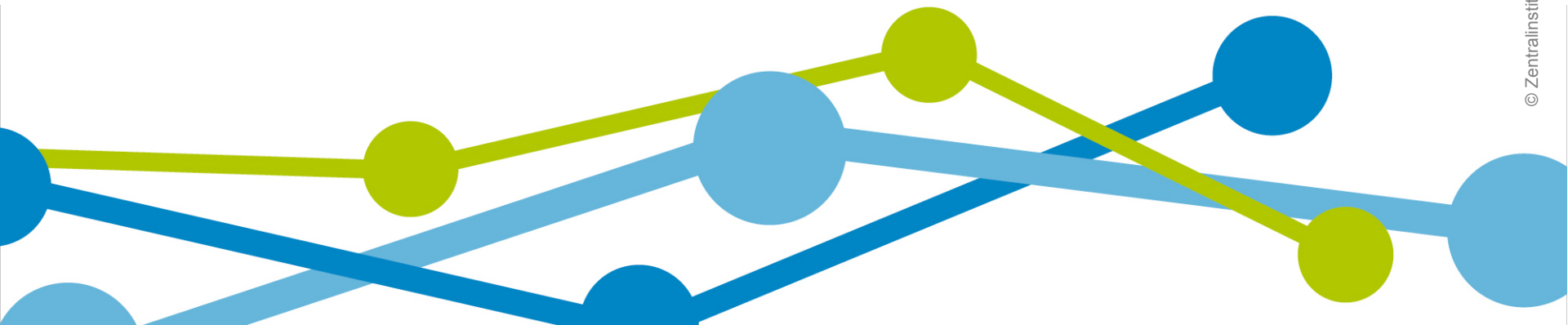**zi** ZENTRALINSTITUT FÜR DIE KASSENÄRZTLICHE VERSORGUNG IN DEUTSCHLAND

The Wennberg International Collaboration, London , **September 2014**

Is there a systematic relationship between inpatient care and ambulatory care and do we need to take account of it when studying regional variation?

Dr. Dominik von Stillfried, Thomas Czihal

What is the issue?

- most policy issues focus on **one type / group** of services and/or providers (e.g. quality of services / provider payment / capacity planning)

- they are often triggered or supported by **focused reports** on e.g. variation in specific procedures provided by hospitals, variation in specific services provided by physicians, etc …

- In many health systems this approach is based on **routine data** which is produced according sector-specific regulatory requirements (due to e.g. specific payment schemes, different responsibilities of local and central government, different legislative context etc.)

- **e.g. Germany**: the healthcare system is split into **two distinct „sectors"**,
    1. **ambulatory care** provided by **office-based physicians**
    2. **inpatient care** (and outpatient care) provided by **hospitals**

This leads to a central question:

**If there is some degree of intersectoral interdepence:
how much of the variation in one „sector" is compensated by variation in another „sector" of the healthcare system?**

In short: *How much of variation is substitution?*

Database

- **all data refer to statutory health insurance** (coverage 90% / 72 million) only (no data on private health insurance)

- claims data refer to ambulatory care by office-based physicians available 2007 – 2011 at patient/physician level (~500 million cases p.a.; case = same patient/payor/practice/quarter of the year)

- inpatient admissions / days are reported by destatis eg. rates per DRG according to county of residence of the patients (~18 million cases p.a.),

- Information on age, morbidity (claims data), mortality and social structure and provider structure publically available per county; some cities provide reference per quarter

- 16 states, 17 jurisdictions of regional physician associations, 412 counties

City of Hamburg as a model

Differences in risk structure according to quarters
(based on age, gender, diagnoses of office-based physicians
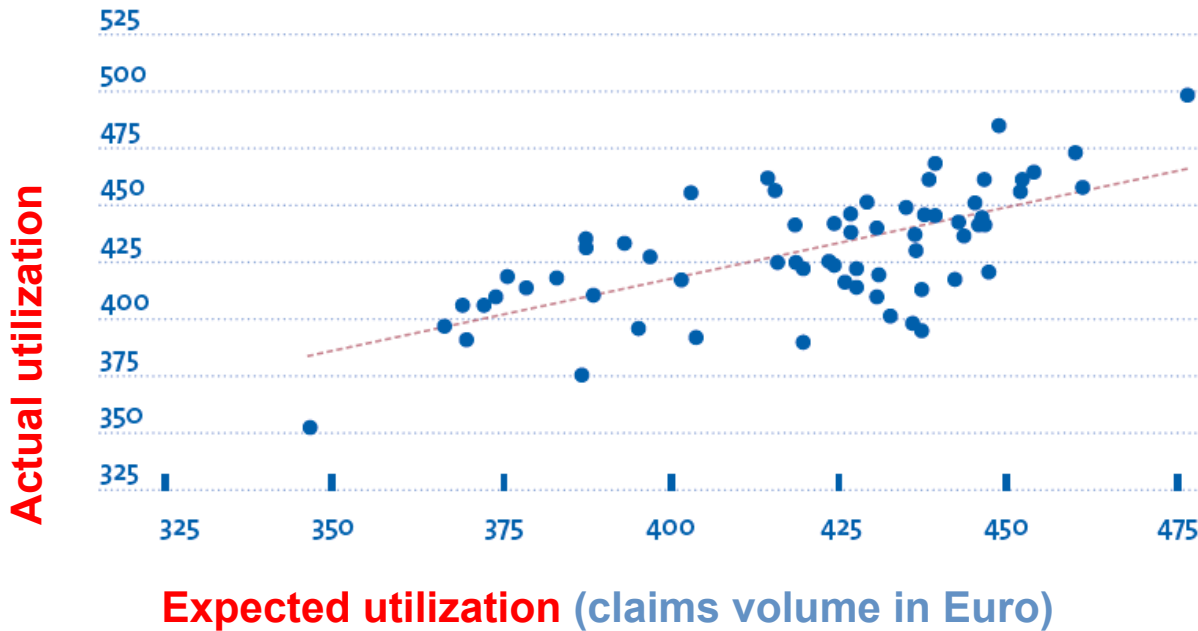 for resident statutorily insured population)
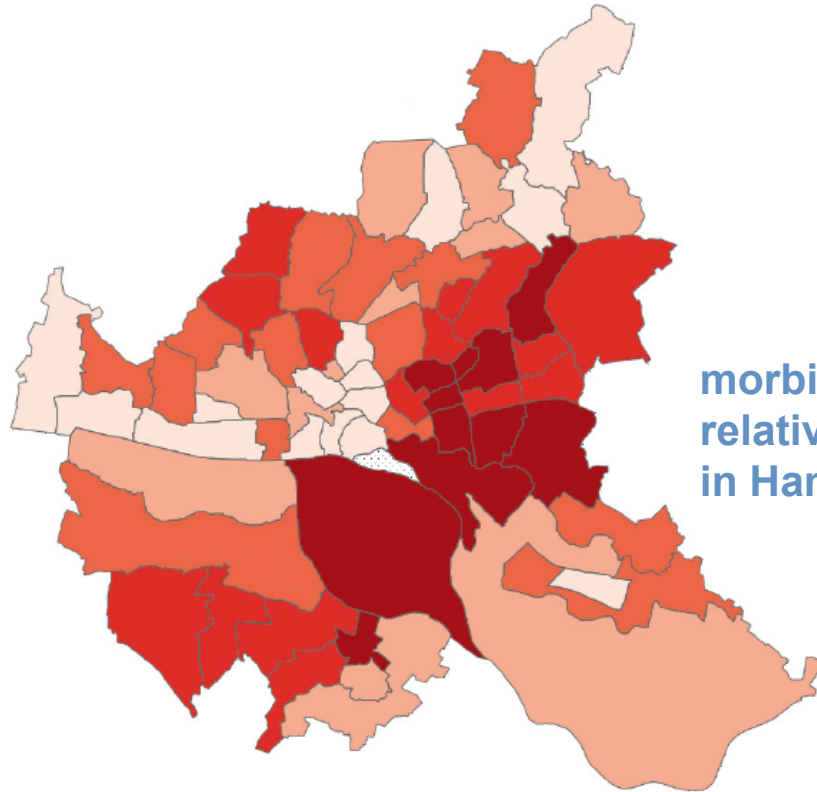
morbidity (RRS) of seniors (age 65 to 79)
relative to average (100%)
in Hamburg

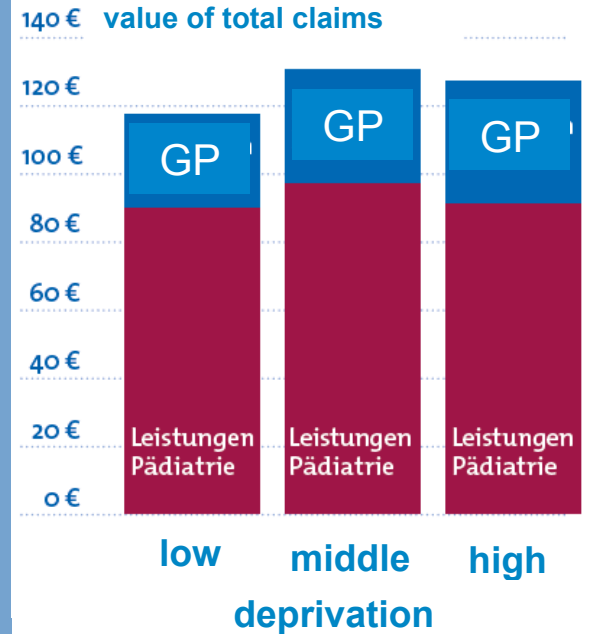|	
	134 bis 160%
	160 bis 165 %
	165 bis 170 %
	170 bis 175 %
	175 bis 200 %
	Datengrundlage nicht ausreichend

Data: claims database (Zi), DRG data by city of Hamburg

City of Hamburg as a model

Utilization of ambulatory care: higher in quarters with higher risk structure (age/gender/morbidity - all ages)

Actual utilization

Expected utilization (claims volume in Euro)

Social deprivation: associated with different patterns of utilization

140 €   value of total claims

GP   GP   GP

Leistungen Pädiatrie   Leistungen Pädiatrie   Leistungen Pädiatrie

low   middle   high

deprivation

eg juniors (age 0-17) use less paediatric but more GP services

zi

City of Hamburg as a model

More intensive utilization of ambulatory care associated with reduced number of inpatient cases (eg ages 18 to 64)

inpatient cases per 1.000 inhabitants

actual / expected ambulatory utilization (predictive ratio)
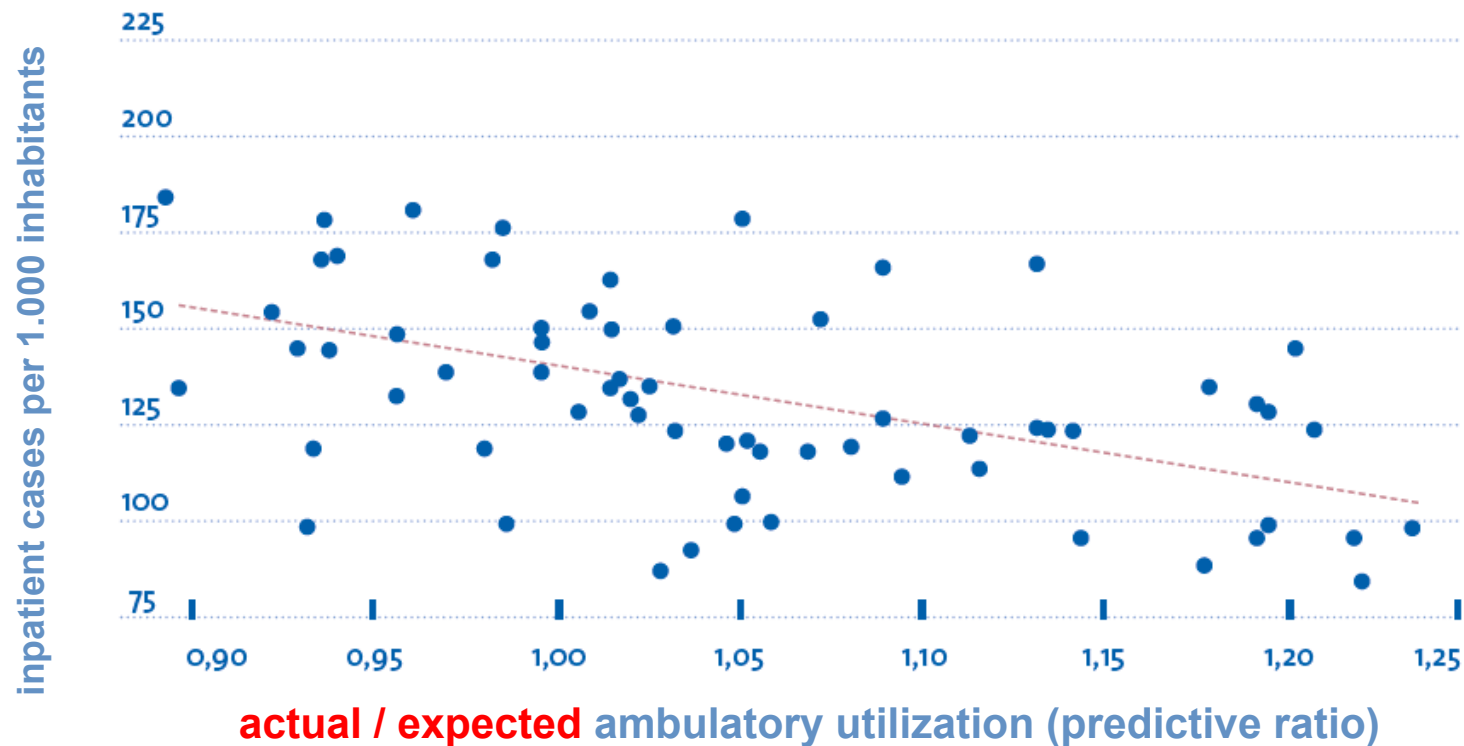
N.B.: utlization of inpatient and ambulatory care is higher for more deprived quarters, but *share of inpatient care* tends to be *highest for most deprived quarters*
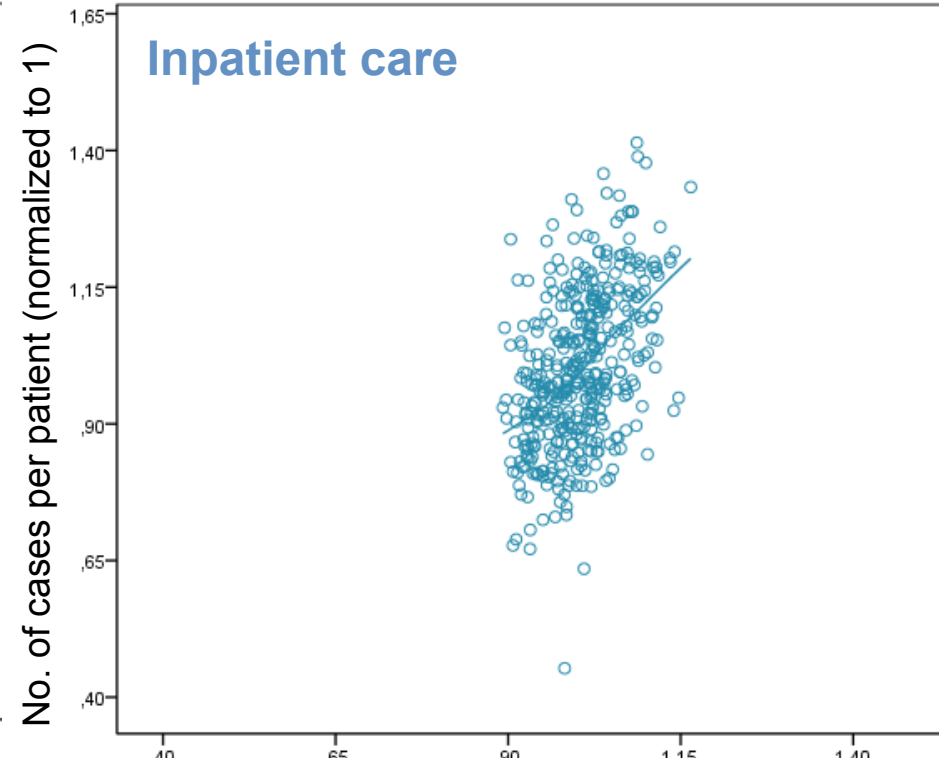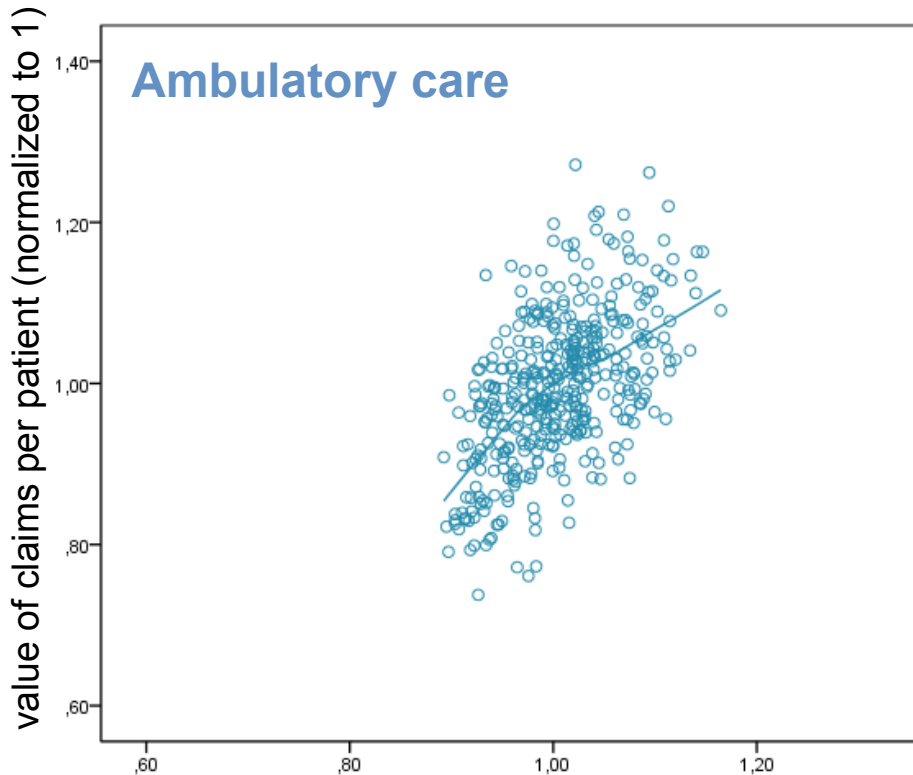
What did we see?

- **Utilization of both inpatient and ambulatory care respond to indicators of need**

- **given the risk structure of a population, there is a degree of potential substitution between inpatient and ambulatory care,**

- **however, socio-economic factors (deprivation) might interfere.**

Questions arising when looking at variation in ambulatory health care:

- **Check: Do we find more „need" in highly serviced regions?**

- **Do we account for the fact that more intensive ambulatory care can reduce utilization of inpatient care (after adjusting for social structure)?**

- **If we find lower than expected utilization of inpatient care: Does this indicate a higher level of quality of ambulatory care? (N.B. low hospitalization rates feature as quality indicators for continous chronic care)**

- **If medical progress constantly allows for higher share of ambulatory care, could we create benchmarks for a health policy target?**

Utilization of ambulatory and inpatient care and risk structure at county level

Ambulatory care — value of claims per patient (normalized to 1) vs Relative risk score

Inpatient care — No. of cases per patient (normalized to 1) vs Relative risk score

Relative risk score (age, gender diagnoses from physician claims)
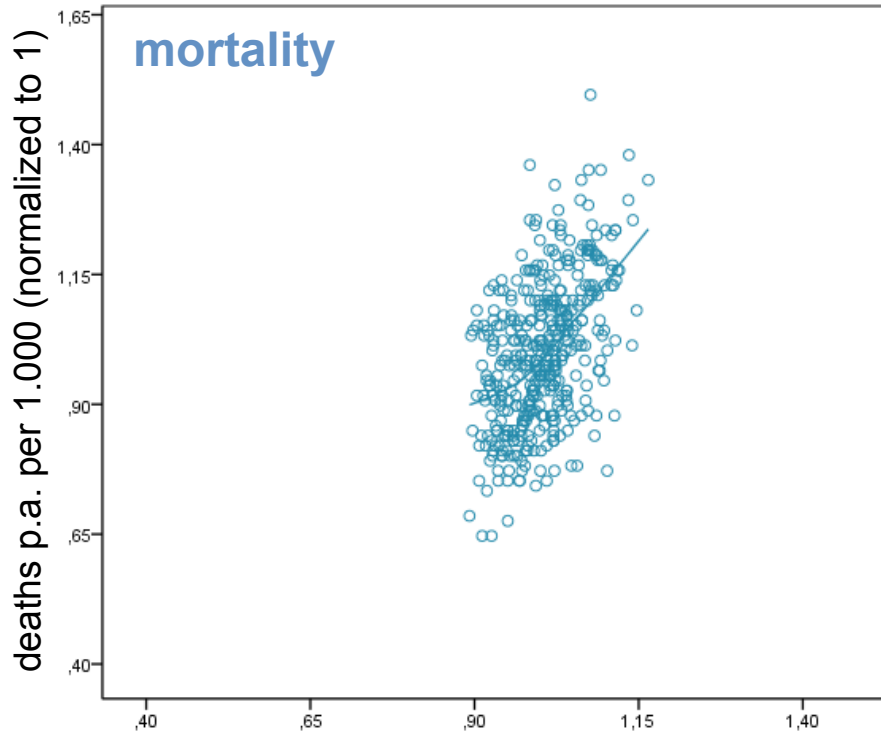
**CC, Pearson: 0,55 (p < 0,01)**   **CC, Pearson: 0,46 (p < 0,01)**

413 counties; riskoadjustiment 1-year prospective using H15EBA on age. Gender, diagnoses of office-based physicans in Germany
inpatient data: destatis, ambulatory data: KBV claims database 2008

Risk structure, mortality and physician density

mortality

deaths p.a. per 1.000 (normalized to 1)

physician density
(office-based physicians)

physician density (normalized to 1) after adjusting for outlow/inflow

Relative risk score (age, gender diagnoses from physician claims)

CC, Pearson: 0,49 (p < 0,01)
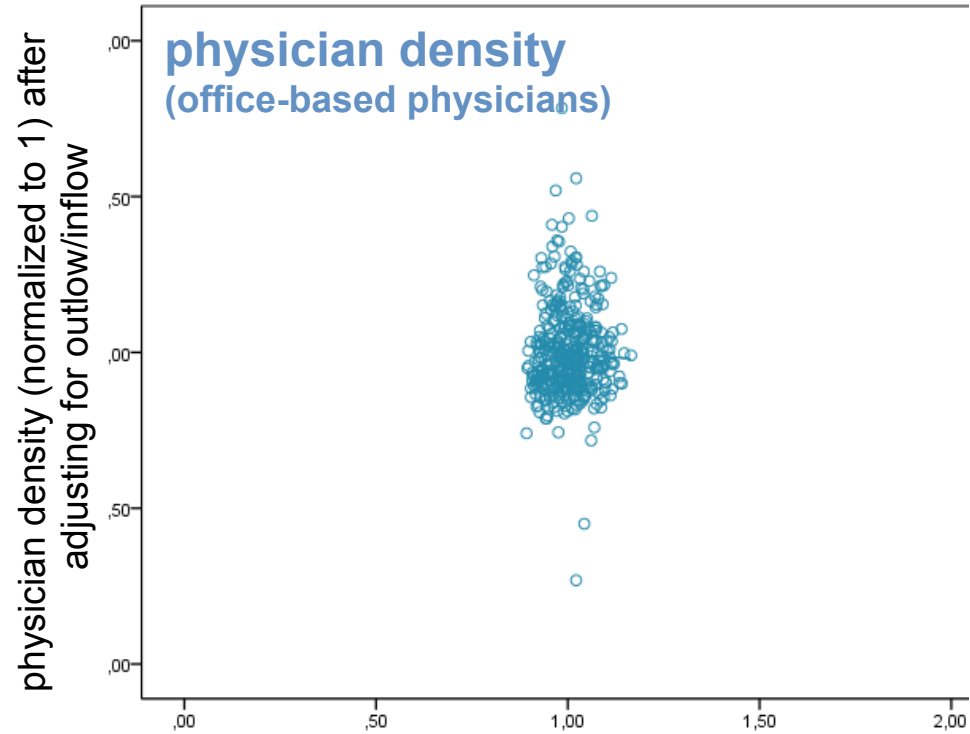
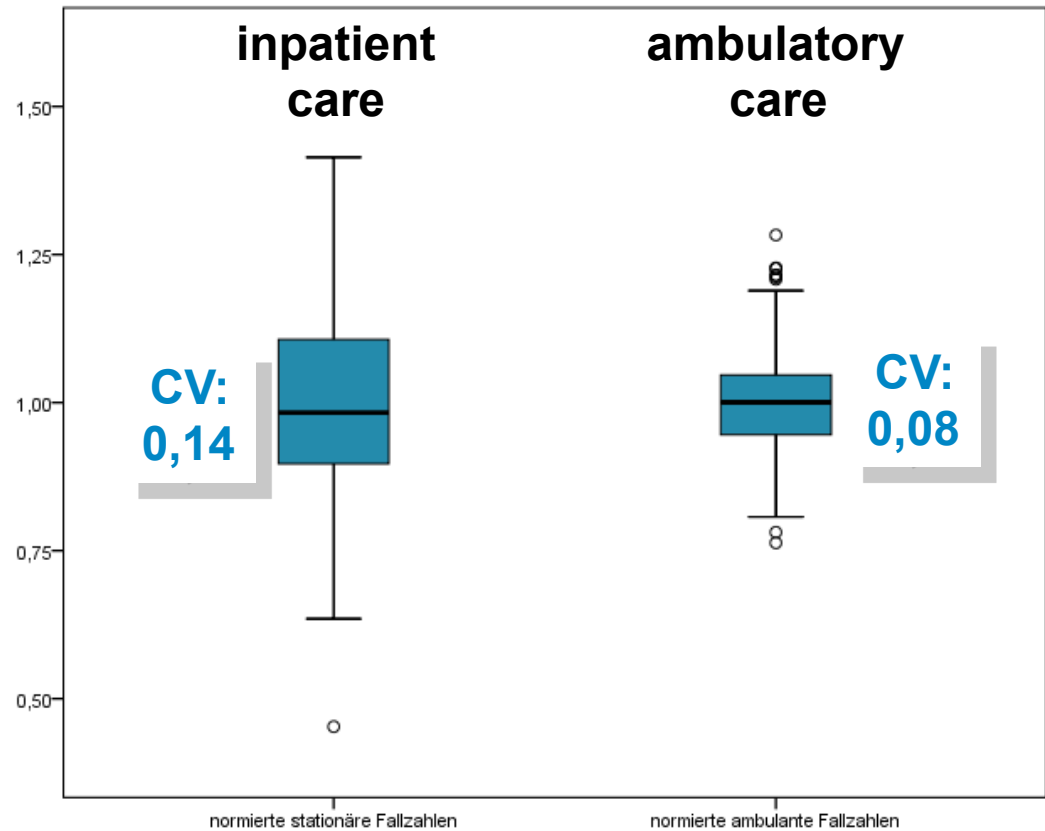**CC, Pearson: 0,02 (p = 0,67)**

413 Landkreise und kreisfreie Städte; Eigene Berechnungen; Risikoadjustierung nach H15EBA 1-jährig prospektiv;
Datenbasis: StBA, vollständige vertragsärztliche Abrechnungsdaten 2007/2008

Observation

regional variation in inpatient cases (based on DRGs) per insuree exceeds variation of cases*/insuree in ambulatory care

regional variation
in no. of cases per resident insuree for inpatient and ambulatory care after normalization to 1
regions: 413 counties

Data sources: DRG Statistik (destatis), KBV claims database 2008

What defines a case in ambulatory care?
same patient, same payor, same practice,
same quarter of the year

Observations on variations of ambulatory care
deviation from national average, no of services per resident insuree (age/sex adjusted)

Chapter 33: Ultrasound diagnostics

The image cannot be displayed. Your computer may not have enough memory to open the image, or the image may have been corrupted. Restart your computer, and then open the file again. If the red x still appears, you may have to delete the image and then insert it again.

Chapter 34: CT. MRT, diagnostic & interventional radiology

The image cannot be displayed. Your computer may not have enough memory to open the image, or the image may have been corrupted. Restart your computer, and then open the file again. If the red x still appears, you may have to delete the image and then insert it again.

VC = 21,4%

The image cannot be displayed. Your computer may not have enough memory to open the image, or the image may have been corrupted. Restart your computer, and then open the file again. If the red x still appears, you may have to delete the image and then insert it again.

VC = 9,9%

The image cannot be displayed. Your computer may not have enough memory to open the image, or the image may have been corrupted. Restart your computer, and then open the file again. If the red x still appears, you may have to delete the image and then insert it again.
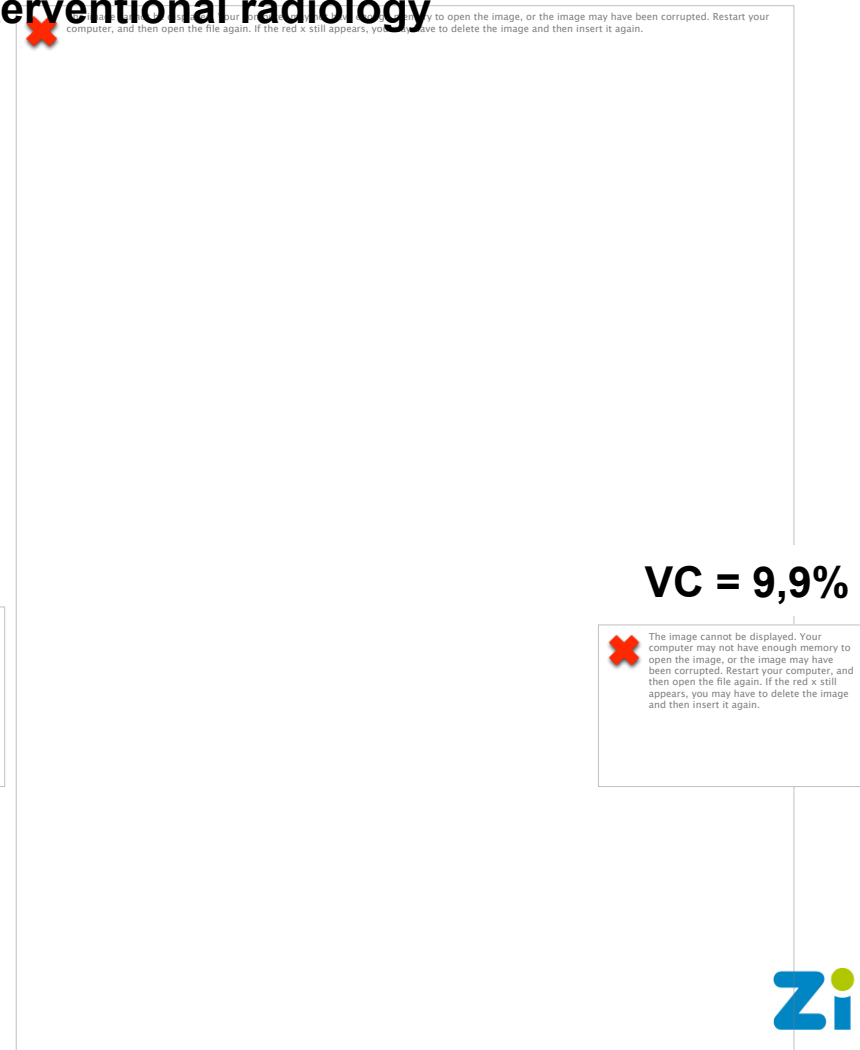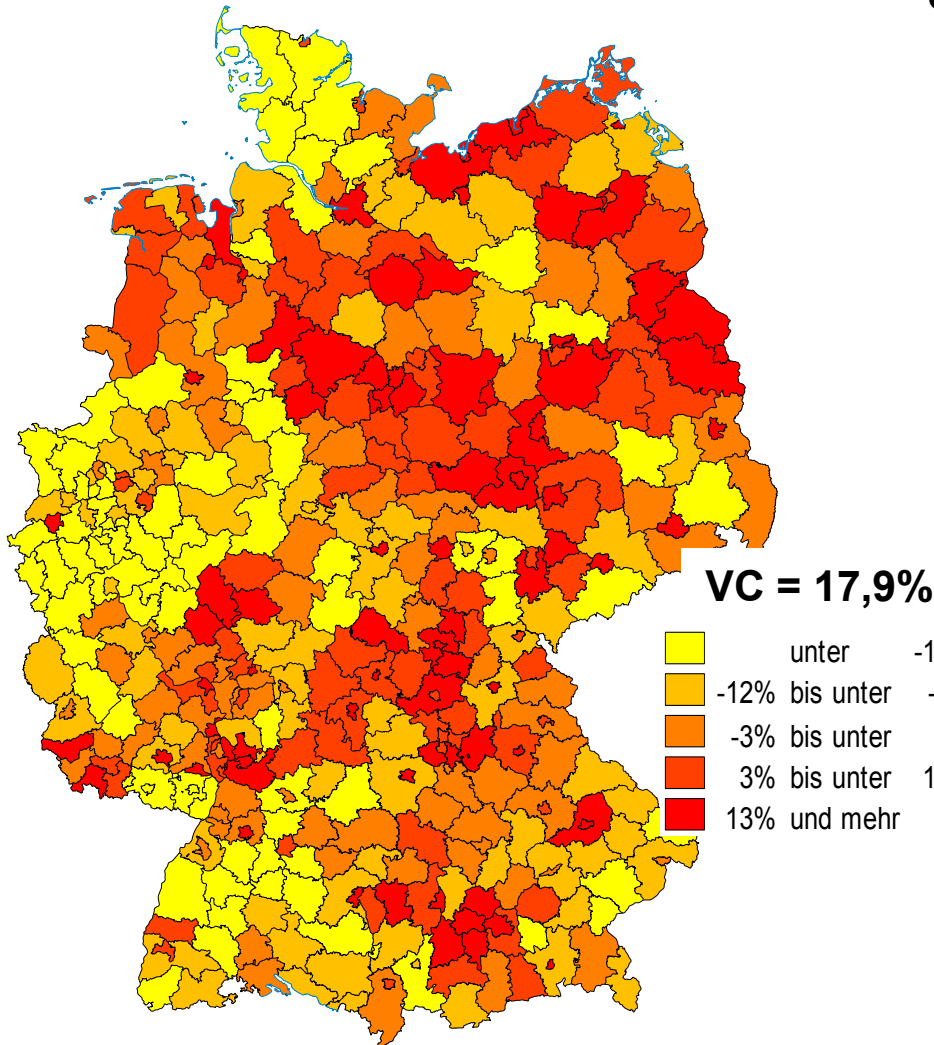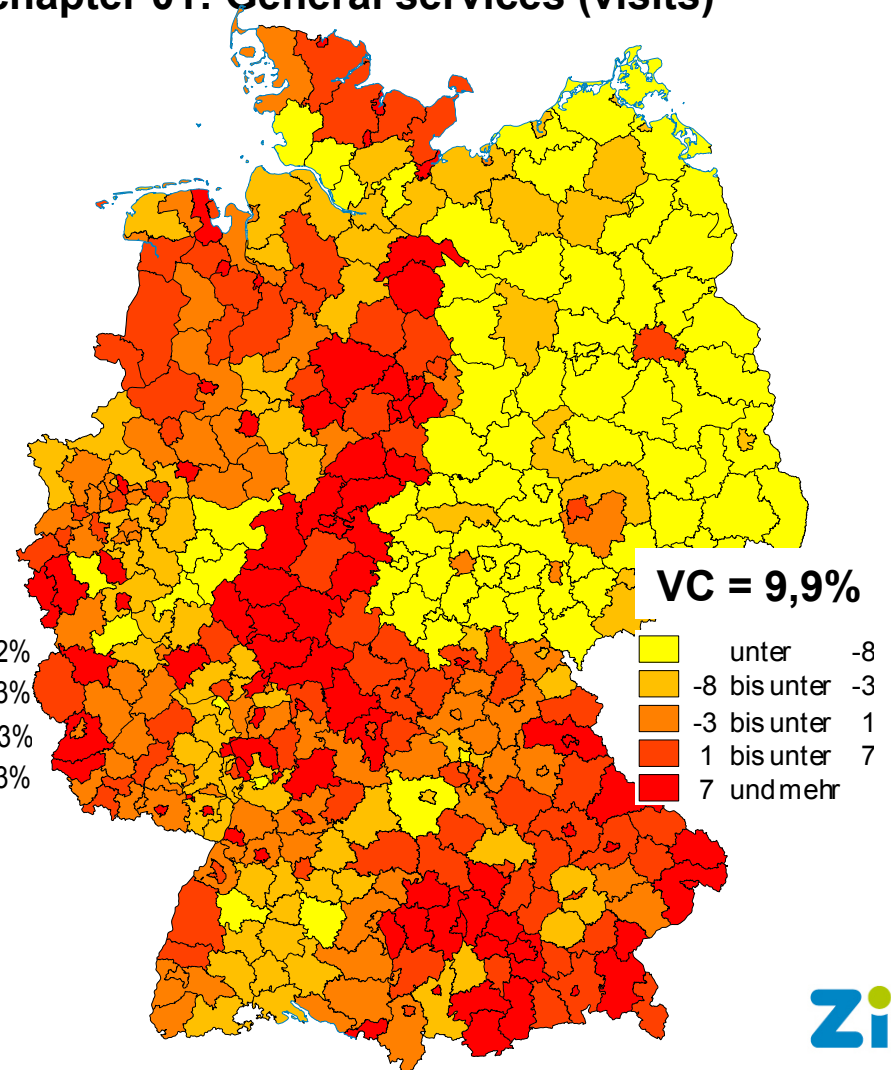
zi

Observations on variations of ambulatory care
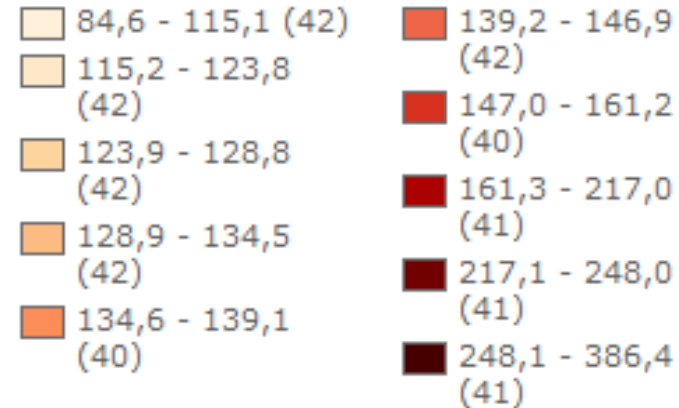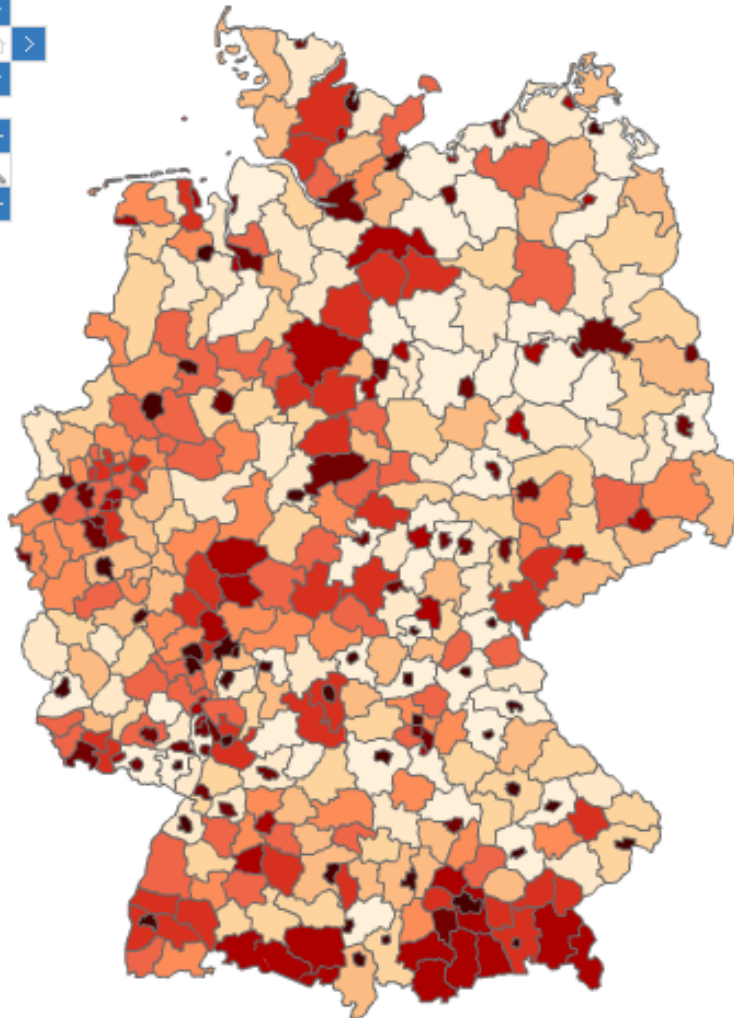## deviation from national average, no of services per resident insuree (age/sex adjusted)

chapter 13: Internal medicine

chapter 01: General services (visits)

VC = 17,9%

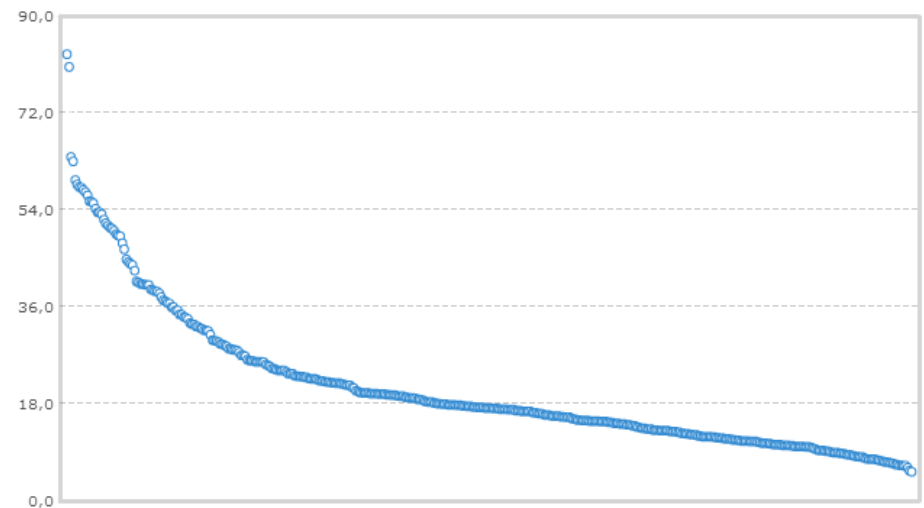|	
	unter -12%
	-12% bis unter -3%
	-3% bis unter 3%
	3% bis unter 13%
	13% und mehr

VC = 9,9%

	unter -8
	-8 bis unter -3
	-3 bis unter 1
	1 bis unter 7
	7 und mehr

zi

Variation in physician density (all specialties) in ambulatory care per 100.000 inhabitants and county 2011

Legend:
- 84,6 – 115,1 (42)
- 115,2 – 123,8 (42)
- 123,9 – 128,8 (42)
- 128,9 – 134,5 (42)
- 134,6 – 139,1 (40)
- 139,2 – 146,9 (42)
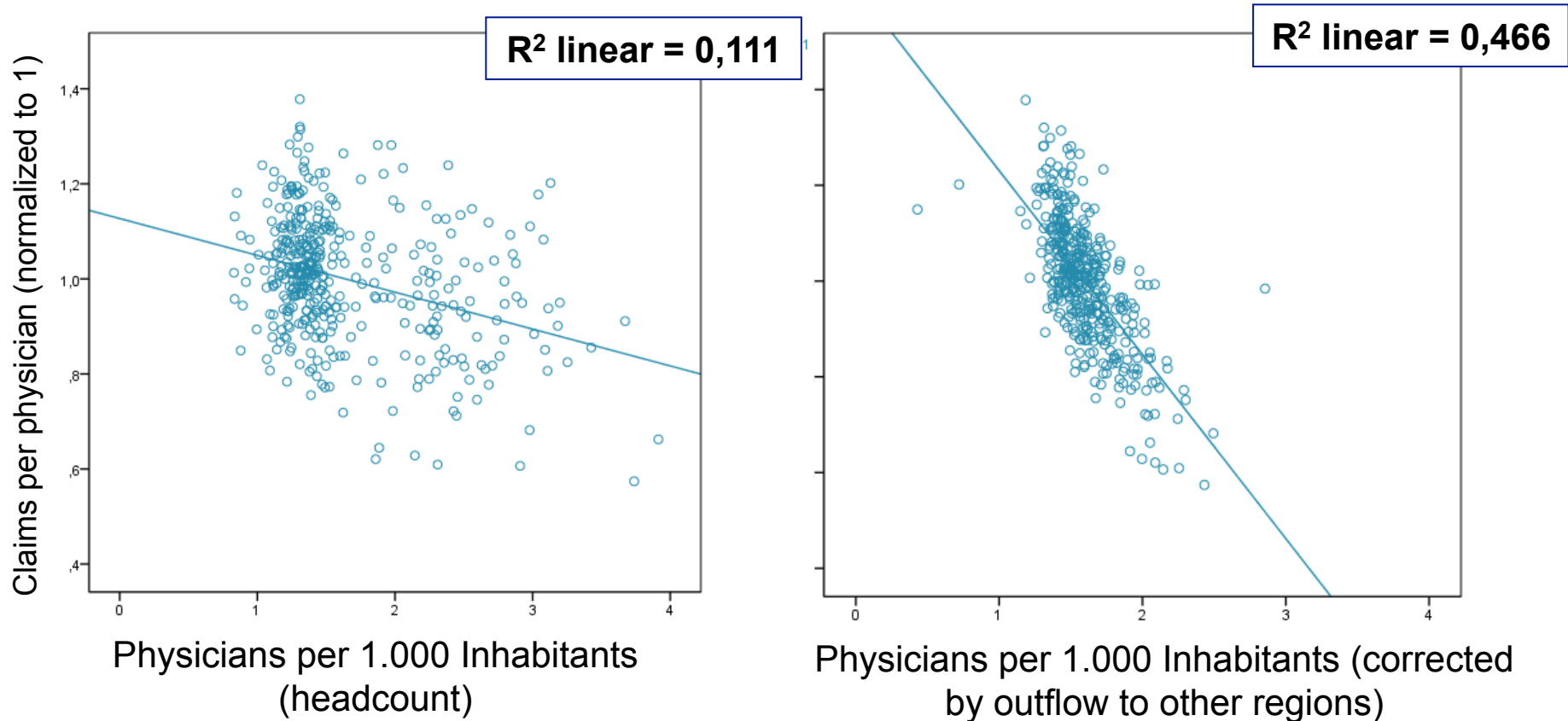- 147,0 – 161,2 (40)
- 161,3 – 217,0 (41)
- 217,1 – 248,0 (41)
- 248,1 – 386,4 (41)
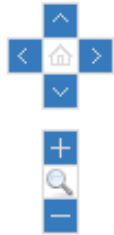
Outflow to other counties in % of all ambulatory services per county

source: www.versorgungsatlas.de

Physician density and volume of services per physician
– the importance of adjusting for outflow

R^2 linear = 0,111

R^2 linear = 0,466

Claims per physician (normalized to 1)

Physicians per 1.000 Inhabitants
(headcount)

Physicians per 1.000 Inhabitants (corrected
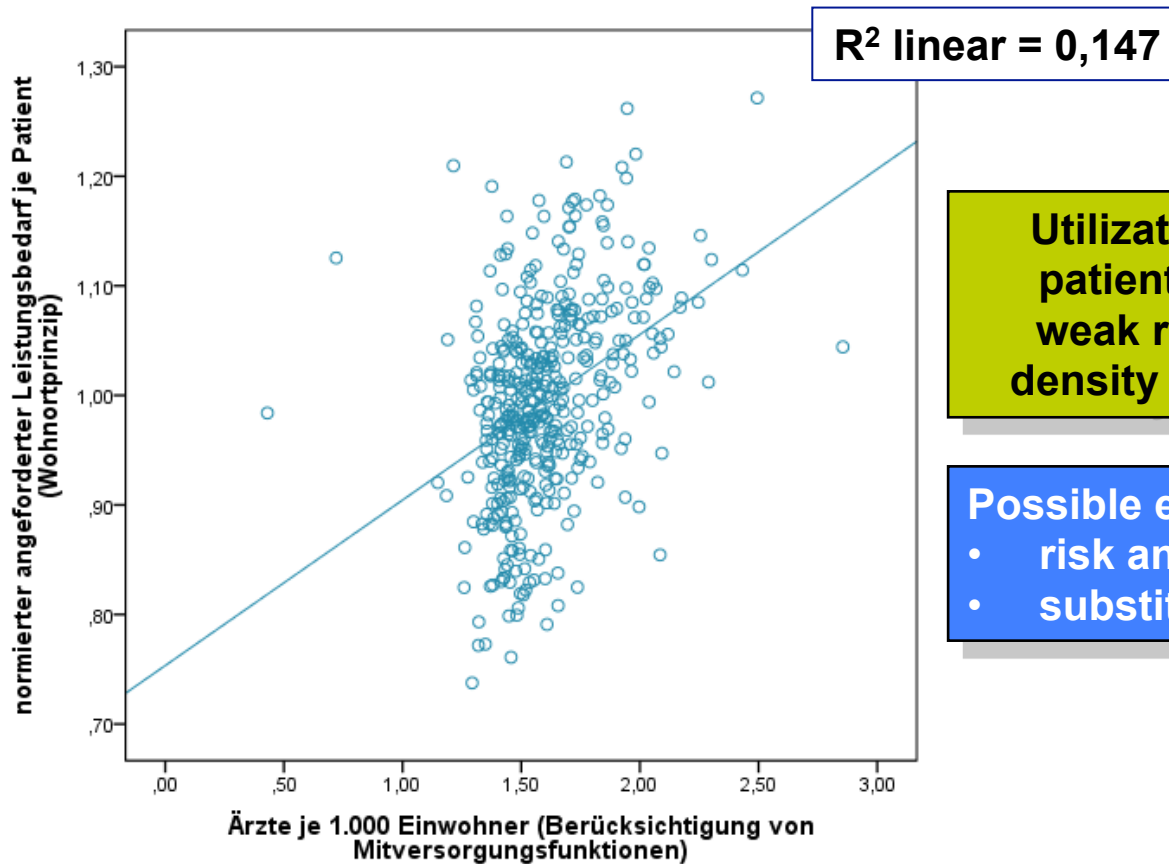by outflow to other regions)

**After correcting for outflow of services to other regions
a high physician density is clearly negatively associated
with service volume per physician**

413 counties; database: destatis, claims database 2008

Intensity of ambulatory care per patient and physician density (after correcting for outflow)

R² linear = 0,147

Utilization of ambulatory care per patient (by county of residency): weak relationship with physician density (after adjusting for outflow)

Possible explanations?
- risk and social structure of patients
- substitution for inpatient care

413 Landkreise und kreisfreie Städte; Eigene Berechnungen; Datenbasis: StBA, vollständige vertragsärztliche Abrechnungsdaten 2008

Zi-index of social structure / set of indicators

**selection of indicators was based on literature
and availability at county-level
method: factor analysis**

Factor 1:

Socio-economic Health Index (SGX)

rate of unemployment /welfare recipients

no. of persons in supported housholds

share of working welfare recipients

recipients of rent-subsidies
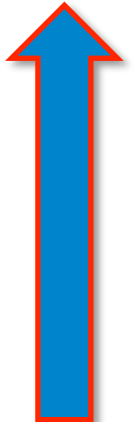
High values of SGX

life expectancy (men)

income per household

Factor 2:

Index of Urbanization (UX)

mobility (Out- and Inmigration)

rate of single-housholds

share of foreigners

rate of jobless foreigners

Rate of highly qualified employees

Population density

welfare payments to pensioners

High values of UX

Size of households

zi

Zi-index of social structure / geographic distibution

	unter 0,41
	0,41 bis unter 0,57
	0,57 bis unter 0,73
	0,73 bis unter 0,87
	0,87 bis unter 1,03
	1,03 bis unter 1,32
	1,32 bis unter 1,86
	1,86 und mehr
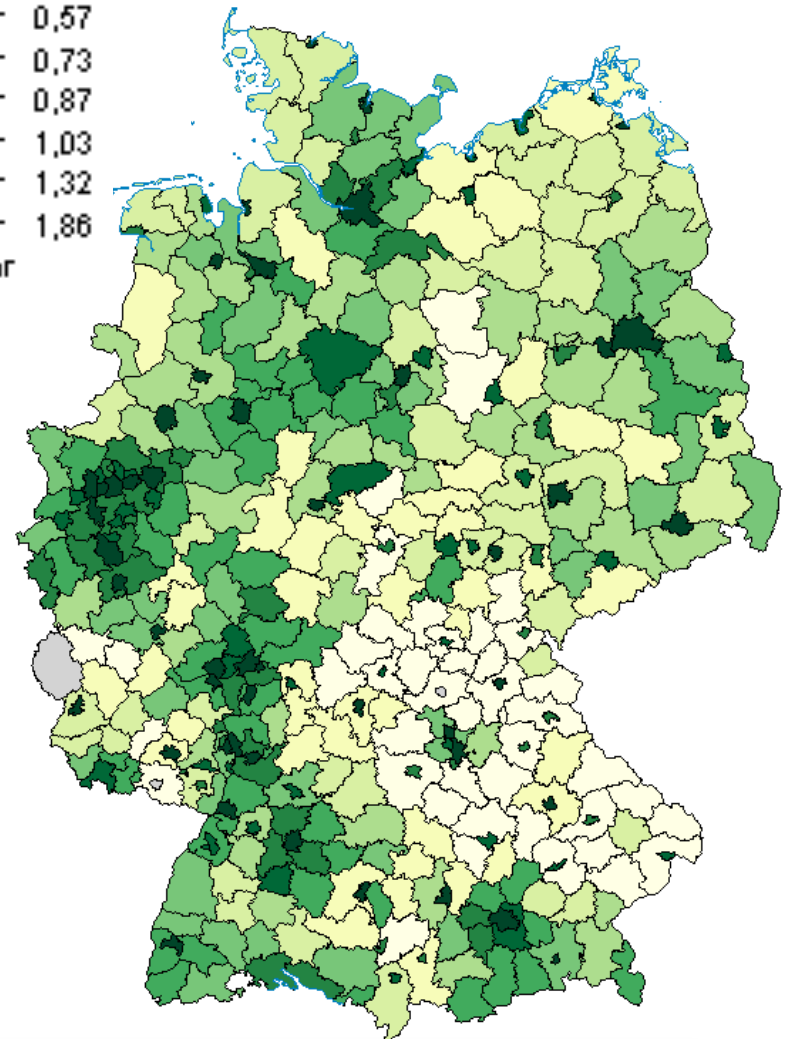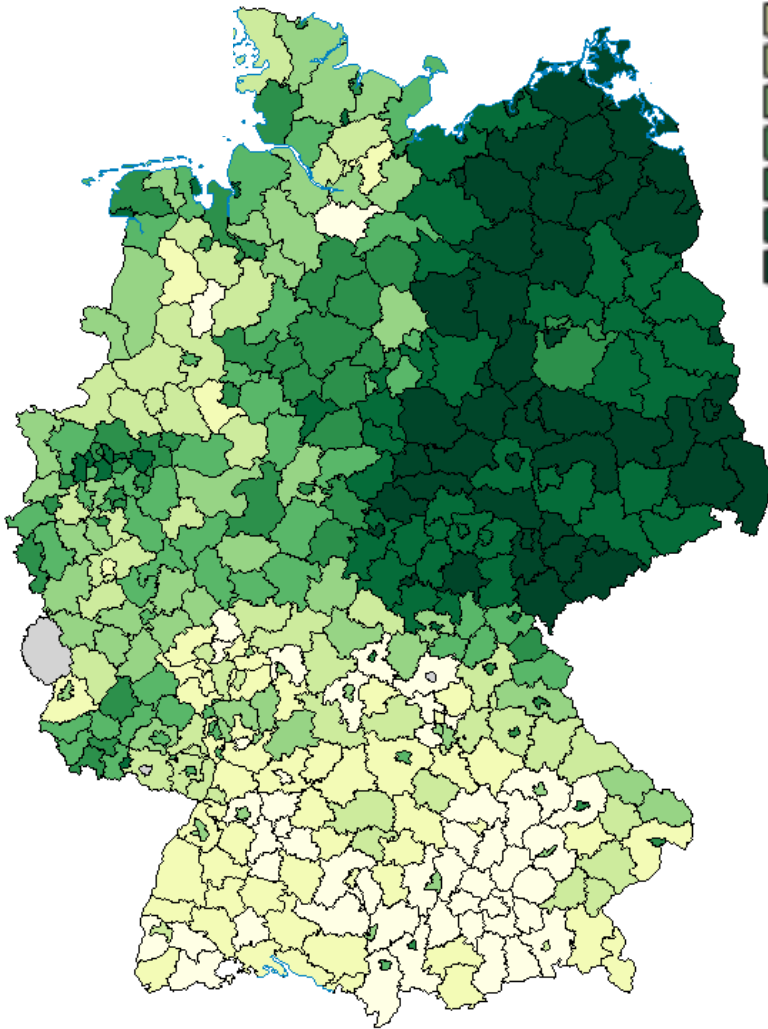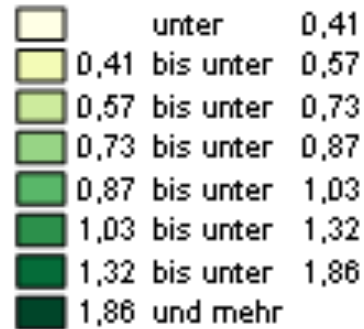
Socio-economic Health Index (SGX)

Index of Urbanization (UX)

zi

Zi-index of social structure / medical need

Correlation of SGX und UX with indicators of medical need		
Indicator	CC r (p-value)	
	SGX	**UX**
morbidity/mortality		
RRS	0,790 (<0,001)	ns
total mortality (standardised)	0,675 (<0,001)	-0,190 (0,024)
premature mortality (standardised)	0,738 (<0,001)	0,138 (0,005)
inpatient care		
admissions per 100.000	0,650 (<0,001)	-0,226 (<0,001)
ambulatory care		
value of all claims	0,346 (<0,001)	0,473 (<0,001)
GP claims	0,459 (<0,001)	ns
Specialists claims	ns	0,583 (<0,001)
Value of specific fee-items		
drug substitution (01950)	ns	0,613 (<0,001)
multiple chronic diseases (03212)	0,666 (<0,001)	-0,109 (0,027)
psychotherapy (chapter 35)	-0,403 (<0,001)	0,645 (<0,001)

Relationship between inpatient and ambulatory care for ambulatory sensitive conditions

ORIGINAL PAPER

The impact of office-based care on hospitalizations for ambulatory care sensitive conditions

Leonie Sundmacher · Thomas Kopetsch

Fig. 1 Geographical distribution of ambulatory care-sensitive hospitalizations and the corresponding UVS points billed (for services performed in the ambulatory sector) for women (**a,b**) and men (**c,d**). Both indicators are age-standardized

Relationship between inpatient and ambulatory care for ambulatory sensitive conditions
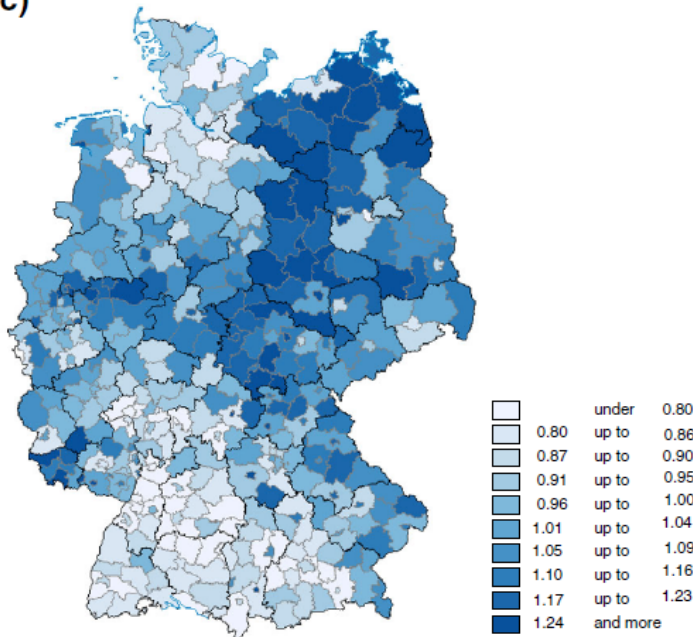
ORIGINAL PAPER

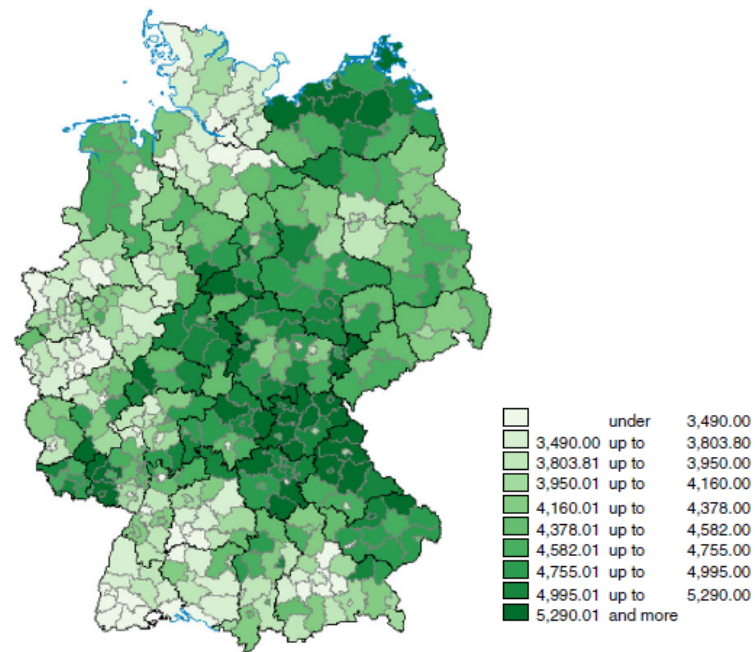## The impact of office-based care on hospitalizations for ambulatory care sensitive conditions

Leonie Sundmacher · Thomas Kopetsch

Relationship between UVS points and
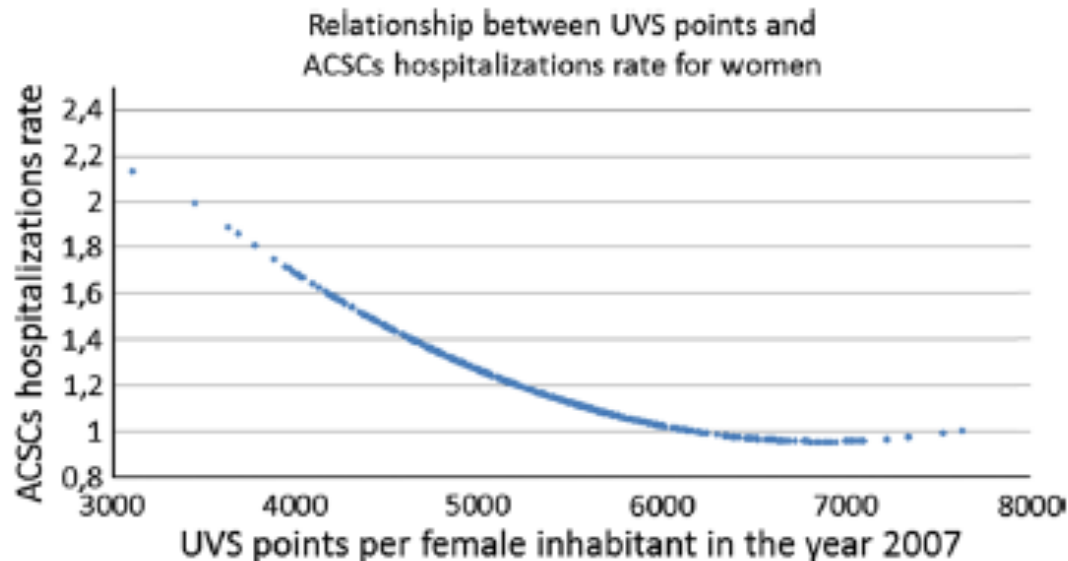ACSCs hospitalizations rate for women

Fig. 2 Relationship between UVS points and ACSCs hospitalization rate for women (evaluated at the mean value of the covariates)

Germany: Demographic aging and longterm development of inpatient cases

TABELLE 2

Indexzerlegung stationäre Versorgung ausgewählter chronischer Krankheiten 2000–2009, beide Geschlechter

Hauptdiagnosegruppe/Diagnosegruppe	Fallzahlen		Index (Veränderung in %)		
	2000	2009	insgesamt	wegen Risiko	wegen demografischer Alterung
beide Geschlechter					
A00–T98 alle Krankheiten und Folgen äußerer Ursachen	16 723 761	17 567 310	1,050 (+5,0)	0,990 (−1,0)	1,061 (+6,1)
darunter					
I00–I99 Herz-Kreislauf-Erkrankungen	2 752 941	2 695 860	0,979 (−2,1)	0,852 (−14,8)	1,150 (+15,0)
– I20–I25 ischämische Herzkrankheiten	895 016	661 317	0,739 (−26,1)	0,641 (−35,9)	1,152 (+15,2)
– I50 Herzinsuffizienz	239 148	363 256	1,519 (+51,9)	1,245 (+24,5)	1,220 (+22,0)
– I60–I69 zerebrovaskuläre Krankheiten	390 598	357 141	0,914 (−8,6)	0,773 (−22,7)	1,183 (+18,3)
C00–C97 (ohne C44) bösartige Neubildungen	1 617 804	1 425 633	0,881 (−11,9)	0,772 (−22,8)	1,142 (+14,2)
– C18–C21 Darmkrebs	248 352	173 455	0,698 (−30,2)	0,613 (−38,7)	1,139 (+13,9)
– C33–C34 Lungenkrebs	177 450	188 100	1,060 (+6,0)	0,922 (−7,8)	1,150 (+15,0)
– C50 Mammakarzinom	250 510	146 587	0,585 (−41,5)	0,553 (−44,7)	1,057 (+5,7)
– C61 Prostatakarzinom	80 088	83 868	1,047 (+4,7)	0,845 (−15,5)	1,239 (+23,9)
M00–M99 Krankheiten des Muskel-Skelett-Systems und des Bindegewebes	1 239 222	1 641 564	1,325 (+32,5)	1,244 (+24,4)	1,065 (+6,5)
– M15–M19 Arthrosen	298 507	419 411	1,405 (+40,5)	1,256 (+25,6)	1,118 (+11,8)
– M40-M54 Krankheiten der Wirbelsäule und des Rückens	340 625	545 418	1,601 (+60,1)	1,508 (+50,8)	1,061 (+6,1)

Quelle: Krankenhausdiagnosestatistik des Statistischen Bundesamtes, eigene Berechnungen

Germany: Demographic aging and longterm development of inpatient cases

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C00–C97 (ohne C44) bösartige Neubildungen	1 617 804		(−11,5)	(−22,5)	(+1
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– C33–C34 Lungenkrebs	177 450	188 100	1,060 (+6,0)	0,922 (−7,8)	
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Quelle: Krankenhausdiagnosestatistik des Statistischen Bundesamtes, eigene Berechnungen

2000-2009

Index (Veränderung in %)

insgesamt	wegen Risiko	wegen demografischer Alterung
observed		**expected***
1,050 (+5,0)	0,990 (−1,0)	1,061 (+6,1)

after adjusting for demographic aging: no of inpatient admissions 1% lower (~ 20% of observed)

Germany: Demographic aging and longterm development of inpatient cases

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Quelle: Krankenhausdiagnosestatistik des Statistischen Bundesamtes, eigene Berechnungen

Circulatory system: - 14,8%

Neoplasms: - 22,8%

musculoscelettal: + 24,4%

Germany: longterm development of inpatient days 2007 – 2011 per region

	observed	expected based on demographic aging	after adjusting for aging
Schleswig-Holstein	0,30%	4,26%	**-3,96%**
Hamburg	-3,25%	3,15%	**-6,39%**
Bremen	-6,22%	2,27%	**-8,49%**
Niedersachsen	-2,66%	3,20%	**-5,86%**
Westfalen-Lippe	-2,52%	2,19%	**-4,71%**
Nordrhein	-2,50%	3,28%	**-5,78%**
Hessen	-2,09%	3,67%	**-5,76%**
Rheinland-Pfalz	-2,06%	2,82%	**-4,88%**
Baden-Württemberg	-4,14%	4,28%	**-8,42%**
Bayern	-4,97%	4,01%	**-8,98%**
Berlin	-0,62%	5,89%	**-6,50%**
Saarland	-3,80%	2,10%	**-5,90%**
Mecklenburg-Vorpommern	-2,81%	4,78%	**-7,59%**
Brandenburg	-2,79%	5,65%	**-8,44%**
Sachsen-Anhalt	-6,94%	1,88%	**-8,83%**
Thüringen	-0,18%	2,95%	**-3,13%**
Sachsen	-1,25%	3,05%	**-4,31%**
Bund / Germany	-2,94%	3,55%	**-6,49%**

Database: destatis DRG statistics

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observed: -2,94%

expected based on aging: +3,55%

after adjustment for aging: - 6,49%

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How much of variation is substitution? / WIC / London September 2014 / www.zi.de
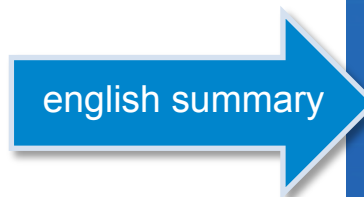
Germany: recent development of inpatient days and intensity of ambulatory care 2011 – 2012 by region and indication

- Comparison of recent developments in intensity of ambulatory care (volume of claims) and in inpatient days; after adjustment for aging by region differentiated by ICD-10 chapters.

- 17 regions and 20 ICD-10 chapters: **340 cells**

service development 2011-2012		ambulatory care (office-based physicians)	
		increase	**reduction**
inpatient care	reduction	175 (51%)	56 (16%)
	increase	82 (24%)	27 (8%)

descriptive analysis
to stimulate evaluation and discussion on *desired developments at regional level*

english summary

versorgungsatlas.de

health policy targets for a joint development of ambulatory care and inpatient care?

A provocative suggestion: 21 best-practice counties in Germany

Utilization of inpatient care: 15% <u>below</u> national average
Utilization of ambulatory care 13% <u>above</u> national average

Federal State	county	inhabitants in 2011
Baden-Württemberg	Rhein-Neckar-Kreis	537.625
Niedersachsen	Oldenburg	127.282
Baden-Württemberg	Konstanz	278.983
Baden-Württemberg	Ulm, Stadt	122.801
Hessen	Wiesbaden, Stadtt	275.976
Baden-Württemberg	Mannheim, Stadt	313.174
Baden-Württemberg	Karlsruhe, Stadt	294.761
Hessen	Main-Taunus-Kreis	227.398
Niedersachsen	Ammerland	118.004
Bayern	München, Stadt	1.353.186
Niedersachsen	Lüneburg	177.279
Berlin	Berlin	3.460.725
Sachsen	Leipzig, Sadt	522.883
Mecklenburg-Vorpommern	Rostock	202.735
Hamburg	Hamburg	1.786.448
Niedersachsen	Osnabrück, Stadt	164.119
Bayern	München, Landkreis	323.015
Mecklenburg-Vorpomern	Bad Doberan	117.197
Niedersachsen	Oldenburg, Stadt	162.173
Baden-Württemberg	Freiburg im Breisgau	224.191
Baden-Württemberg	Heidelberg, Stadt	147.312

21 counties out of 8 federal states, mostly metropolitan but also rural,

total of **10.9 million inhabitants**

UX above average SGX below average but no clear pattern in middle group

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health policy targets for a joint development of ambulatory care and inpatient care?

A provocative suggestion: 21 best-practice counties in Germany

Inpatient cases per insuree (according to county of residence), standardised for age, morbidity, gender social structure
selected chronic diseases
(low inpatient admission rates = sign of good quality ambulatory care)

high blood pressure

chronic heart failure

asthma, status asthmaticus

diabetes mellitus
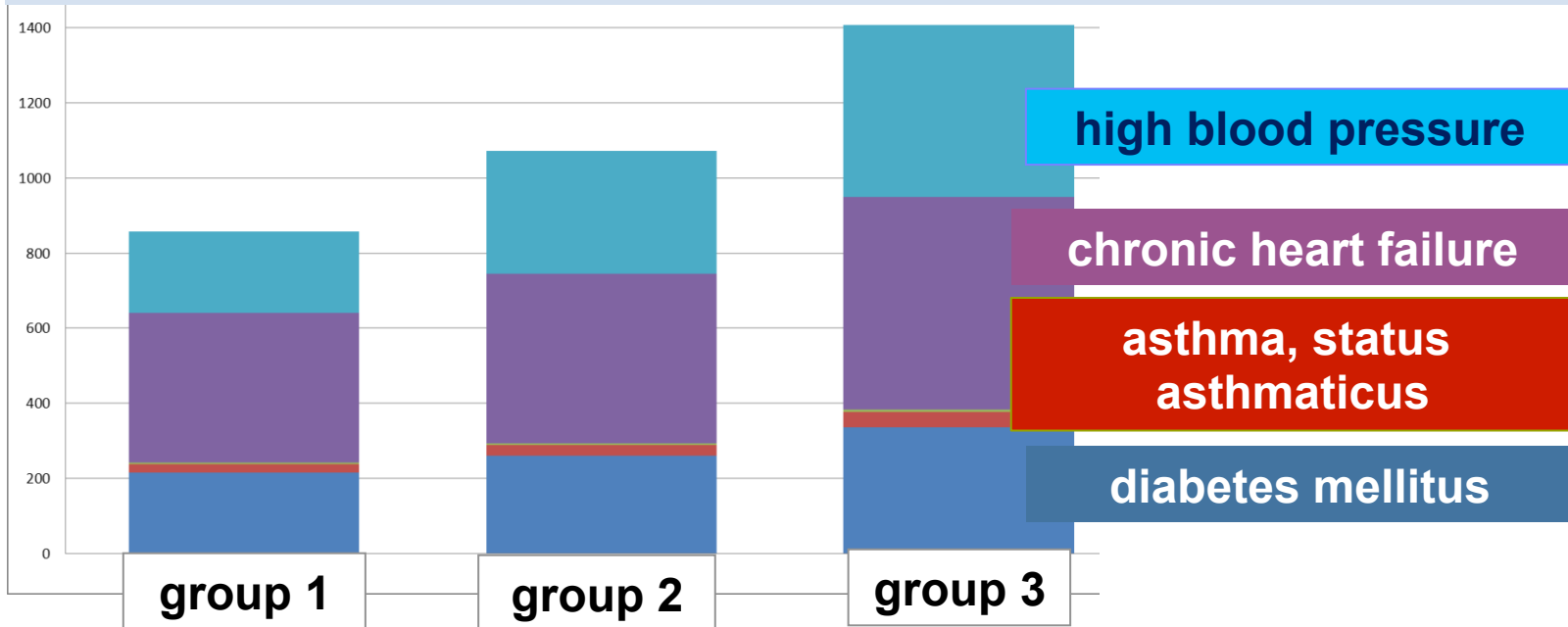
share of ambulatory care
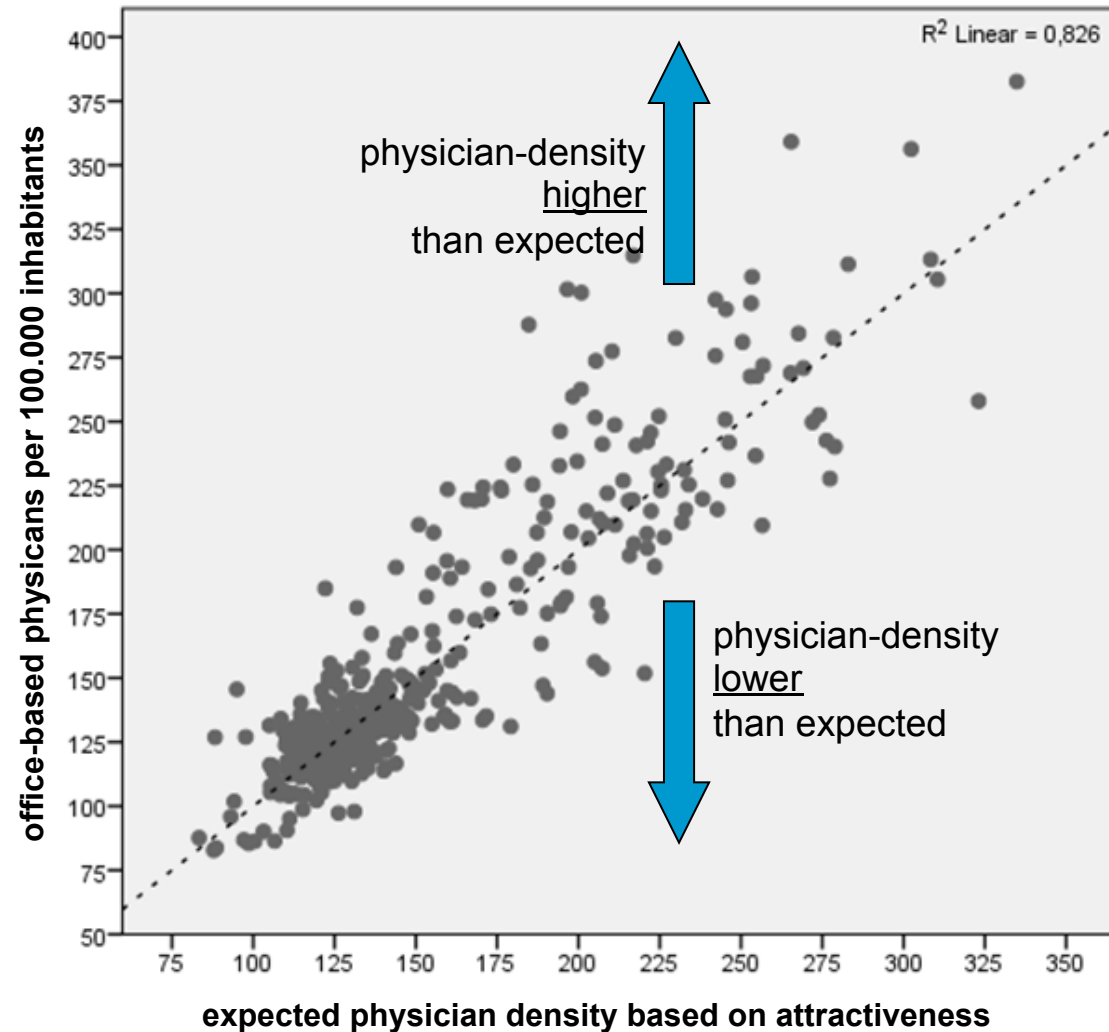group 1: high (**best-practice**);
group 2: average;
group 3: low

Index of regional attractiveness (for physicians)

Regression model to explain physician density by county - variables based on surveys among physicians (and availability)

- **professional opportunities, metropolitan environment** (GDP per capita, rate of highly qualified employees, high rate of inmigration for professional training, rate of male part-time employees)

- **availablity of childcare** (rate of day-care for toddlers and preschool children)

- **Opportunities for professional exchange and vocational training** (density of hospital beds, nursing home capacity, rate of students)

- **rural environment (-)** (rate of employment, rate of labour force participation, share of recreational areas, low population density, distance from metropolitan areas and subcentres, access to fast train-lines and motorways)

Scatter plot with R^2 Linear $= 0{,}826$; y-axis: office-based physicans per 100.000 inhabitants; x-axis: expected physician density based on attractiveness. Annotations: "physician-density higher than expected" and "physician-density lower than expected".

Best-practice regions and regional attractiveness

Efficient division of labour between inpatient and ambulatory care does not depend on a specific attractiveness of regions and spreads across different types of regions in terms of physician density (and social structure)

How much of variation is substitution? / WIC / London September 2014 / www.zi.de
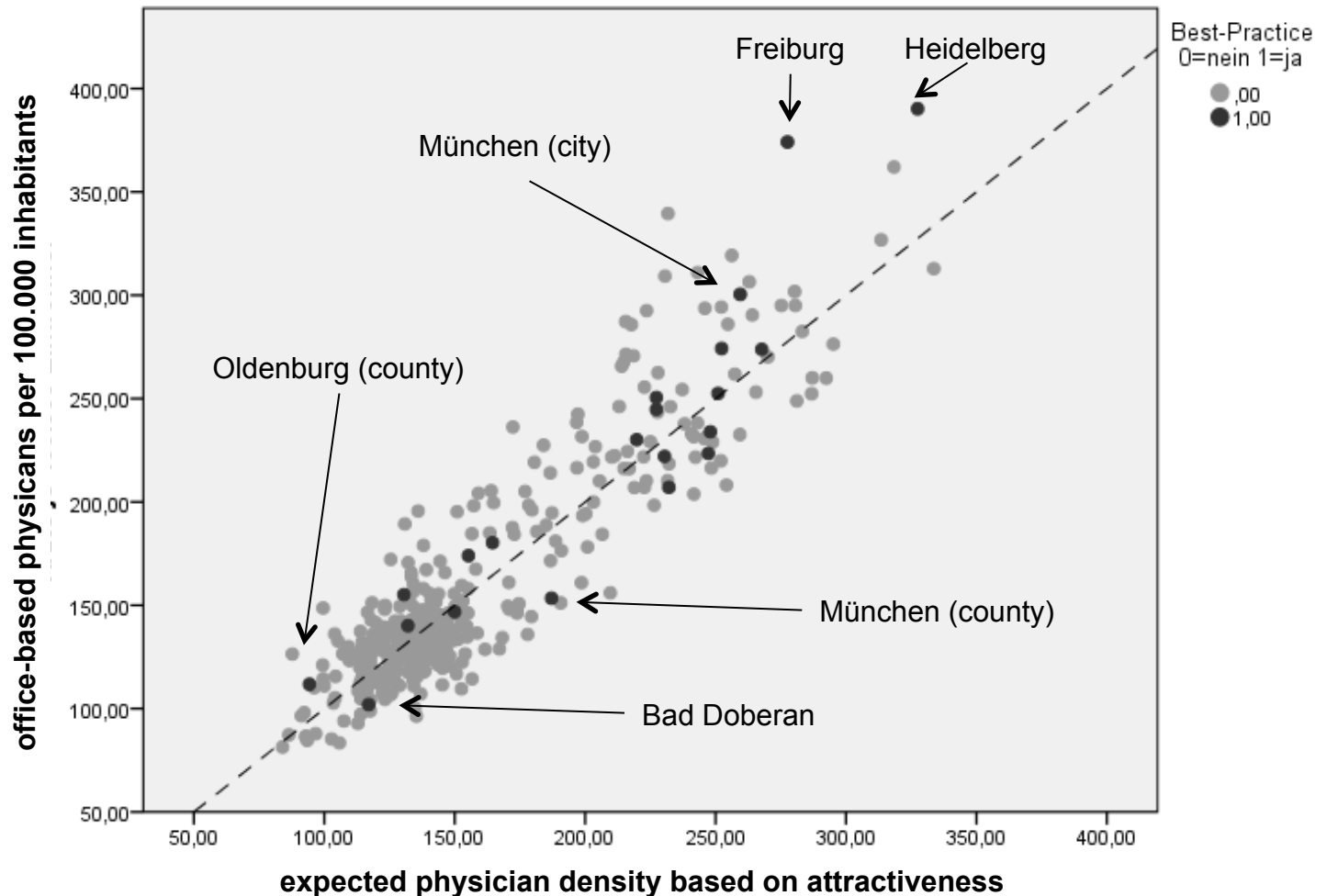
What have we learned so far?

- overall level of care is higher in areas with a less favorable risk structure (age, gender, morbidity, mortality , social structure) but there is no homogeneity of care

- areas with less favorable risk structure tend to have a lower density of physicians both ambulatory and inpatient ; urban regions are more likely to have higher rates of ambulatory care

- there is a varying share of ambulatory and in patient care in total care – as well as eg a varying share of care provided by GPs and by specialists within the ambulatory care sector

- a lot of the variation in individual services appears to be substitution between different types of services / specialties / sectors

- regulators tends to think from a „national average" as a reference for capacity planning or penalizing overtreatment - which turns out to be meaningless

- to guide investment (eg in ambulatory care) / disinvestment (eg in inpatient care) decisions and quality improvement strategies we need population-based „best-practise" benchmarks taken from regional variation which can then be transformed into local targets

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Thank you for your attention

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