First EUBIROD Diabetes Report

Design and Statistical Analysis

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Serectrix snc

EUBIROD Final Meeting
Brussels, 26-27th August 2011

Directorate-General for
Health & Consumers

Executive
Agency for
Health and
Consumers

Data sources

University of Perugia (I)
University of Dundee (UK)
Joanneum Research (AT)
NOKLUS (NO)
Paulescu Institute (RO)
University of Malta (MT)
Republic of Cyprus (CY)
Sahlgrenska Institute (SE)
University of Debrecen (HU)
Institute of Public Health (BE)
Adelaide Meath Hospital (IR)
CBO (NL)
Centre Hospitalier (LU)
University of Ljubljana (SI)
Medical University Silesia (PL))
Vuk Vrhovak University (HR)

Directorate-General for Health & Consumers

Executive Agency for Health and Consumers

Data collection 2011

- 01/7/2011 Launch of data collection (Agenda)
- 15/7/2011 BIRO Release 2.0.9
- 16/7/2011 First Local Report (S.Pruna, Romania)
- 19/7/2011 BIRO UIDs Distributed
- 21/7/2011 BIRO Beta Test Group (Italy, Scotland, Netherlands, Croatia, Romania, Ireland)
- 11/8/2011 BIRO Release 2.1.0
- 20/8/2011 Last Local Report (F.Storms, Netherlands)
- 21/8/2011 Upload of the EU Report

The BIRO System
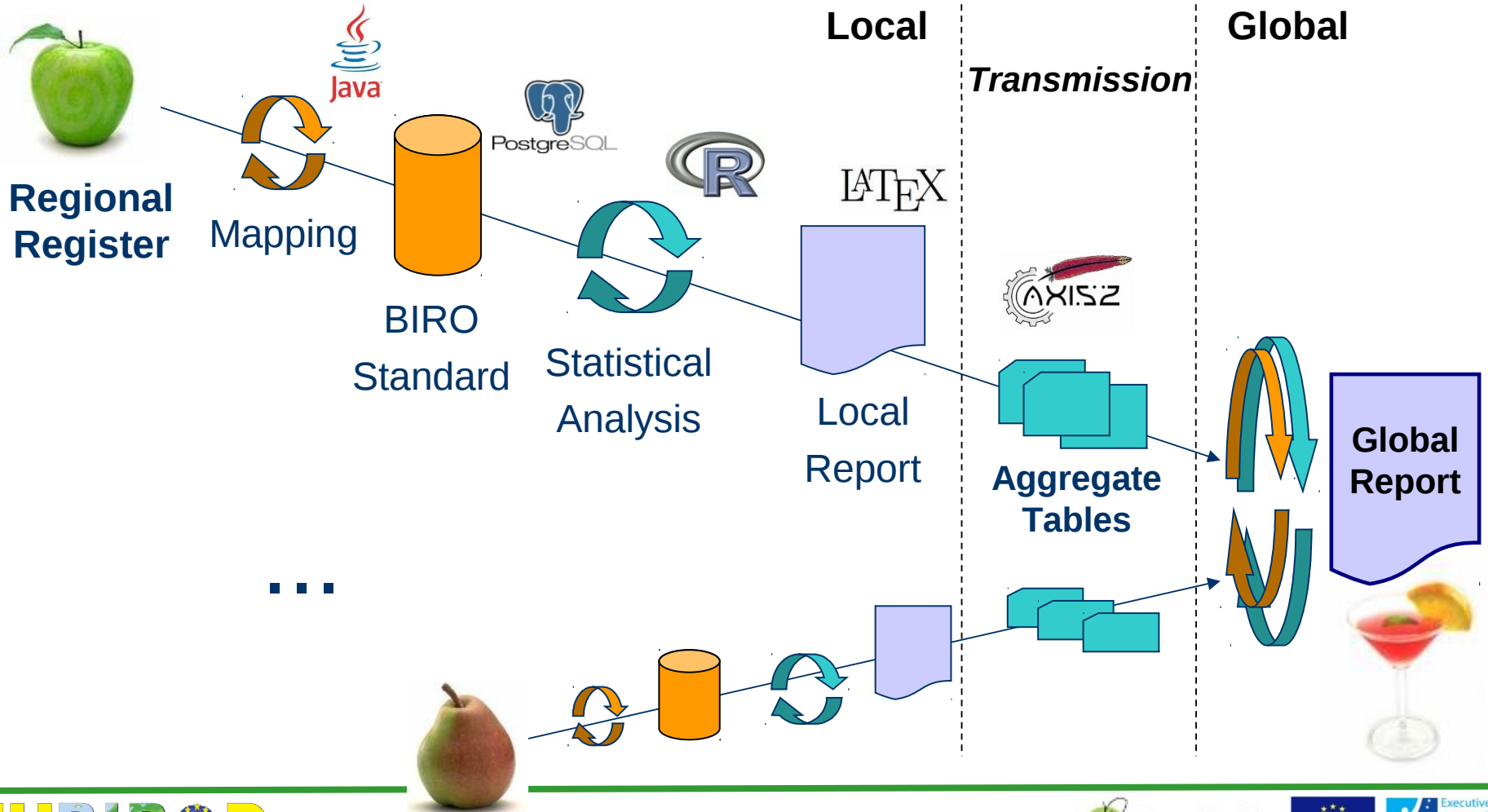
Data Definitions

EUBIROD COMMON DATASET
WORKPACKAGE 5 (University of Dundee)
Deliverable 5.1 (September 2010)
http://www.eubirod.eu/documents/downloads/D5_1_Common_Dataset.pdf

BIRO XML UPDATE
WORKPACKAGE 4 (University of Dundee)
Deliverable 4.3 (July 2009)
http://www.biro-project.eu/documents/downloads/D4_3_Dictionary_XML_Update_v1_0.pdf

CLINICAL REVIEW UPDATE
WORKPACKAGE 2 (Joanneum)
Deliverable 2.2 (January 2009)
http://www.biro-project.eu/documents/downloads/D2_2_Clinical_Review_Update.pdf

Data Entry System
the BIROBox

Data Source Profile

Mapping

Data Quality Check
Inclusion Criteria

DATABASE ENGINE
EUBIROD WORKPACKAGE 5 (University of Perugia)
DELIVERABLE 5.3 (September 2010)
http://www.eubirod.eu/documents/downloads/D5_3_Database_Engine.pdf

1. DATA QUALITY CHECK
DATA FORMAT
•Missing Values
•Wrong Format (not parsable)
•Out of Range
COHERENCE
•Date of Birth>Date of Diagnosis, Date of Birth>Episode Date
•Date of Diagnosis>Episode Date
DUPLICATES

2. DATA CLEANING
Records with null values for the key fields (patient id, episode date) and in general for all
mandatory fields (patient id, episode date, sex, date of diagnosis, date of birth, type of diabetes)
ARE DISCARDED

Database Import

Target Indicators

EUBIROD Report Template
WORKPACKAGE 7
Deliverable 7.2 (May 2009)

http://www.biro-project.eu/documents/downloads/D7_2_Reports_Template_Update_XML_Metadata_Reports.pdf

Statistical Methods

STATISTICAL MATERIALS
EUBIROD WORKPACKAGE 6 (Serectrix snc)
DELIVERABLE 6.1 (September 2010)
http://www.eubirod.eu/documents/downloads/D6_1_Statistical_Materials.pdf

Valid Values
Contingency Tables
Chi-Square
Bars
Boxplots
Trellis Plots
Standardized Results (Tables, Bars, Forest Plot)

Standardization Method
(Risk Adjusted Indicators)

Risk adjustment model (overall or within a region)

$$Y(\%) = \beta_0 + \beta_1(\text{females}) + \beta_2(\text{age\_class1}) + ... \beta_k(\text{age\_class4})$$
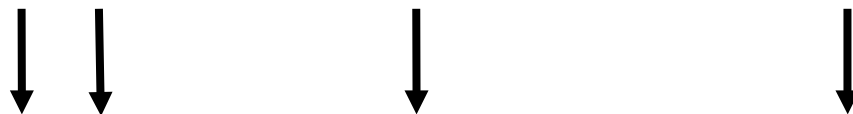
Source unit

$$Y_i \text{ expected} = \beta_0 + \beta_1(\text{females}) + \beta_2(\text{age\_class1}) + ... \beta_k(\text{age\_class4})$$

$$\sum \text{Pred}_i \times 100 = \text{Expected Rate}$$

Standardized Rate= (observed rate/expected rate)*population rate

Standardization Method

J.Lachin

...they consider a region with a set of K hospitals. Their approach is a **hybrid of direct and indirect adjustment**. They fit a logistic model as a function of covariates (say age and sex) in the pooled group of K hospitals, as in indirect adjustment. Then they use a direct approach to estimate the expected number of events in the ith hospital.

..I thought the AHRQ derivation should have accounted for the correlation of the Oi and Ei since when numbers of events rather than rates are used, (O-E) = V(O) +V(E), the covariance being zero because the two terms are based on different samples.

But on further thought, their **approach looks to be approximately OK**. Their Oi and Ei are both rates so that their Ei -> a constant in probability as ni-> infinity. In that case you can invoke Slutsky's theorem and treat the Ei as a constant, as they did in steps 2 and 4.

J.Gastwirth

It **probably is an OK approximation** but I'd be concerned that all the Pij's are based on fitting the logistic to all the data. A possible check is a variant of Peters-Belson, which I did with Sam (Stat Med 1995, approx). One could delete hospital i, say, from the data used to create the logistic model. Then Oi and Ei would be independent.

J.Lachin

It would be nice to work out a more exact solution, but what you're doing is OK.

If the model is fit to a large sample, say 100,000 subjects, and then applied to a single hospital (included in the 100,000) with say 1000 subjects, then the correlation will be minimal and everything will be fine. A problem might arise when there are only 3 hospitals used to fit the data with say n of 3,000 total.

Total Sample

Root (Class) Table

Type of Diabetes (Class Variable)	Exposure Variable 1	Exposure Variable 2

Response Variable

Valid Values

Body (Class) Table

Type of Diabetes (Class Variable)	Exposure Variable 1	Exposure Variable 2

Response Variable

Not Valid/ Not Available
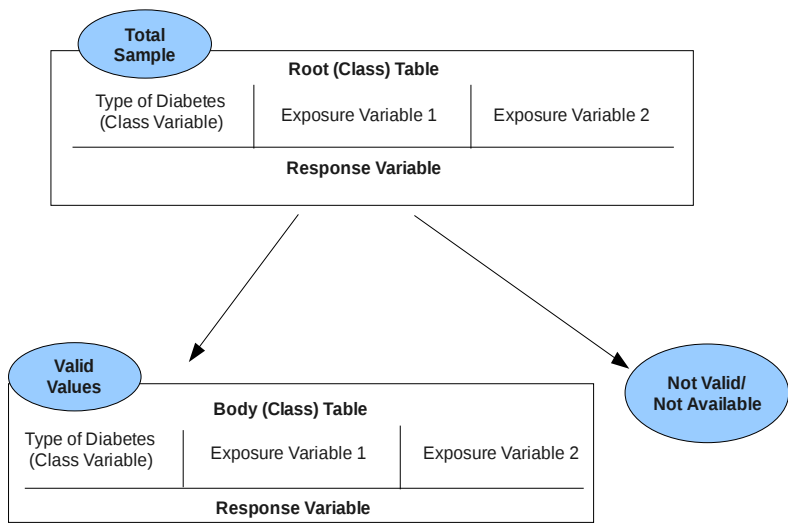
Body (Class) Graphs

BARPLOTS
Exposure Variable 1 (Exposure Variable 2)
Data Source
Response Variable=Categorical

TRELLIS / BOXPLOTS
Exposure Variable 1 (Exposure Variable 2)
(Data Source)
Response Variable=Continuous

Standardized (Class) Estimates (Risk Adjusted Estimators)
Data Source
Response Variable

Standardized (Class) Graphs
BARPLOTS
FOREST PLOTS
Data Source
Response Variable

EU.B.I.R.O.D

Directorate-General for Health & Consumers

Executive Agency for Health and Consumers

Sending the results

Building the global report:
using the Central Engine

Outputs

Execution Times:

    Local : 13 minutes – 1 hour 13 minutes

    Global: 3 Hours 6 Minutes 15 Seconds (N=16 partners)

GLOBAL REPORT

N Indicators = 76

N Subjects = 118,156

PDF No. Pages: 1,708

Html/Tables/Graphs

Statistical Objects (Recursive application)

NO.1 [European Union].[Norway]
SE232.1 [European Union].[Sweden].[Sodra Sverige].[Vastsverige].[Vastra Gotalands lan]
UKM21.1 [European Union].[United Kingdom].[SCOTLAND].[Eastern Scotland].[Angus and Dundee City]
IE021.1 [European Union].[Ireland].[IRELAND].[Southern and Eastern].[Dublin]
PL22A.1 [European Union].[Poland].[REGION POLUDNIOWY].[Slaskie].[Katowicki]
NL321.1 [European Union].[Netherlands].[WEST-NEDERLAND].[Noord-Holland].[Kop van Noord-Holland]
BE.1 [European Union].[Belgium]
DEB.1 [European Union].[Germany].[RHEINLAND-PFALZ]
HU.1 [European Union].[Hungary]
AT22.1 [European Union].[Austria].[SUDOSTERREICH].[Steiermark]
SI.1 [European Union].[Slovenia]
HR.1 [European Union].[Croatia]
RO321.1 [European Union].[Romania].[Macroregiunea trei].[Bucuresti-Ilfov].[Bucuresti]
ITE2.1 [European Union].[Italy].[CENTRO(I)].[Umbria]
CY.1 [European Union].[Cyprus]
MT.1 [European Union].[Malta]

EUBIROD Cohort
General Population

Number of Subjects by Data Sources (EUBIROD cohort – Year 2009 – N=118156)

Data Source	Number of Subjects
05	32533
16	18458
04	14343
14	10956
02	10327
08	9996
07	5036
10	4689
11	2734
09	2235
13	1986
01	1679
06	1307
03	772
15	569
12	536
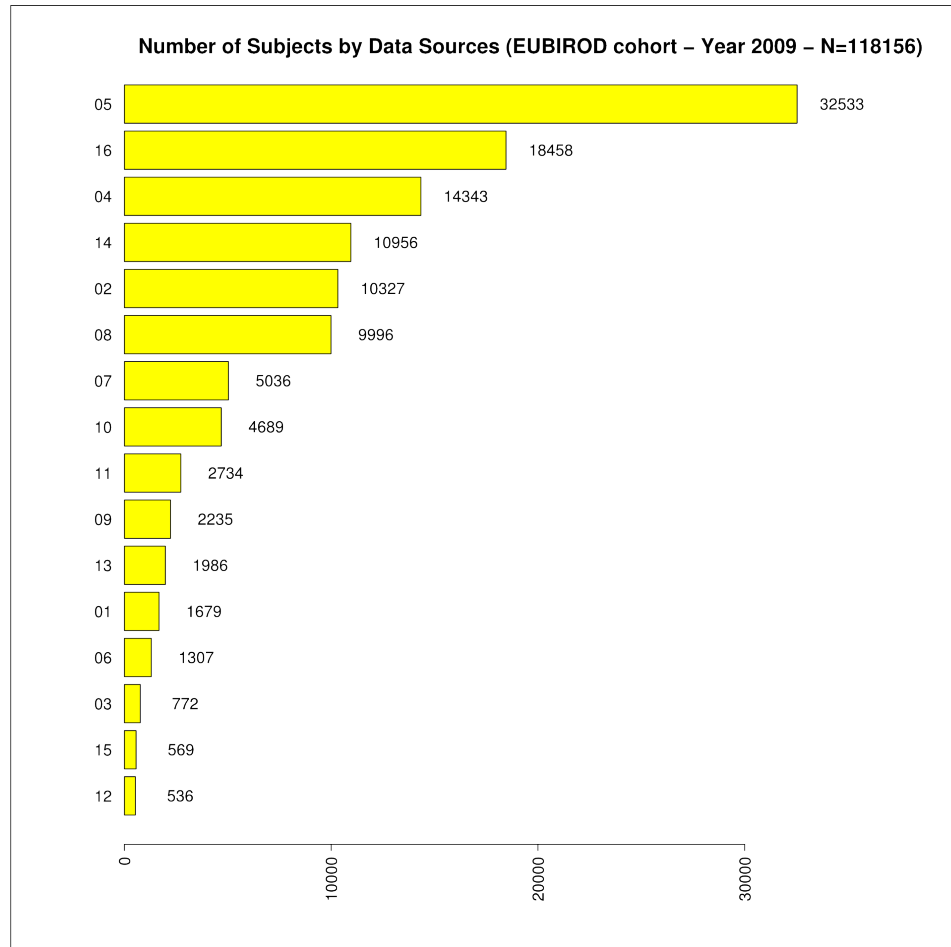
All data relate to year 2009, except for Belgium (2007), Hungary, Sweden (2008)

EUBIROD Cohort
Diabetes Type 1

Number of Subjects by Data Sources (EUBIROD cohort – Year 2009 – N=13759)

Data Source	Number of Subjects
02	3432
05	2133
04	1745
16	1733
11	992
07	842
14	720
08	661
15	569
12	530
01	189
09	90
13	74
03	49
10	0
06	0
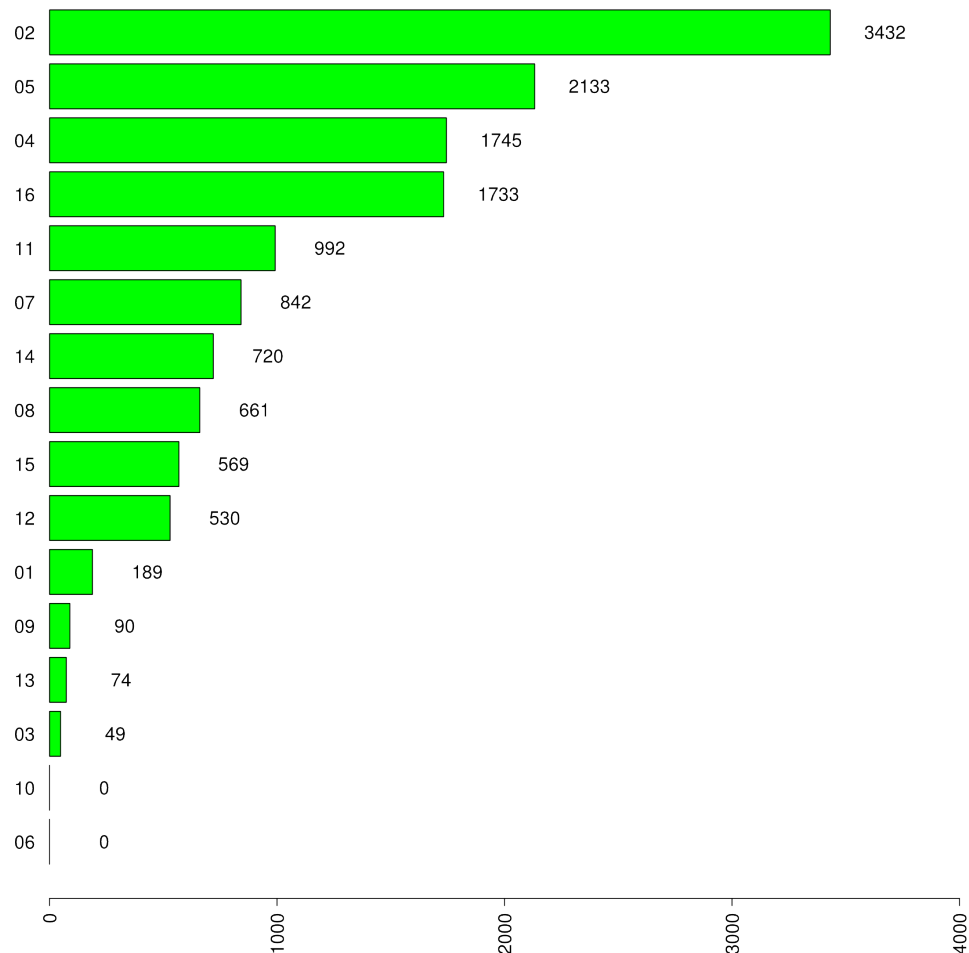
EUBIROD Cohort
Diabetes Type 2

Number of Subjects by Data Sources (EUBIROD cohort – Year 2009 – N=96198)

Data Source	Number of Subjects
05	29824
16	16698
04	12258
08	8949
02	6895
10	4689
14	3833
07	3813
09	2121
13	1912
11	1717
01	1461
06	1307
03	721
15	0
12	0
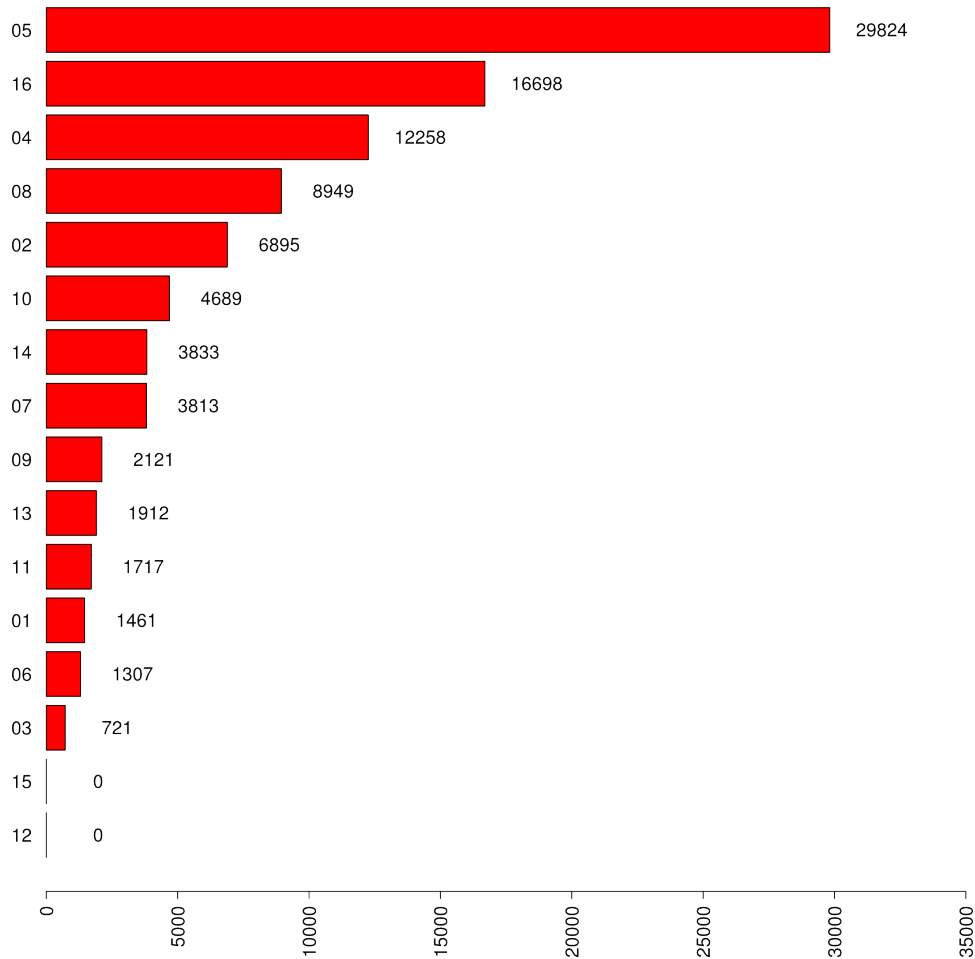
EUBIROD Cohort
Other Type of Diabetes

Number of Subjects by Data Sources (EUBIROD cohort – Year 2009 – N=8199)
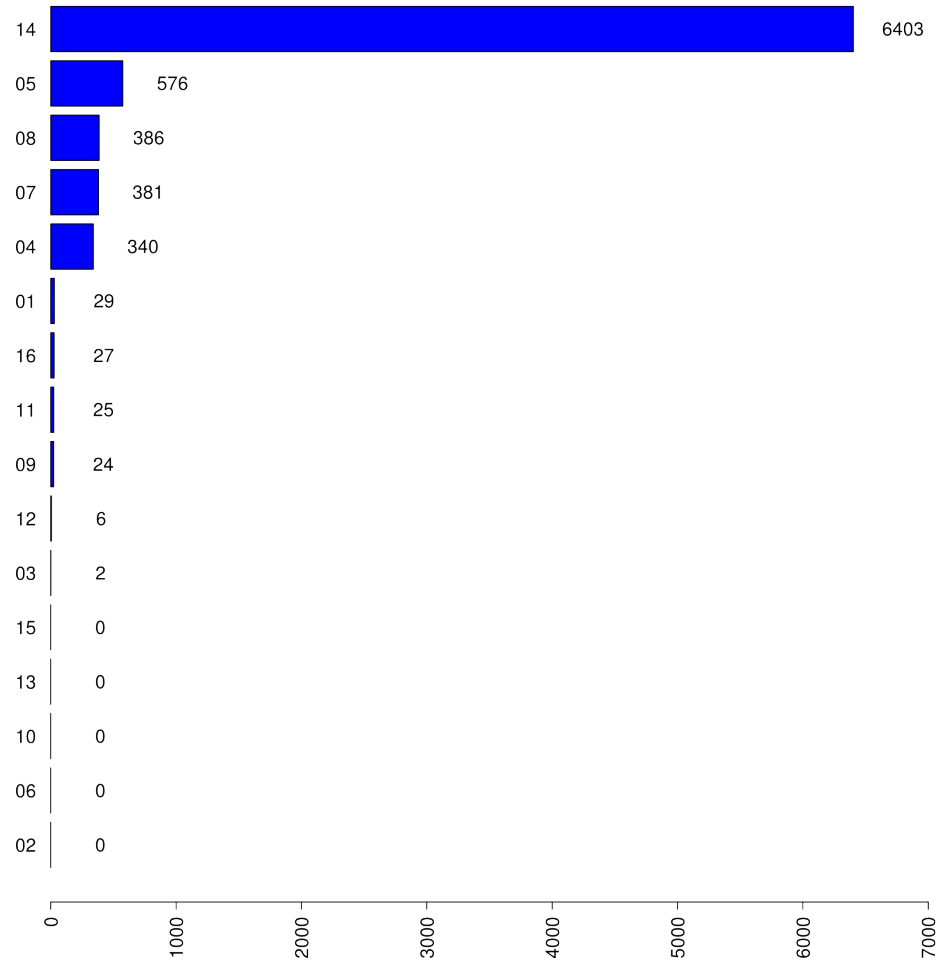
Data Source	Number of Subjects
14	6403
05	576
08	386
07	381
04	340
01	29
16	27
11	25
09	24
12	6
03	2
15	0
13	0
10	0
06	0
02	0

1. Demographics

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Age, Gender	1.1.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

2.1 Clinical characteristics

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Type of Diabetes	2.1.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Diabetes Duration	2.1.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

2.2 Risk Factors for Diabetes Complications

Indicator		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
2.2.1 Obesity																	
Weight	2.2.1.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
BMI	2.2.1.2					X		X			X						
2.2.2 Lifestyle																	
Smoking Status	2.2.2.1	X	X	X	X	X	X	X		X	X	X	X	X	X		X
2.2.3 Clinical Measurements																	
SBP	2.2.3.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
DBP	2.2.3.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Tot Cholesterol	2.2.3.3	X	X	X	X	X	X	X	X	X	X	X			X		X
HDL	2.2.3.4	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Creatinine	2.2.3.5	X	X	X	X	X	X	X	X	X	X	X		X	X		X
HbA1c	2.2.3.6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

2.3 Diabetes Complications

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Retinopathy	2.3.1	X		X	X	X	X	X		X		X	X				X
ESRF	2.3.2	X	X	X	X	X		X		X	X		X				X
Foot Ulcer	2.3.3	X	X	X	X	X	X	X		X			X		X		X
L.E. Amputation	2.3.4	X	X	X	X	X	X	X		X		X	X		X		X
Stroke	2.3.5	X	X	X	X	X	X			X		X	X		X		X
AMI	2.3.6	X	X	X	X	X	X			X					X		X
Hypertension	2.3.7	X		X	X	X	X			X		X	X	X	X		X

3. Health System (1)

3.1. Structure (provider level)

Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Type of Provider	3.1.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Av. Diab.Pop.Centre	3.1.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

3.2 Structural Quality

Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
H.Beds x 100,000	3.2.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Physicians x 100,000	3.2.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

3. Health System (2)

3.3. Processes

3.3.1-3 Examinations, Measurements

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Foot	3.3.1.1	X	X	X	X	X	X	X				X	X		X		X
Eye	3.3.2.1	X	X	X	X	X	X	X		X		X	X		X		X
Blood Pressure	3.3.3.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Lipids	3.3.3.2	X	X	X	X	X	X	X	X	X	X	X	X		X		X
Microalbumin	3.3.3.3	X	X	X	X	X		X		X	X	X	X				X
HbA1c	3.3.3.4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

3.3.4 Treatment

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Antihypertensive	3.3.4.1	X	X	X	X	X	X			X		X	X		X		X
Lipid Lowering	3.3.4.2	X	X	X	X	X	X					X	X		X		
Aspirin	3.3.4.3	X	X	X	X		X					X	X				
Diet Only	3.3.4.4.1	X		X	X	X		X	X	X							X
Tablets	3.3.4.4.2	X		X	X	X		X	X	X							X
Insulin Only	3.3.4.4.3	X	X	X	X	X		X	X	X			X			X	X
Insulin and Tablets	3.3.4.4.4	X	X	X	X	X		X	X	X			X				X
Insulin Pump	3.3.4.4.5	X	X	X	X	X		X				X				X	

3.3.5 Management

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Self-Monitoring	3.3.5.1	X	X	X	X	X				X			X				X
Visit Frequency	3.3.5.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

4. Population

4.1 Area Level

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Total Population	4.1.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Life Expectancy	4.1.2	X	X	X	X	X	X	X	X	X	X	X		X	X		
Mortality Data	4.1.3	X	X	X	X	X	X	X	X	X	X	X		X	X		

5. Risk Adjusted Indicators (1)

5.1 Epidemiology

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Prevalence x 1,000	5.1.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Age at diagnosis	5.1.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

5.2 Process Quality

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
% HbA Done	5.2.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
% Microalb. Done	5.2.2	X	X	X	X	X		X		X	X	X	X				X
% Eye Exam Done	5.2.3	X	X	X	X	X	X	X		X		X	X		X		X
% Feet Exam Done	5.2.4	X	X	X	X	X	X	X				X	X		X		X
% Smoking Ascert.	5.2.5	X	X	X	X	X	X	X		X	X	X	X	X	X		X
% Serum Creat. Done	5.2.6	X	X	X	X	X	X	X	X	X	X	X		X	X		X
% BP Measured	5.2.7	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
% Hypert. + H.Medic.	5.2.8	X		X	X	X	X			X		X					
% Sulphonyureas	5.2.9.1	X		X		X	X					X			X		
% Biguanides	5.2.9.2	X		X		X	X					X			X		
% Glucos.Inhib.	5.2.9.3	X		X		X	X								X		
% Glitazones	5.2.9.4			X		X	X						X		X		
% Glinides	5.2.9.5			X		X	X								X		
% Insulin	5.2.10	X	X	X	X	X		X	X	X			X			X	X
% Insulin + OADs	5.2.11	X	X	X	X	X		X	X	X			X			X	X
% Insulin Pump	5.2.12	X	X	X	X	X		X								X	
% Antihypertensive	5.2.13	X		X	X	X	X			X		X	X		X		X
% Lipid Lowering	5.2.14	X	X	X	X	X	X					X	X		X		
% Aspirin	5.2.15	X	X	X	X		X					X	X				
% B.G. Self-monitoring	5.2.16	X	X	X	X	X				X			X				X

5. Risk Adjusted Indicators (2)

5.3 Intermediate Outcomes

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
% HbA1c>9	5.3.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
% Hba1c >7.5	5.3.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
% BP<140/90 mmHg	5.3.3	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
% BMI>30	5.3.4					X		X			X						
% Microalbuminuria	5.3.5	X	X	X	X	X		X		X	X	X	X				X
% Smoking	5.3.6	X	X	X	X	X	X	X		X	X	X	X	X	X		X
% Foot Ulcer	5.3.7	X	X	X	X	X	X	X		X			X		X		X

5.4 Terminal Outcomes

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Inc. Dyalisis x100,000	5.4.1			X				X				X	X				X
% ESRF	5.4.2	X	X	X	X	X		X			X		X				X

6. Pediatric Indicators

6.1 Demographics

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Age	6.1.1	X		X	X	X		X	X				X	X	X	X	X

6.2 Diabetes Status

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Type of Diabetes	6.2.1	X		X	X	X		X	X				X	X	X	X	X
Duration of Diabetes	6.2.2	X		X	X	X		X	X				X	X	X	X	X

6.3 Control

	Indicator	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
HbA1c	6.3.1	X		X	X	X		X	X				X	X	X	X	X

Conclusions (1)

- After two rounds the First EUBIROD Diabetes Report has been finalized
- The report includes more details and delivers more readable outputs
- Software is much more stable
- The BIROBox now includes all steps for the global analysis: the report has been produced for the first time using the same interface available to all local users
- Statistical objects can be transmitted using the communication software
- Statistical objects include an origin descriptor adopting a unique BIRO UID
- The entire infrastructure may now be applied to a much wider community

- The report can be now interpreted and directly used by clinical experts
- Now is your turn (after six years of hard technical work)!

Thanks for the attention!