Treatment Tracking for Brain Tumor Patients

Isabella | CIS 129

01

Introduction

THE TOPIC: the basics and importance

- Temozolomide (TMZ) is the first line chemotherapy treatment for malignant brain tumors such as grade III astrocytomas and grade IV glioblastomas

- Standard of care: surgical resection + radiation + concurrent chemotherapy (TMZ) + adjuvant therapy

- Specific regimen for concurrent and adjuvant chemotherapy

    - Concurrent: daily temozolomide for 42 days dosed at 75 mg/m2
    - Adjuvant: TMZ days 1-5 out of a 28-day cycle dosed at 150 or 200 mg/m2

- Why this topic?

    - I work with brain tumor patients, and they often struggle to keep track of their treatment whether that be the total dose or which day of treatment they are on

    - Tracking patient treatment schedules would help boost patient compliance
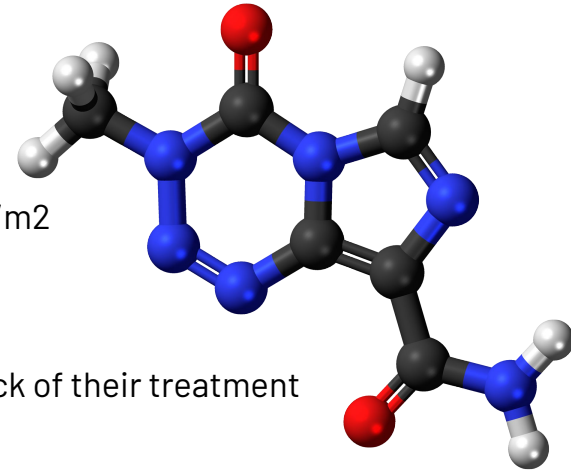
THE TOPIC: patient compliance

- Patient compliance is a barrier to optimal outcomes for various diseases/illnesses

- Monitoring compliance can improve health outcomes by preventing adverse events clinically (symptoms) or structurally (e.g tumor progression)

  - Non-compliance can lead to ineffective treatment outcomes, higher hospitalization rates, more adverse events/complications, higher healthcare costs, and death

  - E.g. fragility fractures: Percentage of secondary fragility fractures in each patient group
    1. Refusal of clinic monitoring or treatment: 26.51% experienced new fractures
    2. Low compliance: 8.79% experienced new fractures
    3. High compliance: 1.4% experienced new fractures

- It is critical to monitor and track patients with gliomas throughout their treatment and care the disease dysregulates normal brain functioning; it is harder for patients to manage their own care and they need outside help through caregivers and their healthcare team

THE TOPIC: TMZ treatment regimen

- Landmark study found that 42 days of radiotherapy plus daily temozolomide (concurrent therapy) followed by six 28-day cycles of adjuvant temozolomide extended median survival and two-year survival rate compared to radiotherapy on its own (Stupp, et al.) and adjuvant TMZ on its own (Sher, et al.)

- Concurrent: 42 days of daily temozolomide alongside radiation

- Adjuvant:
    - Six to twelve total 28-day cycles
    - Dosed days 1-5 with a 23 day rest period
    - Bloodwork done day 21 and day 28 to monitor neutropenia (low level of white blood cells) and thrombocytopenia (low platelets) – WBCs must be above 3 and platelets must be above 100

Day 1: Start of treatment

TMZ is only taken on Day 1, 2, 3, 4, 5

D21

Day 1

Labwork on Day 21 and Day 28

D28

02

Existing Solution

There is no widespread TMZ tracking software

- General softwares and workflows exist within Electronic Health Records
- Pain point of my job is not having an easy way to track treatment compliance
- Standardized monitoring system just for glioma patients would ensure they don't fall through the cracks
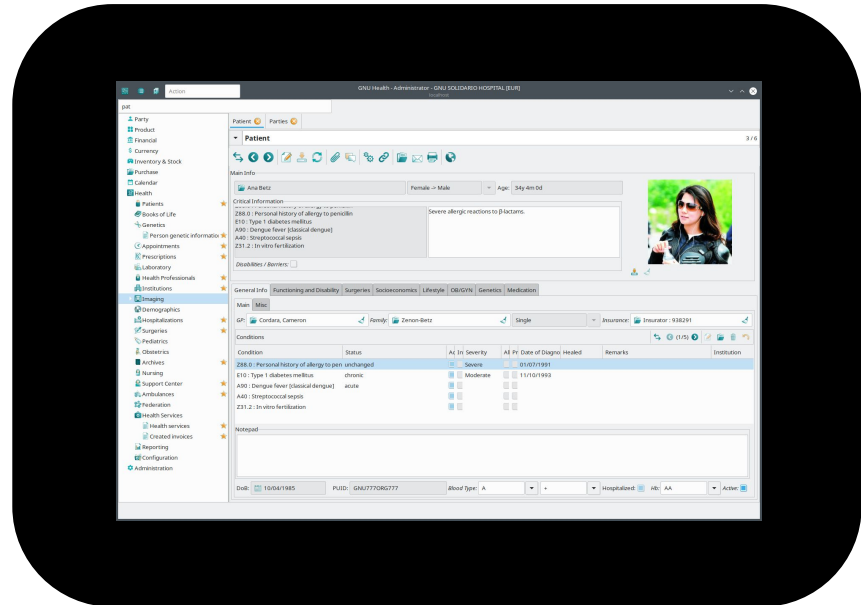
03

Real-World Applications

Needs

- Tracking compliance relies on dates and timelines
- Software would be used by patients and their caretakers to help them stay on track with treatment
- Tracking program mainly needed for adjuvant therapy of TMZ

Scenario 1:
Gloria, Cycle #2 Day 21 of TMZ

- Software would flag that labs are due to both the medical assistant (MA) and the patient/caretaker
- MA would get a reminder to check if MRI and follow-up appointment have been scheduled

Scenario 2:
Jon, started Cycle #5 today

- Software knows that Jon's Day 28 labs look good
- Pop-up appears that allows Jon to input his Day 1
- MA receives notification that Jon inputted his Day 1 and must verify that information before Day 21 and 28 labs are calculated & displayed to patient
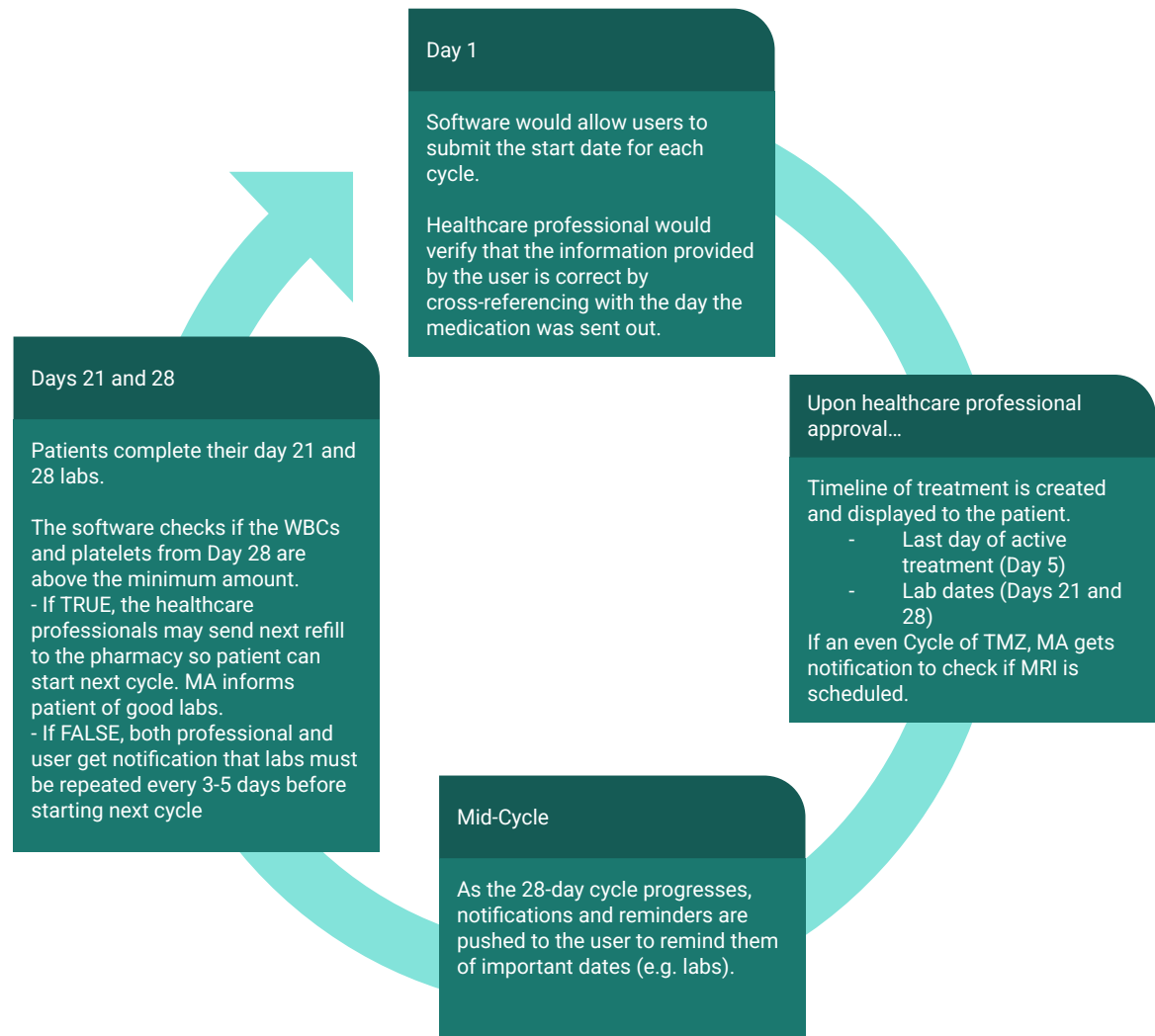
Scenario 3:
Alicia, Day 28 lab results are in

- Software checks if WBC > 3 and platelets > 100
    - If TRUE: MA gets the go-ahead to sent Rx
    - If FALSE: patient and MA get notification that labs must be repeated every 3-5 days until criteria is met

Planning Process

Day 1

Software would allow users to submit the start date for each cycle.

Healthcare professional would verify that the information provided by the user is correct by cross-referencing with the day the medication was sent out.

Days 21 and 28

Patients complete their day 21 and 28 labs.

The software checks if the WBCs and platelets from Day 28 are above the minimum amount.
- If TRUE, the healthcare professionals may send next refill to the pharmacy so patient can start next cycle. MA informs patient of good labs.
- If FALSE, both professional and user get notification that labs must be repeated every 3-5 days before starting next cycle

Upon healthcare professional approval…

Timeline of treatment is created and displayed to the patient.
- Last day of active treatment (Day 5)
- Lab dates (Days 21 and 28)
If an even Cycle of TMZ, MA gets notification to check if MRI is scheduled.

Mid-Cycle

As the 28-day cycle progresses, notifications and reminders are pushed to the user to remind them of important dates (e.g. labs).

Your healthcare provider has cleared you to start Cycle #_

Please input your start date (i.e. first day of TMZ) in the following format mm/dd/yy:

_____

Your healthcare provider has verified your start date.

You must get labs done on the following days:
Day 21: ____
Day 28: ____

User Interface Mock-Up
Day 1 >> Treatment Timeline

Day 28 Labs are adequate.

Patient is clear to start Cycle #_

Please contact patient to inform.

Day 28 labs are too low.

Patient must repeat labs every 3 to 5 days until platelets > 100 and WBCs > 3

User Interface Mock-Up
Day 28 Labs (MA view)

04

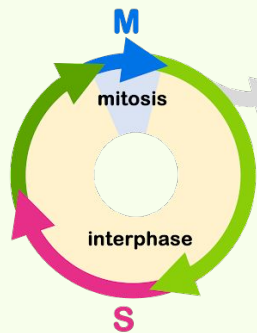## Solution Design Proposal

Pseudocode

01

Day 1 Input

02

Day 1 Verification

03

Mid-Cycle

04

Day 21 and Day 28

01: Day 1

WHILE current_cycle <= total_cycles:

    #User input of start date

    INPUT cycle_start_date #mm/dd/yy

    #MA/health professional verification

    DISPLAY cycle_start_date to medical_professional
    RETRIEVE medication_send_date
    IF cycle_start_date =< medication_sent_date
        DISPLAY "Cycle start verified. Cycle timeline may be shared with patient"
        APPROVE cycle start
    ELSE
        DISPLAY "Cycle start unclear. Reach out to patient to clarify start date"
        REPEAT verification

02: Post-approval

WHILE current_cycle <= total_cycles: (cont.)

```
        #Treatment timeline calculations
        day1 =  cycle_start_date
        day5 = cycle_start_date + 4
        day 21 = cycle_start_date + 20
        day28 = cycle_start_date +27

        DISPLAY treatment timeline to user and MA AS f"Your first day of TMZ
treatment for Cycle {current_cycle} is {day1}. Your last of TMZ treatment for Cycle
{current_cycle} is {day5}. You must get labs on Day 21 and Day 28, which are {day21}
and {day28}."

        #Check if MRI is due
        IF cycle_count MOD 2 ==
                DISPLAY to MA/professional "Reminder: MRI is due this cycle (Cycle
{cycle_count})
```

03: Mid Cycle

WHILE current_cycle <= total_cycles: (cont.)

#Notification creator
IF today = day5,
        DISPLAY to user Today is your last day of chemotherapy
ELIF today = day 21 OR day28
        DISPLAY to user Please get labs done today.
ELSE
        CONTINUE

04: Day 21 and Day 28

WHILE current_cycle <= total_cycles: (cont.)

    #Lab result collection

    IF after day21 OR day 28
        IMPORT lab results
        ASSIGN variables wbc_count AND platelet_count

    #Evaluate lab results

    IF wbc >= 3 AND platelets >= 100
        DISPLAY to MA/professional "Day 28 Labs are adequate. Patient is clear to start Cycle #_. Please contact patient to inform."
    ELSE
        DISPLAY to patient AND MA/professional "Day 28 labs are too low. Patient must repeat labs every 3 to 5 days until platelets > 100 and WBCs > 3"
        REPEAT lab check loop UNTIL wbc >= 3 AND platelets >= 100

Finishing treatment

END WHILE

IF cycle_count > total_cycles
        DISPLAY "Treatment is complete. Please follow-up with your provider

Citations

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