**[create view patientdataSL of ("hospID" char,"hospDesc" char,"patientID" int,"rCode" int,"address" char, "birthdate" date,"admission" date,"ICD10" char,"diagnosis" char,"treatments" char) as get using hospitalssl]**

where hospitalssl is a table describing the hospitals and the URLs used to get their data:

|  |  |  |
| --- | --- | --- |
| 'CMH' | 'Choithram Memorial Hospital' | 'http://root:admin@localhost:8078/sleone/patientrecordcmh' |
| 'HS' | 'Holy Spirit Hospital' | 'http://root:admin@localhost:8078/sleone/patientrecordholyspirit' |
| 'MABESSS' | 'St John of God Catholic (Mabesseneh) Hospital' | 'http://root:admin@localhost:8078/sleone/patientrecordmabesss' |

The first column here corresponds to the contributor id (CID) field in the attached PowerPoint presentation, which calls this table T1 and gives additional details about the example data.

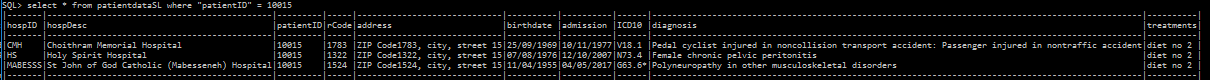
The system is considered a success if answering queries of interest to the government is achieved with minimal data transfer and costs at both the government and the hospitals, using queries derived automatically from the above view definitions. From a technical point of view the interesting thing is the automatic generation of a large set of specific queries from the single very simple view definition above.

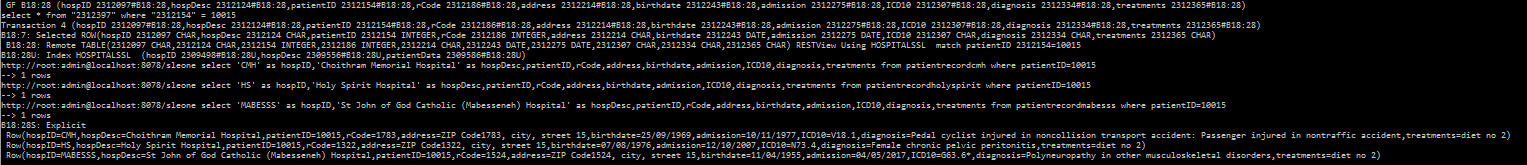
In the following notes I have included the –E, -V and –H traces from the server as in the document “The May 2018 version..”. Like it, this document uses small fonts where needed so that lines of output do not wrap around. I expect that readers can zoom in on the image and/or select text into documents for more detailed study.

The queries “of interest to the government” have the following example forms:

(1)

[select \* from patientdataSL where "patientID" = 10015]





GF B18:28 (hospID 2312097#B18:28,hospDesc 2312124#B18:28,patientID 2312154#B18:28,rCode 2312186#B18:28,address 2312214#B18:28,birthdate 2312243#B18:28,admission 2312275#B18:28,ICD10 2312307#B18:28,diagnosis 2312334#B18:28,treatments 2312365#B18:28)

select \* from "2312397" where "2312154" = 10015

Transaction 4 (hospID 2312097#B18:28,hospDesc 2312124#B18:28,patientID 2312154#B18:28,rCode 2312186#B18:28,address 2312214#B18:28,birthdate 2312243#B18:28,admission 2312275#B18:28,ICD10 2312307#B18:28,diagnosis 2312334#B18:28,treatments 2312365#B18:28)

B18:7: Selected ROW(hospID 2312097 CHAR,hospDesc 2312124 CHAR,patientID 2312154 INTEGER,rCode 2312186 INTEGER,address 2312214 CHAR,birthdate 2312243 DATE,admission 2312275 DATE,ICD10 2312307 CHAR,diagnosis 2312334 CHAR,treatments 2312365 CHAR)

B18:28: Remote TABLE(2312097 CHAR,2312124 CHAR,2312154 INTEGER,2312186 INTEGER,2312214 CHAR,2312243 DATE,2312275 DATE,2312307 CHAR,2312334 CHAR,2312365 CHAR) RESTView Using HOSPITALSSL match patientID 2312154=10015

B18:28U: Index HOSPITALSSL (hospID 2309498#B18:28U,hospDesc 2309556#B18:28U,patientData 2309586#B18:28U)

http://root:admin@localhost:8078/sleone select 'CMH' as hospID,'Choithram Memorial Hospital' as hospDesc,patientID,rCode,address,birthdate,admission,ICD10,diagnosis,treatments from patientrecordcmh where patientID=10015

--> 1 rows

http://root:admin@localhost:8078/sleone select 'HS' as hospID,'Holy Spirit Hospital' as hospDesc,patientID,rCode,address,birthdate,admission,ICD10,diagnosis,treatments from patientrecordholyspirit where patientID=10015

--> 1 rows

http://root:admin@localhost:8078/sleone select 'MABESSS' as hospID,'St John of God Catholic (Mabesseneh) Hospital' as hospDesc,patientID,rCode,address,birthdate,admission,ICD10,diagnosis,treatments from patientrecordmabesss where patientID=10015

--> 1 rows

B18:28S: Explicit

Row(hospID=CMH,hospDesc=Choithram Memorial Hospital,patientID=10015,rCode=1783,address=ZIP Code1783, city, street 15,birthdate=25/09/1969,admission=10/11/1977,ICD10=V18.1,diagnosis=Pedal cyclist injured in noncollision transport accident: Passenger injured in nontraffic accident,treatments=diet no 2)

Row(hospID=HS,hospDesc=Holy Spirit Hospital,patientID=10015,rCode=1322,address=ZIP Code1322, city, street 15,birthdate=07/08/1976,admission=12/10/2007,ICD10=N73.4,diagnosis=Female chronic pelvic peritonitis,treatments=diet no 2)

Row(hospID=MABESSS,hospDesc=St John of God Catholic (Mabesseneh) Hospital,patientID=10015,rCode=1524,address=ZIP Code1524, city, street 15,birthdate=11/04/1955,admission=04/05/2017,ICD10=G63.6\*,diagnosis=Polyneuropathy in other musculoskeletal disorders,treatments=diet no 2)

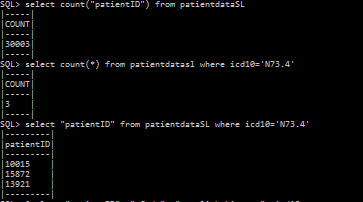
Each hospital has received a simple query against the view they supply, for example:

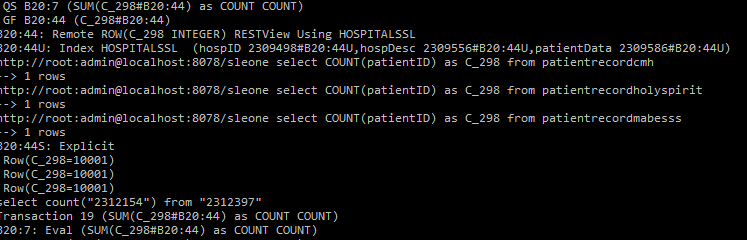
select 'CMH' as hospID,'Choithram Memorial Hospital' as hospDesc,patientID as patientID,rCode as rCode,address as address,birthdate as birthdate,admission as admission,ICD10 as ICD10,diagnosis as diagnosis,treatments as treatments from patientrecordcmh where patientID=10015



The select \* in the global request has caused the hospital ID and description have been inserted from the above “using table” as these columns are in the virtual global table. We will avoid using select \* in future, and this will reduce the length of output lines (and the volume of data transmitted).

select count("patientID") from patientdataSL





QS B20:7 (SUM(C\_298#B20:44) as COUNT COUNT)

GF B20:44 (C\_298#B20:44)

B20:44: Remote ROW(C\_298 INTEGER) RESTView Using HOSPITALSSL

B20:44U: Index HOSPITALSSL (hospID 2309498#B20:44U,hospDesc 2309556#B20:44U,patientData 2309586#B20:44U)

http://root:admin@localhost:8078/sleone select COUNT(patientID) as C\_298 from patientrecordcmh

--> 1 rows

http://root:admin@localhost:8078/sleone select COUNT(patientID) as C\_298 from patientrecordholyspirit

--> 1 rows

http://root:admin@localhost:8078/sleone select COUNT(patientID) as C\_298 from patientrecordmabesss

--> 1 rows

B20:44S: Explicit

Row(C\_298=10001)

Row(C\_298=10001)

Row(C\_298=10001)

select count("2312154") from "2312397"

Transaction 19 (SUM(C\_298#B20:44) as COUNT COUNT)

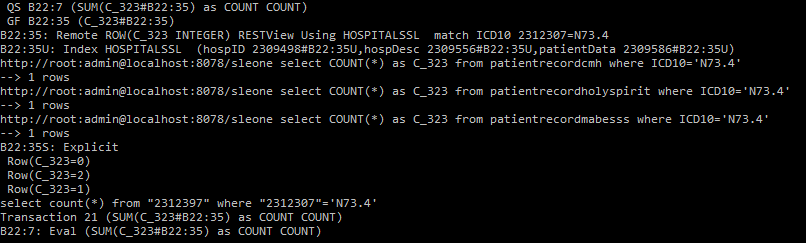
B20:7: Eval (SUM(C\_298#B20:44) as COUNT COUNT)

Here we see that the aggregation operation has been done on the remote systems, so that each hospital has returned just one row of data, in response to a query of form

select COUNT(patientID) as C\_XX from patientrecordXX

select count(\*) from patientdatasl where icd10='N73.4'





QS B22:7 (SUM(C\_323#B22:35) as COUNT COUNT)

GF B22:35 (C\_323#B22:35)

B22:35: Remote ROW(C\_323 INTEGER) RESTView Using HOSPITALSSL match ICD10 2312307=N73.4

B22:35U: Index HOSPITALSSL (hospID 2309498#B22:35U,hospDesc 2309556#B22:35U,patientData 2309586#B22:35U)

http://root:admin@localhost:8078/sleone select COUNT(\*) as C\_323 from patientrecordcmh where ICD10='N73.4'

--> 1 rows

http://root:admin@localhost:8078/sleone select COUNT(\*) as C\_323 from patientrecordholyspirit where ICD10='N73.4'

--> 1 rows

http://root:admin@localhost:8078/sleone select COUNT(\*) as C\_323 from patientrecordmabesss where ICD10='N73.4'

--> 1 rows

B22:35S: Explicit

Row(C\_323=0)

Row(C\_323=2)

Row(C\_323=1)

select count(\*) from "2312397" where "2312307"='N73.4'

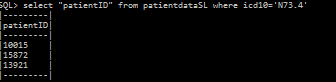
Transaction 21 (SUM(C\_323#B22:35) as COUNT COUNT)

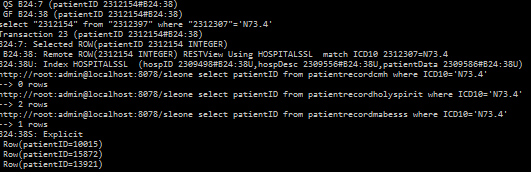
B22:7: Eval (SUM(C\_323#B22:35) as COUNT COUNT)



Notice that we got 1 row from each remote query.

select "patientID" from patientdataSL where icd10='N73.4'







We see that the query needed to go to all the hospitals, and hospitals reported differing numbers of rows.

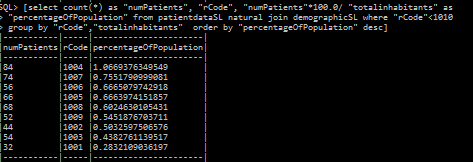
(2)  [select count( \*) as "numPatients", "rCode", count( \*)\*1.0 / "totalinhabitants" as "percentageOfPopulation" from patientdataSL natural join demographicSL group by "rCode","totalinhabitants" order by "percentageOfPopulation" desc]

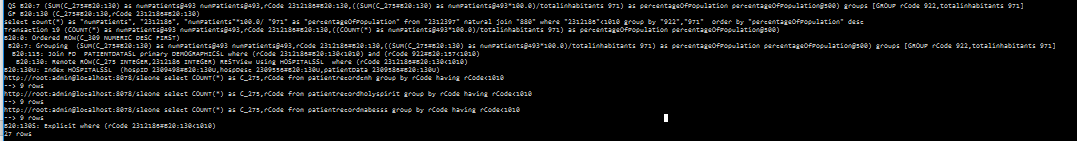
This works if the database engine notices the functional dependency of totalinhabitants on rCode. To reduce the quantity of data returned: let us test this by adding the condition rCode<1010:

[select count(\*) as "numPatients", "rCode", "numPatients"\*100.0/ "totalinhabitants" as

"percentageOfPopulation" from patientdataSL natural join demographicSL where "rCode"<1010

group by "rCode","totalinhabitants" order by "percentageOfPopulation" desc]







(3) [create view patientSummary as

select "rCode",

extract(year from "admission")-extract(year from "birthdate") as "age",

extract(year from "admission") as "adyear",

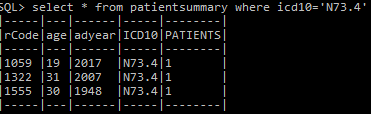
icd10,

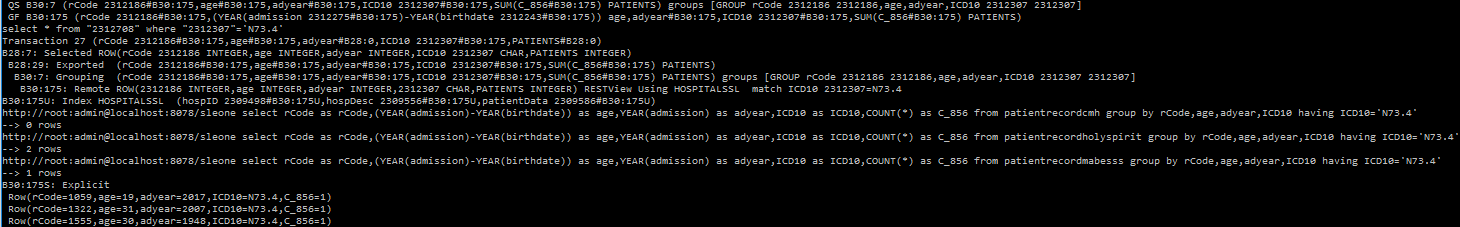
count(\*) as patients

from patientDataSL

group by "rCode", "age", "adyear", icd10]

select \* from patientsummary where icd10='N73.4'



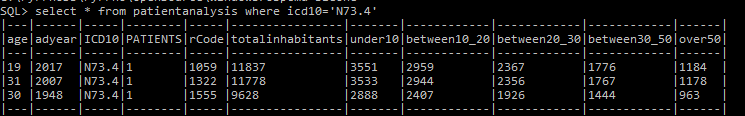


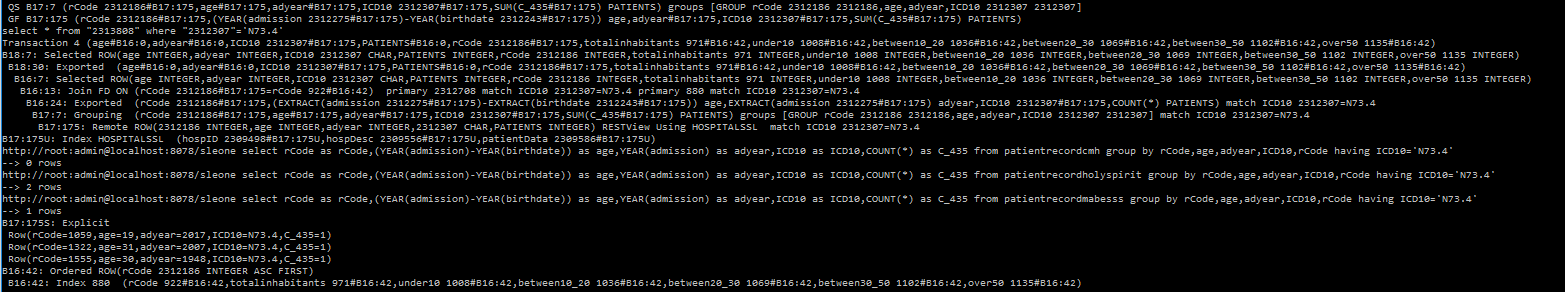


(4) create view patientAnalysis as

select \* from patientSummary natural join demographicSL;

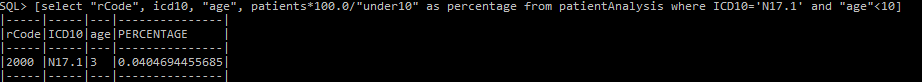
select \* from patientanalysis where icd10='N73.4'

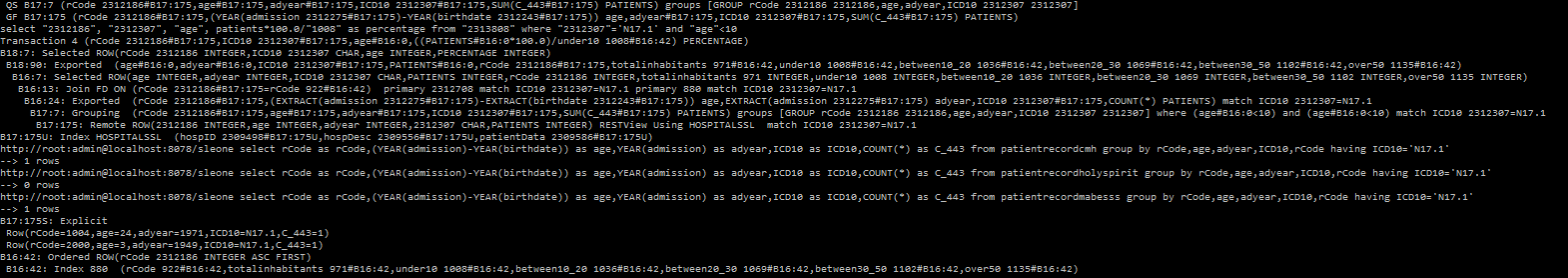






(5) [select "rCode", icd10, "age", patients\*100.0/"under10" as percentage from patientAnalysis where ICD10='N17.1' and "age"<10]







(6) [select coalesce(young.icd10,older.icd10) as "icd10", youngPat, oldPat from

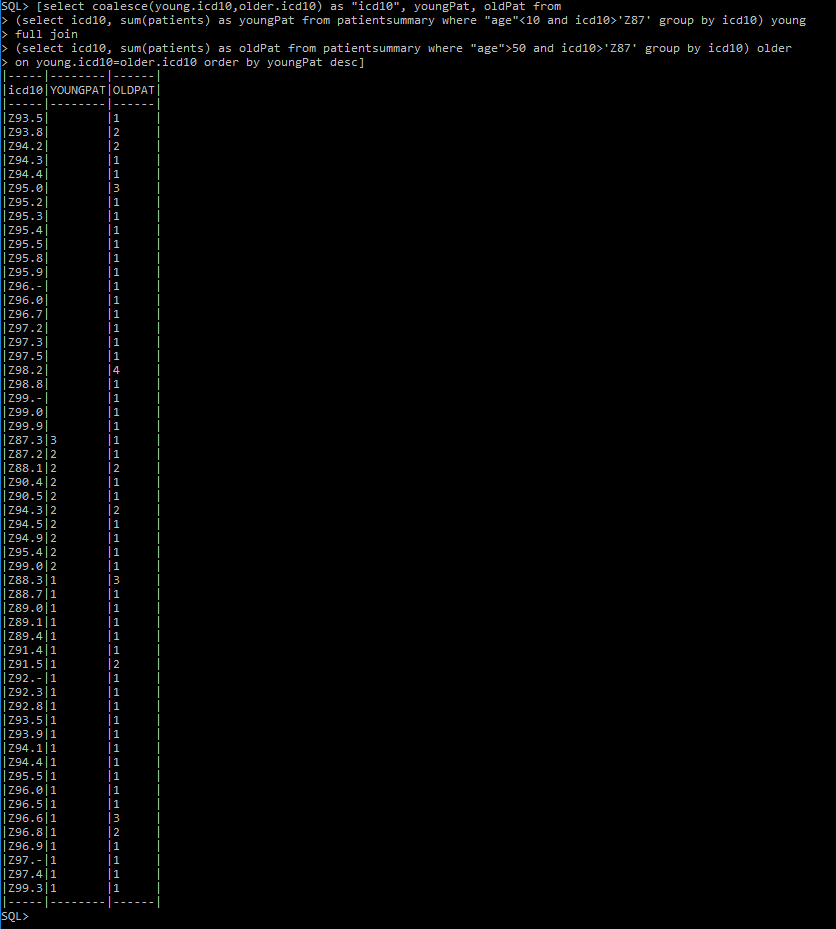
(select icd10, sum(patients) as youngPat from patientsummary where "age"<10 and icd10>'Z87' group by icd10) young

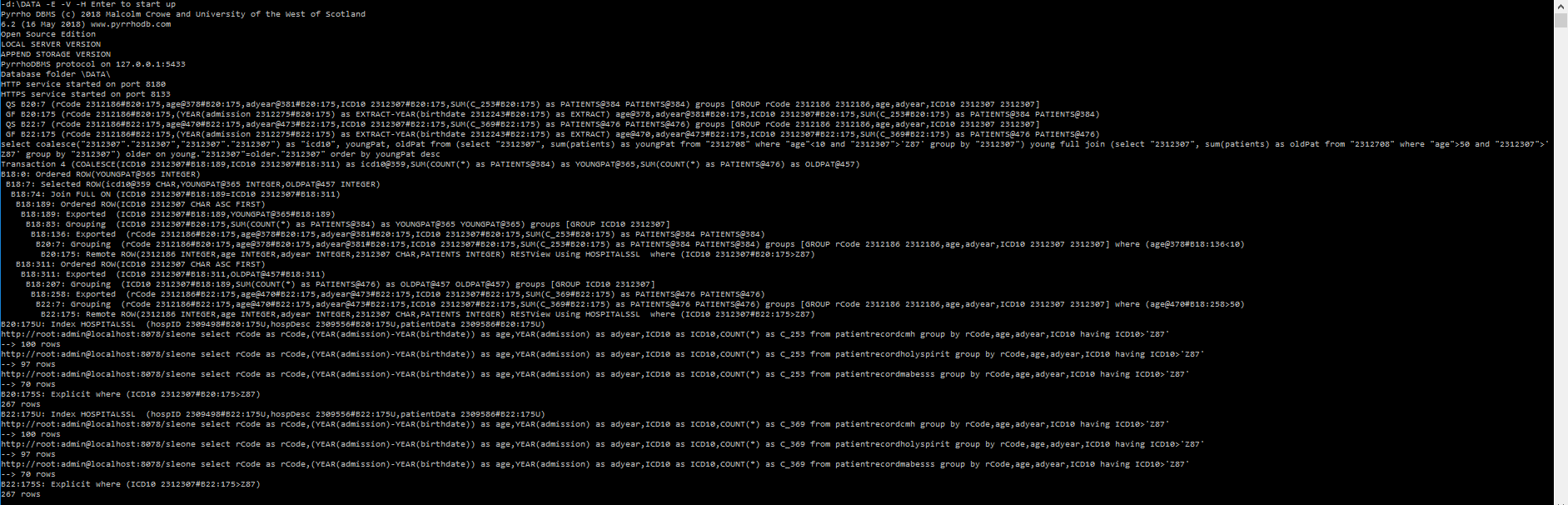
full join

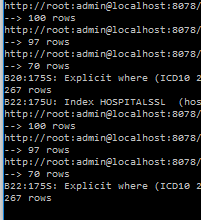
(select icd10, sum(patients) as oldPat from patientsummary where "age">50 and icd10>'Z87' group by icd10) older

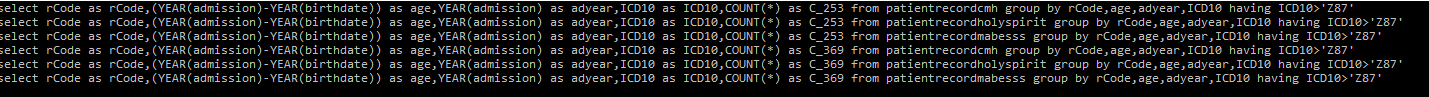
on young.icd10=older.icd10 order by youngPat desc]

Each half of this join exercise retrieves 100, 97,70 records from the hospitals, and groups the results into a table with 56 rows. Also the descending order is honoured but nulls still come first.. It is nice and fast! Still impressive speed if the conditions in yellow are omitted (10001 rows from each hospital, 5534 in the result).



 Magnifying the rows returned section





-d:\DATA -E -V -H Enter to start up

Pyrrho DBMS (c) 2018 Malcolm Crowe and University of the West of Scotland

6.2 (16 May 2018) www.pyrrhodb.com

Open Source Edition

LOCAL SERVER VERSION

APPEND STORAGE VERSION

PyrrhoDBMS protocol on 127.0.0.1:5433

Database folder \DATA\

HTTP service started on port 8180

HTTPS service started on port 8133

QS B20:7 (rCode 2312186#B20:175,age@378#B20:175,adyear@381#B20:175,ICD10 2312307#B20:175,SUM(C\_253#B20:175) as PATIENTS@384 PATIENTS@384) groups [GROUP rCode 2312186 2312186,age,adyear,ICD10 2312307 2312307]

GF B20:175 (rCode 2312186#B20:175,(YEAR(admission 2312275#B20:175) as EXTRACT-YEAR(birthdate 2312243#B20:175) as EXTRACT) age@378,adyear@381#B20:175,ICD10 2312307#B20:175,SUM(C\_253#B20:175) as PATIENTS@384 PATIENTS@384)

QS B22:7 (rCode 2312186#B22:175,age@470#B22:175,adyear@473#B22:175,ICD10 2312307#B22:175,SUM(C\_369#B22:175) as PATIENTS@476 PATIENTS@476) groups [GROUP rCode 2312186 2312186,age,adyear,ICD10 2312307 2312307]

GF B22:175 (rCode 2312186#B22:175,(YEAR(admission 2312275#B22:175) as EXTRACT-YEAR(birthdate 2312243#B22:175) as EXTRACT) age@470,adyear@473#B22:175,ICD10 2312307#B22:175,SUM(C\_369#B22:175) as PATIENTS@476 PATIENTS@476)

select coalesce("2312307"."2312307","2312307"."2312307") as "icd10", youngPat, oldPat from (select "2312307", sum(patients) as youngPat from "2312708" where "age"<10 and "2312307">'Z87' group by "2312307") young full join (select "2312307", sum(patients) as oldPat from "2312708" where "age">50 and "2312307">'Z87' group by "2312307") older on young."2312307"=older."2312307" order by youngPat desc

Transaction 4 (COALESCE(ICD10 2312307#B18:189,ICD10 2312307#B18:311) as icd10@359,SUM(COUNT(\*) as PATIENTS@384) as YOUNGPAT@365,SUM(COUNT(\*) as PATIENTS@476) as OLDPAT@457)

B18:0: Ordered ROW(YOUNGPAT@365 INTEGER)

B18:7: Selected ROW(icd10@359 CHAR,YOUNGPAT@365 INTEGER,OLDPAT@457 INTEGER)

B18:74: Join FULL ON (ICD10 2312307#B18:189=ICD10 2312307#B18:311)

B18:189: Ordered ROW(ICD10 2312307 CHAR ASC FIRST)

B18:189: Exported (ICD10 2312307#B18:189,YOUNGPAT@365#B18:189)

B18:83: Grouping (ICD10 2312307#B20:175,SUM(COUNT(\*) as PATIENTS@384) as YOUNGPAT@365 YOUNGPAT@365) groups [GROUP ICD10 2312307]

B18:136: Exported (rCode 2312186#B20:175,age@378#B20:175,adyear@381#B20:175,ICD10 2312307#B20:175,SUM(C\_253#B20:175) as PATIENTS@384 PATIENTS@384)

B20:7: Grouping (rCode 2312186#B20:175,age@378#B20:175,adyear@381#B20:175,ICD10 2312307#B20:175,SUM(C\_253#B20:175) as PATIENTS@384 PATIENTS@384) groups [GROUP rCode 2312186 2312186,age,adyear,ICD10 2312307 2312307] where (age@378#B18:136<10)

B20:175: Remote ROW(2312186 INTEGER,age INTEGER,adyear INTEGER,2312307 CHAR,PATIENTS INTEGER) RESTView Using HOSPITALSSL where (ICD10 2312307#B20:175>Z87)

B18:311: Ordered ROW(ICD10 2312307 CHAR ASC FIRST)

B18:311: Exported (ICD10 2312307#B18:311,OLDPAT@457#B18:311)

B18:207: Grouping (ICD10 2312307#B18:189,SUM(COUNT(\*) as PATIENTS@476) as OLDPAT@457 OLDPAT@457) groups [GROUP ICD10 2312307]

B18:258: Exported (rCode 2312186#B22:175,age@470#B22:175,adyear@473#B22:175,ICD10 2312307#B22:175,SUM(C\_369#B22:175) as PATIENTS@476 PATIENTS@476)

B22:7: Grouping (rCode 2312186#B22:175,age@470#B22:175,adyear@473#B22:175,ICD10 2312307#B22:175,SUM(C\_369#B22:175) as PATIENTS@476 PATIENTS@476) groups [GROUP rCode 2312186 2312186,age,adyear,ICD10 2312307 2312307] where (age@470#B18:258>50)

B22:175: Remote ROW(2312186 INTEGER,age INTEGER,adyear INTEGER,2312307 CHAR,PATIENTS INTEGER) RESTView Using HOSPITALSSL where (ICD10 2312307#B22:175>Z87)

B20:175U: Index HOSPITALSSL (hospID 2309498#B20:175U,hospDesc 2309556#B20:175U,patientData 2309586#B20:175U)

http://root:admin@localhost:8078/sleone select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_253 from patientrecordcmh group by rCode,age,adyear,ICD10 having ICD10>'Z87'

--> 100 rows

http://root:admin@localhost:8078/sleone select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_253 from patientrecordholyspirit group by rCode,age,adyear,ICD10 having ICD10>'Z87'

--> 97 rows

http://root:admin@localhost:8078/sleone select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_253 from patientrecordmabesss group by rCode,age,adyear,ICD10 having ICD10>'Z87'

--> 70 rows

B20:175S: Explicit where (ICD10 2312307#B20:175>Z87)

267 rows

B22:175U: Index HOSPITALSSL (hospID 2309498#B22:175U,hospDesc 2309556#B22:175U,patientData 2309586#B22:175U)

http://root:admin@localhost:8078/sleone select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_369 from patientrecordcmh group by rCode,age,adyear,ICD10 having ICD10>'Z87'

--> 100 rows

http://root:admin@localhost:8078/sleone select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_369 from patientrecordholyspirit group by rCode,age,adyear,ICD10 having ICD10>'Z87'

--> 97 rows

http://root:admin@localhost:8078/sleone select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_369 from patientrecordmabesss group by rCode,age,adyear,ICD10 having ICD10>'Z87'

--> 70 rows

B22:175S: Explicit where (ICD10 2312307#B22:175>Z87)

267 rows

The queries sent to MySQL were

select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_253 from patientrecordcmh group by rCode,age,adyear,ICD10 having ICD10>'Z87'

select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_253 from patientrecordholyspirit group by rCode,age,adyear,ICD10 having ICD10>'Z87'

select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_253 from patientrecordmabesss group by rCode,age,adyear,ICD10 having ICD10>'Z87'

select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_369 from patientrecordcmh group by rCode,age,adyear,ICD10 having ICD10>'Z87'

select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_369 from patientrecordholyspirit group by rCode,age,adyear,ICD10 having ICD10>'Z87'

select rCode as rCode,(YEAR(admission)-YEAR(birthdate)) as age,YEAR(admission) as adyear,ICD10 as ICD10,COUNT(\*) as C\_369 from patientrecordmabesss group by rCode,age,adyear,ICD10 having ICD10>'Z87'