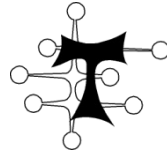


# Technological tools based models for integrated health care.

Carlos Alonso-Villaverde



# Summary

- History.
- Introduction.
- General considerations.
- Our Network.
- Geographical distribution.
- Structure of centers.
- Connecting and sharing of information inter levels.
- Big data creation.
- Exploitation of results.
- Modeling and risk prediction.
  
- Conclusions

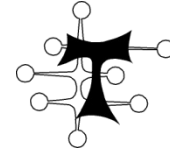
# History

---



XARXA Sanitària i Social  
de SANTA TECLA

# History



- **Year 1151:** The history of the Hospital de Sant Pau and Santa Tecla was born in the old hospital of Santa Tecla (now seat of the Regional Council of Tarragona), the first documents about the existence of this appears in the twelfth century (1151) with a donation of goods to a particular hospital.
- **Year 1464:** On 15 December 1464, nominated by Archbishop Pedro de Urrea, the City and the Cathedral Chapter agreed to the union of the two hospitals, which legally has survived until today.
- **Year 1985:** In July 1985 formally recognized the Public Hospital Network of Catalonia



# Summary

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# Introduction.

- There is the need to manage information efficiently. The loss of translation of information from biomedical research to patient experience; induces the loss of opportunities for human well-being

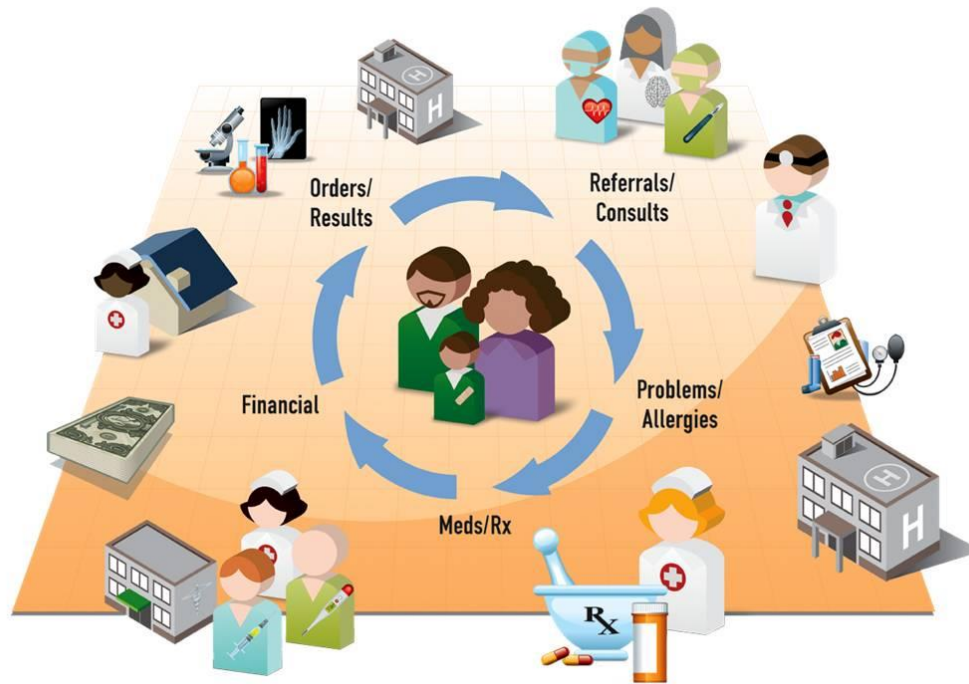


# Introduction.

## Disease versus Patient Focus



# Introduction.

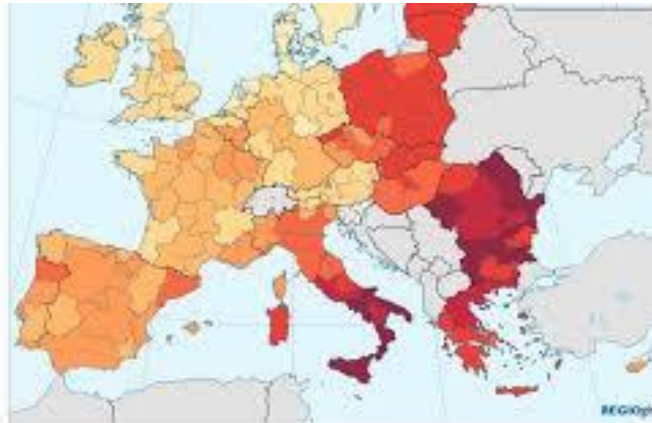




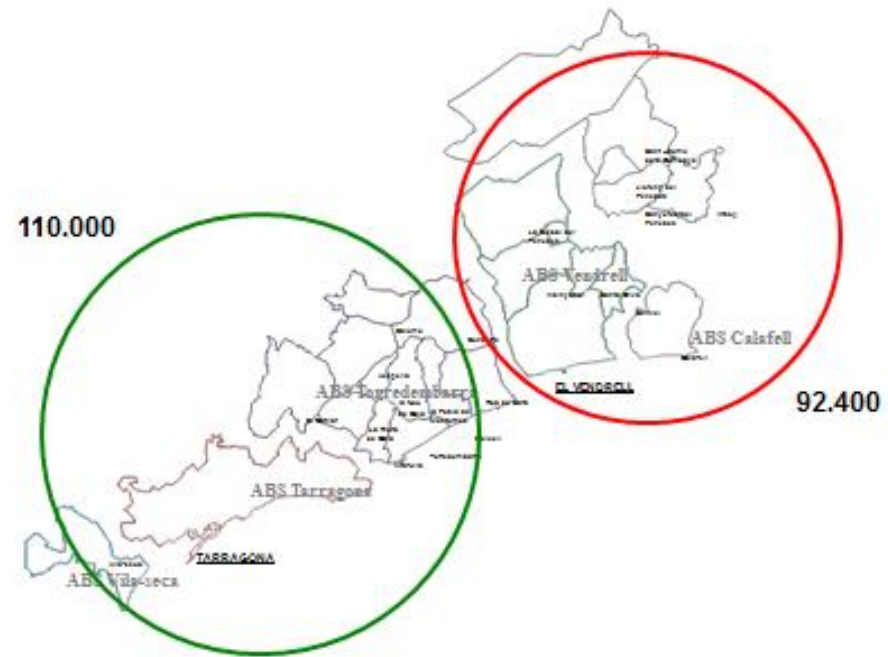
# Summary

- History.
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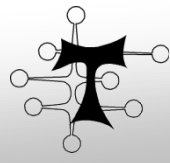
# Geographical distribution.



European Quality of Government Index, 2009  
Standard deviation, range from poor quality (negative) to high quality (positive)



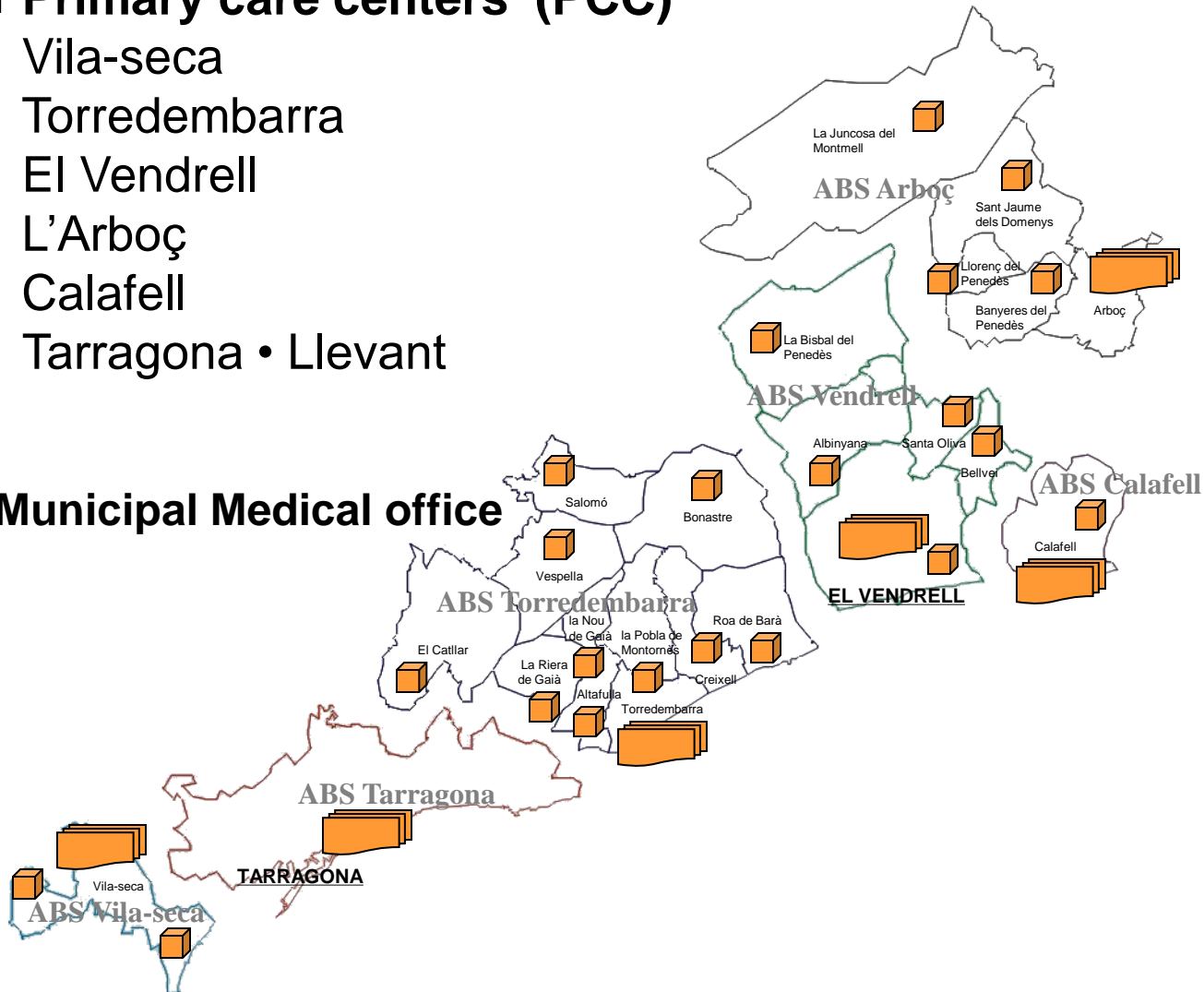
# Primary Care (Our Network)



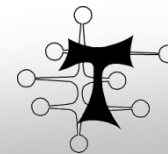
## Primary care centers (PCC)

- Vila-seca
- Torredembarra
- El Vendrell
- L'Arboç
- Calafell
- Tarragona • Llevant

## Municipal Medical office



# Basic Health Units



**ABS Arboç**



**ABS Calafell**



**ABS Arboç**



**ABS Torredembarra**



**ABS Vila-seca**

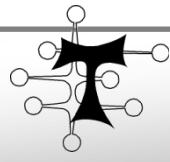


**ABS Vendrell**

## Services

**Family and Community Medicine • Dentistry • Pediatric Nursing • Adult • Nursing • Pediatrics and Reproductive Health Care (ASSIR) • Extractions and blood sampling • Home Care • Customer Service • community health programs**

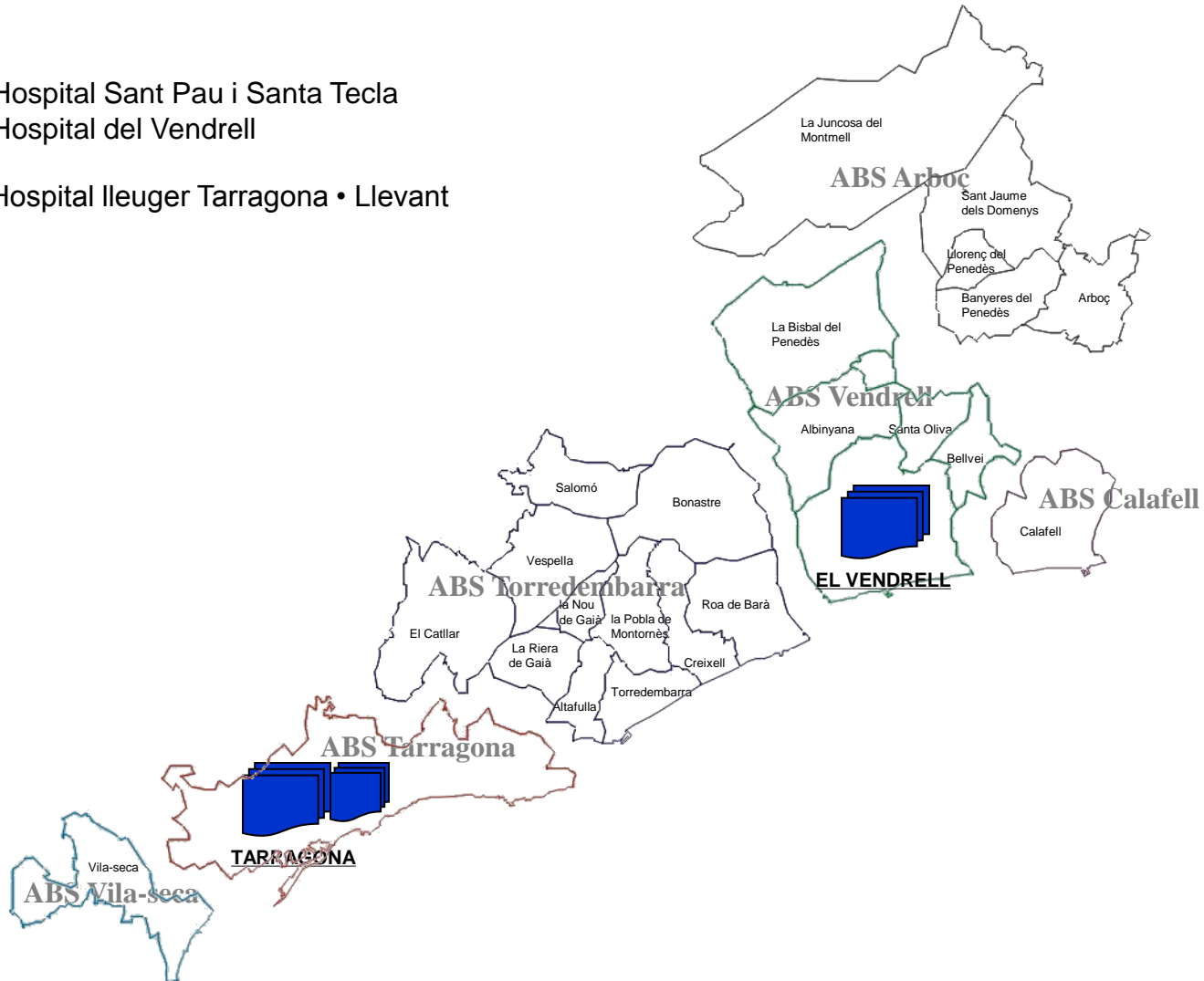
# Hospitals services (Our Network)

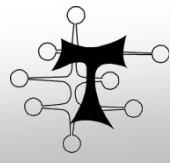


Hospital Sant Pau i Santa Tecla  
Hospital del Vendrell



Hospital lleuger Tarragona • Llevant





Total built area: 20,000 m<sup>2</sup>

## SERVICES

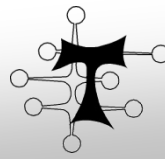
**Medical specialties:** Allergies • Digestive • Cardiology • Dermatology • Endocrinology • Hematology and Internal Medicine Haemotherapy • • Intensive Medicine Nephrology • Neurology • Paediatrics • Pulmonology • Rheumatology

**Surgical specialties:** General Surgery • Orthopaedic • Maxillofacial Surgery • Vascular Surgery • Obstetrics and gynecology • Otorhinolaryngology • Ophthalmology • Urology

**Headquarters:** • Clinical Pathology • Anesthesiology • Diagnostic imaging • Pharmaceuticals • Sports Medicine Rehabilitation • • Emergency Intensive Care Unit



# Hospital Lleuger Santa Tecla • Llevant



Total built area: 17,520 m<sup>2</sup>

## outpatients

**Services:** • Allergies • Surgery • Cardiology • Dermatology • Endocrinology • Neurology • Obstetrics and Gynaecology • Ophthalmology Otolaryngology • Pediatrics • Pulmonology • specialized orthopedics and traumatology

## REHABILITATION

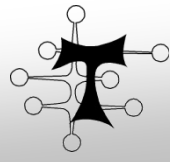
**Services:** Gymnasium • Hydrotherapy • Electrotherapy • Occupational Therapy

## DIAGNOSTIC IMAGING

CT	Densitometry
ECO	simple Radiology
MRI	orthopantographs
mammography	

## Surgical

• Ambulatory Surgery • Endoscopy Day Hospital



Total built area: 15,798 m<sup>2</sup>

## SERVEIS

**Especialitats mèdiques: Aparell digestiu • Cardiologia • Dermatologia • Endocrinologia • Hematologia**

**Medical specialties: Digestive System • Cardiology • Dermatology • Endocrinology • Hematology and Internal Medicine Haemotherapy • Neurology • Pediatrics • Pulmonology • Rheumatology**

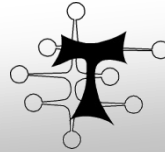
**Surgical specialties: General Surgery • Orthopaedic • Maxillofacial Surgery • Vascular Surgery • Obstetrics and gynecology • Otorhinolaryngology • Ophthalmology • Urology**

**Headquarters: • Clinical Pathology • Anesthesiology • Diagnostic imaging • Pharmaceuticals • Rehabilitation • Sports Medicine • Emergències i Hemoteràpia • Medicina interna • Neurologia • Pediatria • Pneumologia • Reumatologia**





# Social Healthcare services (Our Network)



Centre sociosanitari Santa Tecla • Llevant



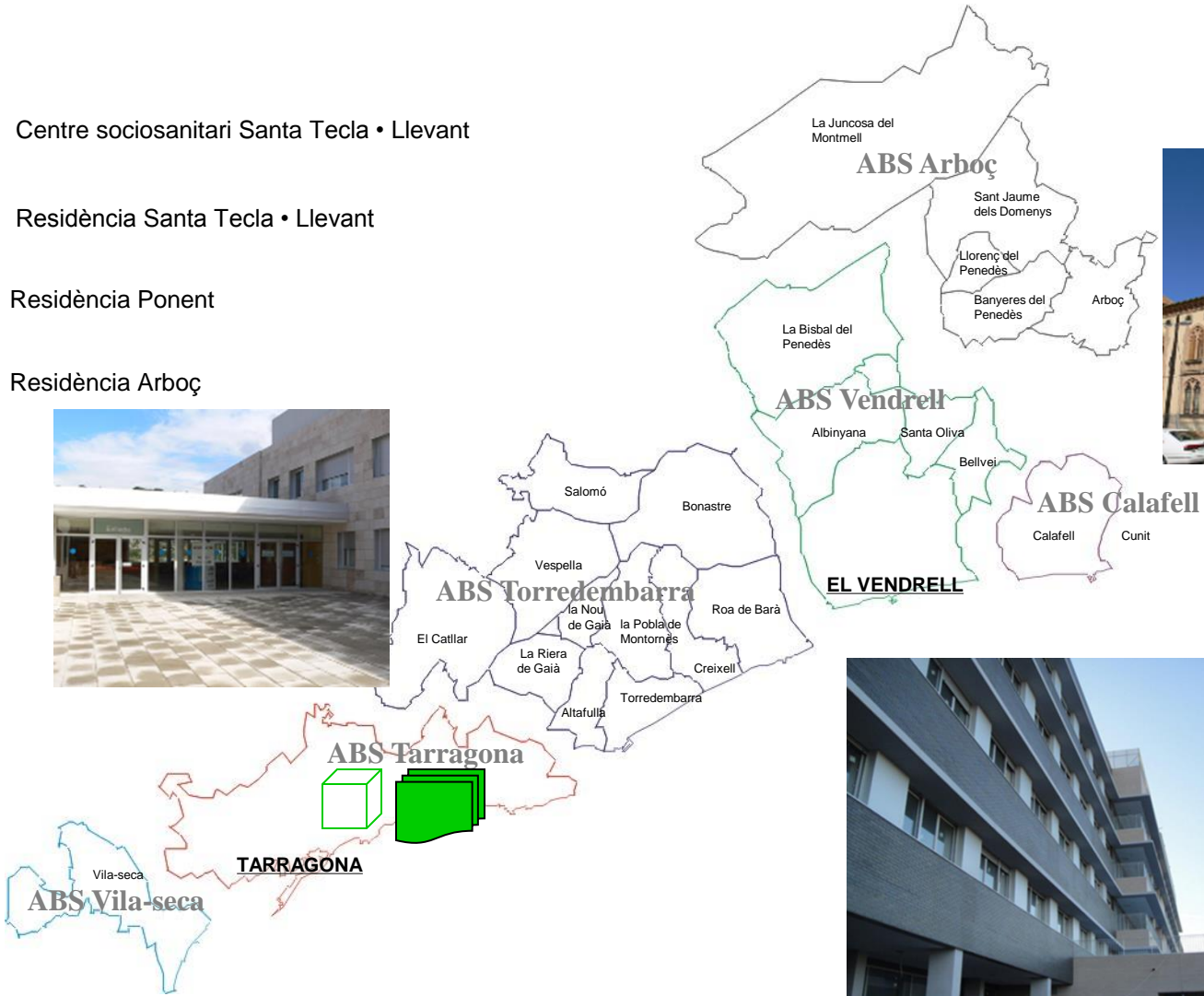
Residència Santa Tecla • Llevant



Residència Ponent



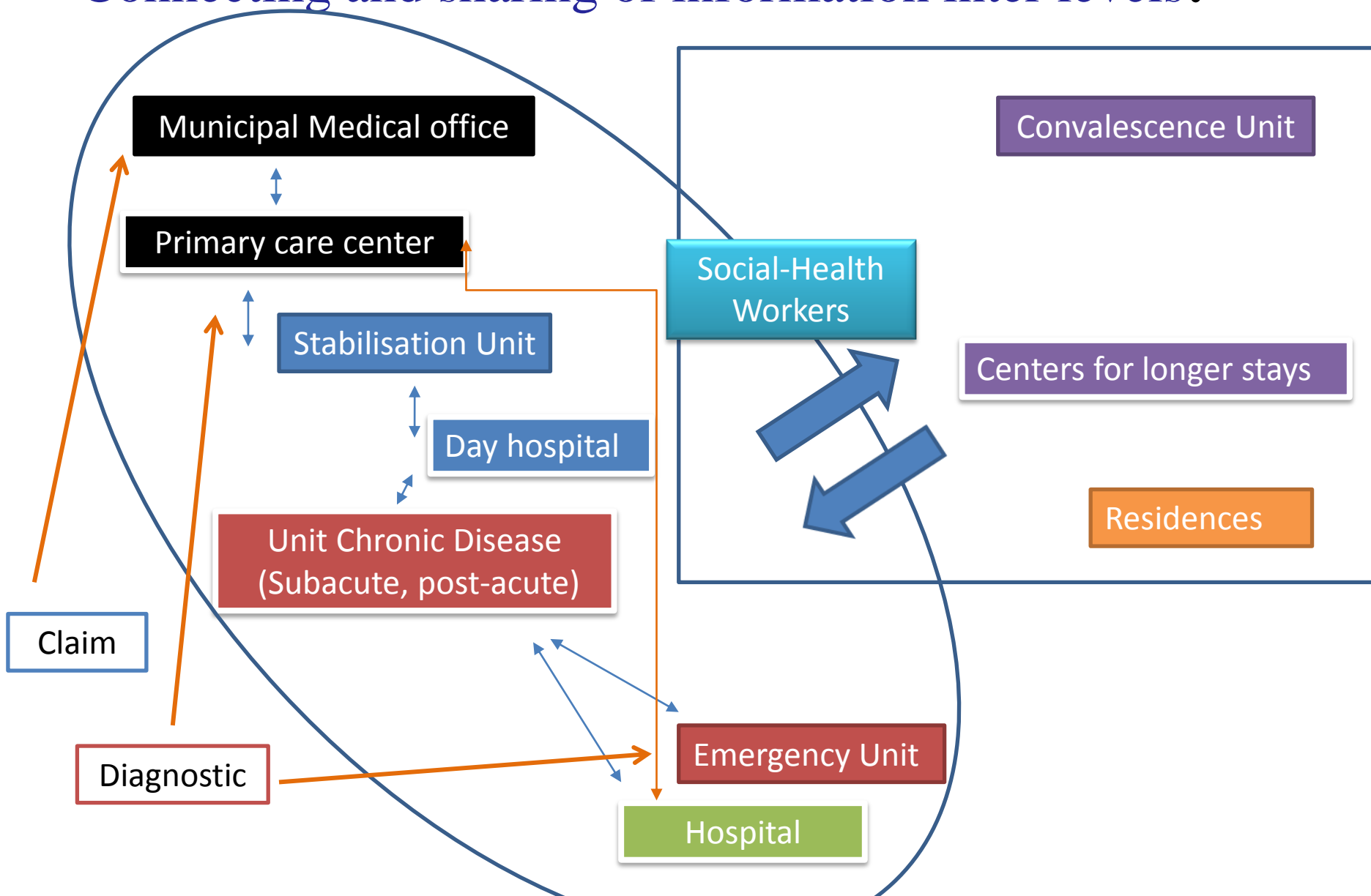
Residència Arboç



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# Connecting and sharing of information inter levels.

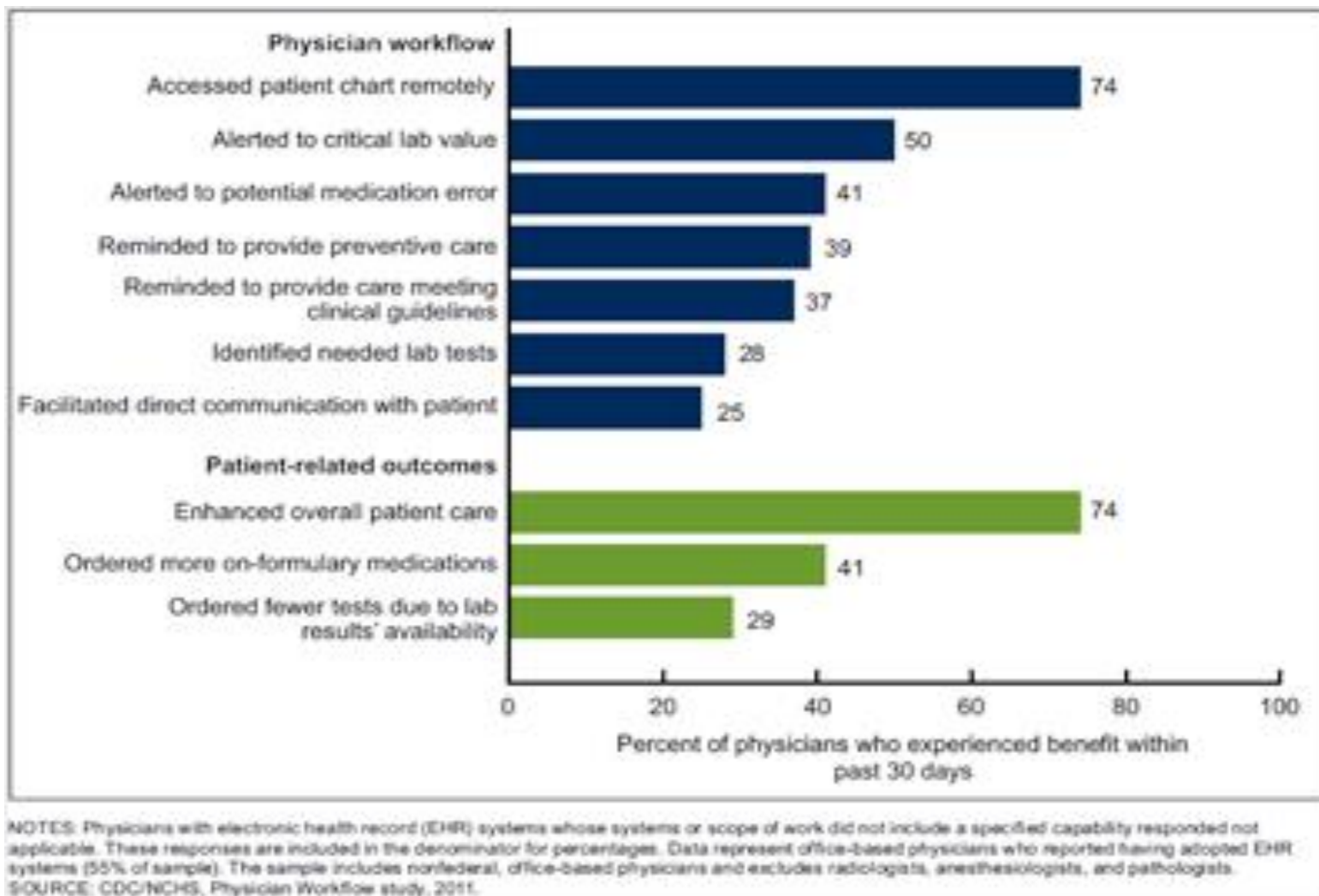


## Connecting and sharing of information inter levels.

- The geographical distribution of population diversity (seasonal, retired ...) and the desire to focus on the patient; led our organization to develop systems in which patient information could be shared between different levels of care.
- It was developed our HealthIT system

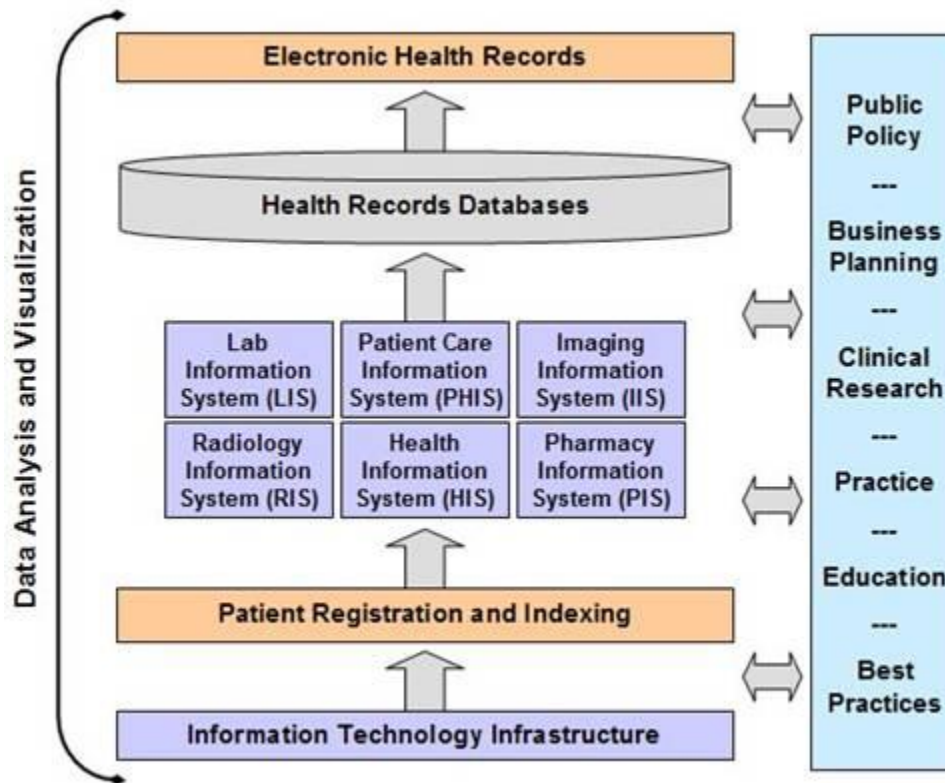


Some studies show the advantages of electronic health records, shared in a system

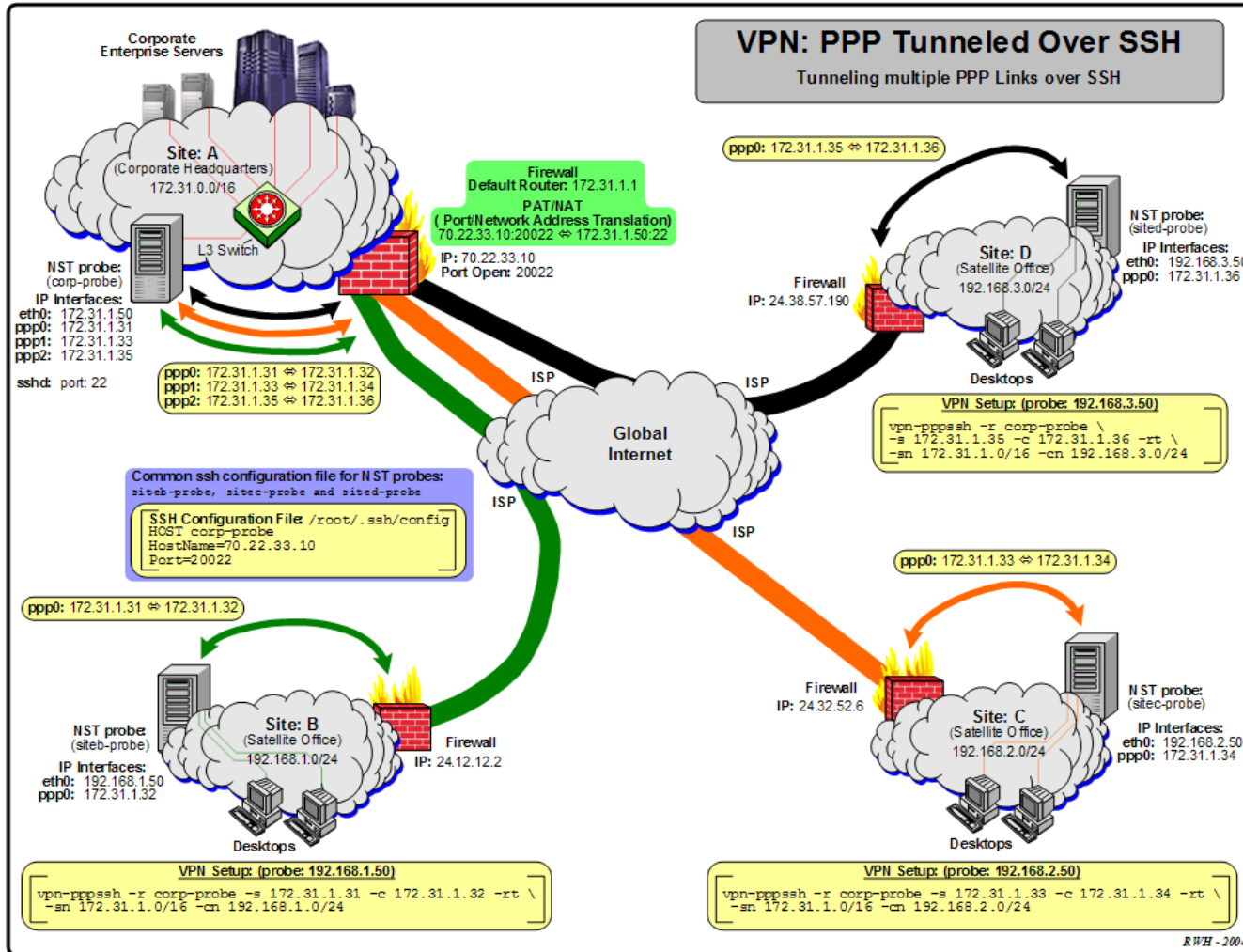


1. Jamoom E, Beatty P, Bercovitz A, et al. (2012) *Physician adoption of electronic health record systems: United States, 2011*. NCHS data brief, no 98. Hyattsville, MD: National Center for Health Statistics.

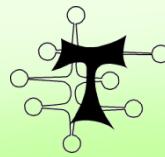
# Connecting and sharing of information inter levels.



# Virtual Private Network



# Shared medical records • home page



The screenshot displays the GoWinWs medical software interface. At the top, there is a navigation bar with icons for 'Sortir', 'Anterior', 'Següent', 'Buscar', 'Cens', 'Història', 'Curs Clínic', 'Dades Exp', 'Agenda', 'Urgències', 'Quiròfan', 'MailBox', and 'InBox'. Below this is a secondary bar with 'Eines', 'Taules Base', 'Palm', 'Canvi d'Usuari', 'Vacunes', 'Tractaments', 'Constants', and 'Llistats'. The main content area is divided into several sections: 'Història' (26366), 'H 69A', 'P Fr Al Va', and 'Ingrés : 01/02/2006'. There are tabs for 'Antecedents Personals', 'Antecedents Familiars', 'Diagnòstics Previs', 'Factors de Risc', 'Al·lèrgies', and 'Historiat'. The 'Antecedents Personals' tab is active, showing a detailed medical history in Spanish. A green callout box labeled 'Specialized' points to this text. The 'Antecedents Familiars' tab is also visible, showing 'Servei: FAM Data: 08/02/2005' and a list of conditions: 'Bebedor de Risc', 'EPOC', 'Hipertensio Arterial', 'Dislipèmia', 'Obesitat', and 'AL,EP,HT,LI,OB,TLD'. A green callout box labeled 'Family doctor' points to this list. Below the history is a 'Tractaments' section with a list of active treatments, including 'TEROMOL RETARD 300 MG 40 COMPR 1 cada 12 hores', 'ZYLORIC 300 MG 30 COMPRIMIDOS 1 cada 24 hores', 'ASTUDAL 5 MG 30 COMPRIMIDOS 1 cada 24 hores', 'ATROVENT 20 MCG/PULS AERO 200 DOS 3 cada 6 hores', 'SEGURIL 40 MG 30 COMPRIMIDOS 3 cada 24 hores', and 'DISIPENSA 250 MG 30 COMPRIMIDOS 1 cada 24 hores'. To the right is an 'Exploracions' section showing a lab result from 21/11/2005. At the bottom, the status bar shows 'GoWin Mw Ver: 4.0.1 Usuari: ADSGEBJOA - Joan M<sup>a</sup> Adsera Gebelli' and 'Àrea: Admissions'. The Windows taskbar at the very bottom shows the 'Inicio' button and several open applications.

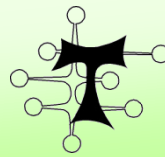
Specialized

Family doctor

Display unique the three levels



# Shared medical records • vaccines



GoWinWs

Sortir Anterior Següent Buscar Cens Història Curs Clínic Dades Exp Agenda Urgències Guiròfan MailBox InBox

Eines Taules Base Palm Carvi d'Usuari Vacunes Tractaments Constants Llistats

Història: 26366 H 69A P Fr Al Va Ingrés : 01/02/2006

### Administració de vacunes

Calendari Nova Administració Guardar Eliminar Imprimir

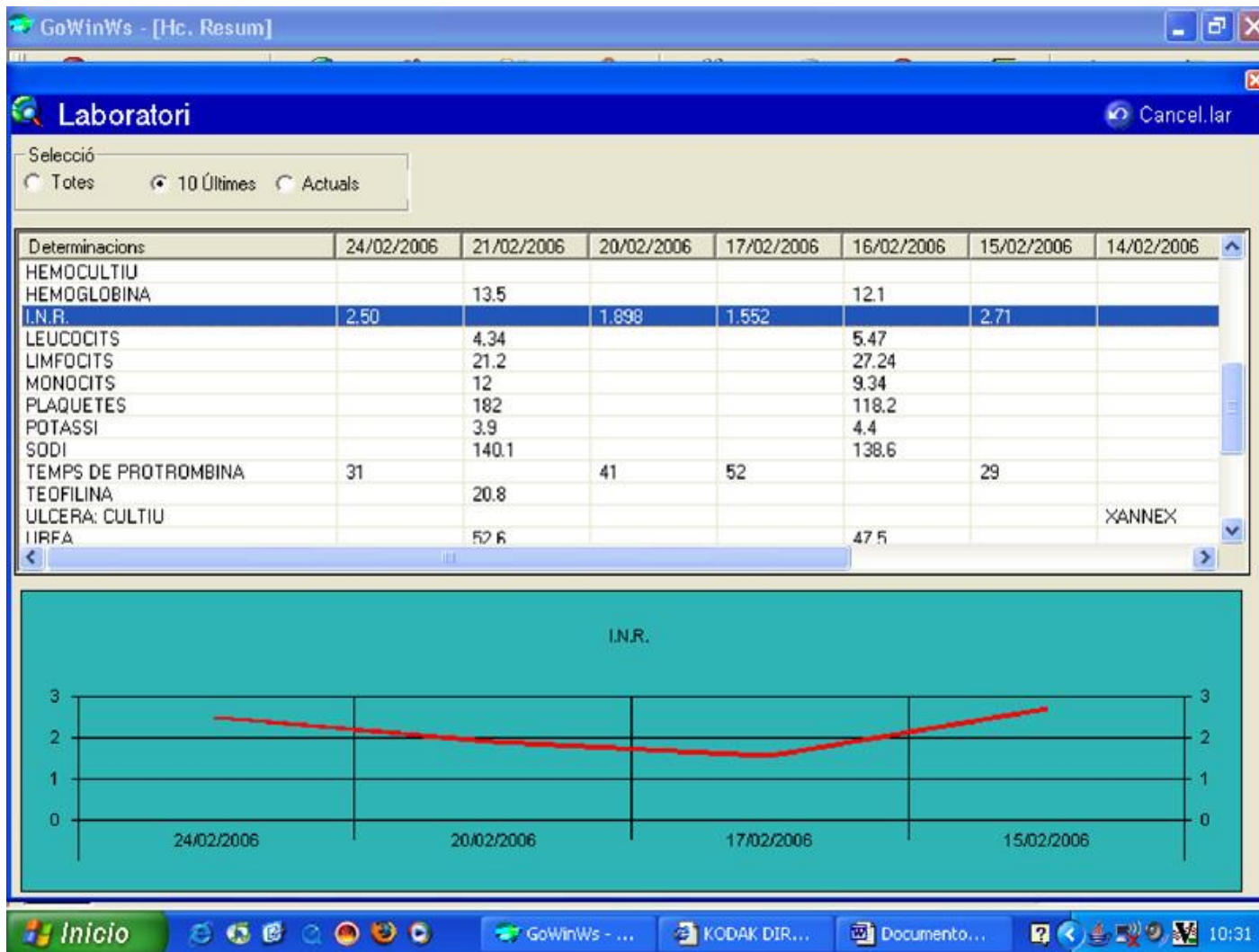
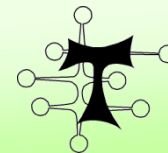
Especial  Ordenar per edat

Vacuna	68A	67A	66A	65A	64A	63A	62A	61A
Triple vírica								
Hepatitis A								
Hepatitis B								
Hepatitis A+B								
Meningitis A+C								
Meningitis C								
Td Primovac...								
Td Record						X		
Grip	X 3000...	X 3000...	X 4901	X	X	X	X	X
Antipneumoc...						X		
Rubeola								
DT								
DTPa+IPV+Hib								
Pcn7 (Preven...								
Varicel·la								
Altres 1								
Altres 2								

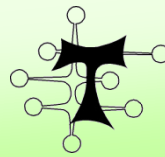
GoWin Mw Ver: 4.0.1 Usuari: ADSGEBJOA - Joan M<sup>a</sup> Adsera Gebelli Àrea: Admissions

Inicio GoWinWs KODAK DIR... Documento... 10:31

# Shared medical records • laboratory



# Shared medical records • treatments



GoWinWs

Sortir Anterior Següent Buscar Cens Història Curs Clínic Dades Exp Agenda Urgències Quiròfan MailBox InBox

Eines Taules Base Palm Carvi d'Usuari Vacunes Tractaments Constants Llistats

Història: 174396 H 83A P Fr Al Va Ingrés : 21/02/2006

Entrada de Tractaments Cancel·lar

Nova Prescripció Imprimir Imprimir Tot Targeta de Medicació Càlcul Receptes per un mes

Actiu Historic Imprimir Entregues

Diagnòstic: PSEUDOOBSTRUCCIÓ DE COLON

Data Inici	Data Fi	Medicament	Dosi	Cada	Dr./Dra.	Centre
04/12/2004		SINEMET PLUS 100/25 MG 100 COMPR	1	24		ABT
04/12/2004		FLUMIL FORTE 600 MG 20 COMPRIMIDOS EFE...	1	24		ABT
04/12/2004		VENTOLIN INHAL 100 MCG/PULS AERO 200 D...	2	6		ABT
05/01/2005		SPIRIVA 18 MCG 30 CAPSULAS + 1 DISPOS HA...	1	24		TRD
05/01/2005		UROTROL NEO 4 MG 28 CAPSULAS	1	24		TRD
02/02/2005		OMEPRAZOL SANDOZ 20 MG 28 CAPSULAS	1	24		TRD
02/02/2005		BOLSAS RECOGIDA ORINA CORYSAN 2 L 30 U	1	24		TRD
17/02/2005		BOLSAS RECOGIDA ORINA PIERNA 500 CC 30 U	1	24		ABT
03/03/2005		SINEMET PLUS RETARD 100/25 100 COMP	1	24		TRD
06/10/2005		GERBIN DIFUCREM 1.5% CREMA 60 G	1	24		TRD
14/10/2005		SEROQUEL 25 MG 6 COMPR RECUB	1	24		TRD
27/10/2005		SERTRALINA BEXAL 50 MG 30 COMPR RECUB	1	24		TRD
27/10/2005		DISTRANEURINE 192 MG 30 CAPSULAS	2	24		TRD

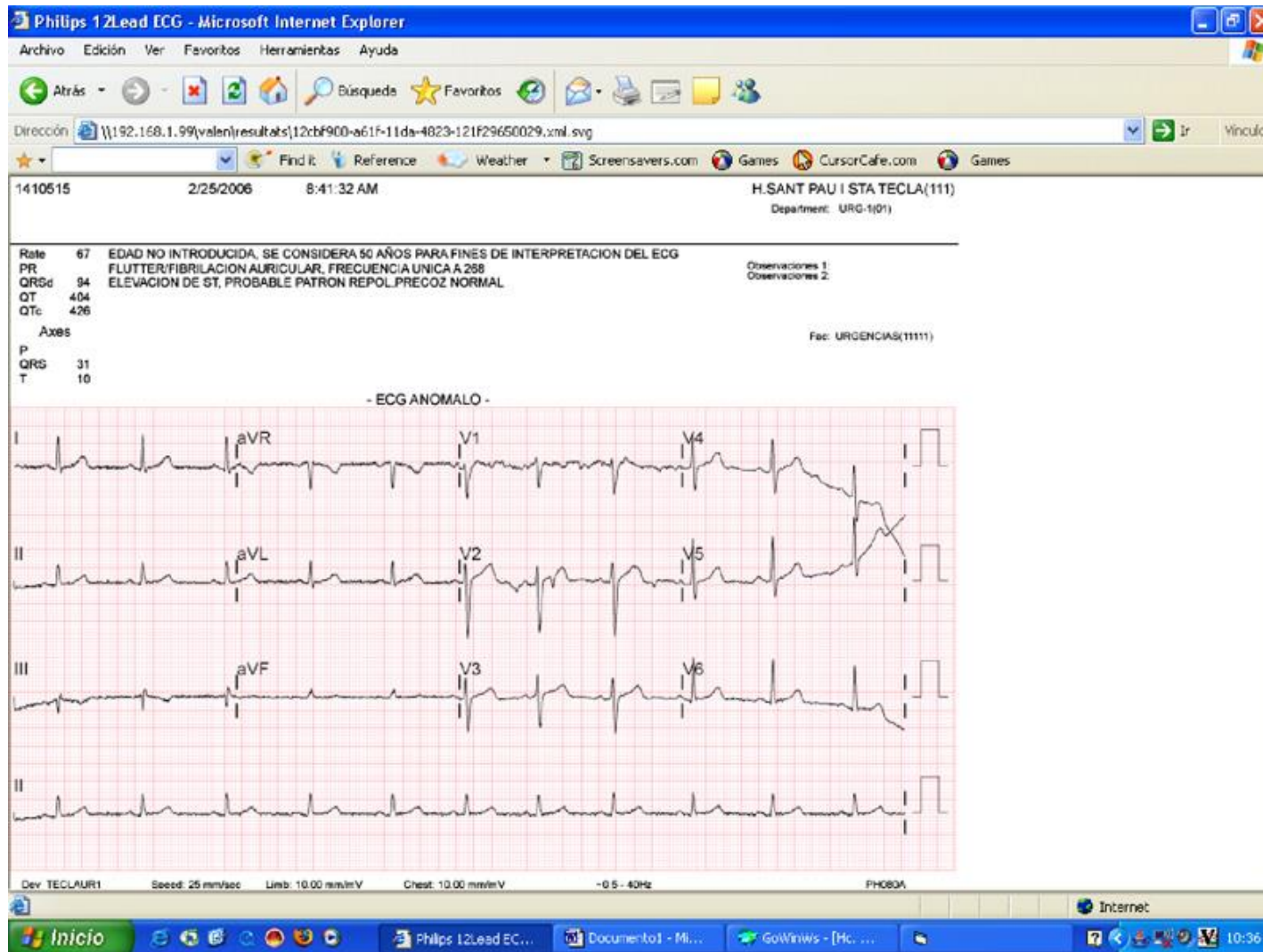
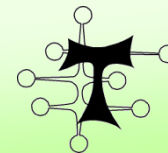
Prescriptor identification

Torredembarra

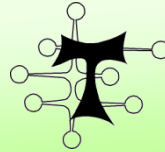
Roda de Barà

Inicio KODAK DIR... Documento... GoWinWs 10:34

# Shared medical records • EKG



# Shared medical records • x-Ray



Lossy: Ratio = 6.87

Sant Pau i Sta Tecla  
KODAK CR850  
25-feb-2006 10:04:56  
Study Desc: ABDOMEN

48Y,M,1410515  
1  
ABDOMEN  
Acc# 26012784JR  
Patient Pos: DE ESPALDAS  
View Pos: AP

20 cm

Rel X Ray Exp: 1310  
File ID: 9104162453

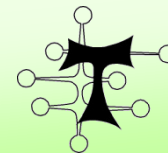
C 2048  
W 4096

File Edit W/L Layout  
G/M Tools Conf My Tab

Select:  Image  
 Group  All

Inicio Documento... GoWinWs - ... http://192... SANCHEZ R... 10:37

# Shared medical records • CT Scan/MRI...



Lossy: Ratio = 4.54  
Sant Pau i Sta Tecla  
87261 GE MEDICAL SYSTEMS LI  
2-1 09-feb-2006 20:03:19  
8,5 mm 120kV, 351mAs  
Acc# 26005031|R SC 500 mm  
Patient Pos: FFS SW 1,25 mm  
Study Desc: TAC Toracico

Lossy: Ratio = 8.52  
Sant Pau i Sta Tecla  
87261 GE MEDICAL SYSTEMS LI  
3-10 09-feb-2006 20:05:30  
-81,5 mm 120kV, 350mAs  
Acc# 26005031|R SC 500 mm  
Patient Pos: FFS SW 1,25 mm  
Study Desc: TAC Toracico

Inicio Documento... GoWinWs - ...

KODAK DIRECTVIEW Web Server Software - Microsoft Internet Explorer

Archivo Edición Ver Favoritos Herramientas Ayuda

GoWinWs

Adobe Reader - [060014983.p

Archivo Edición Ver Documento

**Informed images**

**TÉCNICA:**

Se han realizado secuencias FAT-SAT, GE y SE potenciadas en T1 y T2 y en los tres planos del espacio para estudio de rodilla izquierda.

Nota: exploración artefactada por el movimiento involuntario del paciente, hecho que disminuye la sensibilidad de la técnica.

**HALLAZGOS:**

Se identifican indicios de desgarro en asta posterior del menisco interno, identificando un área de hipersignal que contacta con ambas superficies articulares. De forma asociada se aprecian cambios degenerativos y subluxación medial del cuerpo meniscal.

Cambios de señal en asta anterior del menisco externo en relación a cambios por degeneración mixoide.

En compartimento femorotibial interno se observa pinzamiento del espacio articular a expensas de adelgazamiento del cartilago tanto a nivel tibial como femoral, a lo que se añade alteraciones en la señal del hueso subcondral en forma de edema óseo y pequeñas lesiones óseas subcondrales. Presencia de formaciones osteofíticas marginales. En compartimento

210,3 x 297,0 mm 1 de 1

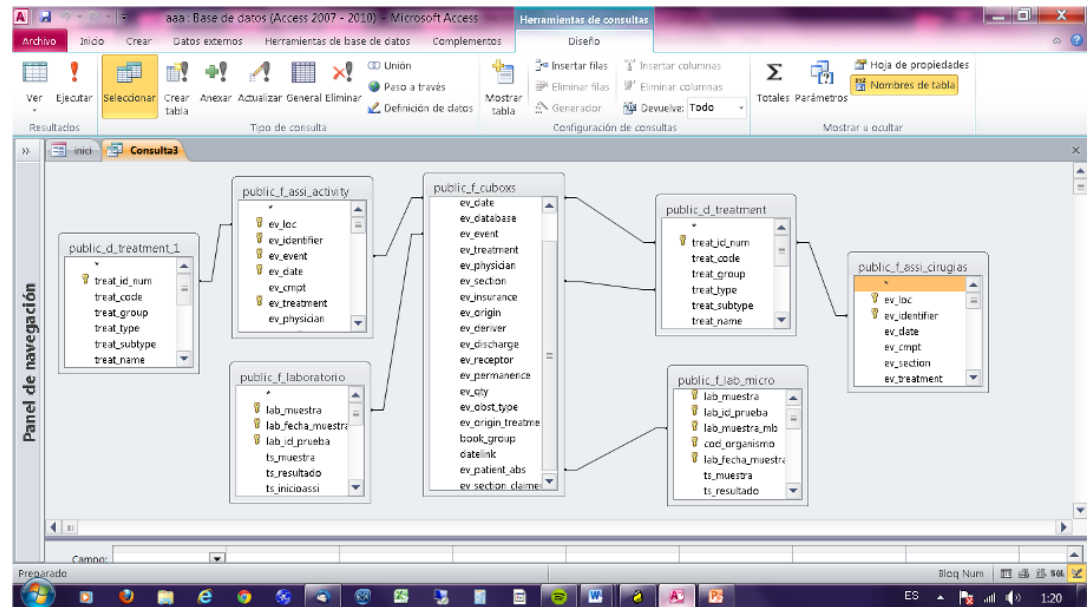
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- **Analysis of results.**
- **Modeling and risk prediction.**
- Conclusions

## Integration of variables:

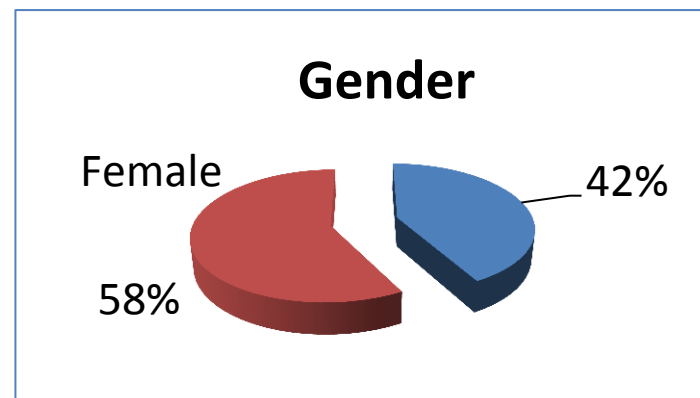
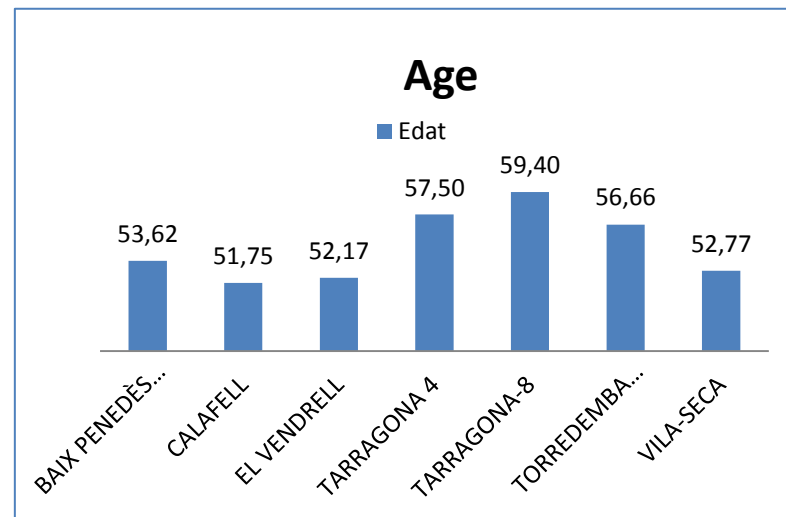
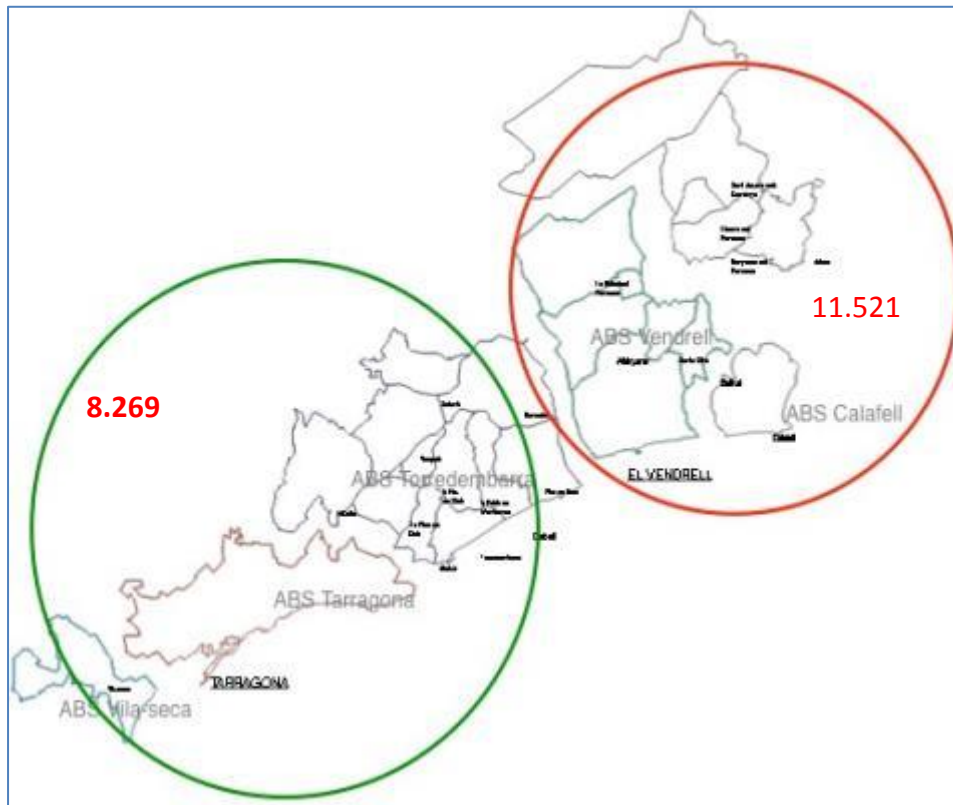
Anthropological  
Clinics.  
Geographic  
Socio-economic.  
Analytical  
Medications

....





# Analysis of results.



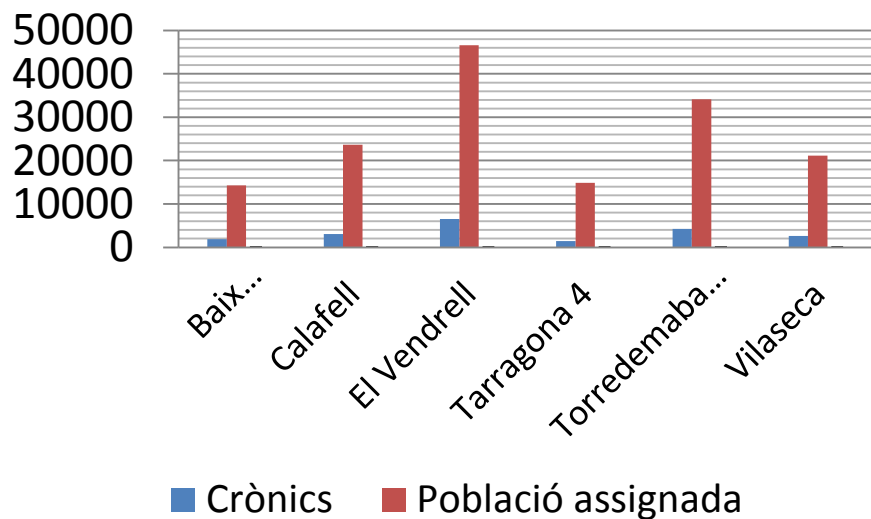
# Analysis of results.

- 25872 Number of persons coded with at least one diagnosis of chronic disease due to any network device at least one time.
- 14,672 Number of people coded with at least one diagnosis code for chronic attended any network device at least one time assigned to a network ABS WITH OVER 50 YEARS OLD.



# Analysis of results.

## Distribució per ABS



ABS	PC/Pobl.Assig
Baix Penedès Interior	13,2%
Calafell	13,07%
El Vendrell	14,00%
Tarragona 4	9,58%
Torredembarra	12,42%
Vilaseca	12,30%

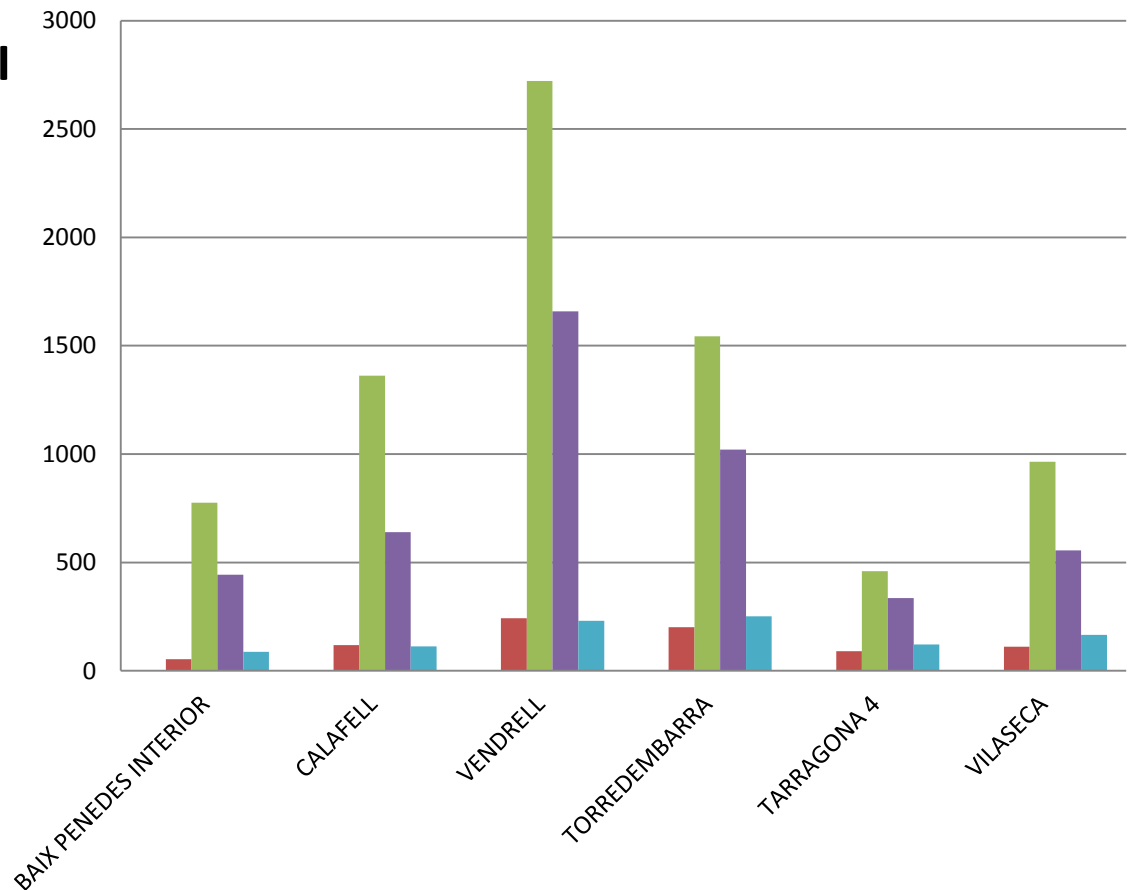


# Analysis of results.

## Diagnostics

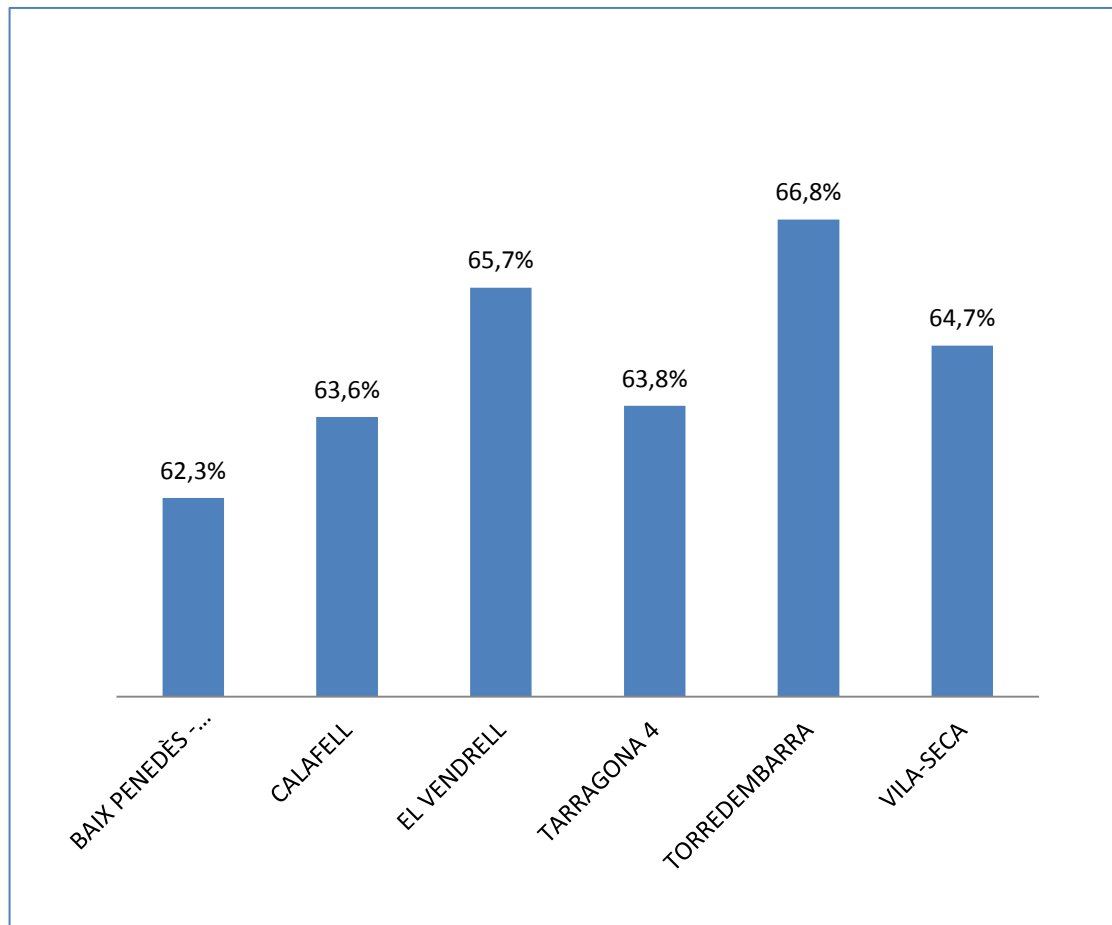
*Group diagnosed by the Department of Health for 2012 CIE.9.MC Code:*

1. Heart failure.
2. COPD.
3. Diabetes Mellitus Type II
4. Pneumonia.
5. Urinary tract infections.



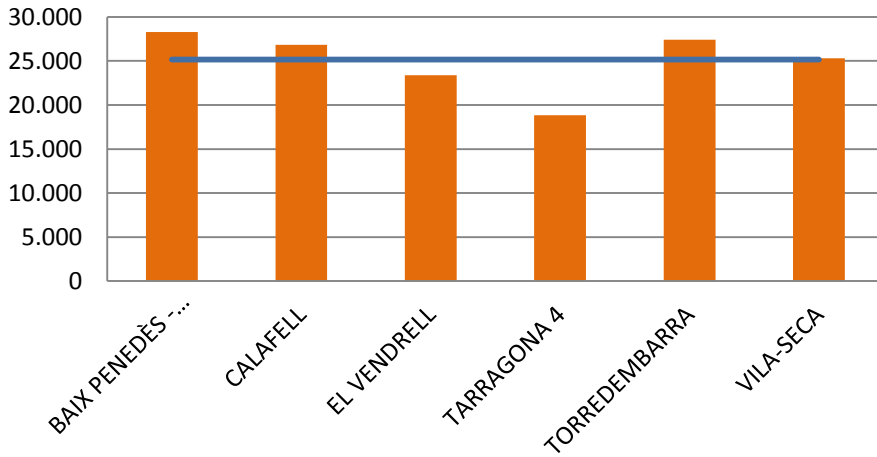
# Analysis of results.

Chronic Patients Taking more of four drugs

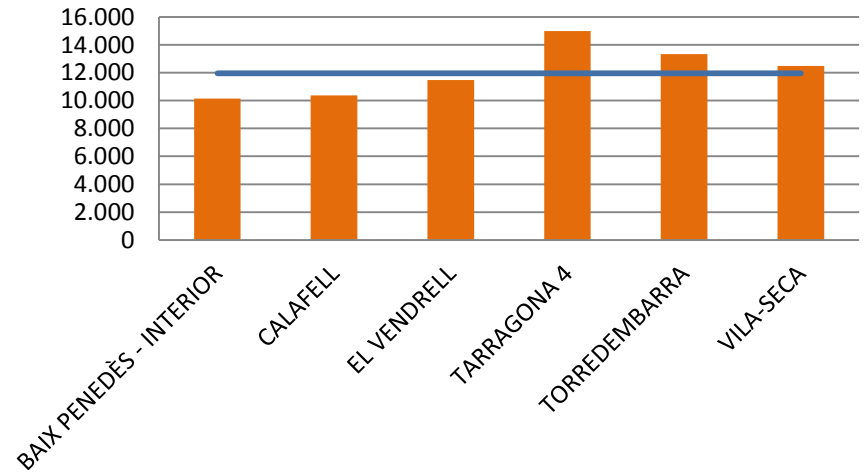


# Analysis of results.

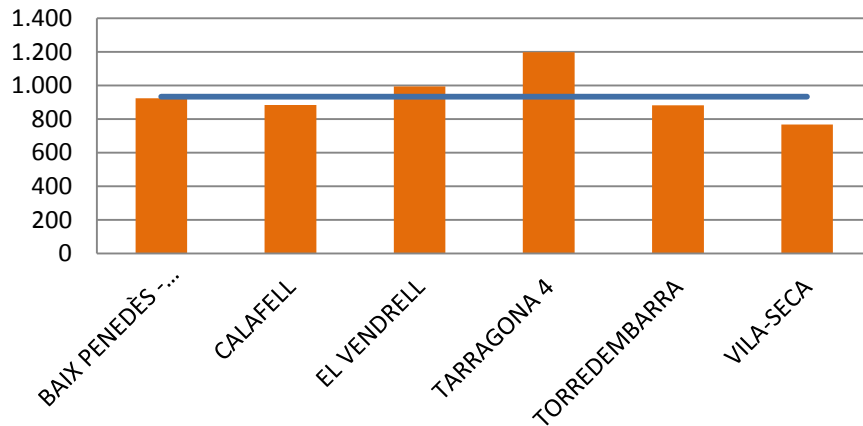
## PRIM



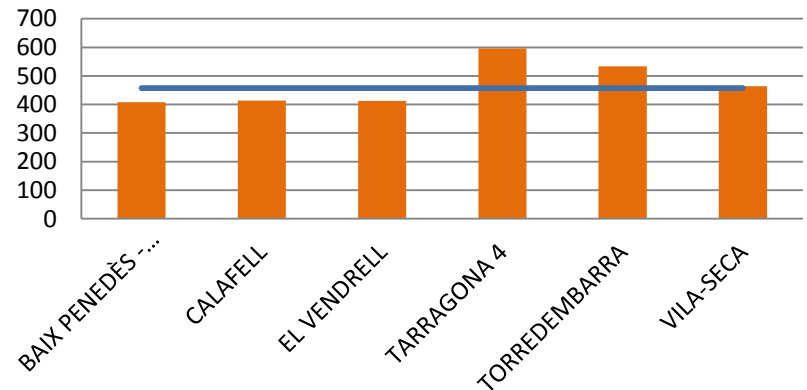
## CONS



## URG



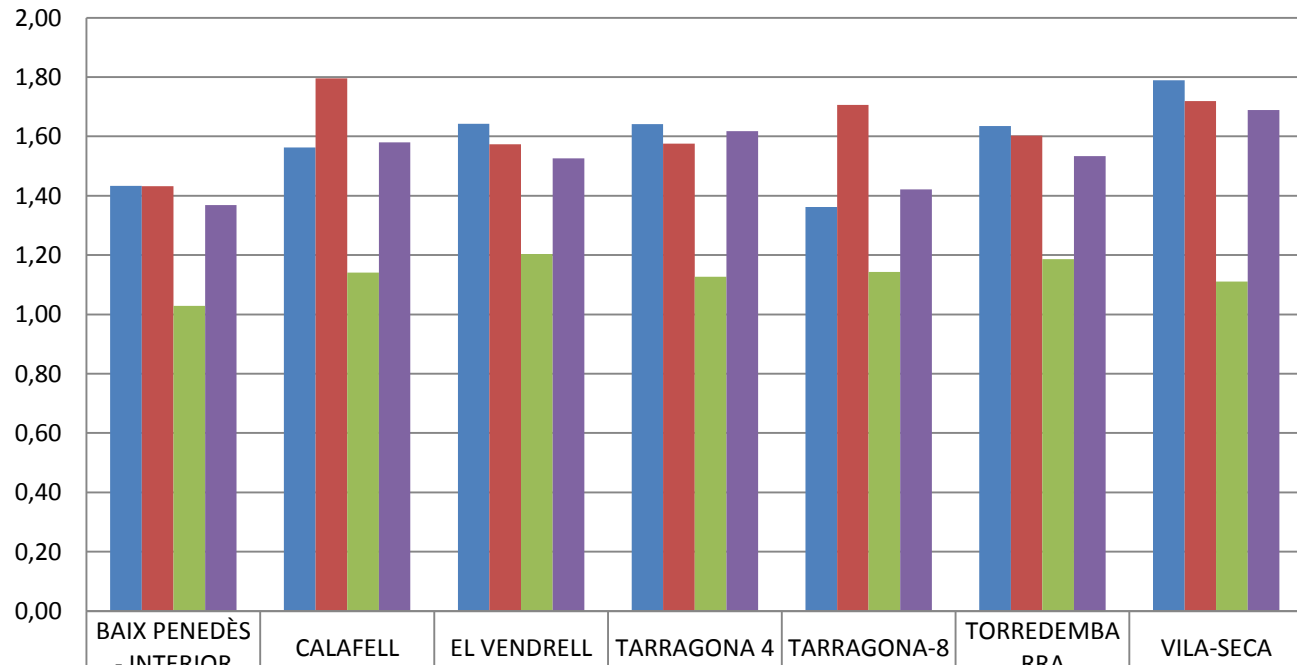
## HOSP



# Analysis of results.

Frequency pathology and basic area

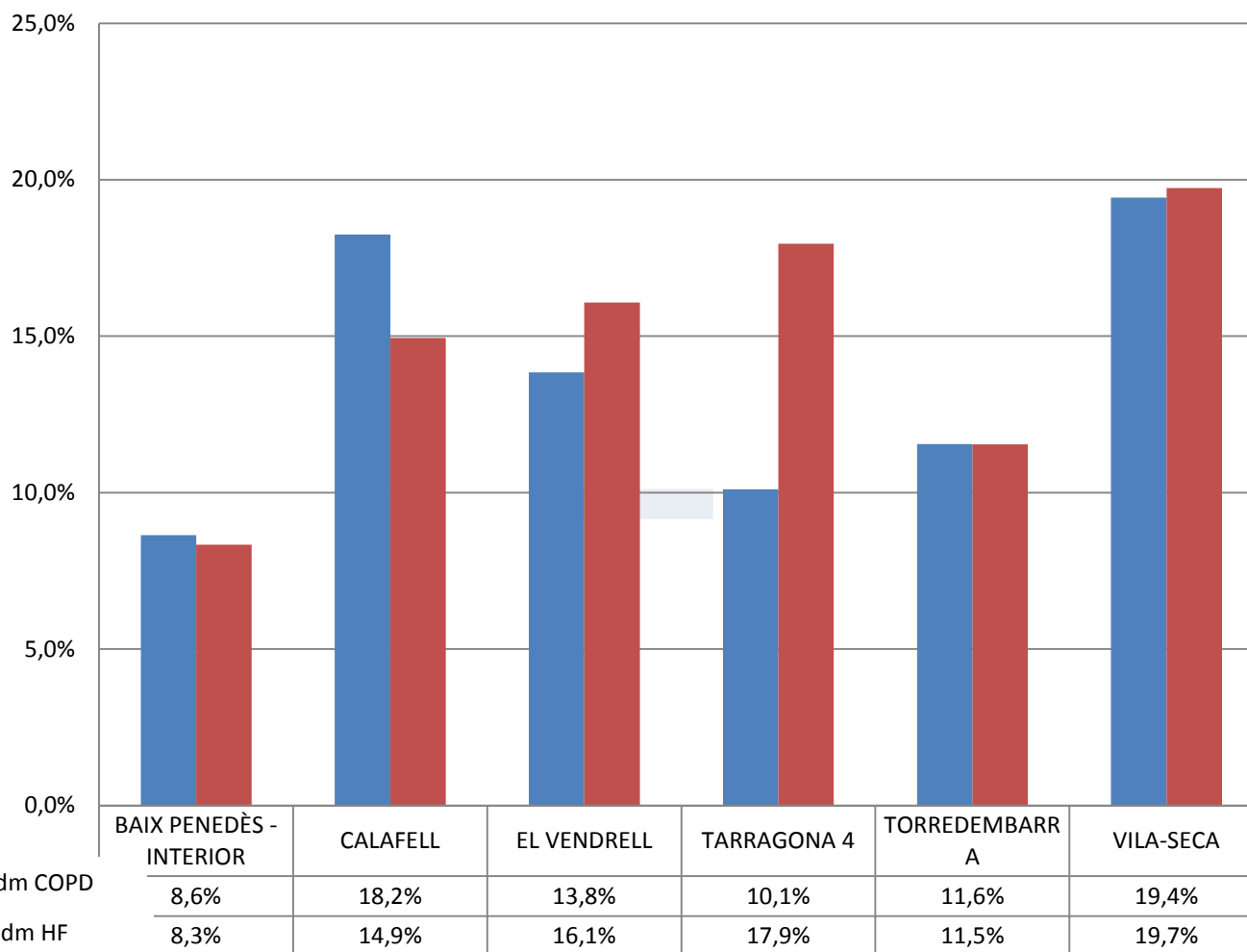
hospital admissions



 Hospitalitzacions ICC	1,43	1,56	1,64	1,64	1,36	1,63	1,79
 Hospitalitzacions MPOC	1,43	1,80	1,57	1,58	1,71	1,60	1,72
 Hospitalitzacions Pneumonia	1,03	1,14	1,20	1,13	1,14	1,19	1,11
 Hospitalitzacions DM	1,37	1,58	1,53	1,62	1,42	1,53	1,69

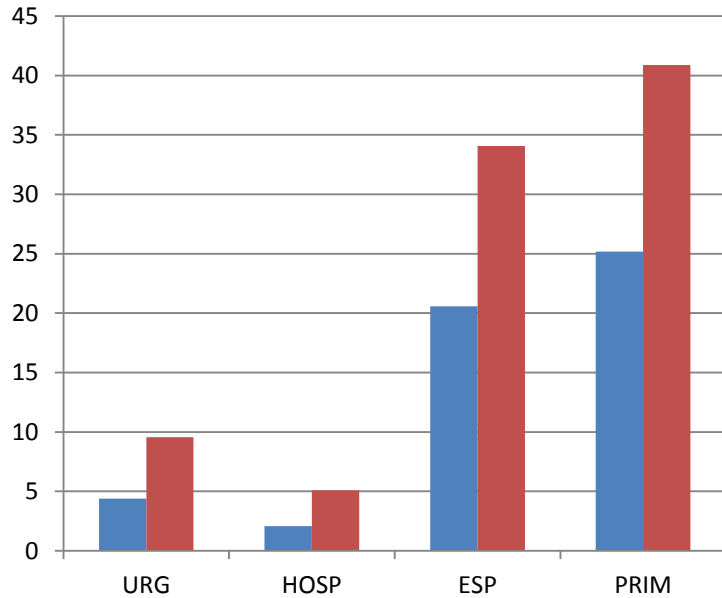


# Analysis of results



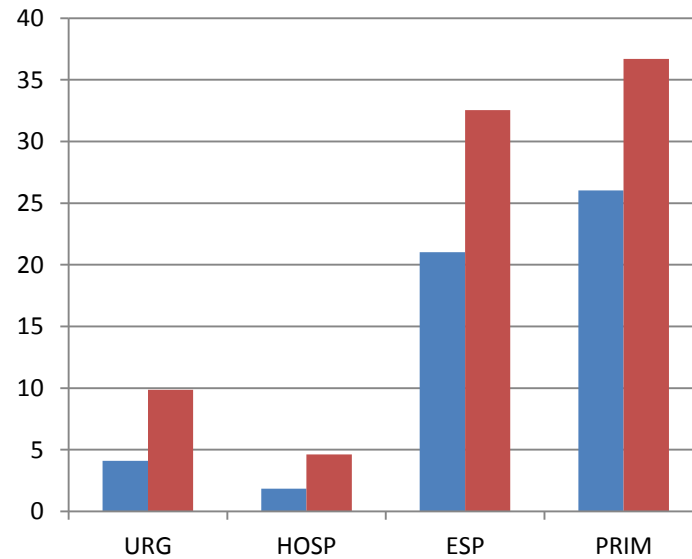


# Analysis of results.



## Heart Failure

■ ICC HOSP < 3  
■ ICC HOSP > 3



## COPD

■ MPOC HOSP < 3  
■ MPOC HOSP > 3



# Analysis of results.

Hospitalary readmission for COPD exacerbation  
Predictive variables.

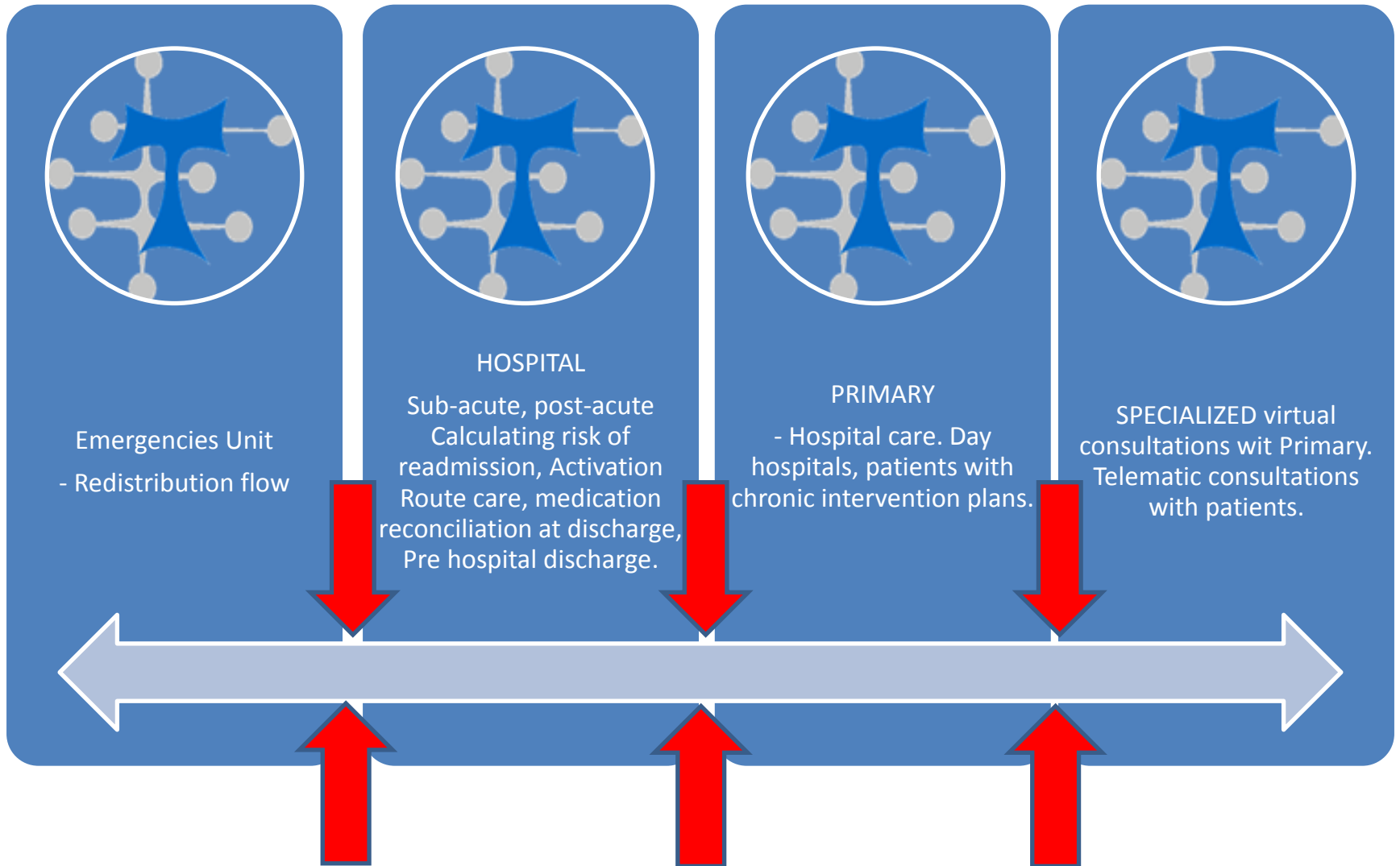
		<b>MPOC HOSP &gt; 3</b>						
		B	E.T.	Wald	gl	Sig.	Exp(B)	
Paso 1(a)	ttoactiv4(1)	-0,901	0,628	2,061	1	0,151	0,406	
	VSG	0,002	0,005	0,129	1	0,719	1,002	
	PCR	-0,006	0,003	3,797	1	0,051	0,994	
	Ferritina	0,001	0	2,295	1	0,13	1,001	
	HbA1	0,041	0,126	0,104	1	0,747	1,042	
	colT	0,009	0,004	5,538	1	0,019	1,009	
	colHDL	0,011	0,008	1,842	1	0,175	1,011	
	<b>Albumina</b>	<b>-1,046</b>	<b>0,268</b>	<b>15,171</b>	<b>1</b>	<b>&lt;0,0001</b>	<b>0,351</b>	
	PRIMARIAfreglobal	0,004	0,005	0,705	1	0,401	1,004	
	CONSESPfreglobal	0,011	0,006	3,822	1	0,051	1,011	
	edad	0,004	0,017	0,064	1	0,8	1,004	
	<b>Sexo(1)</b>	<b>1,586</b>	<b>0,432</b>	<b>13,479</b>	<b>1</b>	<b>&lt;0,0001</b>	<b>4,885</b>	
	creat	0,215	0,179	1,444	1	0,229	1,24	
	DMtotal	0,021	0,052	0,159	1	0,69	1,021	
	Constante	-2,741	1,954	1,968	1	0,161	0,065	



# Summary

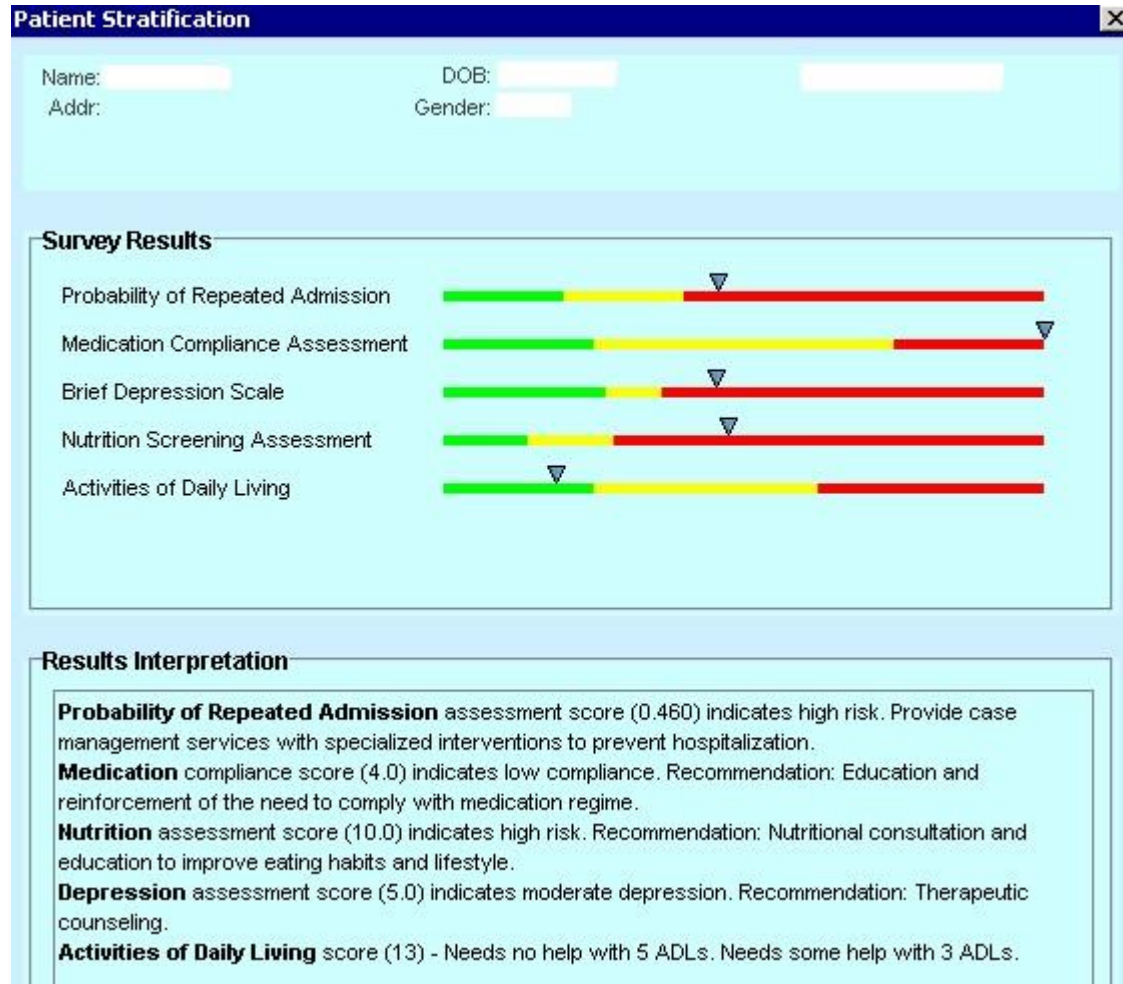
- History.
- Introduction.
- General considerations.
- Our Network.
- Geographical distribution.
- Structure of centers.
- Connecting and sharing of information inter levels.
- Big data creation.
- Exploitation of results.
- Modeling and risk prediction.
  
- **Conclusions**

# Conclusions

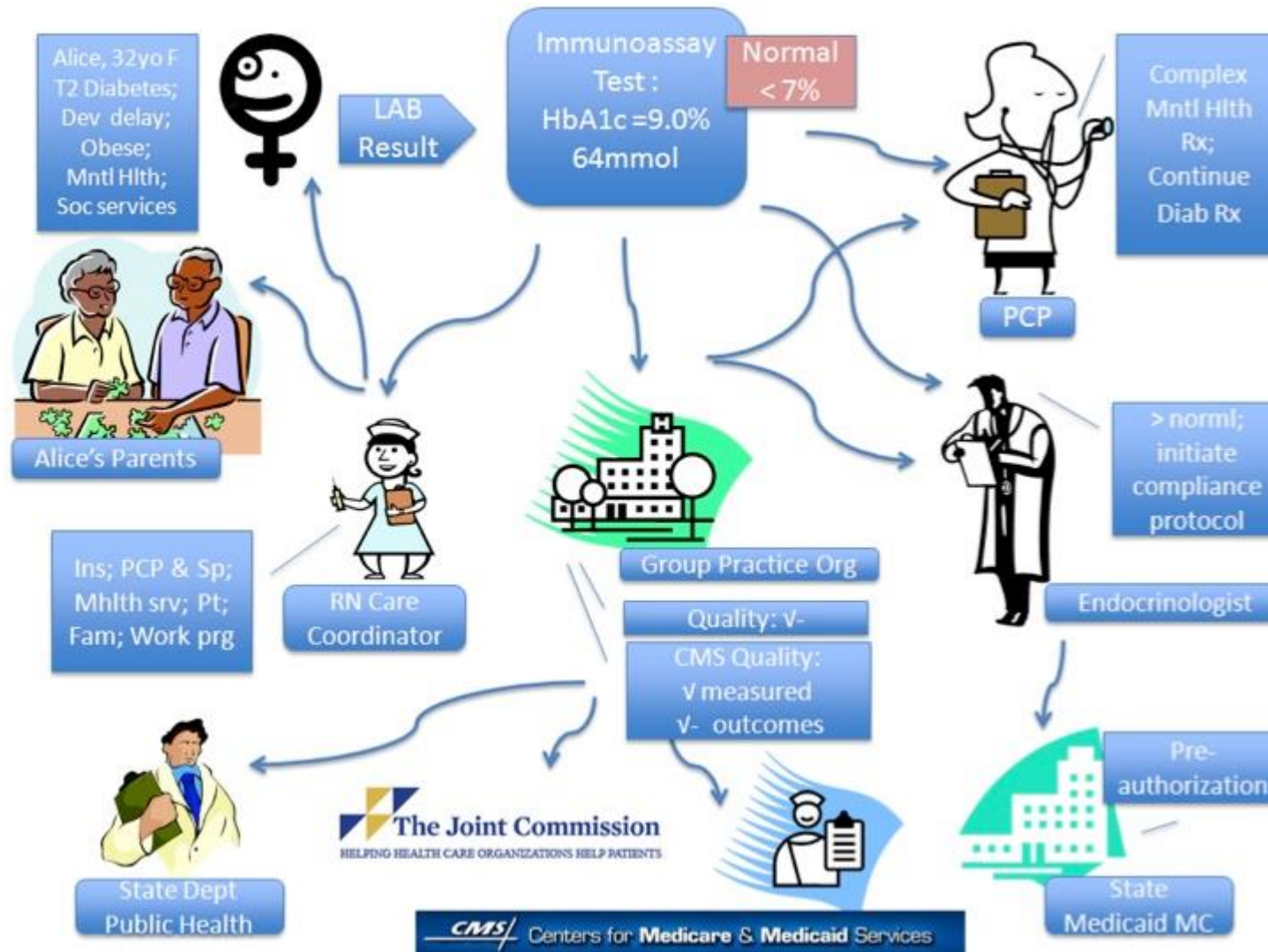


# Conclusions

- <http://aspe.hhs.gov/daltcp/reports/2013/HIEengage.shtml>



# Conclusions

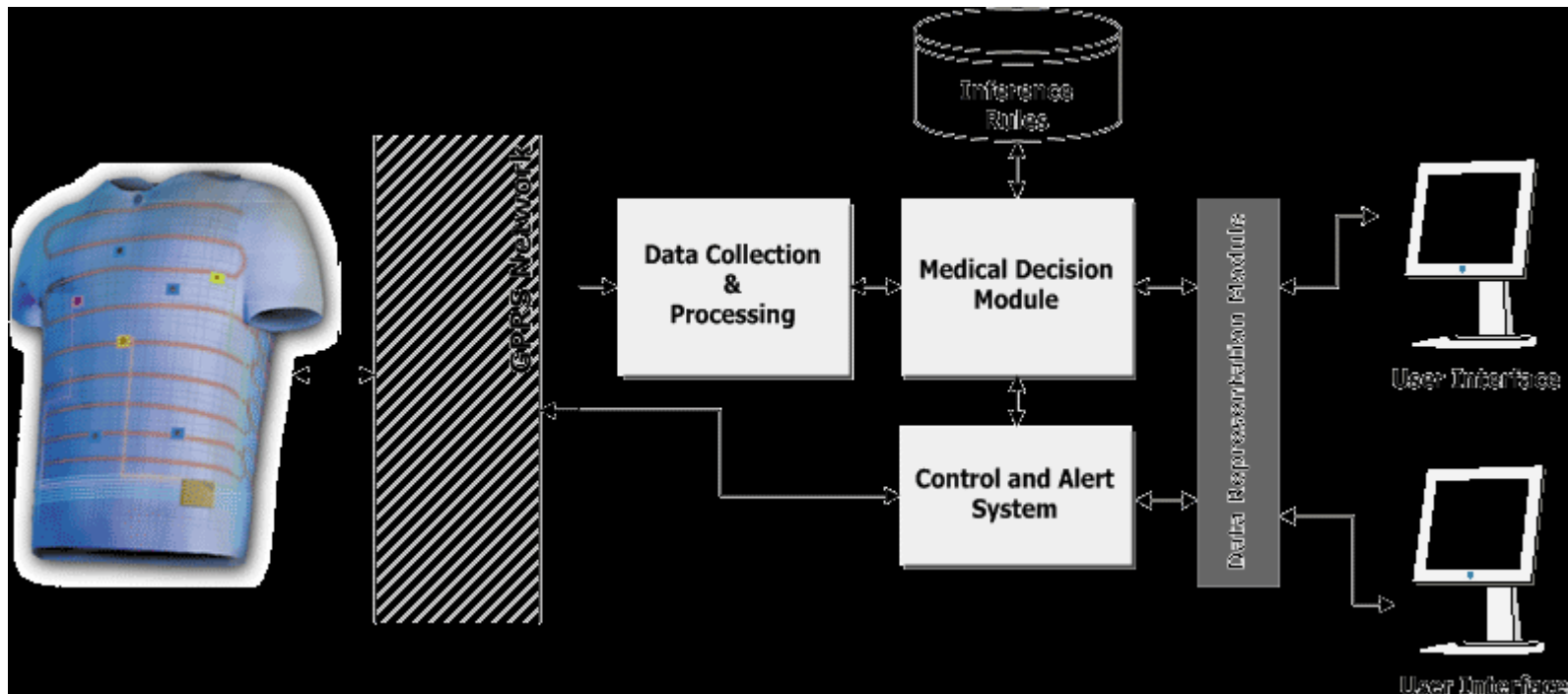


# Conclusions



# Conclusions

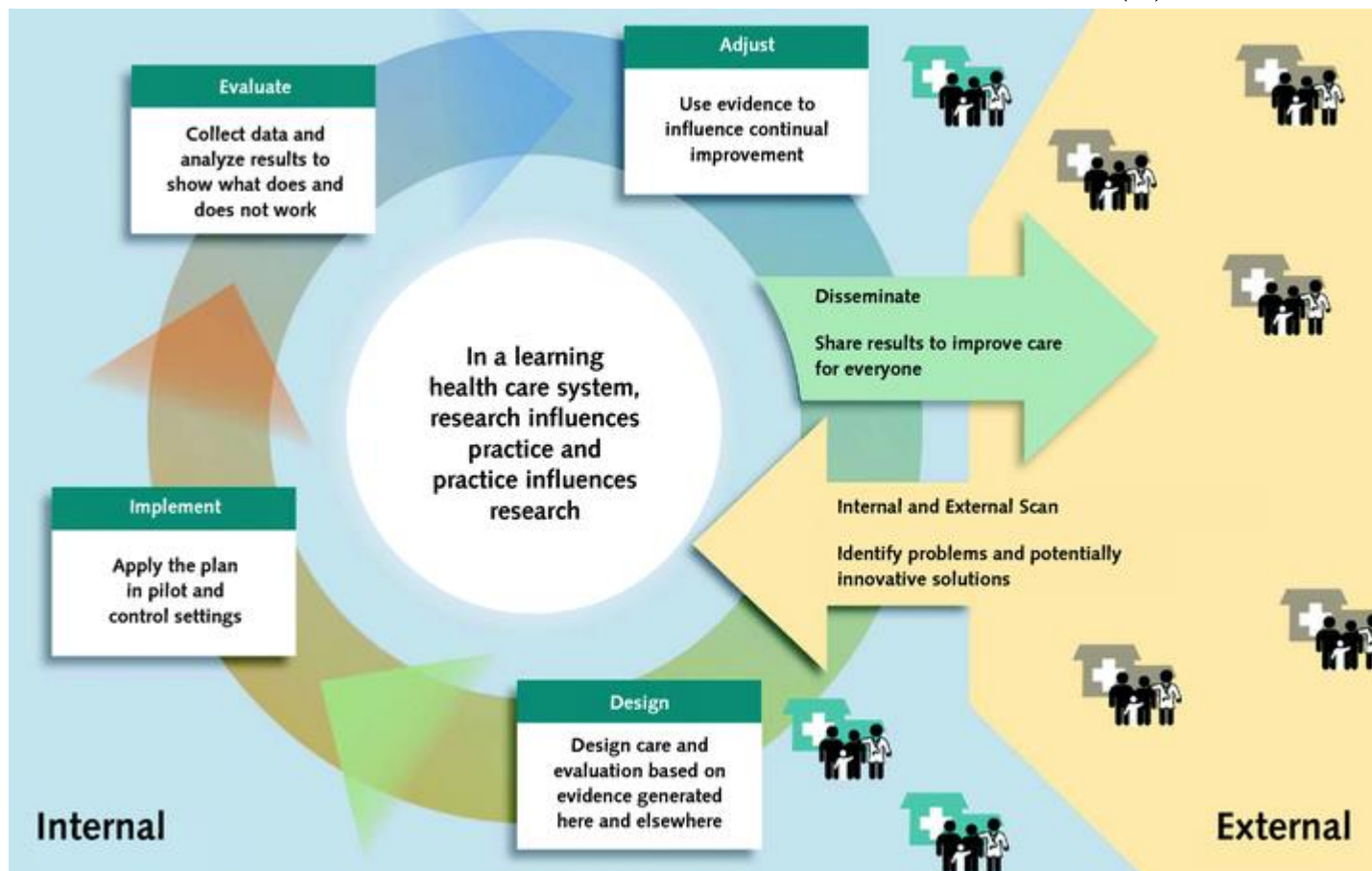
<http://www.health-wear.eu/index.php?pg=1&LANG=en>





# Conclusions

- **Implementing the Learning Health System: From Concept to Action.** Sarah M. Greene. *Ann Intern Med.* 2012;157(3):207-210.



## Benefits of Electronic Health Records (EHRs)

- Improve quality and convenience of patient care
- Increase patient participation in their care
- Improve accuracy of diagnoses and health outcomes
- Improve care coordination
- Increase practice efficiencies and cost savings