Universität Bielefeld
Fakultät für Gesundheitswissenschaften

Landesinstitut für
Gesundheit und Arbeit
des Landes Nordrhein-Westfalen

Burden of Disease in North Rhine-Westphalia (BoD in NRW), part 1

Quantifying the health impacts of policies - principles, methods, and models
Düsseldorf, March, 16 – 17, 2010

C. Terschüren

19.04.2010

Key questions:

Effects of demografic change in NRW

- which effect has the demographic change in North Rhine – Westphalia on the burden of disease?
- 2025: which diseases are contributing which proportion to burden of disease, resulting in needs in terms of health care?

Demografic change in NRW cont.

Characteristics:

- decrease in population : approx. -2.5% until 2025

- life expectancy in 2025: increased by 2 years

male newborns:	75.8 years (2004)	→	78.3 (2025)
female newborns:	81.3 years (2004)	→	83.5 (2025)

Source: population forecast. LDS NRW

	2004		2025		2025 vs 2004	
Age group	male	female	male	female	male	female
0	80952	76868	77110	73068	95%	95%
1-4	343768	326502	314552	298985	92%	92%
5-9	478086	454815	394200	375131	82%	82%
10-14	523088	496979	388647	369965	74%	74%
15-19	527095	503422	402602	385325	76%	77%
20-24	516247	508415	461316	459973	89%	90%
25-29	507824	505354	540502	541166	106%	107%
30-34	582337	573735	584655	587843	100%	102%
35-39	781410	752688	568939	580810	73%	77%
40-44	782147	754707	527277	546083	67%	72%
45-49	679704	667361	487080	512604	72%	77%
50-54	587953	600430	545798	566557	93%	94%
55-59	488125	496806	721319	726561	148%	146%
60-64	534125	[illegible]	691495	707323	129%	127%
65-69	536944	[illegible]	[illegible]	602[illegible]	[illegible]	102%
70-74	368254	[illegible]	[illegible]	514[illegible]	[illegible]	116%
75-79	[illegible]	[illegible]	[illegible]	391142	114%	96%
80-84	[illegible]	[illegible]	[illegible]	[illegible]	188%	114%
85+	71799	229780	[illegible]	[illegible]	365%	199%
total	8 803 255	9 272 097	8 540 989	9 067 031	97%	98%

-2.5%

- 467 332

18.075.352

17.608.020

Source: based on LDS data. LIGA.NRw / Uni Bielefeld)

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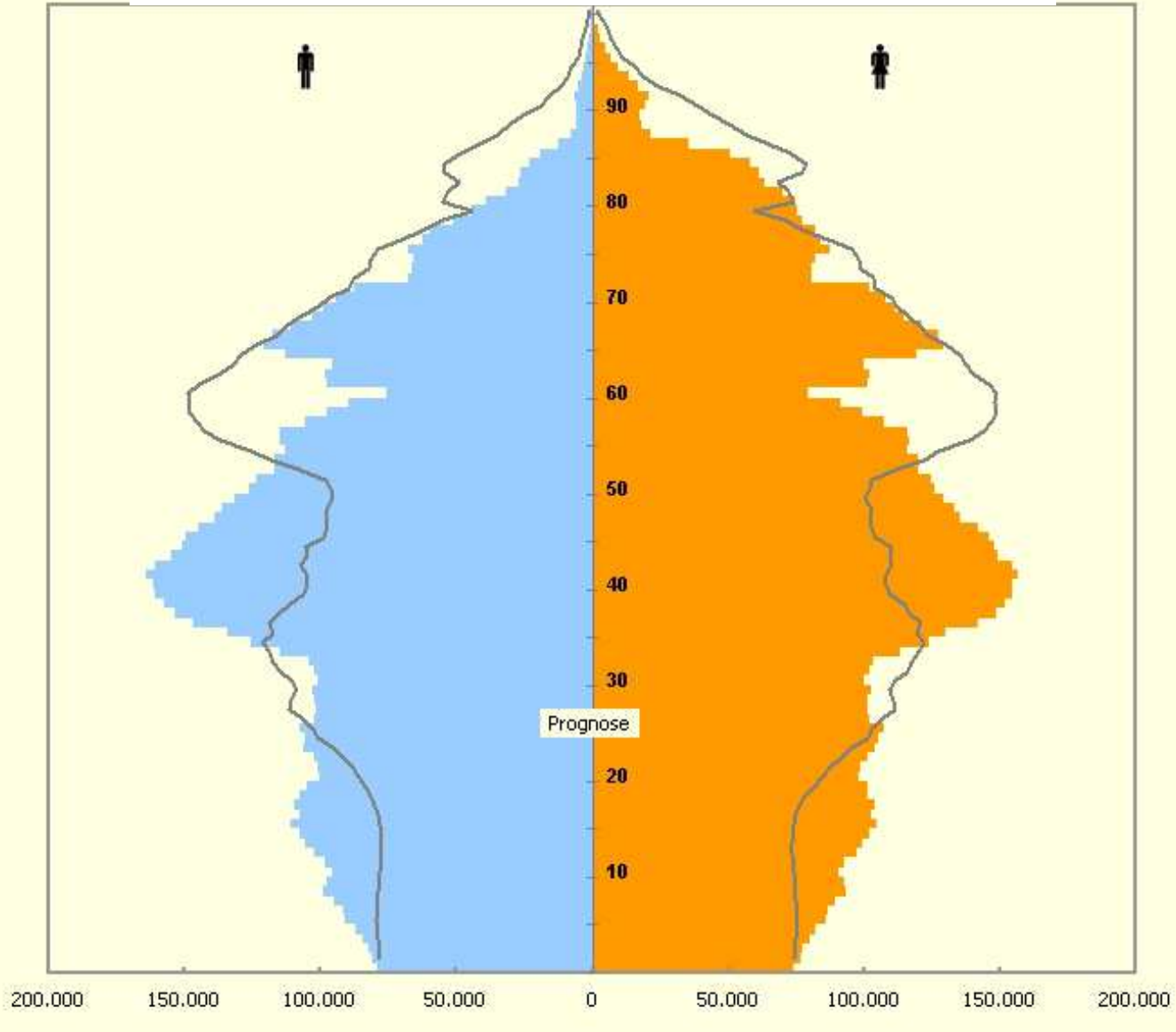
Population pyramid in North Rhine-Westphalia 2005 vs. 2025



Men 2005

Women 2005

Prognosis 2025

Source: Landesamt für Datenverarbeitung und Statistik (LDS) NRW: Vorausberechnung der Bevölkerung in den kreisfreien Städten und Kreisen Nordrhein-Westfalens. Graphik: lögd.

C. Terschüren

Identifying relevant cancer sites:

- lung: 26% of the male cancer patients die of lung cancer, 12% of the female
- colon/rectum: either in men and women, 12% of the cancer patients in total die of colon/rectum cancer
- stomach: men: 5.6%; women 5.1%
- pancreas: men: 5.5%; women 6.2%
- breast: men: not ranked ; women 20.0%
- prostate: men: 9.4%
- ovary: women. 6.3%

Source: Krebsatlas, German Cancer Research Center (DKFZ). 2003

Selected health outcomes for BoD prognosis

Health outcomes	ICD-10
Selected tumour sites	
Lung	C34
Colon	C18
Rectum	C20
Pancreas	C25
Stomach	C16
Prostate	C61
Breast	C50
Ovary	C56
Myocardial infarction	I21-I23
Dementia	F00, F03, G30-G31

WHO approach adapted

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Burden of disease = mortality +
disability due to mobidity

expressed as DALYs (Disability-Adjusted Life Years):

1 DALY = loss of 1 year lived in complete health

calculated as:

DALY = YLL + YLD

YLL = *years of life lost because of premature death*

YLD = *years of life lived with disability due to illness*

WHO approach adapted cont.

$$YLL = N \times (L - l)$$

YLL = years of life lost (due to premature death)

N = number of deaths in the population

L = life expectancy (by age group)

l = age at death

WHO approach adapted cont.

$$YLL = N \times (L - l)$$

N = number of deaths in the population

↳ **data source: death statistics of NRW,**
by administrative unit: county / major city

l = ***age at death (by age group)***

L = ***life expectancy (by age group)***

WHO approach adapted cont.

$$YLD = I \times DW \times d$$

YLD = years lived with disabilities due to the disease

I = number of incident cases in the population

DW = *disability- weight*. disease specific

d = time period lived with disabilities [years]

→ **DALY = YLL + YLD**

Data sources

mortality, incidence

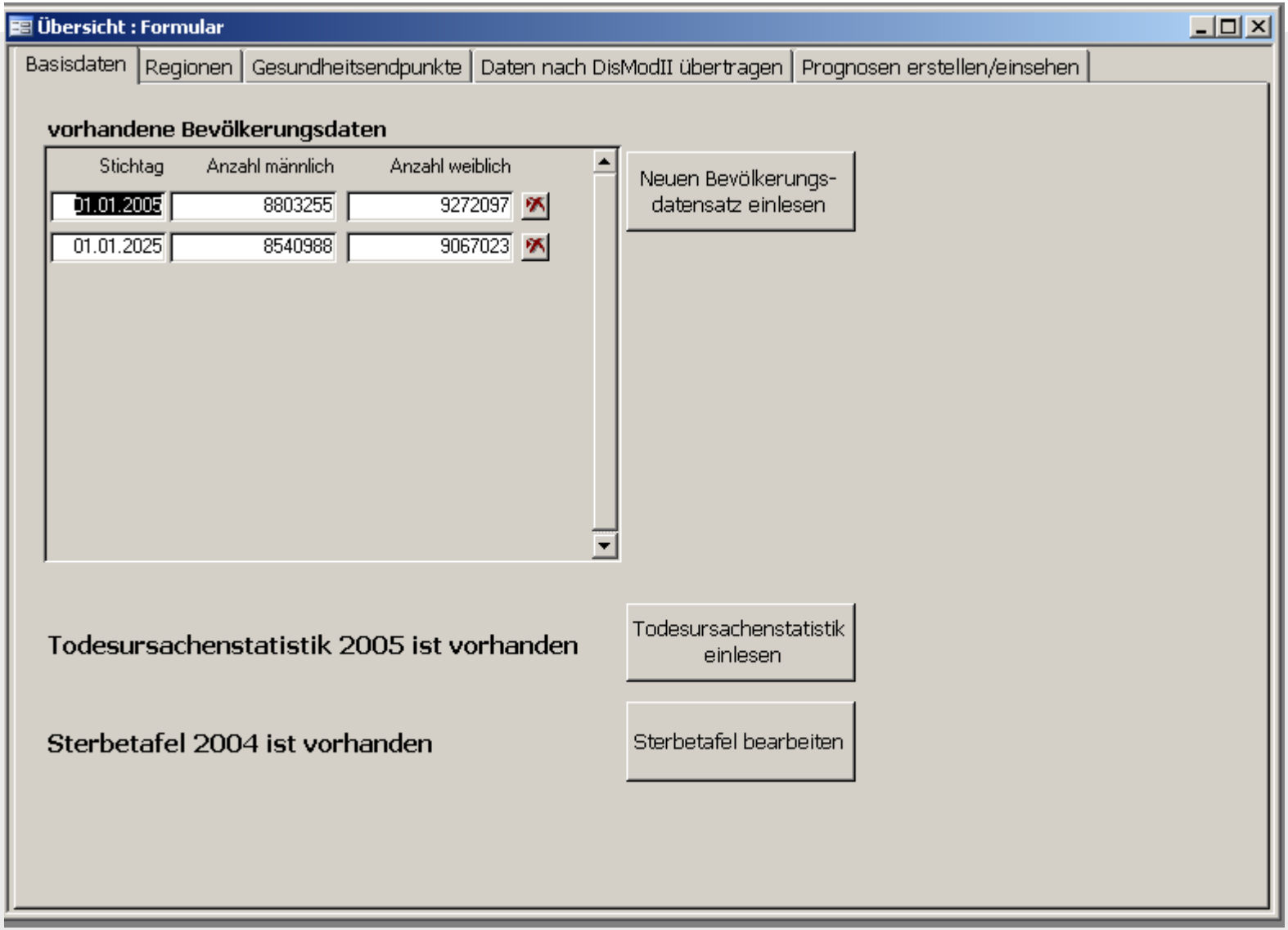
- Cancer registry NRW (tumour sites)
- German infarction registry within the KORA Study, Augsburg (MI)
- Meta-analysis (dementia)

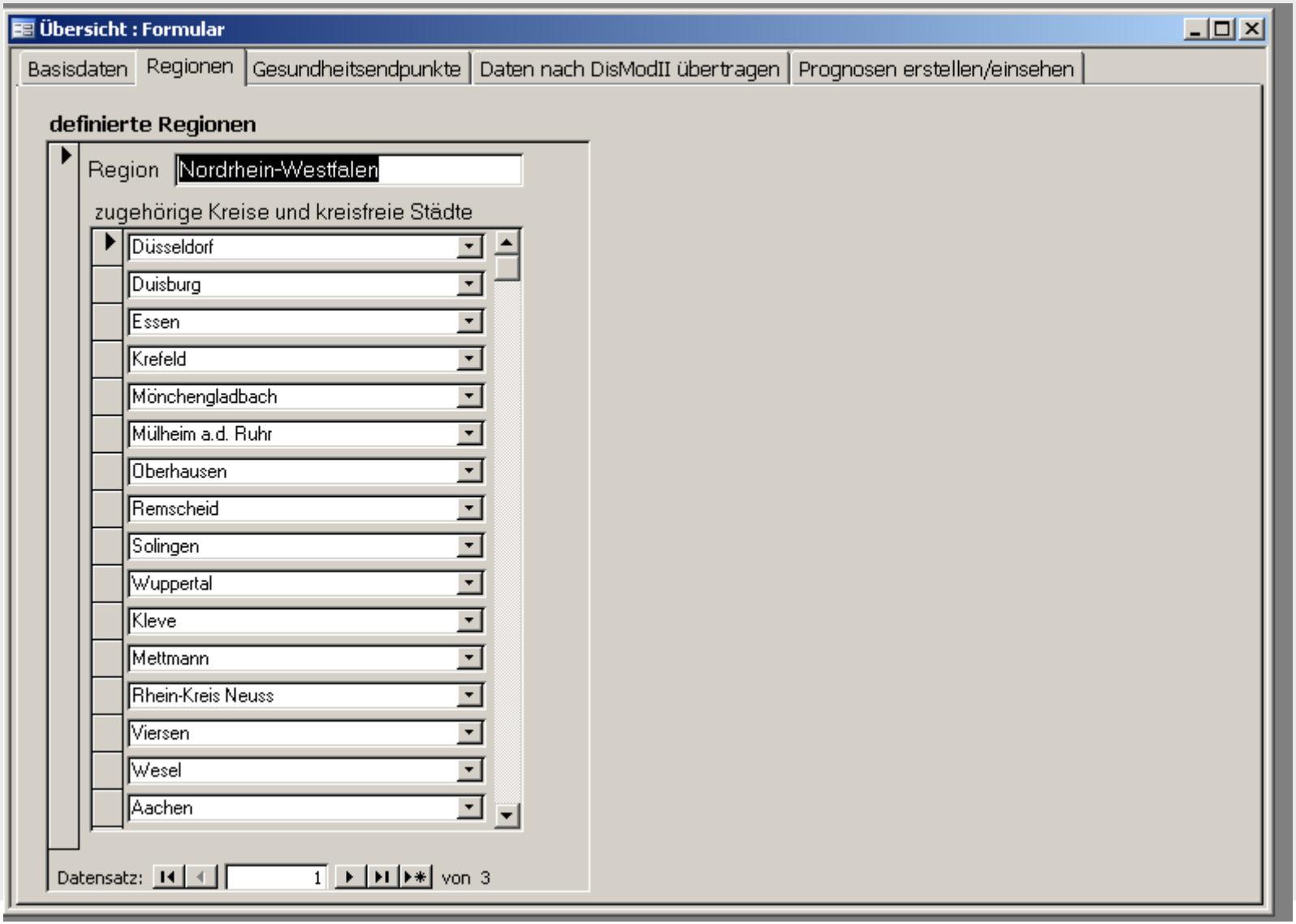
population forecast

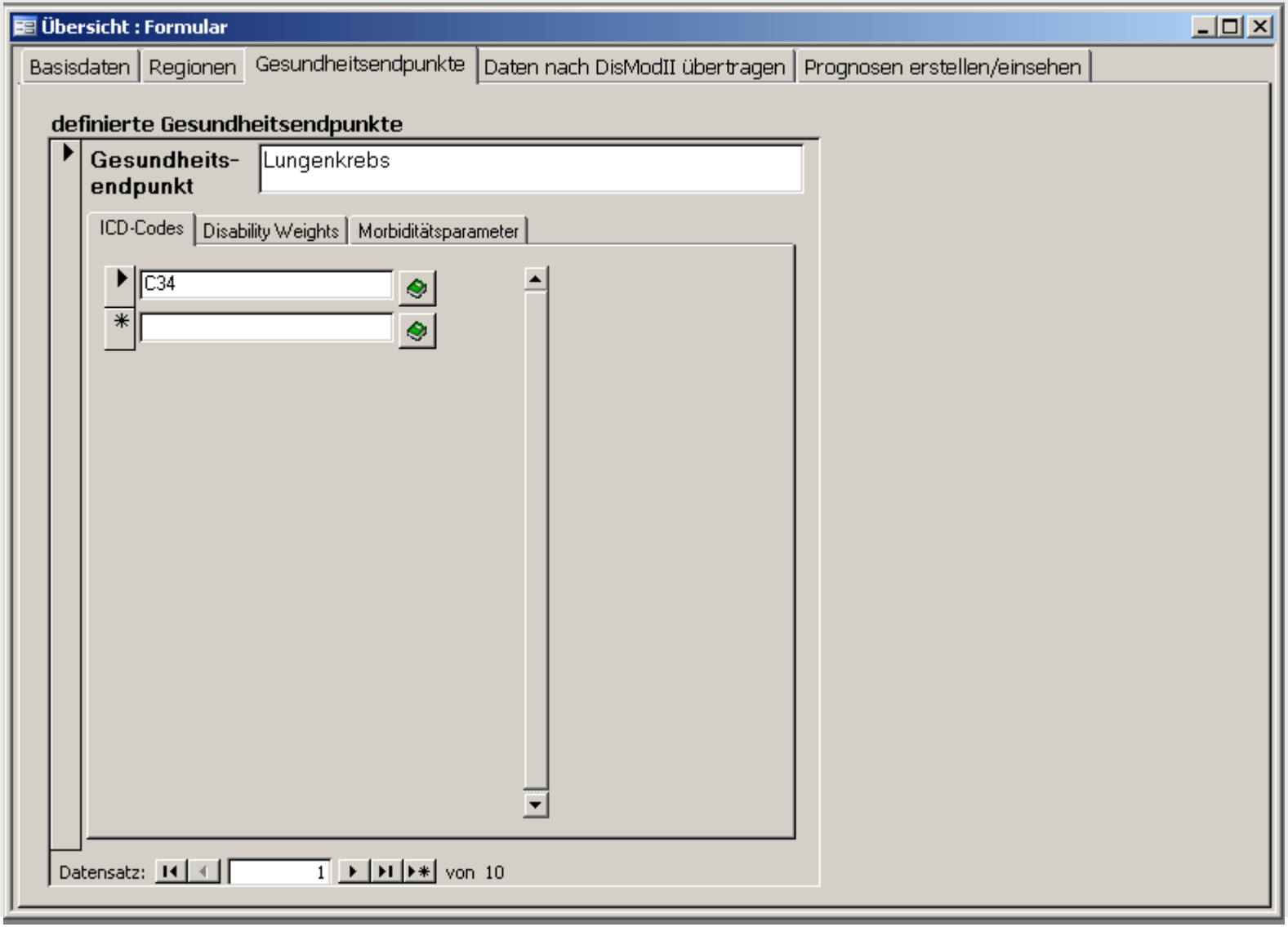
- NRW statitistics bureau

calculation tools

- WHO Excel template
- DisMod function
- Ms Access based tool


Übersicht : Formular
Basisdaten
Regionen
Gesundheitsendpunkte
Daten nach DisModII übertragen
Prognosen erstellen/einsehen
vorhandene Bevölkerungsdaten
Stichtag
Anzahl männlich
Anzahl weiblich
01.01.2005
8803255
9272097
01.01.2025
8540988
9067023
Neuen Bevölkerungs-datensatz einlesen
Todesursachenstatistik 2005 ist vorhanden
Todesursachenstatistik einlesen
Sterbetafel 2004 ist vorhanden
Sterbetafel bearbeiten


Übersicht : Formular
Basisdaten
Regionen
Gesundheitsendpunkte
Daten nach DisModII übertragen
Prognosen erstellen/einsehen
definierte Regionen
Region
Nordrhein-Westfalen
zugehörige Kreise und kreisfreie Städte
Düsseldorf
Duisburg
Essen
Krefeld
Mönchengladbach
Mülheim a.d. Ruhr
Oberhausen
Remscheid
Solingen
Wuppertal
Kleve
Mettmann
Rhein-Kreis Neuss
Viersen
Wesel
Aachen
Datensatz:
1
von 3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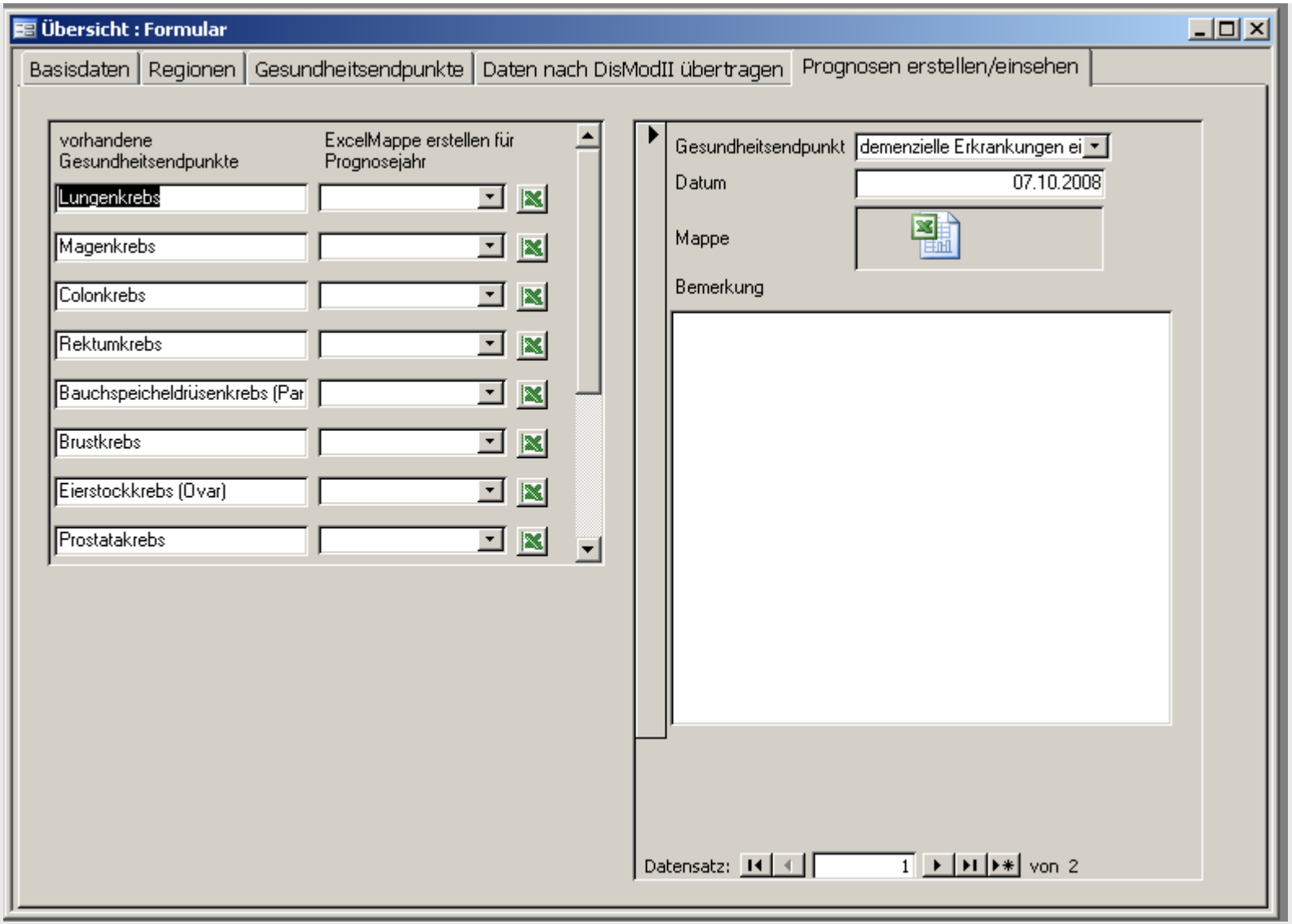
Basisdaten
Regionen
Gesundheitsendpunkte
Daten nach DisModII übertragen
Prognosen erstellen/einsehen
definierte Gesundheitsendpunkte
Gesundheits-endpunkt
Lungenkrebs
ICD-Codes
Disability Weights
Morbiditätsparameter
C34
Datensatz:
1
von 10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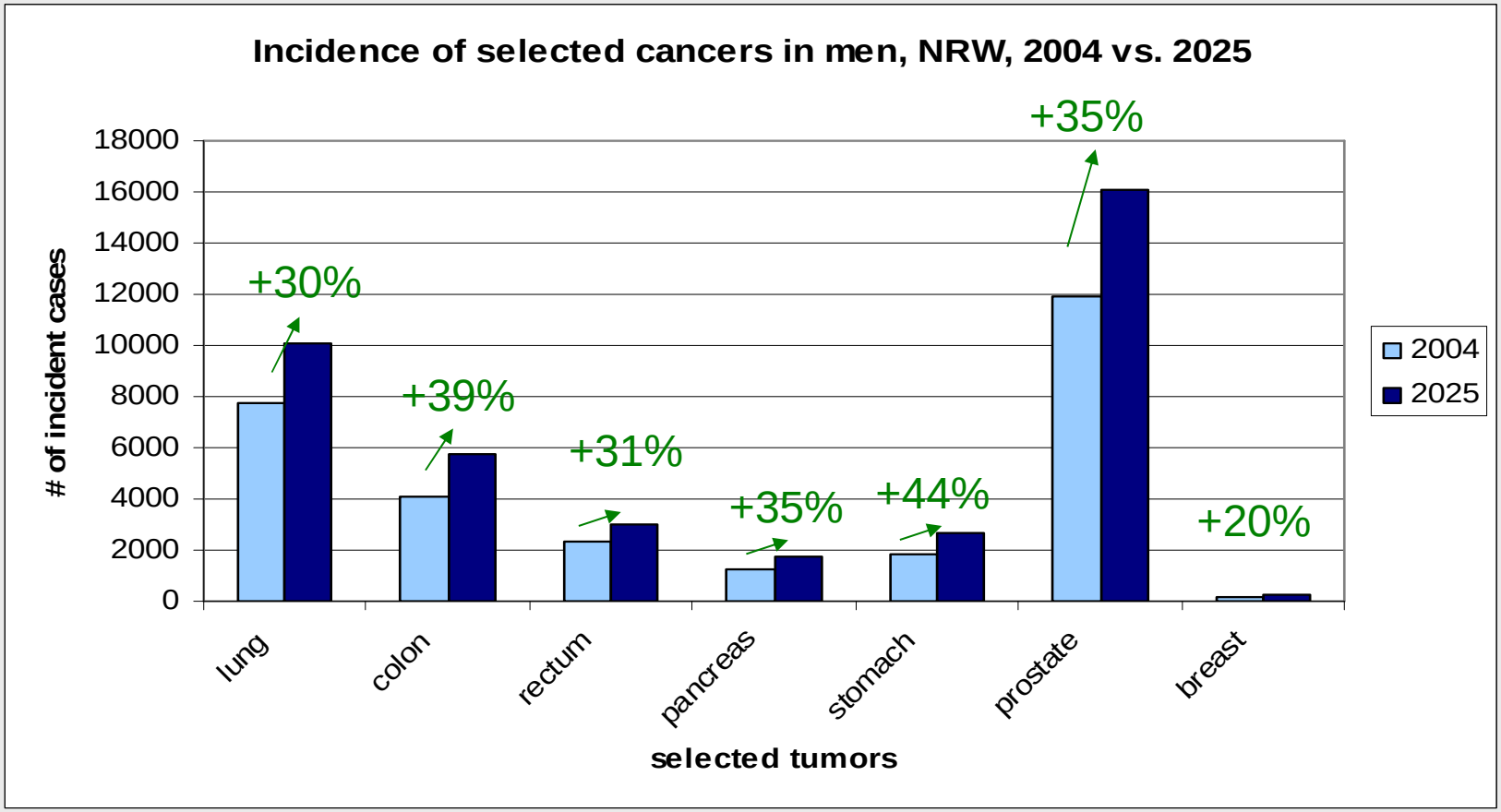
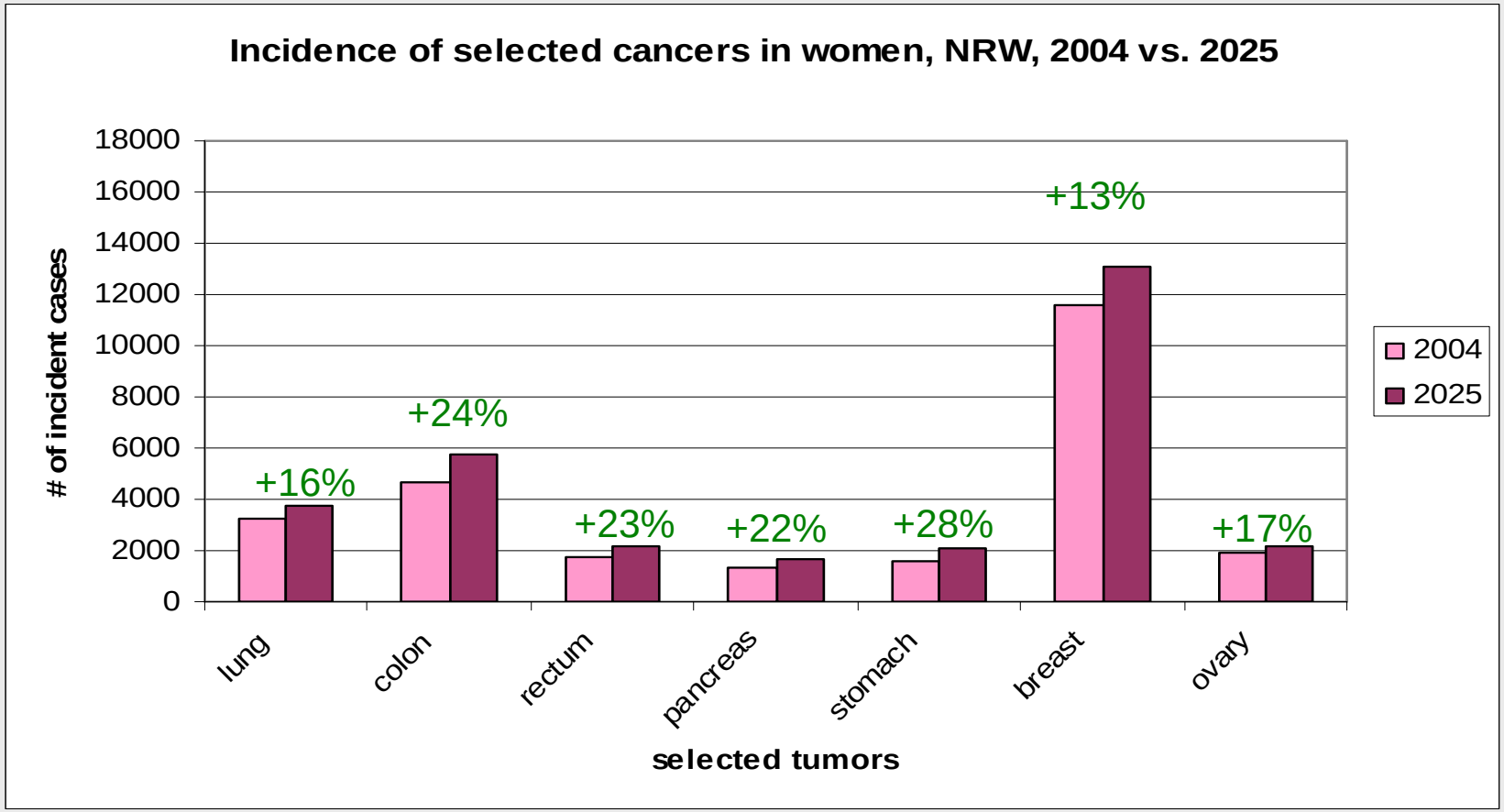
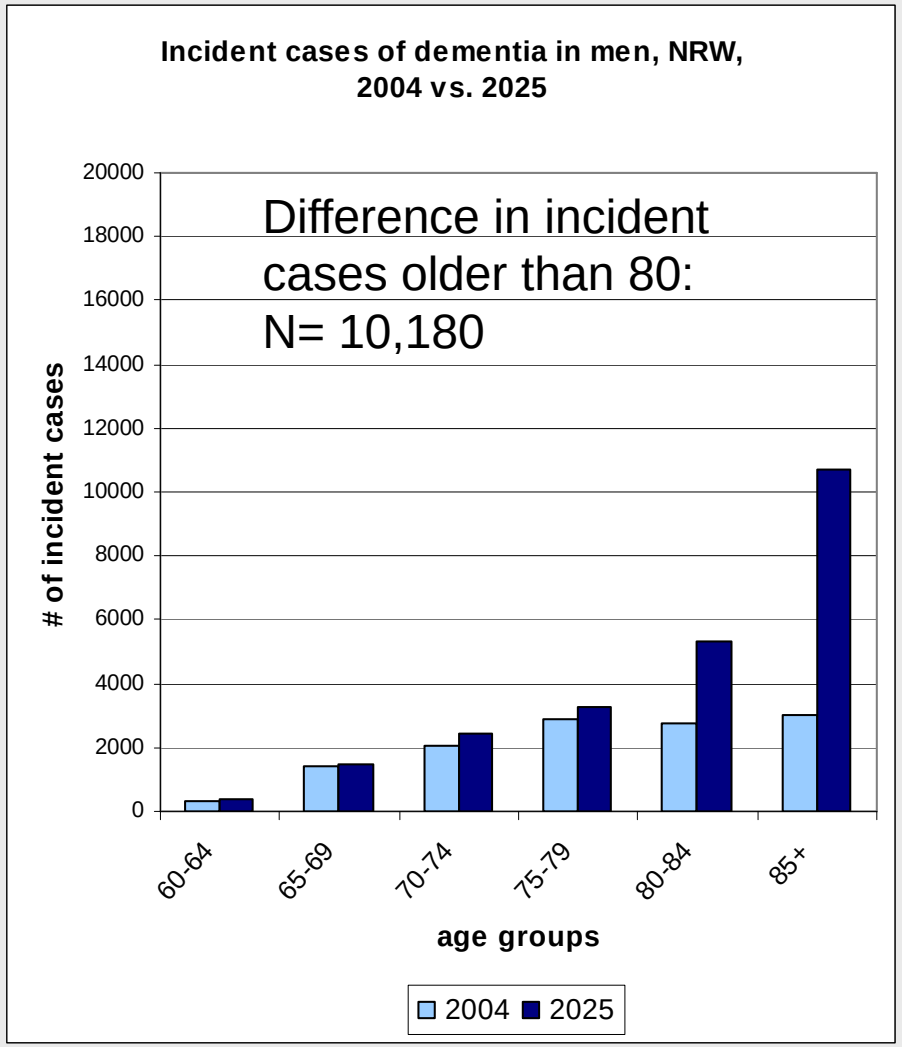
Basisdaten
Regionen
Gesundheitsendpunkte
Daten nach DisModII übertragen
Prognosen erstellen/einsehen
vorhandene Gesundheitsendpunkte
ExcelMappe erstellen für Prognosejahr
Lungenkrebs
Magenkrebs
Colonkrebs
Rektumkrebs
Bauchspeicheldrüsenkrebs (Par
Brustkrebs
Eierstockkrebs (Ovar)
Prostatakrebs
Gesundheitsendpunkt
demenzielle Erkrankungen ei
Datum
07.10.2008
Mappe
Bemerkung
Datensatz:
1
von 2

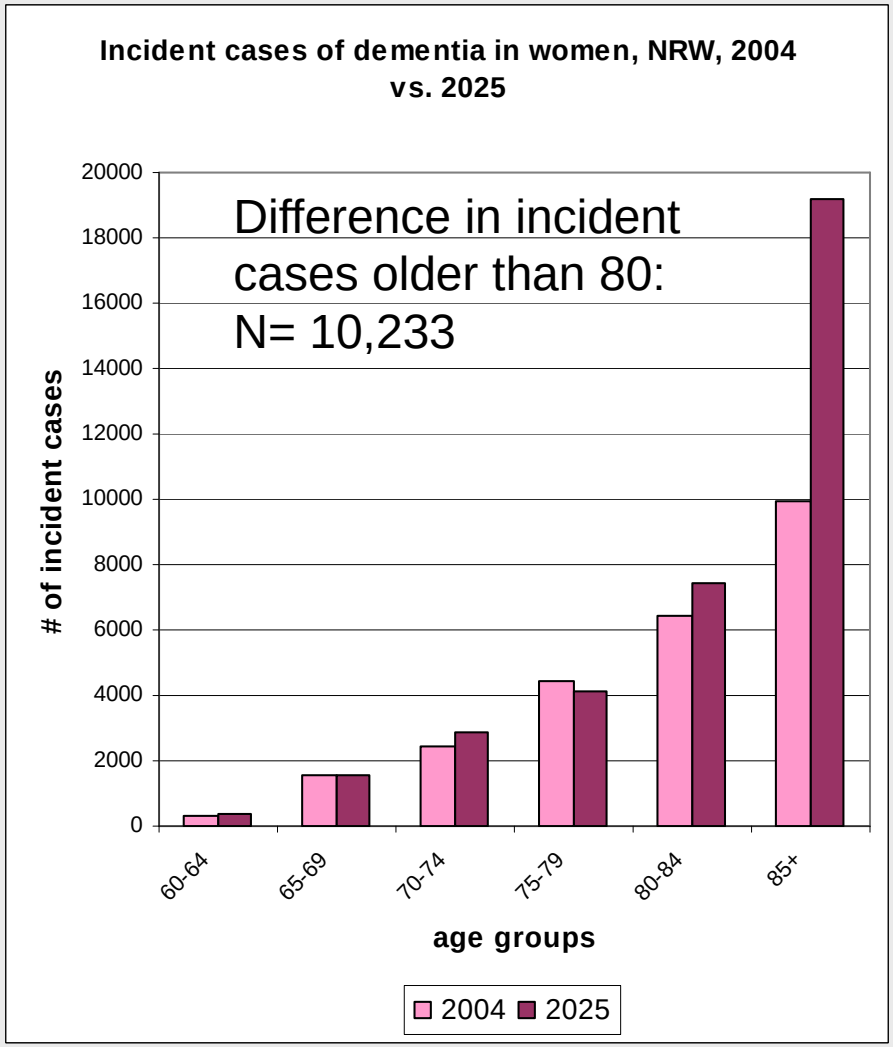


2004 vs.2025: approx. 10,000 additional cases = Ø 34% increase



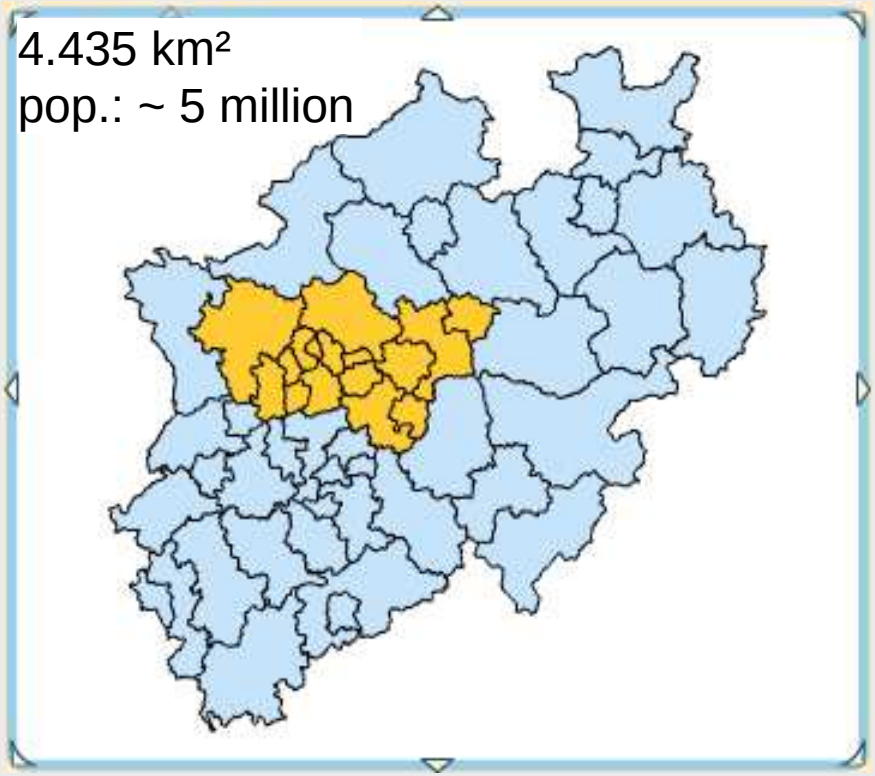
2004 vs.2025: approx. 4,500 additional cases = Ø 20% increase


Incident cases of dementia in men, NRW, 2004 vs. 2025
Difference in incident cases older than 80: N= 10,180
# of incident cases
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
60-64
65-69
70-74
75-79
80-84
85+
age groups
2004
2025


Incident cases of dementia in women, NRW, 2004 vs. 2025
Difference in incident cases older than 80: N= 10,233
# of incident cases
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
60-64
65-69
70-74
75-79
80-84
85+
age groups
2004
2025

BoD prognosis of demografic change in NRW

Ruhr area *(urban)*



East Westphalia Lippe (OWL) *(rural)*

falen

	2004		2025		2025 vs. 2004	
Age group	male	female	male	female	male	female
0	22253	20991	19888	18887	89%	90%
1-4	93713	88636	81514	77416	87%	87%
5-9	131202	124253	103203	97969	79%	79%
10-14	147184	139589	102317	97188	70%	70%
15-19	149553	143274	105720	101259	71%	71%
20-24	148175	145519	121833	121596	82%	84%
25-29	146714	143808	144256	143701	98%	100%
30-34	167133	162550	157608	157249	94%	97%
35-39	220142	210552	152977	155446	69%	74%
40-44	222565	214464	142200	146317	64%	68%
45-49	202491	199865	132584	137690	65%	69%
50-54	180239	184621	150037	153947	83%	83%
55-59	150877	152209		196718	130%	129%
60-64	160424	1	190458	195033		
65-69	160712	181369	160667	175023		
70-74	116007	142395	128540	153512	111%	108%
75-79			91188	115508	103%	86%
80-84			7		165%	101%
85+	20620	70386	7		349%	187%
total	2573085	2729094	2327638	2481324	90%	91%

- 9.5%

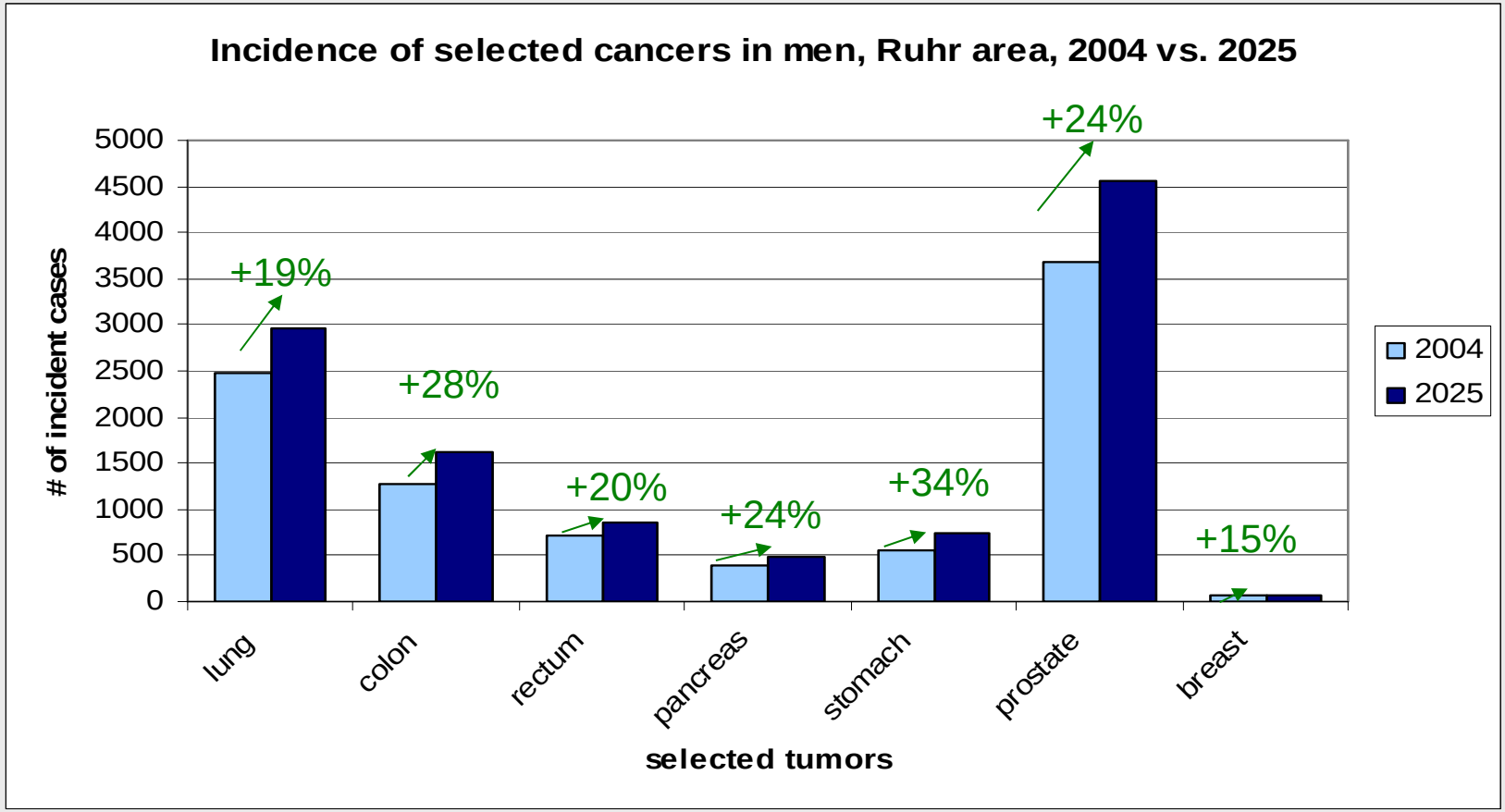
- 493 217

5 302 179

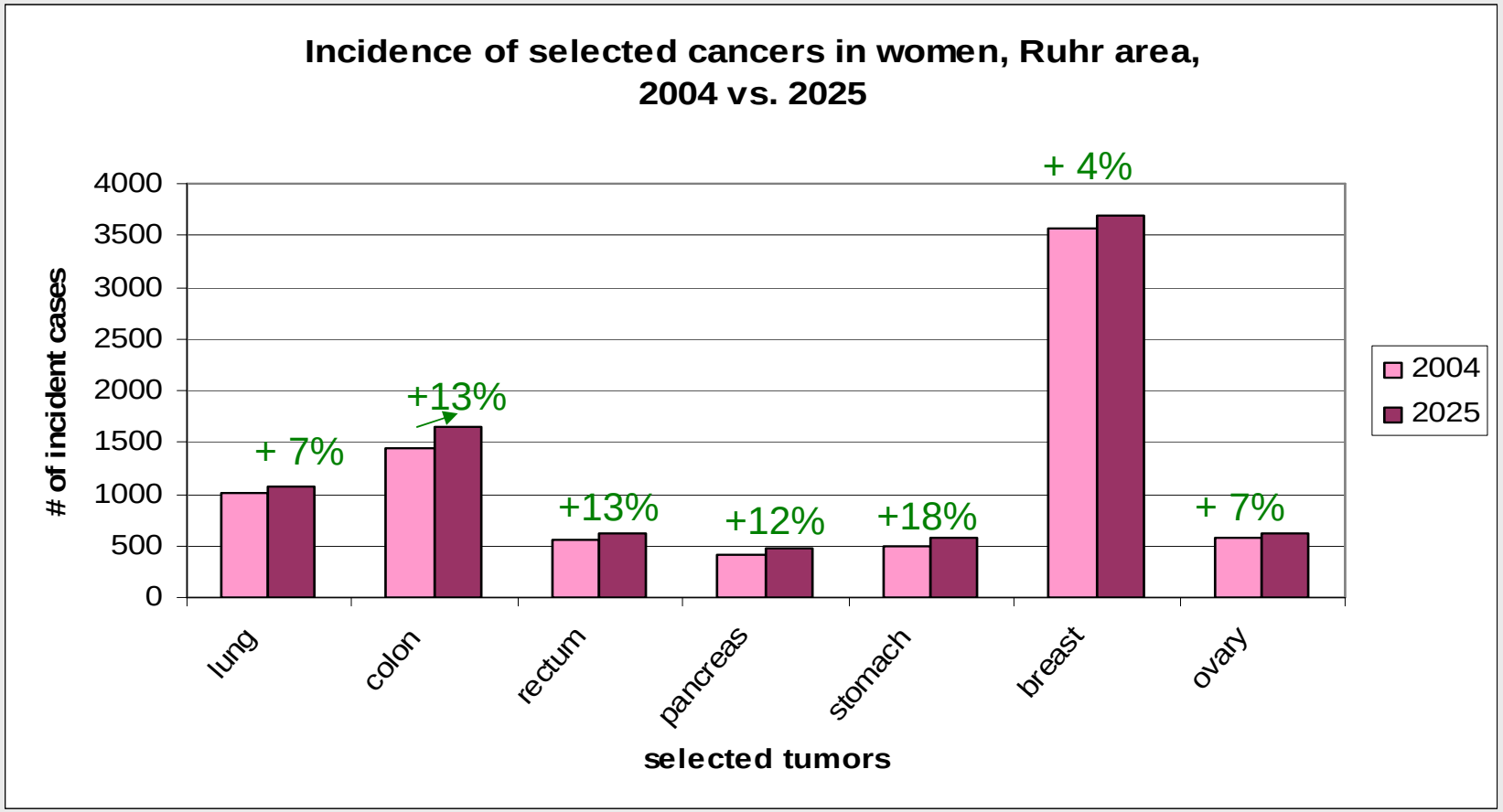
4 808 962

Ruhr area

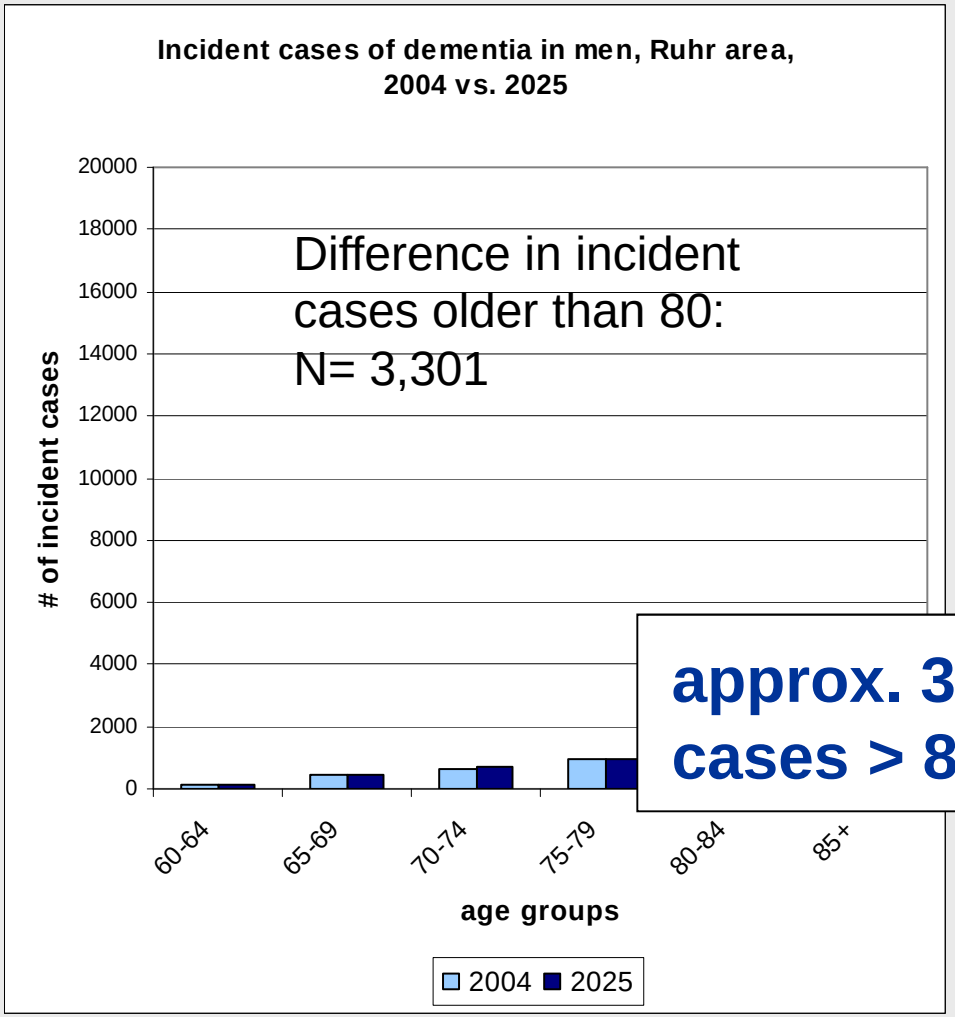
Source: based on LDS NRW Database

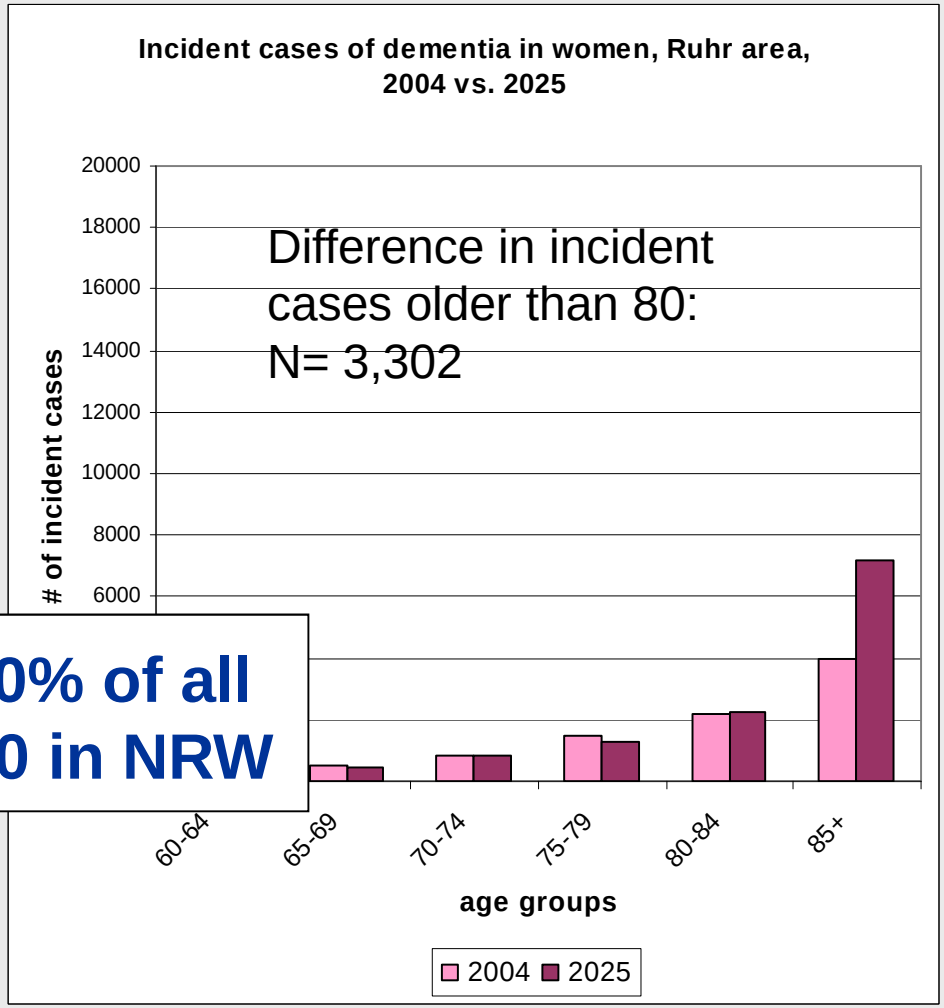


2004 vs.2025: approx. 2,200 additional cases = Ø 23% increase

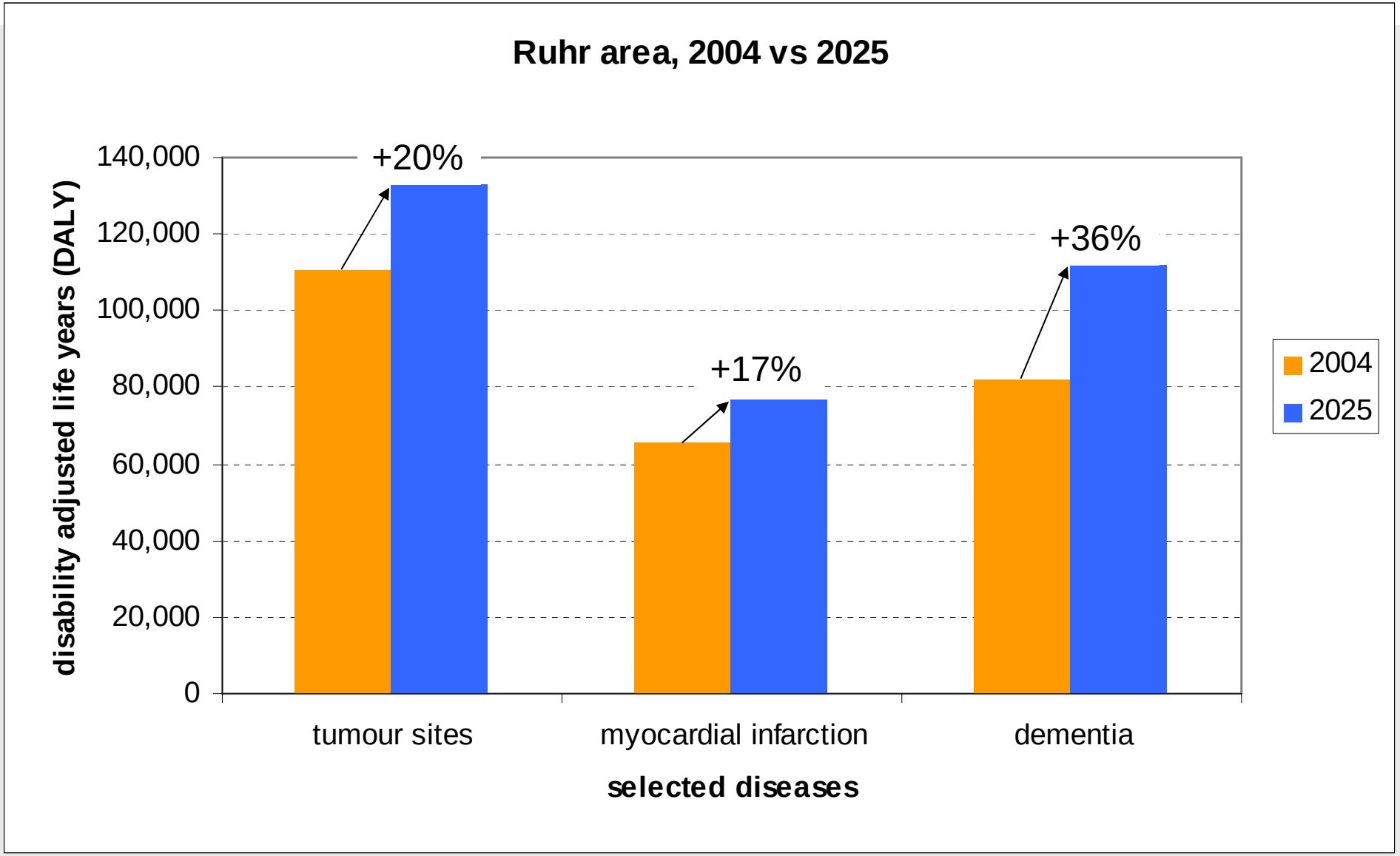


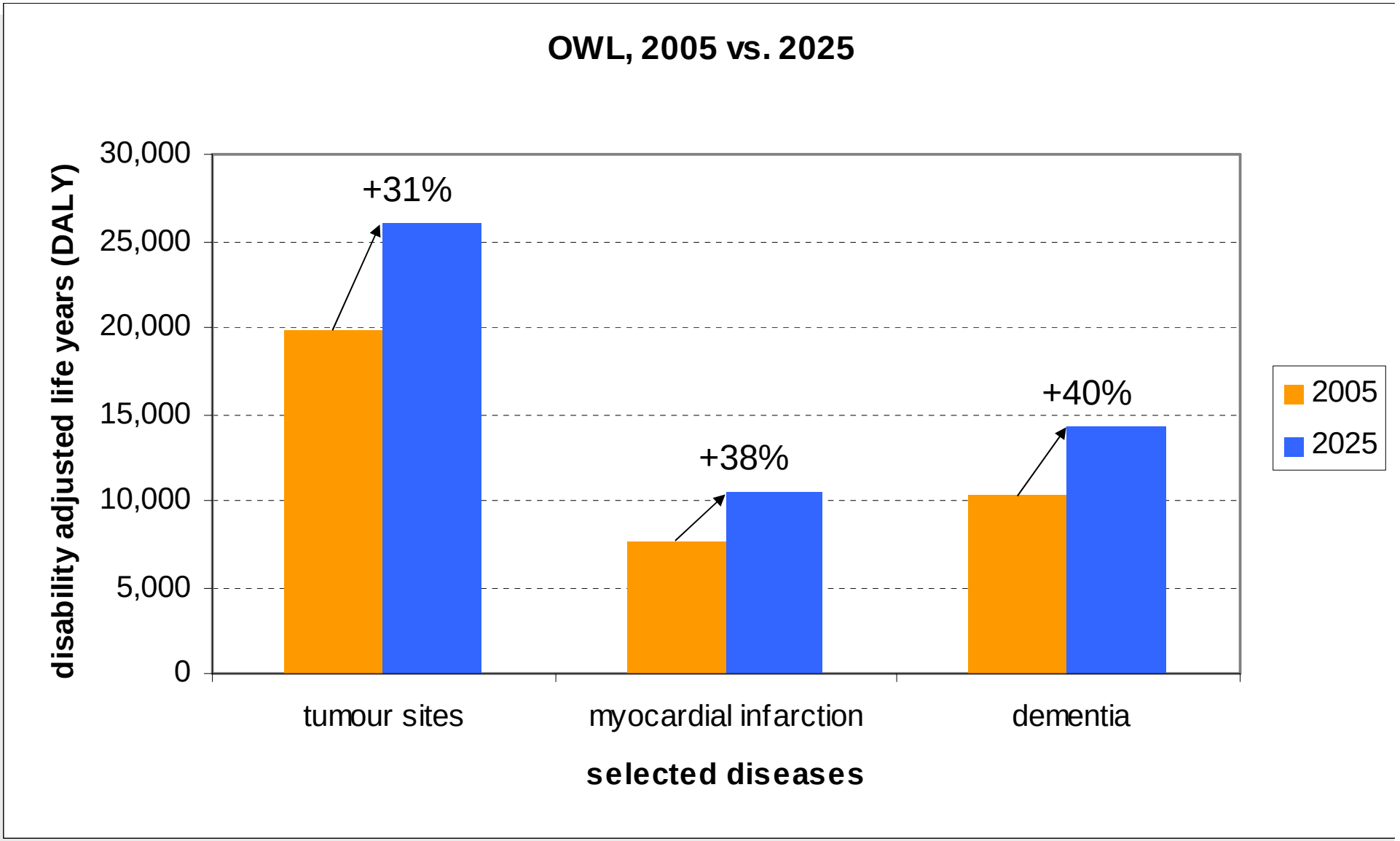
2004 vs.2025: approx. 650 additional cases = Ø 8% increase





approx. 30% of all cases > 80 in NRW


Ruhr area, 2004 vs 2025
disability adjusted life years (DALY)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
+20%
+17%
+36%
2004
2025
tumour sites
myocardial infarction
dementia
selected diseases


OWL, 2005 vs. 2025
disability adjusted life years (DALY)
30,000
25,000
20,000
15,000
10,000
5,000
0
+31%
+38%
+40%
2005
2025
tumour sites
myocardial infarction
dementia
selected diseases

BoD prognosis of demografic change in NRW - Outlook

- prognoses of the development of burden of disease demonstrate large changes
- potentially associated with opportunities for considerable health gains via a range of preventive measures across different sectors
- initiate preparedness in health care for a higher number of patients of very old age
- (medical) therapies need to become more adjusted for patient of old age
- the prognoses will be used as baseline estimates in upcoming HIAs, with the effects of different interventions on health to be quantified accordingly

Thank you very much!

… and now I pass on to: EBD in NRW

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Burden of Disease in North Rhine-Westphalia (BoD in NRW), part 2: Environmental Tobacco Smoke (ETS)

before implementation of non-smoker-protection legislation

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Thomas Claßen, School of Public Health, University of Bielefeld
Odile C.L. Mekel, NRW Institute of Health and Work (LIGA.NRW)
Claudia Terschüren, NRW Institute of Health and Work (LIGA.NRW)
Rainer Fehr, NRW Institute of Health and Work (LIGA.NRW)

Background and objectives

Background:

- Non-smokers exposed to environmental tobacco smoke (ETS) indoors are at risk of the same acute and chronic illnesses (e.g., respiratory & cardiovascular diseases) as are smokers.
- Children are particularly sensitive to ETS.
- Prenatal exposure of a foetus if the mother smokes during pregnancy can have severe adverse healths effects.
- In 2008 legislation came into effect in NRW to protect non-smokers from ETS at the workplace, at recreational sites and inside public buildings.

Background and objectives

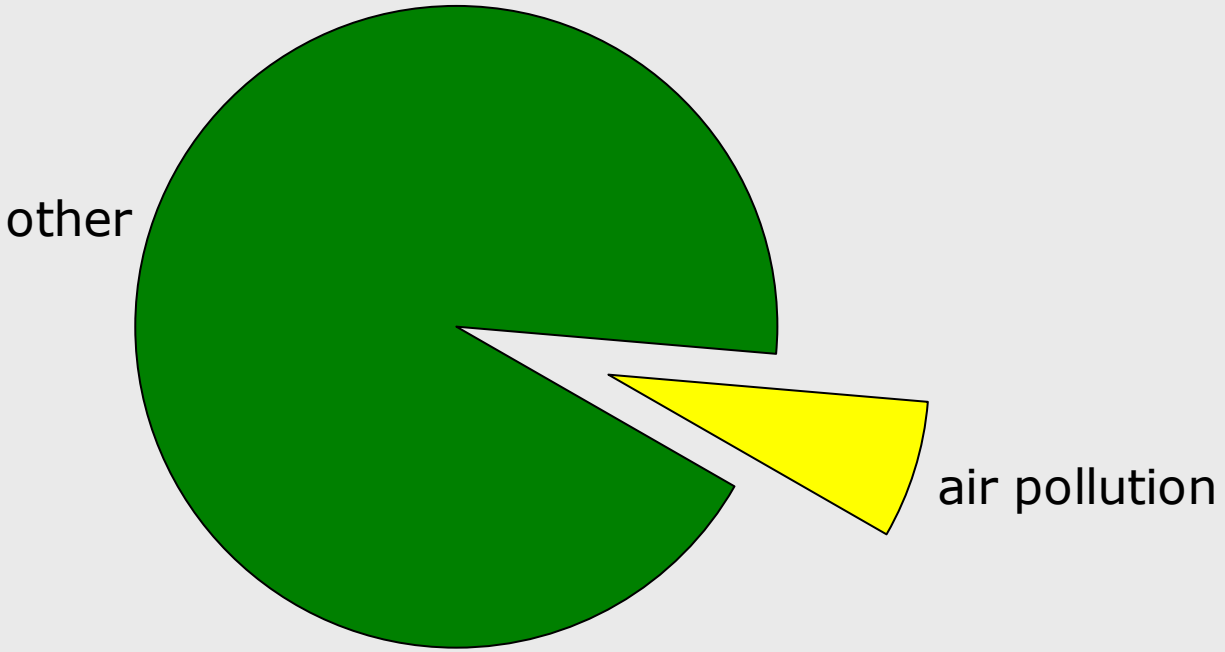
Objectives:

- Estimate the ETS-caused EBD in NRW under the conditions before 2008.
- Estimate the health gains expected from this legislation.

- Test the method developed by the WHO for assessing the environmental burden of disease (EBD) from ETS.

From BoD to comparative risk assessment (CRA) and environmental burden of disease (EBD)

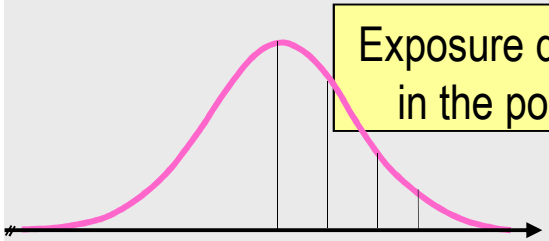
Attributable cases - Health outcome X



How to do EBD

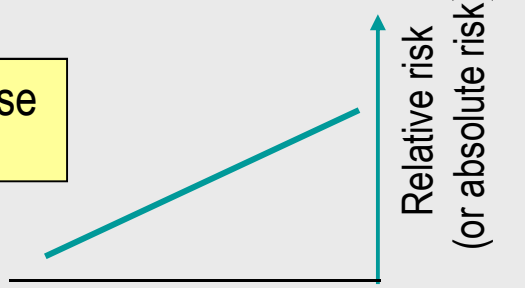
- Specify **exposure**
- Define appropriate health outcomes
- Specify the **dose-response** relationships
- Derive **population baseline frequency** measures for the health outcomes (from morbidity and mortality statistics)
- Calculate the number of **attributable cases** in the target population
- Calculate DALYs attributable to a specific risk factor
- Calculate/assess potential **health gains** (scenarios)

Exposure-based approach in EBD



Exposure distribution in the population

Exposure-response relationship



from evidence-based studies

$$IF = \frac{\sum(Pe_x \bullet RR_x) - 1}{\sum (Pe_x \bullet RR_x)}$$

Impact fraction

Disease burden estimates per **disease**

Incidence
mortality, DALYs

Attributable incidence, mortality, DALYs

Disease burden attributable to **risk factor**

Assumptions for ETS exposure assessment I

- The smoking prevalence and ETS exposure in non-smokers was estimated from data of the

  - German Health Survey 2003

  - German Epidemiological Survey on addictions 2003 (self-assessments given through telephone interviews).

Limitations:

- Data about ETS exposure is differentiated by site of exposure (home, workplace, recreational facilities, other places), but the magnitude of exposure cannot be estimated due to survey design.
- Exposure can only be assumed at home and at work because exposure at recreational facilities and other places is irregular.

Assumptions for ETS exposure assessment II

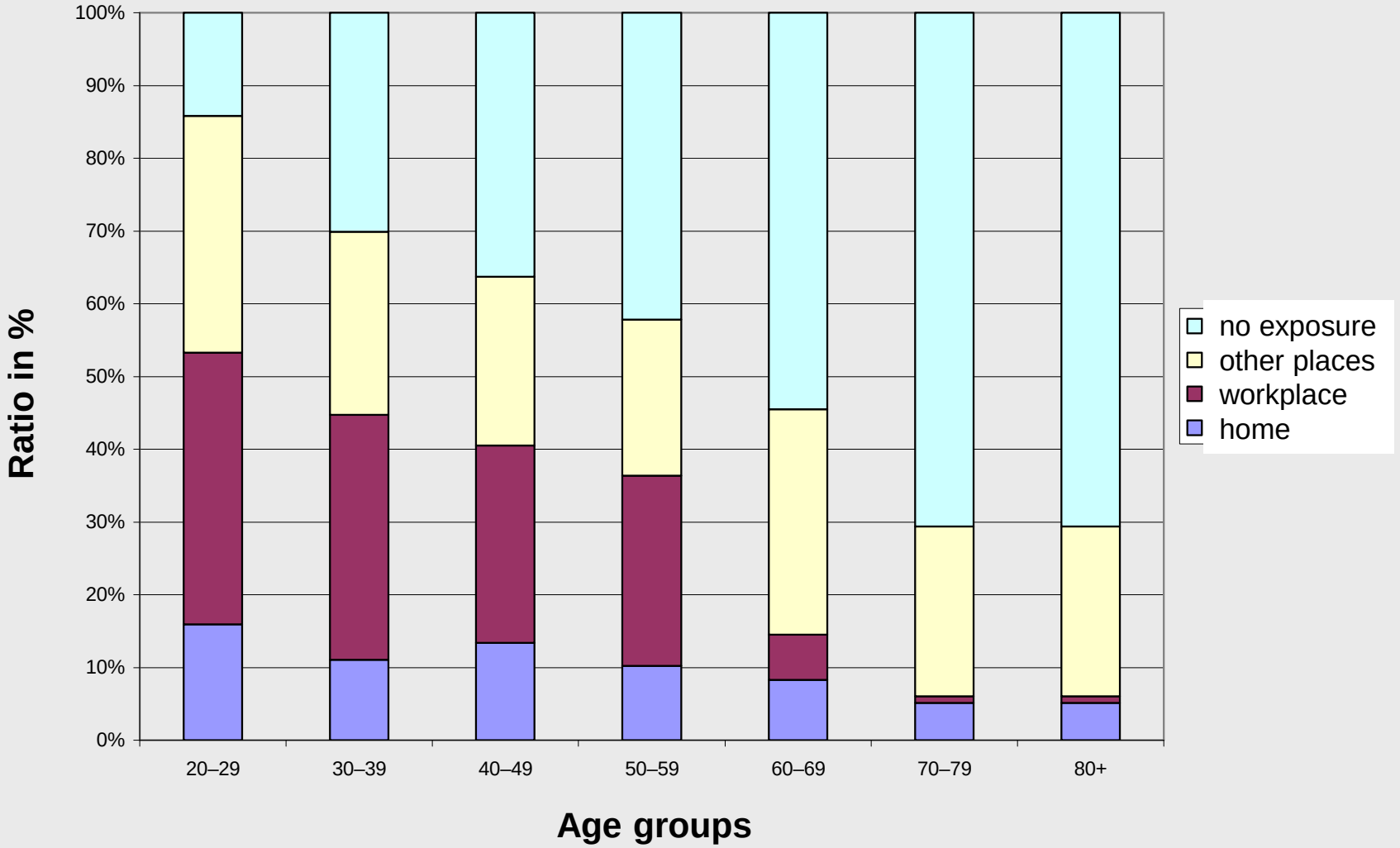
- Smokers are also exposed to ETS, but the additional impact of ETS can be neglected because of the exceedingly high impact of smoking itself.
- Even being a former smoker by far exceeds the impact of ETS regarding lung cancer and COPD (chronic obstructive pulmonary disease).
- Foetal exposure is estimated from the smoking habits of the woman.

Prevalence of smoking

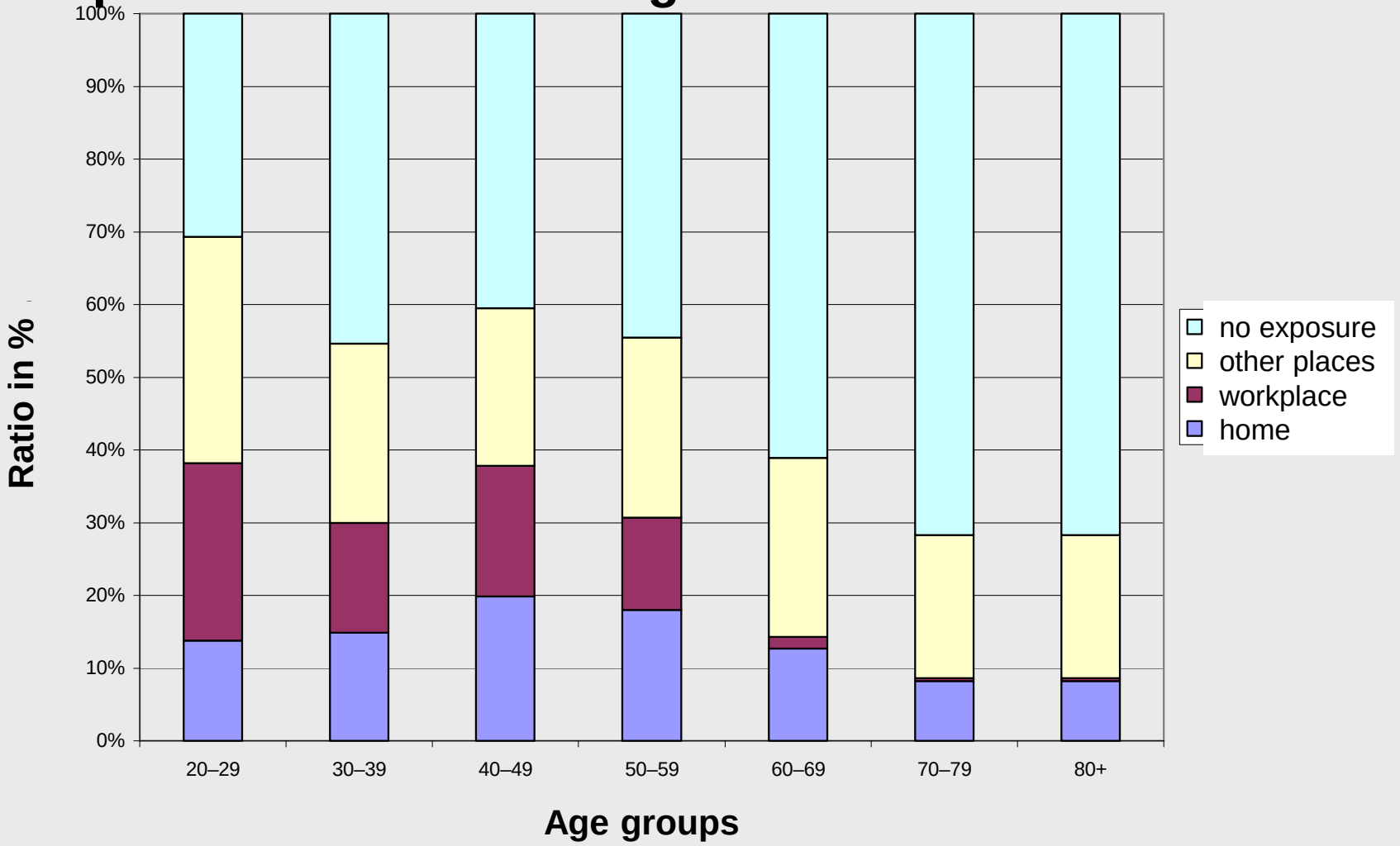
	Current smokers (%)		Current non-smokers (%)		Never smoked (%)		Former smokers (%)	
Age	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
20-29	54	43	46	57	31	42	69	58
30-39	45	37	55	63	33	39	67	61
40-49	43	36	57	64	26	38	74	62
50-59	32	28	68	72	31	44	69	56
60-69	20	15	80	85	35	65	65	35
70-79	15	6	85	94	28	71	72	29
80+	8	4	92	96	28	71	72	29

Source: Telephone health survey 2003; Lampert, Burger 2005

ETS exposure of non-smoking men



ETS exposure of non-smoking women



Health outcomes

	ICD-10	Age groups	Population of non-smokers
Lung cancer	C33, C34	>20 years	Never smoked
Coronary heart disease (CHD)	I20-I24	>20 years	Never smoked & former smokers
COPD	J41-J44	>20 years	Never smoked and former smokers
Stroke	I60-I69	>20 years	Never smoked
Low birth weight	P07.0, P07.1	0 years	
Sudden infant death (SIDS)	C33, C34	<1 year	

Burden of disease (BoD) attributable to tobacco smoke: Assumptions

- For children:
  Active smoking has a minor impact.
  → ETS is responsible for the total burden of disease due to tobacco smoke.

- For adults:
  The BoD fraction attributable to ETS must be estimated by excluding the BoD due to active smoking.

BoD attributable to ETS (cases in 2004)

	Premature deaths	Incidence	Premature deaths	Incidence	Premature deaths	Incidence
			Adults			
	Males		**Females**		**Total**	
Lung cancer	31	34	42	45	74	79
CHD	257	781	333	606	590	1387
COPD	4	60	12	75	16	135
Stroke	44	122	118	225	162	347
			Children			
Low birth weight					3	822
SIDS					24	
Sum	**336**	**997**	**505**	**951**	**869**	**2770**
Total Burden	**31828**	**55116**	**31000**	**51986**	**62828**	**107102**

BoD attributable to ETS in DALYs in 2004

	YLL	YLD	YLL	YLD	YLL	YLD	DALY	DALY/ Mio. inh.
	Males		**Women**		**Adults Total**			
Lung cancer	266	5	356	45	623	50	673	37,23
CHD	2032	847	1322	395	3353	1242	4596	254,24
COPD	31	89	58	113	89	202	291	16,10
Stroke	251	208	454	366	705	574	1279	70,76
					Children			
Low birth weight					787		787	43,54
SIDS					98		98	5,42
Sum	**2580**	**949**	**2190**	**909**	**5655**	**2068**	**7724**	**378,33**

Health gains due to intervention

Assumption: eliminating ETS exposure at work

→ Reduction of DALYs by 26%

- Limitations:
- BoD attributable to ETS might be underestimated due to limitations of the study design.

Conclusions

- Legislation protecting non-smokers cannot directly influence the ETS exposure at home.
- Further efforts are needed to reduce active smoking, especially amongst children and adolescents.

→ Examples would include smoke-free schools and recreational facilities as well as other measures aimed at fighting the ubiquitousness of smoking.

Thank you for your attention!