TigerGraph

TigerGraph Hands-On Training

(Taming the Tiger ☺.)

Unleashing the power of Interconnected Data
for Deeper Insights and Better Outcomes

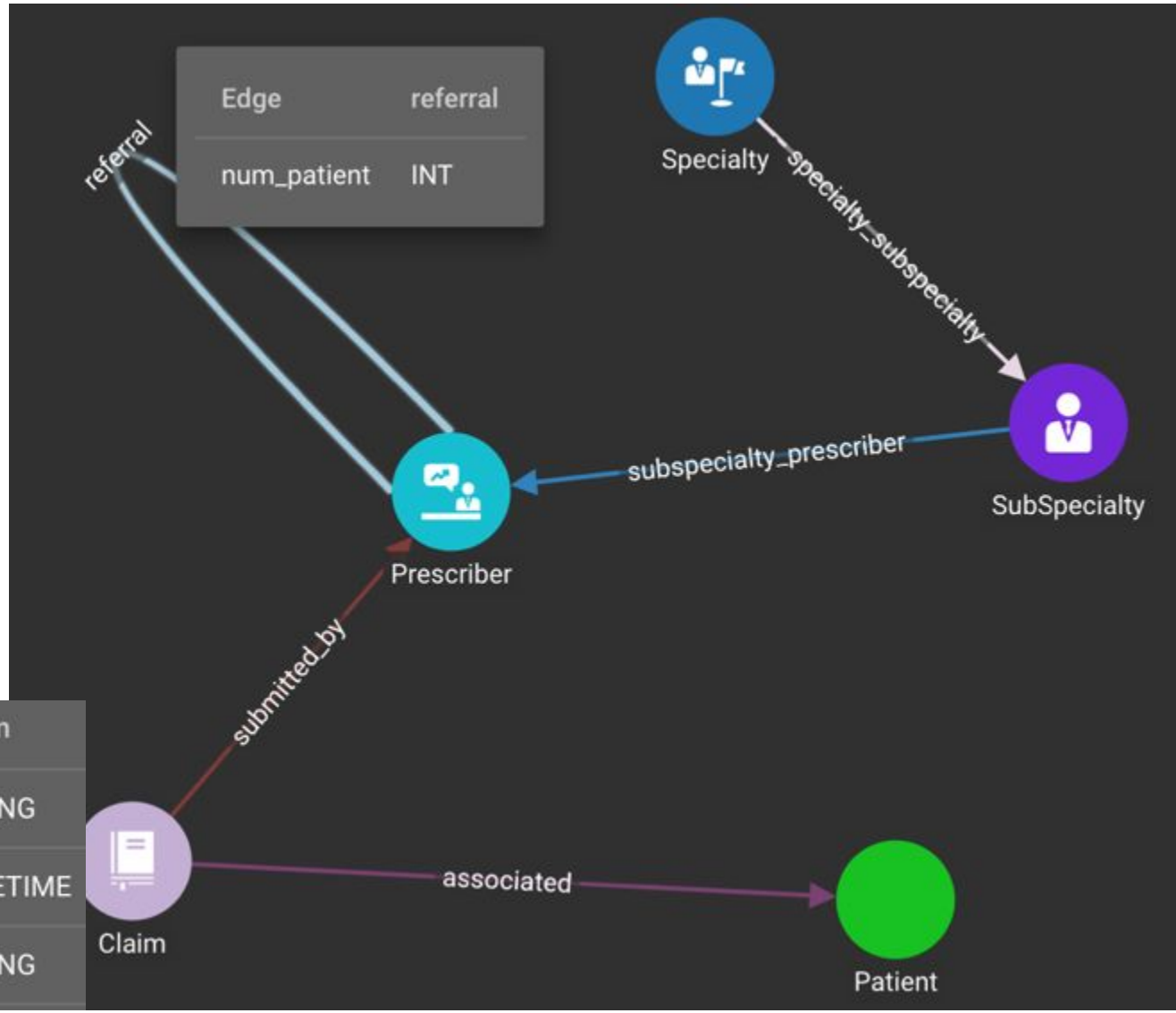
Huiting Su & Gaurav Deshpande (VP of Marketing)

Agenda

1. TigerGraph Introduction
2. Preparation
3. Schema Design and Data Ingestion
4. Simple Query Practice
5. Advanced Query Practice
6. K-hop Query and PageRank Query Practice
7. Graph Algorithms Overview

Understanding Property Graphs

- Vertex = Entities (e.g. claim, patient, phone call, payment, account..)
- Edge = Relationship among entities (e.g. claim to patient, phone call to customer, payment to account)
- Fields or attributes on vertices and edges



Vertex	Claim
(PRIMARY ID) Claim_id	STRING
rx_fill_date	DATETIME
ICD10Code	STRING

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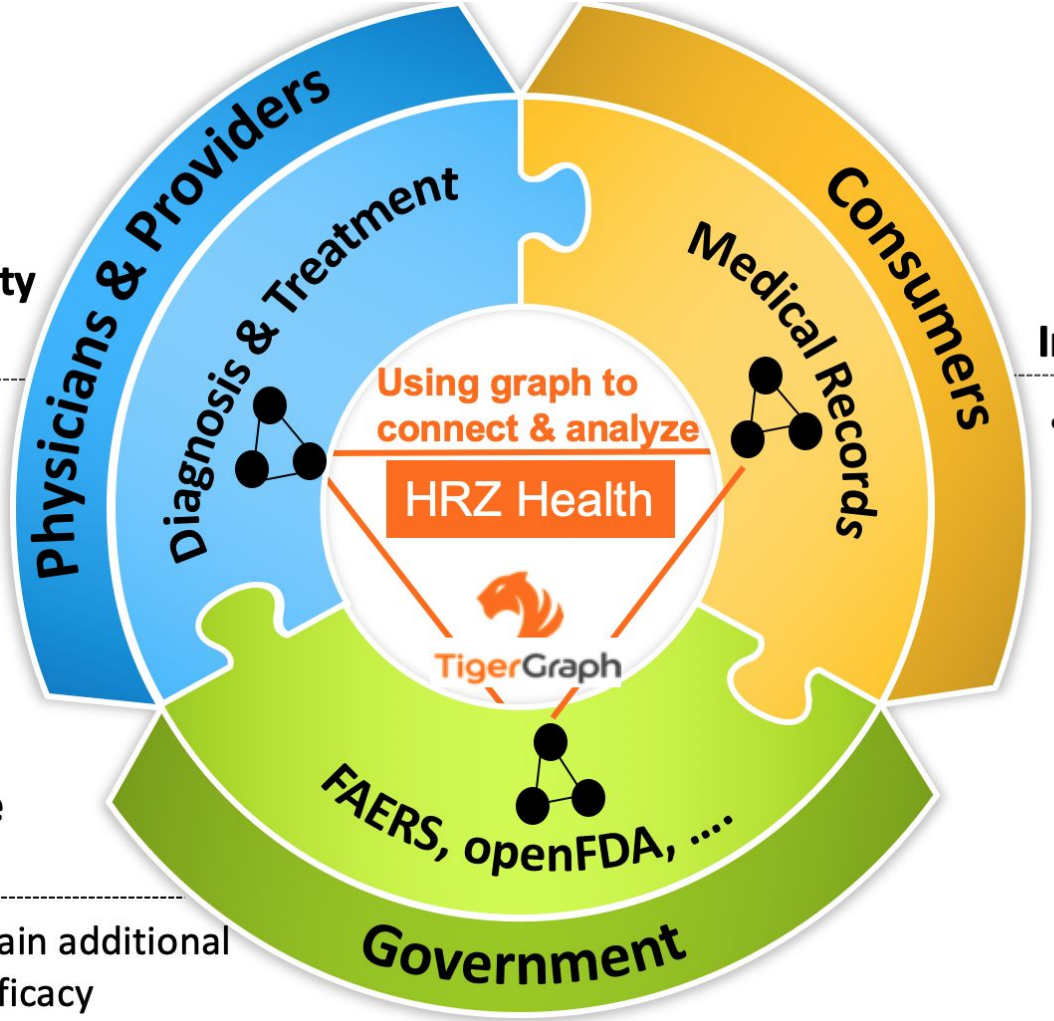
Training Dataset: HRZ Health

- HRZ Health is a diversified healthcare company operating in multiple markets including United States
- Business team at HRZ Healthcare Is interested in:
  - Improve net promoter score (NPS) among members (end consumers using HRZ healthcare services)
  - Deliver consistently high quality of care while controlling costs
  - Leverage public data (such as FAERS) to improve health outcomes for members

Connecting the dots across internal & external data with TigerGraph

Deliver consistently high quality of care while controlling costs

- Detect and prevent waste and abuse
- Understand and optimize referral networks to lower cost of care



Improve Net Promoter Score

- Make better use of the Member 360 data to deliver superior care

Leverage public data to improve healthcare outcomes

- Link with internal claims data to gain additional insights on drug and treatment efficacy

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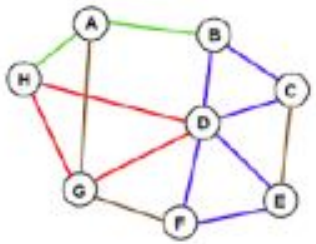
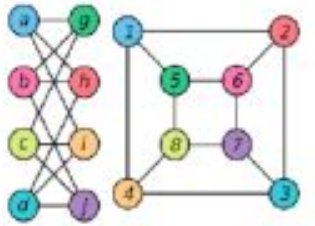
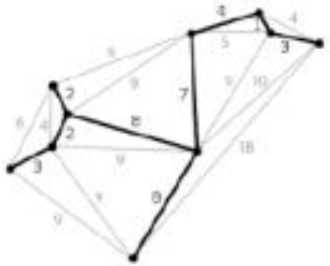
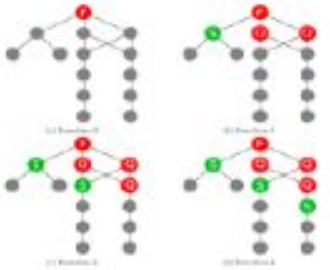
Using Graph Analytics Patterns to Power Use Cases

Graph Analytics Patterns

Use Case	Link analysis	Graph matching	Frequent subgraph discovery	Community detection
	Given an entity, show its connections 	Given a graph, find similar graph patterns 	Given a graph, find its relevant subgraphs 	Describe the evolution of a graph 
Detect and prevent waste and abuse	Uncover Prescriber-Facility Collusion	Discover potential fraudulent patterns	Investigate specific prescriber-patient-facility networks	Identify potential fraud networks
Understand and optimize referral networks to lower cost of care	Understand how prescribers are connected	Prescriber & Member Likeness & Benchmarking	Find and visualize Prescriber Referral Relationships	Identify influential prescribers & linked communities
Link with internal claims data to gain insights on drug & treatment efficacy	✓	✓		✓
Make better use of the Member 360 data to deliver superior care	✓	✓	✓	✓

Focus for today's hands-on training

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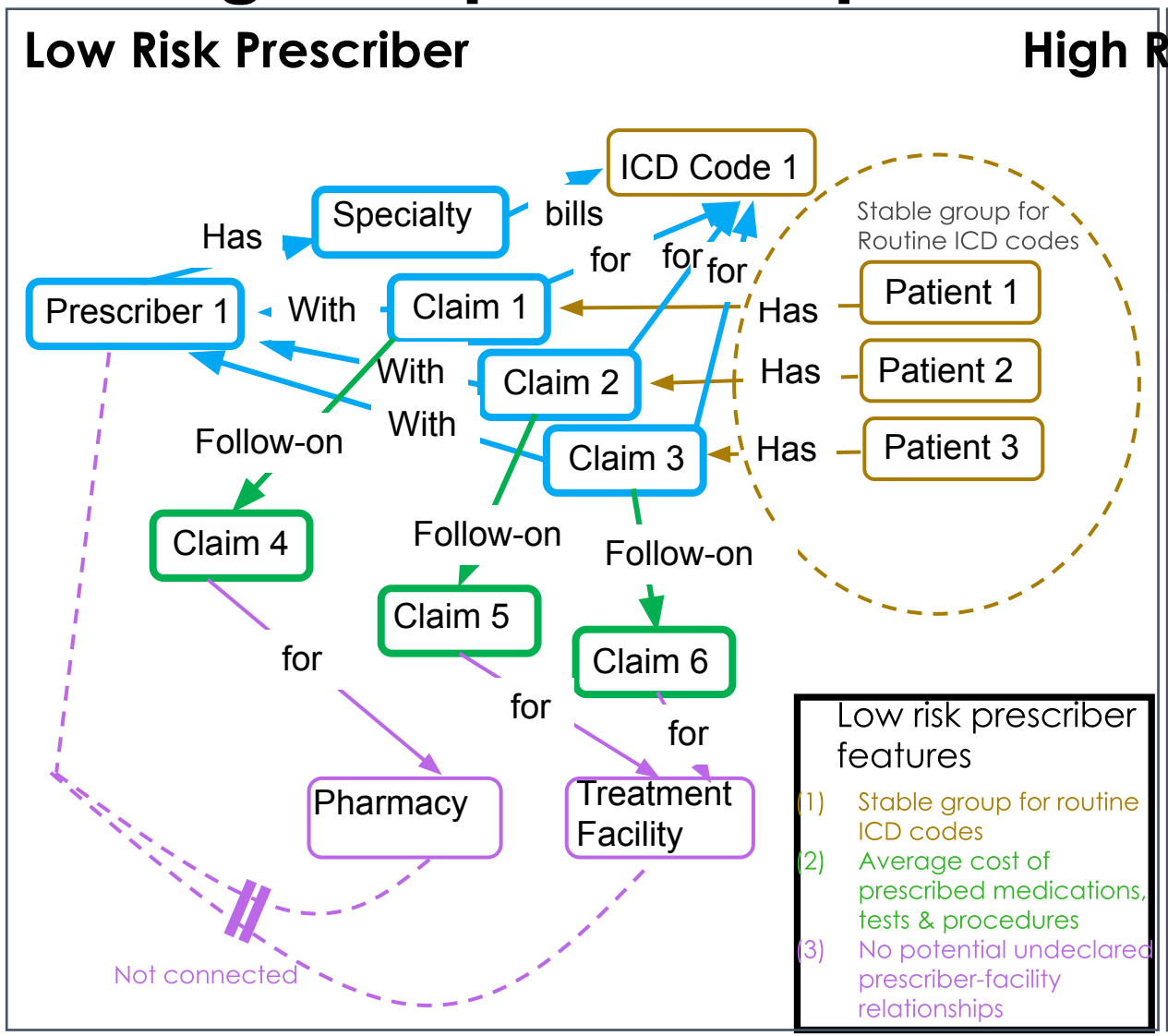
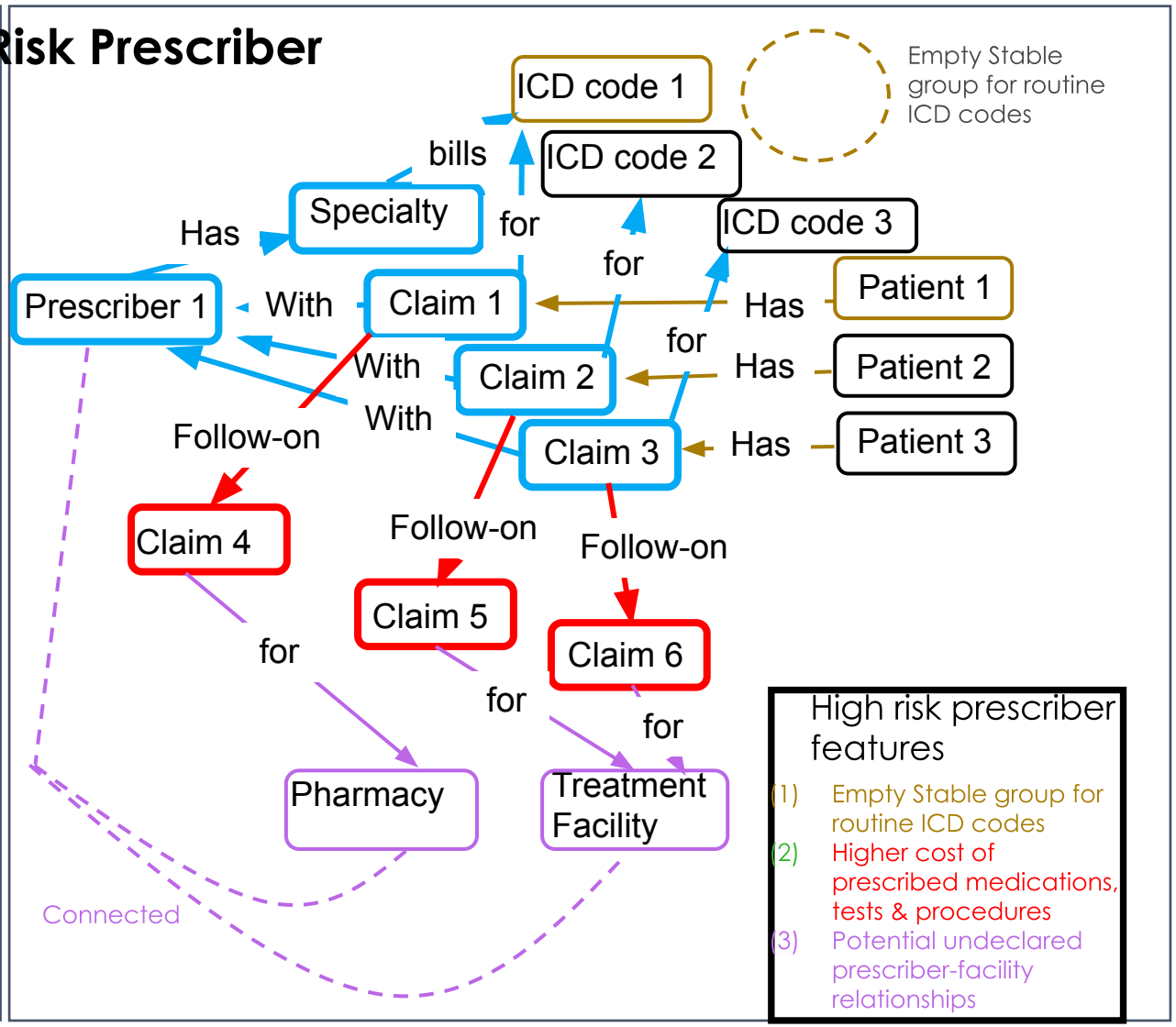
Using Computed Graph Features To Find Bad Actors





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Use Case - Detect and prevent waste and abuse

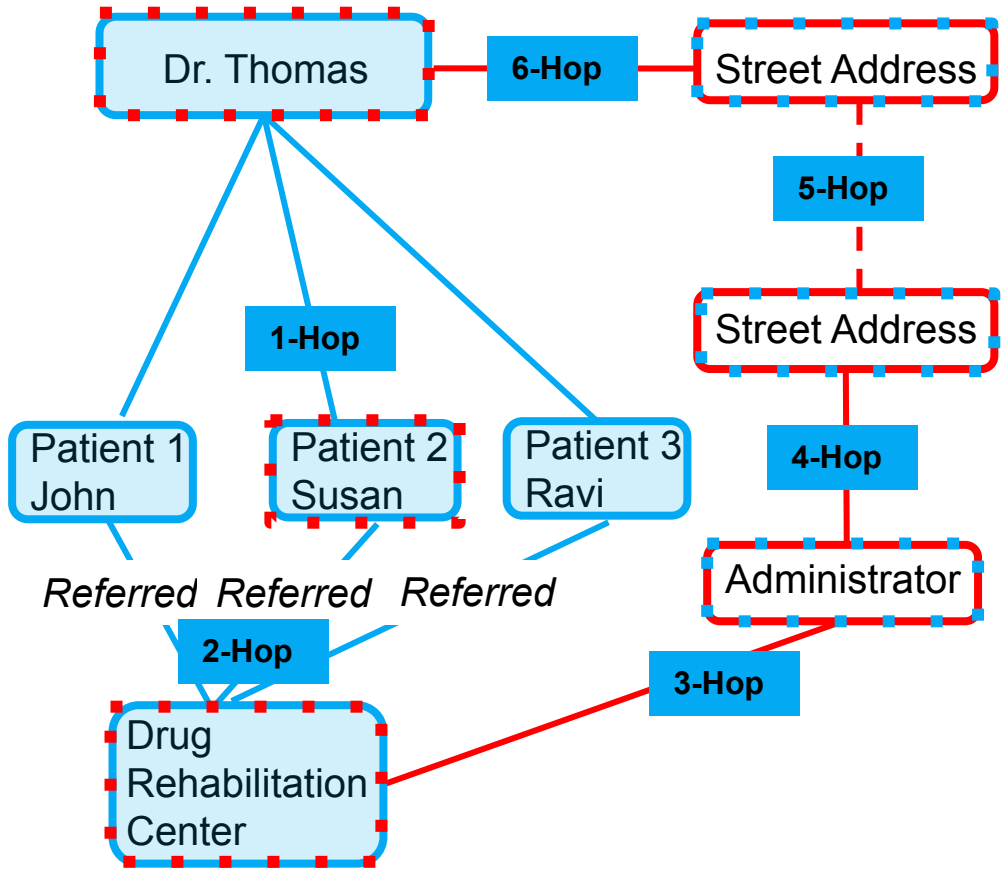
Business Need: Bad-actor providers refer patients to facilities for unprofessional reasons.

6-Hop Query for graph analytics pattern:
Uncover Prescriber–Facility Collusion

Solution:

- **Look for alternative connections** between prescriber/physician & referred facilities
- **Assign risk rating** based on amount of referral & strength of alternative connections
- **Compare billing across facilities** to identify "upcoding" / overbilling
- **Improve efficiency for case investigation** for potential violations with intuitive user interface

Business Value: Reduce improper referrals, improve quality of care for members



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Use Case – Understand & optimize referral networks to lower cost of care

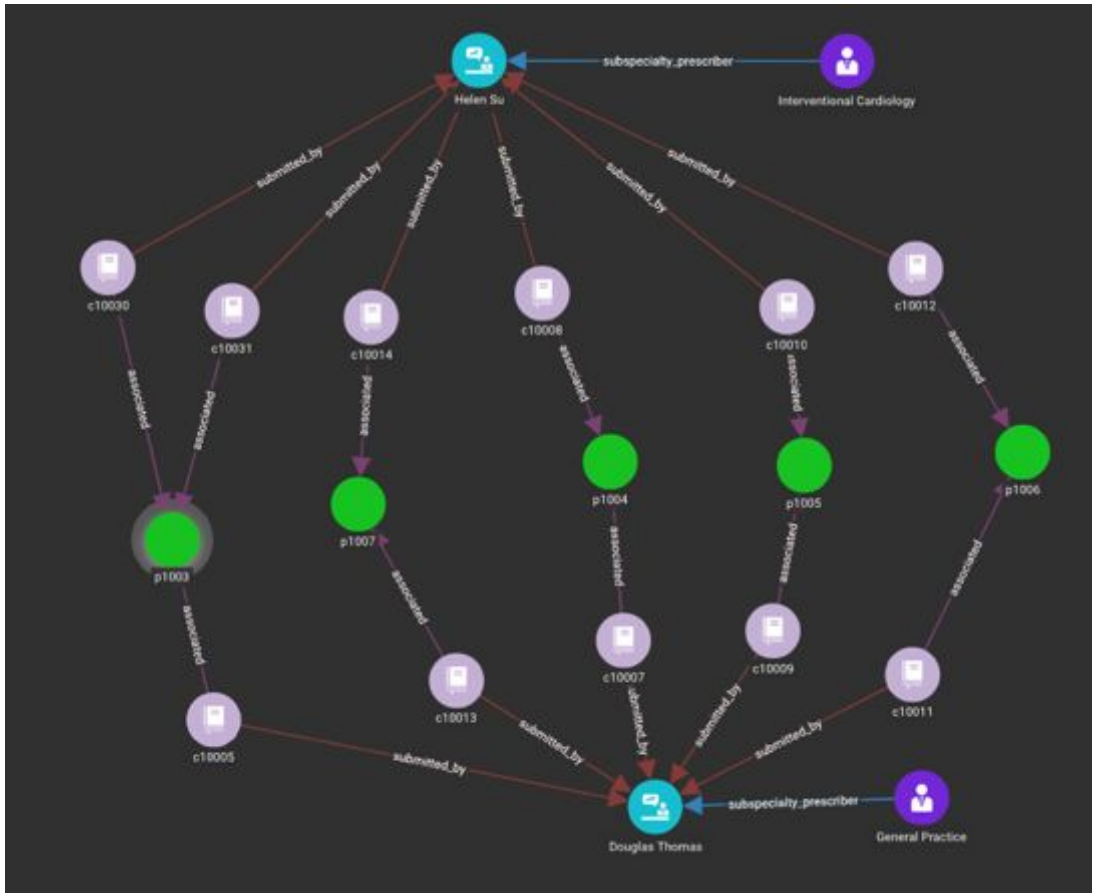
Business Need: Understand and analyze prescriber relationships that support member's healthcare needs

Solution:

- **Understand how prescribers are connected** in terms of linked claims, common patients and treatment facilities
- **Find and visualize Prescriber Referral Relationships** for specific area and/or healthcare condition
- **Find similar prescribers and patients/members** and benchmark cost of care across end-to-end patient care journey
- **Identify influential prescribers & linked communities** to optimize care deliver

Business Value: Lower cost of care while maintaining quality of care

4-Hop Query to find graph analytics pattern:
Understand how prescribers are connected



Focus for today's hands-on training

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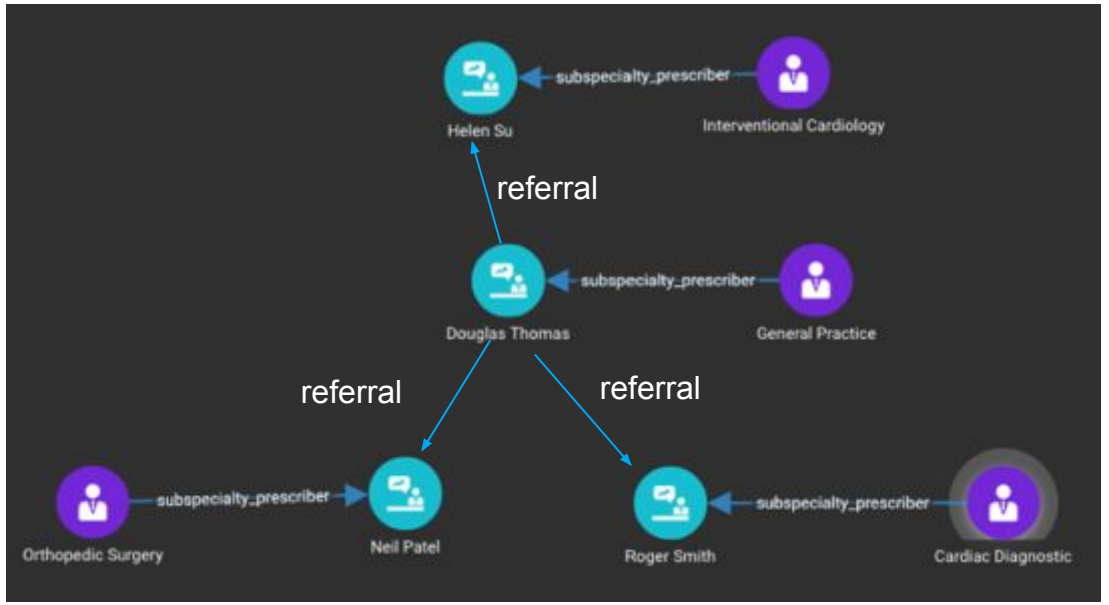
4-Hop Query to find graph analytics pattern:
Find and visualize prescriber referral relationships



Focus for today's hands-on training

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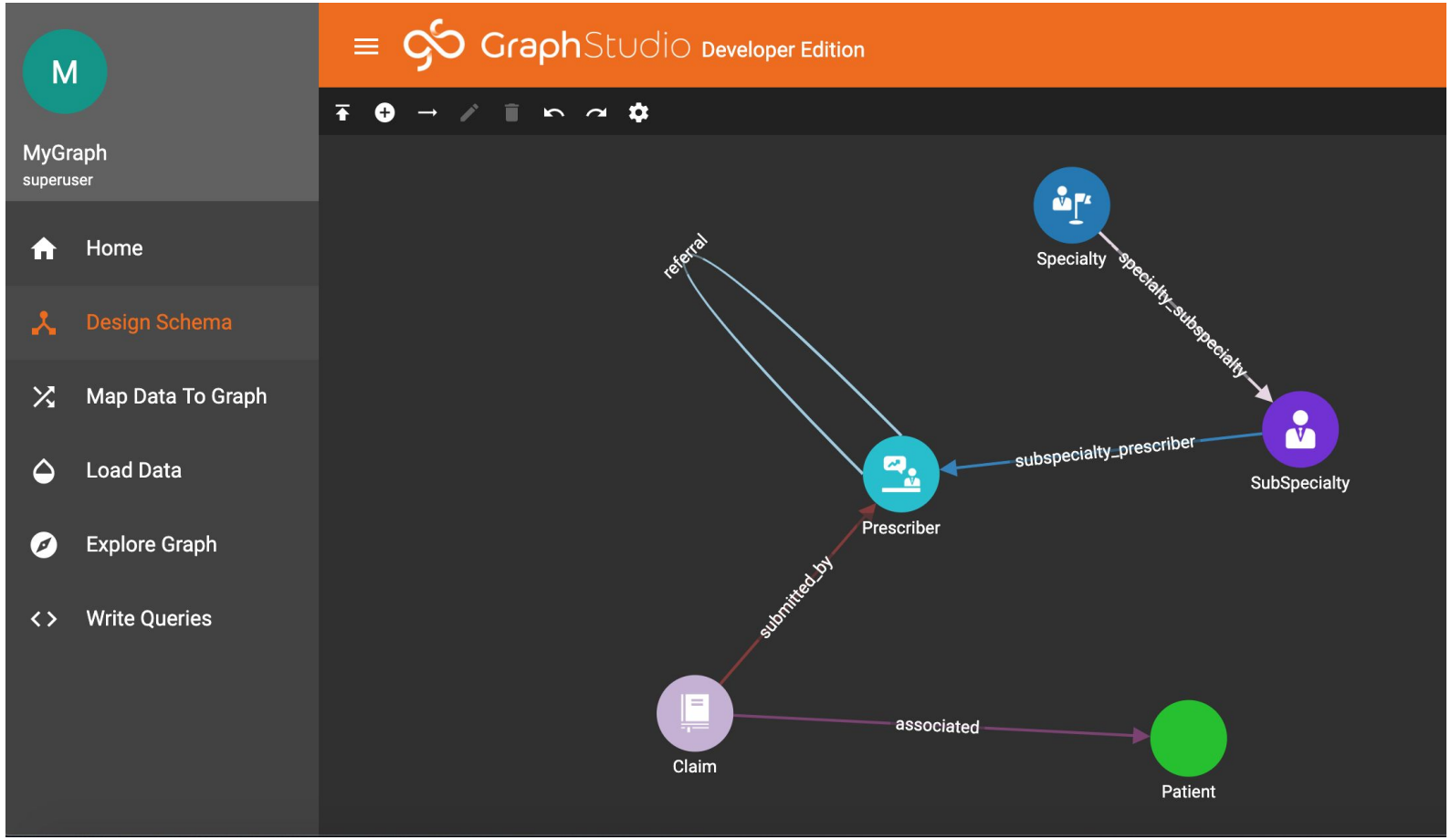
Hands-on Training Exercises

- Exercise 1 – Create data model, map data and load the data for HRZ Health Graph
- Exercise 2 – Execute graph analytics pattern **"Understand how prescribers are connected"** for use case "Understand & optimize referral networks to lower cost of care" in Graph Studio and with GSQL query
- Exercise 3 – Execute graph analytics pattern **"Find and visualize prescriber referral relationships"** for use case "Understand & optimize referral networks to lower cost of care"
  - Simple referral edge creation based on common patients
- For over achievers –
  - Limit the referral edge creation based on 2 week time window (create referral relationship only if the time between claims is less than 2 weeks)
  - Tailor referral edge to remember the number of times a patient is referred by one Doctor to another

Exercise 1 – Building and Loading HRZ Health Graph in TigerGraph GraphStudio



TigerGraph GraphStudio overview videos located at - https://www.youtube.com/watch?v=29PCZEhyx8M&list=PLq4I3NnrSRp7RfZqrtsjevDjpSV8IHhe-

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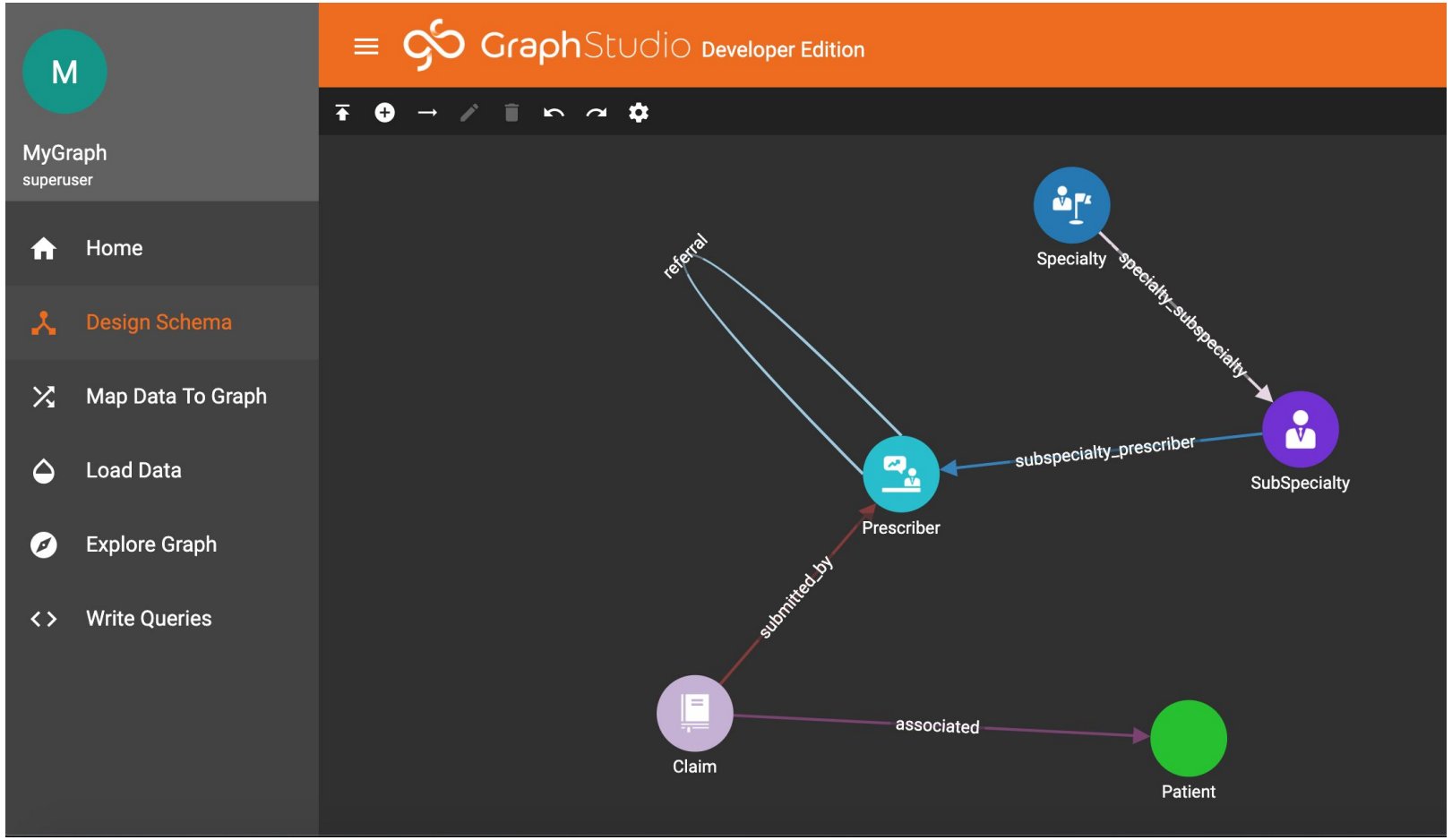
Exercise 1 – Step 1: Create schema for the HRZ Health Graph



Creating Schema video on TigerGraph channel - https://www.youtube.com/watch?v=Q0JUkiU0lbs&index=9&list=PLq4l3NnrSRp7RfZqrtsievDjpSV8lHhe-

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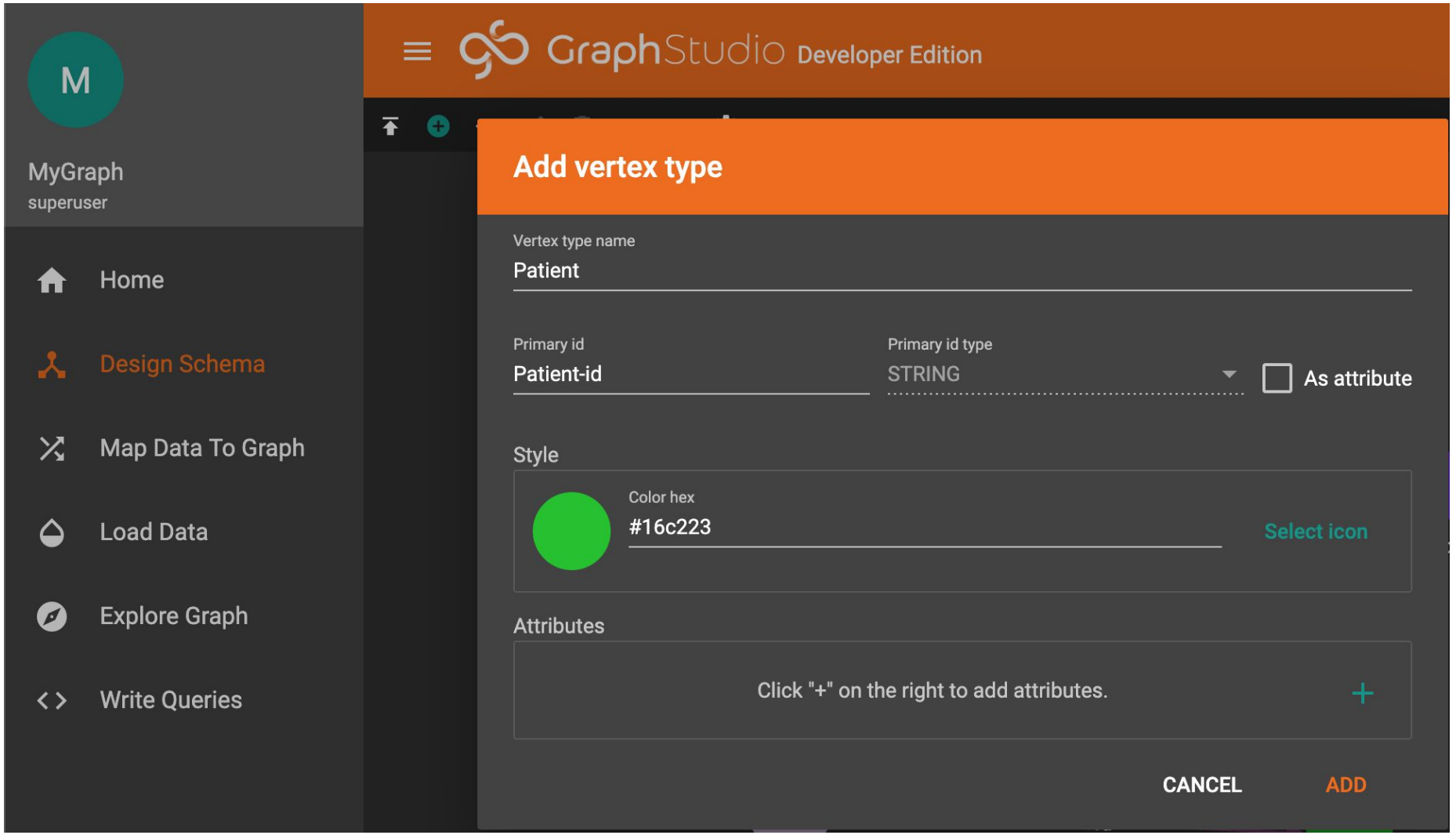
Exercise 1 – Step 1A: Create Patient Vertex



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https://www.youtube.com/watch?v=Q0JUkiU0lbs&index=9&list=PLq4l3NnrSRp7RfZqrtsievDjpSV8lHhe-

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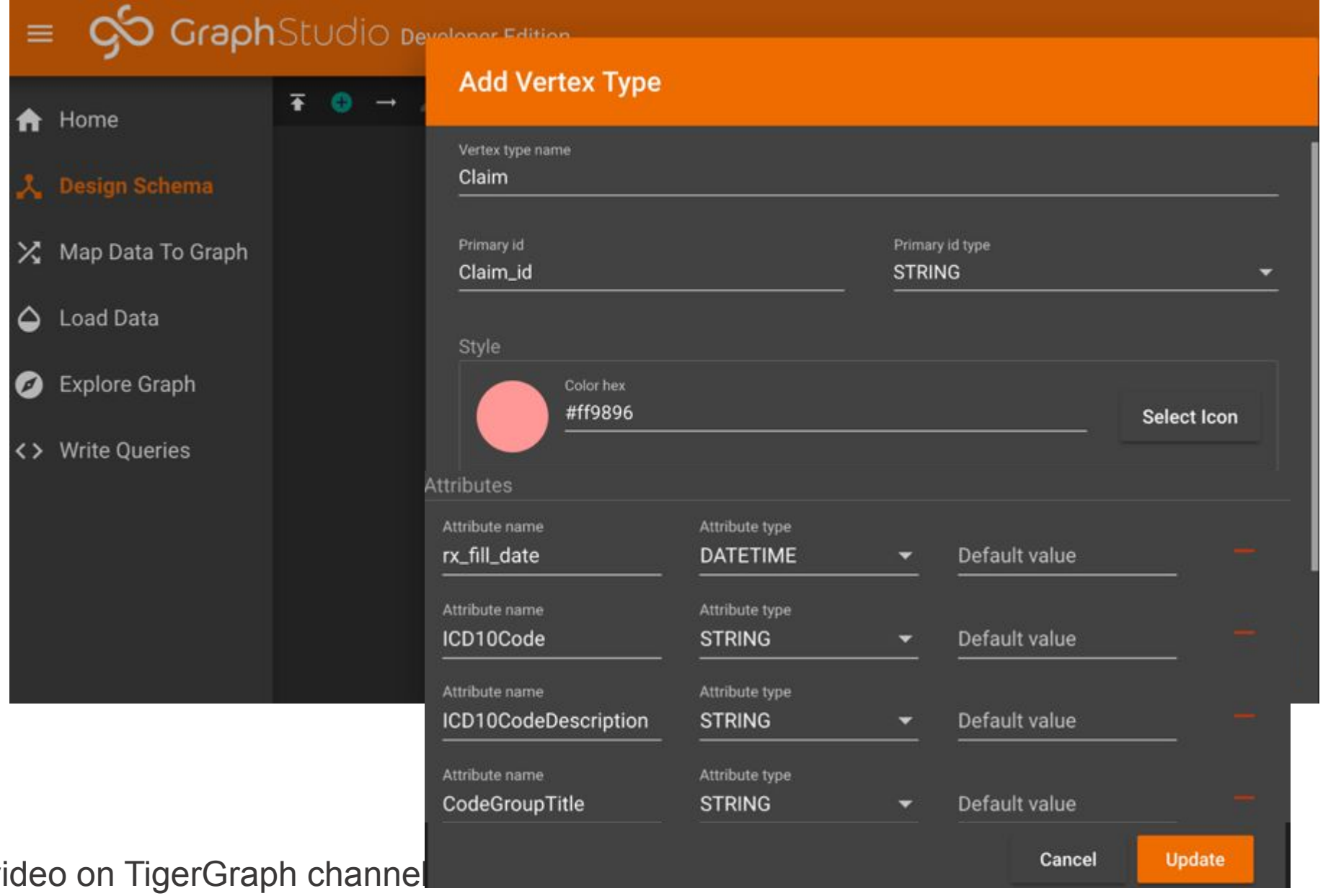
Exercise 1 – Step 1B: Create Claim Vertex



Creating Schema video on TigerGraph channel
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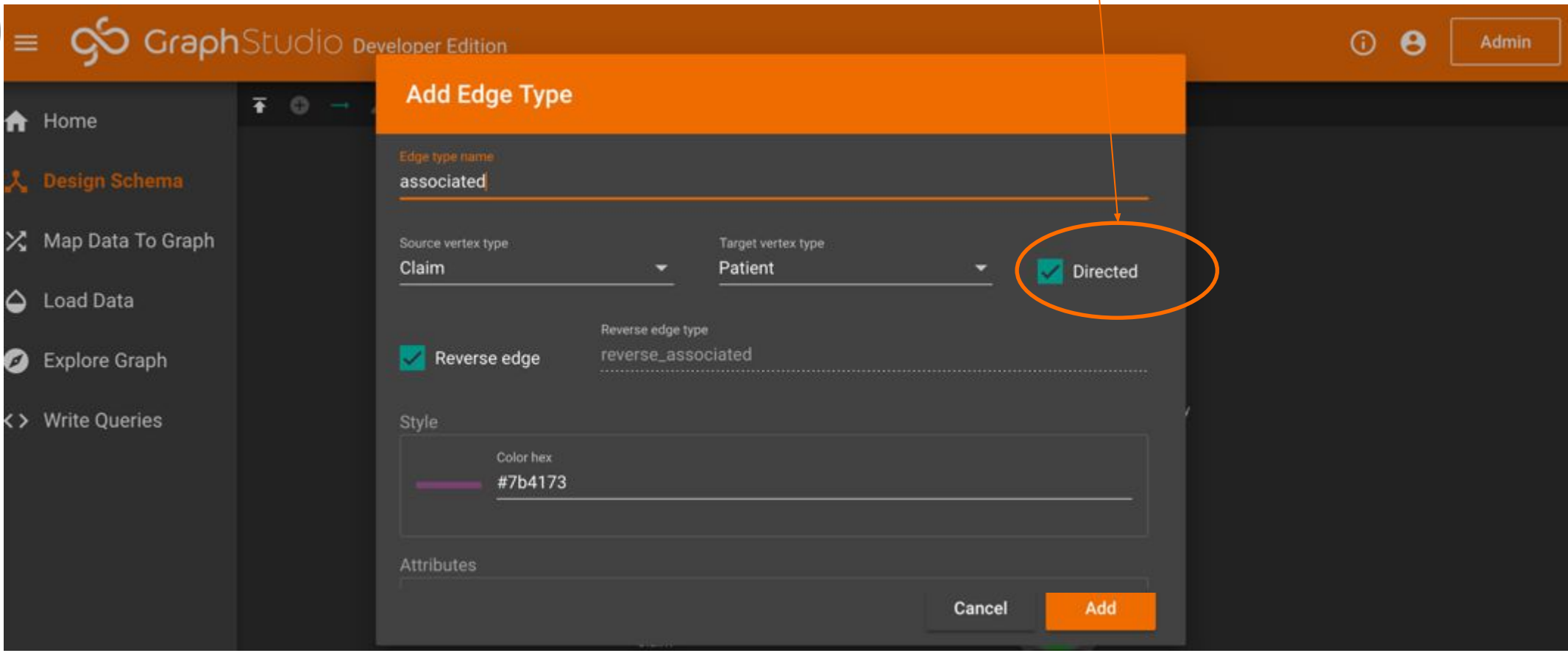
Exercise 1 – Step 1C: Create Claim to Patient associated edge

Be sure to select this as it will allow you to traverse the graph from patient back to claim



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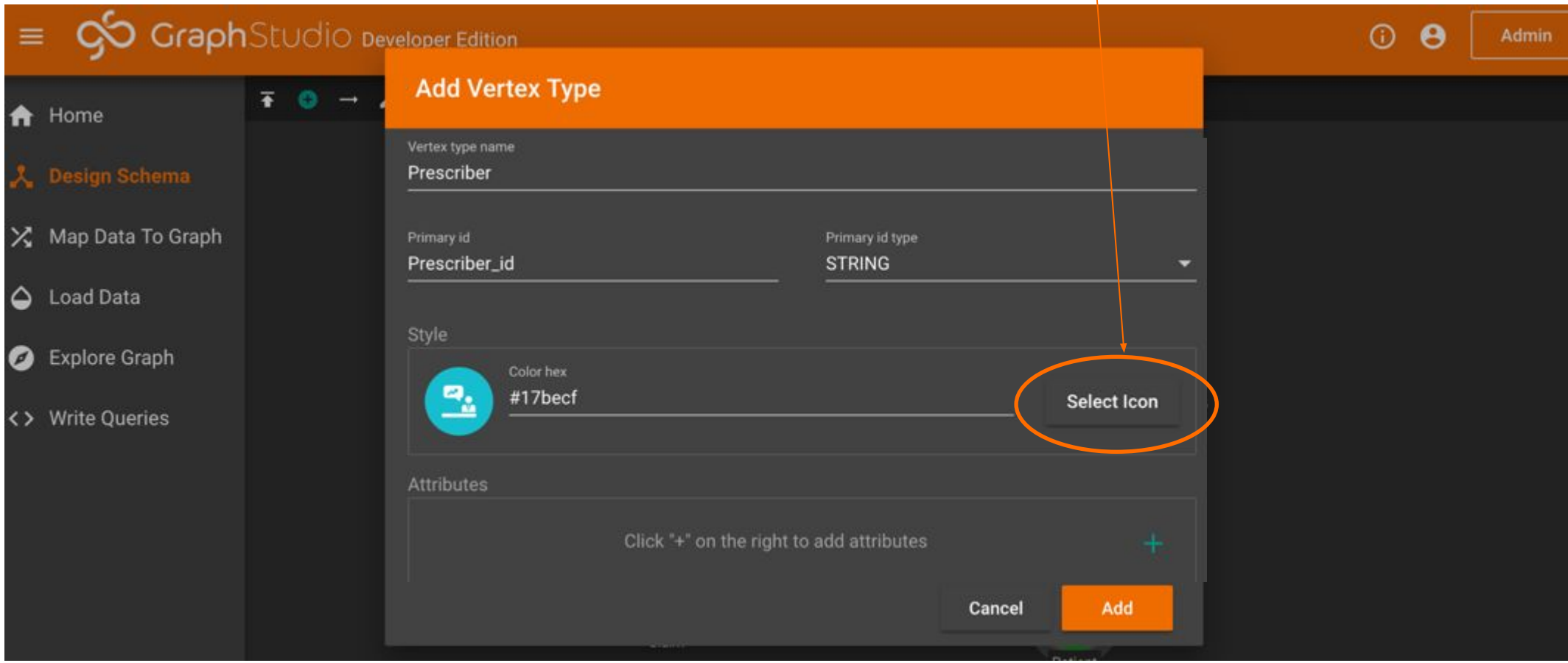
Exercise 1 – Step 1D: Create Prescriber Vertex

Use Select Icon to pick an icon for the node



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https://www.youtube.com/watch?v=Q0JUkiU0lbs&index=9&list=PLq4l3NnrSRp7RfZqrtsievDjpSV8lHhe-

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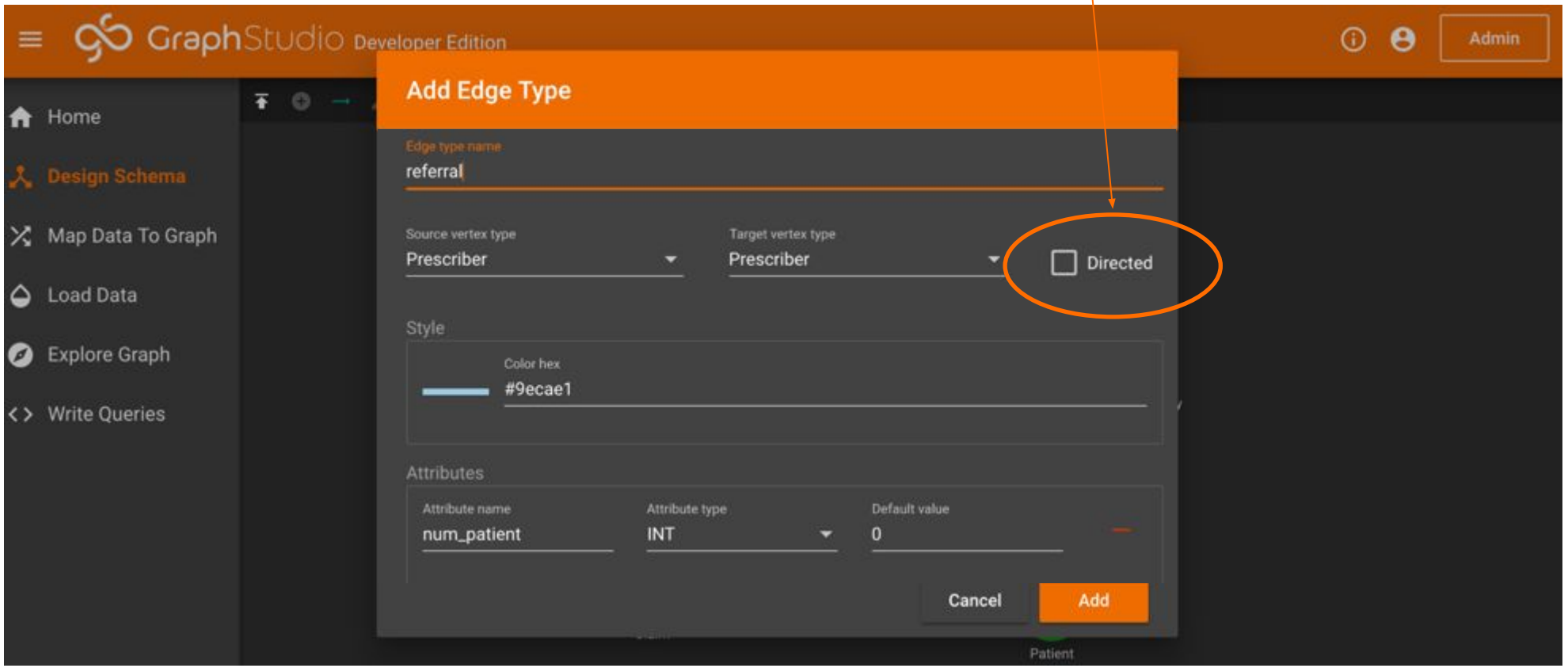
Exercise 1 – Step 1E: Create Referral edge

We are keeping this edge “Undirected” for the sake of simplicity – It will be directed in real customer deployments



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https://www.youtube.com/watch?v=Q0JUkiU0lbs&index=9&list=PLq4l3NnrSRp7RfZqrtsievDjpSV8lHhe-

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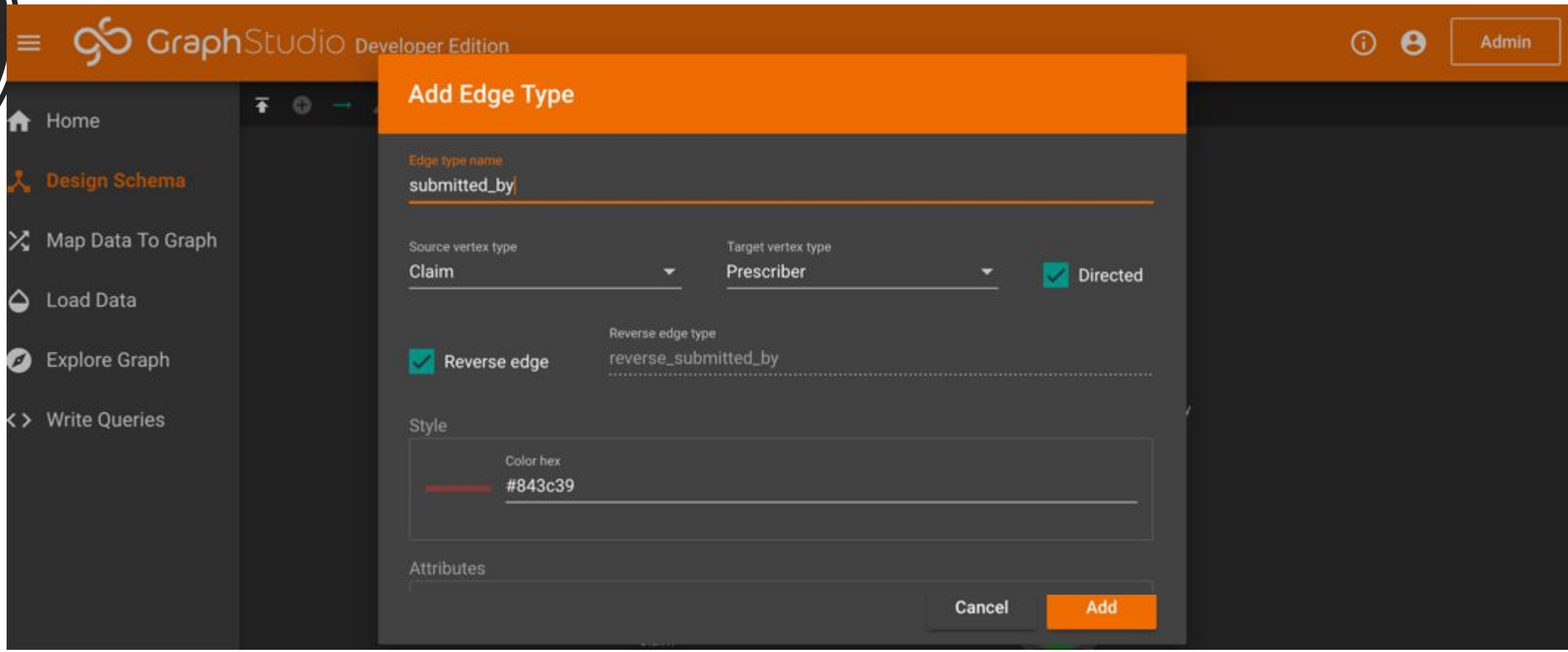
Exercise 1 – Step 1F: Create Claim to Prescriber submitted_by edge



Creating Schema video on TigerGraph channel:
https://www.youtube.com/watch?v=Q0JUkiU0lbs&index=9&list=PLq4l3NnrSRp7RfZqrtsievDjpSV8lHhe-

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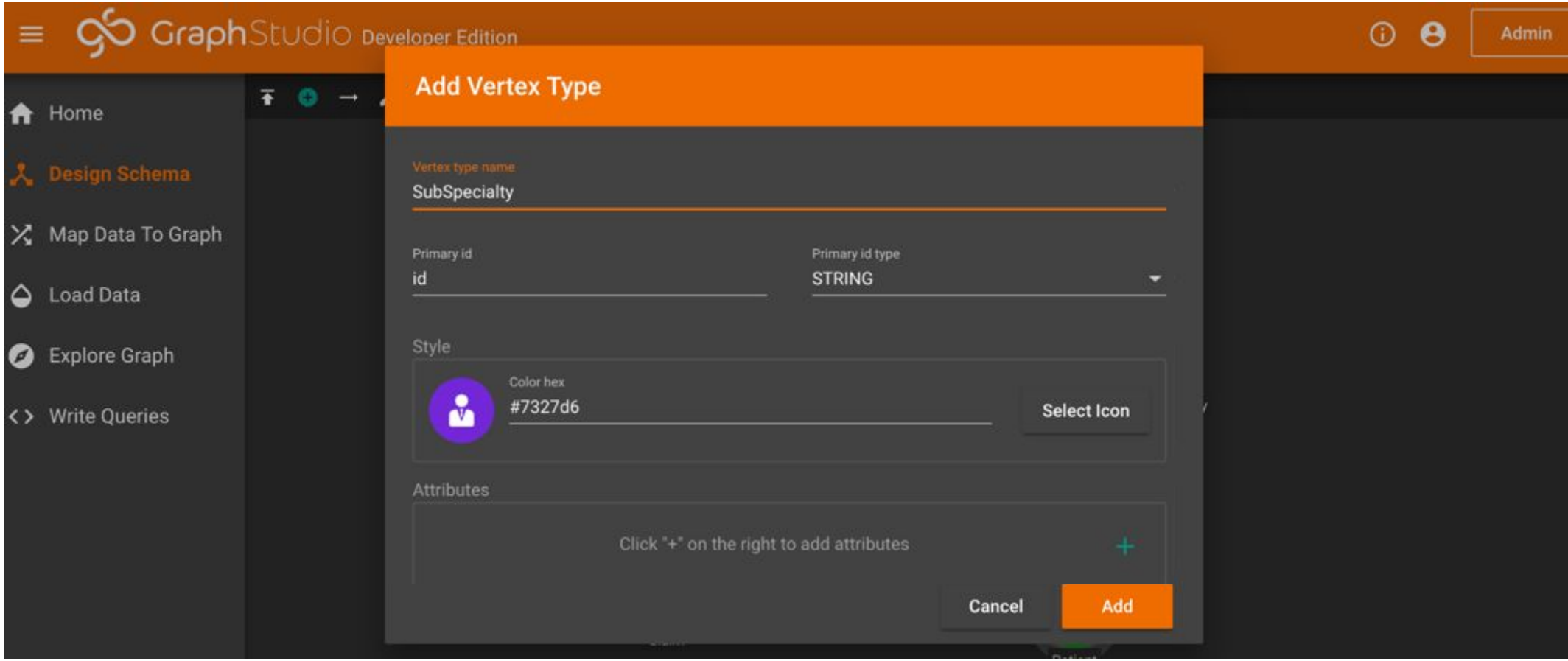
Exercise 1 – Step 1G: Create Subspecialty Vertex



Creating Schema video on TigerGraph channel:
https://www.youtube.com/watch?v=Q0JUkiU0lbs&index=9&list=PLq4l3NnrSRp7RfZqrtsievDjpSV8lHhe-

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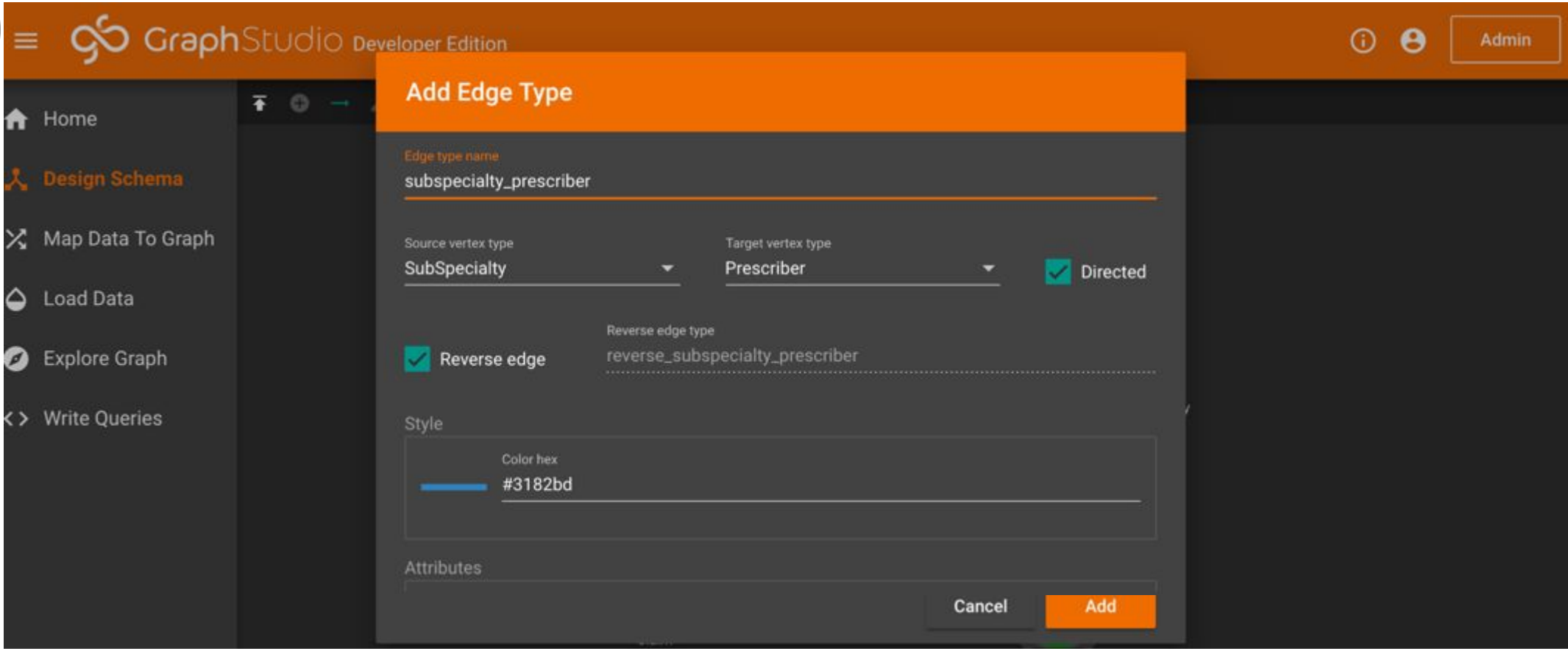
Exercise 1 – Step 1H: Create subspecialty to prescriber edge



Creating Schema video on TigerGraph channel:
https://www.youtube.com/watch?v=Q0JUkiU0lbs&index=9&list=PLq4l3NnrSRp7RfZqrtsievDjpSV8lHhe-

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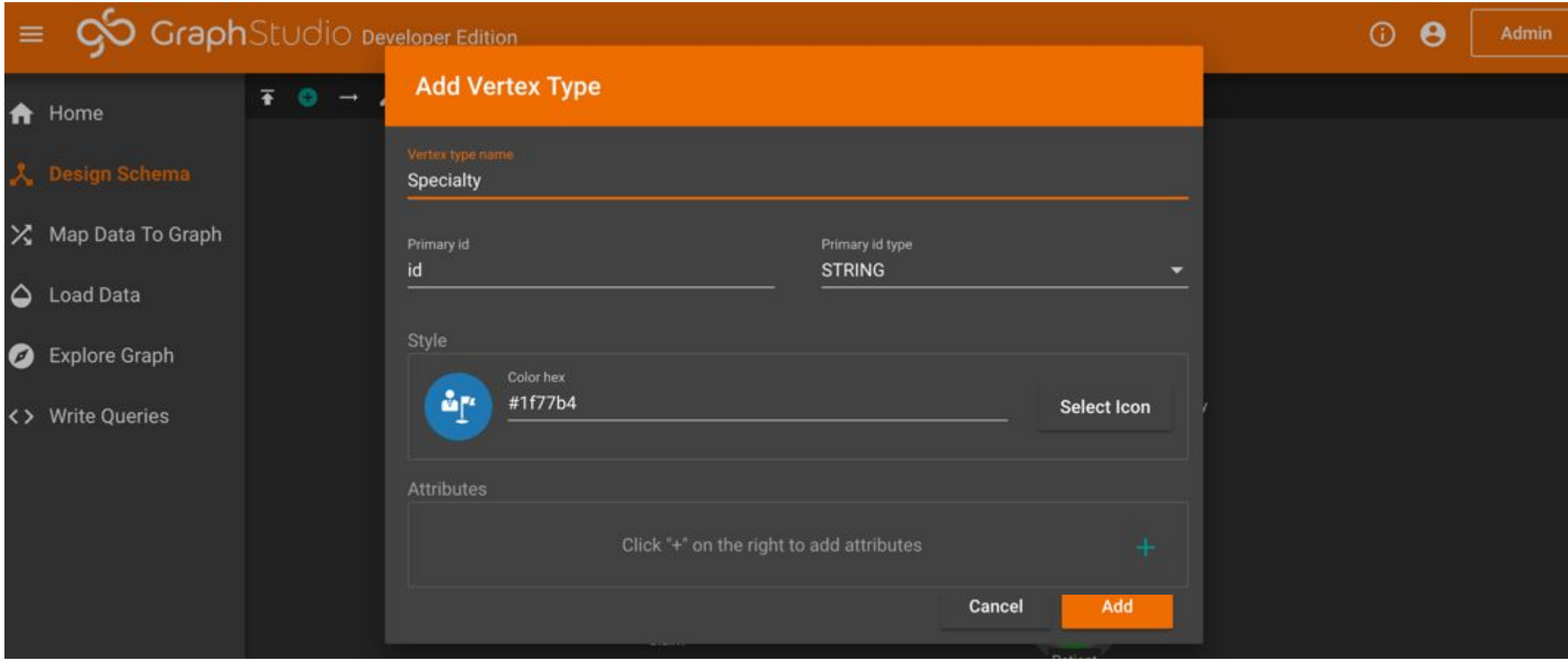
Exercise 1 – Step 1 I: Create Specialty Vertex



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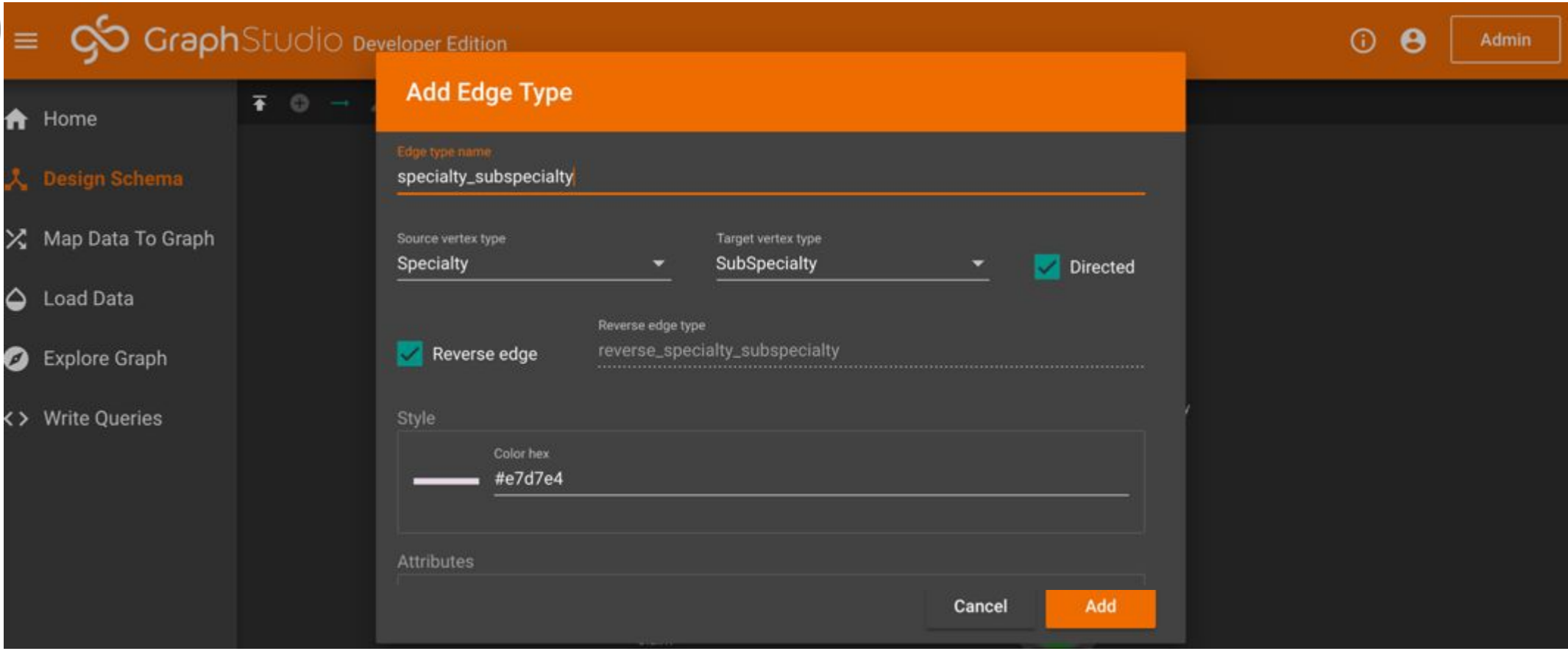
Exercise 1 – Step 1J: Create Specialty to Subspecialty edge



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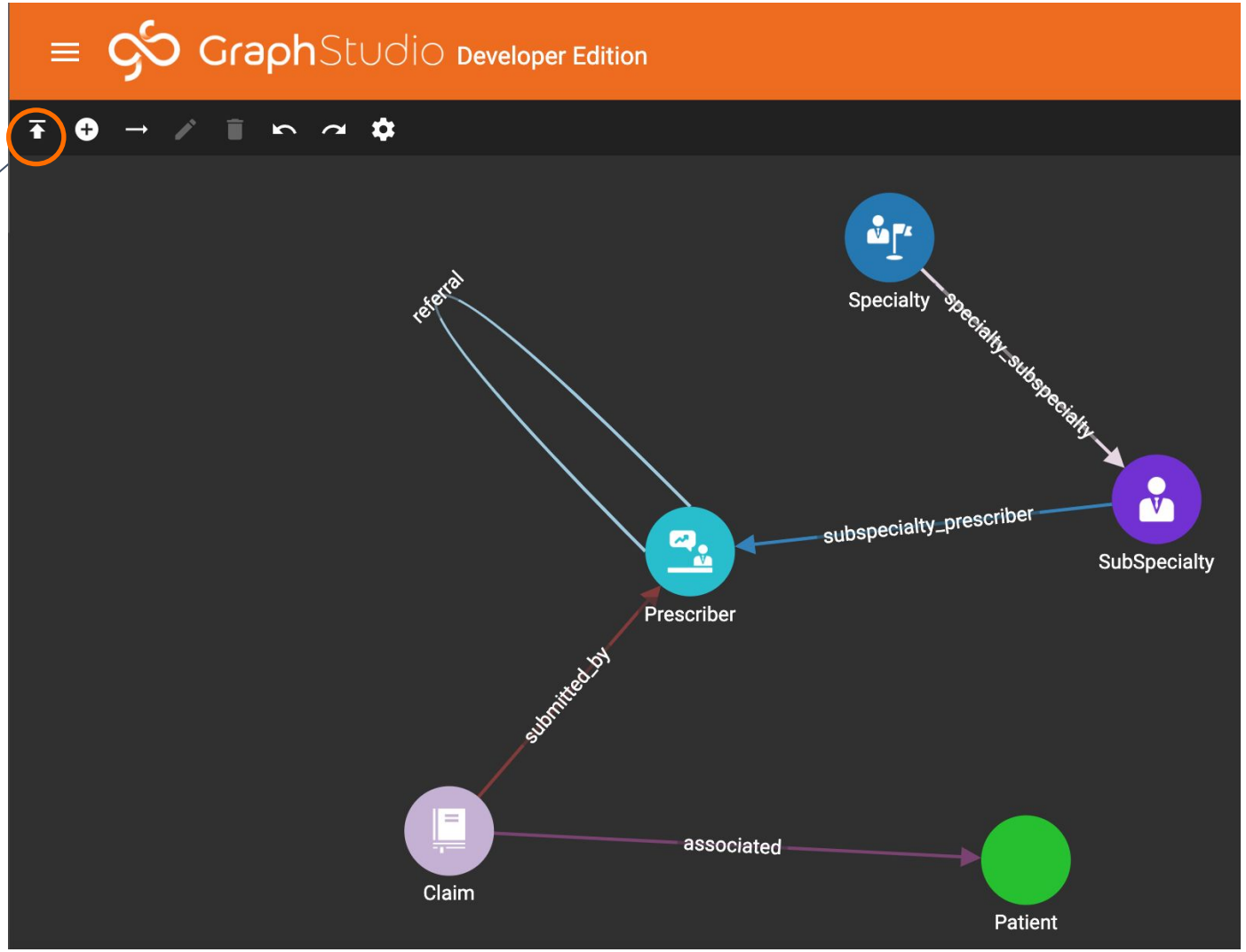
Exercise 1 – Step 1K: Save and Publish Schema

Publish the design schema



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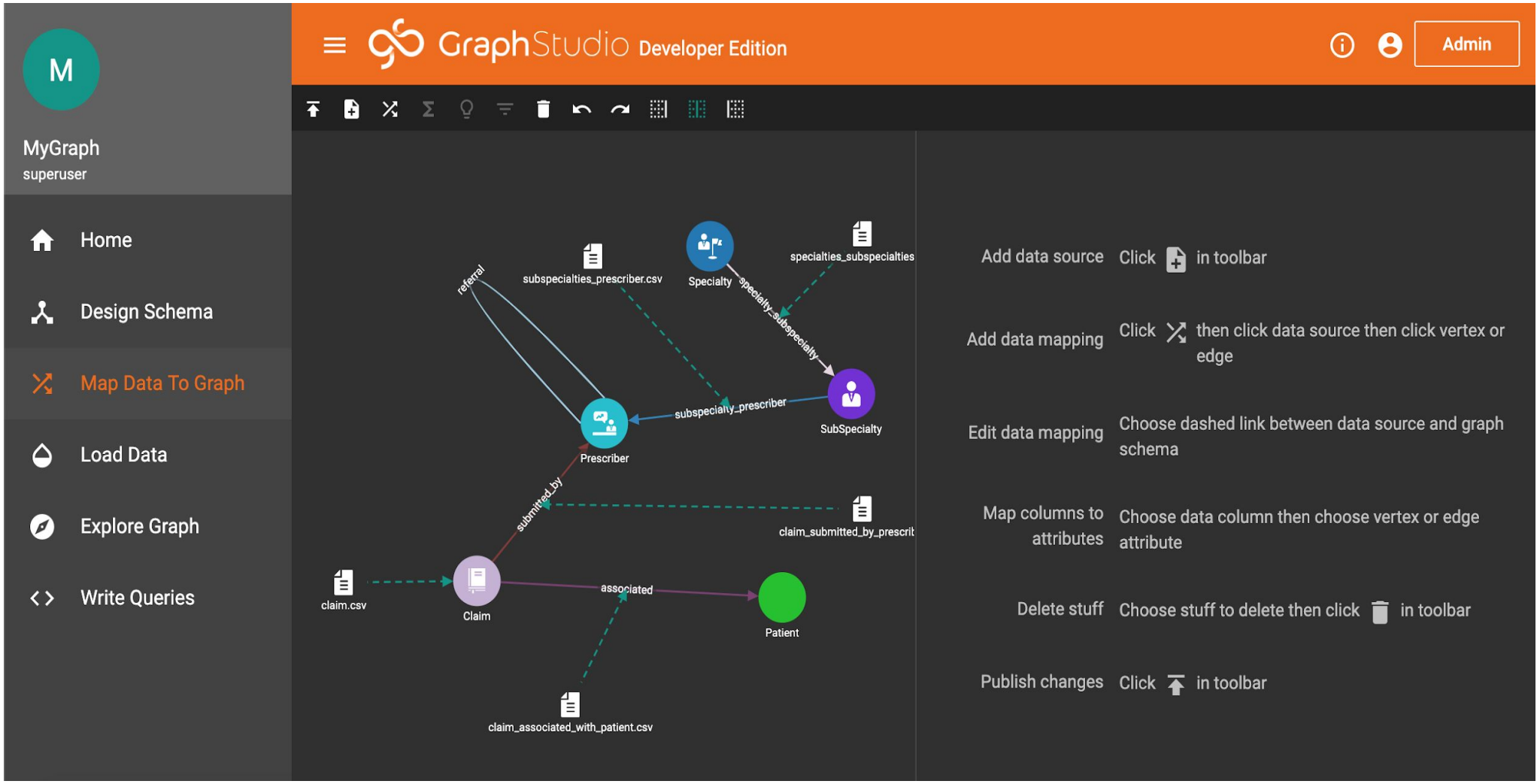
Exercise 1 – Step 2: Map Data to Graph



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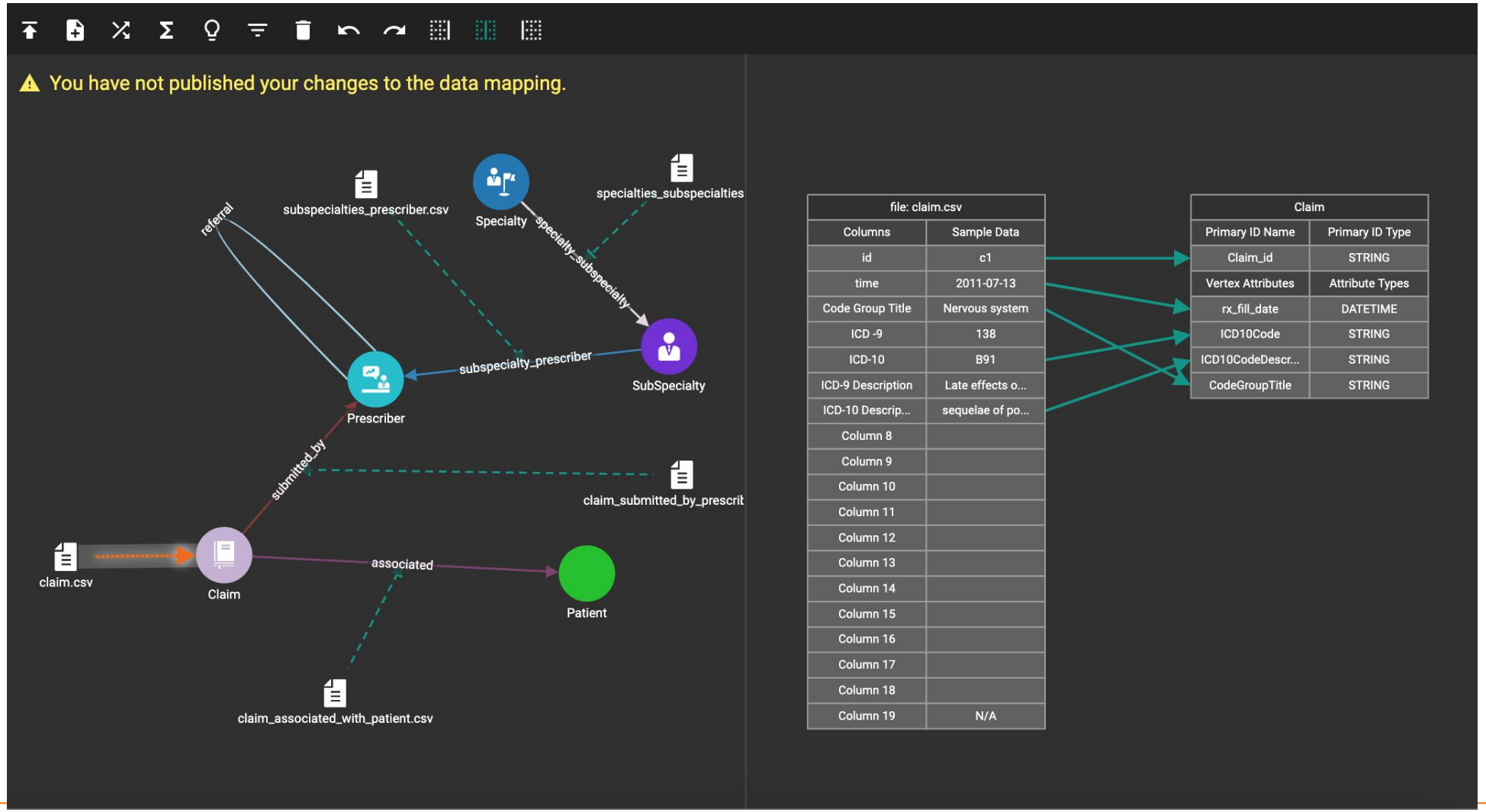
Data Files and Mappings – claim.CSV □ Claim node



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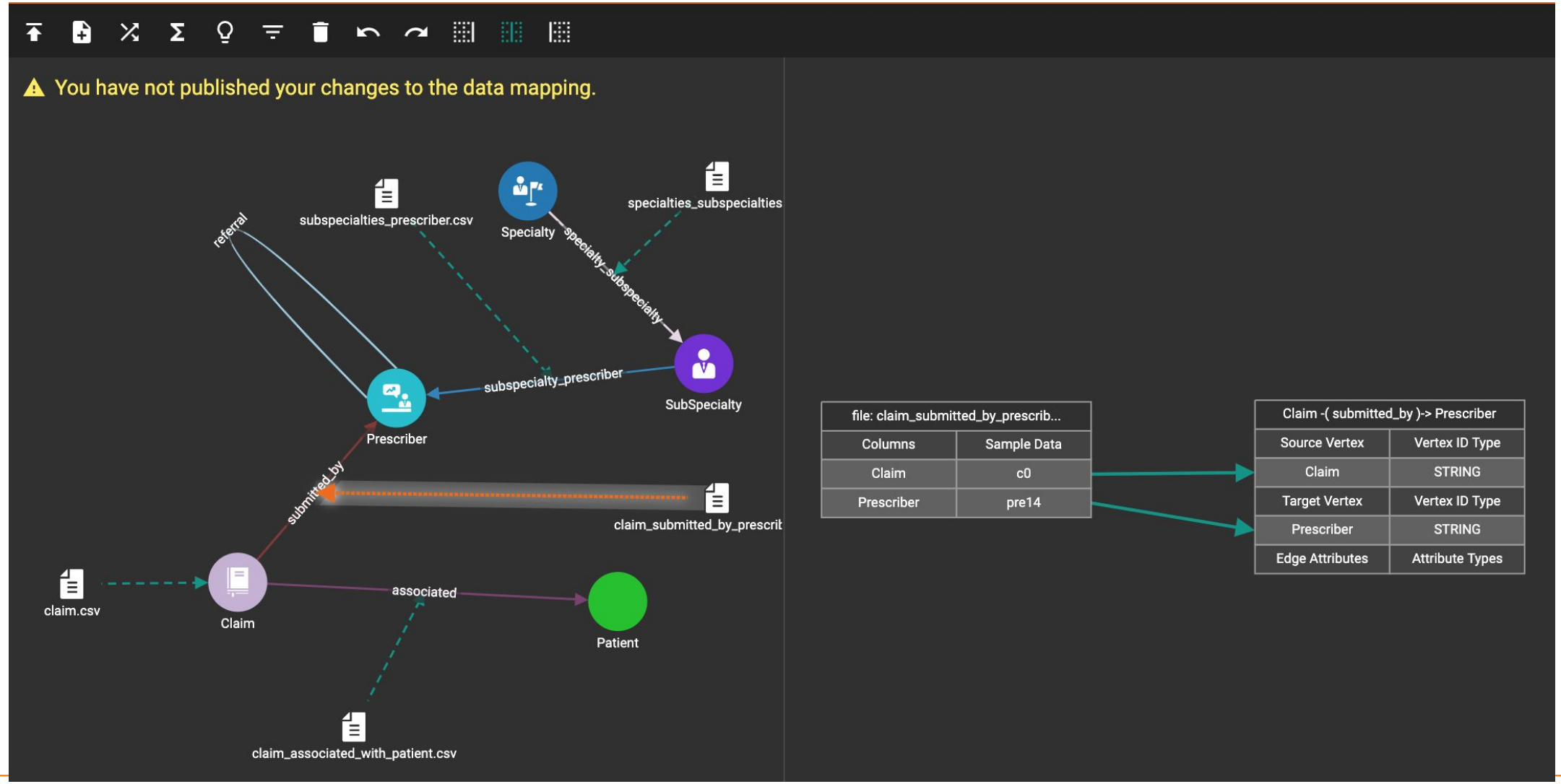
Data Files and Mappings – claim submitted_by prescriber.CSV □ submitted_by edge



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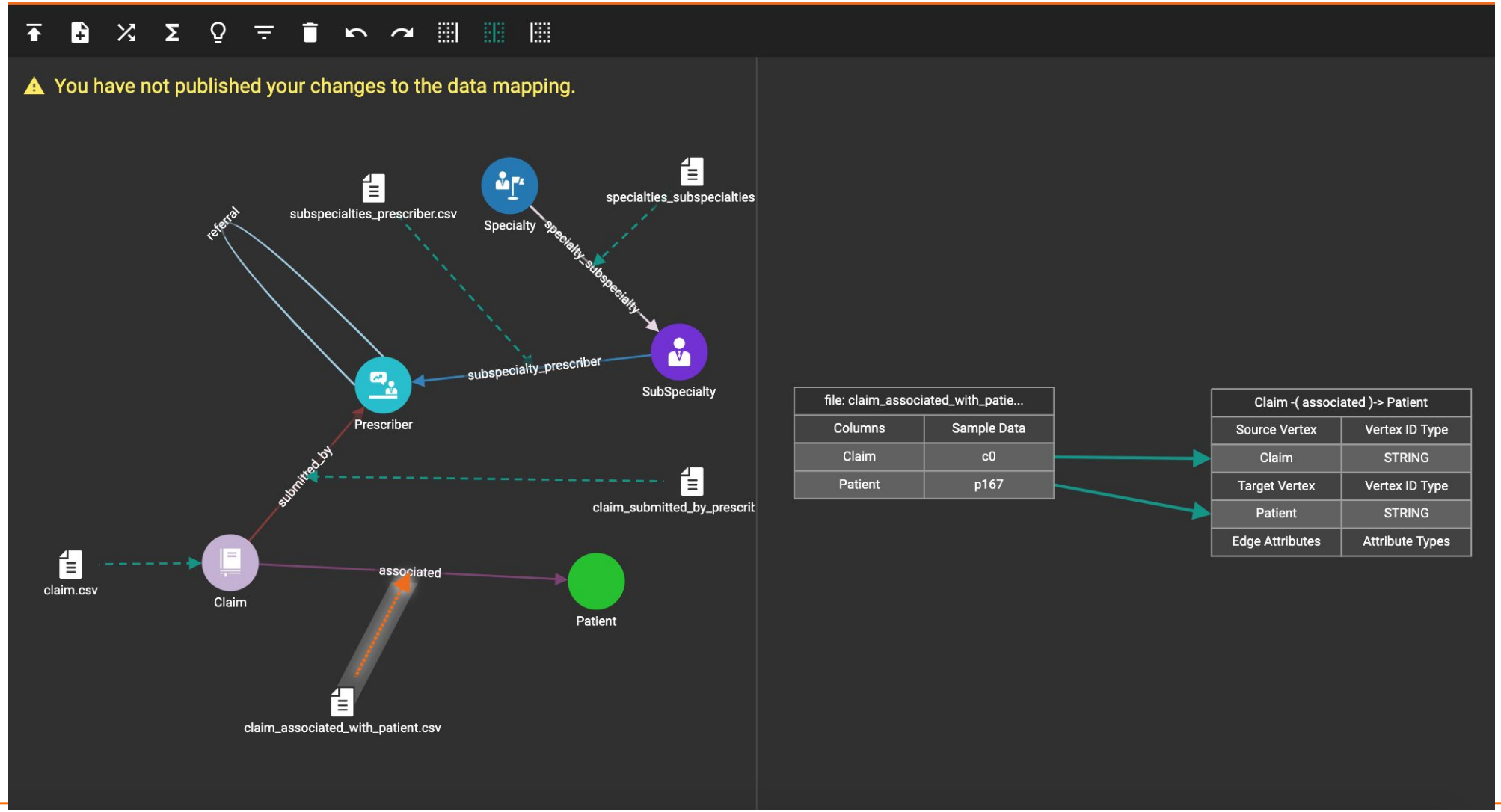
Data Files and Mappings – claim associated with patient.CSV associated_with edge



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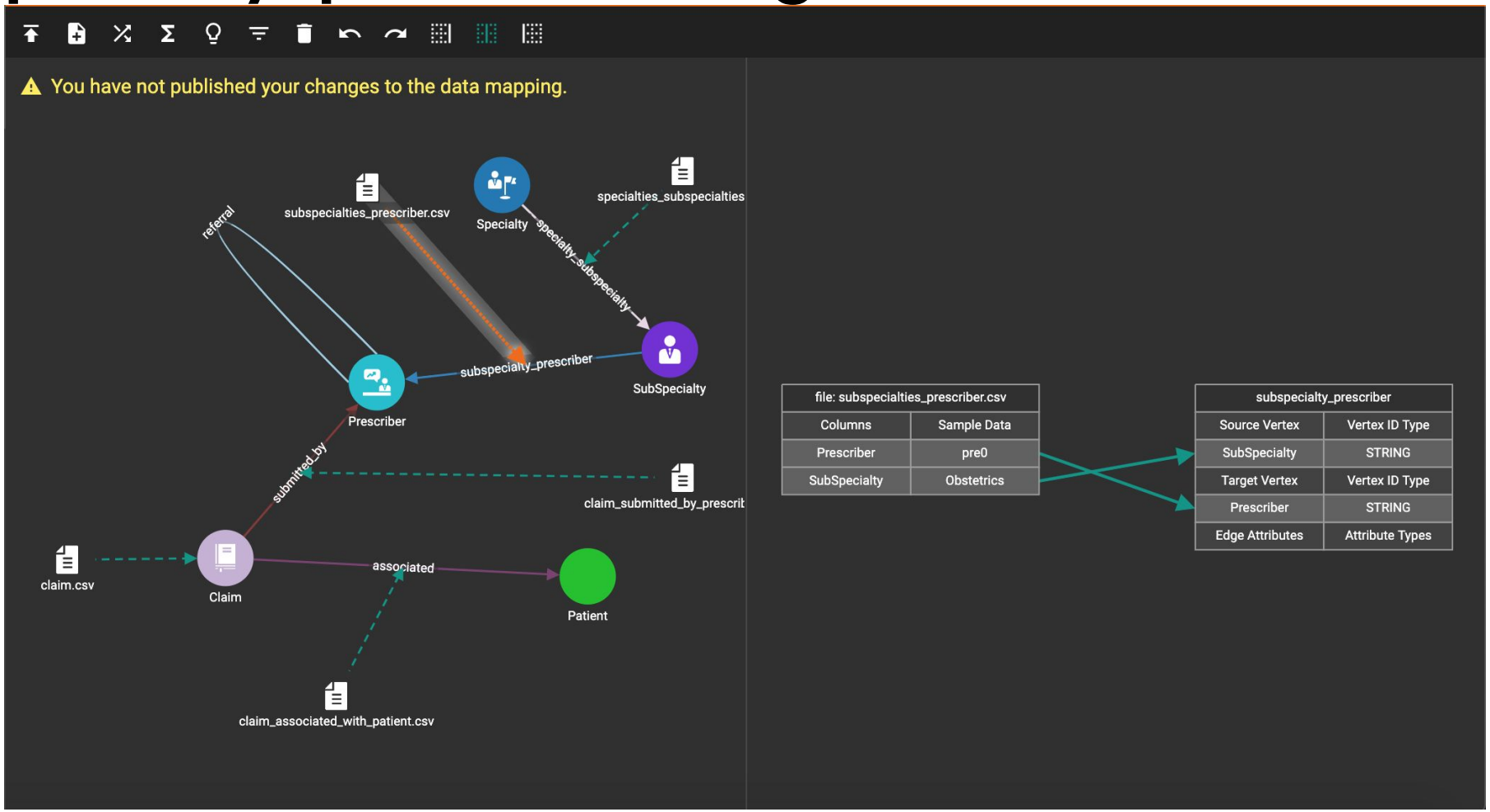
Data Files and Mappings – subspecialties prescriber.CSV subspecialty_prescriber edge



Please note that there is no need to map subspecialties prescriber.csv to Prescriber node – it will be populated automatically based on the edge mapping

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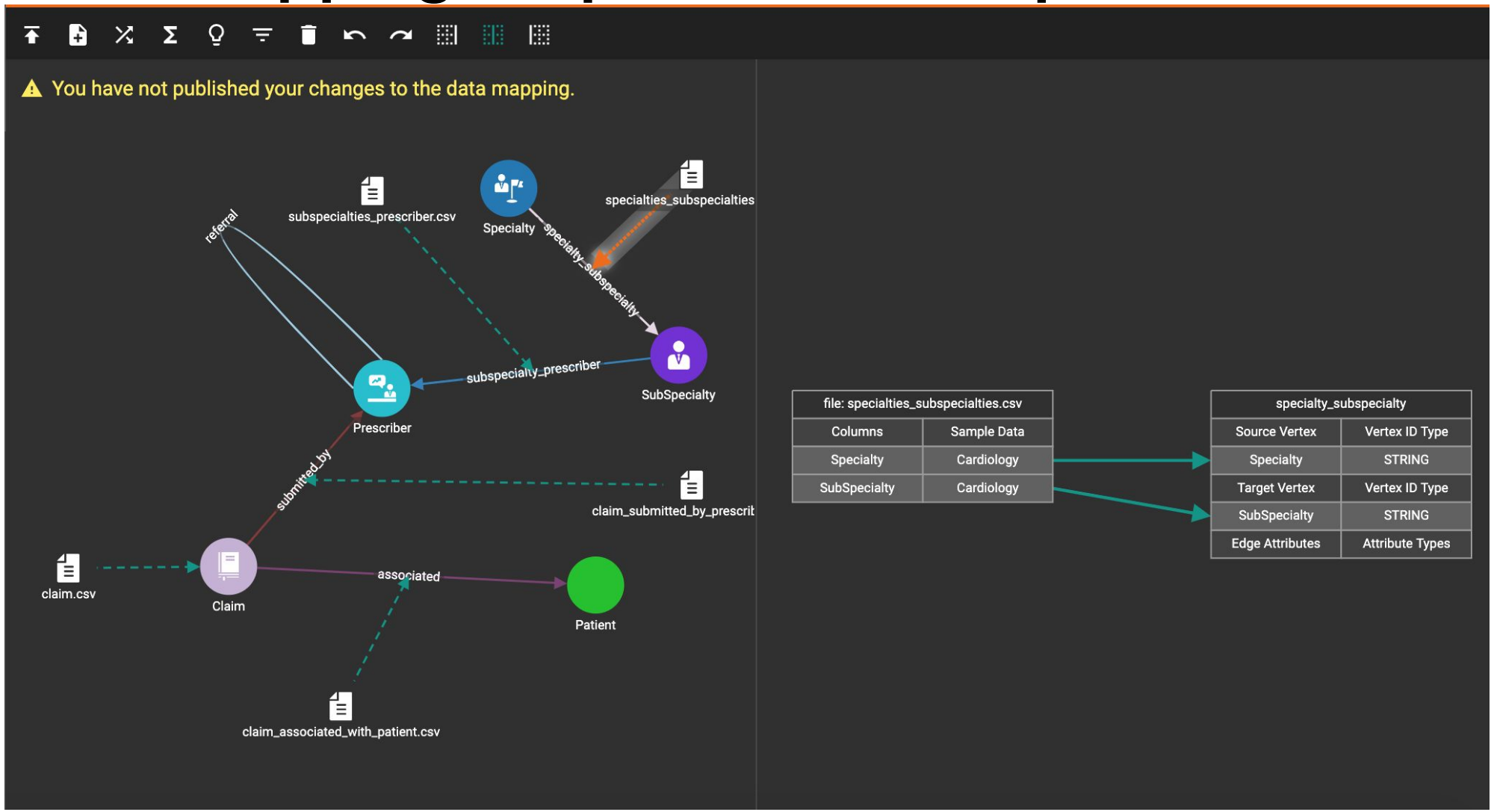
Data Files and Mappings – specialties subspecialties.CSV
□ edge



Please note that there is no need to map to specialty or subspecialty nodes – those will be populated automatically

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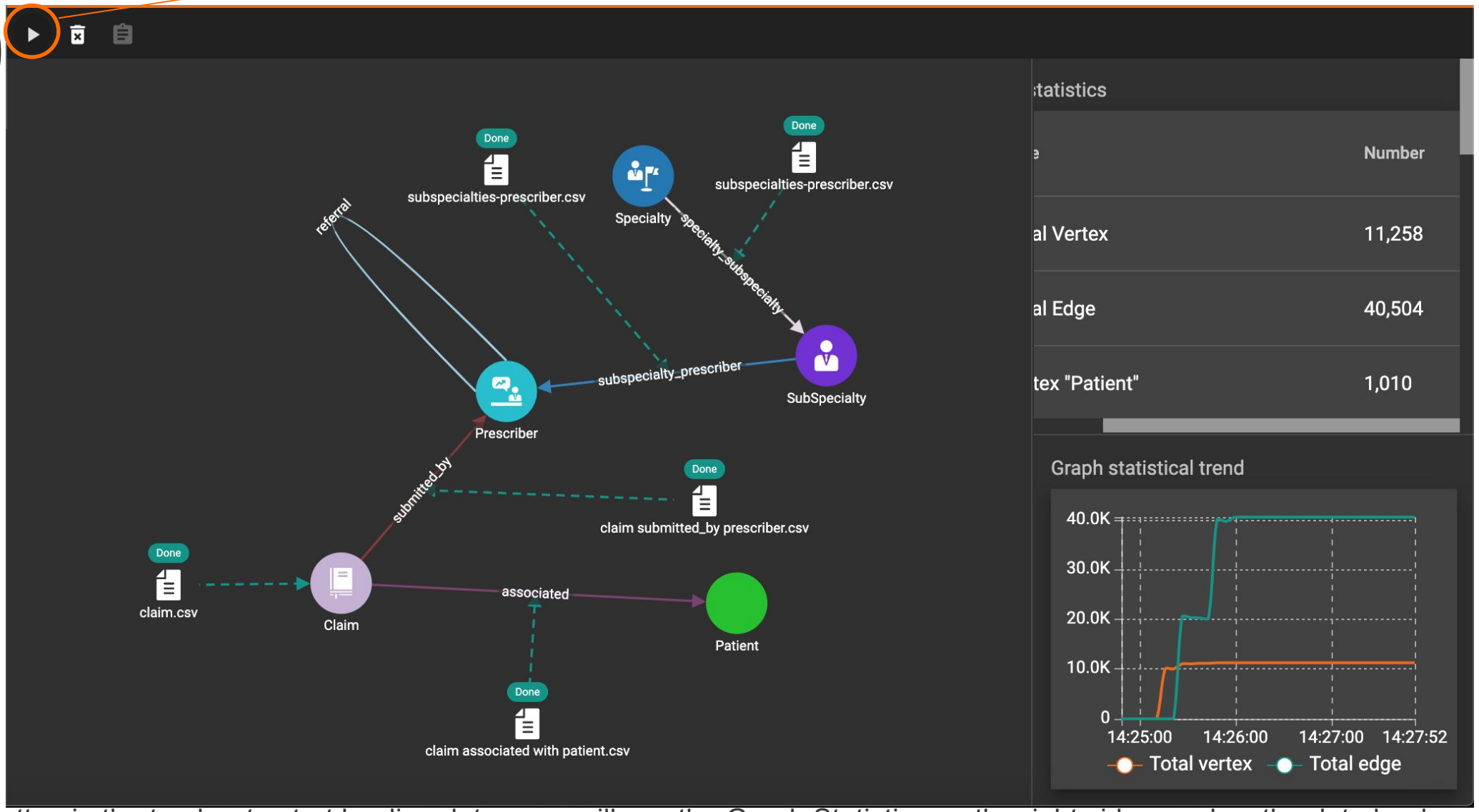
Exercise 1 – Step 3: Load Data

Click on the Play button to load the data



Click on the “Play” button in the top bar to start loading data - you will see the Graph Statistics on the right side panel as the data loads up

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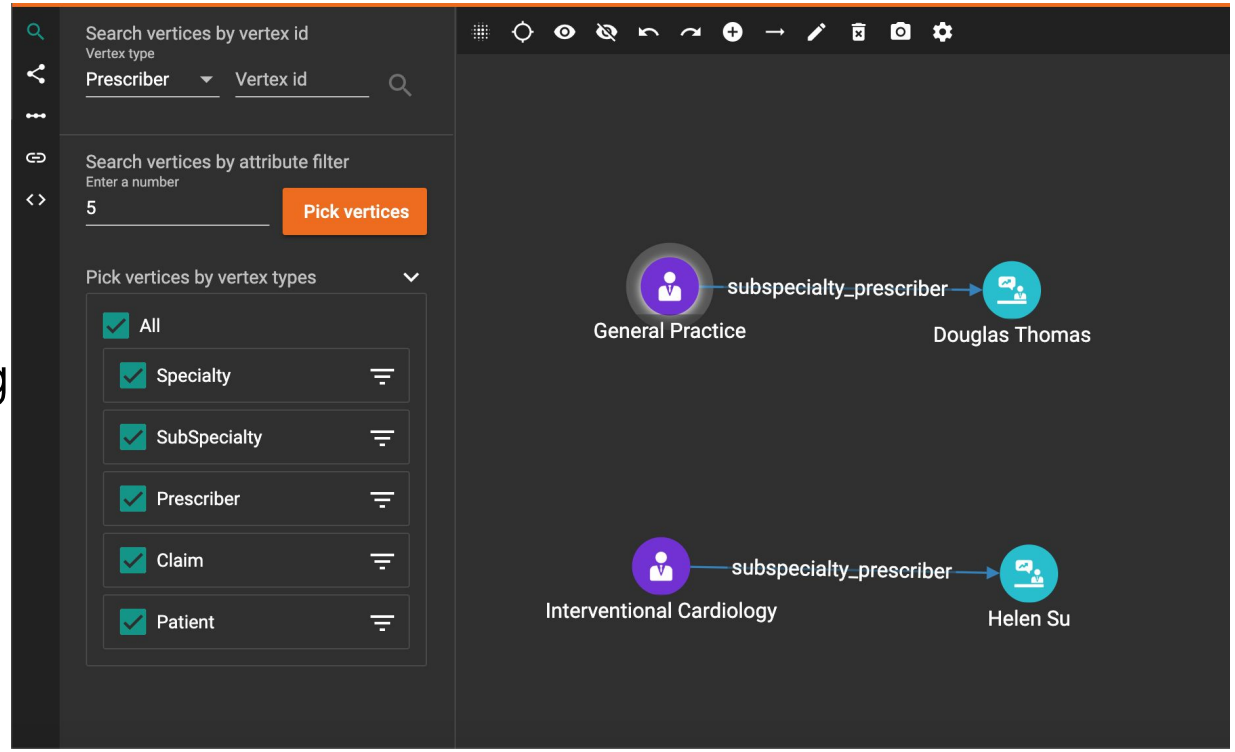
Exercise 2 - Understand how prescribers are connected

- Part 1 - Use GraphStudio to find relationships among following prescribers
  - ”Douglas Thomas” & “Helen Su”
  - **Hint** – Select “Explore Graph” in the Left Navigation and find all ways to navigating from Douglas Thomas to Helen Su or vice versa
  - **Stretch Goal** – Explore Douglas Thomas to expand and find all patients served by Dr. Thomas and find all linked prescribers who are seeing those patients



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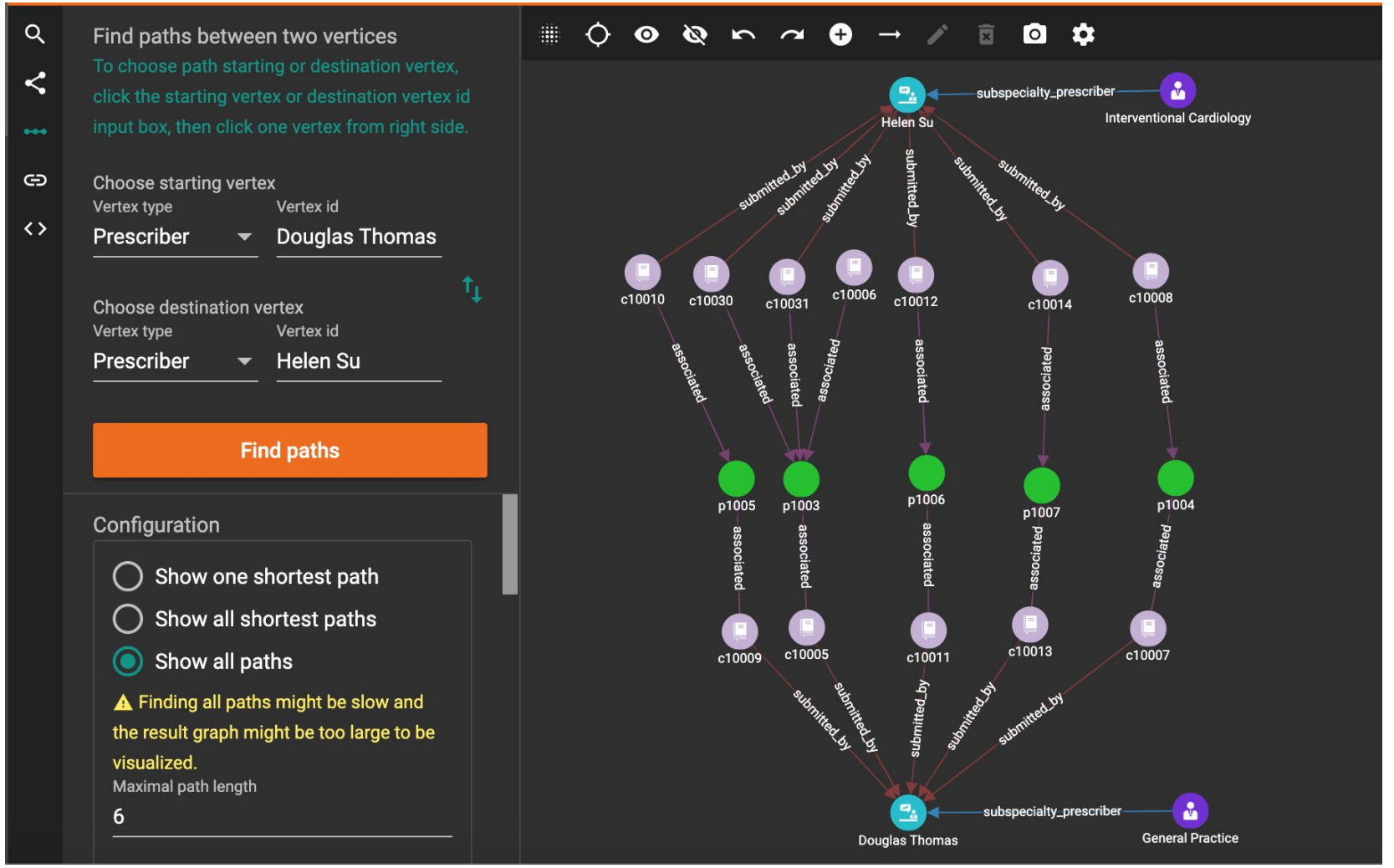
Exercise 2 - Part 1 Answer



Bonus points – Show the date of claim and the ICD 10 code description
Hint: Click on “Settings” Icon to choose the additional attributes to display

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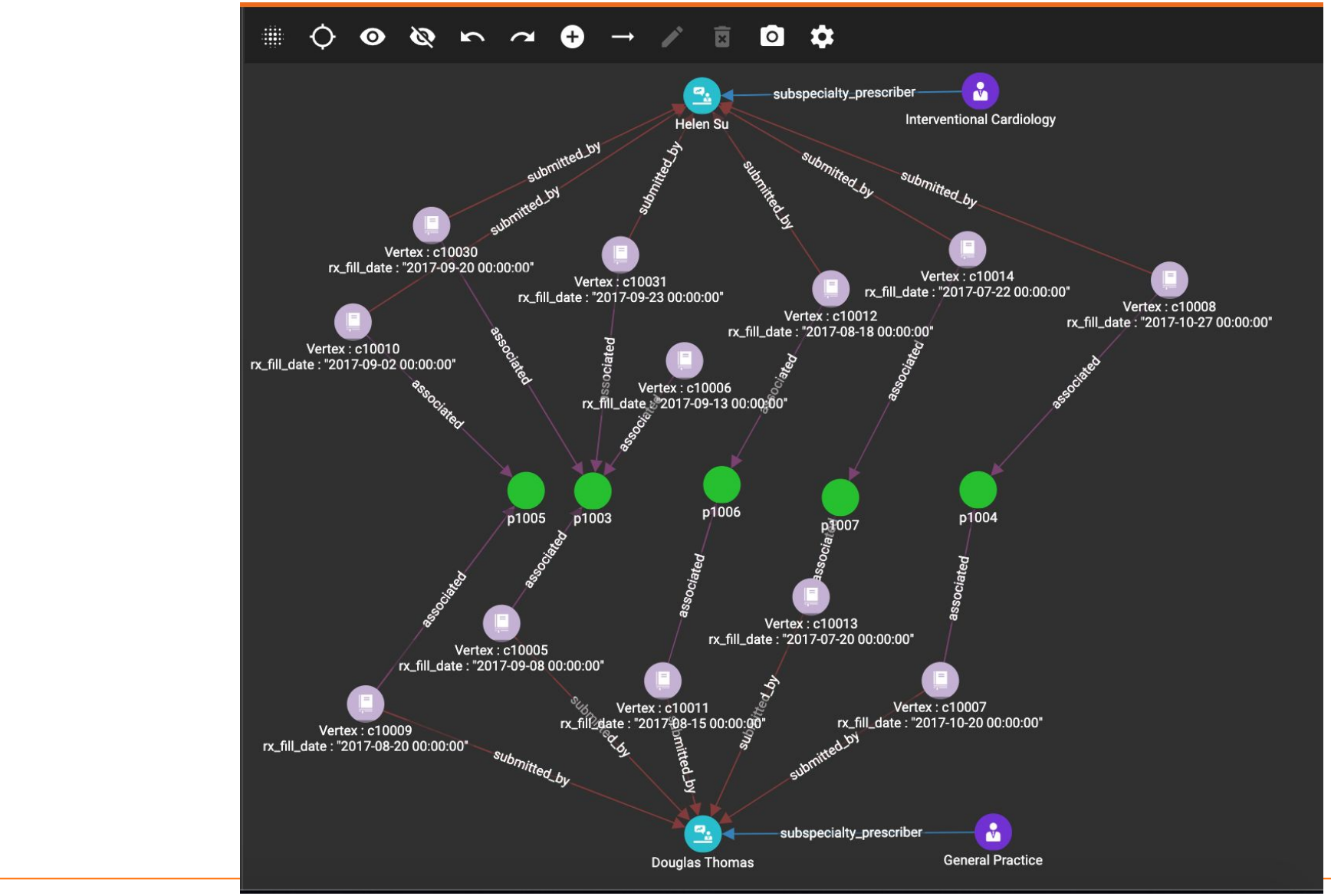
Exercise 2 - Part 1 Answer with claim dates added in



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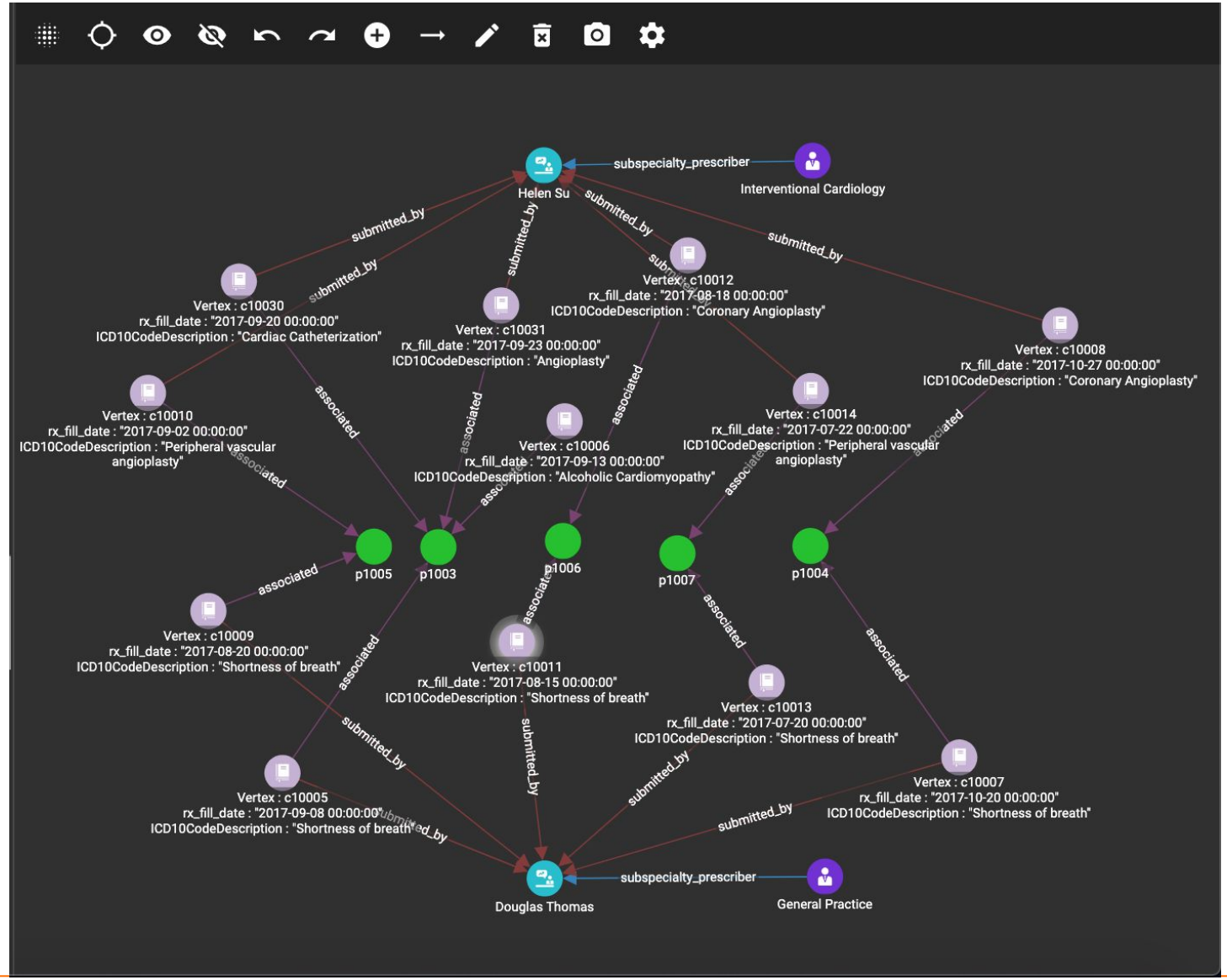
Exercise 2 - Part 1 Answer with claim dates & ICD Code 10 description added in



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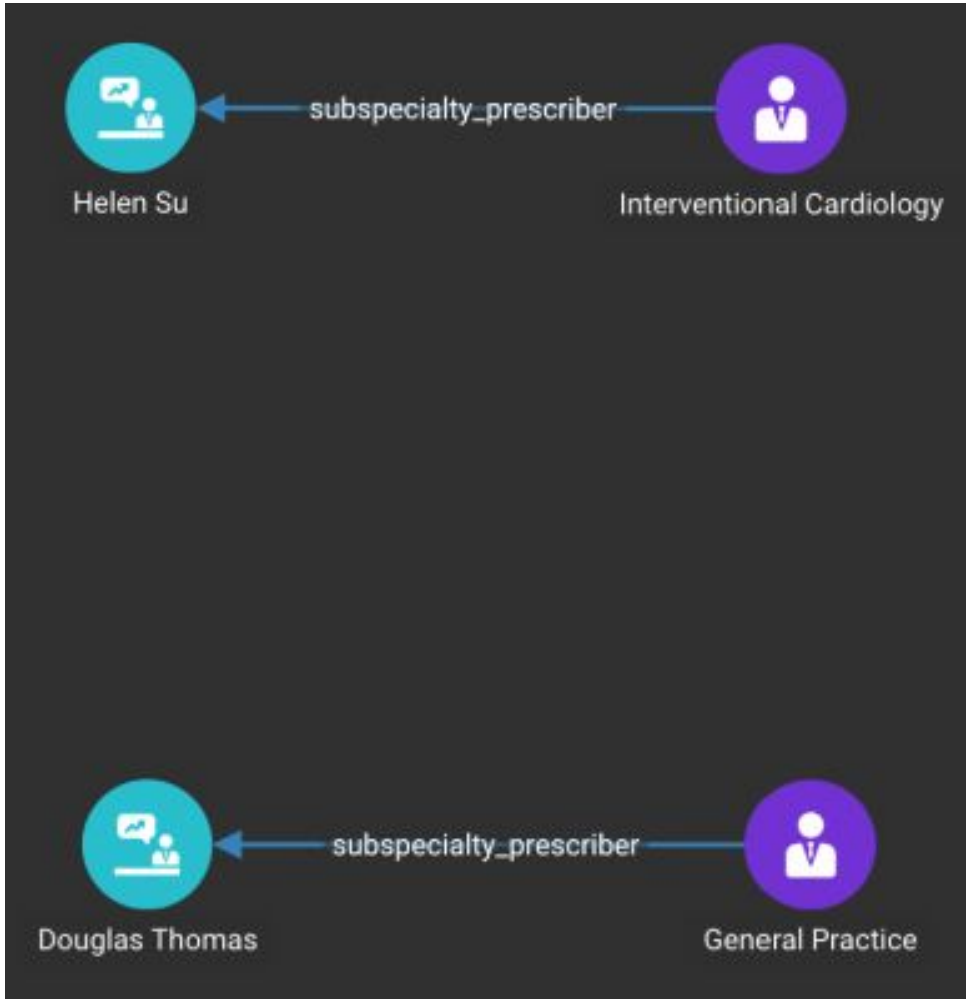
Exercise 2 - Understand how prescribers are connected

- **Part 2 – Write your first GSQL Query: Common Patients**
  - Input: two prescribers
  - Output: Print/Return a list of common patients between the two prescribers
  - **Step 1** – Start graph Traversal from first prescriber to find all associated claims
  - **Step 2** – For those claims, find all the linked patients
  - **Step 3** – find the second prescriber connected via common patients
  - **Step 4** – Find common patients by starting from claims in Step 3
  - **Step 5** – From common patients find all claims that have been visited in earlier steps. Collect the edges so they can be printed
  - **Step 6** – From claims find associated prescribers. Collect and print edges (claims – prescribers) and prescribers.
  - **Hint**
    - Use **OrAccum** to traverse and remember which claims and patients were visited



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GSQL Introduction – Local and Global Variables

- local and global variables are supported in GSQL
- Local variables are use with single @
  - **Usage in the exercise -** @visited (Set visited flag on node (e.g. claim, patient, prescriber) to true to remember which nodes have been visited)
- Global variables are used with @@
  - Usage in the exercise - @@edgeSet (Use edgeSet as a global variable to collect edges for printing those later)

For more details - visit docs.tigergraph.com and search on local and global variables in search window

GSQL Introduction – Select & Where Clause

- **Select statement** – Use this to traverse the graph and go from a node (e.g. Prescriber) via an edge (e.g. reverse_submitted) to another node (e.g. Claim).

Syntax for edge traversal - source_type -(edge_type)-> target_type

- **Usage in the exercise –**

```
claims1 = select t
        from Pre1:s -(reverse_submitted:e)-> Claim:t
```

- Use select query in GSQL to go from Prescriber1 / Pre1 via “reverse_submitted” edge to claim.
- Use alias t for claim, so you can refer to it later in the code. Alias e is used for the edge, while alias s is used for the source prescriber Pre1.

- Use **where** clause along with select for conditional traversal. Usage in the exercise -

```
common_patients = select t
                from claims2:s -(associated:e)-> Patient:t
                where t.@visited == true;
```

- Use select query to go from claims2 via “associated” edge to find common_patients.
- Use the where clause to check visited flag on the patient node (alias t used for patient node).

For more details - https://docs.tigergraph.com/intro/gsql-101/built-in-select-queries

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GSQL Introduction – Accumulators

- **AndAccum/OrAccum –** The AndAccum and OrAccum types calculate and store the cumulative result of a series of boolean operations. The output of an AndAccum or an OrAccum is a single boolean value (True or False). AndAccum and OrAccum variables operate on boolean values only.
  - **Usage in the exercise – OrAccum @visited;**
- **SetAccum –** The SetAccum type maintains a collection of unique elements. The output of a SetAccum is a list of elements in arbitrary order. A SetAccum instance can contain values of one type. The element type can be any base type, tuple, or STRING COMPRESS.
- **Usage in the exercise – SetAccum<edge> @@edgeSet;**

For more details - https://docs.tigergraph.com/dev/gsql-ref/querying/accumulators

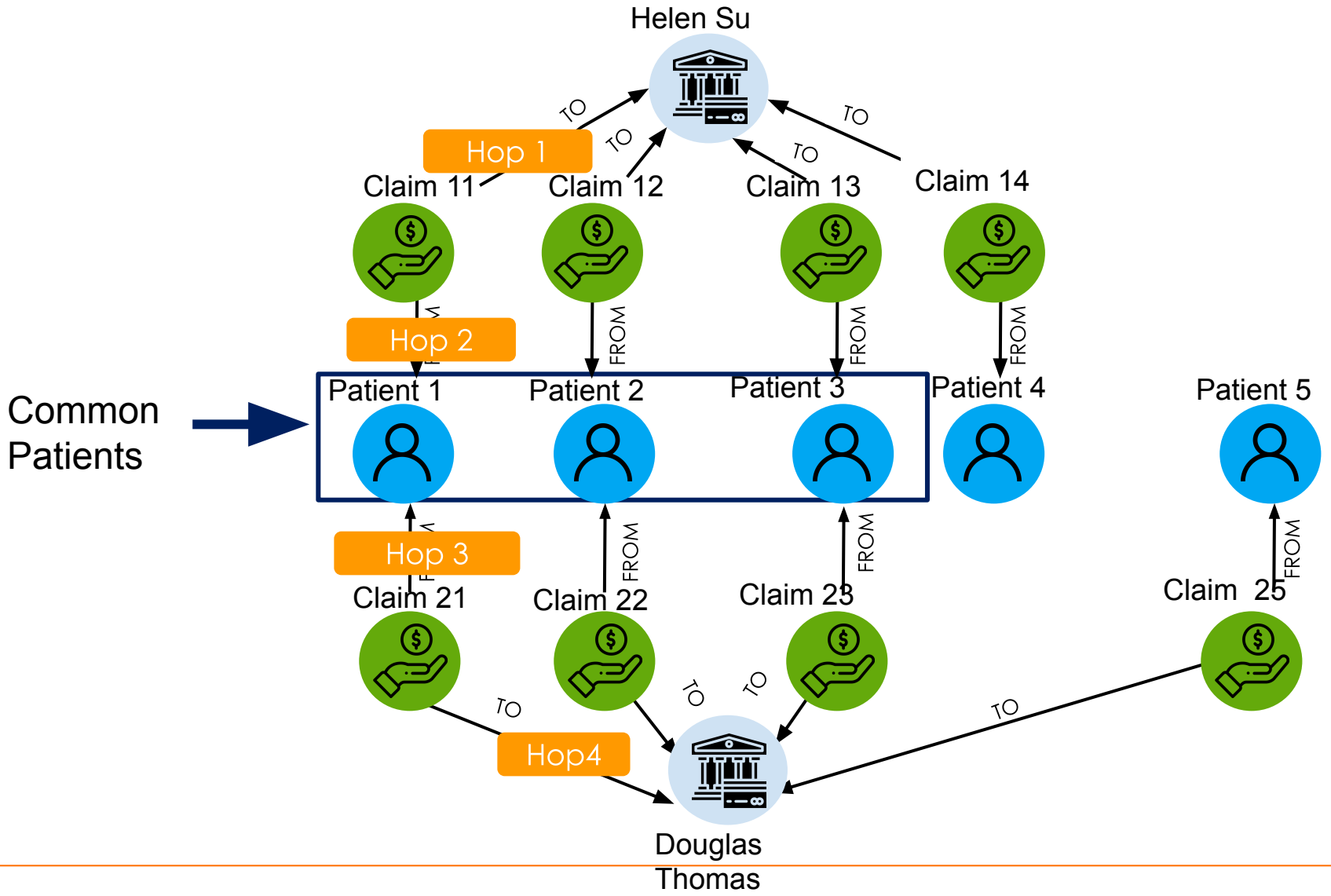
GSQL Introduction – Print command

- **Print –** The PRINT statement specifies output data. Each execution of a PRINT statement adds a JSON object to the results array which will be part of the query output. A PRINT statement can appear anywhere that query-body statements are permitted.
  - **Usage in the exercise – print claims;**

For more details - https://docs.tigergraph.com/dev/gsql-ref/querying/output-statements-and-file-objects#print-statement-api-v-2

SubGraph or Relationship Discovery & Computation Example

Merchant Relationship Data Analysis in Financial Services



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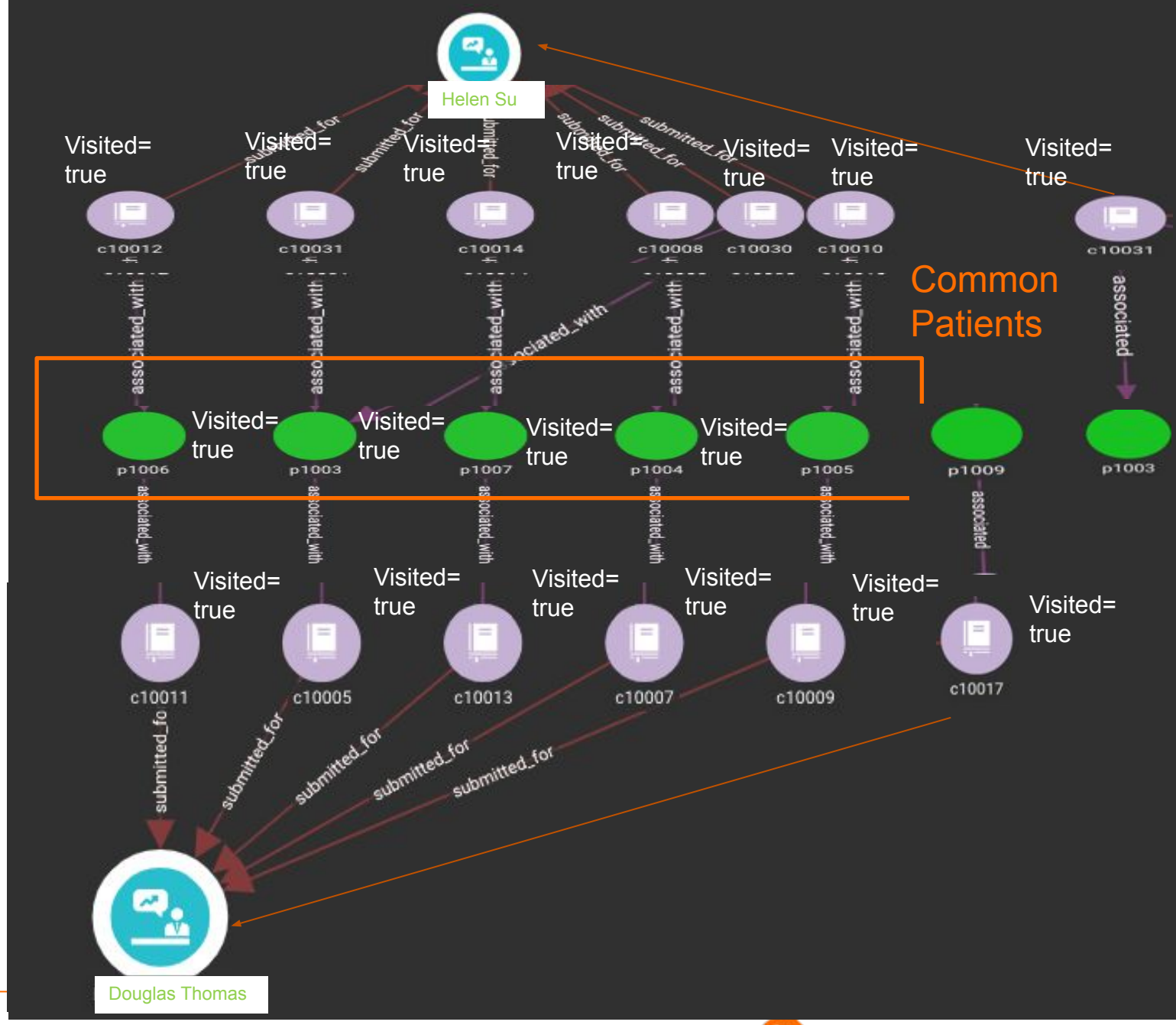
Putting It All Together Step-by-Step for CommonPatients Query

- Input: two prescribers: Douglas Thomas, Helen Su
- Output: Print/Return a list of common patients between the two prescribers
- **Step 1** – Start graph Traversal from first prescriber to find all associated claims
- **Step 2** – For those claims, find all the linked patients
- **Step 3** – Start graph traversal from second prescriber to find all associated claims
- **Step 4** – Find common patients by starting from claims in Step 3
- **Step 5** – From common patients find all claims that have been visited in earlier steps. Collect the edges so they can be printed
- **Step 6** – From claims find associated prescribers. Collect and print edges (claims – prescribers) and prescribers.



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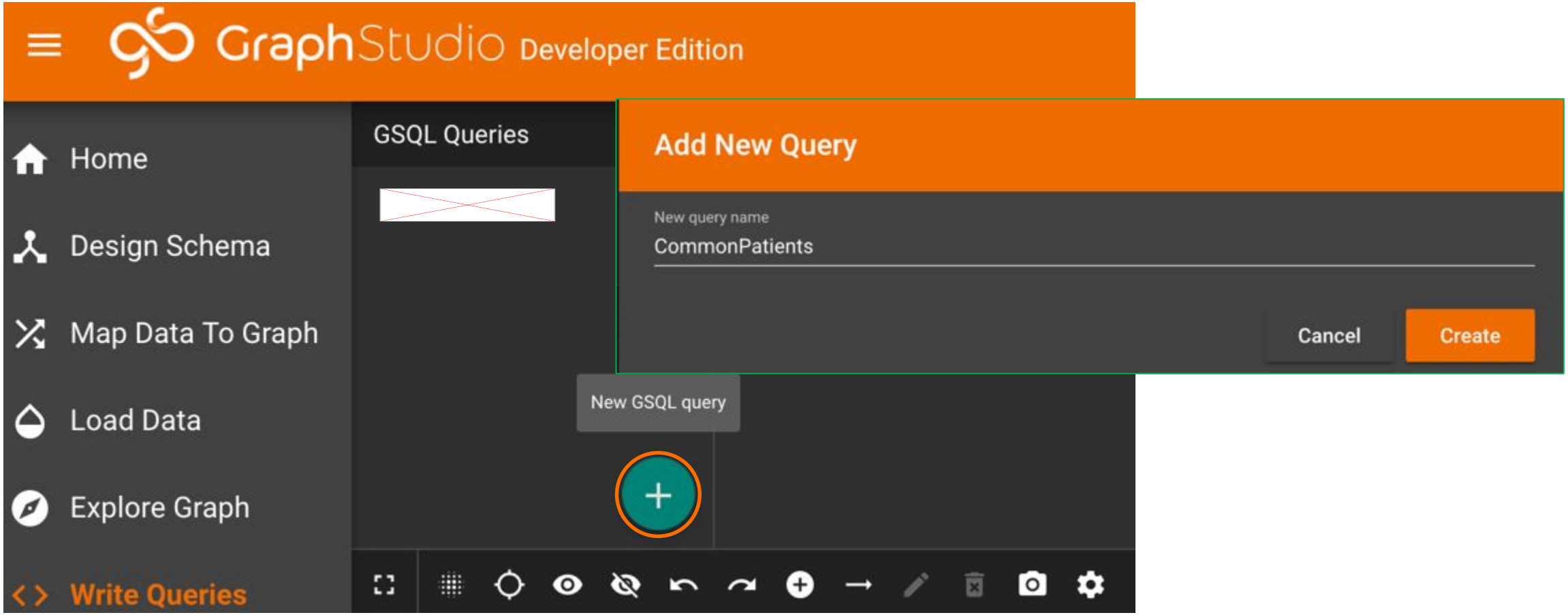
Exercise 2 - Part2: Create new query



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Exercise 2 – Part 2 : Step 1

```
CREATE QUERY CommonPatients(vertex<Prescriber> Prescriber1,
vertex<Prescriber> Prescriber2) FOR GRAPH MyGraph {

 OrAccum @visited;

 SetAccum<edge> @@edgeSet;

   Pre1 =  {Prescriber1};

   Pre2 =  {Prescriber2};

   /* Step 1 – Start graph Traversal from first prescriber to find all associated
claims. Use visited flag to remember claims visited. */

   claims1 = select t

          from Pre1:s -(reverse_submitted:e)-> Claim:t

          accum t.@visited += true;
```

Query CommonPatients takes two inputs Prescriber 1 and Prescriber 2 of vertex type <Prescriber>. Developer edition is limited to only one graph – MyGraph.

Boolean variable used to remember which nodes or edges have been visited (@ indicates local variable)

Global variable of type <edge> used to collect the edges so that they can be printed in the last step (@@ indicates a global variable)

- Use select query in GSQL to go from Prescriber1 / Pre1 via “reverse_submitted” edge to claim.
- Use alias t for claim, so you can set the variable “visited” on the claim via accum

- Want to learn all the ways you can use built-in SELECT queries? - https://docs.tigergraph.com/intro/gsql-101/built-in-select-queries & https://docs.tigergraph.com/dev/gsql-ref/querying/select-statement
- Curious what more accumulators can do for you? - https://docs.tigergraph.com/dev/gsql-ref/querying/accumulators
- Want to explore more? – Go to https://docs.tigergraph.com/intro/gsql-101 for a quick refresher and use search box to look specific keywords

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Exercise 2 – Part 2 : Step 1, Step 2

```
CREATE QUERY CommonPatients(vertex<Prescriber> Prescriber1,
vertex<Prescriber> Prescriber2) FOR GRAPH MyGraph {

 OrAccum @visited;

   SetAccum<edge> @@edgeSet;

   Pre1 =  {Prescriber1};

   Pre2 =  {Prescriber2};

   /* Step 1 – Start graph Traversal from first prescriber to find all associated
claims. Use visited flag to remember claims visited. */

   claims1 = select t

          from Pre1:s -(reverse_submitted:e)-> Claim:t

          accum t.@visited += true;

    /* Step 2 – For those claims, find all the linked patients. */

   patients1 = select t

           from claims1:s -(associated:e)-> Patient:t

           accum t.@visited += true;
```

- Use select query in GSQL to go from each claim from claims 1 via “associated” edge to claim.
- Use alias t for patient, so you can set the variable “visited” on the patient node via accum in the last statement

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Exercise 2 – Part 2 : Step 1, Step 2, Step 3

```
CREATE QUERY CommonPatients(vertex<Prescriber> Prescriber1,
vertex<Prescriber> Prescriber2) FOR GRAPH MyGraph {

 OrAccum @visited;

   SetAccum<edge> @@edgeSet;

   Pre1 =  {Prescriber1};

   Pre2 =  {Prescriber2};

   /* Step 1 – Start graph Traversal from first prescriber to find all associated
claims. Use visited flag to remember claims visited. */

   claims1 = select t

          from Pre1:s -(reverse_submitted:e)-> Claim:t

          accum t.@visited += true;

    /* Step 2 – For those claims, find all the linked patients. */

   patients1 = select t

            from claims1:s -(associated:e)-> Patient:t

            accum t.@visited += true;

/* Step 3 Start graph traversal from second prescriber to find all claims */

   claims2 = select t

          from Pre2:s -(reverse_submitted_by:e)-> Claim:t

          accum t.@visited += true;
```

- Use select query in GSQL to go from second prescriber via “reverse_submitted_by” edge to claims.
- Use alias t for claim, so you can set the variable “visited” on the claim node via accum in the last statement

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Exercise 2 – Part 2 – Step 1, 2, 3, 4

```
CREATE QUERY CommonPatients(vertex<Prescriber> Prescriber1,
vertex<Prescriber> Prescriber2) FOR GRAPH MyGraph {

 OrAccum @visited;

   SetAccum<edge> @@edgeSet;

   Pre1 =  {Prescriber1};

   Pre2 =  {Prescriber2};

   /* Step 1 – Start graph Traversal from first prescriber to find all associated
claims. Use visited flag to remember claims visited. */

   claims1 = select t

          from Pre1:s -(reverse_submitted:e)-> Claim:t

          accum t.@visited += true;

    /* Step 2 – For those claims, find all the linked patients. */

   patients1 = select t

            from claims1:s -(associated:e)-> Patient:t

            accum t.@visited += true;

/* Step 3 Start graph traversal from second prescriber to find all claims */

   claims2 = select t

          from Pre2:s -(reverse_submitted_by:e)-> Claim:t

          accum t.@visited += true;
```

```
/* Step 4 – Find common patients  by starting from claims in
Step 3 */

common_patients = select t

                from claims2:s -(associated:e)-> Patient:t

                where t.@visited == true;

  print common_patients;
```

- Use select query to go from claims2 from step 3 via “associated” edge to find common_patients.
- Use the where clause to check visited flag on the patient node (alias t used for patient node).

Exercise 2 – Part 2 – Step 1, 2, 3, 4 and 5

```
CREATE QUERY CommonPatients(vertex<Prescriber> Prescriber1,
vertex<Prescriber> Prescriber2) FOR GRAPH MyGraph {

 OrAccum @visited;

   SetAccum<edge> @@edgeSet;

   Pre1 =  {Prescriber1};

   Pre2 =  {Prescriber2};

   /* Step 1 – Start graph Traversal from first prescriber to find all associated
claims. Use visited flag to remember claims visited. */

   claims1 = select t

          from Pre1:s -(reverse_submitted:e)-> Claim:t

          accum t.@visited += true;

    /* Step 2 – For those claims, find all the linked patients. */

   patients1 = select t

            from claims1:s -(associated:e)-> Patient:t

            accum t.@visited += true;

/* Step 3 Start graph traversal from second prescriber to find all claims */

   claims2 = select t

          from Pre2:s -(reverse_submitted_by:e)-> Claim:t

          accum t.@visited += true;
```

```
/* Step 4 – Find common patients  by starting from claims in
Step 3 */

common_patients = select t

          from claims2:s -(associated:e)-> Patient:t

          where t.@visited == true;

   print common_patients;

/* Step 5 – From common patients find all claims that have been visited
in earlier steps. Collect the edges so they can be printed.*/

claims = select t

          from common_patients:s -(reverse_associated:e)-> Claim:t

          where t.@visited == true

          accum @@edgeSet += e;

   print claims;
```

- Use select query to go from common_patients from step 4 via “reverse_associated” edge to find claims (check the visited flag).
- Use accum clause to collect the edges (alias e was assigned to reversed_associated edge in from clause, so that it can be added to edgeSet global variable via accum)

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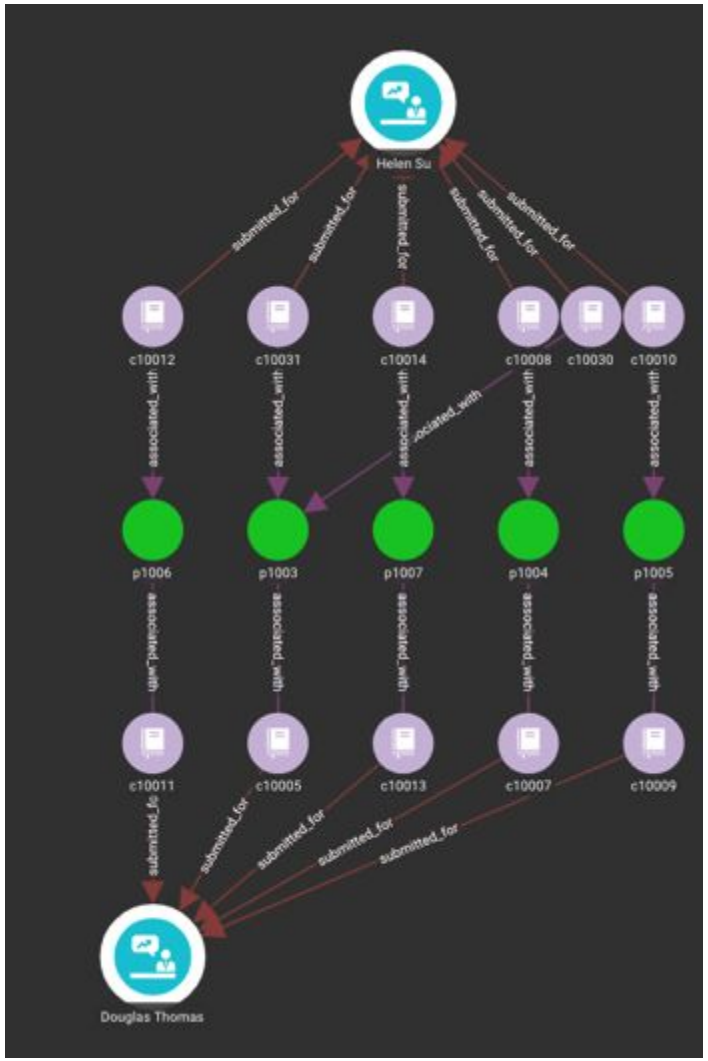
Exercise 2 – Part 2 - Common Patients Query (all steps)

```
CREATE QUERY CommonPatients(vertex<Prescriber> Prescriber1,
vertex<Prescriber> Prescriber2) FOR GRAPH MyGraph {

 OrAccum @visited;

   SetAccum<edge> @@edgeSet;

   Pre1 =  {Prescriber1};

   Pre2 =  {Prescriber2};

   /* Step 1 – Start graph Traversal from first prescriber to find all associated
claims. Use visited flag to remember claims visited. */

   claims1 = select t

          from Pre1:s -(reverse_submitted:e)-> Claim:t

          accum t.@visited += true;

    /* Step 2 – For those claims, find all the linked patients. */

   patients1 = select t

           from claims1:s -(associated:e)-> Patient:t

           accum t.@visited += true;

/* Step 3 Start graph traversal from second prescriber to find all claims */

   claims2 = select t

          from Pre2:s -(reverse_submitted_by:e)-> Claim:t

          accum t.@visited += true;

/* Step 4 – Find common patients  by starting from claims in
Step 3 */

common_patients = select t

                from claims2:s -(associated:e)-> Patient:t

                where t.@visited == true;

   print common_patients;

/* Step 5 – From common patients find all claims that have been visited
in earlier steps. Collect the edges so they can be printed.*/

 claims = select t

          from common_patients:s -(reverse_associated:e)-> Claim:t

          where t.@visited == true

          accum @@edgeSet += e;

   print claims;

/* Step 6 – From claims find associated prescribers. Collect
and print edges (claims – prescribers) and prescribers. */

   pres = select t

        from claims:s -(submitted_by:e)-> Prescriber:t

        accum @@edgeSet += e;

   print pres;

   print @@edgeSet;

}
```

Exercise 2 - **Output** (Common Patients)



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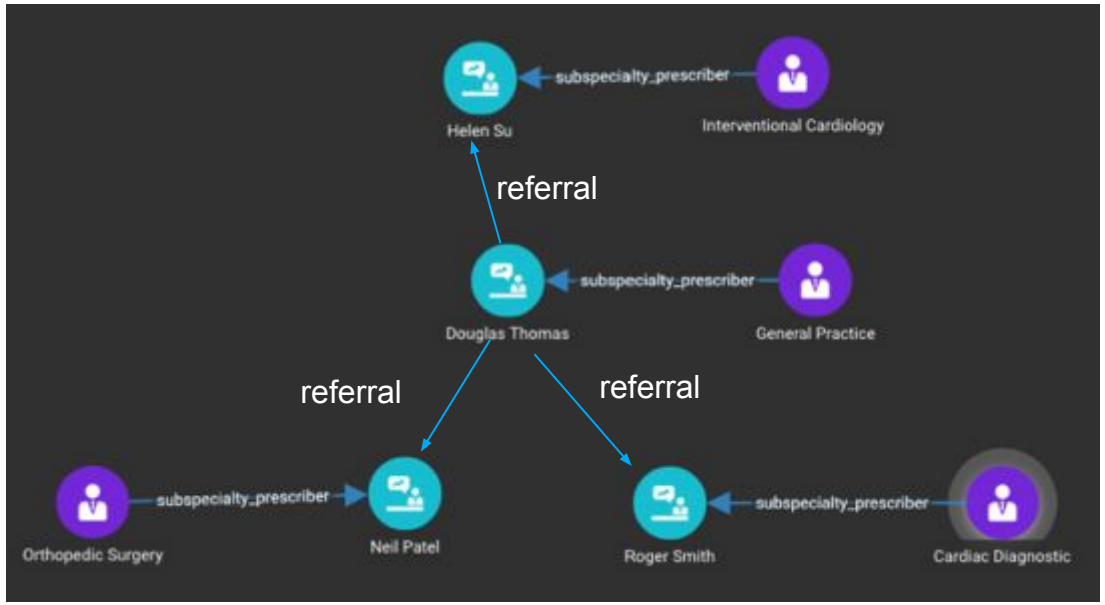
Exercise 3 - Find and visualize prescriber referral relationships

- Write your second GSQL Query: CreateReferralEdge_Simple
  - **Input:** a prescriber (Douglas Thomas)
  - **Output:** Print/Return all doctors that have a referral relationship with that prescriber
  - **Step 1** – Start graph traversal from the input prescriber, find all claims for that prescriber (**be sure use OrAccum to remember which claims were visited**)
  - **Step 2** – For each claim, traverse graph to the patient and find all other claims for that patient (**remember to use output from OrAccum in step 1 to skip claims that have been already visited**)
  - **Step 3** – From all other claims, find related prescriber (**be sure to skip collecting the prescriber if it is same as the input prescriber**)
  - **Step 4** - Print related/likely referred prescribers and the input prescriber
  - **Step 5 (Stretch goal)** – Create the referral edges between input and related prescriber and print



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Exercise 3 – CreateReferralEdge_Simple Query: Step 1

```
CREATE QUERY CreateReferralEdge_Simple(VERTEX<Prescriber>
input) FOR GRAPH MyGraph {

 /* Step 1 - Start graph traversal from the input prescriber, find all
claims for that prescriber.

 */

 OrAccum<bool> @visited;

given_prescriber (ANY) = {input};


claims = select t

          from given_prescriber:s-(:e)-> Claim:t

        accum t.@visited += true;
```

- You will notice that the edge name is missing. It's ok not to provide the edge name if there's only 1 edge that goes between the nodes in the direction of graph traversal.
- In general, it's a good practice to explicitly include the name of clarity

Exercise 3 – CreateReferralEdge_Simple Query: Step 1, 2

```
CREATE QUERY CreateReferralEdge_Simple(VERTEX<Prescriber>
input) FOR GRAPH MyGraph {

 /* Step 1 - Start graph traversal from the input prescriber, find all
claims for that prescriber.

 */

 OrAccum<bool> @visited;

given_prescriber (ANY) = {input};


claims = select t

            from given_prescriber:s-(:e)-> Claim:t

         accum t.@visited += true;

/* Step 2 - For each claim, traverse graph to the patient and find
all other claims for that patient.  Use visited flag set earlier to
avoid claims that are already traversed.

*/

patients = select t

             from claims:s-(:e)-> Patient:t;

other_claims = select t

                 from patients:s-(:e)-> Claim:t

              where t.@visited == false;
```

Exercise 3 – CreateReferralEdge_Simple Query: Step 1, 2, 3

Part A

```
CREATE QUERY CreateReferralEdge_Simple(VERTEX<Prescriber> input) FOR GRAPH MyGraph {

 /* Step 1 - Start graph traversal from the input prescriber, find all claims for that prescriber.

 */

 OrAccum<bool> @visited;

given_prescriber (ANY) = {input};


claims = select t

           from given_prescriber:s-(:e)-> Claim:t

         accum t.@visited += true;

/* Step 2 - For each claim, traverse graph to the patient and find all other claims for that patient.  Use visited flag set earlier to avoid claims that are already traversed.

*/

patients = select t

            from claims:s-(:e)-> Patient:t;
```

Part B

```
other_claims = select t

                from patients:s-(:e)-> Claim:t

               where t.@visited == false;

 /* Step 3 - From all other claims, find related prescriber. be sure to skip collecting the prescriber if it is same as the input prescriber.

 */

 related_prescribers = select t

                       from other_claims:s-(:e)-> Prescriber:t

                      where t != input;
```

Step 5 Hint - Use insert command to populate referral edges

Exercise 3 – CreateReferralEdge_Simple Query

Part A

```
CREATE QUERY CreateReferralEdge_Simple(VERTEX<Prescriber> input) FOR GRAPH MyGraph {

 /* Step 1 - Start graph traversal from the input prescriber, find all claims for that prescriber.

 */

 OrAccum<bool> @visited;

given_prescriber (ANY) = {input};


claims = select t

          from given_prescriber:s-(:e)-> Claim:t

        accum t.@visited += true;

/* Step 2 - For each claim, traverse graph to the patient and find all other claims for that patient.  Use visited flag set earlier to avoid claims that are already traversed.

*/

patients = select t

            from claims:s-(:e)-> Patient:t;
```

Part B

```
other_claims = select t

                from patients:s-(:e)-> Claim:t

              where t.@visited == false;

 /* Step 3 - From all other claims, find related prescriber. be sure to skip collecting the prescriber if it is same as the input prescriber.

 */

 related_prescribers = select t

                       from other_claims:s-(:e)-> Prescriber:t

                     where t != input;

/* Step 4 - Print related/likely referred prescribers and the input prescriber

 */

    print related_prescribers;

    print given_prescriber;

}
```

Step 5 Hint - Use insert command to populate referral edges

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Exercise 3 – CreateReferralEdge_Simple Query

Part A

```
CREATE QUERY CreateReferralEdge_Simple(VERTEX<Prescriber> input) FOR GRAPH MyGraph {

 /* Step 1 - Start graph traversal from the input prescriber, find all claims for that prescriber.

 */

 OrAccum<bool> @visited;

given_prescriber (ANY) = {input};


claims = select t

          from given_prescriber:s-(:e)-> Claim:t

        accum t.@visited += true;

/* Step 2 - For each claim, traverse graph to the patient and find all other claims for that patient.  Use visited flag set earlier to avoid claims that are already traversed.

*/

patients = select t

            from claims:s-(:e)-> Patient:t;
```

Part B

```
other_claims = select t

                from patients:s-(:e)-> Claim:t

              where t.@visited == false;

 /* Step 3 - From all other claims, find related prescriber. be sure to skip collecting the prescriber if it is same as the input prescriber.

 */

 related_prescribers = select t

                       from other_claims:s-(:e)-> Prescriber:t

                     where t != input;

/* Step 4 - Print related/likely referred prescribers and the input prescriber

 */

    print related_prescribers;

    print given_prescriber;

}
```

Step 5 Hint - Use insert command to populate referral edges

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Exercise 3 - Output (Input: Douglas Thomas)

Stretch goal – print referral edges by using insert command to populate referral edges & print them at the end

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Additional Resources

Download the Developer Edition or Enterprise Free Trial

https://www.tigergraph.com/download/

Guru Scripts

https://github.com/tigergraph/ecosys/tree/master/guru_scripts

Join TigerGraph Developer Forum

https://groups.google.com/a/opengsql.org/forum/#!forum/gsql-users

Read the eBook - Native Parallel Graphs

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