ANNA: Automated Neural Nursing Assistant

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Study Objective

Test the feasibility of an AI conversational agent-based intensive cognitive assessment to detect neurotoxicity side-effects of immunotherapy for hematologic malignancies.

Motivation

- 20-60% of patients with blood cancers treated with immunotherapy (CAR-T) develop immune effector cell-associated neurotoxicity syndrome (ICANS)
- ICANS is a treatable condition currently diagnosed with manually administered instruments for detecting immune effector cell associated encephalopathy (ICE).
- Manual assessments may not be frequent enough to detect ICANS at the most treatment-optimal time
- More intensive assessments (multiple times a day) may be beneficial but are not feasible in ambulatory settings.

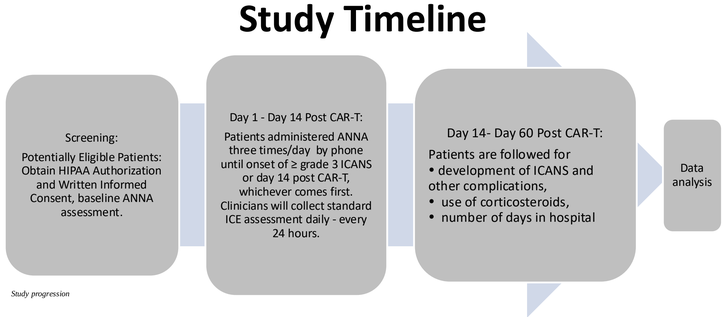
ICANS Symptoms

- Confusion
- Memory and attention deficits
- Speech/language disturbances

Study Design

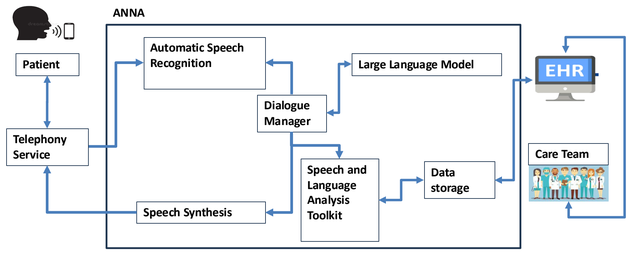
- An observational pilot study with a target enrollment of 38 participants for an estimated 15 ICANS events.
- University of Minnesota Masonic Cancer Center
- **Hypothesis**: The use of ANNA is feasible as a diagnostic tool to detect ICANS in patients treated with CAR-T cell therapy
- Data analysis team currently blinded to patient ICANS status

Study Timeline

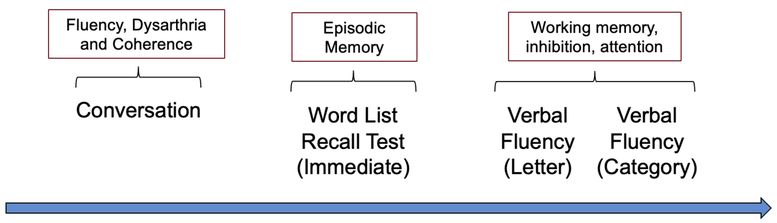


Study progression

ANNA Architecture



ANNA Assessment Flow



Long version: 8 minutes Short Version: < 6 minutes

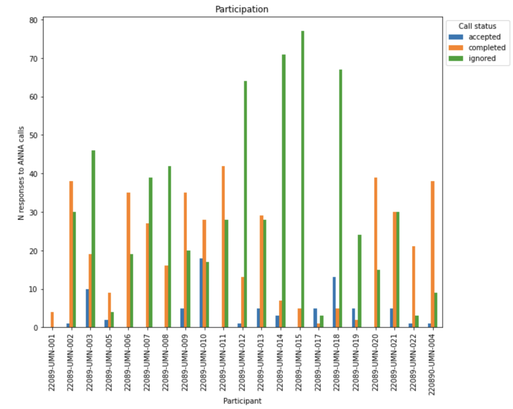
Automated transcription of a patient conversation with ANNA

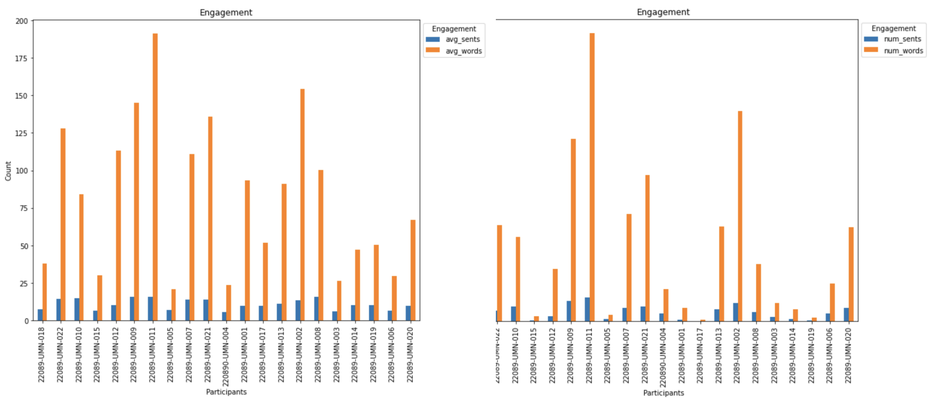
ANNA: "Are you ready to have a chat?"
PATIENT: "Ready"
ANNA: "Okay. First, tell me how you've been doing in the last few hours."
PATIENT: "Very good. I went for a mile walk. Had a good breakfast. Continue."
ANNA: "Thank you for sharing. Is there anything else you want to share about your day so far?"
PATIENT: "I'm excited about going home or to my daughter's house today. Continue."
ANNA: "Thank you for sharing. Now, I would like to ask you to tell me as much as you are able about your friends. Feel free to take your time in answering."
PATIENT: "I have some amazing friends. I have friends that go back to kindergarten, friends from high school, friends from work. I'm in two book clubs. I made friends in the neighborhood. I just am very blessed."
ANNA: "That sounds wonderful! Having many different groups of friends can be really enriching. How do you balance spending time with each group?"
PATIENT: "Well, just kind of when opportunity comes, you just kind of all fall together and everyone is just a phone call away. So it's very, very nice. Continue."
ANNA: "That makes sense. It's great that you have so many people in your life who care about you. Can you tell me more about what you enjoy doing with your friends?"
PATIENT: "I have one group of friends that I go golfing with. I have another group of friends that are at the public library. So we read a wide genre of books. I have another group of book clubs with that are all social friends. So we read usually like recent bestsellers and probably more social than book club. And then I have friends that I sew with."

Preliminary Analysis of Acceptability

Summary of results:

1. As of early October 2024, 27 patients have been enrolled; 6 dropped out before ANNA assessments.
2. 7 (33%) developed ICANS
3. 45% of ANNA assessments were completed or partially completed
4. Mean N of sentences/utterances per ANNA assessment: 11 (SD 3.5)
5. Mean N of words per ANNA assessment: 82.5 (SD 48.5)





Conclusions and Lessons Learned

1. Willingness to participate is variable
2. Patients who do participate tend to engage with ANNA
3. Repetitive nature and difficulty of cognitive tests is a barrier
4. Domain-specific guardrails are needed for the Large Language Model

Acknowledgments

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