will speak to the receptionist to acquire check-in paperwork. They will travel back to the waiting area to fill out the papers, then return to the registration desk to complete their check-in. A co-pay is required upon check-in.

While in the waiting room, patients occasionally decide that they want to leave without being seen (LWBS). A patient's LWBS tolerance time is defined as the length of time a patient will wait after completing check-in, before deciding to cancel their co-pay and exit the clinic. This tolerance time can vary based on the severity of the patient's condition.

Patients arriving for unscheduled treatments will be triaged by a nurse. While waiting to be triaged, patients will stay in the waiting room. Patients with an appointment will not be triaged but will also remain in the waiting room until a nurse is available to assist them to their next location. All patient movements to or from a triage area, exam room,

procedure room, or imaging room require assistance by a nurse. Patients requiring lab work do not travel to the lab. Instead, the technician will travel to the location of the patient, collect the samples, and return with the samples to the lab. Patients will depart the facility and will be notified of lab results after the tests are complete.

Patients who are feeling unwell may be moving at slower than average walking speeds when traveling throughout the building. Some patients might also require additional aid if they have limited mobility. Wheelchairs are always readily available at the SCUC. It is estimated that 50% of geriatric patients will need a wheelchair during their visit. Additionally, about 50% of patients who have come in with a severe orthopedic injury will need a wheelchair due to the location of their trauma. The patients with wheelchairs will move on average 0.5 meters per second.

As patients arrive at the reception desk, they are helped in order of their arrival. At reception, a quick assessment is made to determine if a patient should be considered "urgent" or "stable". Patients labeled as "urgent" will be called back to triage by the nurse before patients labeled as "stable". Once a patient's condition is assessed at triage, they are assigned a numeric priority. Table 4 specifies the types of patients, along with their priority. Nurses use a patient's priority to determine who is moved into an open room so that more critical patient types are seen first. A smaller number indicates a more critical patient condition.

Table 4: The patient types treated at the SCUC and their associated ID and priority.

Patient Type	Type ID	Priority
Mild Sickness	1	5
Standard Sickness	2	4
Injuries Ortho-setting/casting	3	2
Injuries Ortho- Non setting/casting	4	3
Injuries - Laceration	5	2
Injuries – Minor Cut Bruise	6	3
Cardio problems	7	1
Severe Non-Treatable	8	1
Scheduled Appointment	9	5

Activity and Patient Data

Since the new facility is not yet operational, the team will be unable to make decisions based on data from the actual facility. Therefore, the administration has prepared historical data from another SCUC location, known as SCUC West, for the team to analyze. The new SCUC location will perform many of the same treatments and procedures as the existing SCUC West location, so SCUC West's data can be used to generalize how the new facility might operate.

Files given to review include SCUC West's patient records which share information on demographics such as age and gender. Patients 65 and older are considered geriatric patients while patients under the age of 18 are considered pediatric patients. These demographics could impact treatment times for certain procedures. For example, patients in the 18-64 age range might be observed for longer after cardio treatment since cardio issues are more likely to begin developing in this age range.

SCUC has also prepared patient logs from SCUC West's patient treatment database. The logs contain timestamped patient activities starting when they request check-in paperwork and ending when they complete checkout. The log includes information about rooms and staff required for each task. Due to the equipment required, some procedures are only done in a procedure room, not an exam room.

SCUC facilities use a system to display and record the statuses of the rooms. Statuses indicate if the room is available, unavailable, or being cleaned. This allows the caregivers to know if a patient can be moved into a room or if the room must be sanitized and set up for the next patient. The time a room is unavailable might not reflect the total time it is in use, as caregivers are not always readily available to start cleaning. The log collecting the timestamps and status changes for rooms from the SCUC West location is included in the provided data.

Because the new urgent care is located in a new area, the administration anticipates a notable change in patient demographics, which in turn will affect the mix and average service times of patients. Table 5 shows the established SCUC West's estimated age demographics and the new locations predicted age demographics. In addition to age demographics, the estimated service population of the new location is significantly larger than the SCUC West location. The estimated service population of the SCUC

West is 154,000, while the estimated service population of the new location is 223,000. The administration expects this increase in service population to affect both the number of scheduled patients and the number of unscheduled patients.

Table 5: The age demographics of the population each SCUC facility serves.

	Pediatric	Middle-aged	Geriatric
Established location (SCUC West) – estimated age demographics	25%	58%	17%
New location – predicted age demographics	9%	55%	36%

Analysis and Problem Deliverables

The primary objective of this project is to minimize the cost of the proposed new facility in terms of the number of rooms and staffing levels to achieve a reasonable level of patient satisfaction. The SCUC measures patient satisfaction using two metrics: patient time in the clinic and the percentage of patients who leave without being seen (LWBS). The administration does not have a quantitative goal for how long patients are in the facility, but in general, would like to decrease the length of time. Although an LWBS of 0% is ideal, this may be cost prohibitive to achieve. An LWBS of 10% or more is considered unacceptable.

The SCUC administration would like evidence that shows the model is a good representation of their future facility. Devise and implement a validation plan for the project.

Evaluation Questions:

1. The requirements for the new facility's layout have not yet been determined. With the growth of service population, the SCUC administration anticipates the relative position and quantity of rooms may change. What staffing level and number of each type of room results in the lowest cost while maintaining an acceptable LWBS level? Include a recommendation about how rooms/stations might be placed for optimal patient flow.
2. Offer alternative employee schedules showing tradeoffs between patient satisfaction and cost. Should staffing levels change throughout the week?
3. Study the effect of hiring physician assistants (PA) for the new location. PAs have an hourly rate of \$55 and can cover the physician's roles for patients that are mildly sick, patients with minor and major lacerations, and patients with scheduled check-ups.
4. Since there are no scheduled appointments on weekends, demand for orthopedic physicians might be reduced. Consider testing an approach where one or more of the orthopedic physicians are on-call for part or all of Saturday or Sunday. If on-call, it takes about 30 minutes for the orthopedic physician to arrive at the center. In this scenario, they will receive 50% of their regular pay while on-call and 150% if called in. If called in, they will continue to be paid 50% of their regular pay while traveling to the facility.
5. The SCUC must be prepared for occurrences which might cause an influx of patients to arrive. If all scheduled appointments for a day are canceled, what is the anticipated maximum number of unscheduled patients that can be seen within standard operating hours? Assume that no new patients will be accepted past closing time. Adjust staffing levels accordingly, but the layout decided in the standard operating plan must remain the same.

Challenge Problem A

The SCUC administration is considering adding a different type of room to the facility. This will be a versatile space that is used to triage patients as well as perform exam

room activities. The hourly cost for the hybrid room will be \$21 per hour and the cleaning time will be roughly similar to that of an exam room. Determine if the SCUC should build any of these hybrid rooms. Will these replace any triage stations or exam rooms from the initial layout design?

Challenge Problem B

The SCUC is evaluating if the addition of kiosks to automate the check-in and check-out process would benefit the facility. These kiosks would be able to perform all the same tasks as the registration desk. When checking in with a kiosk, instead of working on paperwork while sitting in the waiting room, the patient will use the machine to complete the required documents. The kiosk will also accept patients' co-pay and can refund patients if they choose to leave without being seen. When using the machine, there is a 4% chance the check-in or check-out will fail. When a failure occurs, the patient will need to restart the process with a receptionist. One kiosk will cost \$1,845 dollars, and each year a \$1,500 general service fee is required for software maintenance which covers all kiosks. Should the SCUC invest in kiosk machines, and if so, how many? How long before the SCUC would see a return on their investment?

Data File

Included in the SCUC West – Data Logs Excel workbook (SCUCWestDataLogs.xlsx) are three sheets: Activity Log, Patient Data, and Room Log. The link to the file containing the SCUC West data can be found below.

https://cdn.simio.com/StudentCompetition/2021_SCUCWestDataLogs.xlsx