

Cancer surveillance

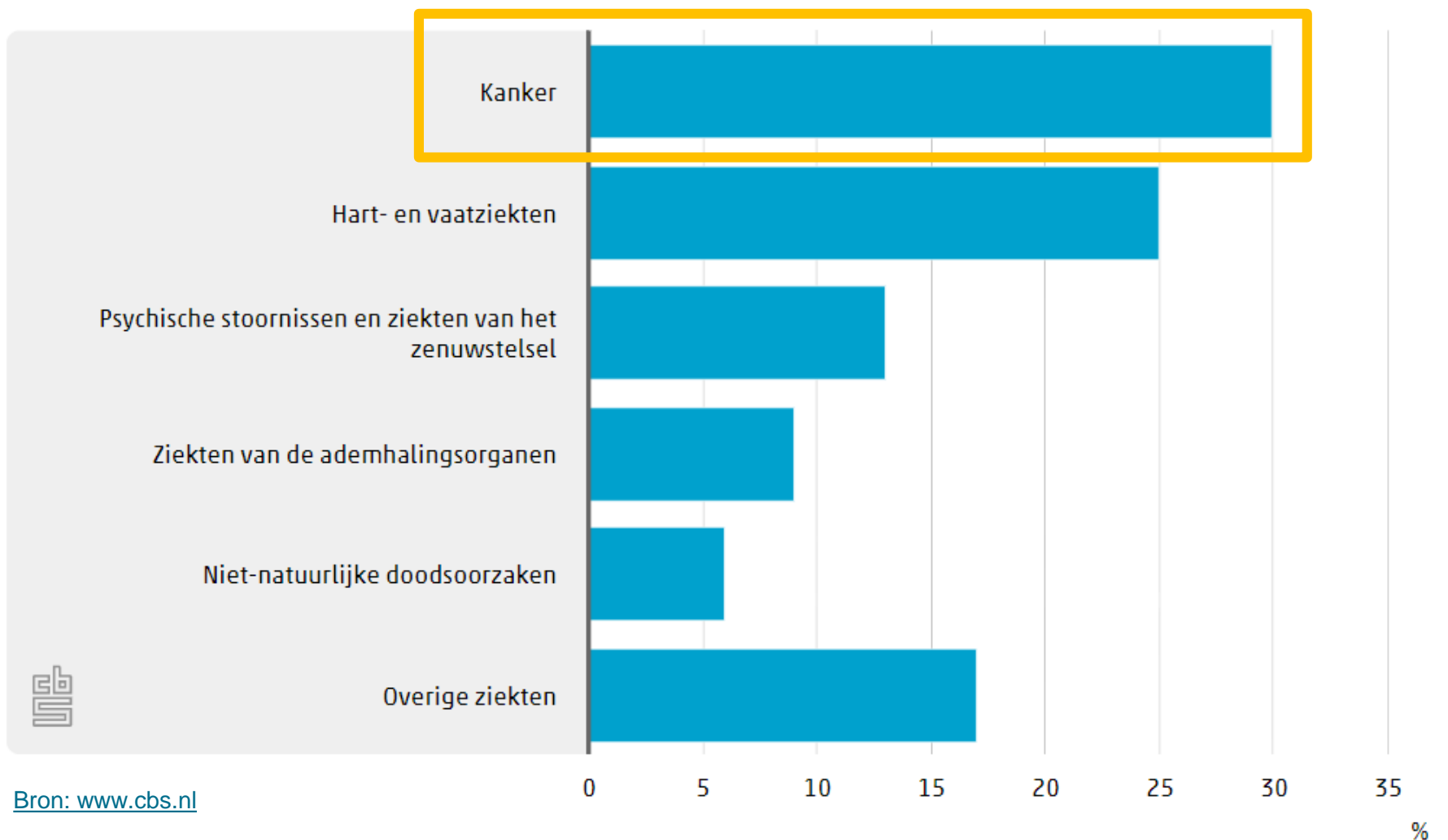
TU/e: big data & health meetings

- IKNL
- Cancer surveillance program
- Tooling
- Demo
- Projects

Cancer in 2018: cause of death

Doodsoorzaken, 2018

30%



Cancer in 2018



Incidence: 116.500

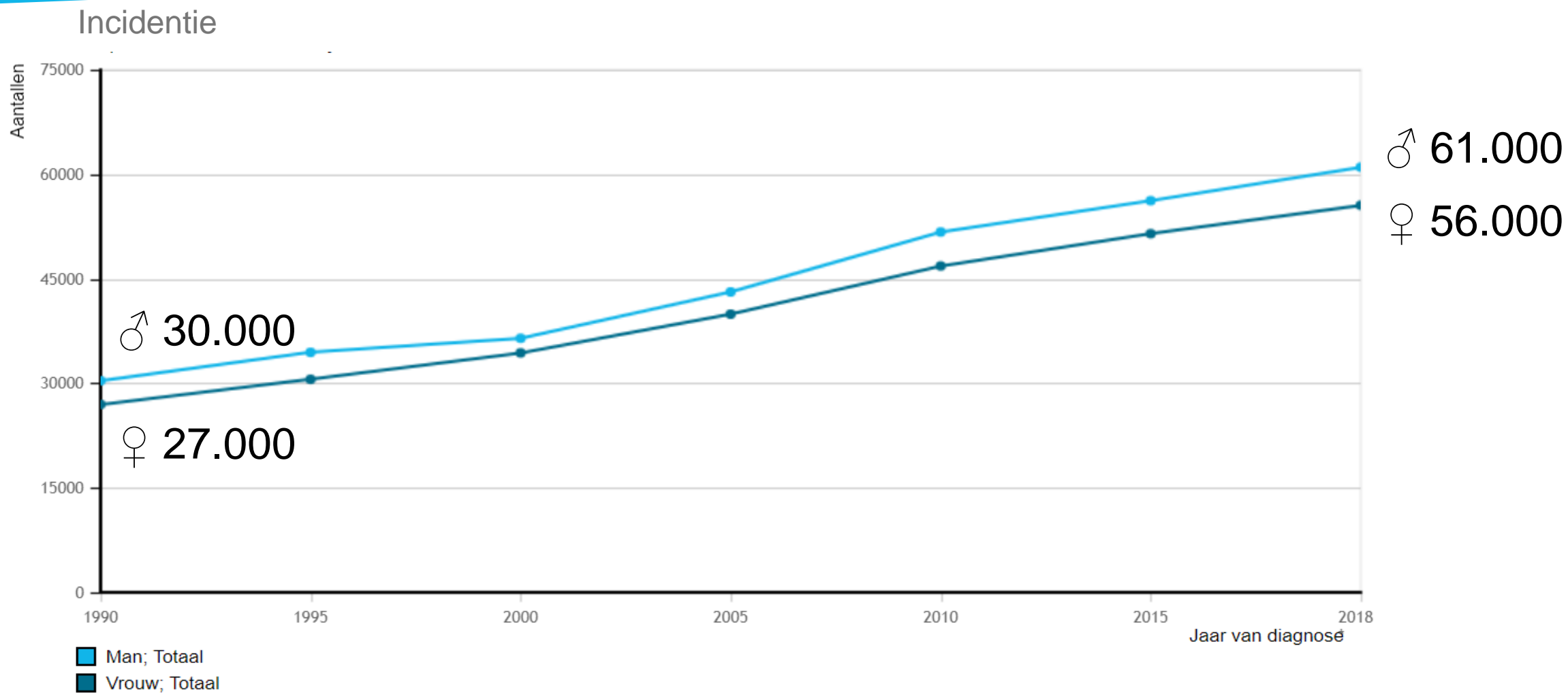
Prevalence: 800.000

5-yr survival: 64%

meest voorkomende kankersoorten in 2018



Cancer 1990-2018



- Independent knowledge institute
- Netherlands cancer registry (NCR)
- National coverage since 1989
- ~550 employees (500 FTE)
- Financing: 85% VWS, 15% subsidies



To reduce the
impact of cancer

mission

vision

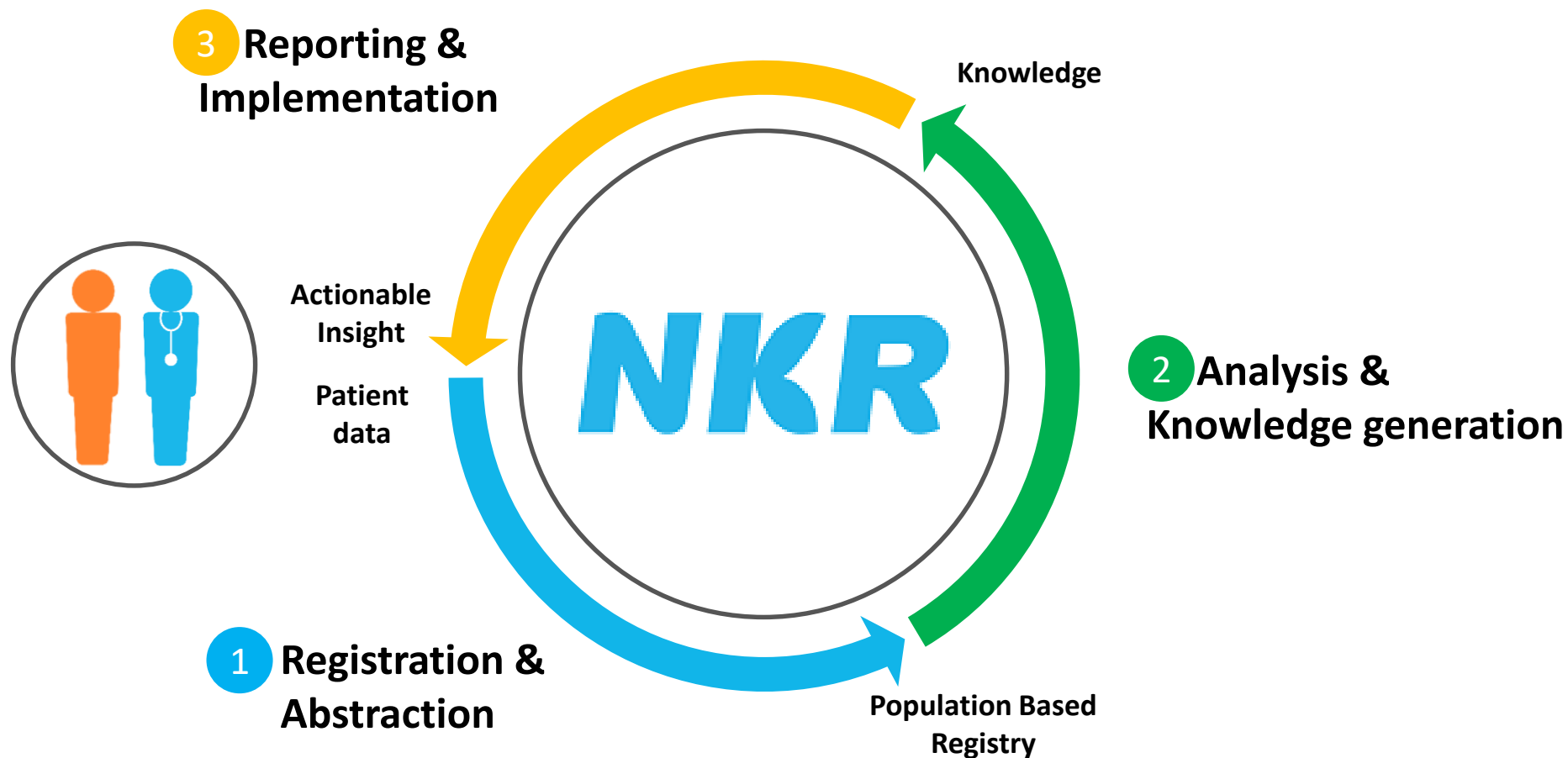
- Less cancer
- More cure or longer lives
- Better quality of life
- Improved societal participation
- Dying with dignity

values

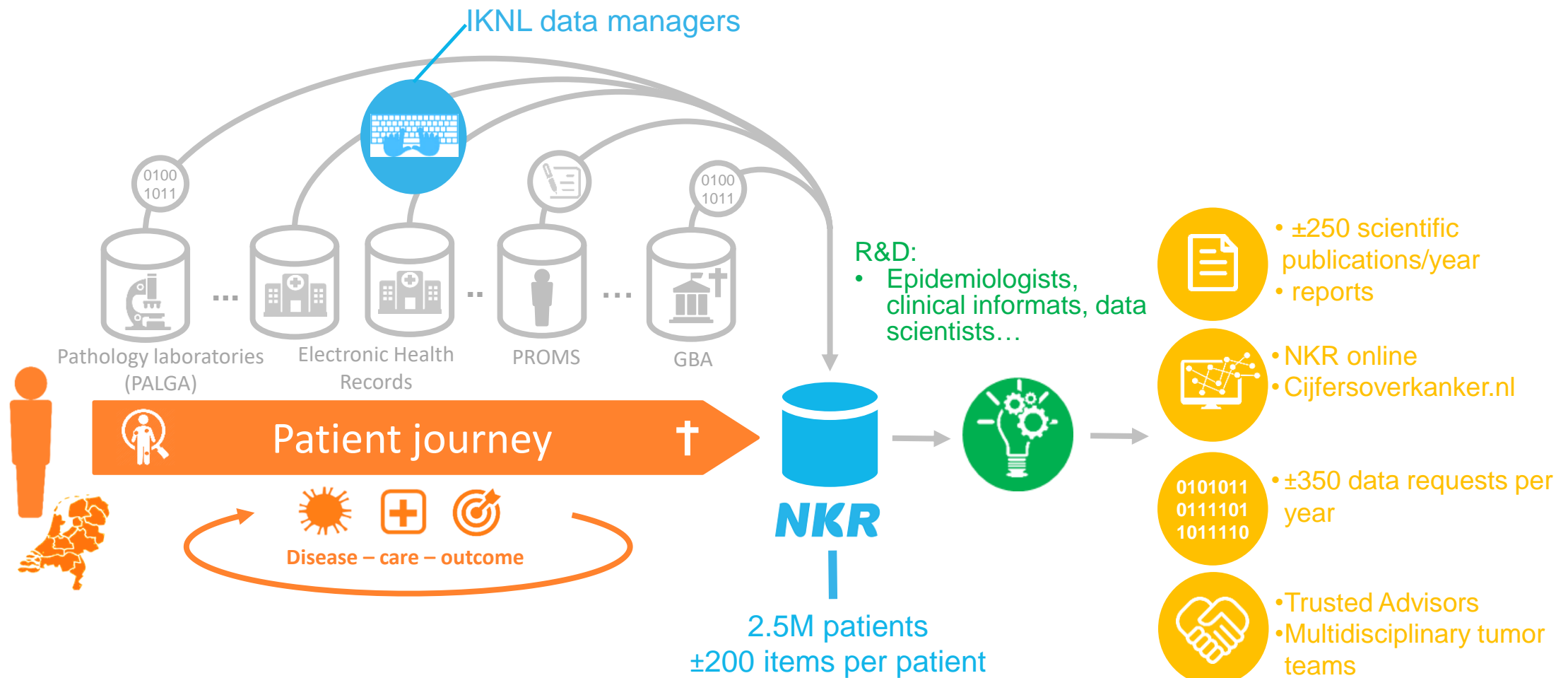
- Independent •
- Data driven and innovative •
- Resolute but flexible •
- Ambitious and humble •

Letting Data Live 

Core activities



Netherlands cancer registry



Netherlands comprehensive cancer organisation

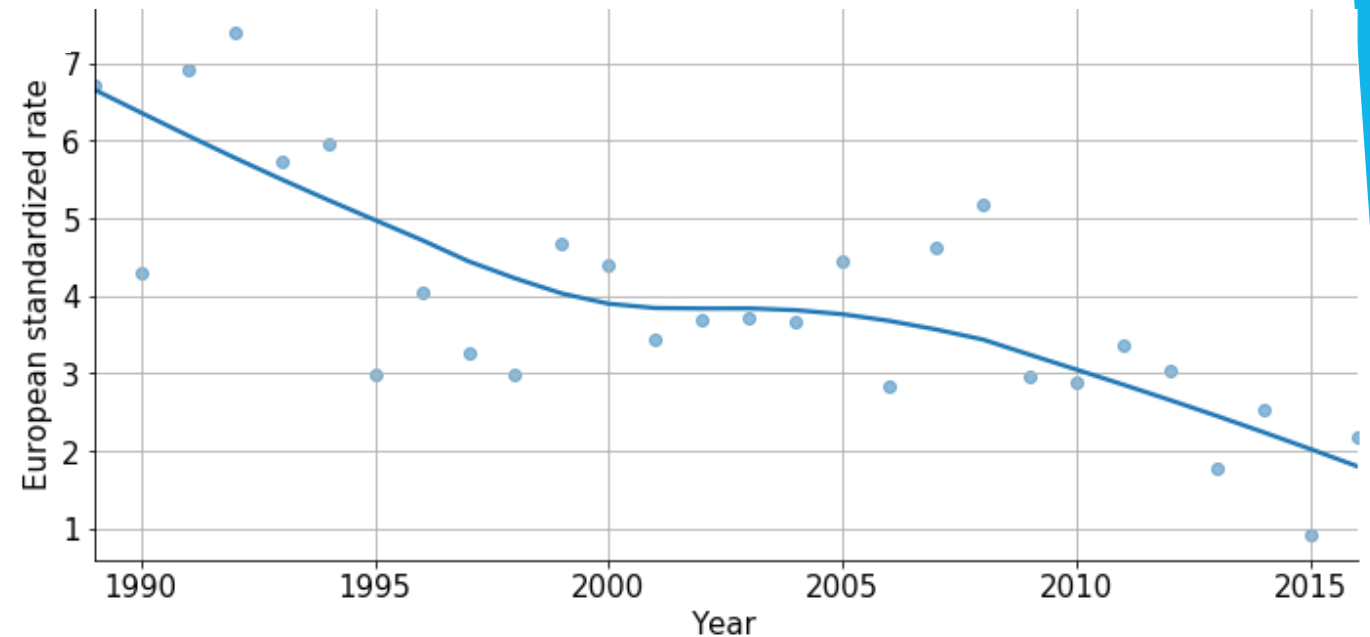


Cancer surveillance

Cancer population monitor based on the NCR

Mesothelioma incidence in a Dutch shipyard

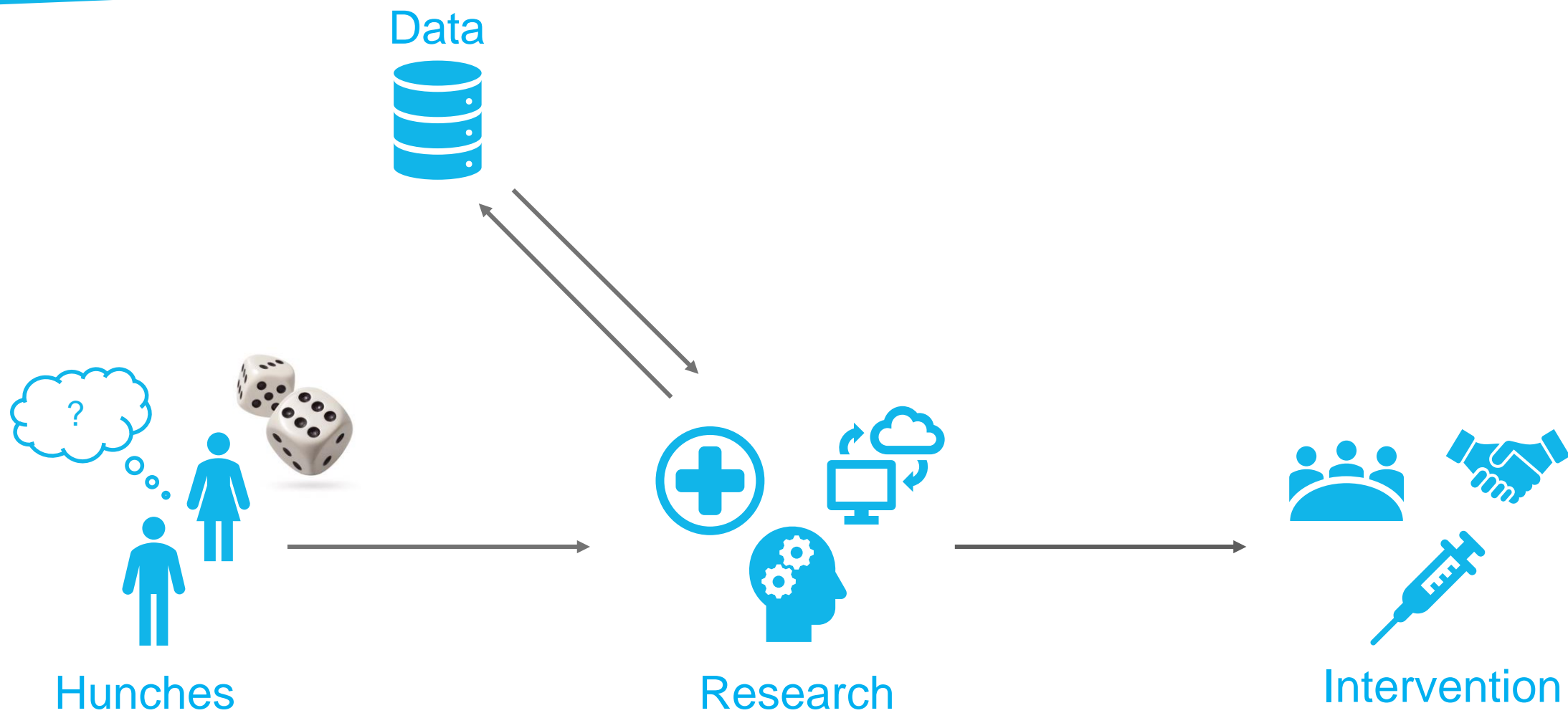
Stumphius J.



Mesothelioma - ESR – North Zeeland

Stumphius
saved lives!

Progress in cancer outcomes



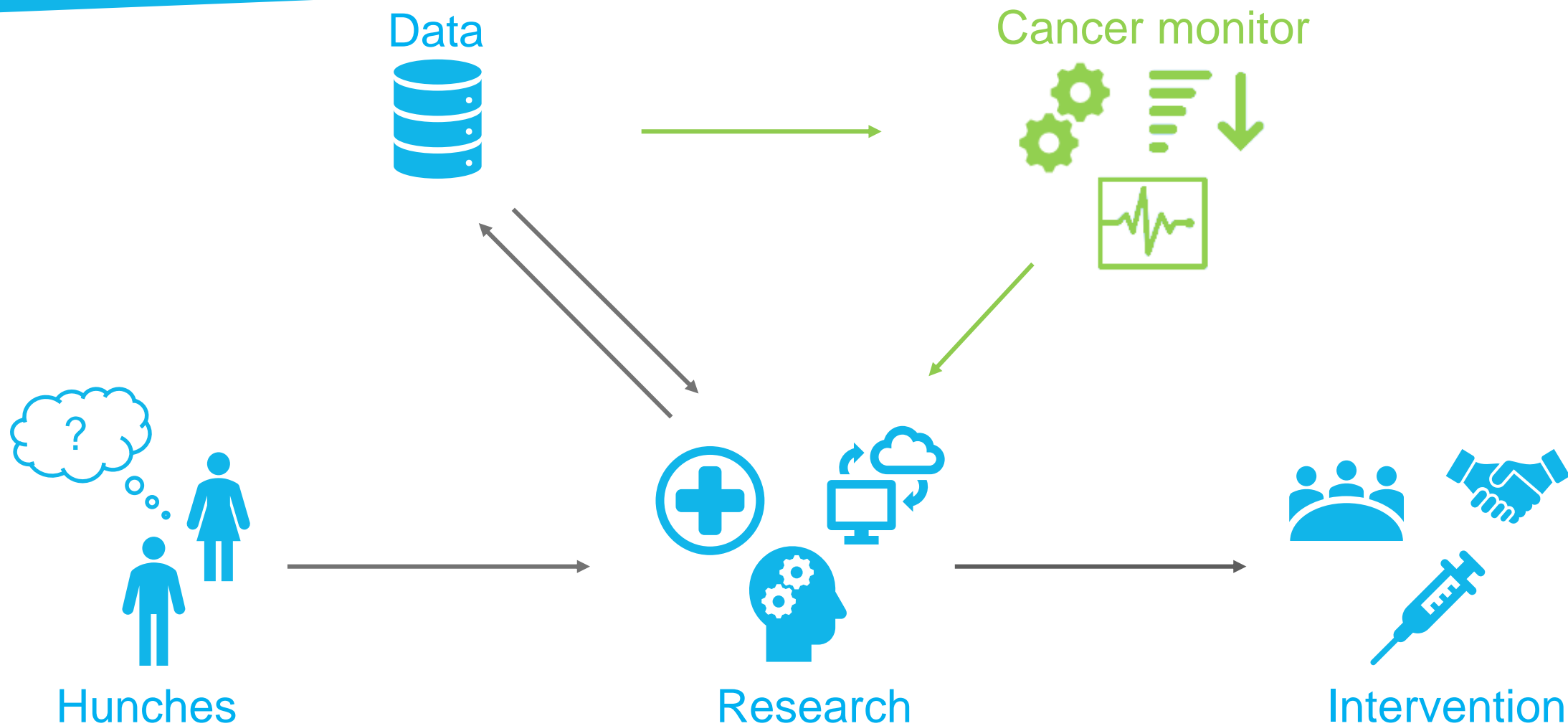
But...

- What if no-one has an insight?
- We have the **cancer registry (NCR)**
- Can we let the **NCR** speak?
- Don't have a **moral obligation** to do so?



0008393 IMMANUEL KANT (1724-1804).
Credit: The Granger Collection, New York

Cancer surveillance program



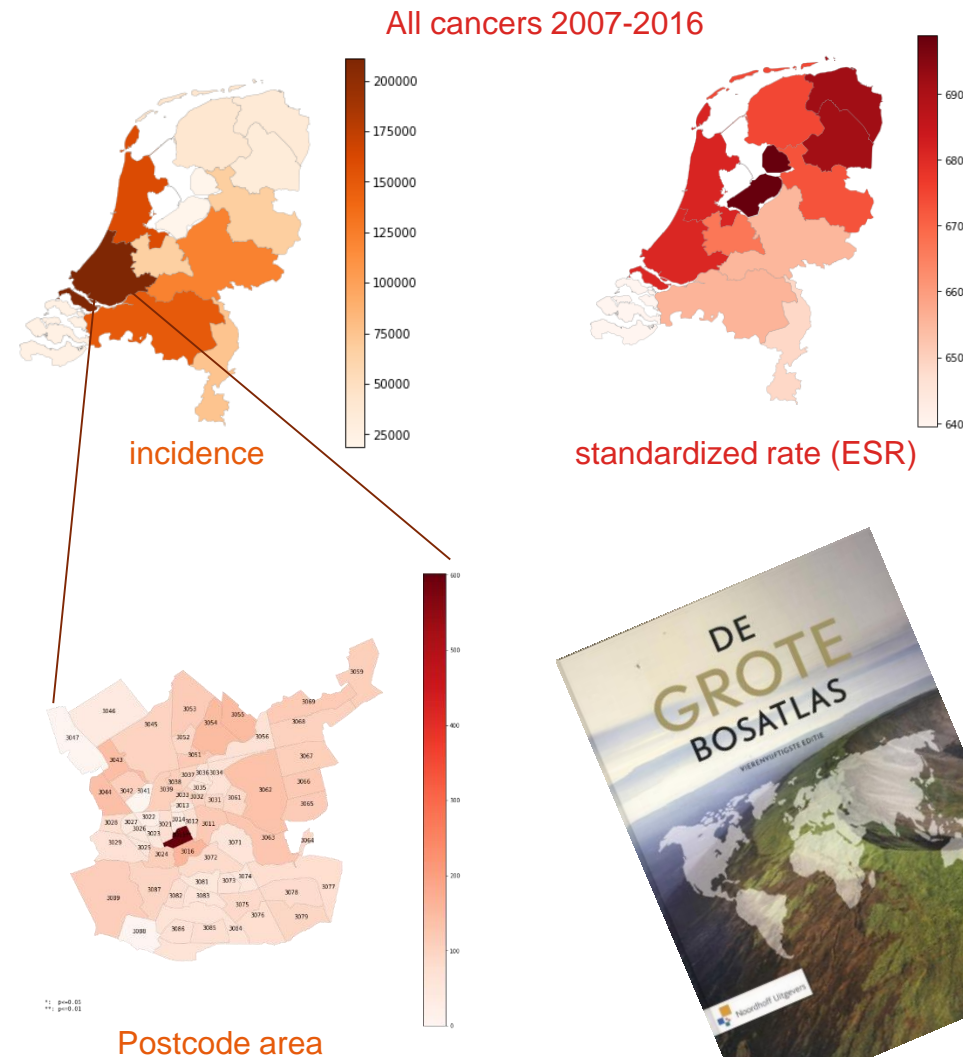
Cancer monitor: a net of analyses

Statistics:

- Incidence
- Survival
- Care variation
- ...

Dimensions

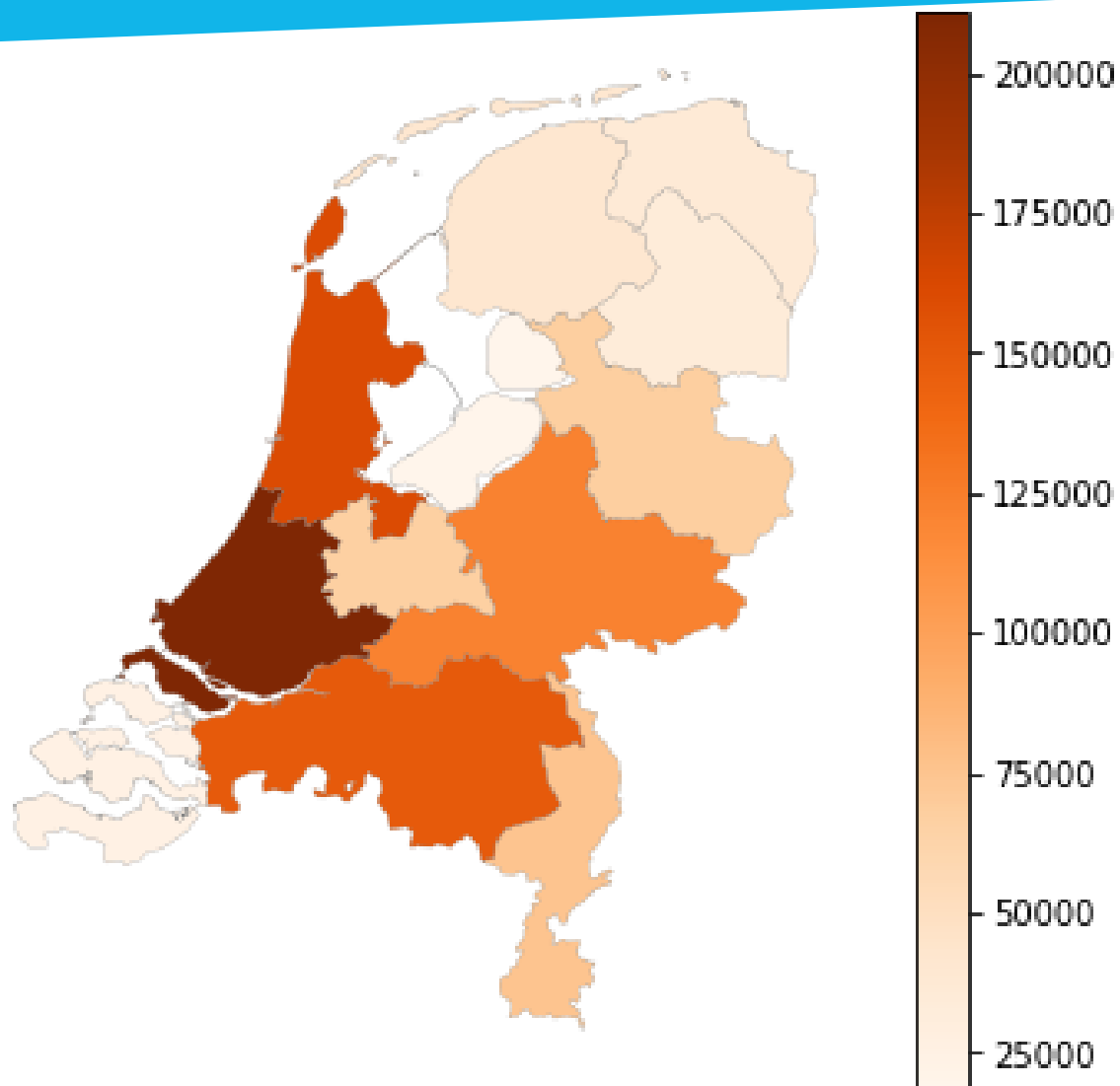
- Regions
- Hospital
- Patient groups
- ...



Geographical analysis 2007-2016

Where are most new cancer cases?

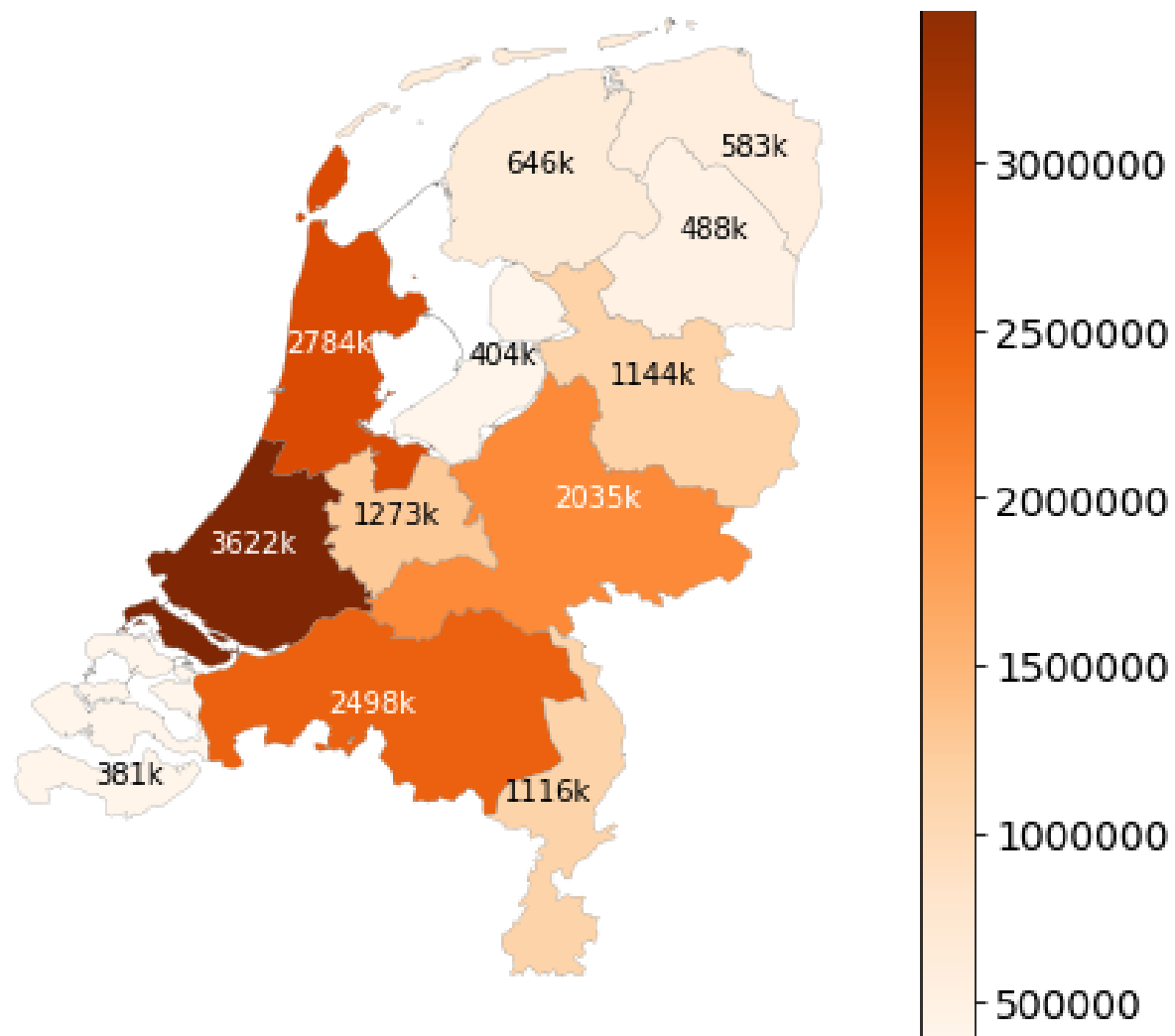
All cancers - incidence



Statistic: incidence

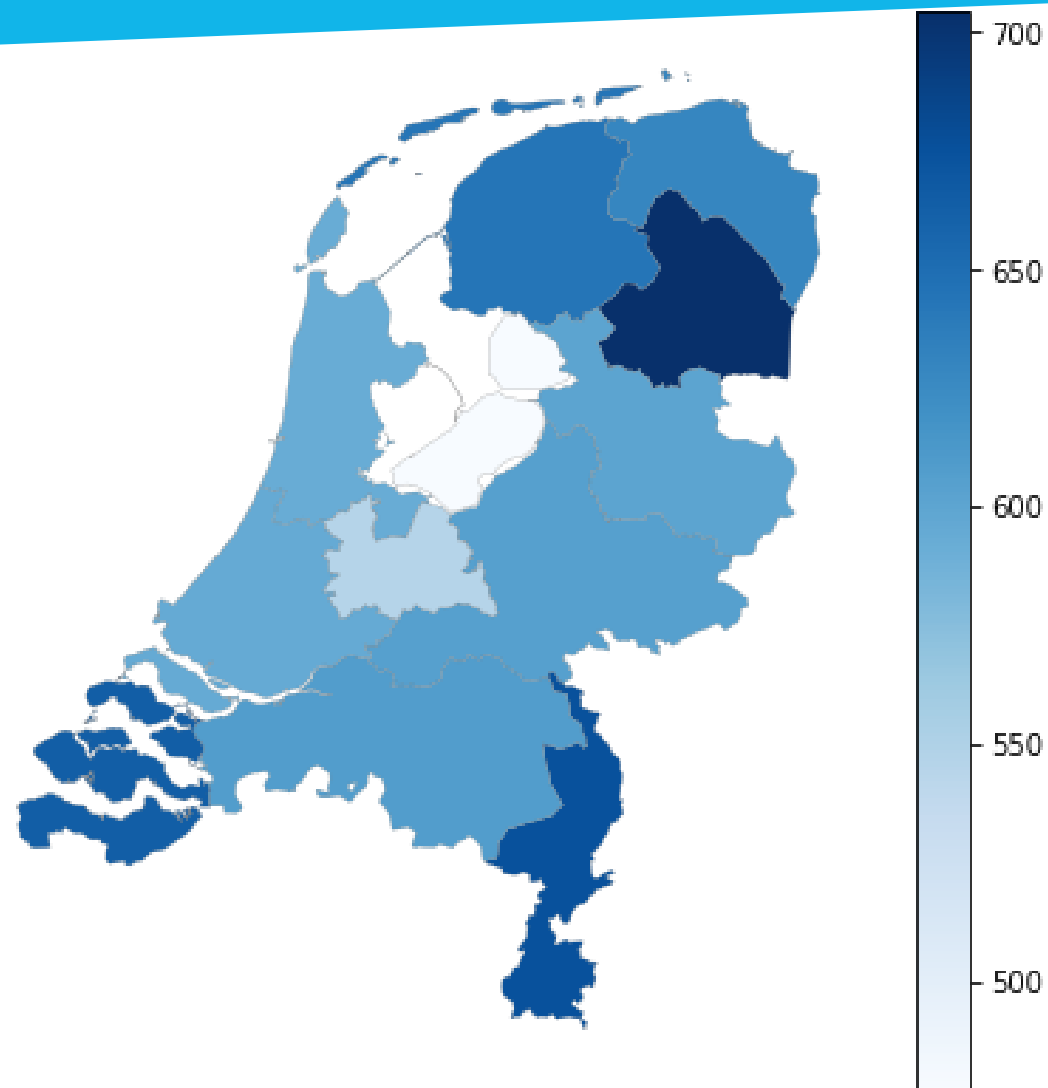
Dimensions: province

Population - 2016



Where are **relatively** most new cancer cases?

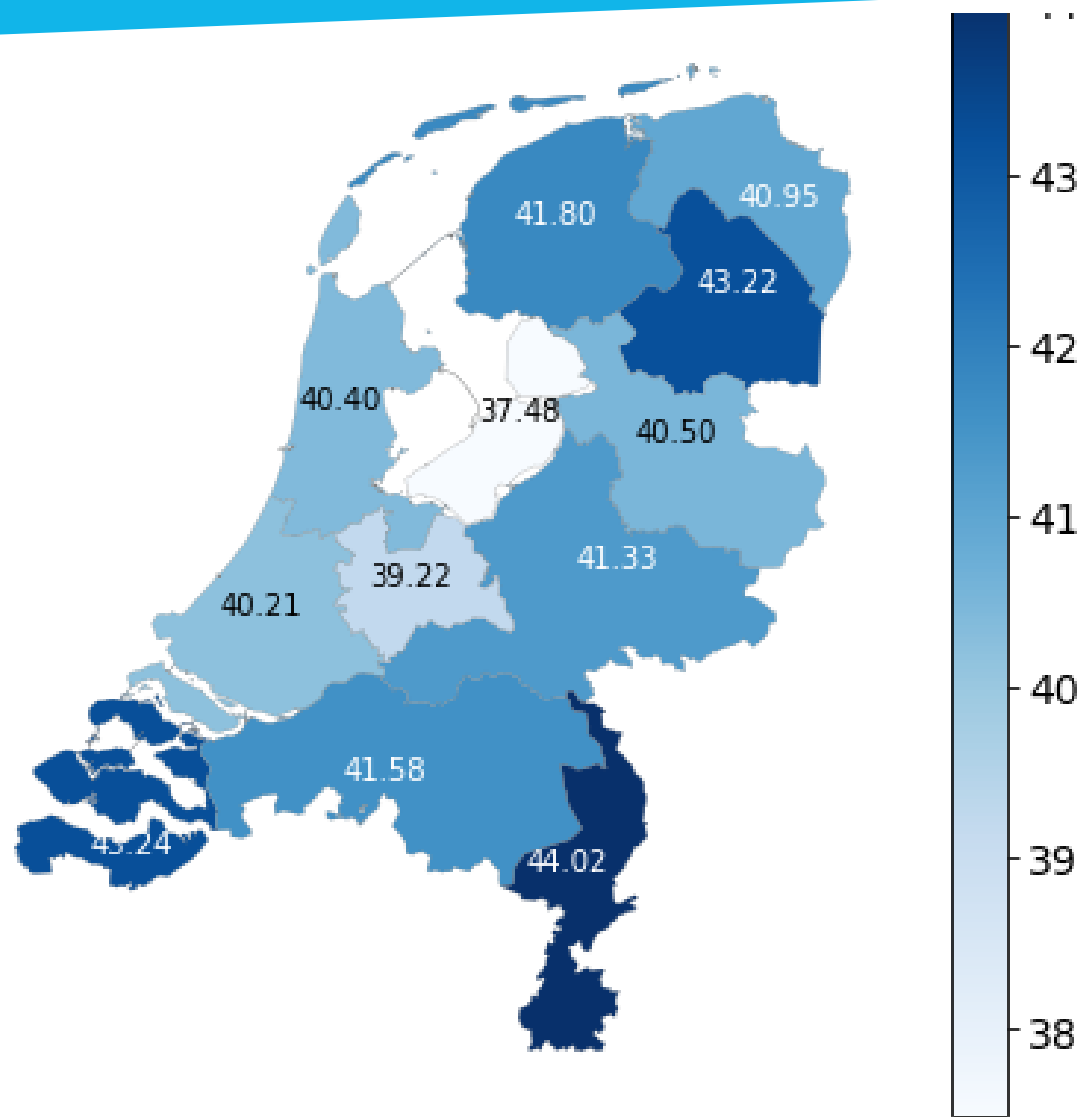
All cancers – crude rate (cases/100.000 people)



Statistic: crude rate

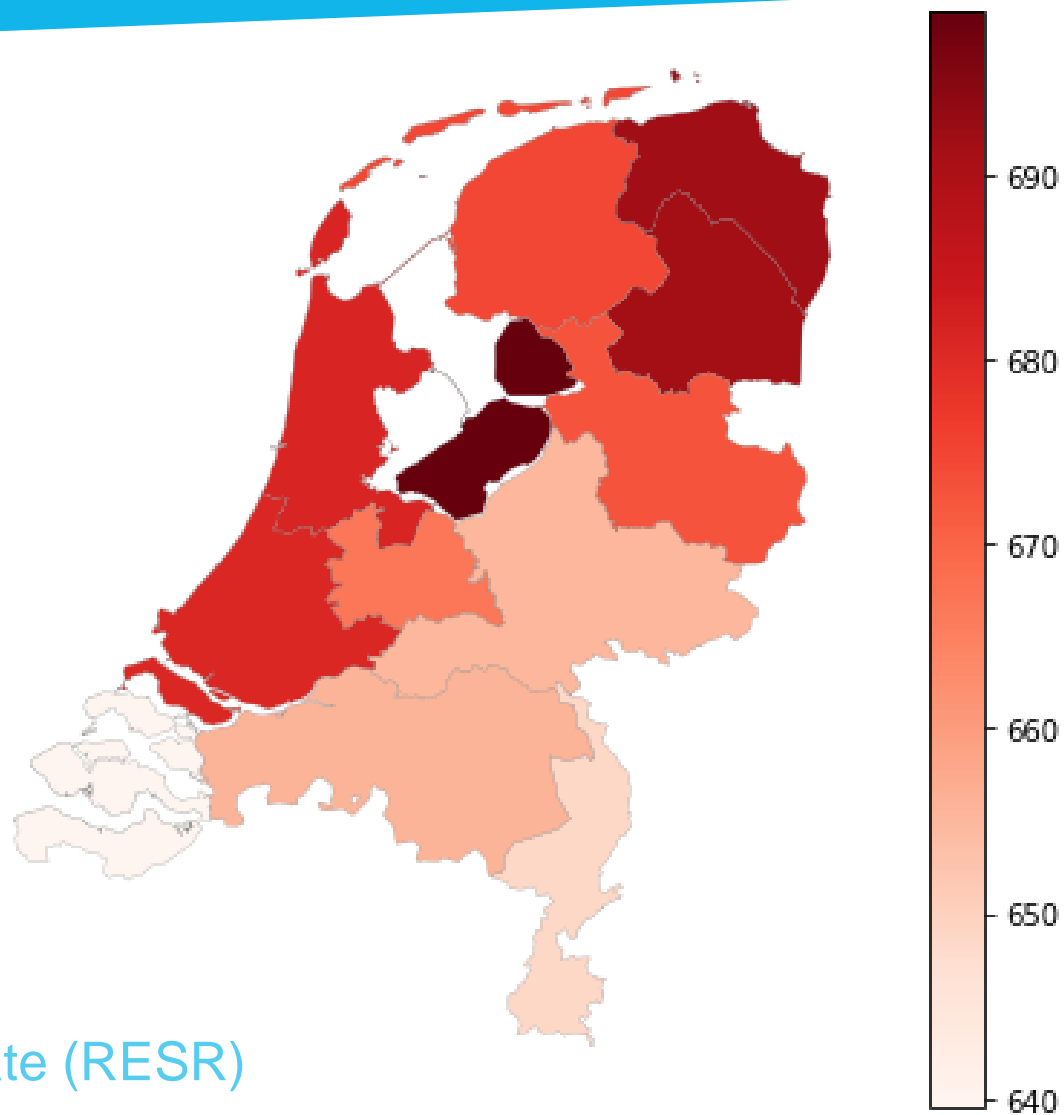
Dimensions: province

Average age - 2016



And if we **standardize** for age?

All cancers – European standardized rate (RESR, 2013)



Statistic: standardized rate (RESR)

Dimensions: province

Finding surprising insights across tumors & regions 2007-2016

Finding surprising facts

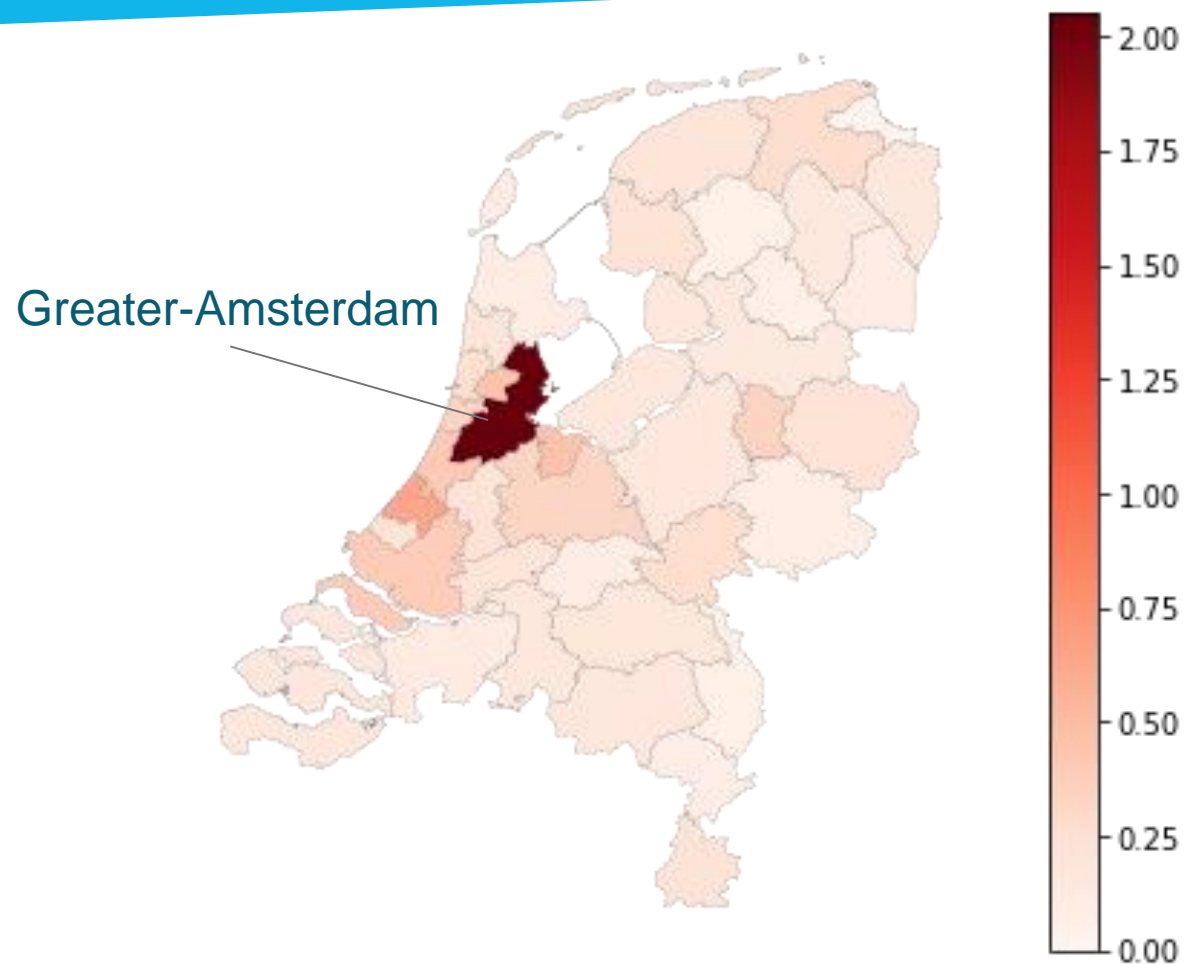
Net:

- Alle tumor types (~300)
- 40 COROP region's

Cause: Human herpesvirus (HHV8)
Risk factor: HIV

Regio	diff_norm	Incidence	tumorsoort
?	3.496993	746.0	51 Kaposi sarcoma
Overig Zeeland	2.253364	60.0	Mesothelium van het peritoneum
Achterhoek	2.161902	196.0	19 Spijsverteringsorganen, niet nader omschreven
Arnhem/Nijmegen	2.133622	317.0	19 Spijsverteringsorganen, niet nader omschreven

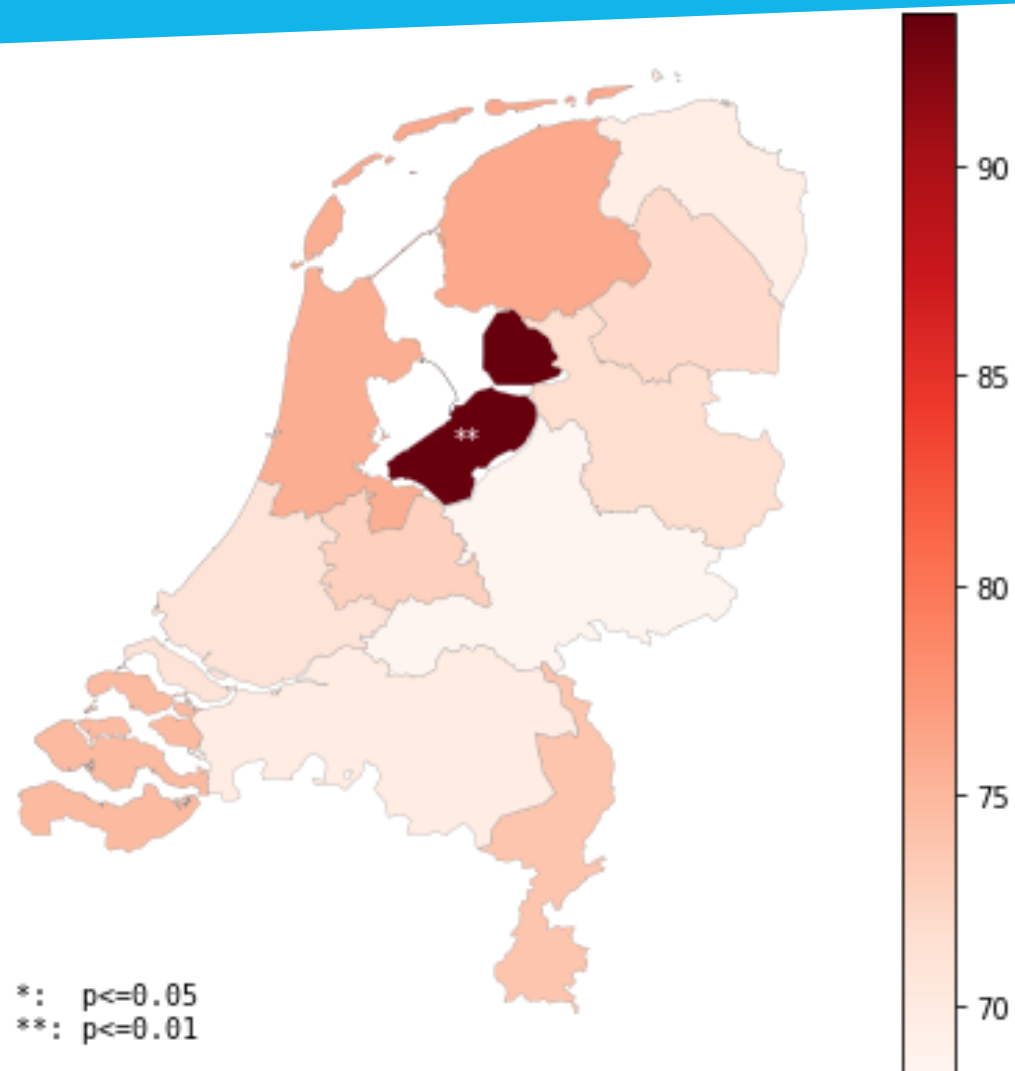
Kaposi sarcoma



Kaposi sarcoma (1989-2016)
ESR (1976) – NKR 1989-2018

omschrijving	Regio	Incidence	diff_standardized
Prostaatcarcinoom	Flevoland	2330.0	3.010453
Kaposi sarcoma	Noord-Holland	168.0	2.995154

Prostate carcinoma in Flevoland

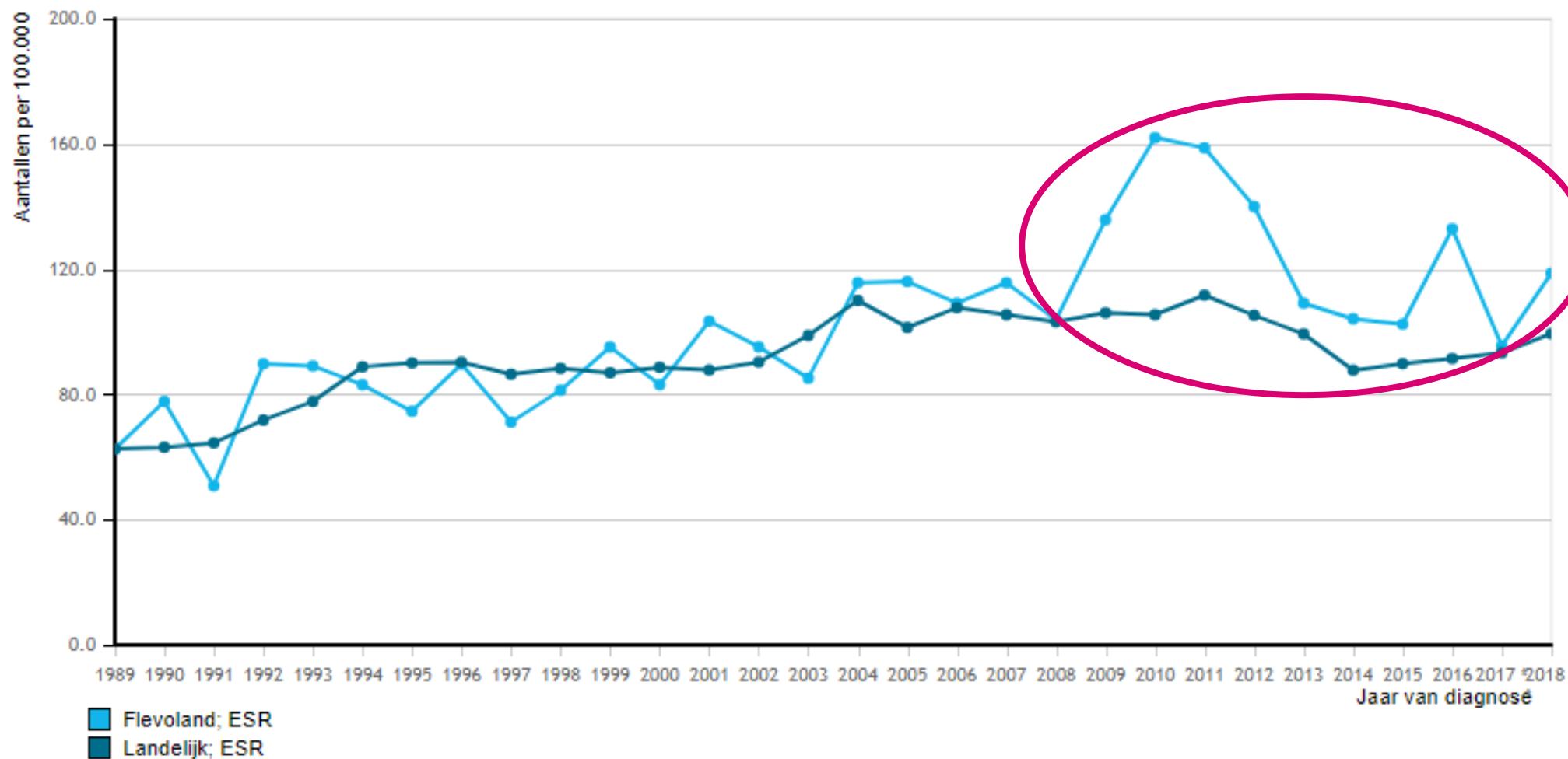


Statistic: standardized rate

Dimension: province

Prostate carcinoma

Incidentie | Prostaat; Man; Invasief



Cluster analysis

Cancer cluster analysis (guideline 2012)



Receives signals from worried citizens and doctors
(+/- 40 per year) → communication



Provides data from the Netherlands Cancer Registry



Rijksinstituut voor Volksgezondheid
en Milieu
Ministerie van Volksgezondheid,
Welzijn en Sport

Can investigate further, e.g. environmental links

Reactive

	A	B	C	D	E	F	G	H	I
1	Info berekening								
2	Locatie:					Bereken verwachte incidentie			
3	Ref. nummer:								
4	Berekende periode:		10 jaar						
5									
6									
7						Verwachte aantal op basis van landelijke incidentie in 10 jaar tijd			
8	Periode		Kankersoort					ondergrens	bovengrens
9	(1989 tot 2010)								
10	vanaf	t/m				Mannen		7	21
11	2001	2010	Luchtpijp & Long			Vrouwen		2	12
12							Mannen+vrouwen	11	29
13	Aantal inwoners in gebied								
14	Leeftijd	Mannen	Vrouwen	Totaal					
15	0-4	60,95238	59,28571	120,238095		Betrouwbaarheidsinterval		95	
16	5-9 jr	64,04762	65,47619	129,52381					
17	10-14jr	66,42857	62,14286	128,571429					
18	15-19	63,57143	55,47619	119,047619					
19	20-24	48,80952	43,57143	92,3809524					
20	25-29	50,71429	48,09524	98,8095238					
21	30-34	62,14286	63,33333	125,47619		Aantekeningen			
22	35-39	76,19048	76,42857	152,619048					
23	40-44	85,47619	83,80952	169,285714					

- Population by age group from CBS
- Crude rate by age group from cijfersoverkanker.nl

Expected incidence

Incidentie | Mesotheliom; Landelijk; Man & Vrouw; Invasief

		GEDRAG Invasief																			
		GESLACHT Man & Vrouw																			
		REGIO Landelijk																			
TUMOR	PERIODE	UITKOMSTMAAT																			
		0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95+
Mesotheliom	2012	0,00	0,00	0,00	0,00	0,00	0,20	0,20	0,19	0,16	0,00	1,63	3,51	6,49	10,33	15,35	27,16	21,80	15,82	7,73	0,00
Mesotheliom	2013	0,00	0,00	0,00	0,10	0,00	0,00	0,00	0,00	0,00	0,23	1,04	2,49	6,77	8,57	16,58	24,77	27,56	21,84	10,88	0,00
Mesotheliom	2014	0,00	0,00	0,00	0,00	0,00	0,00	0,20	0,20	0,25	0,77	0,95	1,40	4,78	9,76	14,67	29,24	26,15	13,13	7,47	16,33
Mesotheliom	2015	0,00	0,00	0,00	0,10	0,00	0,09	0,00	0,10	0,26	0,23	0,94	1,81	3,91	10,64	15,74	23,25	25,88	20,41	11,73	2,86
Mesotheliom	2016	0,00	0,00	0,00	0,00	0,00	0,09	0,00	0,10	0,18	0,16	1,09	1,52	5,48	10,34	16,25	23,30	28,06	23,53	5,83	32,24

- Incidence from IKNL (data request)

Poisson(incidence, expected)
→ P-value

- Which **tumor** – **PC4** combinations are potential cluster candidates in the period **2008-2017**?

	description
PC4	Medullair schildklier carcinoom
	B-ALL, niet ander omschreven
	Dermatofibrosarcoom
	Kaposi sarcoma
	Kaposi sarcoma

- Hereditary condition Multiple endocrine neoplasia type 2 (**MEN2**)
- “If a child inherits the mutated *RET* gene from an affected parent, there is almost a **100%** chance of developing medullary thyroid cancer”
- Patient's turned out to be **family members**

Cancer surveillance program (2019)



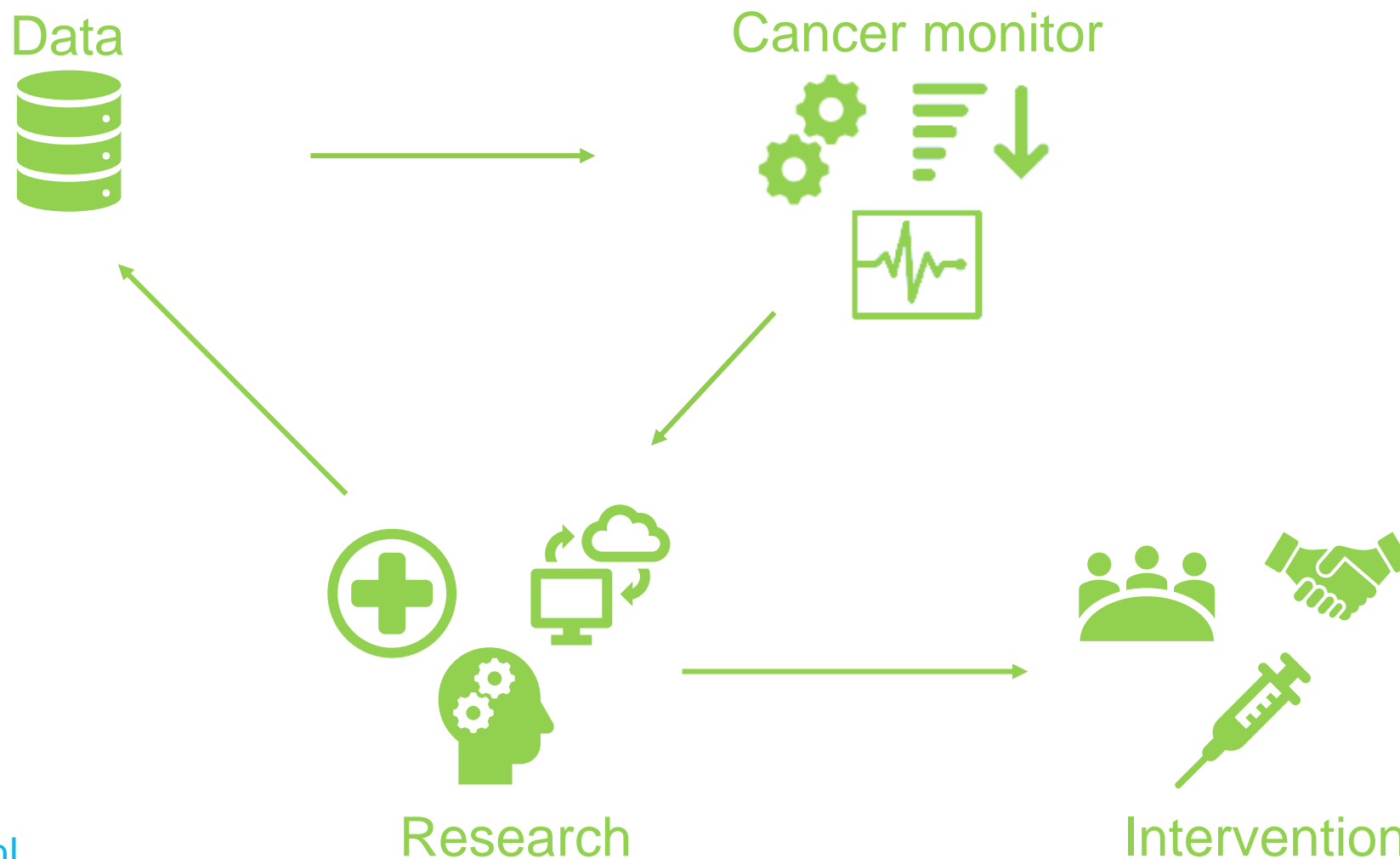
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Welzijn en Sport



iKNL integraal
kankercentrum
Nederland

Proactive

Summary cancer surveillance program



Contact:
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Cancer surveillance

Tooling

An interactive explorer for the Netherlands Cancer Registry

Explorer Monitor Cluster 

Tumor type:

prost

702000 Prostaat

Region:

Province

Statistic:

SIR

Period: 2006 .. 2017

Gender:

Both

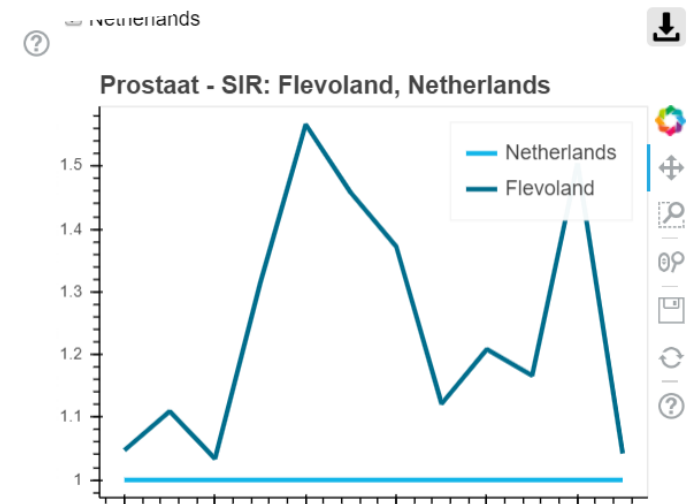
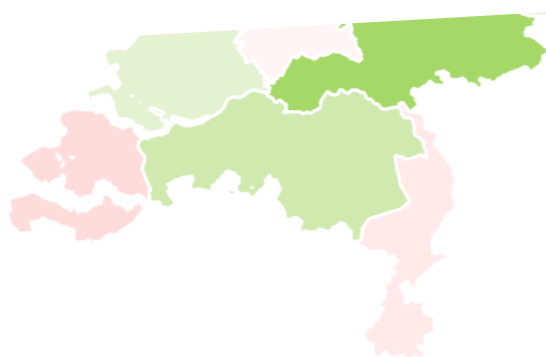
Age: 0 .. 95

Update

Prostaat - SIR - 2006-2017

Demo!

#	Regio	SIR
0	Groningen	0.957
	Friesland	1.067
	Drenthe	1.012
	Overijssel	0.982
	Flevoland	1.244
	Utrecht	0.935
	Limburg	1.004
	North-Holland	1.047
	South-Holland	0.975



- NCR in datawarehouse
- Back-end:
 - Python: pandas, geopandas, scipy, ...
 - Object-oriented setup (statistics, regions, tumor classifications)
- Front-end:
 - Bokeh
 - JavaScript/jquery/CSS/HTML

Welcome to Bokeh

Bokeh is an interactive visualization library that targets modern web browsers for presentation. Its goal is to provide elegant, concise construction of versatile graphics, and to extend this capability with high-performance interactivity over very large or streaming datasets. Bokeh can help anyone who would like to quickly and easily create interactive plots, dashboards, and data applications.

To get started using Bokeh to make your visualizations, start with the [User Guide](#).

For examples of how you might use Bokeh with your own data, check out the [Gallery](#).

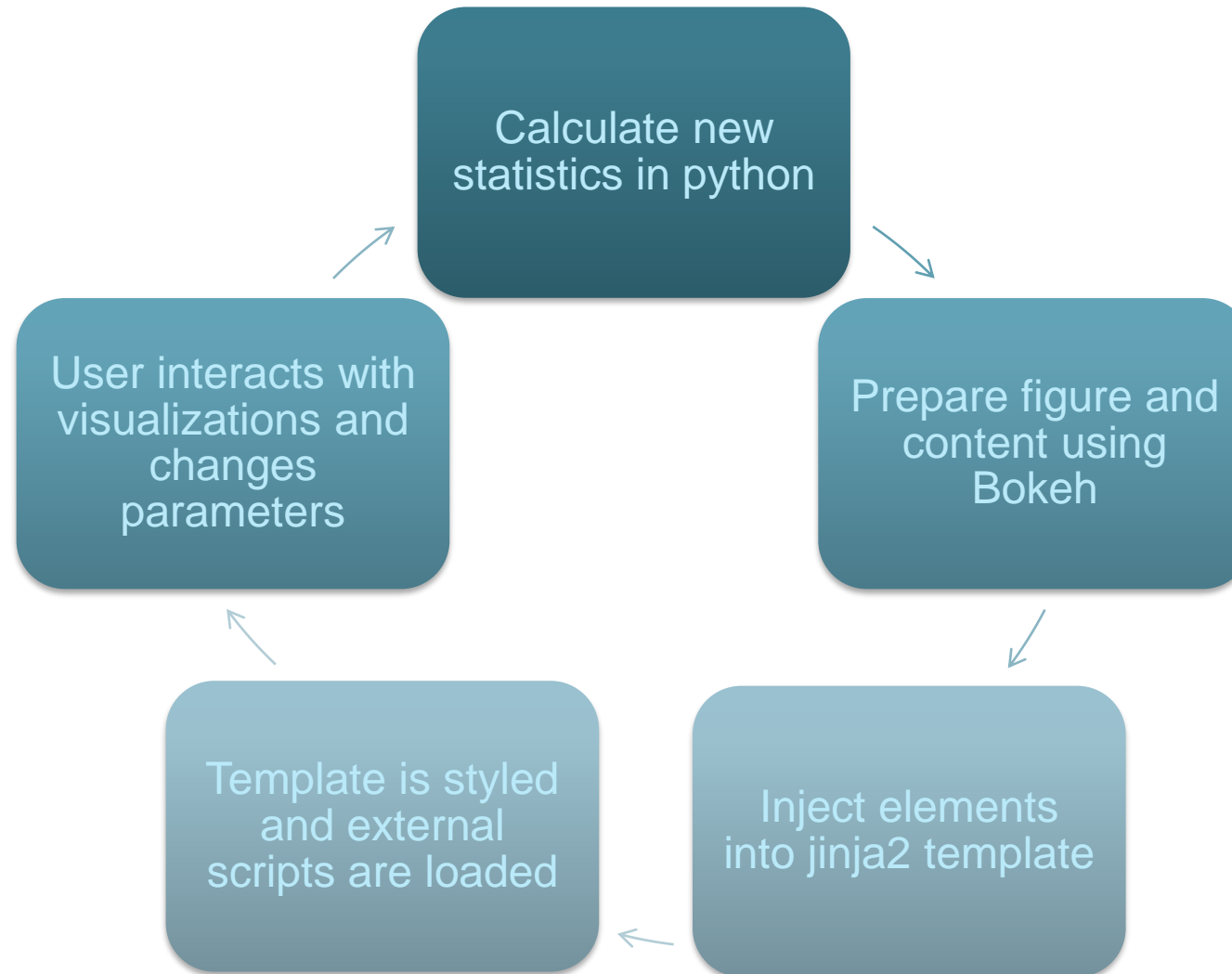
For detailed information about specific Bokeh components, consult the [Reference Guide](#).

If you are interested in contributing to Bokeh, or extending the library, see the [Developer Guide](#).



- Package for **Python**
- Visualization library focused on **interactivity**
- Embedding using jinja2 package
- Fast prototyping using Bokeh server
- **But...**
 - Small userbase, but active developers
 - Reference material is minimal
 - Steep learning curve

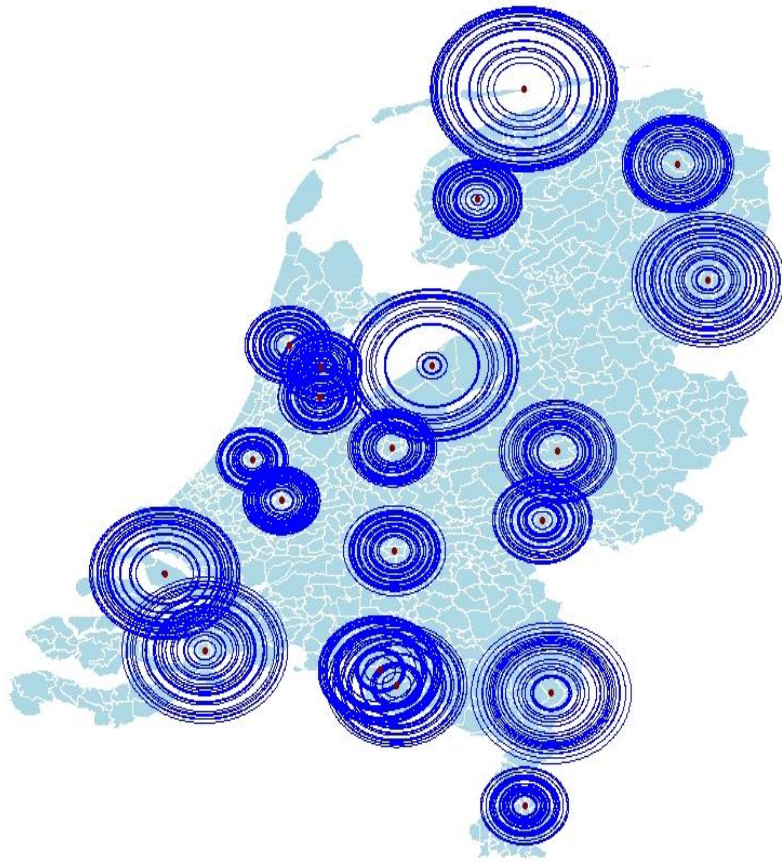
The circle of life



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Cancer surveillance

Current activities



For each circle.

- Obtain **actual** and **expected number** of cases inside and outside the circle and calculate the **Likelihood**

Compare Circles:

- Pick circle with highest likelihood function as **Most Likely Cluster**

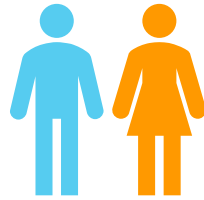
- Cluster detection irrespectively of **administrative boundaries**, and without assumptions about **cluster size or location**
- Adjusts for **multiple testing**



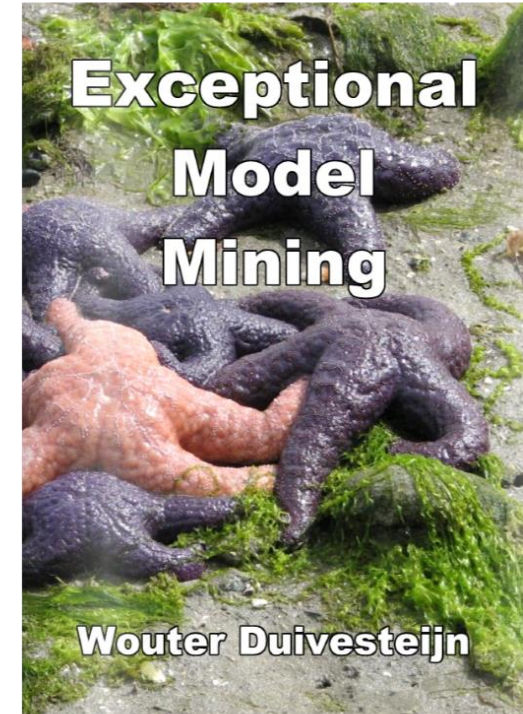
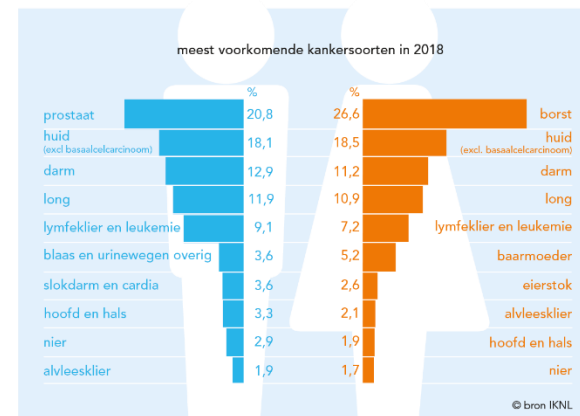
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Local pattern detection from cancer registry data: a descriptive approach

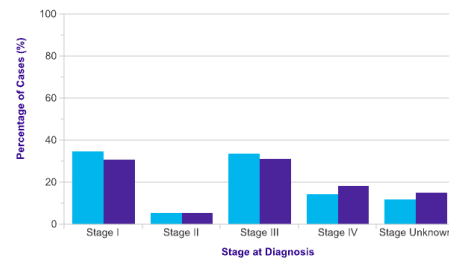
Target Attributes



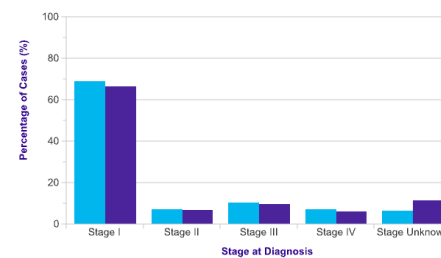
Model = target concept =
incidence distribution



Interestingness (mock data)



Overall Population*



Lateralization left, < 25yo, Noord-Brabant*



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Other activities



**Time
patterns**



Prognosis



**Data
portal**

**Interactive
dashboard**



Care



**Knowledge
system**



Help is needed!

We welcome collaborations and interns!

Summary cancer surveillance program

Data



Cancer monitor



Thank you for your attention!



Research



Intervention



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