

# FunSQL

A library for compositional construction  
of SQL queries

<https://github.com/MechanicalRabbit/FunSQL.jl>

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*Find all patients born in or after 1970.*



```
SELECT p.person_id  
FROM person p  
WHERE p.year_of_birth >= 1970
```



```
function find_patients(conn)  
  sql = ""  
  SELECT p.person_id  
  FROM person p  
  WHERE p.year_of_birth >= 1970  
  ""  
  DBInterface.execute(conn, sql)  
end
```

*Find all patients born between*  *and*

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

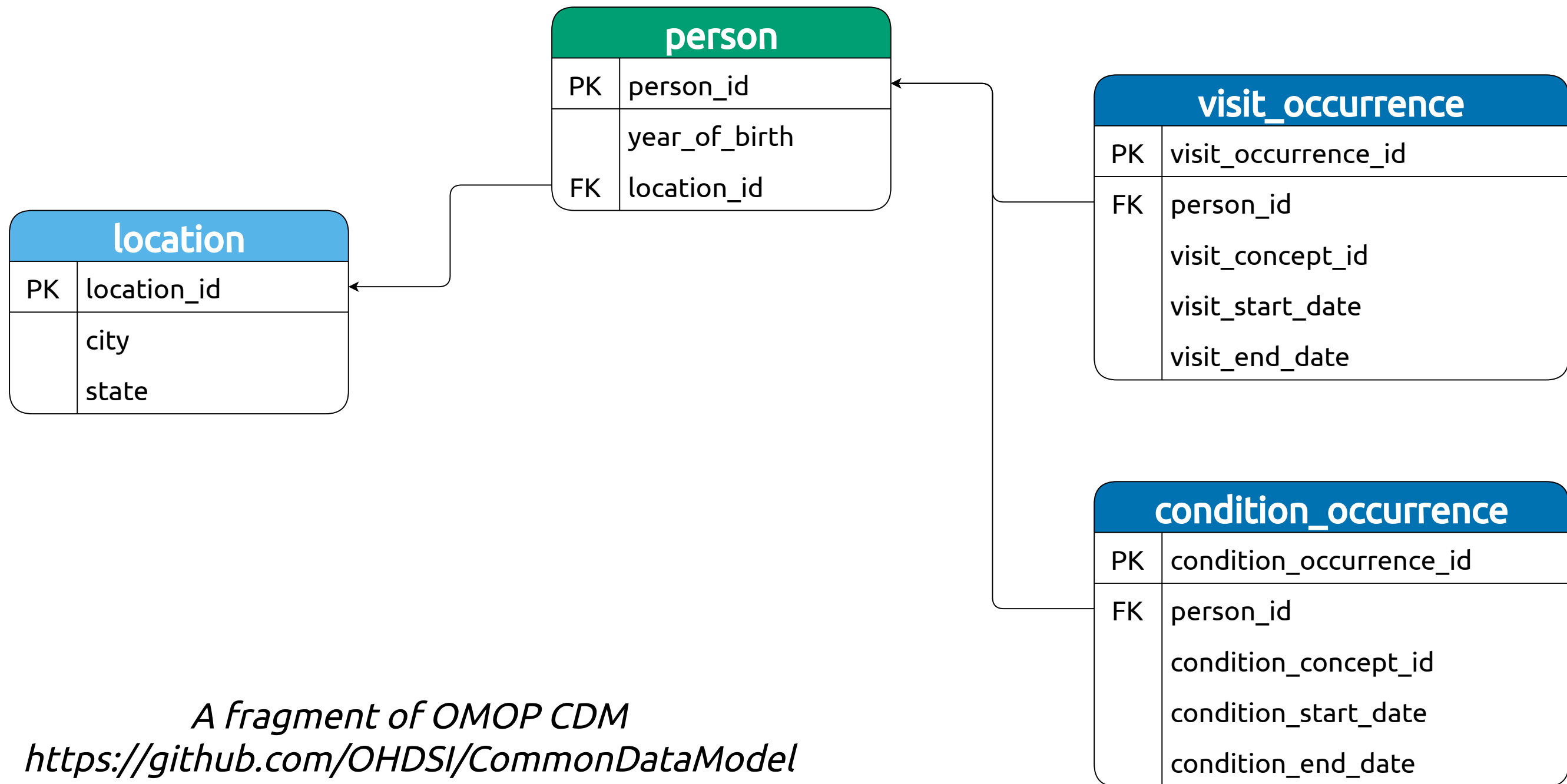


```
function find_patients(conn; start_year = nothing,  
                        end_year = nothing,  
                        state = nothing,  
                        conditions = [],  
                        latest_visit = nothing)
```

```
    sql = ???
```

```
    DBInterface.execute(conn, sql)
```

```
end
```



*A fragment of OMOP CDM*  
<https://github.com/OHDSI/CommonDataModel>

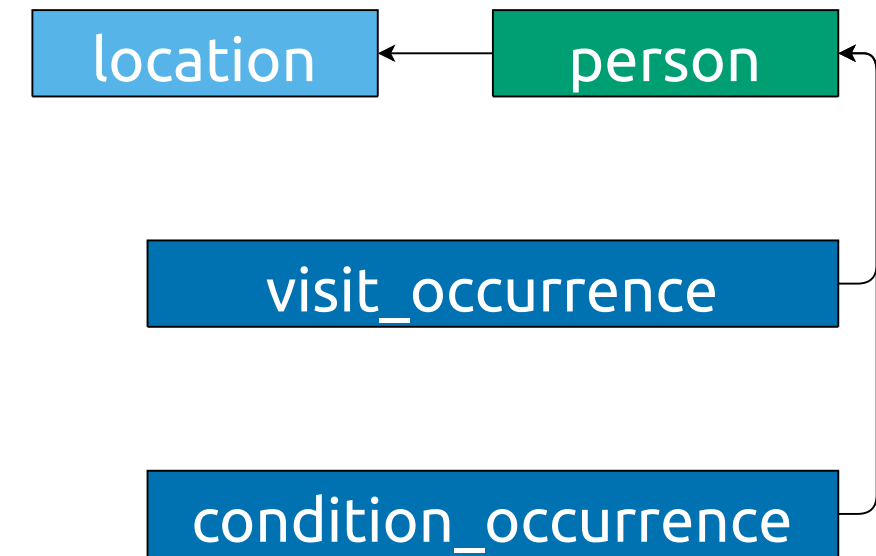
```
using FunSQL: SQLTable
```

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

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



*Find all patients born in or after 1970.*

**FROM** person p



**FROM** person p  
**WHERE** p.year\_of\_birth >= 1970



**SELECT** p.person\_id  
**FROM** person p  
**WHERE** p.year\_of\_birth >= 1970

**using** FunSQL: From, Get, Select, Where, render

q = From(person)



q = From(person) |>  
 Where(Get.year\_of\_birth .>= 1970)



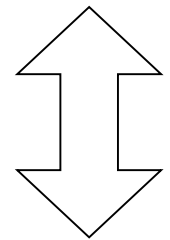
q = From(person) |>  
 Where(Get.year\_of\_birth .>= 1970) |>  
 Select(Get.person\_id)

sql = render(q, dialect = :postgresql)

```

q1 = From(person)
q2 = q1 |> Where(q1.year_of_birth .>= 1970)
q   = q2 |> Select(q2.person_id)

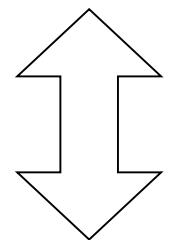
```



```

q = From(person) |>
  Where(Get.year_of_birth .>= 1970) |>
  Select(Get.person_id)

```



```

BornInOrAfter(Y) = Get.year_of_birth .>= Y

```

```

q = From(person) |>
  Where(BornInOrAfter(1970)) |>
  Select(Get.person_id)

```

*bound references*

*unbound references*

person	
PK	person_id
	year_of_birth
FK	location_id



```
SELECT p.person_id  
FROM person p  
WHERE p.year_of_birth >= 1970
```

```
WHERE p.year_of_birth >= 1970 AND  
      p.year_of_birth <= 2000
```

```
WHERE p.year_of_birth  
      BETWEEN 1970 AND 2000
```

**using** FunSQL: Fun

*"Fun" notation*

Fun.">="(Get.year\_of\_birth, 1970)

*or*

Get.year\_of\_birth .>= 1970

*broadcasting*

Fun.and(Get.year\_of\_birth .>= 1970,  
 Get.year\_of\_birth .<= 2000)

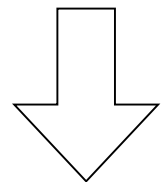
Fun.between(Get.year\_of\_birth, 1970, 2000)

*Show patients with their state of residence.*

**FROM** person p



**FROM** person p  
**JOIN** location l  
    **ON** (p.location\_id = l.location\_id)



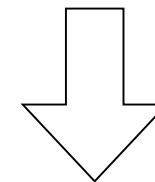
**SELECT** p.person\_id, l.state  
**FROM** person p  
**JOIN** location l  
    **ON** (p.location\_id = l.location\_id)

**using** FunSQL: Join

q = From(person)



q = From(person) |>  
    Join(:location => location,  
        Get.location\_id .==  
        Get.location.location\_id)



q = From(person) |>  
    Join(:location => location,  
        Get.location\_id .==  
        Get.location.location\_id) |>  
    Select(Get.person\_id, Get.location.state)



```

qp = From(person)
ql = From(location)
q  = qp |> Join(ql, qp.location_id .== ql.location_id)

```



Get

- person\_id
- year\_of\_birth
- location\_id*
- city
- state

```

q = From(person) |>
  Join(:location => From(location),
       Get.location_id .== Get.location.location_id)

```

Get

- person\_id
- year\_of\_birth
- location\_id
- location**
  - location\_id
  - city
  - state

## person

PK	person_id
	year_of_birth
FK	location_id

## location

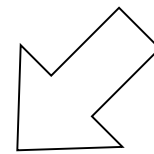
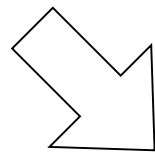
PK	location_id
	city
	state

## Find patients

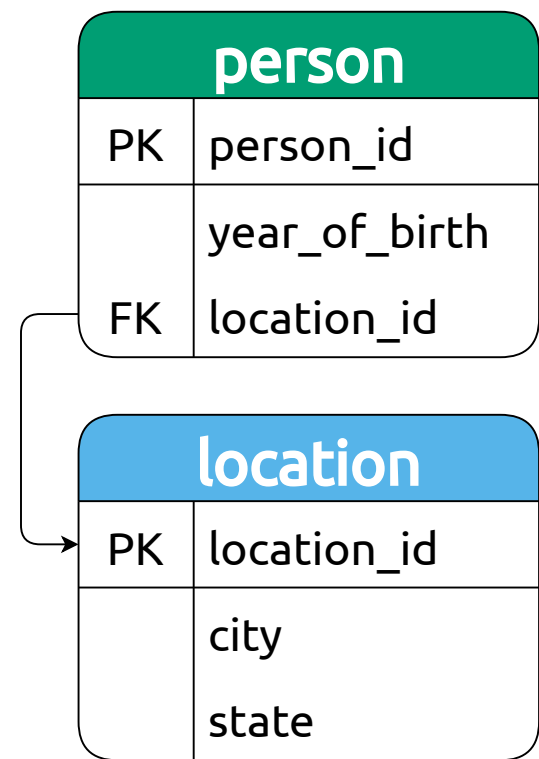
- *born in or after 1970*
- *living in Illinois*

```
qp = From(person) |>  
  Where(Get.year_of_birth .>= 1970)
```

```
ql = From(location) |>  
  Where(Get.state .== "IL")
```



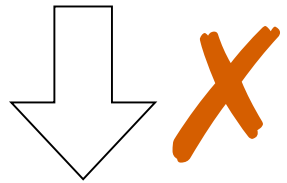
```
qp |> Join(:location => ql,  
           Get.location_id .==  
           Get.location.location_id)
```



**FROM** person p



**FROM** person p  
**WHERE** p.year\_of\_birth >= 1970

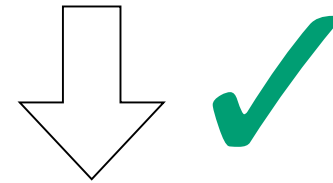


**FROM** person p  
**WHERE** p.year\_of\_birth >= 1970  
**JOIN** location l  
    **ON** (p.location\_id = l.location\_id)

From(person)



From(person) |>  
Where(Get.year\_of\_birth .>= 1970)



From(person) |>  
Where(Get.year\_of\_birth .>= 1970) |>  
Join(:location => From(location),  
      Get.location\_id .==  
      Get.location.location\_id)



From(*table*)

```
SELECT ???  
FROM $table
```

|>  
Where(*condition*)

```
SELECT ???  
FROM ()  
WHERE $condition
```

|>  
Join(, *condition*)

```
SELECT ???  
FROM ()  
JOIN ()  
ON $condition
```

|>  
Select(*list...*)

```
SELECT $(list...)  
FROM ()
```

**SELECT ???**  
**FROM** person

**SELECT ???**  
**FROM** location

**SELECT ???**  
**FROM** ( ) p  
**WHERE** p.year\_of\_birth >= 1970

**SELECT ???**  
**FROM** ( ) l  
**WHERE** l.state = 'IL'

```
q1 = From(person)
q2 = q1 |> Where(q1.year_of_birth .>= 1970)
q3 = From(location)
q4 = q3 |> Where(q3.state .== "IL")
q5 = q2 |> Join(q4, q2.location_id .==
               q4.location_id)
q6 = q5 |> Select(q5.person_id)
```

**SELECT ???**  
**FROM** ( ) p  
**JOIN** ( ) l  
**ON** p.location\_id = l.location\_id

**SELECT** p.person\_id  
**FROM** ( ) p



```
SELECT person_id, year_of_birth, location_id
FROM person
```

```
SELECT location_id, state
FROM location
```

```
SELECT p.person_id, p.location_id
FROM ( ) p
WHERE p.year_of_birth >= 1970
```

```
SELECT l.location_id
FROM ( ) l
WHERE l.state = 'IL'
```

```
q1 = From(person)
q2 = q1 |> Where(q1.year_of_birth .>= 1970)
q3 = From(location)
q4 = q3 |> Where(q3.state .== "IL")
q5 = q2 |> Join(q4, q2.location_id .==
               q4.location_id)
q6 = q5 |> Select(q5.person_id)
```

```
SELECT p.person_id
FROM ( ) p
JOIN ( ) l
  ON p.location_id = l.location_id
```

```
SELECT p.person_id
FROM ( ) p
```