FunSQL:
A library for compositional construction of SQL queries

Find all patients born at or after 1950.

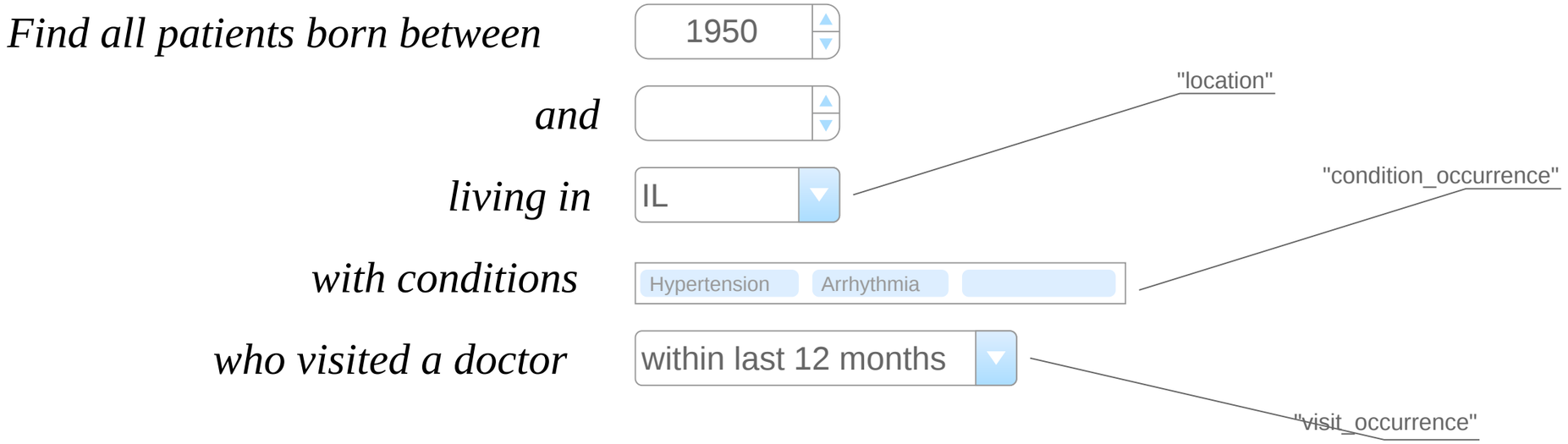
```
function find_patients(conn)
    sql = """
    SELECT person_id
    FROM patient
    WHERE year_of_birth >= 1950
    """
    DBInterface.execute(conn, sql)
end
```

- What is SQL? Data is often stored in relational databases, and to retrieve it, we write queries in SQL.
- Popular databases with SQL interface include MySQL, PostgreSQL, SQLite, Microsoft SQL Server, Redshift, BigQuery, and many others.
- Julia already has a number of libraries that let you interact with SQL databases.
- Why another tool?

Find all patients born between 1950

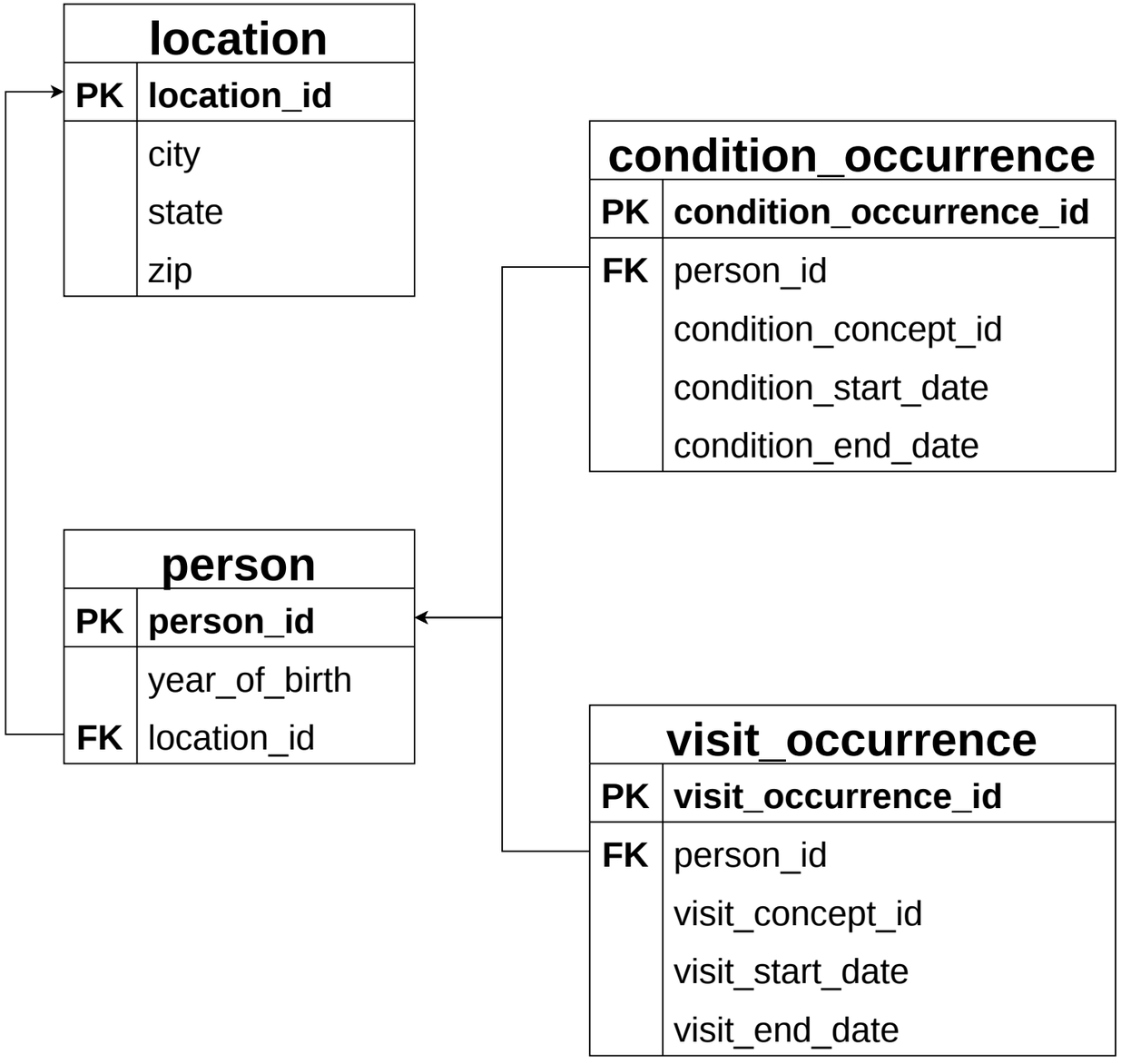
and

```
function find_patients(conn; start_year = nothing,
                             end_year = nothing)
    sql = """
    SELECT person_id
    FROM patient
    """
    conditions = String[]
    if start_year !== nothing
        push!(conditions, "year_of_birth >= $start_year")
    end
    if end_year !== nothing
        push!(conditions, "year_of_birth <= $end_year")
    end
    if !isempty(conditions)
        sql *= "\nWHERE " * join(conditions, " AND ")
    end
    DBInterface.execute(conn, sql)
end
```




```
function find_patients(conn; start_year = nothing,
                             end_year = nothing,
                             state = nothing,
                             conditions = []
                             last_visit = nothing)
    sql = """
    SELECT person_id
    FROM patient
    """
    ???
    DBInterface.execute(conn, sql)
end
```

- Clearly, a more systematic approach is necessary.



- A small diversion to introduce the database schema which we will use in subsequent examples.
- OMOP Common Data Model is a popular open-source used in healthcare of observational research.
- As typical in healthcare, the schema is patient-centric. The *person* table stores information about patients including basic demographic information. Their address is stored in a separate table called *location*.
- Most of the patient data consists of clinical events: encounters with healthcare providers, recorded observations, diagnosed conditions, performed procedures, etc.

```
using FunSQL: SQLTable

const person =
    SQLTable(name = :person,
             columns = [:person_id, :year_of_birth, :location_id])

const location =
    SQLTable(name = :location,
             columns = [:location_id, :city, :state, :zip])

const condition_occurrence =
    SQLTable(name = :condition_occurrence,
             columns = [:condition_occurrence_id, :person_id,
                        :condition_concept_id,
                        :condition_start_date, :condition_end_date])

const visit_occurrence =
    SQLTable(name = :visit_occurrence,
             columns = [:visit_occurrence_id, :person_id,
                        :visit_concept_id,
                        :visit_start_date, :visit_end_date])
```