



Healthcare
DENMARK

Big Data in the Health System – the Danish Experience

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Healthcare DENMARK is a public-private partnership



MINISTRY OF FOREIGN AFFAIRS OF DENMARK

SYSTEMATIC



Falck





Her Royal Highness Crown Princess Mary is patron for Healthcare Denmark

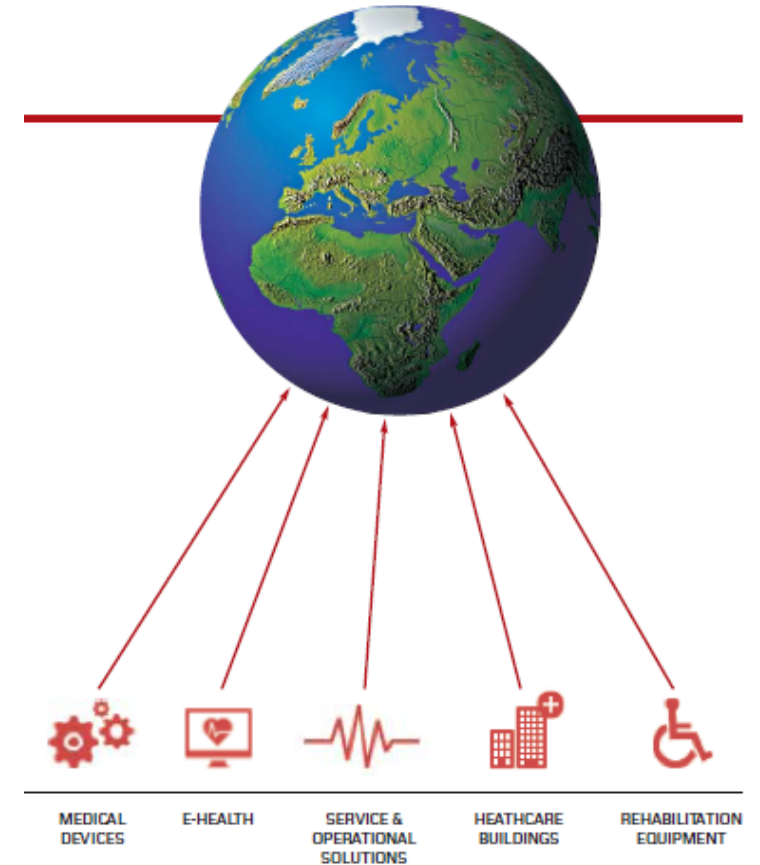
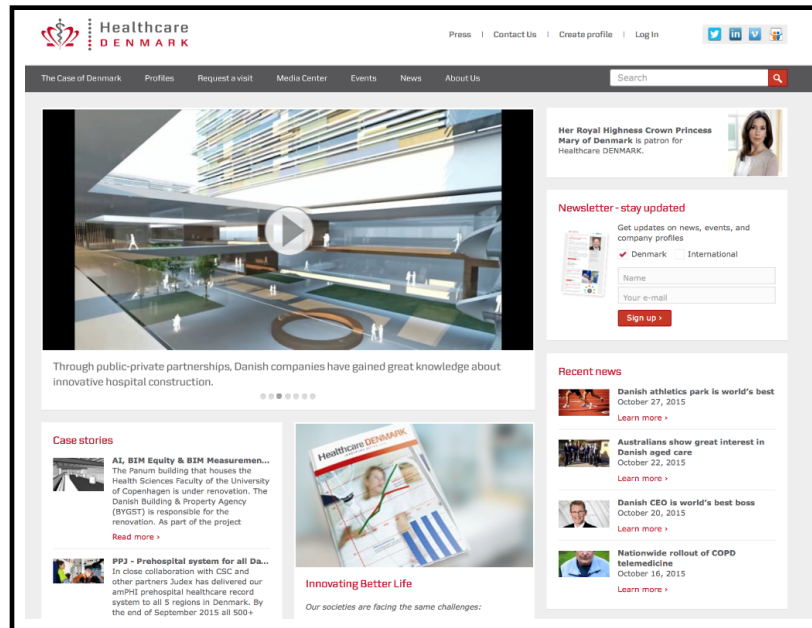


“In Denmark, our focus on putting the patient first – combined with constant efforts to improve efficiency and quality – has resulted in a wide array of innovative healthcare solutions.

I sincerely believe Danish technologies, products and expertise can have a positive impact on global health.”

Healthcare DENMARK

- Danish healthcare visitor programs
- Conferences
- Danish delegation visit to other countries
- Communication and press activities
- The Healthcare DENMARK homepage



Agenda

- The Danish Healthcare strategy and initiatives
- National Health Data - background and status
- Big Data in Denmark – today
- Future Big Data perspectives
- Big Data pre-requisites

Basic Features

Universal Coverage

Financed by general
taxes

Free & Equal
Access

A high degree of
decentralization

Organization of the Healthcare System



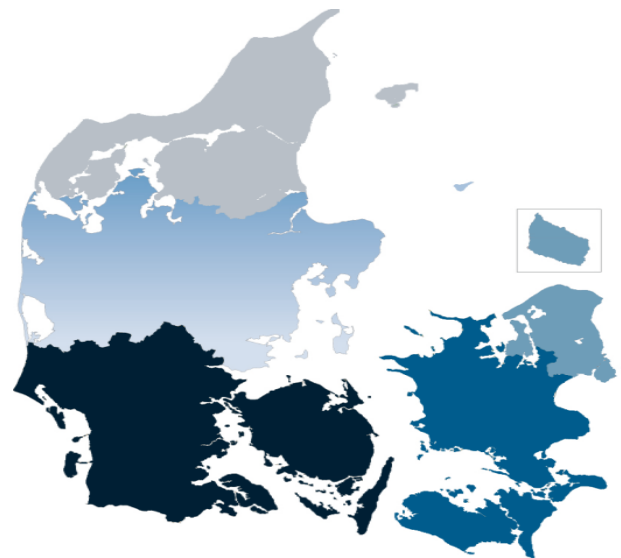
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National Level



Ministry of Health

Regional Level



5 Regions

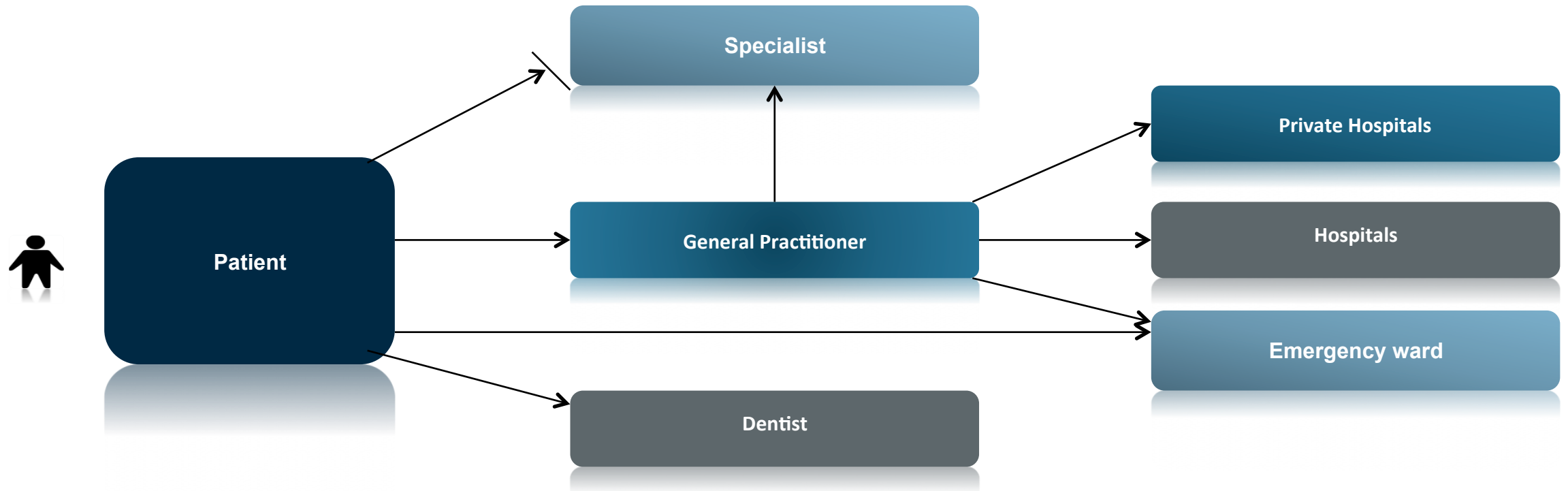
Local Level



98 Municipalities



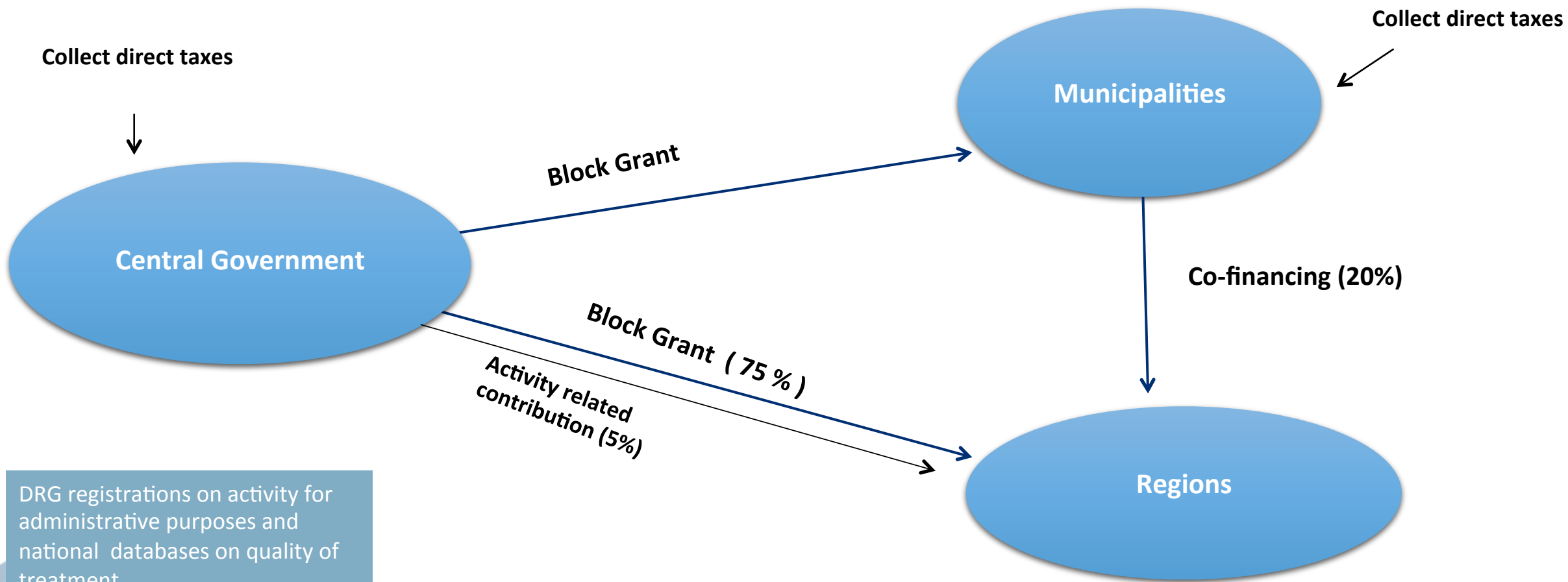
Where to go to if you get ill?



Financing Healthcare



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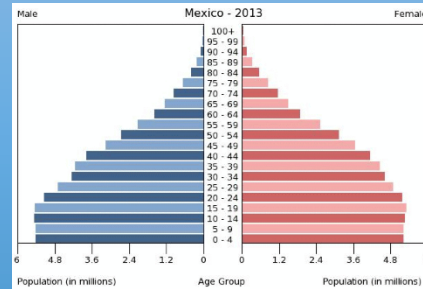
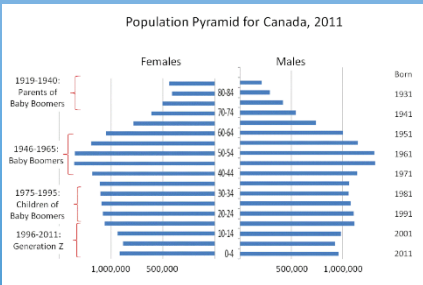


DRG registrations on activity for administrative purposes and national databases on quality of treatment

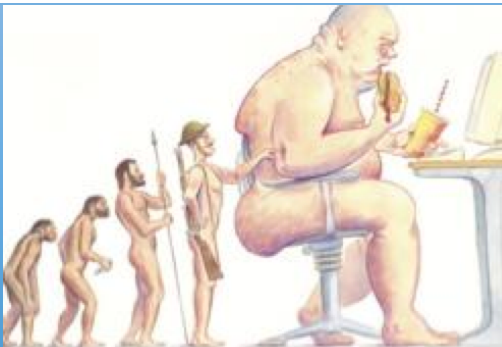
All countries face the same healthcare challenges

Healthcare challenges

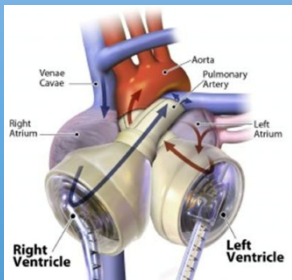
Demographics



Life style



New treatments



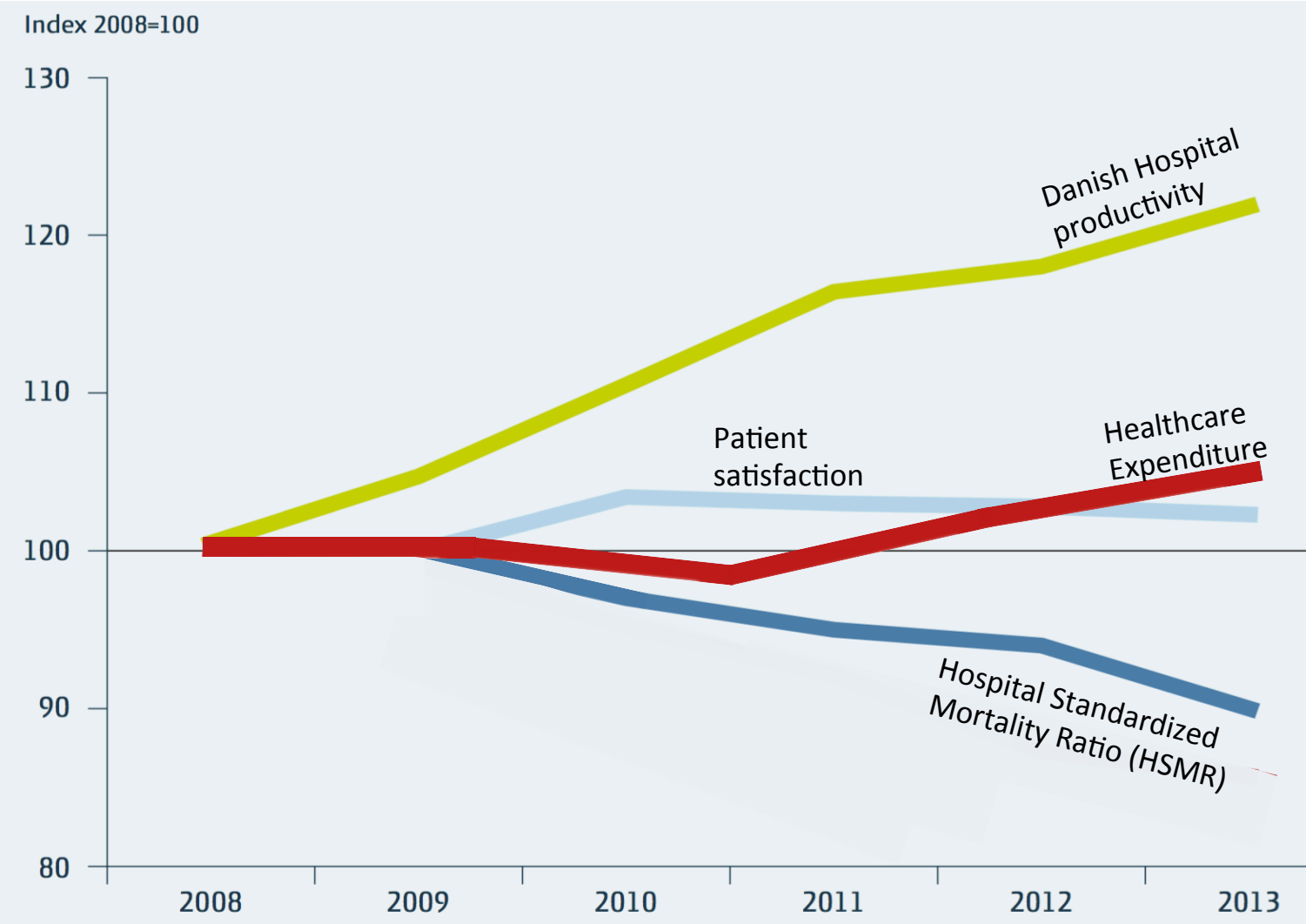
Denmarks initiatives

- **Early detection of critical diseases, population health initiatives and patient empowerment**
 - Early detection of diseases and immediate start of treatment
 - Nationwide screening
 - Fast access to diagnostics
 - Population health and prevention initiatives
 - Primary healthcare clinics
 - E-health, telehealth and patient empowerment
 - Ambient Assisted Living
 - Personalized Medicine
- **High quality and effective hospital treatment**
 - High quality treatment
 - "Just-in-time" coordination and logistics
 - More outpatient treatment

Danish citizens are happy with their lives and with healthcare services



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Life satisfaction and happiness: #1	1 2 3 4	Access to healthcare: #2
Satisfaction with health: #2		Health services: #4
Denmark ranking, Quality of life in Europe report 2012		

Ongoing work in the Ministry of Health

The right to fast diagnose and treatment

- Maximum waiting of 30 days

Cancer Strategy IV

- Holistic and coherent approach to cancer treatment

Targeted effort for the elderly medical patients

- New action plan.
- Focus among other on prevention, treatment and follow-up at home.

Action plan for dementia

- Denmark as a dementia-friendly country. Individual tailored solutions. Focus on relatives.

Personalised Medicine

National Telehealth by 2019

The Danish eHealth and Telehealth plan

- National EHR and E-health architecture
- International standards
 - HL7
 - Continua Health Alliance
- First fully regional telehealth implementations
- Coordinated strategy:
 - Ministry of Health
 - Danish Regions
 - Danish Municipalities



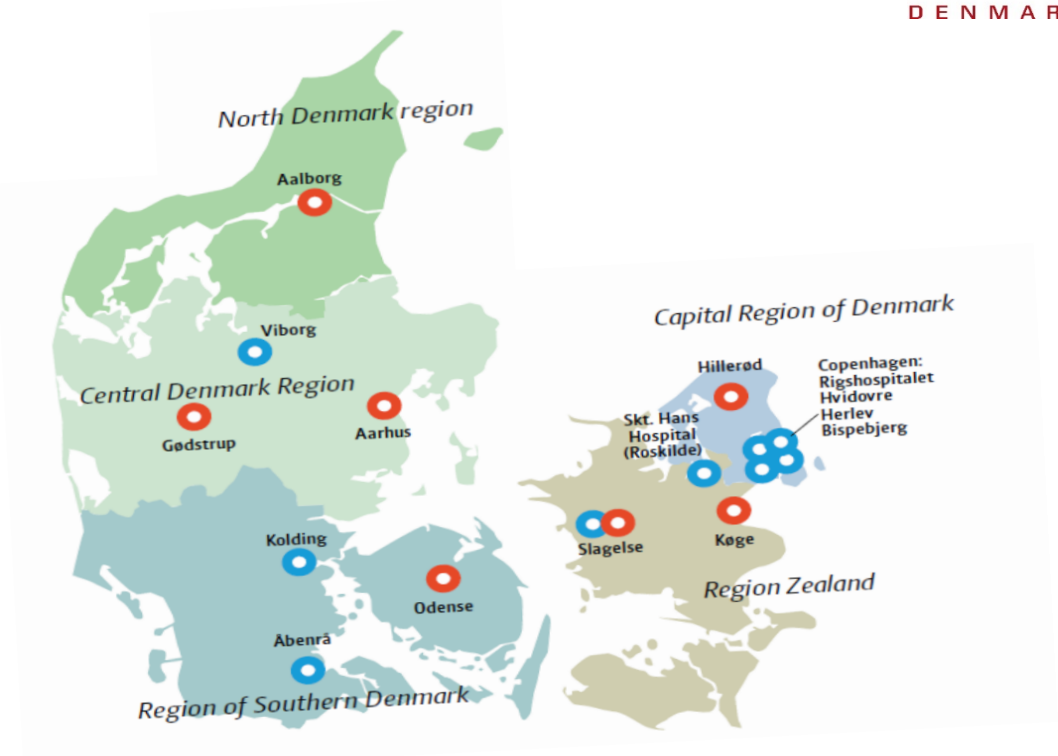
The eHealth and telehealth strategy will align with the 2013 – 2020 Assisted Living strategy

- Full scale implementation of proven solutions
 - Ceiling lifts
 - Digital rehabilitation
 - Selected robot technology
- Full scale Smart Home implementation
- Smart Home technology for disabled citizens
- Coordinated strategy:
 - Ministry of Health and Prevention
 - Danish Regions
 - Danish Municipalities

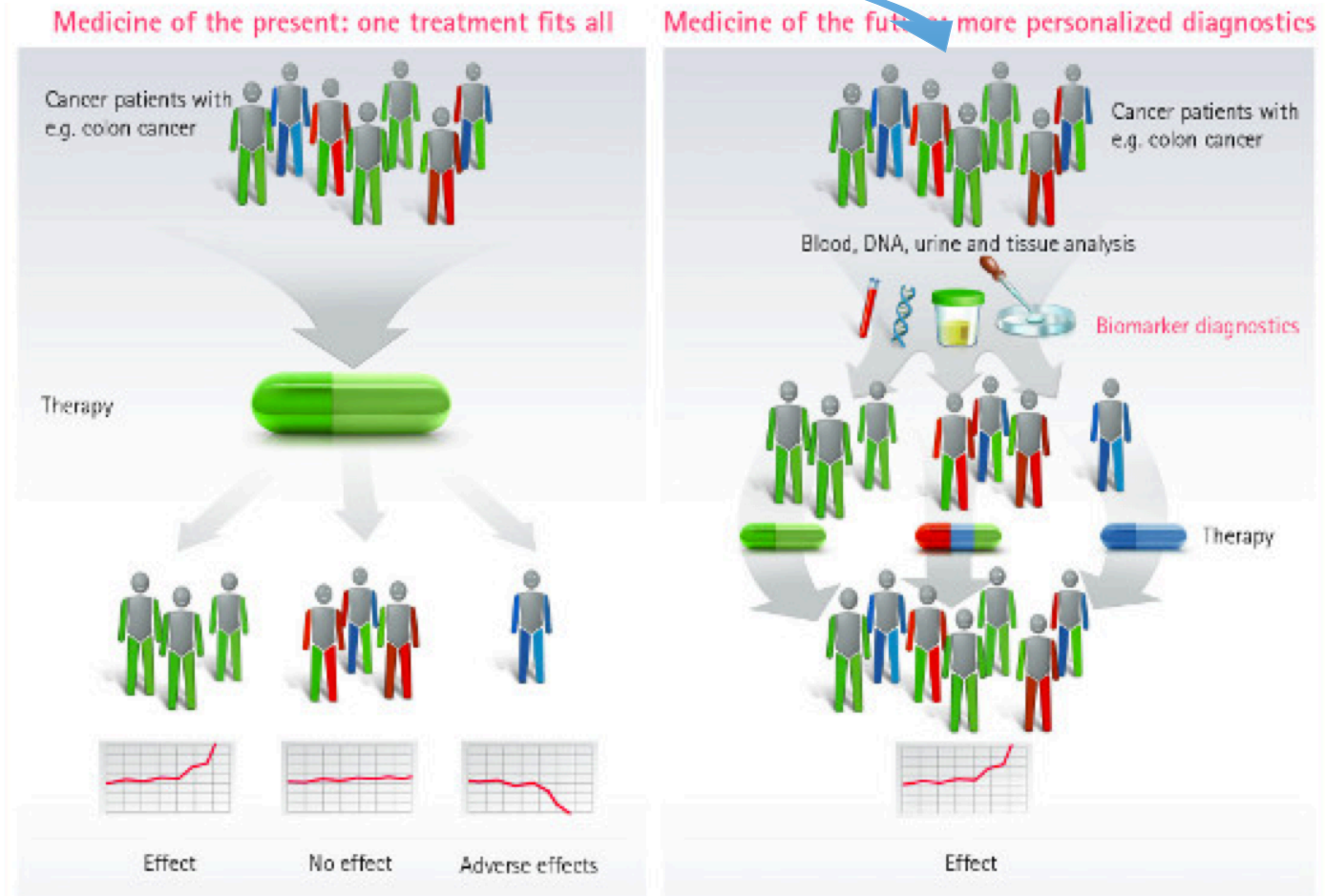
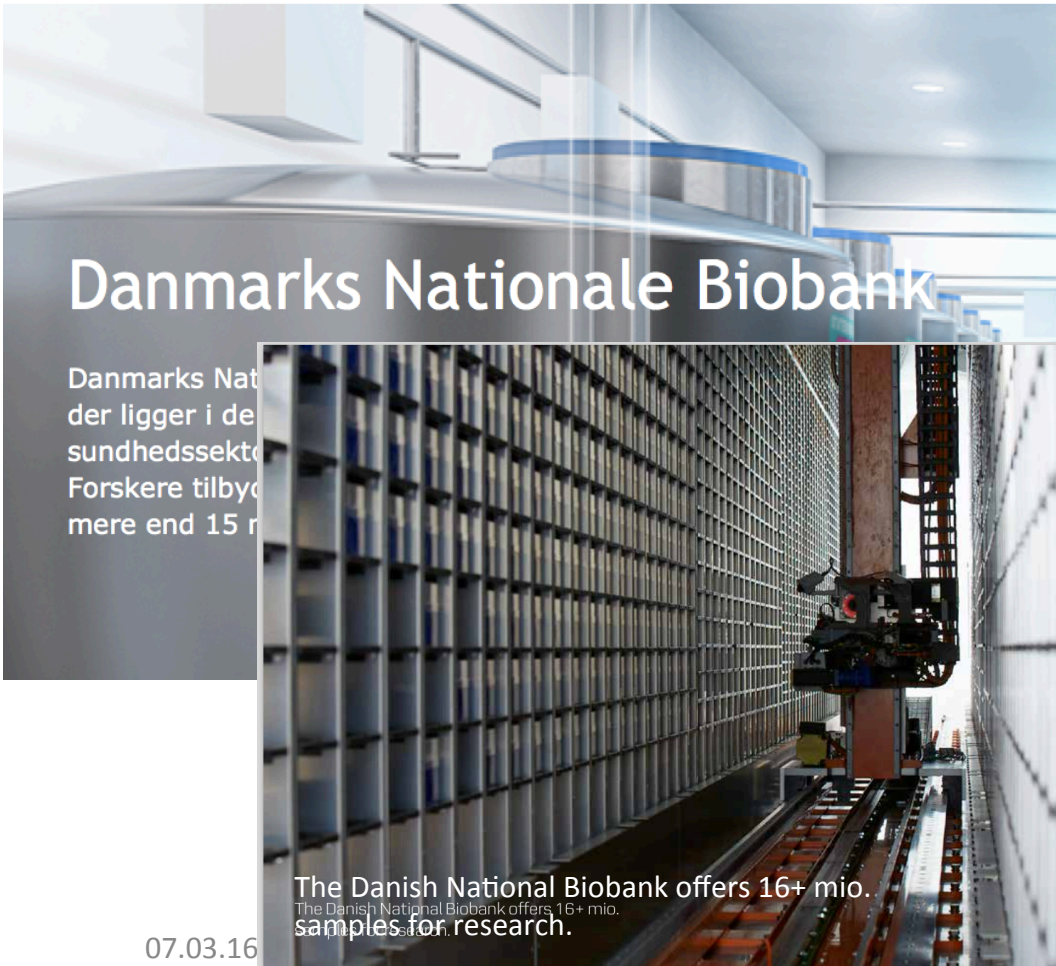


16 new hospitals will be the backbone of patient centric healthcare

- **Public-private partnerships**
- **New innovations**
- **Danish design**
- **Green technology**



Personalised Medicine will increase treatment efficiency and reduce adverse effects:



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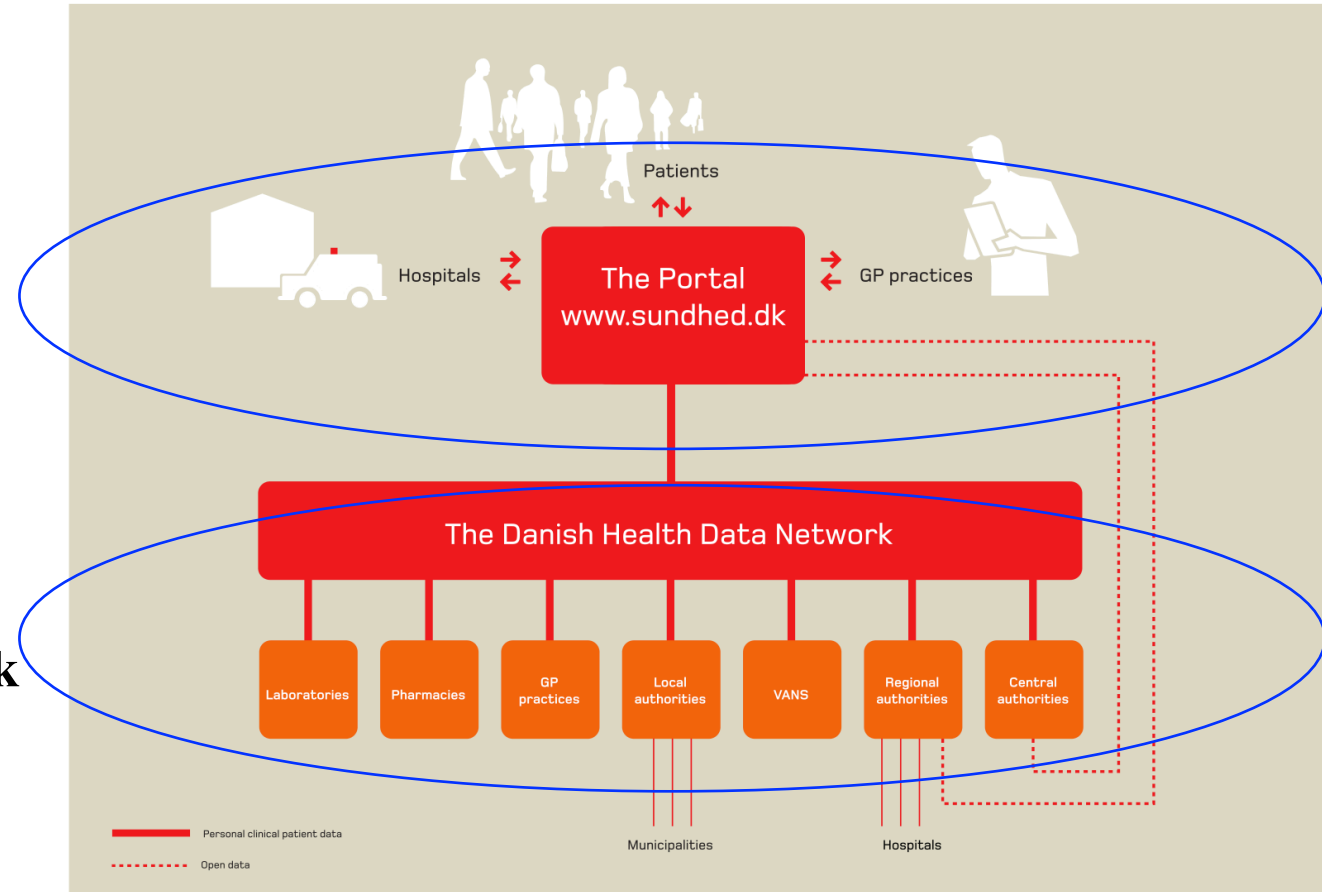


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A long term focus on health data networks and on e-health provide efficient access to healthcare information

Sundhed.dk
E-health Portal
2003 -

MedCom
Health Data Network
1994 -



Who is behind?

Ministry of Health, Danish Regions, Ministry of Interior, National Association of Local Authorities, National Board of Health, Copenhagen Hospital Corporation, Danish Pharmaceutical Association

SERVICES FOR CITIZENS

- **Access to personal health data on treatment**
 - E.g. e-Record from hospitals and GPs and Shared Medication Card
- **Communication with health care providers**
 - E.g. Contact information and e-services like booking, prescription renewals and electronic communication
- **General information on health service**
 - E.g. quality in health care, patient rights
- **Accurate and updated information on health, disease and treatment**
 - E.g. medical handbook
- **Personal home care/hospital solutions**
 - E.g. diabetes and anticoagulant therapy
- **Patient to patient dialogue**

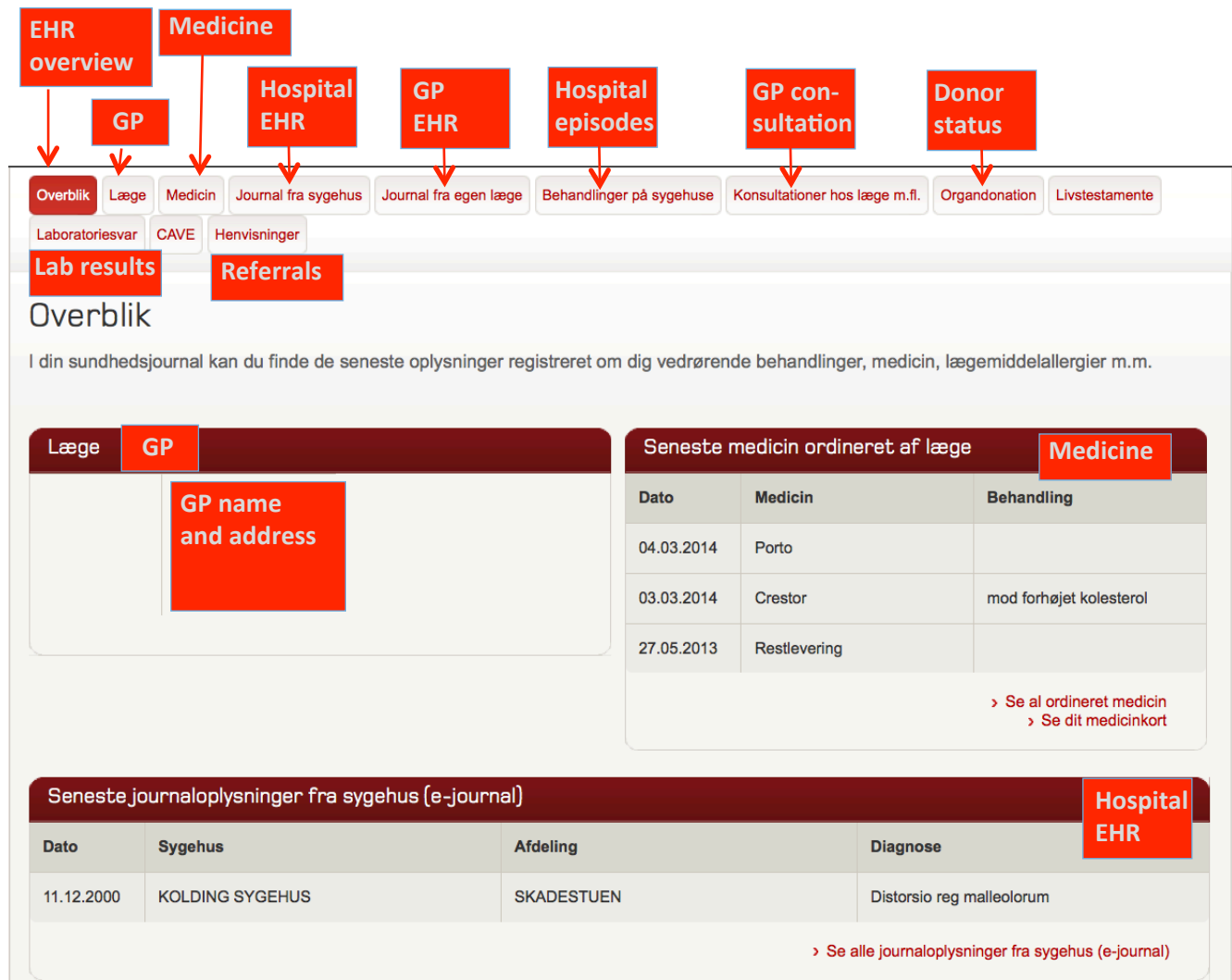


SERVICES FOR HEALTH CARE PROFESSIONALS

- **Access to personal health data on patients**
 - E.g. e-Record, laboratory data and Shared Medication Card
- **Contact and service information on other health care providers**
- **General information on health service**
 - E.g. waiting lists, quality in health care, health and prevention programs, visitation
- **Accurate and updated information on health, disease and treatment**
 - E.g. medical handbook, treatment feedback and benchmarking
- **Personal home care/hospital solutions**
 - E.g. diabetes and anticoagulant therapy



The national EHR today (e-journal)



EHR overview **Medicine**

GP **Hospital EHR** **GP EHR** **Hospital episodes** **GP consultation** **Donor status**

Overblik Læge Medicin Journal fra sygehus Journal fra egen læge Behandlinger på sygehuse Konsultationer hos læge m.fl. Organdonation Livstestamente

Laboratoriesvar CAVE Henvisninger

Lab results **Referrals**

Overblik

I din sundhedsjournal kan du finde de seneste oplysninger registreret om dig vedrørende behandlinger, medicin, lægemiddelallergier m.m.

Læge **GP**

GP name and address

Seneste medicin ordineret af læge **Medicine**

Dato	Medicin	Behandling
04.03.2014	Porto	
03.03.2014	Crestor	mod forhøjet kolesterol
27.05.2013	Restlevering	

> Se al ordineret medicin
> Se dit medicinkort

Seneste journaloplysninger fra sygehus (e-journal) **Hospital EHR**

Dato	Sygehus	Afdeling	Diagnose
11.12.2000	KOLDING SYGEHUS	SKADESTUEN	Distorsio reg malleolorum

> Se alle journaloplysninger fra sygehus (e-journal)

Seneste journaloplysninger fra læger (p-journal) **GP EHR**

Dato	Hos	Speciale	Fagligt område
20.06.2011	GP name	Alment praktiserende læge	HOVEDOVERSIGT

> Se alle journaloplysninger fra egen læge og speciallæger (p-journal)

Behandlinger på sygehuse **Hospital episodes**

Se oplysninger om:

- Behandlinger på sygehus efter 1977
- Ambulant behandling og skadestuebesøg efter 1995

> Se oversigt over behandlinger på sygehuse

Konsultationer hos læge, tandlæge, fysioterapeut **Specialists**

Se de behandlinger, du har fået tilskud til fra sygesikringen. På oversigten kan du se:

- Hvornår du sidst var hos tandlæge, fysioterapeut o.lign.
- Hvor meget tilskud, du har fået fra sygesikringen

> Se behandlinger hos læge, tandlæge, fysioterapeut m.fl.



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Central user interface – patient overview:

det fælles **medicinkort**

Du er logget ind som **Terri Dalsgård**
Region Sjællands Sygehusvæsen, PRO Distriktspsyk. Log ud

Patient 110201-4746 Jody Svendsen **Status** Aktivt - sidst ændret 30-09-2010 **Afstemt** 19-08-2010 **Maksimer** ▾

Medicinkortet Afsluttede lægemiddelordinationer

Opret ordination Ordinationen er seponeret

Lægemiddelordinationer på FMK:

Startdato	Slutdato	Lægemiddel	Form	Styrke	Dosering	Indikation
25-09-2010	25-10-2010	Procoralan	Filmovertrukne tabletter	5 mg	1 stk morgen og aften	Mod hjertekrampe
21-09-2010	21-09-2011	Simvastatin "Arrow"	Filmovertrukne tabletter	80 mg	1 stk nat	Mod forhøjet kolesterol
17-08-2010		Stilnoct	Filmovertrukne tabletter	10 mg	2 stk nat	Sovemedicin

Følgende recepter er oprettet *efter* seneste medicinkortafstemning men endnu ikke tilknyttet en lægemiddelordination på FMK: Vis alle løse recepter

Oprettet	Udleveret	Lægemiddel	Form	Styrke	Dosering	Indikation
19-08-2010		Norvasc	Tabletter	5 mg	½ tablet 2 gange daglig	Mod forhøjet blodtryk

Central user interface – medication details

Startdato	Slutdato	Lægemiddel	Form	Styrke	Dosering	Indikation
25-09-2010	25-10-2010	Procoralan	Filmovertrukne tabletter	5 mg	1 stk morgen og aften	Mod hjertekrampe
21-09-2010	21-09-2011	Simvastatin "Arrow"	Filmovertrukne tabletter	80 mg	1 stk nat	Mod forhøjet kolesterol

Detaljer Effektueringer Recepter

Simvastatin "Arrow"

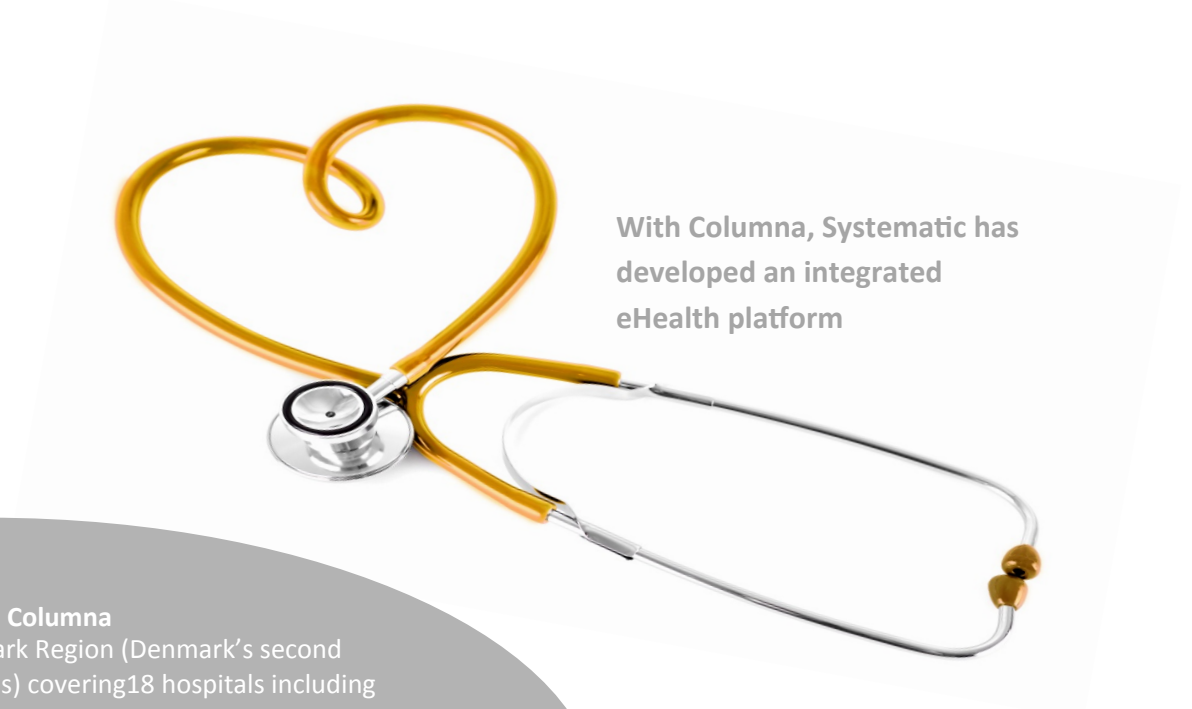
Oprettet:	21-09-2010 12:55	Indikation:	mod forhøjet kolesterol
Ændret:	25-09-2010 10:37	Dosis:	1 stk nat
Startdato:	21-09-2010	Form:	filmovertrukne tabletter
Slutdato:	21-09-2011	Styrke:	80 mg
Virksomt stof:	Simvastatin	Administration:	Oral anvendelse
ATC-kode:	C10AA01	Må substitueres	Ja

Pausér **Seponér** **Effektuer** **Recept** **Rediger**

Data for the National E-health platform is delivered by the regional E-health solutions – e.g. the Systematic eHealth platform

Columna is a full blown eHealth platform consisting of

- The Patient Record
- Patient Administration (ADT)
- Booking
- Order/Result
- Medication Management
- Logistics



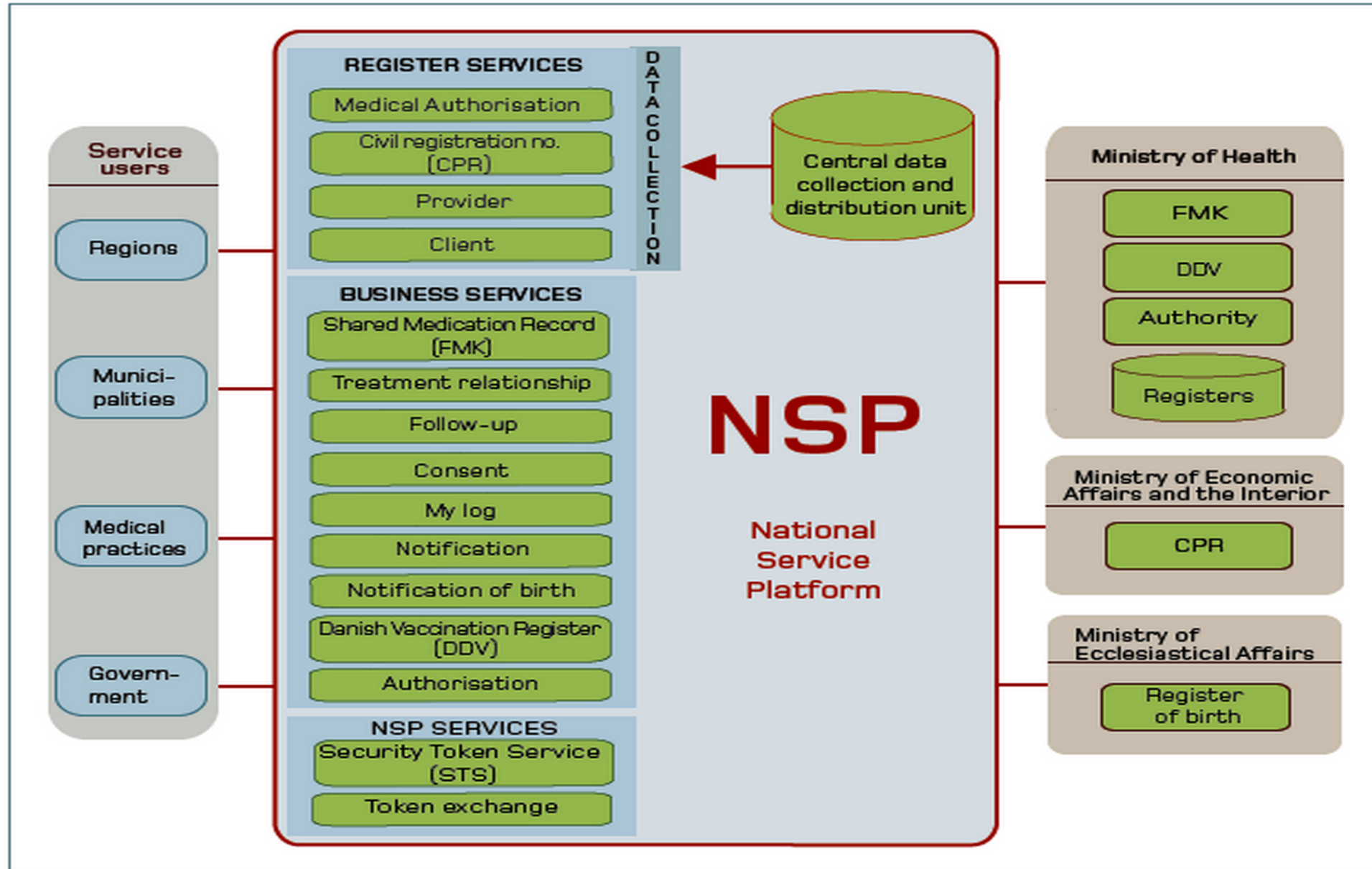
Facts about Columna

- ✓ Columna is used in Central Denmark Region (Denmark's second largest region with 1.3 million citizens) covering 18 hospitals including University Hospitals
- ✓ 10,000 different users per day, 25,000 registered users
- ✓ 6.7 million citizens are registered in Columna, of whom 1.2 million are patients with registered data.
- ✓ Registration of 2,400 admitted patients and 5,500 outpatients per day.
- ✓ More than 25,000 medication prescriptions per day.
- ✓ 40,000 lab results per day. 6,500 per hour in peak.

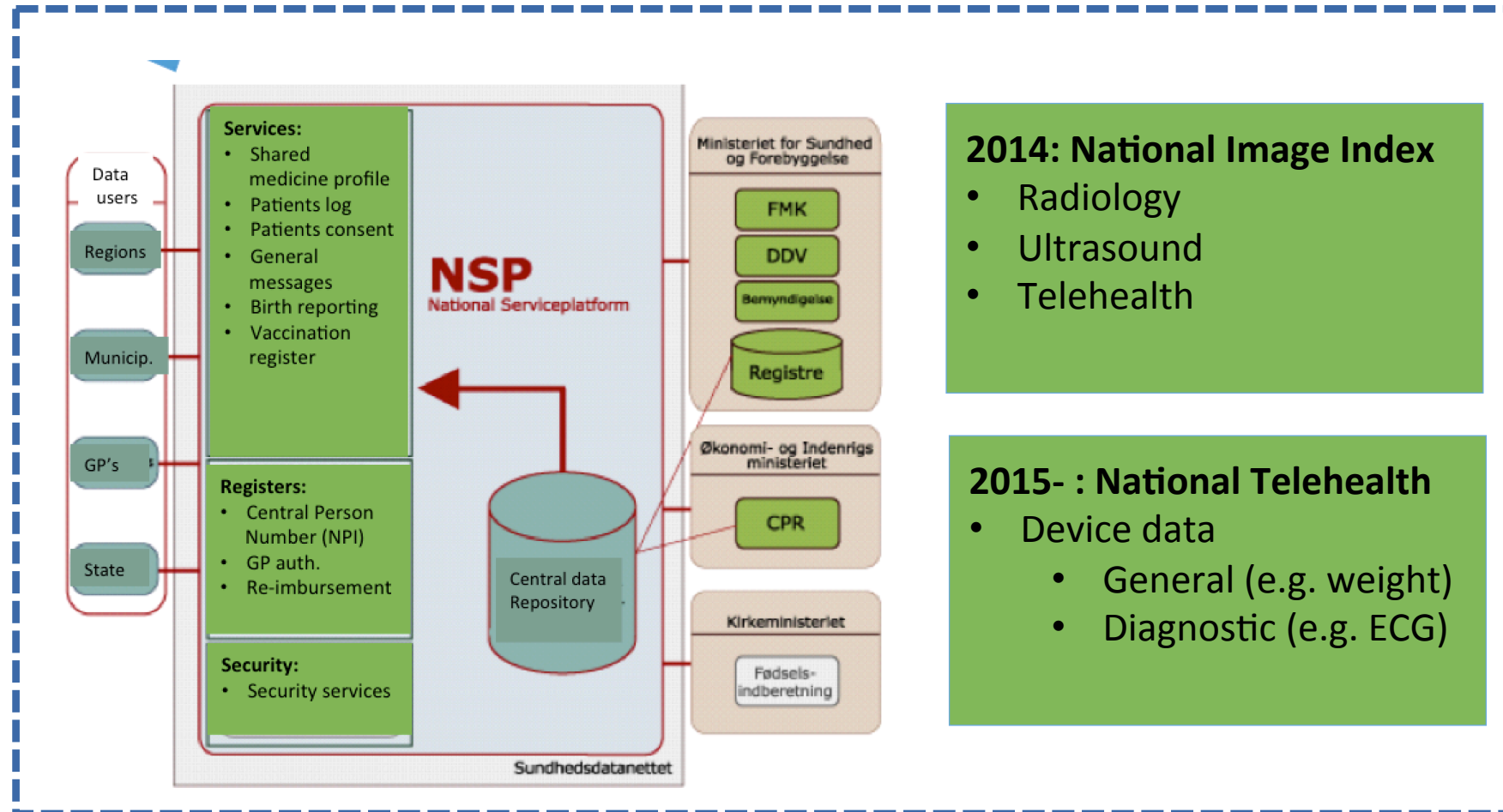
The National Service Platform



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The National Service Platform – and new services



Government National Databases



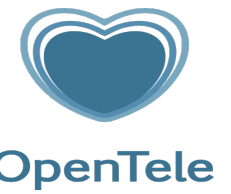
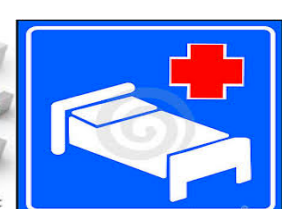
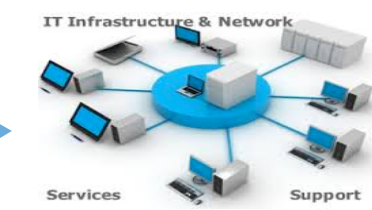
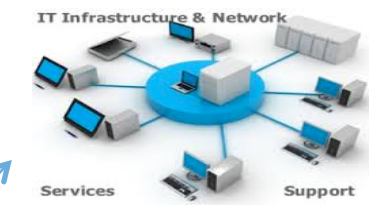
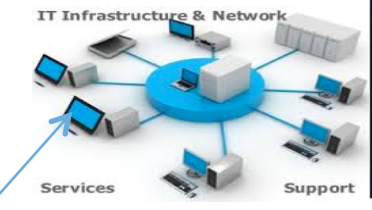
National Healthportal



X 98

Municipal IT

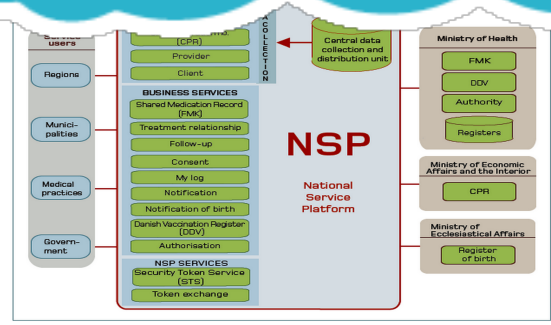
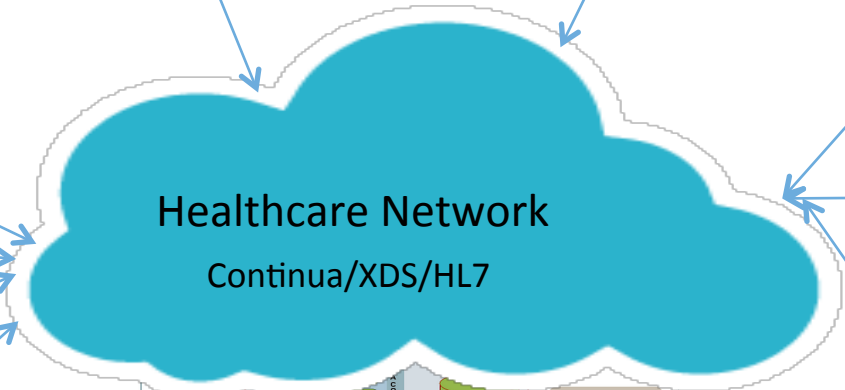
5 Regions



OpenTele



EU systems



NSP Master

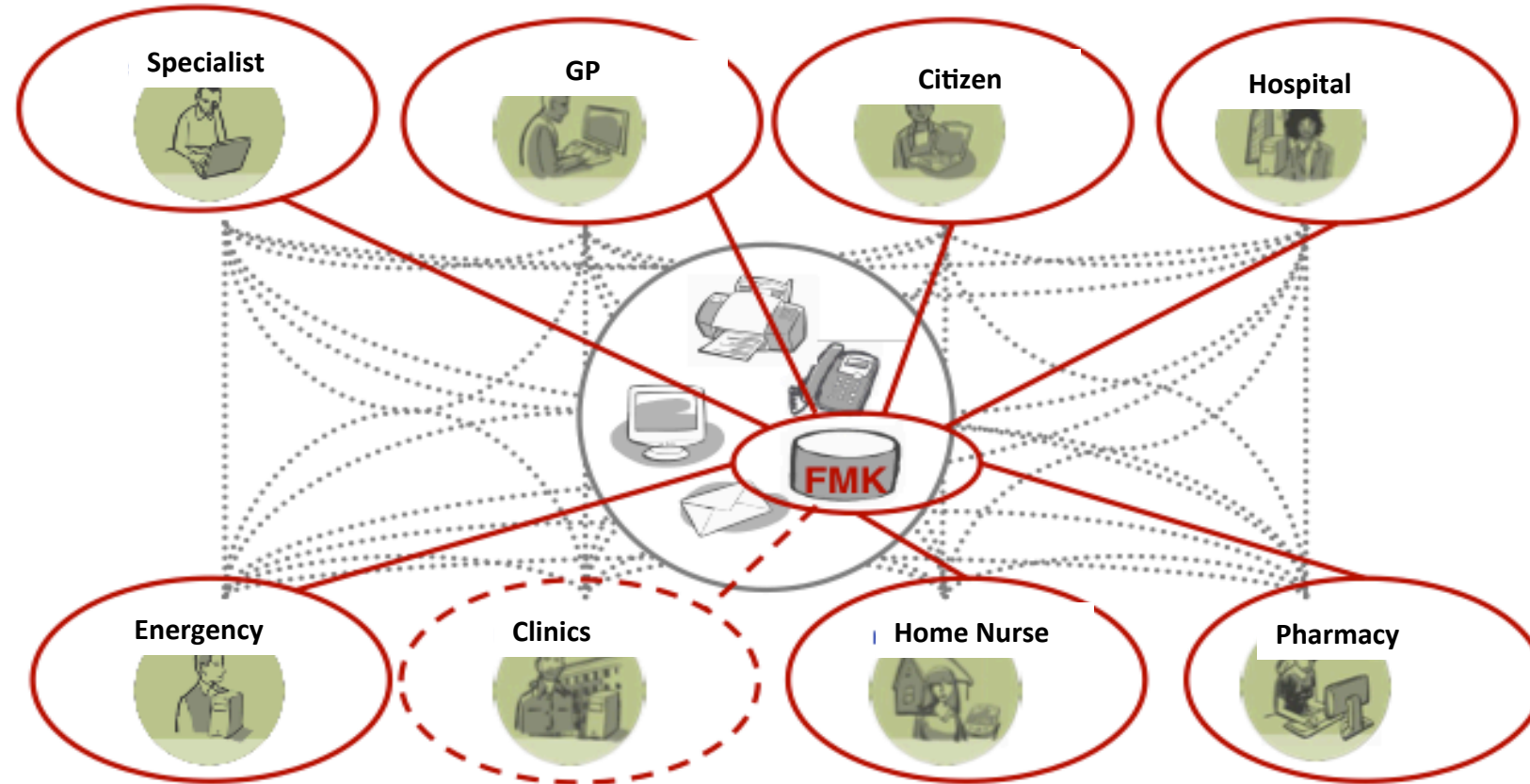


3600 GP's

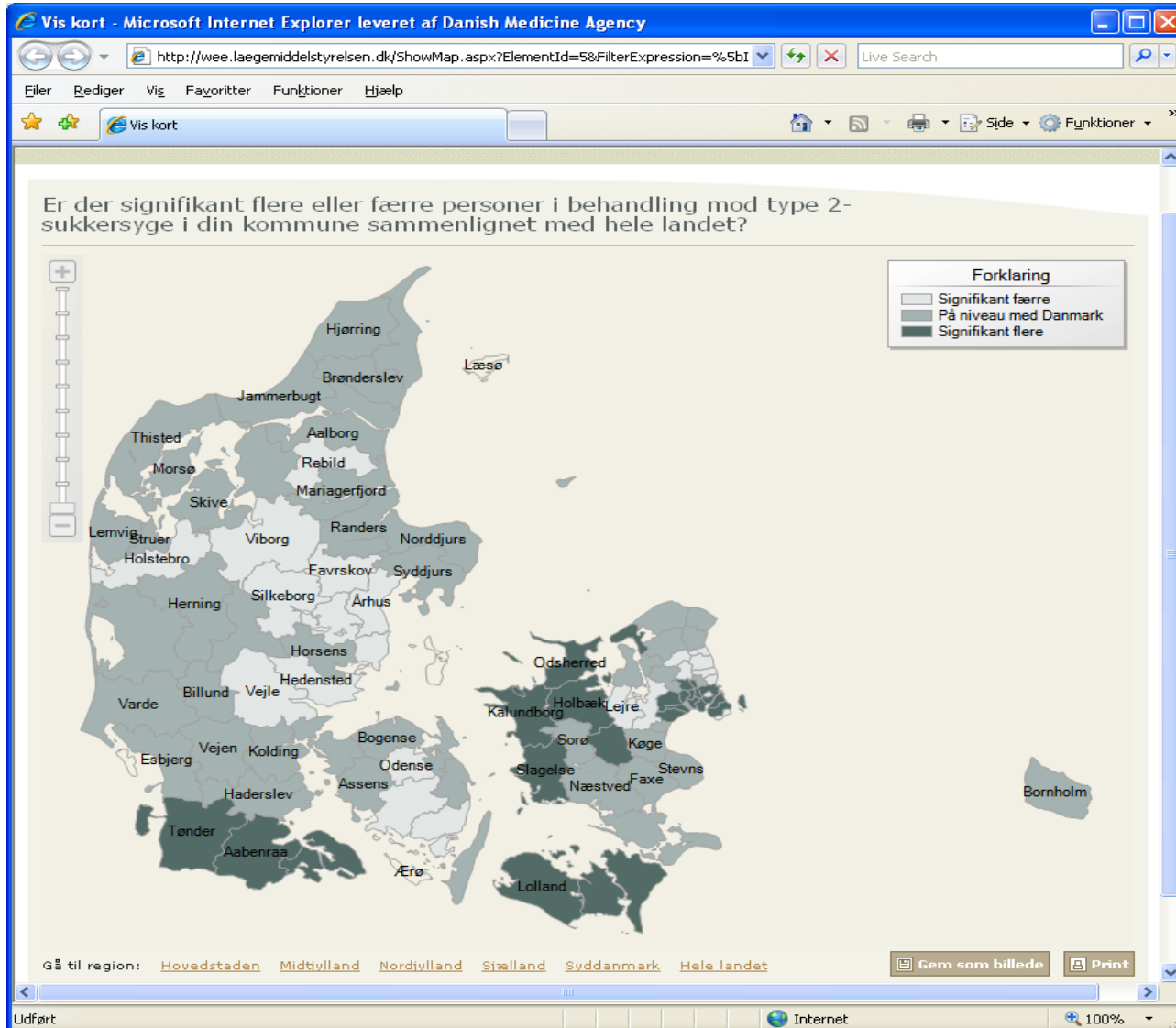
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The Shared Medication Record



Type 2 diabetes distribution in municipalities



Medication compliance



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Startdato	Slutdato	Lægemiddel	Form	Styrke	Dosering	Indikation
25-09-2010	25-10-2010	Procoralan	Filmovertrukne tabletter	5 mg	1 stk morgen og aften	Mod hjertekrampe
21-09-2010	21-09-2011	Simvastatin "Arrow"	Filmovertrukne tabletter	80 mg	1 stk nat	Mod forhøjet kolesterol

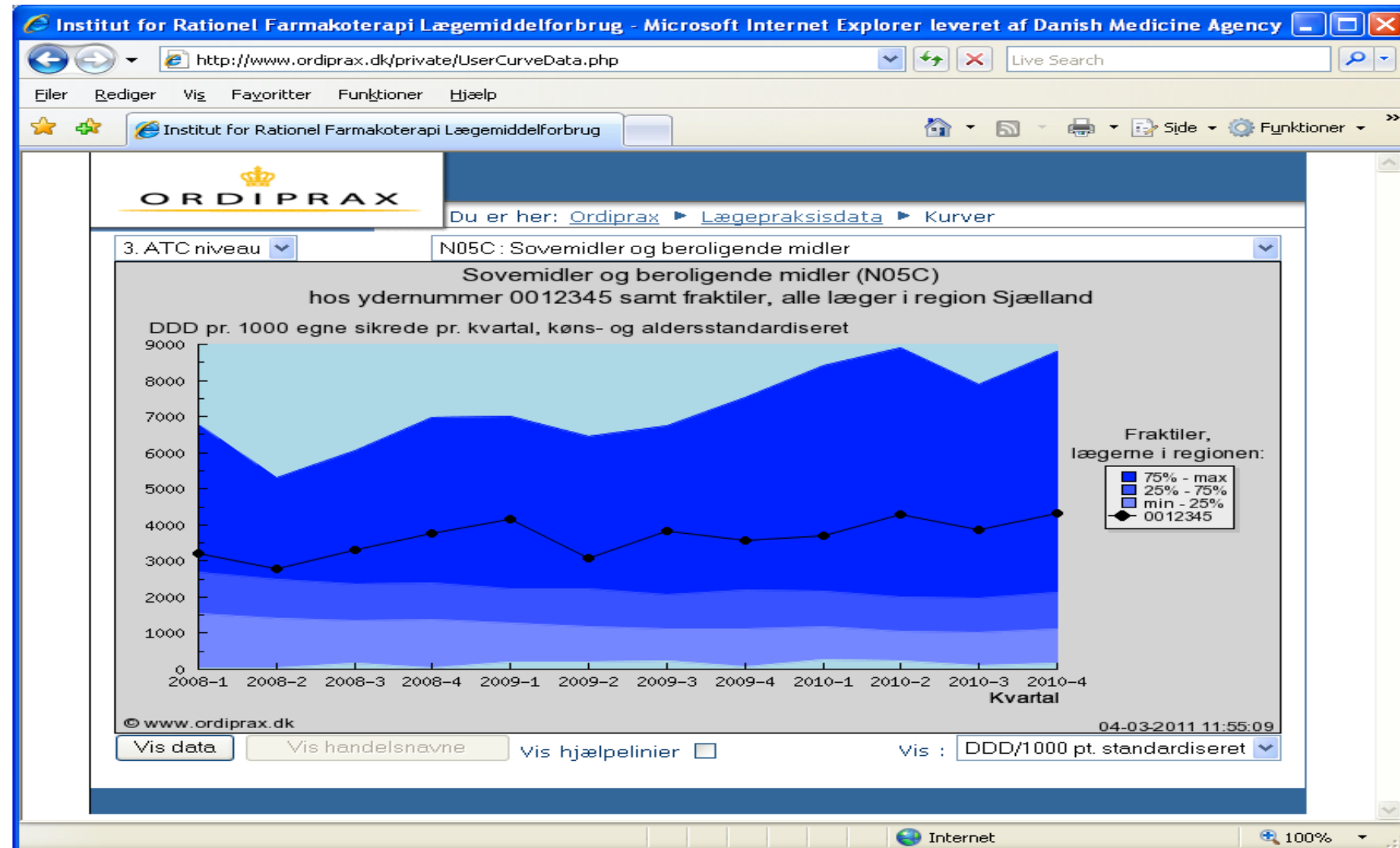
Detaljer	Effektueringer	Recepter
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Simvastatin "Arrow"

Oprettet:	21-09-2010 12:55	Indikation:	mod forhøjet kolesterol
Ændret:	25-09-2010 10:37	Dosis:	1 stk nat
Startdato:	21-09-2010	Form:	filmovertrukne tabletter
Slutdato:	21-09-2011	Styrke:	80 mg
Virksomt stof:	Simvastatin	Administration:	Oral anvendelse
ATC-kode:	C10AA01	Må substitueres	Ja

Pausér **Seponér** **Effektuer** **Recept** **Rediger**

ORDIPRAX example, sedatives



ORDIPRAX example, cost curve



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ORDIPRAX

STATENS
SERUM
INSTITUT 

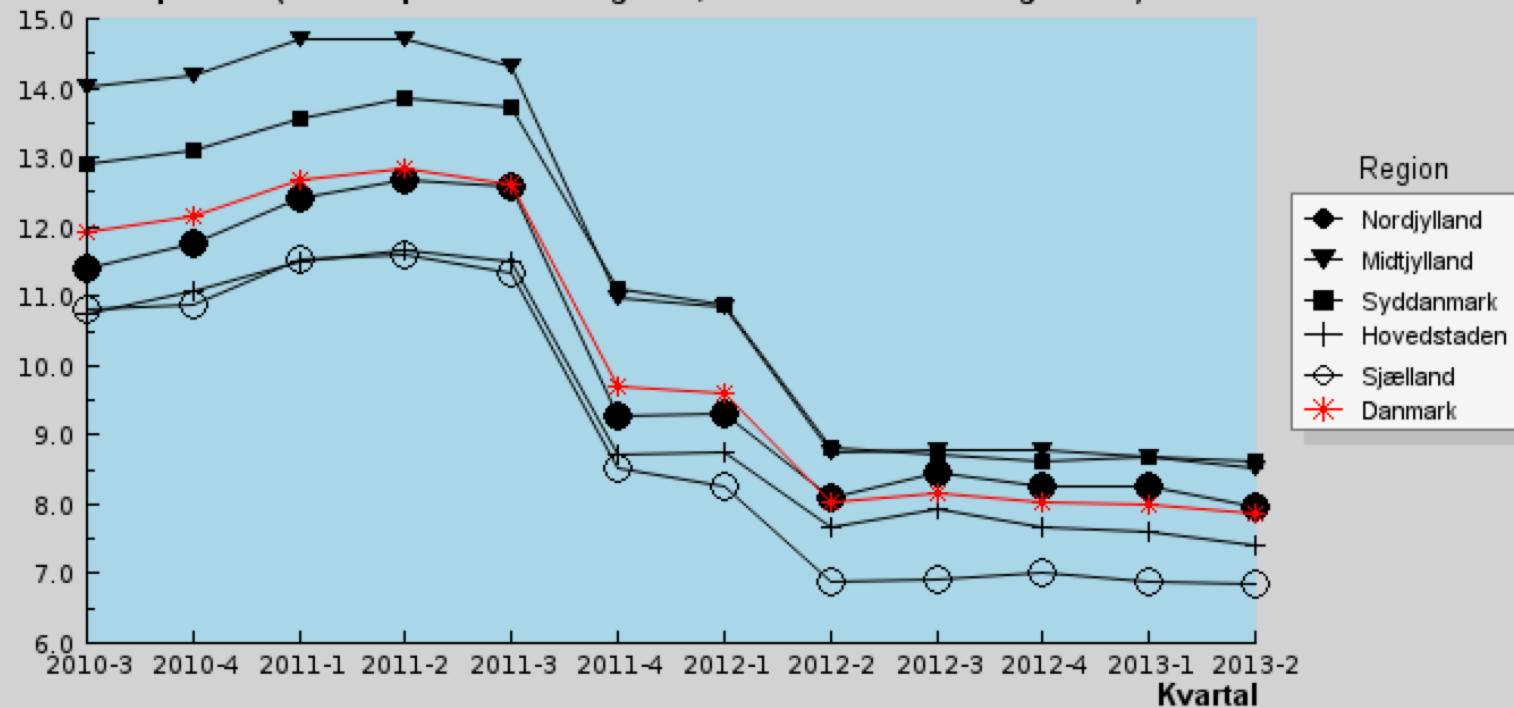
Du er her: [Ordiprax](#) ▶ [Regionsdata](#) ▶ Kurver

2. ATC niveau ▾

N05 : Psykofarmaka ▾

Psykofarmaka (N05), alle regioner

AUP i Kr. pr. DDD (AUP = Apotekets UdsalgsPris, DDD = Definerede DøgnDoser)



© www.ordiprax.dk

28-10-2013 20:09:35

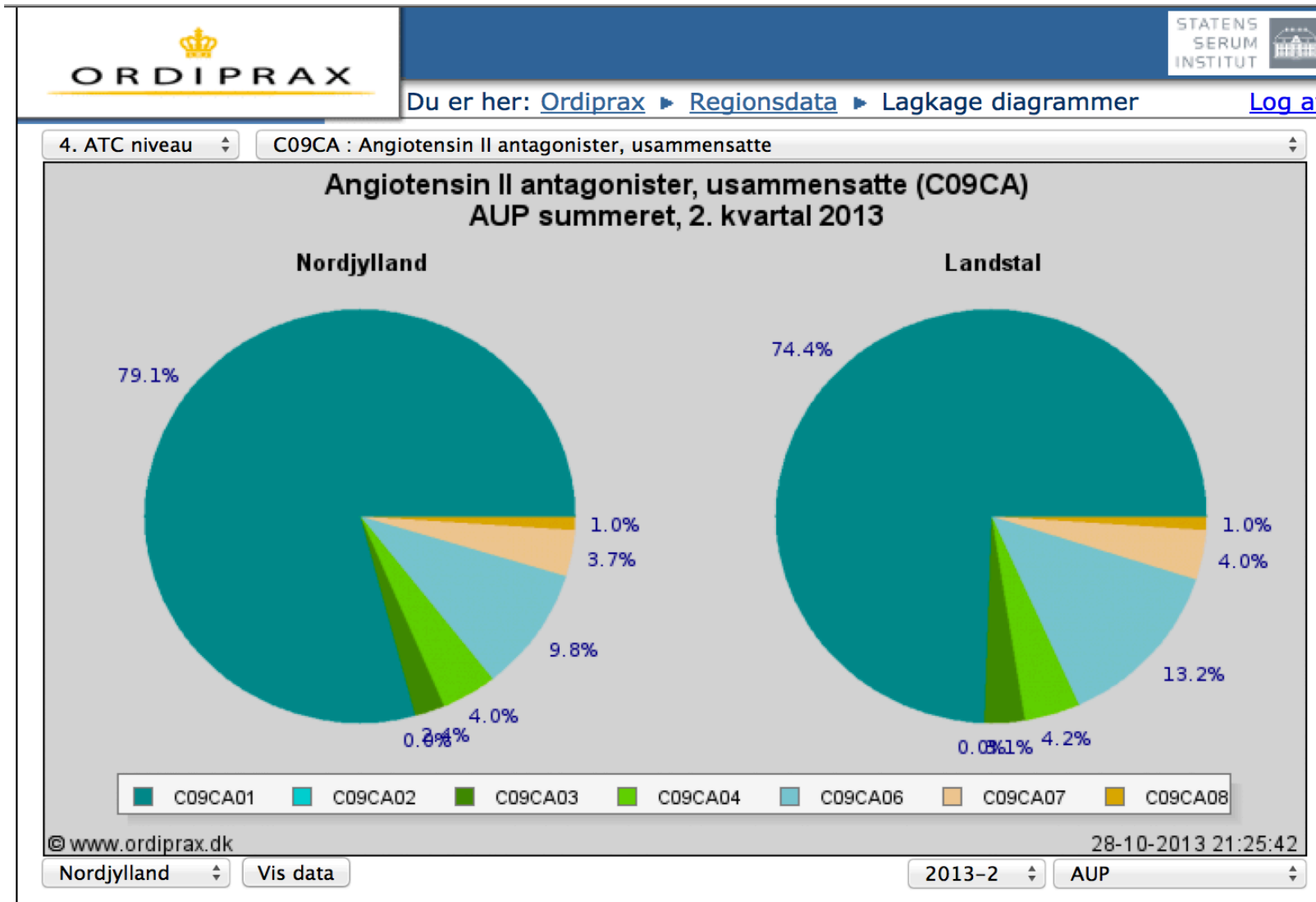
Vis data

Vis handelsnavne

Vis hjælpelinier

Vis : AUP/DDD

ORDIPRAX example, ATC distribution (cost)



National healthcare databases

Administrative

- Citizen Number Register (MPI)
- National Patient Register
- DRG Register
- Rehabilitation Register
- Drug Abuse Register
- Clinical Proff. Authorization Reg.
- Billing Authorization Register

Research

- Cancer Register
- Diabetes Register
- Pathology Register
- Mental Research
- Medication Statistics
- Army Health Register

The National Patient Register

> Diagnose related

Se tal over aktivitet fordelt på diagnoser, f.eks. skadestuebesøg, indlagte patienter og udskrivninger.

> Diagnose Groups

Se tal over aktivitet fordelt på diagnoser, f.eks. skadestuebesøg, indlagte patienter og udskrivninger.

> O.D./suicide

Se tal over indlæggelser med forgiftninger og selvmordsforsøg ved somatiske sygehuse.

> Surgeries

Se tal over antallet af operationer fordelt på sygehuse og bopælsregioner.

> Radiology

Se tal over radiologiske ydelser udført på offentlige og private sygehuse.

Diagnose related

1 SØGEORD

Søg 1 diagnoser (Valgfri)

2 VÆLG OMRÅDE

Diagnose

2 af 1724 valgt

Sygehusejer

3 af 3 valgt

Indikator

4 af 4 valgt

3 VÆLG PERSONER

Køn

Begge køn

Alder

Alle aldre

4 VÆLG ÅR

År

3 af 3 valgt

LANDSPATIENTREGISTERET

SYGEHUSEJER	DIAGNOSE	INDIKATOR	2012	2013	2014
Alle sygehusejere	DA00 Kolera	Ambulante besøg i året	-	-	6
		Sengedage, indlagte	22	16	15
		Skadestuebesøg	<3	3	-
	DA01 Tyfus og paratyfus	Ambulante besøg i året	61	24	61
		Sengedage, indlagte	144	68	100
		Skadestuebesøg	-	-	-
Offentlig	DA00 Kolera	Ambulante besøg i året	-	-	<3
		Sengedage, indlagte	22	16	15
		Skadestuebesøg	<3	3	-
	DA01 Tyfus og paratyfus	Ambulante besøg i året	61	24	61
		Sengedage, indlagte	144	67	100
		Skadestuebesøg	-	-	-
		Udskrivninger, indlagte	21	11	18

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- **Big Data in the future**
- Big Data pre-requisites

Personalised Medicine

A simple view



Peter får taget en blodprøve



- så man kan undersøge hans DNA



Peters DNA sammenlignes med resten af befolkningens DNA. Man kan se hvor han adskiller sig fra andre



Med den viden kan man give Peter nøjagtig den medicin, der passer bedst til ham

The complexity of Personalised Medicine

- Both for diagnostics and for treatment
- Biomarkers and genetics in use already
- Rapidly increasing number of new medicine from pharma companies
- More demand for “Built to order” substances
- Relations between different genetic findings and medicine
- Identifying and correcting new, individual genetic defects which occur over time
- Next of kind and relatives which can benefit from Personalised Medicine

Big Data in the future - and analytics

Personalised Healthcare

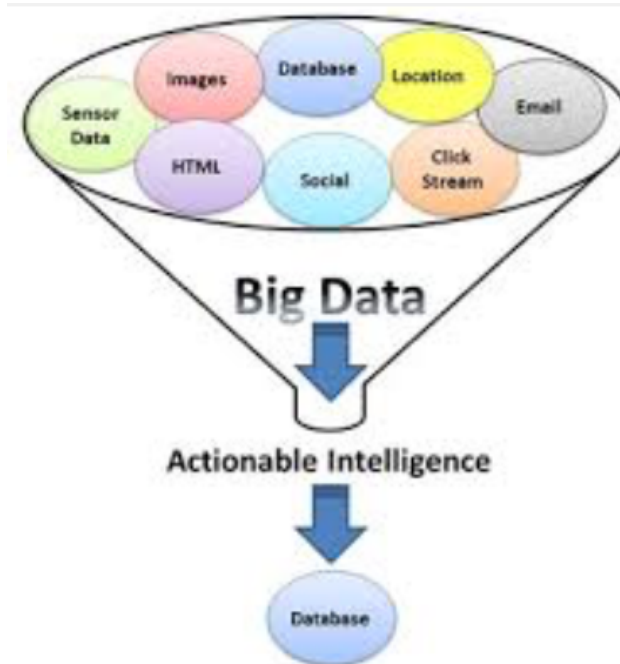
Wearable diagnostics



IOT

BY THE YEAR 2020, THERE WILL BE
50,000,000,000 connected devices,
 creating and sharing
40,000,000,000,000 GB
 worth of data across the Internet of Things.

Healthcare Network Continua/XDS/HL7



Personalised Medicine

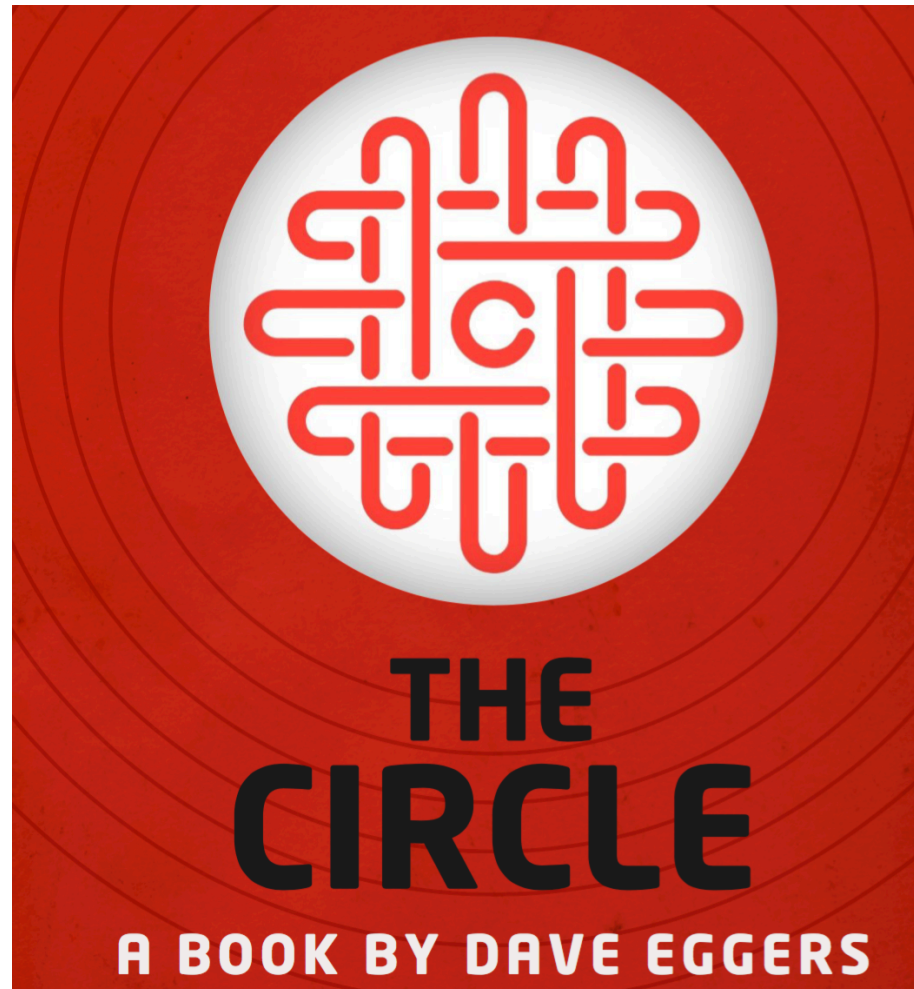
Clinical Genomics



Biobank



Social Media and Big Data ?



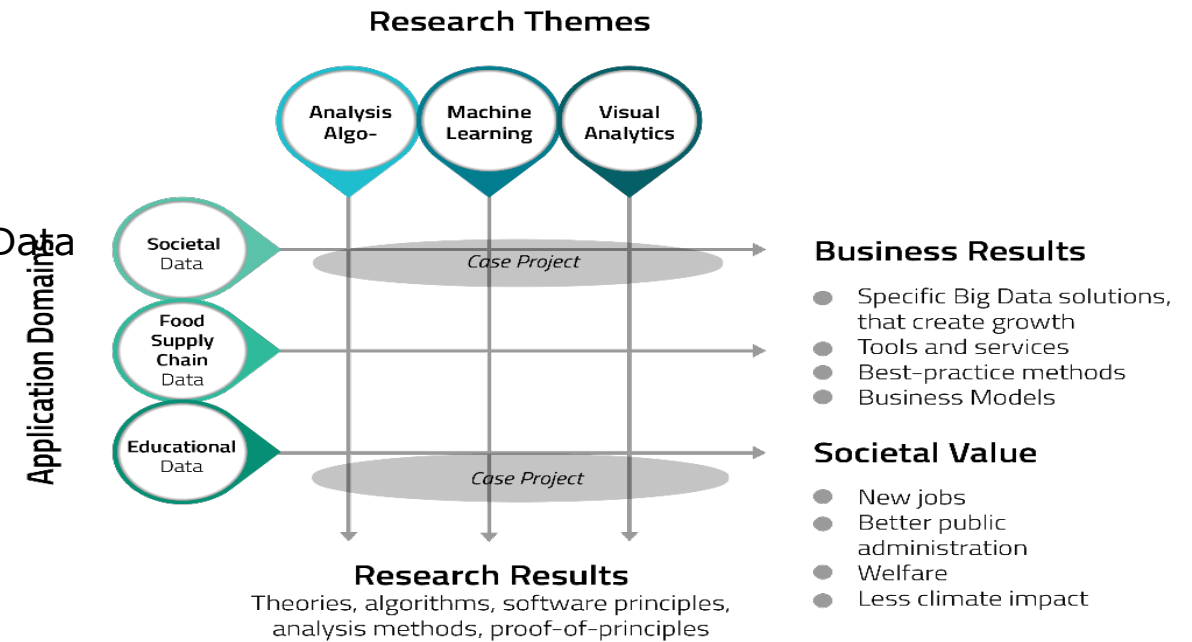
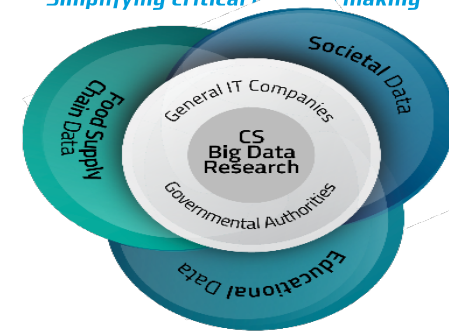


Danish Center for **Big Data Analytics** driven **Innovation**

DABAI

The aim of the DABAI is:

- To develop general technics and methods within:
 - Algorithms for data analysis,
 - Machine learning and
 - Interactive visual analysis.
- To deploy and verify the usability and potentials of Big Data Analysis within 3 application domains:
 - Social data
 - Food Supply Chain
 - Education



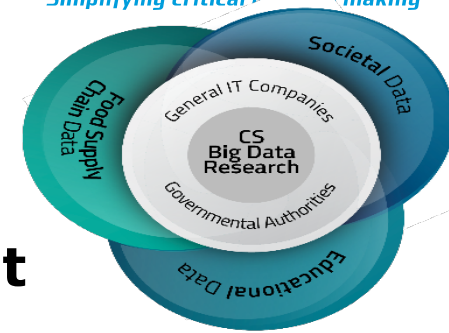
Participants:

- [Alexandra institute](#)
- [Copenhagen University](#)
- [DTU Technical University of Denmark](#)
- [Aarhus University](#)
- [Systematic](#)
- [VISMA Consulting](#)
- [BusinessMinds](#)
- [Danish Business Authority](#)
- [Central Denmark Region](#)
- [Danish Agency for Digitisation](#)



DABAI – within the Social data area

Use of Big Data analysis to gain more efficient and better patient flows within Healthcare



Background:

- Patient flows related to “complicated diagnosis” and “treatment of chronic diseases” are to be treated across multiple specialties and departments and cause coordination issues for healthcare providers.
- Approx. 75% of the total healthcare budget is spend on treatment of chronic diseases.

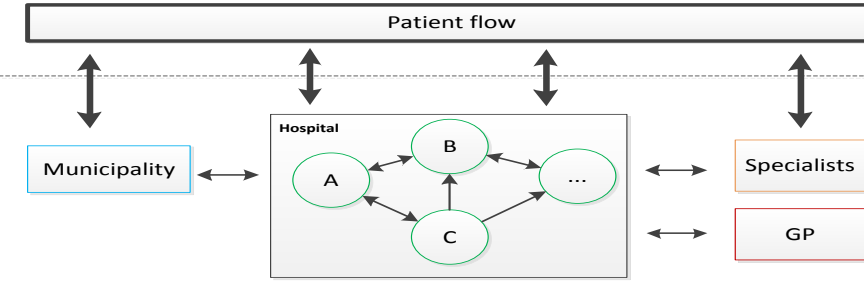


Figure 1 - Generic model of a healthcare system with patient flow and care providers interacting and consuming services. The arrows between the patient flow and the care providers illustrates that the patient flow is influenced by and depended on the providers and their interactions

Objective:

- To support enterprise wide optimization of the entire patient pathway.
- To provide enterprise-wide real-time cockpit of information and insight on both current capacity and the status of active pathways at a hospital.

Deployed Analytic tools:

- The tree research themes (Analysis algorithms, Machine Learning and Visual Analytics) with the focus of:
 - Real-time analysis of inefficiency of patient pathways
 - Identification and prediction of unforeseen bottlenecks and delays that eventually prolongs the pathway
 - Providing evidence based and enterprise wide optimization

Agenda

- The Danish Healthcare strategy and initiatives
- National Health Data - background and status
- Big Data in Denmark – today
- Big Data in the future
- **Big Data pre-requisites**

Some pre-requisites for the future Big Data vision

- Classifications – e.g. from symptom ICD10 to profile diagnose classification
- Standardization:
 - HL7
 - CDA
 - XDF
 - PHMR
- Strong program algorithms for analysis
- Ethical challenges
- Data security



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INNOVATING BETTER LIFE

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