### **Script Documentation: Elixhauser Comorbidities Calculation**

#### **Overview**

This SQL script calculates the **Elixhauser Comorbidities** using the methodology defined by Quan et al. in their 2005 paper, *"Coding Algorithms for Defining Comorbidities in ICD-9-CM and ICD-10 Administrative Data"*. It implements the "Enhanced ICD-9" coding algorithm to derive Elixhauser comorbidities based on ICD-9 diagnosis codes.

The script aggregates individual ICD-9 diagnoses from patients and computes the presence of 30 comorbidities based on specified ICD-9 codes. Each comorbidity is assigned a binary flag (1 for presence, 0 for absence).

#### **Key References**

* Quan, H., et al. (2005). *"Coding Algorithms for Defining Comorbidities in ICD-9-CM and ICD-10 Administrative Data."* [PubMed Link](https://www.ncbi.nlm.nih.gov/pubmed/16224307).

#### **Logic Summary**

1. **ICD-9 Code Matching**: Comorbidities are defined based on ICD-9 diagnosis codes. The logic compares:
   * Full 5-character ICD-9 codes.
   * The first 4 characters for broader classifications.
   * The first 3 characters for high-level diagnoses.
2. **Comorbidity Flags**: The script assigns a 1 or 0 to each comorbidity flag based on the ICD-9 code matching for each patient’s admission.
3. **Combining Comorbidities**: For some conditions, such as hypertension and diabetes, the script chooses the more severe comorbidity to report (e.g., only complicated diabetes is flagged if both forms are present).

#### **Process Steps**

1. **Initial ICD-9 Code Flagging** (eliflg CTE):
   * The script processes the ICD-9 codes associated with hospital admissions.
   * For each admission (hadm\_id), a set of CASE statements checks whether the ICD-9 code matches any in the predefined lists for each comorbidity.
   * If an ICD-9 code matches a condition, the corresponding flag (e.g., chf for congestive heart failure) is set to 1.
2. **Patient-Level Comorbidity Flags** (eligrp CTE):
   * Comorbidity flags are aggregated at the patient level (hadm\_id), and the maximum value is taken for each comorbidity. This ensures that if a patient has multiple ICD-9 codes for a comorbidity, it is only flagged once per admission.
3. **Final Comorbidity Table**:
   * The final SELECT statement merges the individual comorbidity flags and performs further processing for conditions like hypertension and diabetes.
   * The resulting table lists each patient's admission (hadm\_id) and the presence (1 or 0) of 30 comorbidities.

#### **Output**

* The script generates a new table, **elixhauser\_quan**, containing patient admissions with the following comorbidity flags:
  + Congestive heart failure (congestive\_heart\_failure)
  + Cardiac arrhythmias (cardiac\_arrhythmias)
  + Valvular disease (valvular\_disease)
  + Pulmonary circulation disorders (pulmonary\_circulation)
  + Peripheral vascular disorders (peripheral\_vascular)
  + Hypertension (hypertension) – combines uncomplicated and complicated
  + Diabetes (uncomplicated and complicated)
  + Neurological disorders, renal failure, liver disease, etc.

#### **Example Query**

To retrieve all patients with congestive heart failure:

SELECT hadm\_id FROM elixhauser\_quan WHERE congestive\_heart\_failure = 1;

#### **Important Notes**

* **Exclusion of Primary Diagnosis**: The script excludes the primary ICD-9 diagnosis (seq\_num != 1), focusing on secondary diagnoses to identify comorbidities.
* **Customization**: The list of ICD-9 codes can be modified to match updated definitions or include new conditions as needed.

#### **Conclusion**

This script automates the derivation of Elixhauser comorbidities from ICD-9 billing codes, facilitating the analysis of patient comorbidities for use in clinical research and outcomes prediction.