Gobierno de Navarra
Nafarroako Gobernua

BARDENA

Juan Cruz Cigudosa

Navarra Government Minister for the area of University, Innovation and Digital Transformation

Mission

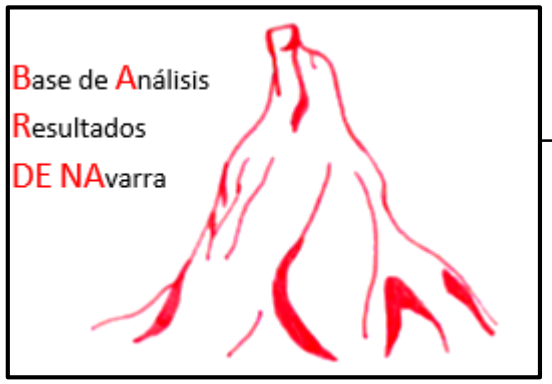
- The **mission** of the Results Analytical Data Base of Navarra (**BARDENA**) is to allow the Evaluation of Health Performance Indicators, providing the Navarra Public Health System (SNS-O) with the autonomy and tools to exploit them.

- The **main objective** is to improve the yield of the work of health professionals by making available curated data that may be use to evaluate their performance, to detecti PDCA cycles and to facilitate work by processes, as well as collaborating in research and innovation.

- For this, the Integrated Database **BARDENA** has been created, a data lake that:
  - ✓ covers a complete and well defined population (homogeneously and universally covered with a single centralized public heath system) and
  - ✓ allows a quality data collection and a series of processes to optimize its use.

Vision & Values

- Maximum requirements of quality of the data
- Compliance with the legislation (GDPR) , with special mention to the protection of the data ensuring their anonymization
- Precision and reproducibility of the data mining
- Coherence and consistency of the information
- Future use of the data for AI



Strenghts BARDENA

- Integrate and unify all data
- Anonymization (GDPR)
- Keep historical records
- Quality Control & Audit
- Performance, speed and power
- Intuitive model for analysis

Metadate Managment

- Single/Unique definition indicators
- Establish accountability for indicators
- Indicator's management and maintenance scheme

Base de Análisis
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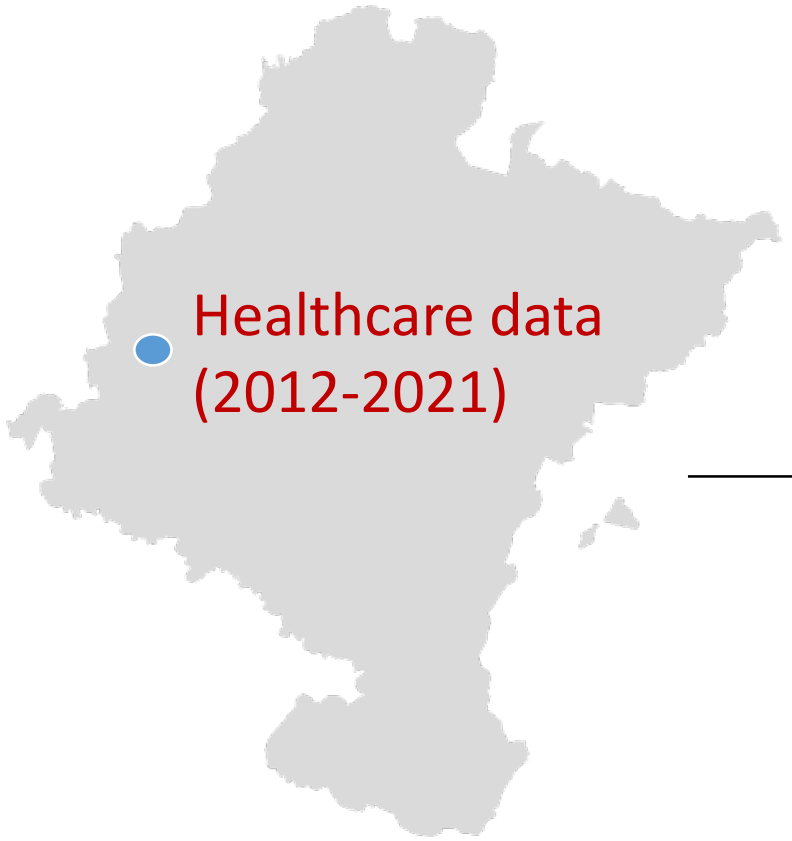
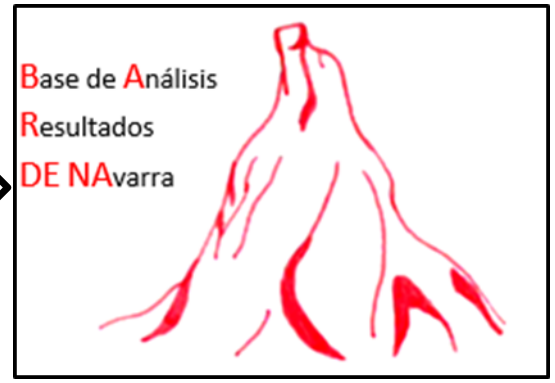
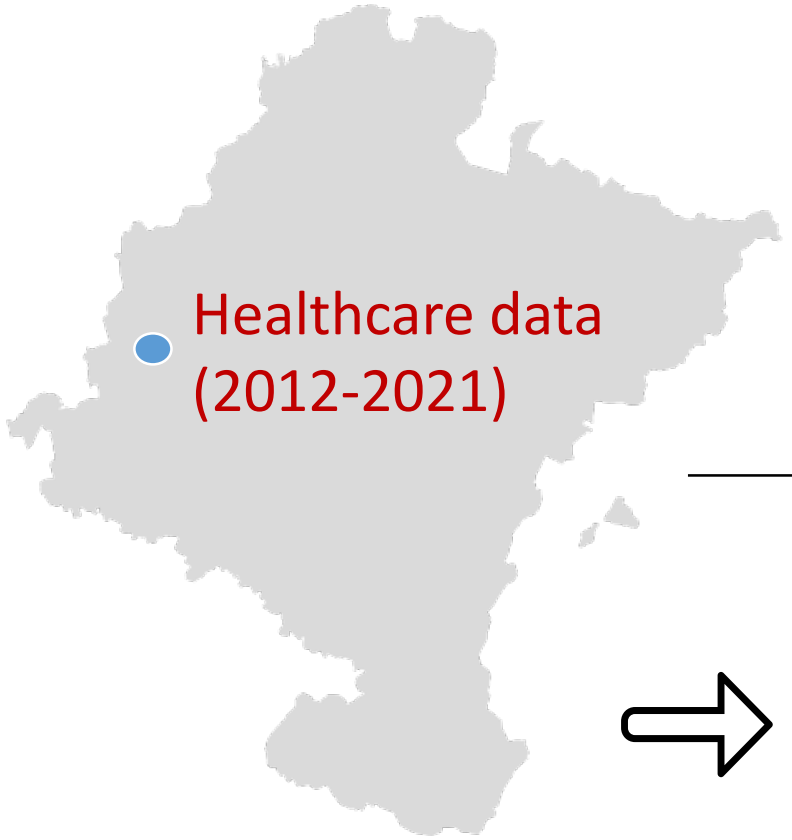
Already incorporated in the DB



- Primary Care
- Hospital Mgment CMBD
- Day Hospital
- Chronic Care
- Emergency
- Surgery
- Mental Health
- Pharma Management
- Coded diagnosis
- Laboral Inhability Lakora-TIS
- Rehab Treatment



On going.....

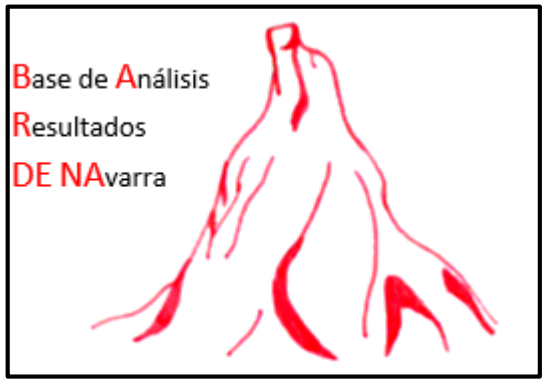


- Clinical Lab data
- Pathology
- Hospital Nursery
- Radiotherapy
- Physiotherapy
- Blood Bank

→ Base de Análisis Resultados DE NAvarra

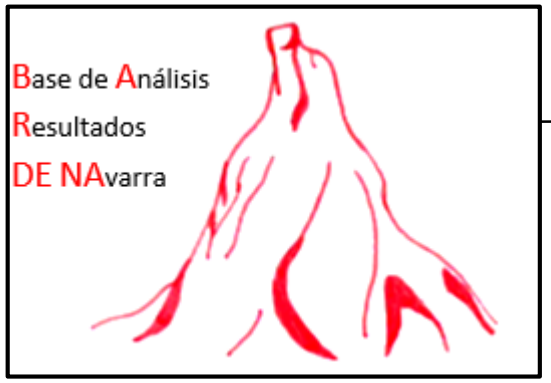
→ **Natural Language Processing**

→ **COVID related data: incidence, clinical records, vaccinaton...**



Some features of the structured DB

1. Descriptive analysis of the information to evaluate actions and detection of problems: wating lists, emergency circuits, drug alerts,…
2. Predictive analysis of trends
3. Generation of data and process mining processes
4. Indicators for:
   - micro management: Direct Clinical professionals (primary care & Hospitals)
   - meso management: Implementation of Strategic Plans
   - macro and strategic management: Definition of the Strategic Actions and Plans
5. Information sources for the different analysts:
   - Simple and easy to handle extracted data for immediate use
   - Snowflake model is also available with the relationships between the different fact and dimension tables that provide advanced analysts with great evaluation power

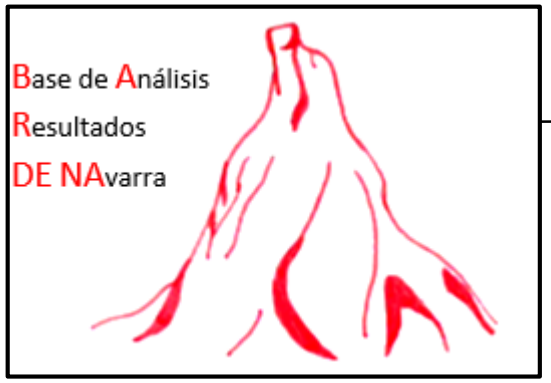


BARDENA, today is a reality for…

Analysis and Research of all healthcare information

Freedom to operate

Coherent information



BARDENA, today is a reality for…

Management by processes. Use cases: Clinical processes

Analyst

→ **Improvement sector identification**

→ **Population segmentation**

→ **Health programs validation**

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Helping clinical processes: Diabetes

PANEL DE CONTROL DIABETES AE

Especialista: M3102870

Fecha de cálculo : 22 de noviembre de 2019

Ordenar por: Nombre
Tipo Diabetes: (Todo)
Complejidad: (Todo)
Ascendente
Descendente

CLASIFICACIÓN | PROCESO | COMPLICACIONES | SEGUIMIENTO

Nombre Completo Paciente	Sex	Edad	Tipo Diabetes	Complejidad Diabetes	Hemoglobina Glicada	LDL-Col	Filtrado Glomerular	Cociente Albumina Creatinina	Tension Arterial	Registro Habito Tabaquico	Categoria Riesgo Pie Diabetico	Clasificacion Retinopatia	Hipoglucemias Frecuencia	Asume Autocuidados	Nº Ingresos 12 meses	Nº Urgencias Especializad..
^lan; -1 -1	Femenino	63	DM2(E11)	Desconocida	5,9	99	83	23	140/70	FUM		1		N		
-1 _balm -1	Masculino	84	DM2(E11)	Desconocida	6,1	88	60	14	129/65	ExF>1A				S		
-1 -1 -1	Masculino	41	DM1(E10)	Desconocida	9	126	60		127/97	FUM				N		
-1 -1 -1	Masculino	47	DM2(E11)	Desconocida	7	78	90	4	115/80	ExF>1A				S		
-1 -1 -1	Masculino	61	DM2(E11)	Moderada	7,2	114	90	27	128/78	ExF>1A	4			N		
-1 -1 -1	Femenino	75	DM2(E11)	Desconocida	6,8	116	79	10	140/70	NF	1	1		S		1
-1 -1 -1	Femenino	72	DM2(E11)	Desconocida	10,3	79	89	4	130/70	NF				S		
-1 -1 -1	Masculino	57	DM1(E10)	Desconocida	6,9	113	90	21	179/80	NF	1			N		
-1 -1 -1	Femenino	77	DM2(E11)	Desconocida	8,4	59	66	8	140/80	NF: Nunc..				N		
-1 -1 -1	Masculino	71	DM2(E11)	Desconocida	6,9	81	78	7	162/88	ExF>1A				N		
-1 -1 -1	Femenino	84	DM2(E11)	Desconocida	6,7	95	65	24	152/73	NF				S		
-1 -1 -1	Femenino	87	DM2(E11)	Desconocida	9	90	72	14	145/82	NF	1			S		2

Nombre Completo Paciente	Fecha Hemoglobina Glicada	Fecha Filtrado Glomerular	Fecha Albumina Creatinina	Fecha Clasificacion Retinopatia	Fecha Categoria Riesgo Pie Diabetico
^lan; -1 -1	2019-04-02	2019-04-02	2017-06-15	2019-04-08	
-1 _balm -1	2019-10-08	2019-10-08	2019-10-08		
	2018-11-27	2018-11-27	2018-11-27		
	2016-01-26	2016-01-26			
	2018-07-23	2019-02-01	2018-07-23		
	2018-03-27	2019-09-06	2018-03-27		2019-10-24

https://desplataformabi.admon-cfnavarra.es/#/site/Salud/views/ECronicosDiabetesPdC/ECronicosDiabetesPdC?Informe=10&Especialista=M3102870&:iid=1

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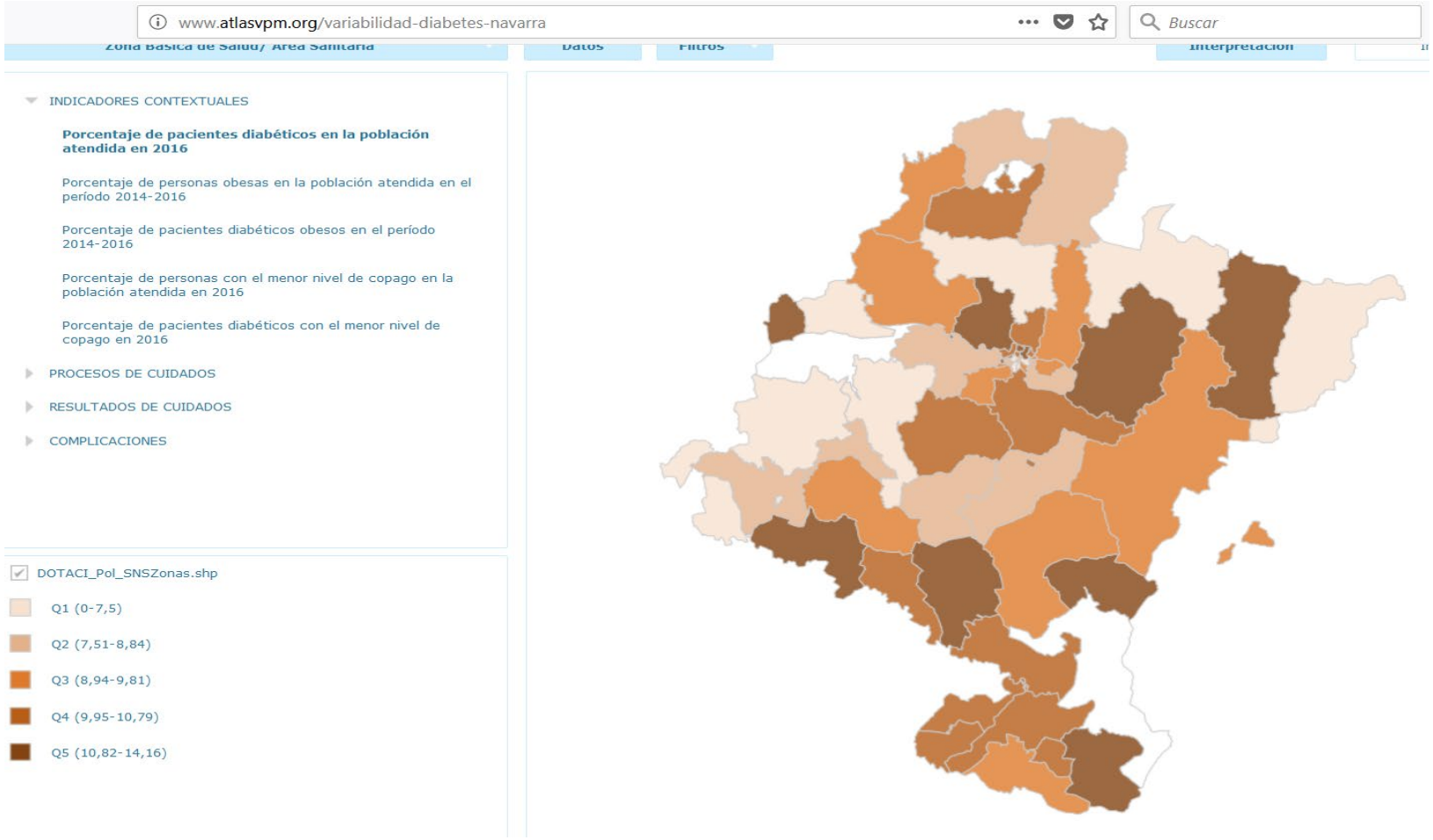
Crossing with geographical data



http://www.atlasvpm.org/variabilidad-diabetes-navarra

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But also with other information sources I

Social Welfare Study of people **receiving help (€) from Social Services** vs **Prevalence** of Type 2 Diabetes

%Diabeticos /población	RIS	RIS	RIS	TotalPoblac No RIS		
	H	M	Total	H	M	Total
5--9	0%	0%	0%	0%	0%	0%
10--17	0%	0%	0%	0%	0%	0%
18-24	0%	0%	0%	0%	0%	0%
25-39	3%	3%	3%	1%	1%	1%
40-54	11%	6%	8%	4%	2%	3%
55-65	6%	4%	5%	6%	3%	4%

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But also with other information sources I

Welfare Study of people receiving **help (€) from Social Services vs Prevalence of Obesity**

%Obesos /población	RIS	RIS	RIS	TotalPoblacExluidRIS		
	H	M	Total	H	M	Total
<5	1%	0%	0%	0%	0%	0%
5--9	0%	1%	0%	0%	0%	0%
10--17	3%	3%	3%	1%	1%	1%
18-24	3%	5%	4%	1%	1%	1%
25-39	7%	10%	8%	2%	2%	2%
40-54	12%	17%	14%	6%	5%	6%
55-65	18%	25%	21%	13%	9%	11%

Clustering – Mental Health

- Study carried out by Dr. Mikel Menta (UPNA)
- BARDENA Anonymized Data Extraction
- Dataset creation
- Testing with different algorithms
- Mental health Segmentation by unservised clustering

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Clustering – Mental Health – unsupervised

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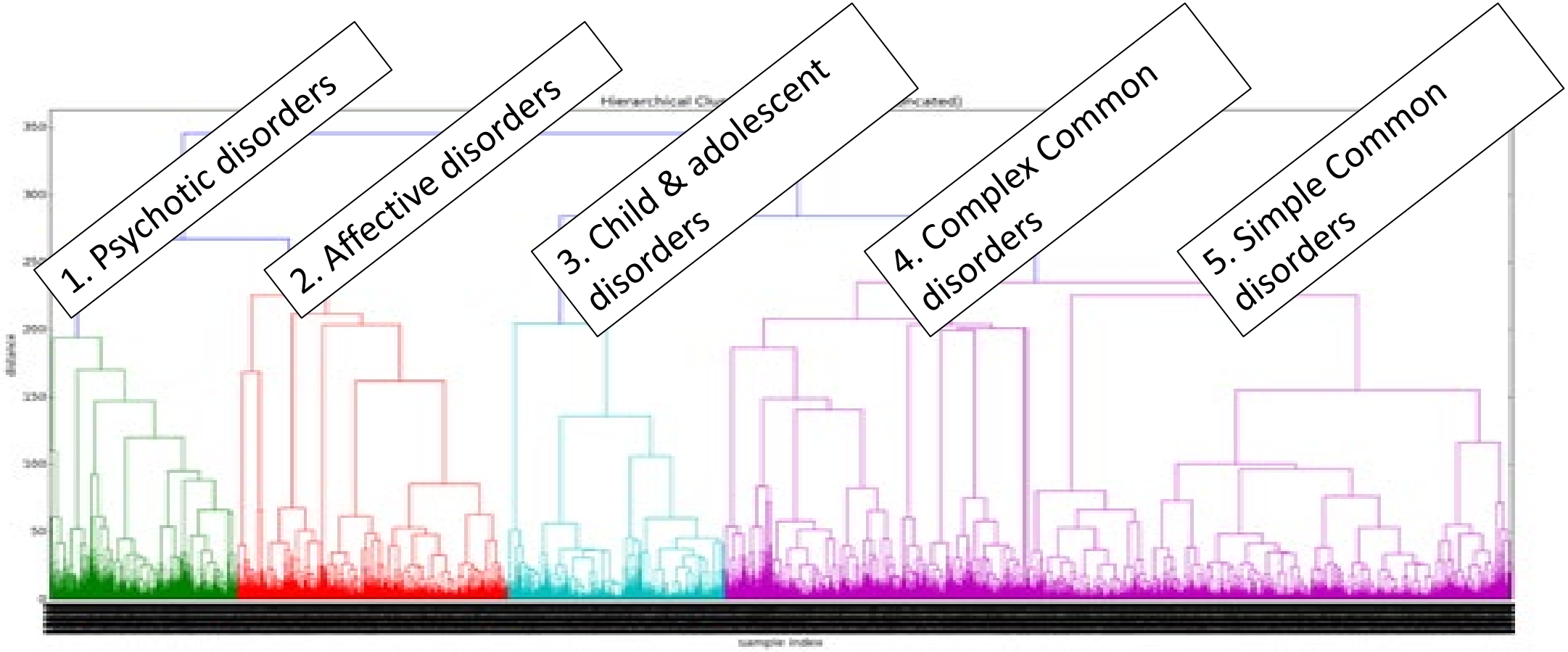
	Centro Clust. 1	std	Centro Clust. 2	std	Centro Clust. 3	std	Centro Clust. 4	std	Centro Clust. 5	std
CONSPSIQUIATRA	5.15	4.07	3.71	2.73	2.96	2.93	3.44	2.85	2.16	2.0
CONSPSICOLOGO	1.02	3.1	1.15	2.96	4.26	6.02	1.92	3.72	1.91	3.13
CONSENFERMERIA	4.43	9.15	0.98	4.31	1.06	2.9	7.74	20.13	0.6	2.33
CONSTRABSOCIAL	1.59	4.36	0.24	1.16	0.21	0.87	0.51	1.64	0.09	0.55
CONSULTASSMFALLIDAS	1.1	2.0	0.6	1.29	0.83	1.58	1.88	3.99	0.51	1.01
CONSULTASNOSM	3.63	5.42	5.96	6.75	2.57	3.97	5.04	6.65	5.95	8.67
NUMESPCONSULTASNOSM	2.64	1.9	3.62	2.32	2.19	1.36	3.08	2.09	3.38	2.36
CONSULTASAP	16.08	15.99	18.69	15.51	10.25	8.44	15.03	14.96	17.3	19.98
NURGENCIAS	0.98	2.8	0.68	1.25	0.57	1.21	0.88	1.64	0.76	1.48
NHOSPIT	0.38	0.93	0.07	0.32	0.01	0.14	0.08	0.34	0.01	0.09
NUMPSICOTROPICOS	3.32	2.36	3.17	2.01	1.0	1.24	2.2	2.15	1.94	1.85
3OMASGRUPOSPSICOT	0.47	0.5	0.35	0.48	0.05	0.23	0.24	0.43	0.13	0.33
FARMG1	0.0	0.02	0.02	0.12	0.0	0.0	0.0	0.0	0.0	0.0
FARMG2	0.16	0.37	0.19	0.39	0.04	0.19	0.22	0.41	0.13	0.34
FARMG3	0.14	0.34	0.0	0.05	0.0	0.04	0.01	0.09	0.0	0.01
FARMG4	0.73	0.45	0.27	0.44	0.1	0.3	0.22	0.41	0.08	0.27
FARMG5	0.1	0.3	0.0	0.03	0.0	0.0	0.0	0.02	0.0	0.0
FARMG6	0.2	0.4	0.19	0.39	0.02	0.14	0.04	0.19	0.0	0.03
FARMG7	0.59	0.49	0.67	0.47	0.12	0.32	0.52	0.5	0.57	0.5
FARMG8	0.44	0.5	0.77	0.42	0.1	0.3	0.47	0.5	0.56	0.5
FARMG9	0.01	0.08	0.0	0.07	0.46	0.5	0.02	0.12	0.0	0.01
FARMG10	0.0	0.0	0.04	0.19	0.0	0.0	0.0	0.0	0.0	0.0
FARMG11	0.01	0.08	0.0	0.03	0.0	0.03	0.08	0.27	0.0	0.03
NUM_NO_PSICATC5	3.81	4.01	5.81	4.81	2.25	2.53	4.04	4.08	4.74	4.54
DIAGG1	0.0	0.03	0.09	0.29	0.0	0.0	0.0	0.0	0.0	0.0
DIAGG2	0.02	0.16	0.0	0.06	0.01	0.11	0.42	0.49	0.0	0.05
DIAGG3	0.81	0.39	0.0	0.06	0.0	0.05	0.02	0.13	0.0	0.02
DIAGG4	0.07	0.25	0.88	0.33	0.03	0.16	0.05	0.21	0.01	0.1
DIAGG5	0.06	0.24	0.02	0.12	0.04	0.19	0.07	0.26	0.73	0.44
DIAGG6	0.01	0.07	0.0	0.03	0.0	0.0	0.09	0.29	0.0	0.01
DIAGG7	0.02	0.13	0.01	0.09	0.0	0.04	0.25	0.43	0.0	0.02
DIAGG8	0.0	0.03	0.0	0.0	0.0	0.0	0.08	0.27	0.0	0.02
DIAGG9	0.0	0.06	0.0	0.0	0.15	0.36	0.0	0.0	0.0	0.0
DIAGG10	0.0	0.06	0.0	0.02	0.74	0.44	0.0	0.03	0.0	0.02
DIAGG11	0.0	0.0	0.0	0.0	0.0	0.0	0.01	0.09	0.0	0.0
DIAGG12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	0.0	0.0
DIAGG13	0.01	0.07	0.0	0.05	0.02	0.15	0.01	0.09	0.26	0.44
NUMDIAGNOSTICOS	1.2	0.47	1.22	0.47	1.34	0.55	1.56	0.67	1.18	0.41
DIAGNOSTICO_GRAVE	0.89	0.31	0.97	0.16	0.1	0.3	0.11	0.31	0.04	0.19
TBIPOLAR	0.01	0.13	0.21	0.41	0.0	0.07	0.01	0.07	0.0	0.01
TESQUIZOFRENIA	0.45	0.5	0.0	0.03	0.0	0.02	0.01	0.1	0.0	0.0
DEPRECURRENTES	0.02	0.13	0.23	0.42	0.0	0.0	0.0	0.07	0.0	0.02
DIAGAGRAVANTE	0.1	0.31	0.05	0.22	0.03	0.17	0.29	0.45	0.0	0.05
EDAD	47.69	15.41	56.82	17.16	15.02	9.79	41.79	15.07	41.74	19.1
SEXO	0.46	0.5	0.66	0.47	0.32	0.46	0.43	0.49	0.63	0.48
NACIDO_EN_EXTRANJERO	0.09	0.29	0.07	0.26	0.08	0.26	0.12	0.33	0.13	0.34
RIS	0.08	0.27	0.05	0.23	0.09	0.28	0.19	0.39	0.09	0.29
TSI	0.15	0.35	0.28	0.45	0.43	0.49	0.19	0.39	0.3	0.46
GMA	6.63	4.52	8.1	5.36	3.21	2.73	6.35	4.49	5.99	4.99
	N=2587 (12.81%)		N=3740 (18.52%)		N=3000 (14.86%)		N=4176 (20.68%)		N=6692 (33.14%)	

Clustering – Mental Health – unsupervised



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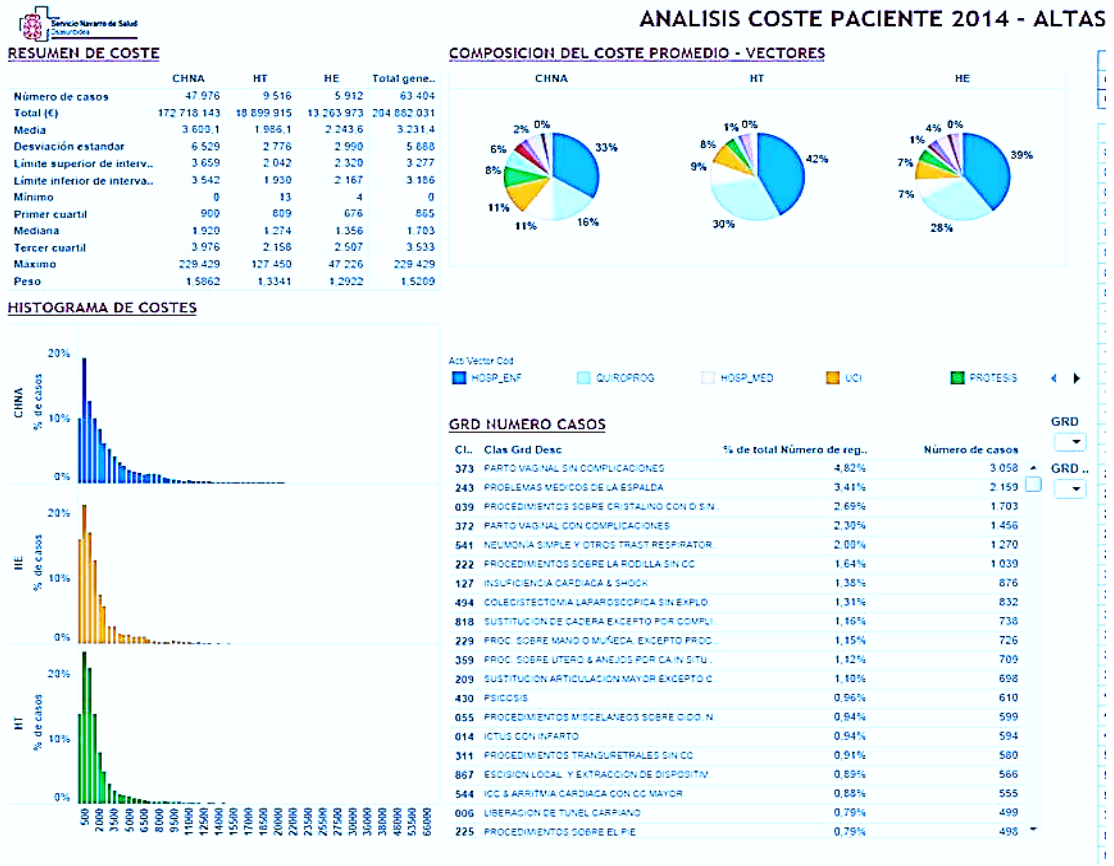
BARDENA, also a tool for **anaytical accounting**

Analyst

- Define costs at patient`s level
- At clinical episode' level



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BARDENA, is today a reality for…

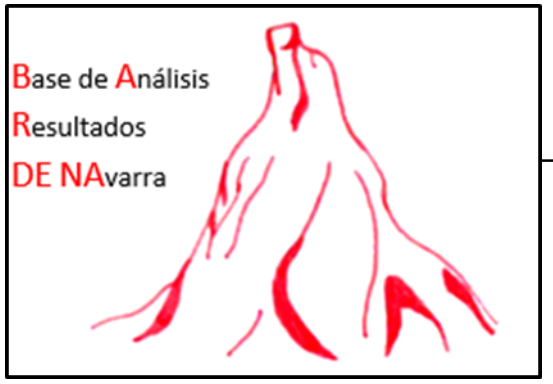
Distribution of clinical and management information

Clinic prof

Manager

Reports (Dashboards) ad-hoc

Indicators with a Single Trustable Source (Metadata)



BARDENA, fron now on…

To improve in …

- Data mining (processes)
- Information distribution (that each manager and each clinician receives what they really need in their day-to-day life)

To do…

- Predictive models (with the support of Artificial Intelligence)

BARDENA Proyect mayor assets

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Leadership & Manegment

- Mission & Vision
- Proper situation analysis
- Realistic aims

Improved use of resources

- Multidisciplinar team
- Robust work pipeline

BARDENA

¡GRACIAS!

Juan Cruz Cigudosa

Navarra Government Minister for the area of University, Innovation and Digital Transformation