



New York GP Referral System

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Patient Referral Management System (RMS)

Objective: Create an optimal Referral Management System for General Practitioners to find appropriate healthcare facilities for their patients

- Referral management systems (RMS) are used to generate appropriate referrals at General Practitioner's (GP) offices when the diagnosis requires a medical specialist
- In the past, issues with referrals lead to serious implications*
- Most beneficial part of RMS is for consultants to vet appropriateness and eligibility of referrals
- Search based on location and diagnosis

Creating an optimal RMS requires 5 components:



Initial Development of **Proof of concept** will focus on creating a basic search engine to achieve features: Integrating Systems, Keeping directory up to date, and engaging key players in New York State

Next steps will be incorporating ability for Patient engagement and analyzing referral metrics nationwide

Data source and procurement

Our RMS will be a combination of two datasets, both of which are **provided by New York State Department of Health**:

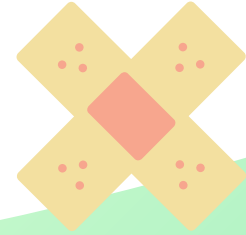
- **Hospital Inpatient Cost Transparency:** The file contains information on the volume of discharges, All Payer Refined Diagnosis Related Group (APR-DRG), the severity of illness level (SOI), medical or surgical classification the median charge, median cost, average charge and average cost per discharge.
- **Health Facility General Information:** The dataset contains the locations of hospitals and hospital extension clinics.

Data Set	Data size	Update Frequency
Hospital Inpatient Cost Transparency	1,081,672 rows and 14 columns	Annually
Health Facility General Information	6115 rows and 36 columns	Daily

Source:

Hospital Inpatient Cost Transparency provided by New York State Department of Health: <https://health.data.ny.gov/Health/Hospital-Inpatient-Cost-Transparency-Beginning-200/7dtz-qxmr>
Health Facility General Information provided by New York State Department of Health: <https://health.data.ny.gov/Health/Health-Facility-General-Information/vn5v-hh5r>

ETL Technologies



Extract

NYC OpenData

Use APIs to get JSON file

- Data is regularly updated by New York Health Data so we use Python to automatically pull data



Transform



Elasticsearch



MongoDB

- **ElasticSearch** used for search engine as it is the most efficient search engine and allows us to sort by mean cost
- No storing data in ElasticSearch because it does not support data structure
- Even though Postgres supports critical operations, we chose to use a NoSQL database such as **MongoDB** instead because it allows for future referral analytics and is more flexible for scaling data allowing for nationwide expansion of business



Load



Flask

- Build simple, user-friendly web page using **Flask** with search function for GPs to interact with so they can easily find relevant referral facilities



Data Governance & Cost Implications

	Proof of Concept (Search Engine)	Business Application (NY State)	Future Opportunities (Nationwide)
Data Governance	<ul style="list-style-type: none">• Data is publicly available and does not involve personal information• Updated the system monthly by maintenance to ensure data is current	<ul style="list-style-type: none">• Patient referral information will be uploaded instantaneously through Pyspark for analysis• Consultant approval/rejection based on patient information• Since more private and sensitive information is uploaded to the system now we need to increase security for our system	
Cost Implications <ul style="list-style-type: none">• Human Resources• Data Storage• Application costs	<ul style="list-style-type: none">• \$2,200 Maintenance Fees: For hiring needs based employee for maintenance and errors• \$60 Storage Costs: For 10GB in MongoDB which is higher than our current needs• \$22 Search Engine: For managing and searching using ElasticSearch	<ul style="list-style-type: none">• \$33.25 cost for running referral metrics analytics through Pyspark	<ul style="list-style-type: none">• Do not foresee additional data storage costs as we are currently only utilizing 1% of MongoDB storage
Estimated Monthly Costs	\$2,282	\$2315.25	



Search Engine Success Criteria

○ Proof of Concept
Search Engine
success criteria

○ New York State

Referral metric analytics and patient engagement features available for all facilities in the state

○ Nationwide Implementation

Available to all facilities nationwide

Quantitative Criteria

- Ensure optimal loading speeds as Doctors have to see many patients a day
- Ensure data is up to date
- Data is available to all and there is no inconsistent or loss of data as it could send patients to the wrong healthcare facility
- Minimum 3 relevant search results per query so patients have options

Qualitative Criteria

- Patient happiness ratings and experience with referrals
- Doctor's opinion experience with referrals
- Patient's feeling on appropriateness of referral based on whether facility specialty
- Doctor's side positive and negative opinions of RMS



Live Demonstration

Assessment of success based on the proposed metrics

Quantitative Criteria

- Ensured optimal loading speeds by using elasticsearch
- Ensure data is up to date using API extracted from NY gov database which updates daily and annually
- Some data inconsistency with duplicated facility names although they are from unique objects
- Search results dependent on combination of search terms



100%



100%



90%



90%

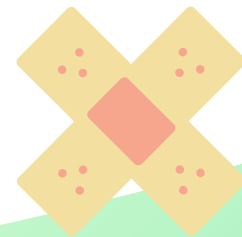
Qualitative Criteria

- Patient happiness ratings and experience with referrals
- Doctor's Net Promoter Score experience with referrals
- Patient's feeling on appropriateness of referral based on whether facility specialty
- Doctor's side positive and negative opinions of RMS





Conclusion & Future Recommendations



Conclusion

- Achieved search engine success criteria
- Some limitations to search engine
 - Duplicated facility issue

Improvements to Search Engine

- Deduplicate facility name and aggregate mean costs
- Include more “sort by” options so users can filter results suited to their preference
- Add map feature so that users can see where facilities are located

Future Recommendations

New York State

Incorporate feature to analyze referral metrics to see facilities with capacity and patient engagement to improve referral suitability

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Analyze Referral Metrics

- Facility capacity
- Referral success

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Patient Engagement

- Patient happiness
- Send follow ups
- Secure messaging
- Insurance

Nationwide Implementation

Available to all facilities nationwide