

Geo-mapping Technology to Inform Timely Access to Stroke Care for patient in Rural areas of Northwestern Ontario

Ayman Hassan¹, Keli Cristofaro¹, Trina Diner¹, Tom Konstig², Abdulsalam Yassane², Rachid Benlamri², Russell MacDonald³

¹Northwestern Ontario Regional Stroke Network, Thunder Bay, ON, ²Lakehead University, Thunder Bay, ON, ³Ornge, Toronto, ON

Background:

In Northwestern Ontario (NWO), a land mass of half a million square kilometers with a population of approximately 230,000. Acute stroke care is provided by one tertiary level hospital and four Telestroke hospitals. (Figure 1 – Map of Stroke services).

Direct transportation protocols facilitate the transport of suspected stroke to the closest acute care hospital capable of providing required services.

Transportation decisions are based on protocols, human judgment and experience. Geomapping Technology and Artificial Intelligence (AI) can be used to inform timely access to stroke care. The proposed intelligent system helps informing the right decision based on geographic information, weather information, patient transport information, and resources available at the nearest hospital/telestroke site.

Objectives:

- Understanding how an application may assist clinicians referring or accepting patients across emergency systems for access to stroke diagnosis and treatment opportunities.

Methods:

- We use Google maps, machine learning techniques and graph theory to build intelligent decision-support algorithms for timely access to acute stroke care.
- Historical data from Ornge (air) and land ambulance services are used to perform a quantitative analysis of the nature of transportation decisions made in the past and historical reality.
- To compare “what happened with what could happen”, we will use existing patient data to simulate patient care pathways. The simulations can be used to identify where improvements could be made and resources better utilized.
- Business logic includes 6 case scenarios as follows:
 1. From anywhere to EVT site. May need to travel to Thunder Bay site or other site (London, Hamilton, Winnipeg, etc.).
 2. From Telestroke Site to EVT site. May need to travel to Thunder Bay or other site (London, Hamilton, Winnipeg, etc.).
 3. Patient at any clinic with Regional Critical Care Response. Must get to CT scan.
 4. Remote Location without Regional Critical Care Response nor Telestroke. Must get to CT scan.
 5. Walk-in at any hospital (Figure 2: Flowchart of Business Logic).
 6. All other sites. Ornge transportation required.

Case Vignette:

- Case Vignette: Patient drove to Hospital in Red Lake. Red Lake Margaret Cochenour Memorial Hospital activated Northwest EMS to land transfer (Northwestern Ontario Acute Stroke Bypass and Transfer Agreement) to Dryden Regional Health Centre (Telestroke Site). Patient received tPA treatment—patient was flown to Thunder Bay Regional Health Sciences Centre (Regional Stroke Centre) via air ambulance by ORNGE, for EVT treatment (Figure 3: Geomap of Case Vignette Scenario: Remote Bypass and ORNGE flight).

Figure 1: Current Map of Stroke Services in Northwestern Ontario

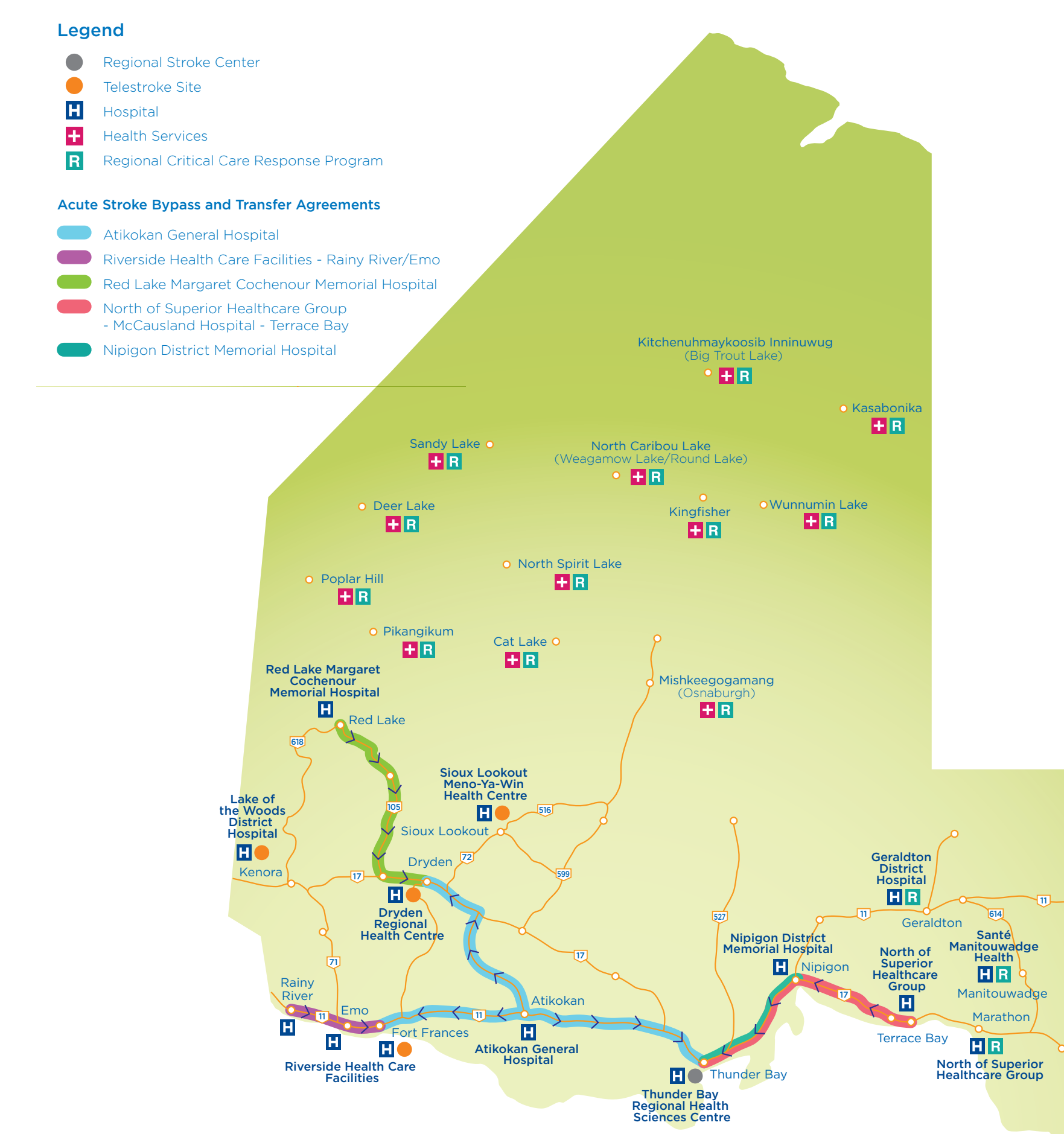


Figure 2: Flowchart of Business Logic

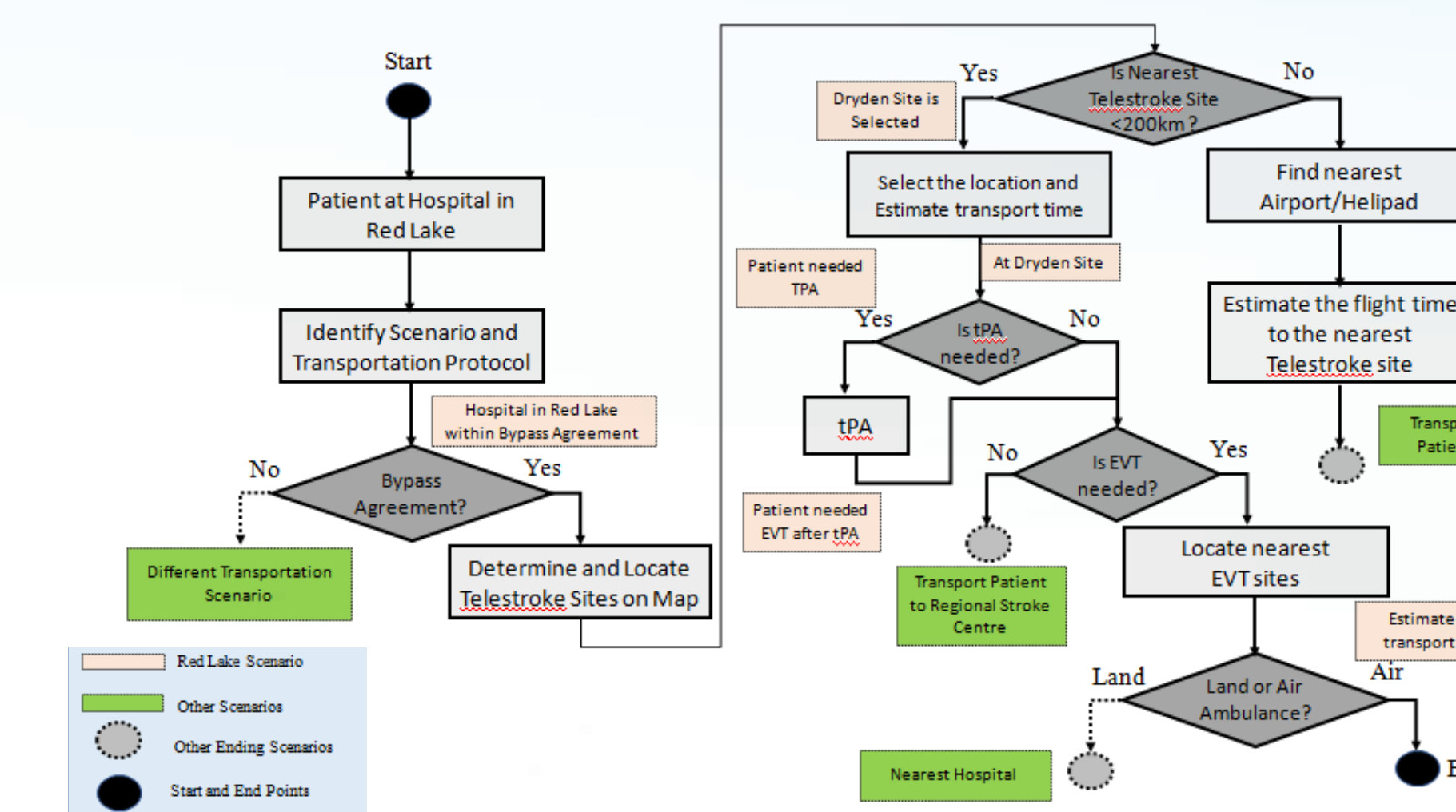
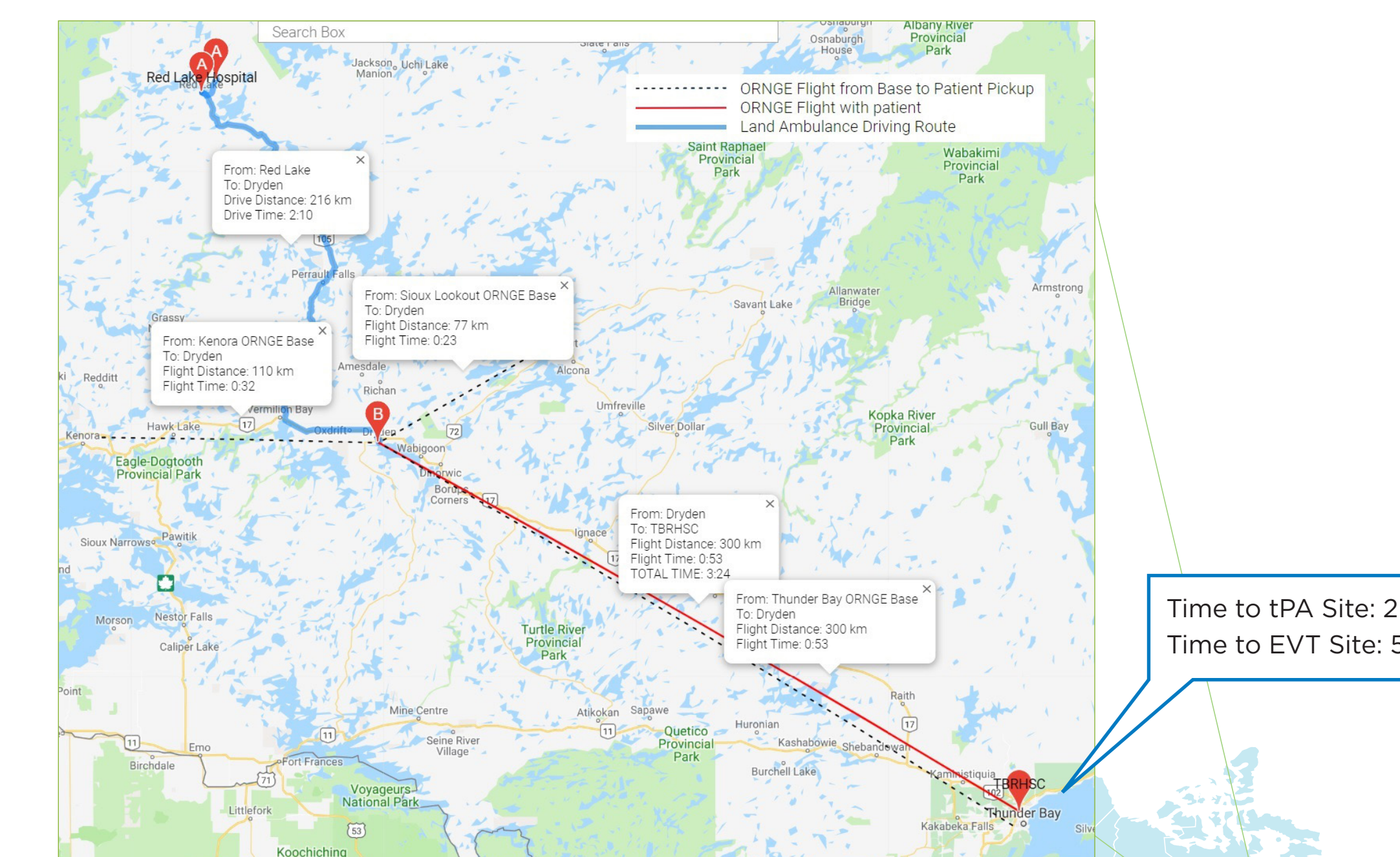


Figure 3: Geomap of Case Vignette Scenario, Remote Bypass and ORNGE flight



This case vignette demonstrates time for a land ambulance transfer time from Red Lake to Dryden of 2h 10m*. Then the patient would utilize air ambulance from Dryden to Thunder Bay 3h 24m**.

Estimated time from patient presentation to tPA centre is 2h 10m. Estimated time from patient presentation to EVT centre is 5h 34m.

*Time estimates do not include door in door out, 'DIDO' at Dryden site. **Air ambulance resources need to depart to Dryden from a base in Sioux Lookout, Kenora or Thunder Bay. Historical data indicates resources from Sioux Lookout base present best option for shortest transport time for patient care. Total time to care includes departure from a Sioux Lookout, transfer of patient care, and travel to final care destination.

Results:

- Historical data, current and potential patient care pathways will be utilized.
- This will be used to inform decision makers in reviewing current policies for stroke care access in NWO.

Conclusions:

- We are developing an innovative geo-mapping system that provides support for evidence-based decision making to facilitate the transfer of patients to the appropriate level of care.

