Creating Triage Pseudocode

Preamble

In this assignment, I am undertaking the daunting task of creating an emergency triage pseudocode. To reduce complications, I will begin by breaking the process down into key factors that I believe should be considered, along with additional factors identified during my research.

To triage patients effectively, I must consider not only the patient's condition, but also the hospital's available resources. For example, this includes the number of doctors and nurses available to treat patients, the number of available beds, and other resources needed for care.This is important because triage is not only about identifying how sick a patient is, but also about deciding how care should be prioritized when resources are limited.

Next, I will need to reassess vital signs, identify valid clinical ranges, and examine different combinations of vital signs that may indicate a patient is at higher risk and requires urgent attention.

I will also need to examine a patient's pre-existing conditions as well to help place them in different risk categories, such as critical, high risk, low risk, and expectant cases- where the chance of survival may be extremely limited even with intervention. This would further help prioritise patients.

To get the possible best results I tried to combine a few elements of various existing triage systems globally.

PseudoCode

```
START AI_TRIAGE_SYSTEM

INPUT hospital_resources # needed to determine who gets priority based on
limited resources
   number_of_available_doctors
   number_of_available_nurses
   number_of_available_beds
   available_resuscitation_bays
   mass_casualty_status

INPUT patient_records
   patient_ID
   age
   gender
   pre_existing_conditions # crucial in determining escalation
   GCS
   SBP
   DBP
   MAP
   pulse
   temperature
   respiratory_rate
   FiO2
   SpO2 # added based on research for assignment 5
   time_of_triage #used to keep track of reassessment



IF available_doctors < 2 OR available_nurses < 2 THEN #values will change
according to each hospital's staff requirement
   hospital_capacity_status = "STAFF SHORTAGE"

ELSE IF available_beds = 0 OR available_resuscitation_bays = 0 THEN
   hospital_capacity_status = "LIMITED SPACE"
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ELSE
   hospital_capacity_status = "ADEQUATE CAPACITY"
END IF


FOR EACH patient IN patient_records DO #keep a track of patients in a
record

   SET danger_flags = empty list #a synopsis of possible patient ailment
based on abnormal vital levels
   SET risk_flags = empty list #pre_existing conditions/ any pertinent
info on a patient that will put him/her at a higher risk
   SET triage_colour = "BLUE" #automatically places patient in the lowest
category
   SET reassessment_time = 240 minutes
   SET staff_alert_required = "NO"

DEFINE triage_categories:

   WHITE:
       severity_order = 1

   BLUE:
       severity_order = 2

   GREEN:
       severity_order = 3

   ORANGE:
       severity_order = 4

   RED:
       severity_order = 5

   BLACK:
       severity_order = 6

   #check patient risk factors
   IF age >= 65 THEN
       ADD "Older patient" TO risk_flags
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   END IF

   IF age <= 5 THEN
       ADD "Young child" TO risk_flags
   END IF

   IF pre_existing_conditions includes heart disease,
      respiratory disease,
      diabetes,
      kidney disease,
      pregnancy,
      stroke history,
      heart attack history,
      cancer,
      autoimmune disease,
   THEN
       ADD pre_existing_conditions TO risk_flags
   END IF


   #reusable function that will categorize patient’s vital sign

   FUNCTION UPDATE_TRIAGE(new_colour, new_time, reason):
     ADD reason TO danger_flags
     IF severity_order[new_colour] > severity_order[triage_colour] THEN
#the worst symptom will be stored and displayed
         triage_colour = new_colour
         reassessment_time = new_time
     END IF
   END FUNCTION

 #this is not an exhausted list and are just some of the numerous vital
signs combinations that can be used categorise patients
   IF SpO2 < 90 AND respiratory_rate > 30 THEN
   UPDATE_TRIAGE("RED", 0 minutes,
   "Low oxygen saturation with severe respiratory distress")
   END IF

   IF GCS <= 8 THEN
       UPDATE_TRIAGE("RED", 0 minutes,
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    "Severely reduced consciousness")
END IF

IF respiratory_rate > 30 OR respiratory_rate < 8 THEN
    UPDATE_TRIAGE("RED", 0 minutes,
    "Dangerously abnormal respiratory rate")
END IF

IF SBP < 90 OR MAP < 65 THEN
    UPDATE_TRIAGE("RED", 0 minutes,
    "Possible shock or poor organ perfusion")
END IF

IF pulse < 40 THEN
    UPDATE_TRIAGE("RED", 0 minutes,
    "Dangerously low pulse")
END IF

IF FiO2 >= 60 AND respiratory_rate > 30 THEN
    UPDATE_TRIAGE("RED", 0 minutes,
    "High oxygen requirement with respiratory distress")
END IF

IF SpO2 < 90 THEN
    UPDATE_TRIAGE("RED", 0 minutes,
    "Severe low oxygen saturation")
END IF

IF GCS BETWEEN 9 AND 12 THEN
    UPDATE_TRIAGE("ORANGE", 10 minutes,
    "Moderately reduced consciousness")
END IF

IF SBP <= 100 AND respiratory_rate >= 22 THEN
    UPDATE_TRIAGE("ORANGE", 10 minutes,
    "Possible sepsis or clinical deterioration")
END IF

IF temperature > 38.5 AND pulse > 100 AND respiratory_rate > 22 THEN
    UPDATE_TRIAGE("ORANGE", 10 minutes,
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    "Fever with raised pulse and raised respiratory rate")
END IF

IF SBP > 180 AND DBP > 120 THEN
    UPDATE_TRIAGE("ORANGE", 10 minutes,
    "Severely elevated blood pressure")
END IF

IF pulse > 130 THEN
    UPDATE_TRIAGE("ORANGE", 10 minutes,
    "Severely raised pulse")
END IF

IF FiO2 >= 40 AND respiratory_rate >= 24 THEN
    UPDATE_TRIAGE("ORANGE", 10 minutes,
    "Increased oxygen requirement with raised breathing rate")
END IF

IF SpO2 BETWEEN 90 AND 94 THEN
    UPDATE_TRIAGE("ORANGE", 10 minutes,
    "Low oxygen saturation requiring urgent monitoring")
END IF

IF respiratory_rate >= 21 THEN
    UPDATE_TRIAGE("GREEN", 60 minutes,
    "Raised respiratory rate")
END IF

IF pulse >= 110 THEN
    UPDATE_TRIAGE("GREEN", 60 minutes,
    "Raised pulse rate")
END IF

IF temperature >= 38 THEN
    UPDATE_TRIAGE("GREEN", 60 minutes,
  "Fever present")
END IF

IF SBP < 110 THEN
    UPDATE_TRIAGE("green", 60 minutes,
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        "Borderline low blood pressure")
    END IF

    IF FiO2 > 21 THEN
        UPDATE_TRIAGE("green", 60 minutes,
        "Patient requires oxygen above room air")
    END IF

    IF danger_flags is empty THEN

        IF GCS = 15
          AND SBP BETWEEN 110 AND 180
          AND MAP >= 65
          AND pulse BETWEEN 60 AND 109
          AND respiratory_rate BETWEEN 12 AND 20
          AND temperature < 38
          AND FiO2 = 21
          AND SpO2 >= 95 THEN

            triage_colour = "BLUE"
            reassessment_time = 120 minutes
            ADD "Stable vital signs" TO danger_flags
        ELSE
            triage_colour = "WHITE"
            reassessment_time = 240 minutes
            ADD "No abnormal pattern detected" TO danger_flags

        END IF

  END IF


   #adjust triage score based on patient risk factors

  IF risk_flags is not empty THEN
    IF triage_colour = "WHITE" THEN
        triage_colour = "BLUE"
        reassessment_time = 120 minutes
        ADD "Escalated due to age or pre-existing condition" TO
danger_flags
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   ElSE IF triage_colour = "BLUE" THEN
       triage_colour = "GREEN"
       reassessment_time = 60 minutes
       ADD "Escalated due to age or pre-existing condition" TO
danger_flags

   ELSE IF triage_colour = "GREEN" THEN
       triage_colour = "ORANGE"
       reassessment_time = 10 minutes
       ADD "Escalated due to age or pre-existing condition" TO
danger_flags

   ELSE IF triage_colour = "ORANGE" THEN
       triage_colour = "RED"
       reassessment_time = 0 minutes
       ADD "Escalated due to high-risk background factors" TO danger_flags

   END IF

 END IF

 SET number_of_RED_patients_waiting = COUNT patients WHERE triage_colour =
"RED" #keep a count of how many patients are RED, this becomes especially
useful in a mass casualty scenario

    #adjust triage based on hospital resources

   IF (hospital_capacity_status = "STAFF SHORTAGE"
      OR hospital_capacity_status = "LIMITED SPACE")
      AND mass_casualty_status = "YES"
   THEN

       IF patient has extremely low chance of survival AND
number_of_RED_patients_waiting > available_resuscitation_bays THEN
#quantifying what would be considered low chances of survival can be
further triaged using the "Mass Casualty Incident Triage"

         ADD "low survival likelihood" TO danger_flags
         triage_colour = "Black"
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        reassessment_time = "Physician review required" #allow physician
review for safe measure

     Else
          ADD “Resusitation/Immediate Care!” to danger_flags
          triage_colour=’RED’
          reassessment_time=0 minutes


    END IF

   END IF


   #calculate the reassessment timer

   next_reassessment_time = time_of_triage + reassessment_time

   STORE patient_ID
   STORE triage_colour
   STORE danger_flags
   STORE risk_flags
   STORE hospital_capacity_status
   STORE time_of_triage
   STORE next_reassessment_time


END FOR



#monitor reassessment times


WHILE patient_in_waiting_room DO

   current_time = GET CURRENT TIME

   FOR EACH patient IN patient_records DO
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      IF current_time >= patient.next_reassessment_time THEN

          staff_alert_required = "YES"

          DISPLAY:
              "Patient [patient.patient_ID] assigned
[patient.triage_colour] is due for reassessment."


          REASSESS patient vital signs:
              GCS
              SBP
              DBP
              MAP
              pulse
              temperature
              respiratory_rate
              FiO2
              SpO2

          UPDATE danger_flags

          IF patient condition has worsened THEN
              UPDATE_TRIAGE(new_colour, new_time, reason)
          END IF

          IF patient condition has improved THEN
              downgrade (new_color,new_time,reason) # in further creation
of the system a downgrade logic will be created to handle those cases
          END IF

          SET new_next_reassessment_time = current_time +
reassessment_time

         UPDATE patient record

      END IF

   END FOR
```

```
END WHILE



OUTPUT:
   patient_ID
   triage_colour
   danger_flags
   treatment_action
   hospital_capacity_status
   time_of_triage
   next_reassessment_time
   staff_alert_status

END AI_TRIAGE_SYSTEM
```

Discussion

As aforementioned, apart from gathering patient vitals, I also decided to assess hospital resources, including available doctors, nurses, beds, and resuscitation bays. This decision was influenced by the Emergency Severity Index, which considers not only patient urgency but also the resources needed to manage the patient. This is important because triage decisions become more crucial when staff, beds, or emergency spaces are limited as priority must now be given to critically ill and “able to save” patients.

The colour-coded categories and reassessment times were based mainly on the Australian Triage Scale and the Manchester Triage System respectively, which uses urgency levels linked to color-coding and maximum waiting times. In this pseudocode, Red represents immediate care, Orange represents reassessment within 10 minutes, Green within 60 minutes, Blue within 120 minutes, and White within 240 minutes. These times help ensure that patients are not only categorized, but are also reassessed while waiting. ￼ ￼

The system also considers age and pre-existing conditions as risk factors. Patients who are elderly, very young, pregnant or who have conditions such as heart disease, respiratory disease, diabetes etc may be at higher risk of rapid and alarming deterioration. Hence, these factors can escalate a patient’s triage colour if they already have abnormal vital signs.

The UPDATE_TRIAGE function ensures that the patient is assigned the most severe colour category detected. This prevents the system from stopping at the first abnormal vital sign and

missing worse findings later in the assessment. For example, if a patient has both a green-level fever and a red-level oxygen problem, the final category remains Red.

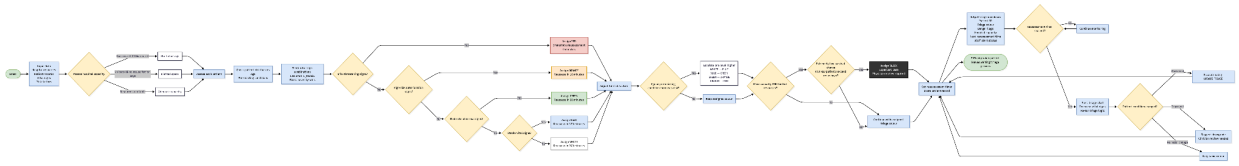
The pseudocode also includes a reassessment monitoring loop. Once a patient is assigned a colour, the system calculates the next reassessment time. When that time is reached, staff are alerted, the patient's vital signs are reassessed, and the triage logic is rerun. This reflects the fact that triage is not a one-time decision, since patients may worsen or improve while waiting.

During mass-casualty, the system includes an expectant category requiring physician review. This part is influenced by the SALT triage, where limited resources may affect who gets treated.

At this stage, the pseudocode does not yet handle patient discharge, admission, or transfer. Additionally, this triage system is only limited to the vital signs I had been given in the tutorials, hence there is always room to improve the metrics on which we based patient prioritization. For example, the addition of the patient's chief complaint would be useful alongside the patient's vital signs to further diagnose him/her. Additionally, It should also be noted that the combinations of vital signs used in this pseudocode were based on patterns identified during research and are not exhaustive. Therefore, much larger amounts of patient data would be required to properly train and improve the accuracy of the system.
Moreover, further consideration must be given to the seminar conducted by Dr. Loren and her colleagues, where they highlighted the severe resource limitations within the Caribbean healthcare systems, including the continued use of pen and paper processes. Nevertheless, this was intended to be a simplified overview focusing primarily on triage categorization, escalation, reassessment alerts, and patient prioritization.

Flowchart

Attached below is a flowchart visualising the key details from my pseudocode



References:

Yancey, C. C., & O'Rourke, M. C. (2023). Emergency department triage. In *www.ncbi.nlm.nih.gov*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK557583/