Microsoft Encode Hackathon

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- Project Name: **Serene Health**

FHIR

Objective/ Goal

- Creation of a Patient Centered Integrated Health Care System
- Enabling a continuous shared singular collection of patient health data through patient and health practitioner submissions.
- Connecting all relevant stake holders in the patients circle of care. (encompassing, but not limited to, General Practitioners, Acute Care Facilities, Medical Specialist Clinics, Pharmacies, Laboratory Testing Facilities, Outpatient Treatment Clinics, Long Term Care Facilities, Community Care, Foot/Wound Care Clinics, Patient Transportation Services).
- Create a streamlined system, without the redundancies and extra layers that have been wasting valuable time and money.

Expected Impact

- Patient empowered data collection (encompassing, but not limited to, personal details, vital signs, blood glucose, allergies, food records, fluid balance, medical/surgical histories, family history, physical/social records, laboratory records).
- Continuously updated Health Data collection for patient and health practitioner submission and viewing, identify trends in collected observations, progression of treatments, symptom identification.
- Alert practitioners to reassess patients' treatment plans in real time utilizing patient collected records (low blood pressures resulting in falls, chronically elevated blood glucose readings, poor wound healing and nutrition, etc.).
- Prevention of redundant data collection

Outcomes

- Better patient care and reduced cost
- Connectedness of patients and the stake holders of their health and wellness.
- Reduction/elimination of physical records
- Ease for practitioner to send referrals, prescriptions and requisitions directly, eliminating unnecessary processes/parties in between.
- Vast collection of health data to use for statistical analyses and research for improvements in health care.

Existing Framework

- Current practice focuses legislation on patient data, via PIPEDA (Personal Information Protection and Electronic Documents Act), for use, disclosure and collection of personal information
  - Key right for individuals: "obtain access to their personal information and ask for corrections if necessary"
- Major EMR providers do not adhere to any interoperability standards, although some are developing their export and mobility capabilities
- HL7, organization behind a major data exchange format, developed the Fast Healthcare Interoperability Resources [FHIR] specification
  - FHIR defines JSON and XML data formats and a RESTful API
  - Although major legislative support has been received, only some support has been implemented by EMR providers towards this capability

Current Market

- Top "hospital" EHR Vendors in Canada (2018) and US (2019)

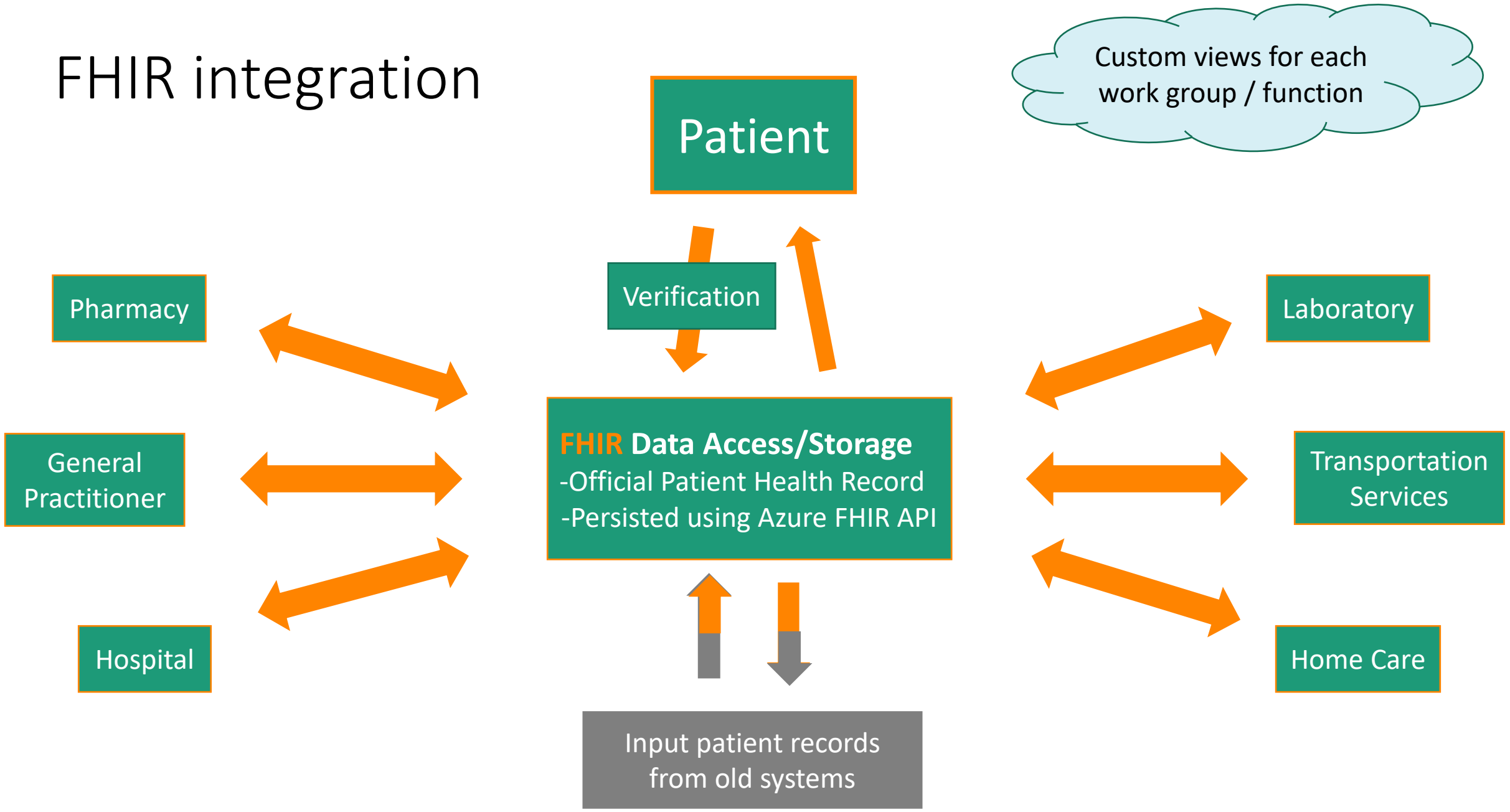
Vendors	Marketshare (%)		FHIR Interoperability	Dev Manual	Link
	Canadian	US			
Meditech	40	17	Y	Y	https://home.meditech.com/restapiresources/
Epic	28	29	Y	Y	https://fhir.epic.com/
Cerner	12	26	Y	Y	https://fhir.cerner.com/smart/
Allscripts	5	6	Y	Y	https://developer.allscripts.com/Content/fhir/
Telus	4	-	-	-	-

https://blog.definitivehc.com/top-canadian-hospitals-ehr-vendors

https://www.ehrinpractice.com/largest-ehr-vendors.html

In 2018 KPMG analyzed the most recent data, [which] includes 515 EHR products for ambulatory settings. KPMG indicated that 15 EHR vendors represented 73% of all EP attestations, whereas the top four vendors occupied represent more than 50% of attestations.

FHIR integration



Architecture - Patient's Medical Data Flow

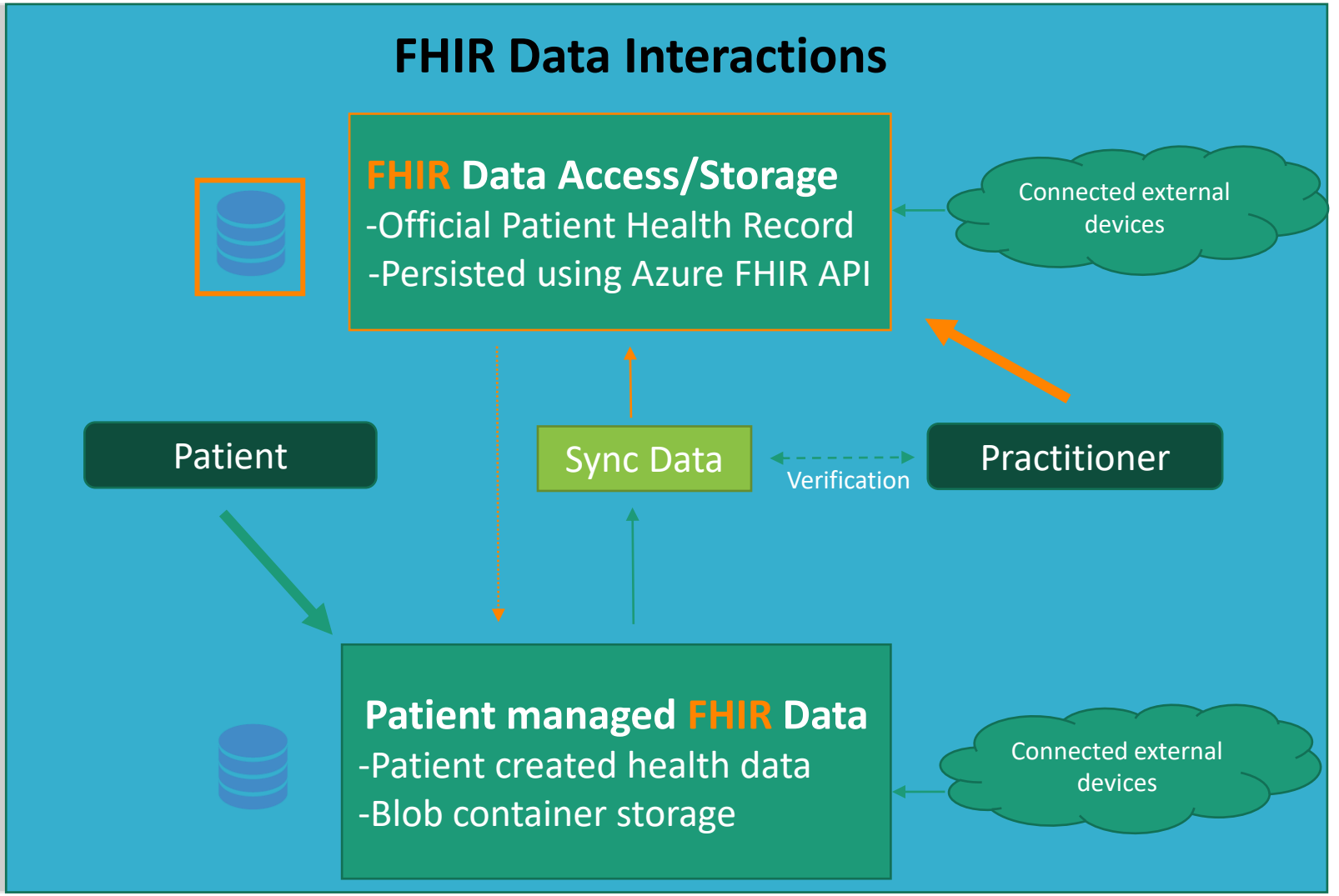
Technologies

Azure FHIR Server/API
Service Bus
Azure Functions

FHIR .NET API
FHIR Codegen
-Models, serializers, etc.

.NET Standard
-all business logic

Client applications for all relevant platforms



Case Scenarios

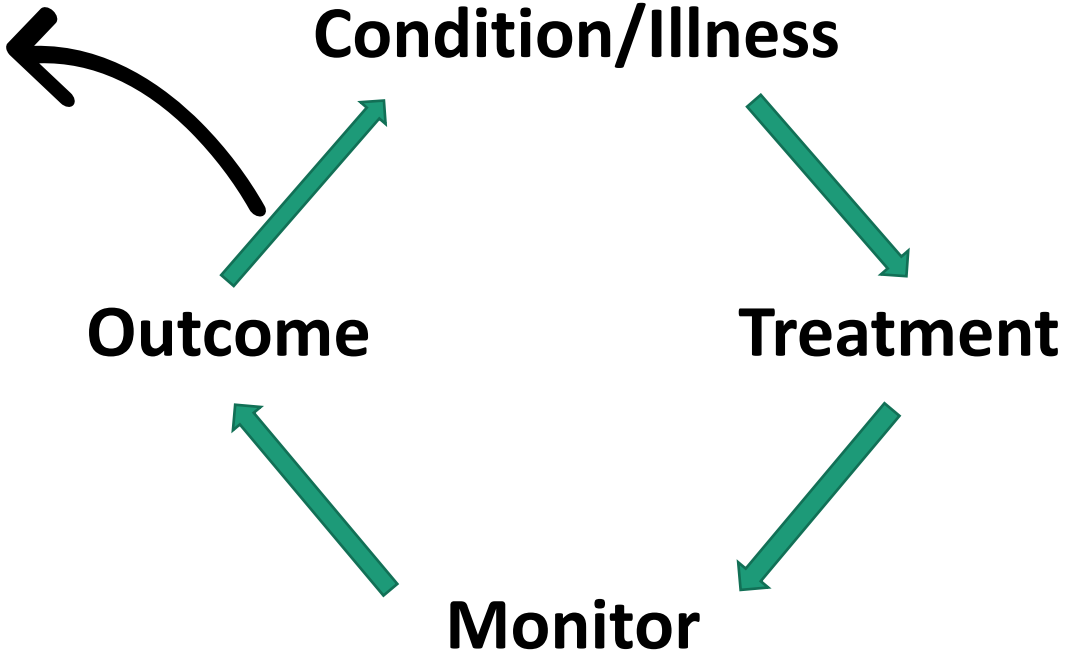
- General Practitioner submits Medication Order → prescription created and added to patient's Pharmacy Portal → prescription filled, pharmacy alerts patient medication available for pick up or sent out for delivery (pharmacy portal allows patient sharing of personal information as well as choices of pickup/delivery, blister pack, etc.).
- Patient submits Blood Glucose readings daily → General Practitioner's records updated → alerts General Practitioner when levels are out of therapeutic range → General Practitioner reviews patient's available records (Blood Glucose readings, Food Records, Medication List → Make timely changes in medication dosages if required → General Practitioner could initiate Referral to Endocrinologist for further investigation → Endocrinologist accepts referral that has been added to Practitioner Portal → Endocrinologist appointment scheduler prompts patient to select a date and time from available dates → Endocrinologist can review observations/information from both patient and practitioner submissions prior to visit to help build customized treatment plan.
- Patient visits Foot Care Clinic → Patient personal details accepted into Clinic Portal → Assessment and data submitted → General Practitioner can view all new data submitted during assessment.
- Community Care ordered for patient → Referral accepted in Portal → Scheduler prompts patient to schedule visits → Assessments and treatment completed → Data submitted (ex. Characteristics/photos of wound(s) and healing progression, medication administration record, dressing type, accessibility needs/equipment rentals, etc).
- Patient awaiting Long Term Care → List of selected LTC homes with position on list → List of other LTC homes with currently available beds.

Business Case – Research

Persisting patient's Medical information using a consistent specification (FHIR) will create opportunities for innovation in Health Data research.

Machine Learning, training models to determine best possible treatment for each patients' circumstance

- Save each Condition-Treatment-Outcome cycle, associated with a snapshot of the patients Health Record.
- Determine the best treatment by analyzing similar Conditions, Health Histories and previous treatment outcomes.
- Record the success of the recommended treatment to continuously improve models.



Conclusion

- Put patients at the center of their own health and the care they receive.
- Create a fully connected singular data repository.
- Keep patients and their practitioners connected in real time.
- Utilize full data collection to search for groundbreaking trends for treatment success.
- Use Machine Learning to predict best possible treatment for each condition per patient with similar health history (Condition → Treatment → Monitoring → Treatment Outcome).