

Workshop on Advancing Data-Driven Healthcare Solutions.
**Application of Optimisation and Queueing Models in
Healthcare Operations.**

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National Institute *for*
Mathematical Sciences
Ghana

OUTLINE OF PRESENTATION

INTRODUCTION

SOME CONSTRAINTS FROM THE UROLOGY DEPARTMENT-KATH

RESULTS

OPEN FOR DISCUSSIONS



THE HEALTHCARE SCHEDULING PROBLEM



Figure 1: A Nurse Schedule

An Automated Nurse Scheduler With An Auxiliary Schedule To Address Absenteeism And Upsurge in Patient Demand.



CONSTRAINTS CONSIDERED

1. Ensures maximum of three consecutive shifts off if the nurse works four consecutive night shifts in his/her individual schedule.
2. Requires that each nurse work a minimum number of afternoon shifts.
3. Ensures that no weekend shifts are scheduled for head nurses.
4. Ensures that the required number of nurses is present in each shift throughout the day.
5. Ensures that each nurse is only assigned one shift type (i.e. morning, afternoon, night, day off, auxiliary shift).
6. Ensures a night shift does not immediately follow a morning shift the next day.



RESULTS

Table 1: PNO_1s' schedule

| | Week_one | | | | | | | Week_two | | | | | | | Week_three | | | | | | | Week_four | | | | | | |
|-----------|----------|------|------|------|------|------|------|----------|------|------|------|------|------|------|------------|------|------|------|------|------|------|-----------|------|------|------|------|------|------|
| | Mond | Tues | Wedn | Thur | Frid | Satu | Sund | Mond | Tues | Wedn | Thur | Frid | Satu | Sund | Mond | Tues | Wedn | Thur | Frid | Satu | Sund | Mond | Tues | Wedn | Thur | Frid | Satu | Sund |
| Morning | M | M | M | M | M | - | - | M | M | M | M | M | - | - | M | M | M | M | M | - | - | M | M | M | M | M | - | - |
| Afternoon | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Night | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Aux-M | - | - | - | - | - | - | S | - | - | - | - | - | - | - | - | - | - | - | - | - | S | - | - | - | - | - | - | |
| Aux-A | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | S | - | |
| Aux-N | - | - | - | - | - | - | - | - | - | - | - | - | S | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Day_off | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | D | |
| Day_off | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Day_off | - | - | - | - | - | D | - | - | - | - | - | - | - | D | - | - | - | - | - | D | - | - | - | - | - | - | - | |



Table 2: SSN_1s' schedule

| | Week_one | | | | | | | Week_two | | | | | | | Week_three | | | | | | | Week_four | | | | | | |
|-----------|----------|------|------|------|------|------|------|----------|------|------|------|------|------|------|------------|------|------|------|------|------|------|-----------|------|------|------|------|------|------|
| | Mond | Tues | Wedn | Thur | Frid | Satu | Sund | Mond | Tues | Wedn | Thur | Frid | Satu | Sund | Mond | Tues | Wedn | Thur | Frid | Satu | Sund | Mond | Tues | Wedn | Thur | Frid | Satu | Sund |
| Morning | M | - | - | - | - | M | - | M | - | - | - | - | - | - | - | M | - | M | M | M | M | M | - | M | M | M | - | - |
| Afternoon | - | - | A | A | - | - | A | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | A | - |
| Night | - | - | - | - | - | - | - | - | N | N | N | N | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Aux-M | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Aux-A | - | - | - | - | S | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Aux-N | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | S | - | - | - | - | - |
| Day_off | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | D | - | - | - | - | - | - | - | - | - | - | - |
| Day_off | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Day_off | - | D | - | - | - | - | - | - | - | - | - | - | D | D | D | - | - | - | - | - | - | - | - | - | - | - | - | D |



Table 3: SSN_5s' schedule

| | Week_one | | | | | | | Week_two | | | | | | | Week_three | | | | | | | Week_four | | | | | | |
|-----------|----------|------|------|------|------|------|------|----------|------|------|------|------|------|------|------------|------|------|------|------|------|------|-----------|------|------|------|------|------|------|
| | Mond | Tues | Wedn | Thur | Frid | Satu | Sund | Mond | Tues | Wedn | Thur | Frid | Satu | Sund | Mond | Tues | Wedn | Thur | Frid | Satu | Sund | Mond | Tues | Wedn | Thur | Frid | Satu | Sund |
| Morning | - | M | M | M | - | M | M | - | M | - | M | M | M | M | M | - | - | M | M | M | M | - | M | M | M | - | M | M |
| Afternoon | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Night | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Aux-M | - | - | - | - | S | - | - | - | - | S | - | - | - | - | - | - | S | - | - | - | - | - | - | - | - | S | - | - |
| Aux-A | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Aux-N | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Day_off | D | - | - | - | - | - | - | D | - | - | - | - | - | - | - | D | - | - | - | - | - | D | - | - | - | - | - | |
| Day_off | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Day_off | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |



WHAT NEXT ?



Figure 2: What next ?



HOSPITAL REFERRAL SYSTEM IN LOWER MIDDLE INCOME COUNTRIES (LMIC)

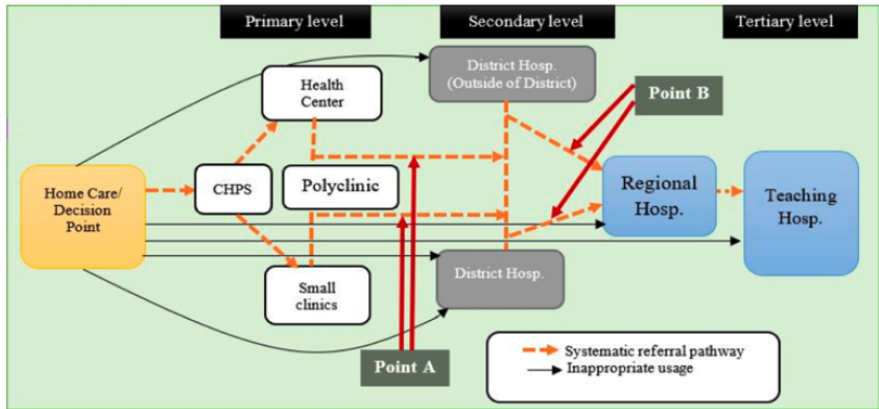


Figure 3: Ghana's Healthcare Referral System



PROBLEM STATEMENT



Figure 4: Overcrowded Hospital

PROBLEM STATEMENT



Figure 5: Registration Process



PROBLEM STATEMENT



Figure 6: Queues to See A Doctor.

PROBLEM STATEMENT



Figure 7: Referred Cases



PROBLEM STATEMENT

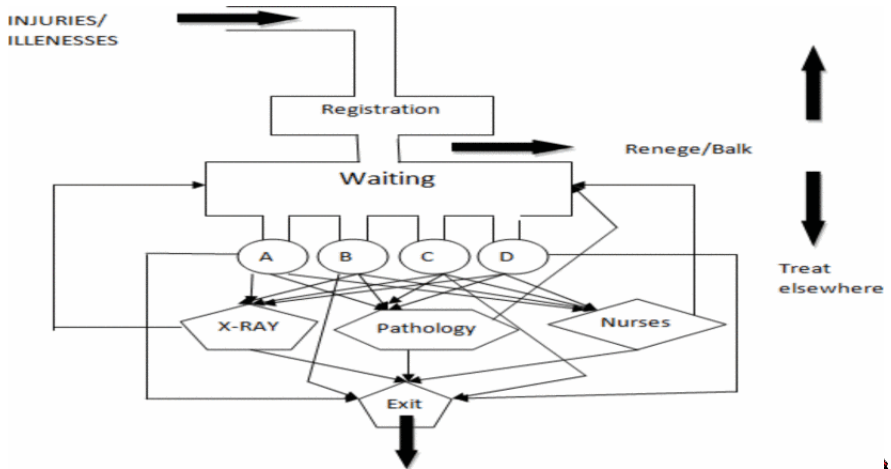


Figure 8: Patient Flow



PROBLEM STATEMENT

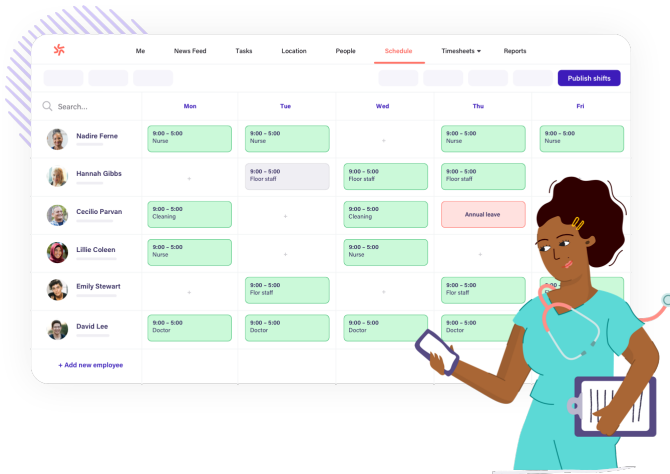


Figure 9: Nurse Scheduling

BASIC UNDERSTANDING OF QUEUES

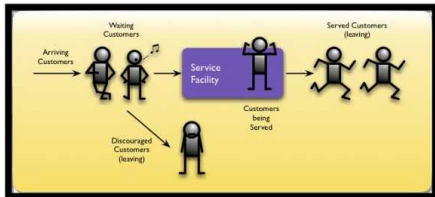


Figure 10: Queue



BASIC UNDERSTANDING OF QUEUES

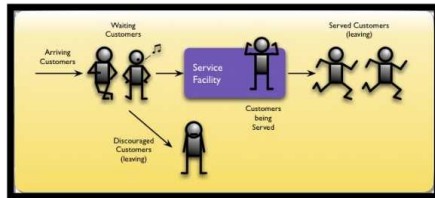


Figure 10: Queue

- A queuing system can be describe as patients arriving for service, waiting for service if it is not immediate, utilizing the service, and leaving the system after being served.



OPEN FOR DISCUSSIONS

- What are the clinical pathways in the hospital?
- How are multiple treatments handled?
- How do you currently deal with an increase in patient demand?
- How are revisits handled?



References

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