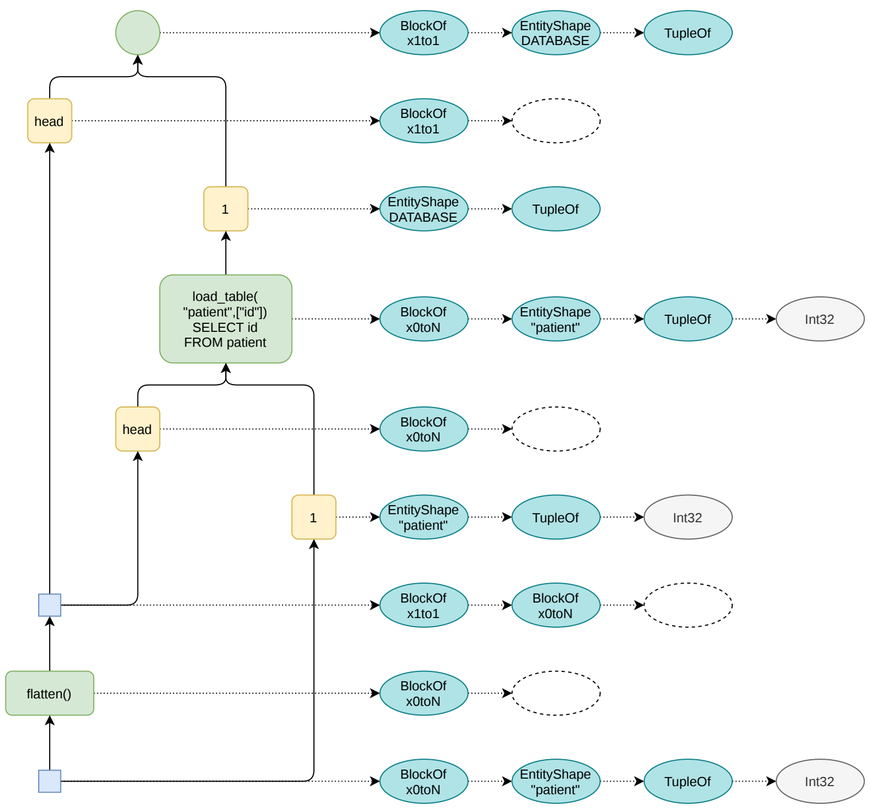
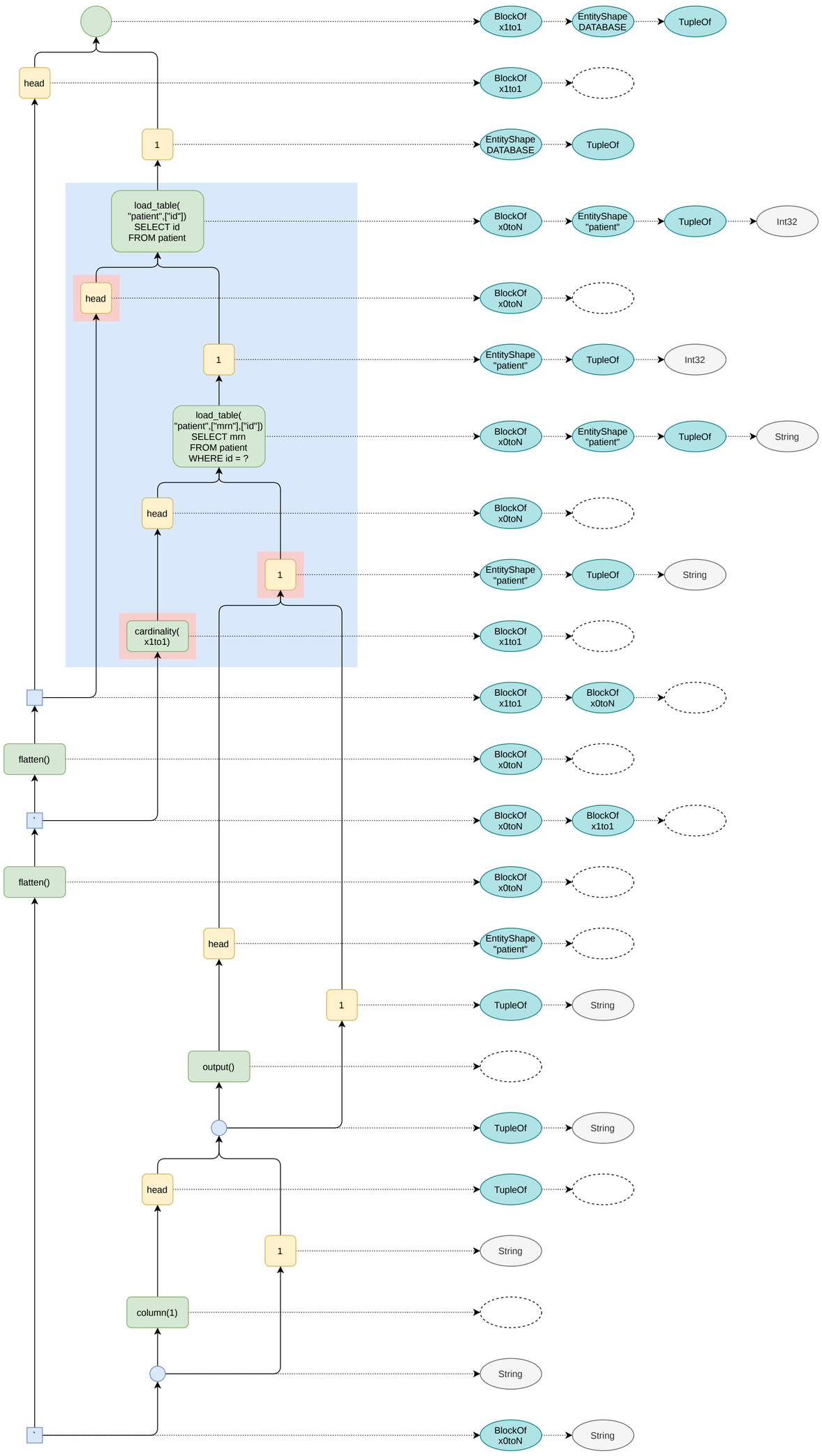
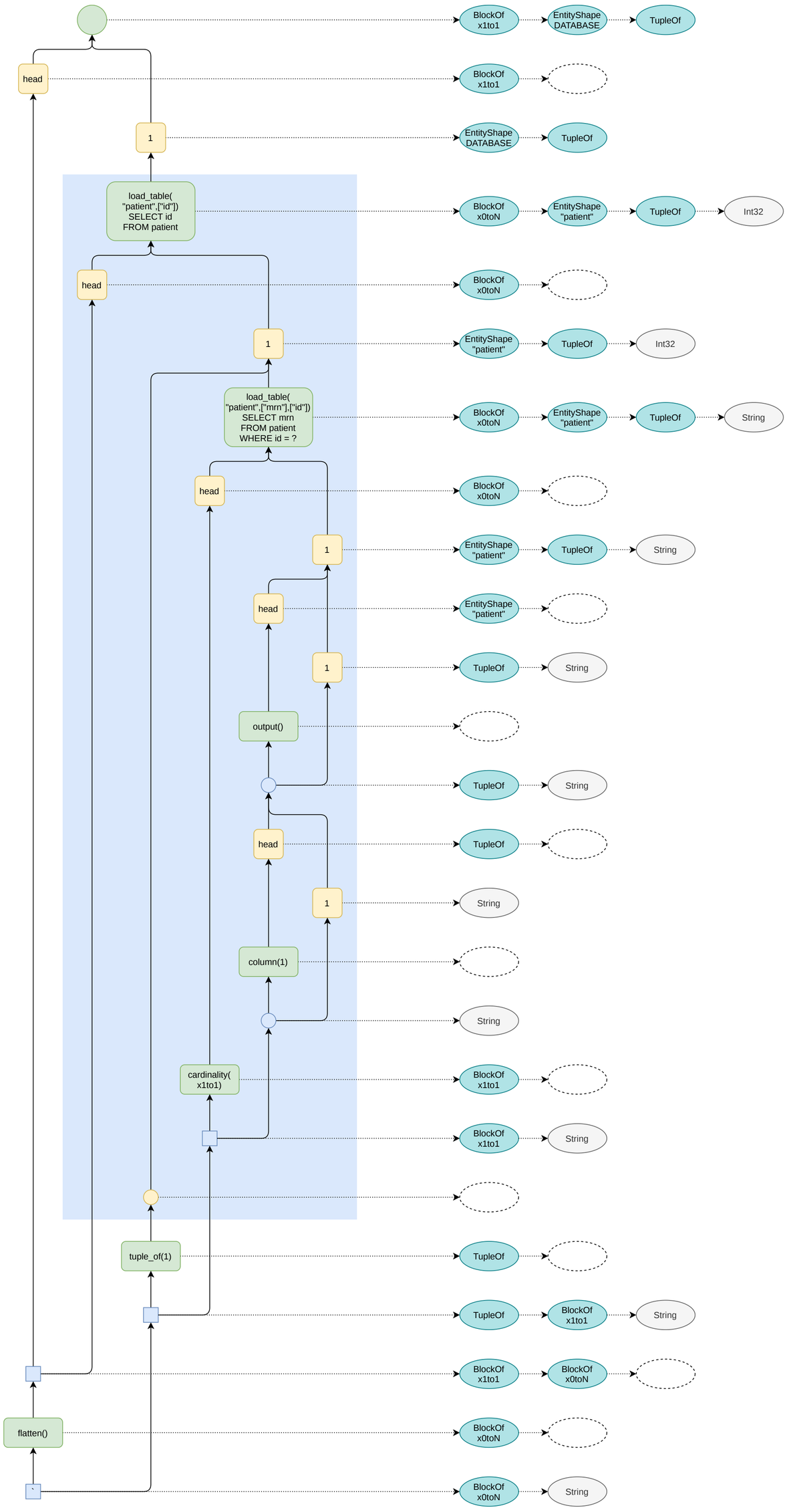
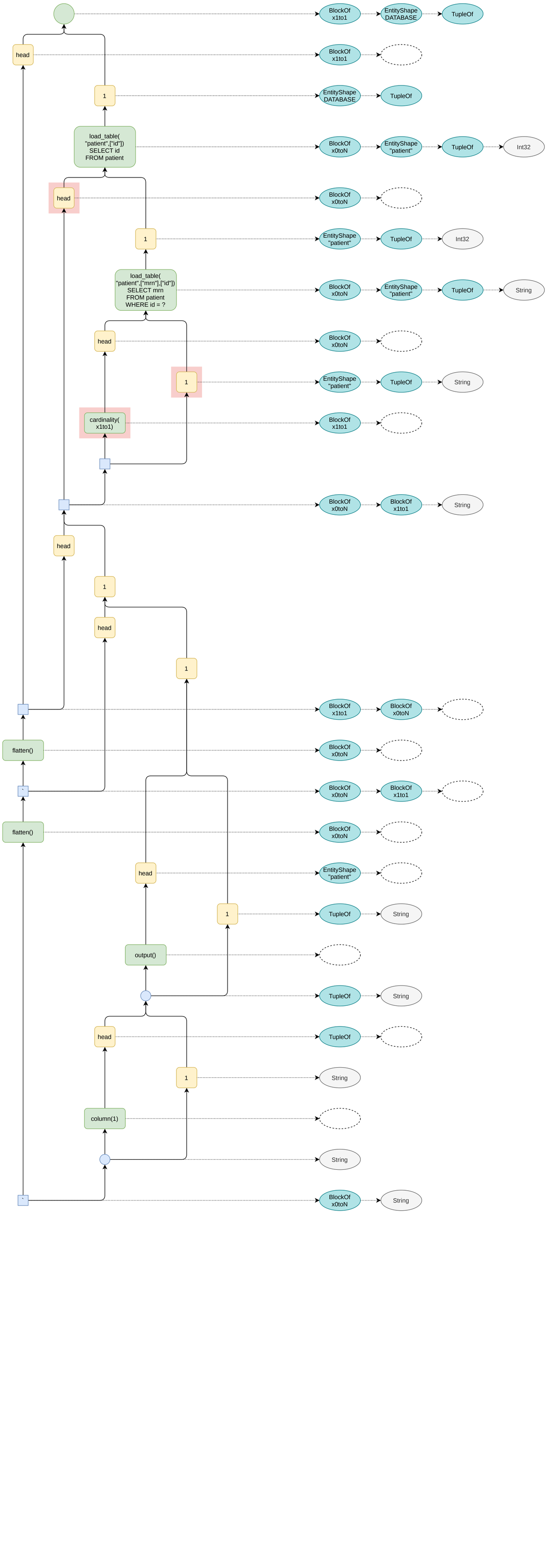
```
chain_of(
    with_elements(load_postgres_table(("public", "patient"), ["id"], [Int32])),
    flatten())
```

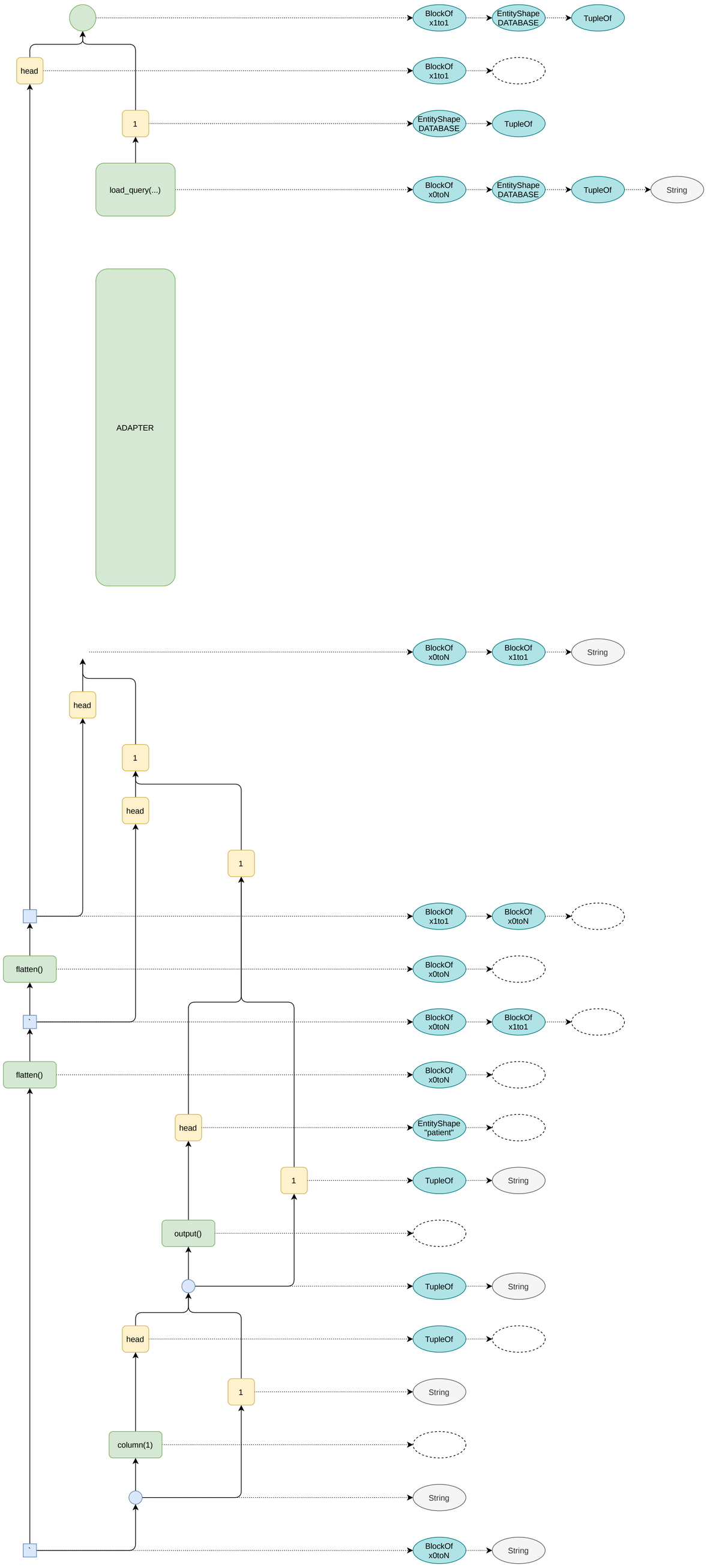


```
chain_of(with_elements(load_postgres_table(("public", "patient"), ["id"], [Int32])),
         flatten(),
         with_elements(
             chain_of(
                 load_postgres_table(("public", "patient"), ["mrn"], [String], ["id"]),
                 block_cardinality(x1to1))),
         flatten(),
         with_elements(
             chain_of(
                 output(),
                 column(1))))
```

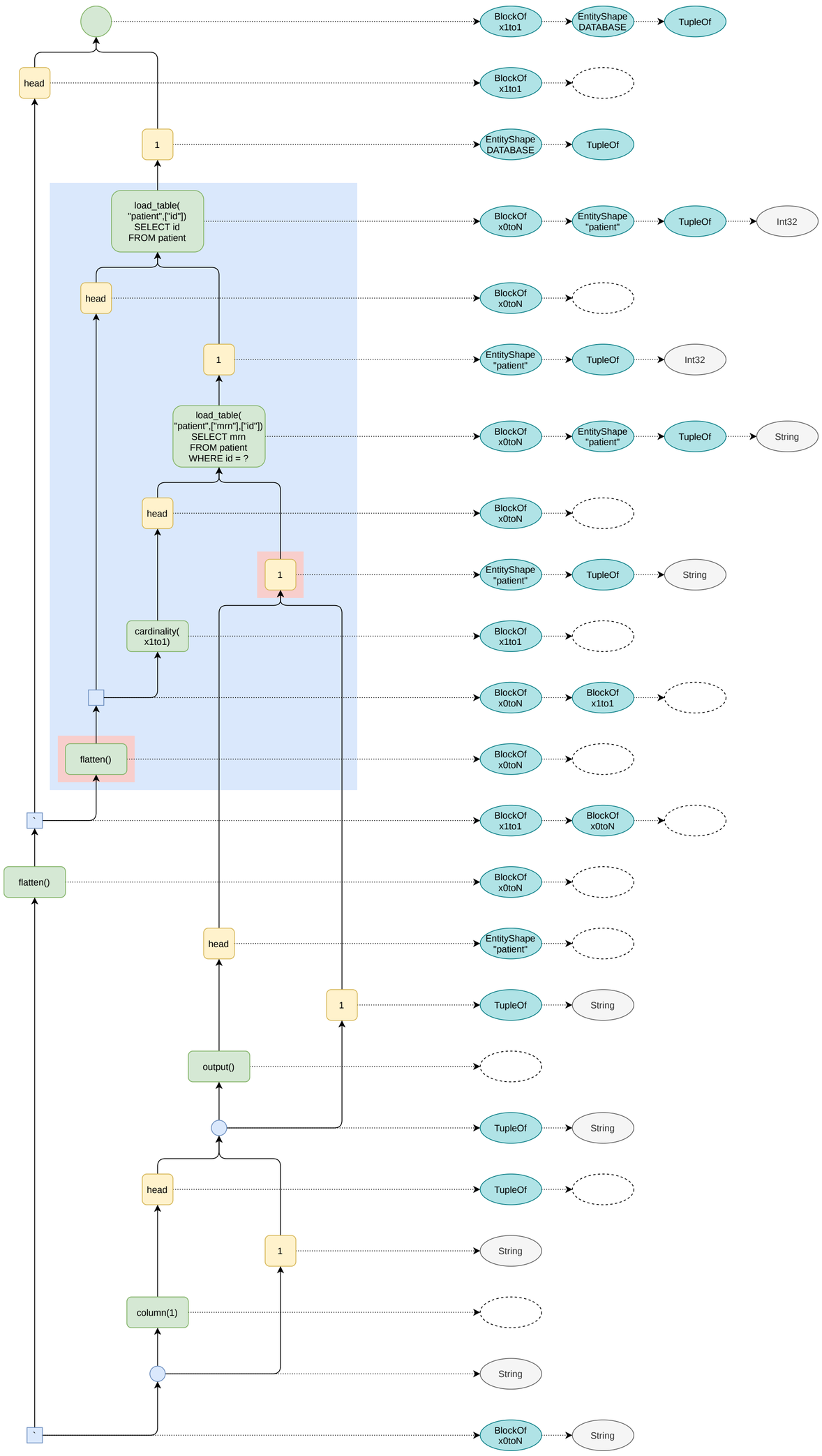


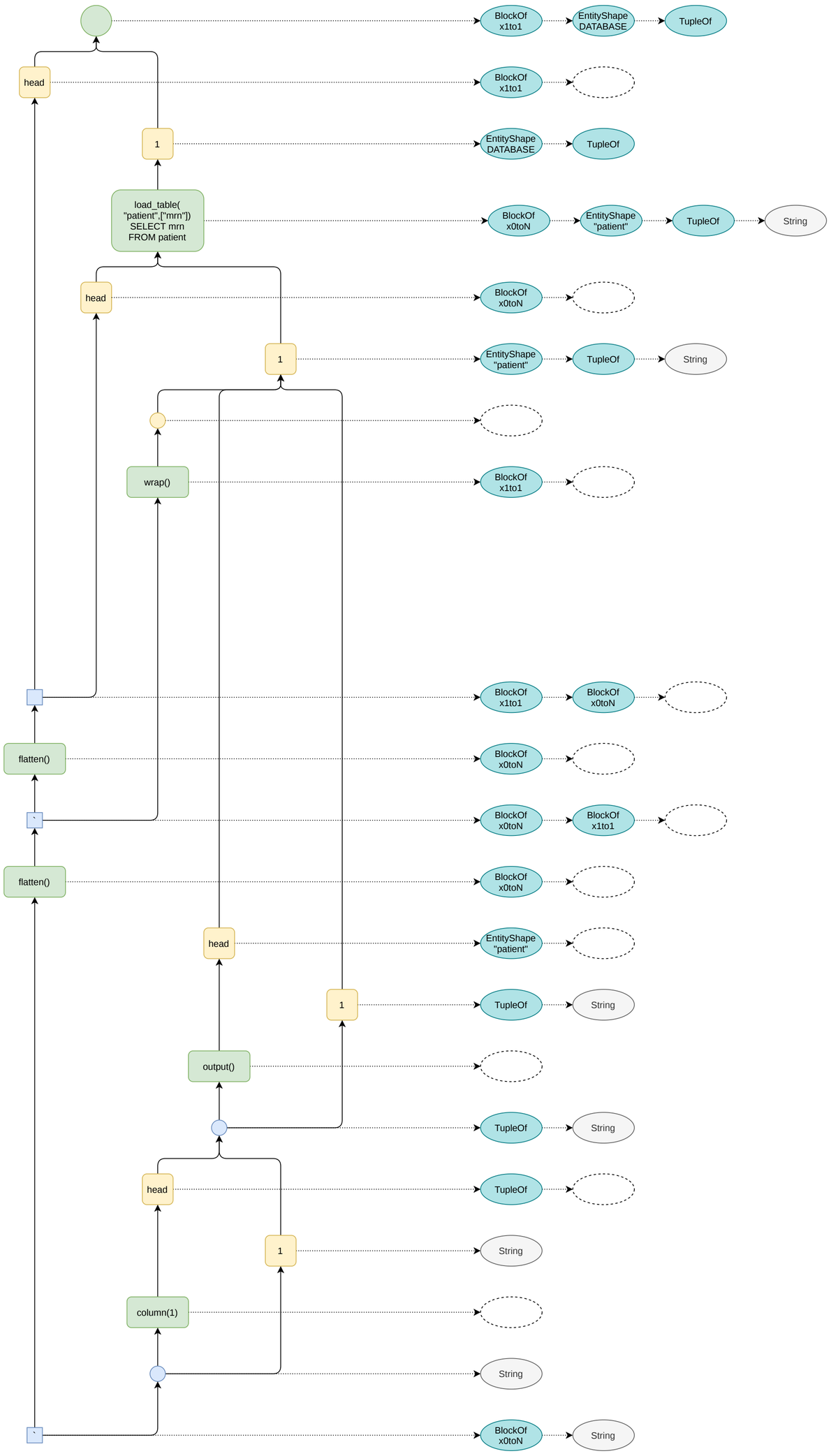

BlockOf x1to1
EntityShape DATABASE
TupleOf
head
BlockOf x1to1
1
EntityShape DATABASE
TupleOf
load_table("patient",["id"]) SELECT id FROM patient
BlockOf x0toN
EntityShape "patient"
TupleOf
Int32
head
BlockOf x0toN
1
EntityShape "patient"
TupleOf
Int32
load_table("patient",["mrn"],["id"]) SELECT mrn FROM patient WHERE id = ?
BlockOf x0toN
EntityShape "patient"
TupleOf
String
head
BlockOf x0toN
1
EntityShape "patient"
TupleOf
String
head
EntityShape "patient"
1
TupleOf
String
output()
TupleOf
String
head
TupleOf
1
String
column(1)
String
cardinality(x1to1)
BlockOf x1to1
BlockOf x1to1
String
tuple_of(1)
TupleOf
TupleOf
BlockOf x1to1
String
BlockOf x1to1
BlockOf x0toN
flatten()
BlockOf x0toN
`
BlockOf x0toN
String

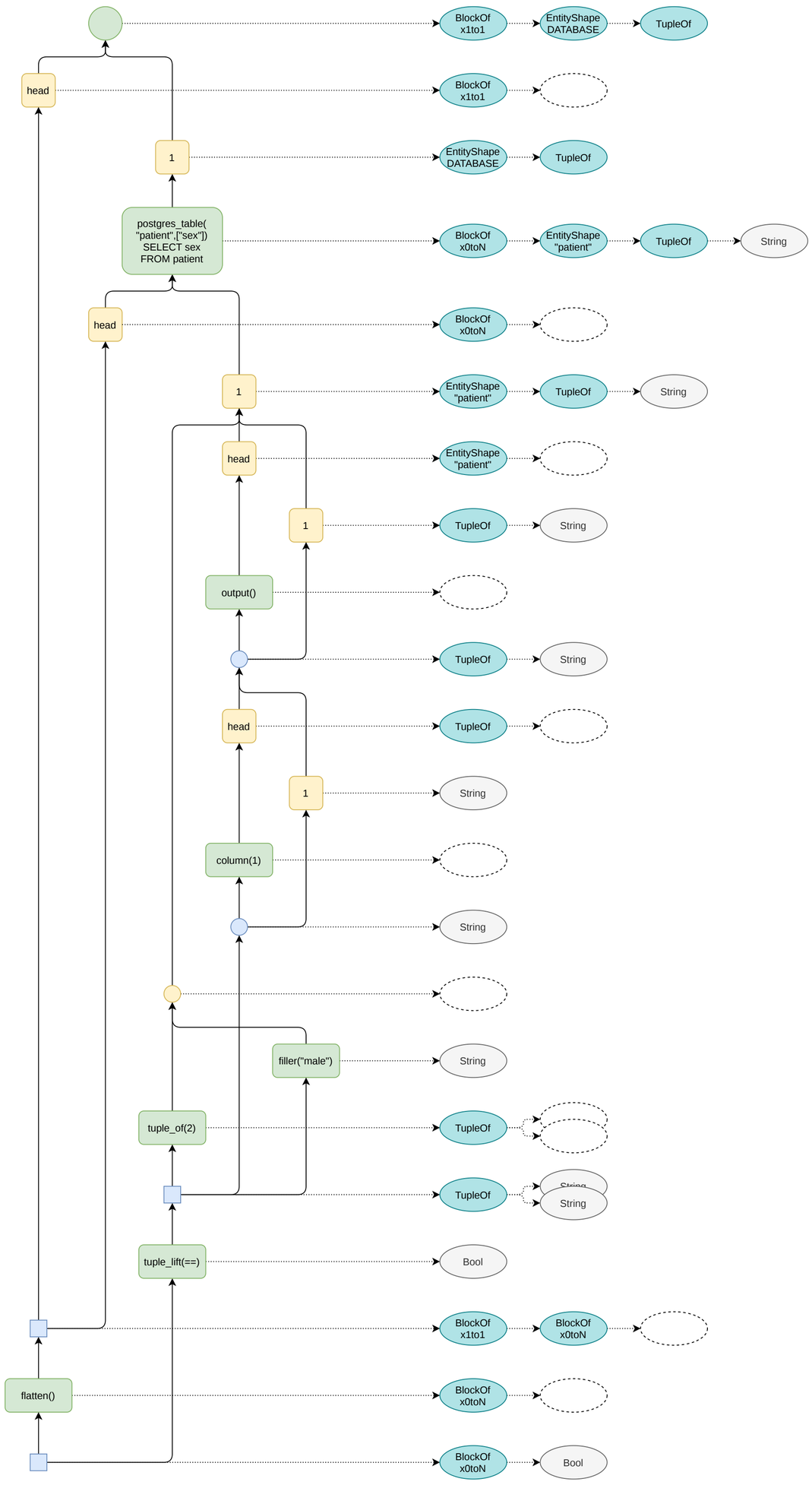

BlockOf x1to1
EntityShape DATABASE
TupleOf
head
BlockOf x1to1
1
EntityShape DATABASE
TupleOf
load_table("patient",["id"]) SELECT id FROM patient
BlockOf x0toN
EntityShape "patient"
TupleOf
Int32
head
BlockOf x0toN
1
EntityShape "patient"
TupleOf
Int32
load_table("patient",["mrn"],["id"]) SELECT mrn FROM patient WHERE id = ?
BlockOf x0toN
EntityShape "patient"
TupleOf
String
head
BlockOf x0toN
1
EntityShape "patient"
TupleOf
String
cardinality(x1to1)
BlockOf x1to1
BlockOf x0toN
BlockOf x1to1
String
head
1
head
1
BlockOf x1to1
BlockOf x0toN
flatten()
BlockOf x0toN
`
BlockOf x0toN
BlockOf x1to1
flatten()
BlockOf x0toN
head
EntityShape "patient"
1
TupleOf
String
output()
TupleOf
String
head
TupleOf
1
String
column(1)
String
`
BlockOf x0toN
String

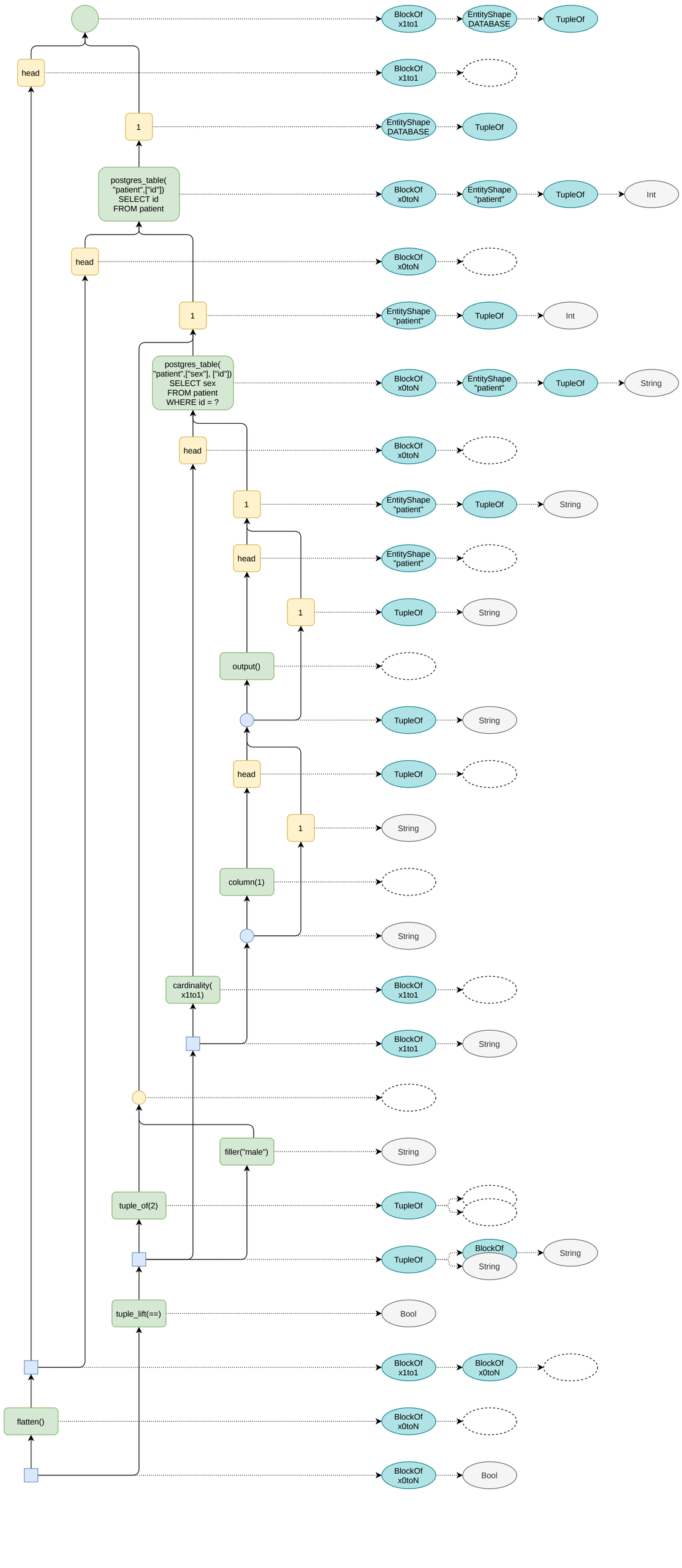

BlockOf x1to1
EntityShape DATABASE
TupleOf
head
BlockOf x1to1
1
EntityShape DATABASE
TupleOf
load_query(...)
BlockOf x0toN
EntityShape DATABASE
TupleOf
String
ADAPTER
BlockOf x0toN
BlockOf x1to1
String
head
1
head
1
BlockOf x1to1
BlockOf x0toN
flatten()
BlockOf x0toN
`
BlockOf x0toN
BlockOf x1to1
flatten()
BlockOf x0toN
head
EntityShape "patient"
1
TupleOf
String
output()
TupleOf
String
head
TupleOf
1
String
column(1)
String
`
BlockOf x0toN
String

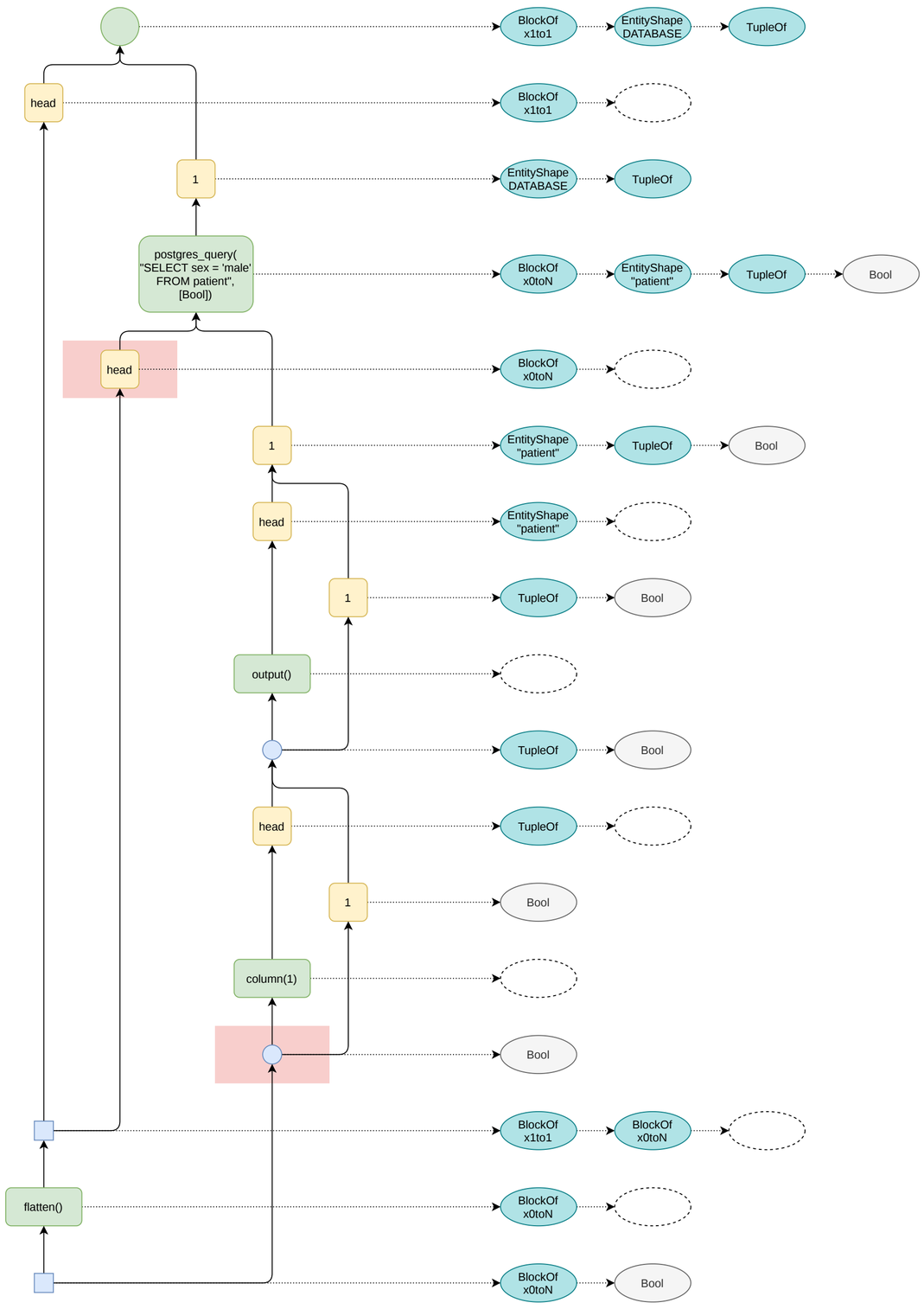
```
chain_of(with_elements(load_postgres_table(("public", "patient"), ["id"], [Int32])),
         flatten(),
         with_elements(
             chain_of(
                 load_postgres_table(("public", "patient"), ["mrn"], [String], ["id"]),
                 block_cardinality(x1to1))),
         flatten(),
         with_elements(
             chain_of(
                 output(),
                 column(1))))
```

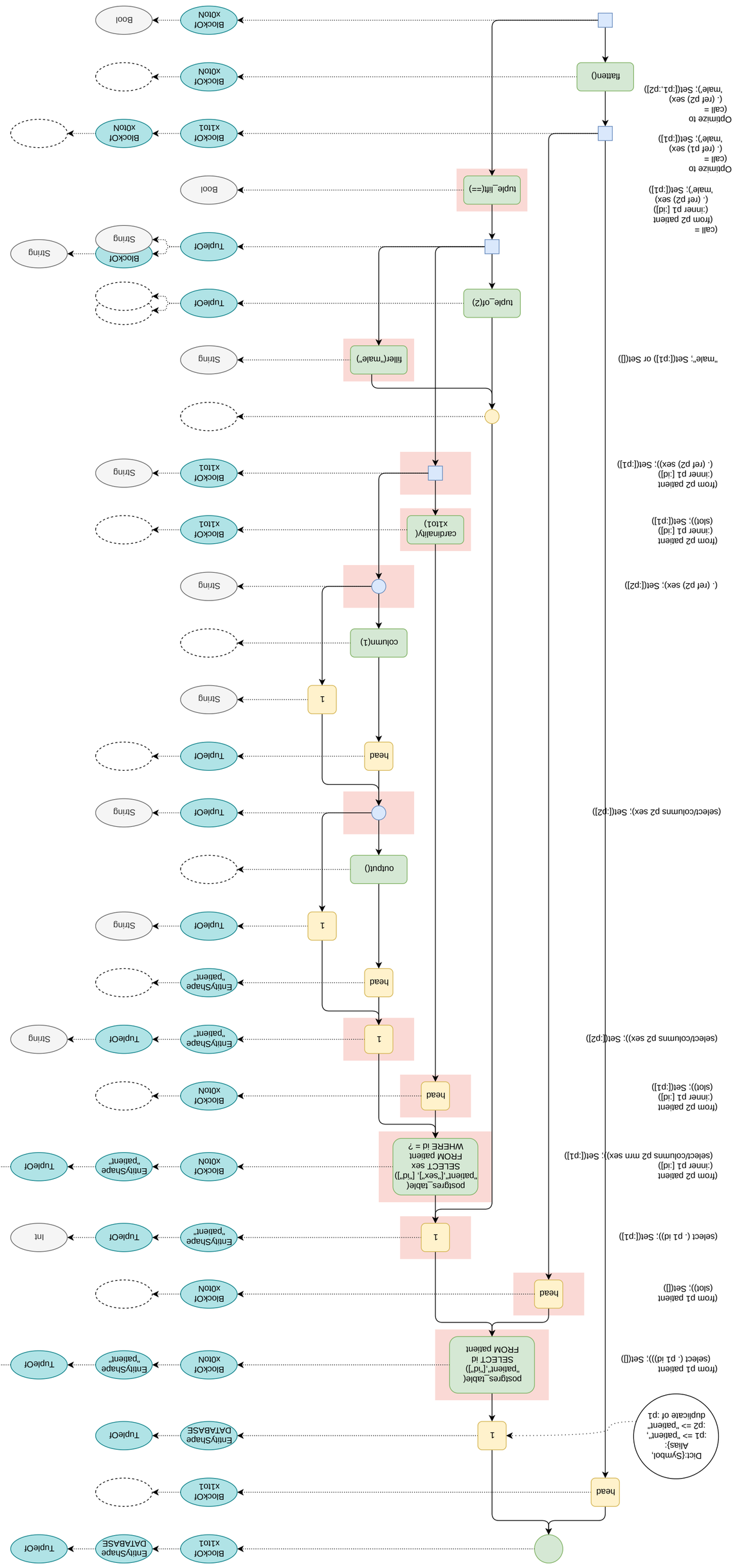


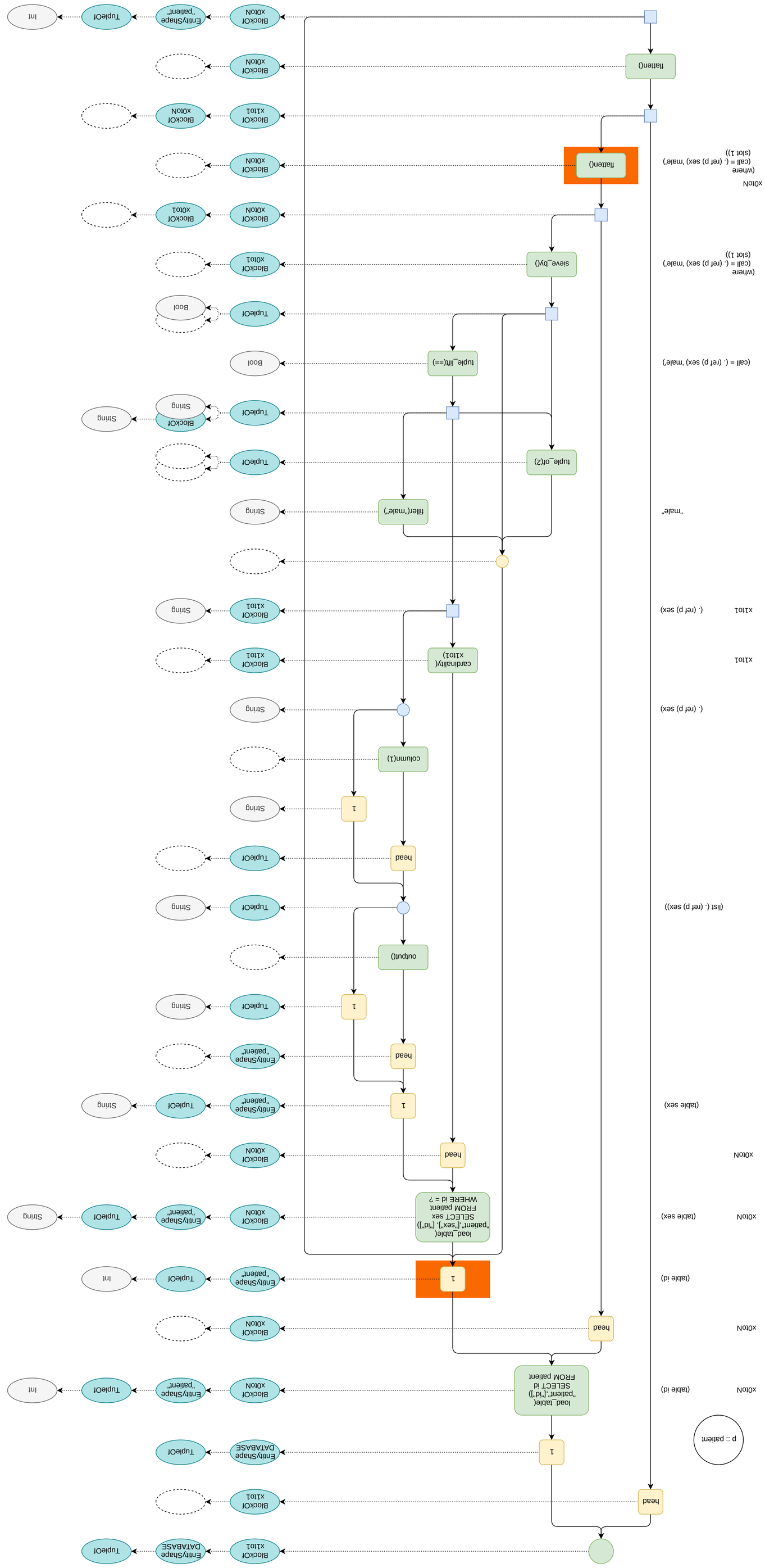

BlockOf x1to1
EntityShape DATABASE
TupleOf
head
BlockOf x1to1
1
EntityShape DATABASE
TupleOf
load_table("patient",["mrn"]) SELECT mrn FROM patient
BlockOf x0toN
EntityShape "patient"
TupleOf
String
head
BlockOf x0toN
1
EntityShape "patient"
TupleOf
String
wrap()
BlockOf x1to1
BlockOf x1to1
BlockOf x0toN
flatten()
BlockOf x0toN
`
BlockOf x0toN
BlockOf x1to1
flatten()
BlockOf x0toN
head
EntityShape "patient"
1
TupleOf
String
output()
TupleOf
String
head
TupleOf
1
String
column(1)
String
`
BlockOf x0toN
String

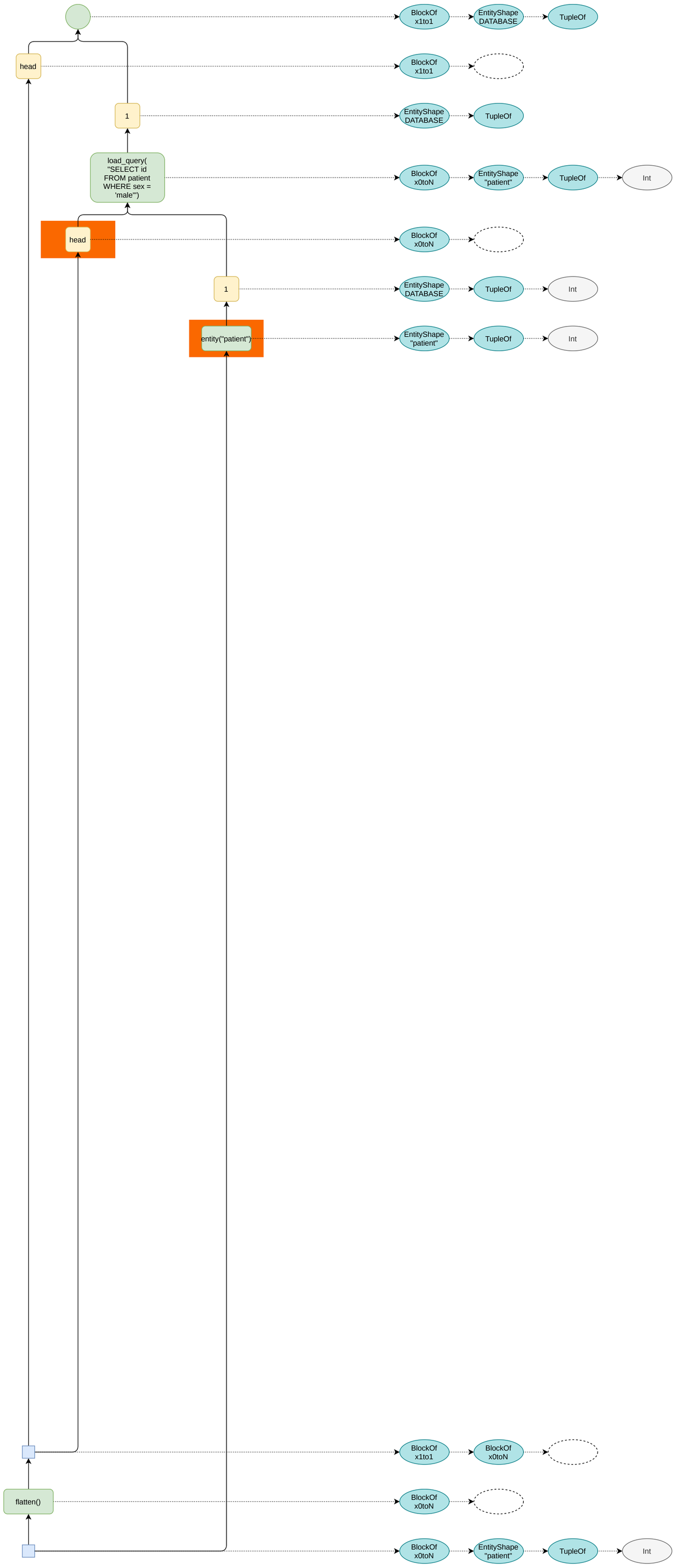

BlockOf x1to1
EntityShape DATABASE
TupleOf
head
BlockOf x1to1
1
EntityShape DATABASE
TupleOf
postgres_table("patient",["sex"]) SELECT sex FROM patient
BlockOf x0toN
EntityShape "patient"
TupleOf
String
head
BlockOf x0toN
1
EntityShape "patient"
TupleOf
String
head
EntityShape "patient"
1
TupleOf
String
output()
TupleOf
String
head
TupleOf
1
String
column(1)
String
filler("male")
String
tuple_of(2)
TupleOf
TupleOf
String
tuple_lift(==)
Bool
BlockOf x1to1
BlockOf x0toN
flatten()
BlockOf x0toN
BlockOf x0toN
Bool


BlockOf x1to1
EntityShape DATABASE
TupleOf
head
BlockOf x1to1
1
EntityShape DATABASE
TupleOf
postgres_table("patient",["id"]) SELECT id FROM patient
BlockOf x0toN
EntityShape "patient"
TupleOf
Int
head
BlockOf x0toN
1
EntityShape "patient"
TupleOf
Int
postgres_table("patient",["sex"], {"id"}) SELECT sex FROM patient WHERE id = ?
BlockOf x0toN
EntityShape "patient"
TupleOf
String
head
BlockOf x0toN
1
EntityShape "patient"
TupleOf
String
head
EntityShape "patient"
1
TupleOf
String
output()
TupleOf
String
head
TupleOf
1
String
column(1)
String
cardinality(x1to1)
BlockOf x1to1
BlockOf x1to1
String
filler("male")
String
tuple_of(2)
TupleOf
TupleOf
BlockOf
String
String
tuple_lift(==)
Bool
BlockOf x1to1
BlockOf x0toN
flatten()
BlockOf x0toN
BlockOf x0toN
Bool


BlockOf x1to1
EntityShape DATABASE
TupleOf
head
BlockOf x1to1
1
EntityShape DATABASE
TupleOf
postgres_query("SELECT sex = 'male' FROM patient", [Bool])
BlockOf x0toN
EntityShape "patient"
TupleOf
Bool
head
BlockOf x0toN
1
EntityShape "patient"
TupleOf
Bool
head
EntityShape "patient"
1
TupleOf
Bool
output()
TupleOf
Bool
head
TupleOf
1
Bool
column(1)
Bool
BlockOf x1to1
BlockOf x0toN
flatten()
BlockOf x0toN
BlockOf x0toN
Bool


Dict{:Symbol, Alias}:
:p1 => "patient",
:p2 => "patient",
duplicate of :p1
head
1
postgres_table("patient",["id"])
SELECT id
FROM patient
BlockOf
x1to1
EntityShape
DATABASE
TupleOf
Int
head
1
postgres_table("patient",["id","sex"])
SELECT sex
FROM patient
WHERE id = ?
BlockOf
x0toN
EntityShape
"patient"
TupleOf
String
head
1
BlockOf
x1to1
EntityShape
"patient"
TupleOf
Int
head
1
BlockOf
x0toN
EntityShape
"patient"
TupleOf
String
head
1
BlockOf
x1to1
String
cardinality(
x1to1)
BlockOf
x1to1
head
1
BlockOf
x0toN
String
head
1
BlockOf
x1to1
EntityShape
"patient"
TupleOf
String
head
1
BlockOf
x0toN
String
head
1
BlockOf
x1to1
String
column(1)
head
1
String
head
1
BlockOf
x0toN
TupleOf
String
output()
head
1
TupleOf
String
head
1
BlockOf
x0toN
TupleOf
String
tuple_of(2)
tuple_lift(==)
Bool
BlockOf
x1to1
BlockOf
x0toN
flatten()
BlockOf
x0toN
Bool
flatten()
column(1)
head
1
head
1
output()
head
1
postgres_query(
"SELECT sex = 'male'
FROM patient",
[Bool])
1
head
(from p1 patient
(select (. p1 id))); Set([])
(from p1 patient
(select (. p1 id)); Set([:p1])
(from p2 patient
(select (. ref p2) sex)); Set([:p2])
(from p1 patient
(select/columns p2 sex)); Set([:p2])
(from p2 patient
(:inner p1 [:id])
(select/columns p2 mm sex)); Set([:p1])
(from p2 patient
(:inner p1 [:id])
(slot)); Set([:p1])
(from p2 patient
(:inner p1 [:id])
(. (ref p2) sex)); Set([:p1])
"male"; Set([:p1]) or Set([])
(select/columns p2 sex)); Set([:p2])
(from p1 patient
(slot)); Set([])
(from p2 patient
(:inner p1 [:id])
(slot)); Set([:p1])
(from p2 patient
(:inner p1 [:id])
(. (ref p2) sex)); Set([:p1])
Optimize to
(call =
(. (ref p1) sex)
'male'); Set([:p1])
Optimize to
(call =
(. (ref p2) sex)
'male'); Set([:p1,:p2])
(call =
(from p2 patient
(:inner p1 [:id])
(. (ref p2) sex)
'male'); Set([:p1])


p :: patient
xOtoN
(table id)
head
BlockOf
xOtoN
1
EntityShape
"patient"
TupleOf
Int
load_table(
"patient",["id"])
SELECT id
FROM patient
BlockOf
x1to1
EntityShape
DATABASE
TupleOf
Int
xOtoN
(table id)
head
BlockOf
xOtoN
1
EntityShape
"patient"
TupleOf
Int
xOtoN
(table id)
load_table(
"patient",["sex"], ["id"])
SELECT sex
FROM patient
WHERE id = ?
BlockOf
xOtoN
EntityShape
"patient"
TupleOf
String
x1to1
(. (ref p) sex)
head
BlockOf
xOtoN
1
EntityShape
"patient"
TupleOf
String
head
BlockOf
xOtoN
1
EntityShape
"patient"
TupleOf
String
x1to1
cardinality(
x1to1)
BlockOf
x1to1
EntityShape
"patient"
TupleOf
String
x1to1
(. (ref p) sex)
"male"
(table sex)
xOtoN
(table sex)
(. (ref p) sex)
(list (. (ref p) sex))
(table id)
xOtoN
(where
(call = (. (ref p) sex) 'male')
(slot 1))
(call = (. (ref p) sex) 'male')
flatten()
BlockOf
xOtoN
BlockOf
xOtoN
BlockOf
xOtoN
BlockOf
xOtoN
BlockOf
xOtoN
BlockOf
xOtoN
BlockOf
x1to1
BlockOf
xOtoN
filter("male")
String
tuple_of(2)
TupleOf
TupleOf
BlockOf
String
String
tuple_lift(==)
Bool
TupleOf
Bool
sieve_by()
BlockOf
xOtoN
BlockOf
xOtoN
flatten()
BlockOf
xOtoN
BlockOf
x1to1
EntityShape
"patient"
TupleOf
String
EntityShape
"patient"
TupleOf
String
EntityShape
"patient"
TupleOf
String
EntityShape
"patient"
TupleOf
String
EntityShape
"patient"
TupleOf
String
EntityShape
"patient"
TupleOf
String
EntityShape
"patient"
TupleOf
Int
EntityShape
"patient"
TupleOf
Int
EntityShape
DATABASE
TupleOf
Int
(where
(call = (. (ref p) sex) 'male')
(slot 1))
xOtoN


BlockOf x1to1
EntityShape DATABASE
TupleOf
head
BlockOf x1to1
1
EntityShape DATABASE
TupleOf
load_query("SELECT id FROM patient WHERE sex = 'male'")
BlockOf x0toN
EntityShape "patient"
TupleOf
Int
head
BlockOf x0toN
1
EntityShape DATABASE
TupleOf
Int
entity("patient")
EntityShape "patient"
TupleOf
Int
BlockOf x1to1
BlockOf x0toN
flatten()
BlockOf x0toN
BlockOf x0toN
EntityShape "patient"
TupleOf
Int