Technische Universität Berlin

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Health care and avoidable mortality in Germany

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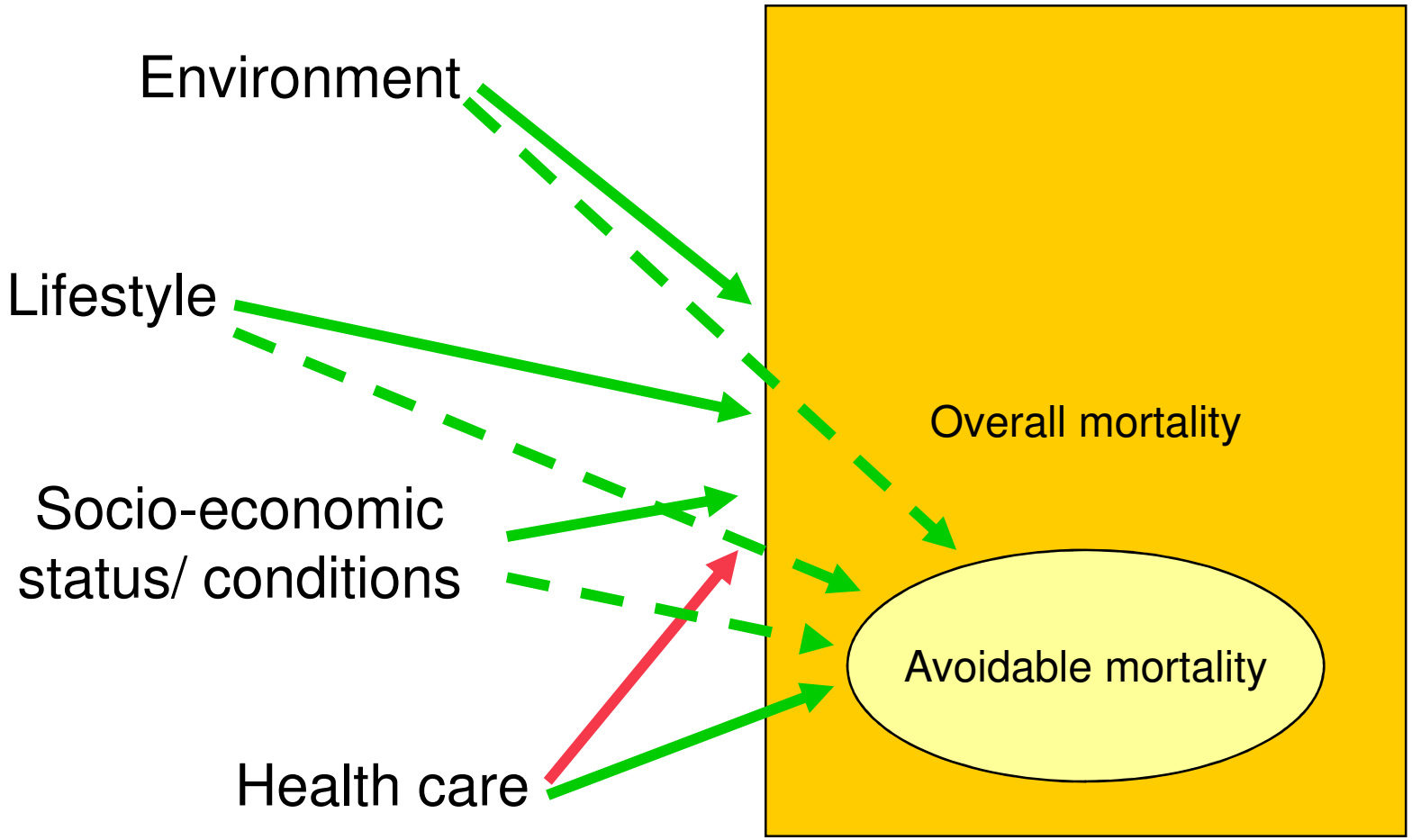
The concept of avoidable mortality (AVM; also „amenable to health care“)

- Deaths from certain causes that should not occur in the presence of timely and effective health care
- Introduced by David Rutstein in the 1970s (originally for quality assurance purposes)
- Walter Holland published European Community Atlas of ‘Avoidable Deaths’ in 1988; intends to provide warning signals of potential shortcomings in health care delivery
- Mackenbach et al. argue that associations between AVM and health care services are rather weak and inconsistent. Most health care measures only reflect quantity and not quality. Many studies use insufficient set of covariates.
- Nolte and McKee (2002) reviewed list of amenable causes of death

Avoidable/amenable causes of death: Nolte & McKee (2002)

Todesursache	ICD 10	Alter	Todesursache	ICD 10	Alter
Bösartige Neubildung der weiblichen Brust	C50	0-74	Bösartige Neubildungen des Hodens	C62	0-74
Hypertonie und Hochdruckkrankheiten	I10-13 I15	0-74	Morbus Hodgkin	C81	0-74
Krankheiten zerebrovaskulaeres System	I60-69	0-74	Leukaemie	C91-95	<15
Ischaemische Herzkrankheiten*0.5	I20-25	0-74	Krankheiten der Schilddrüse	E00-07	0-74
Bösartige Neubildung der Luftröhre, der Bronchien und der Lunge	C33-34	0-74	Diabetus mellitus	E10-14	0-49
Chronische Leberkrankheiten und Zirrhose	K73-74	0-74	Chronische rheumatische Herzkrankheiten	I05-09	0-44
Kraftfahrzuegunfälle	V01-V99	Alle	Krankheiten der Atmungsorgane	J00-09, J20-99	1-14
Infektiöse Darmkrankheiten	A00-09	0-14	Pneumonie und Grippe	J10-18	0-74
Typhus Diptherie Tetanus Sepsis Poliomyeltis Osteomyelitis	A01 A36 A35 A40-41 A80 M86 M46,2	0-74	Magengeschwür	K25-27	0-74
			Krankheiten der Appendix	K35-38	0-74
			Eingeweidebrüche	K40-46	0-74
			Gallensteinleiden	K80-81	0-74
Keuchhusten/ Pertussis	A37	0-14	Nephritis, Nephrotisches Syndrom und Nephrose	N00-07 N17-19 N25-27	0-74
Masern	B05	1-14	Prostatahyperplasie	N40	0-74
Tuberkulose	A15-19 B90	0-74	Schwangerschaft, Geburt und Wochenbett	O00-99	alle
Sonstige bösartige Neubildungen der Haut	C44	0-74	Bestimmte Affektionen, die ihren Ursprung in der Perinatalzeit haben	P00-96	alle
Bösartige Neubildungen der Zervix uteri	C53	0-74	Angeborene Fehlbildungen des Kreislaufsystems	Q20-28	1-14

Hypothesis


Environment
Lifestyle
Socio-economic
status/ conditions
Health care
Overall mortality
Avoidable mortality

Published data provide evidence that this is the case …

	England & Wales	USA	France	Japan	Italy	Sweden	Nether-lands	Spain
Time analysed	**1956-1978**						**1969-84**	**1975-90**
Age groups included	**5-64 y.**						**0-74 y.**	**5-64 y.**
Share "medically amenable/ avoidable" mortality of total mortality (cross-sectional analysis)								
1956	**17.3%**	**15.8%**	**15.3%**	**33.3%**	**19.7%**	**15.8%**		
1969							**18.4%**	
1975/ 78	**9.6%**	**6.3%**	**7.4%**	**19.6%**	**11.3%**	**7.1%**		**15.5%**
1984							**11.7%**	
1990								**7.5%**
Change in mortality per year (longitudinal analysis)								
„Medically amenable" mortality	**-3.2%**	**-3.6%**	**-4.5%**	**-5.6%**	**-3.8%**	**-4.2%**	**-4.5%**	**-6.5%**
Other mortality	**-0.2%**	**-0.4%**	**-1.0%**	**-2.5%**	**-0.8%**	**-0.1%**	**-1.1%**	**-1.2%**
Total mortality	**-0.6%**	**-0.9%**	**-1.4%**	**-3.4%**	**-1.3%**	**-0.6%**	**-1.6%**	**-1.8%**
Share of "medically amenable" mortality of change in total mortality								
	71%	**59%**	**38%**	**46%**	**45%**	**78%**	**43%**	**41%**

Busse 2006

Applying the concept of AVM to regional data in Germany

• To investigate the health care-AVN link for all 439 counties/ cities (2000–2004)

DATA SOURCES

• Mortality data is taken from the “Todesursachenstatistik”, (Forschungsdaten-zentrum)

• Data on health care variables and covariates taken from a variety of sources

RESULTS

• Overall mortality: 4,139,315 deaths; 46.43% female, 53.57% male; 13,422 age (0-19]; 774,274 age (19-65]; 3,351,619 age>65

Not avoidable	**3,438,172**	**(83.1%)**
Avoidable	**701,143**	**(16.9%)**
Davon: - Bösartige Neubildung der weiblichen Brust	53,874	(1.3%)
- Hypertonie und Hochdruckkrankheiten	19,448	(0.5%)
- Krankheiten zerebrovaskuläres System	94,025	(2.3%)
- Ischaemische Herzkrankheiten (*0.5)	273,520	(6.6%)
- Bösartige Neubildung der Luftroehre, der Bronchien und der Lunge	141,619	(3.4%)
- Chronische Leberkrankheiten und Zirrhose	17,944	(0.43%)
- Kraftfahrzeugunfälle	30,801	(0.74%)

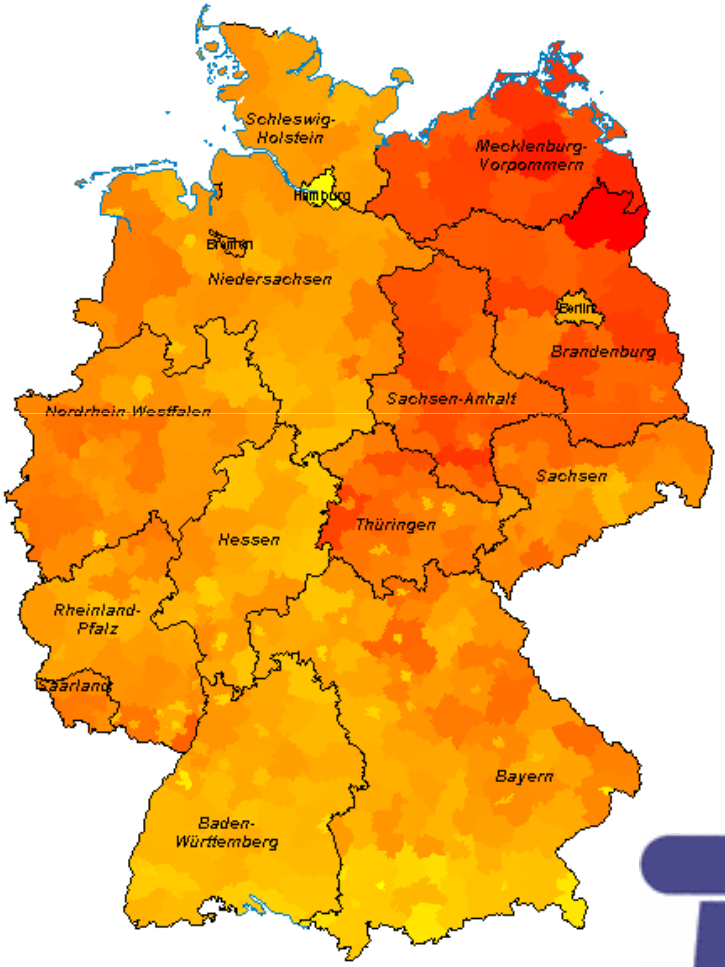
† avoidable deaths defined according to Nolte et al (2002); however we used age limit of 75 instead of 74 for respective death causes

Avoidable mortality (AVM) in Germany as % of all causes of death, averaged for 2000-2004

AVM by Bundesländer

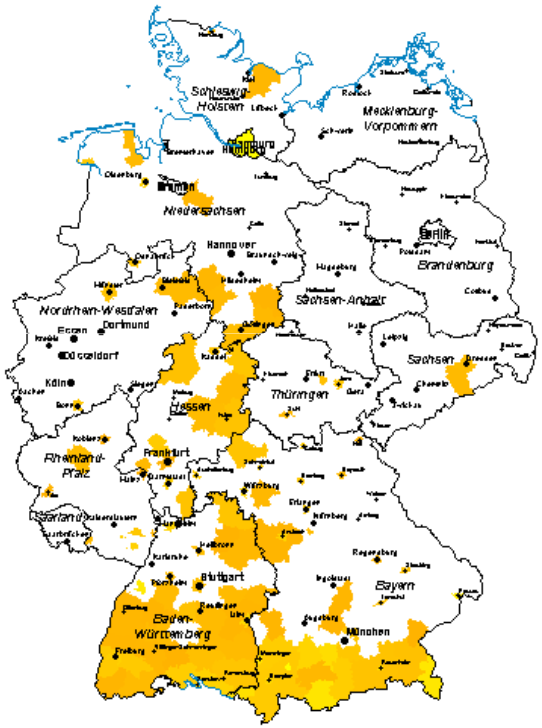
Avoidable mortality (AVM) in Germany as % of all causes of death, averaged for 2000-2004

AVM by Bundesländer



AVM by 439 counties

Avoidable mortality (AVM) in Germany by county, in quartiles, averaged for 2000-2004

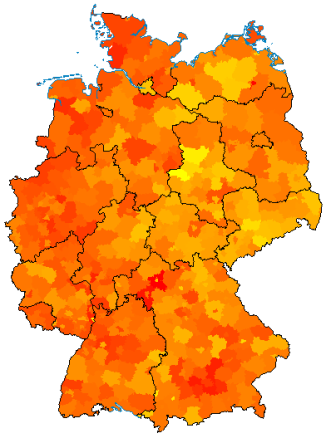


„Best“ 25% in terms of AVM as % of all deaths

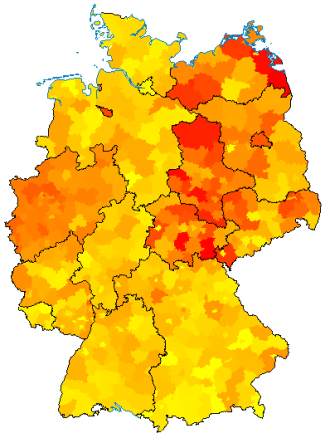
Middle 50%

„Worst“ 25% in terms of AVM as % of all deaths

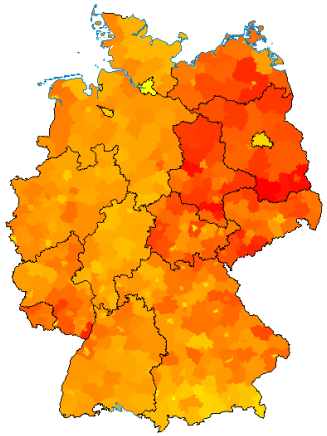
Disease specific avoidable mortality



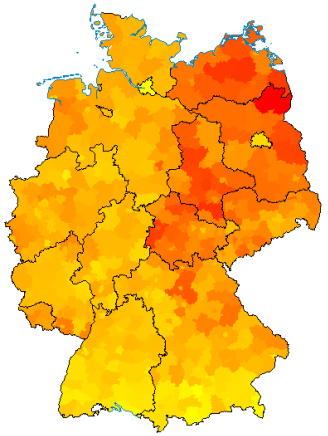
Bösartige Neubildungen der weiblichen Brust



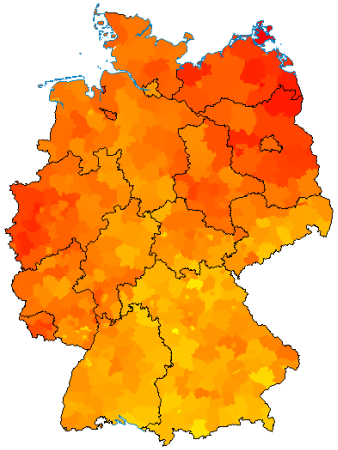
Hypertonie und Hochdruckkrankheiten



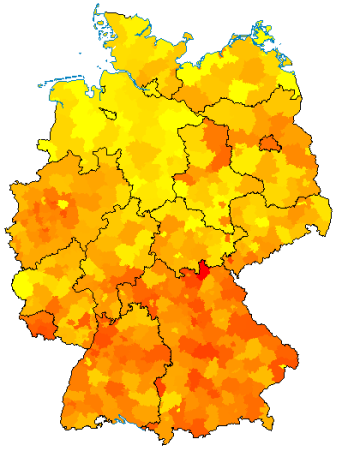
Krankheiten des zerebro-vaskulären Systems



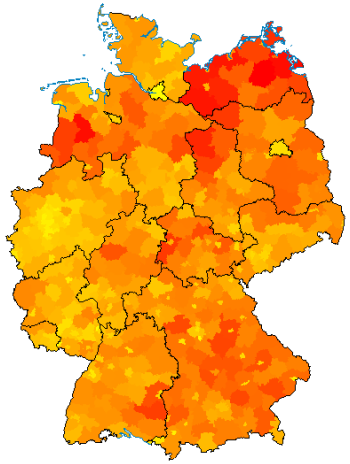
Ischaemische Herzkrankheiten



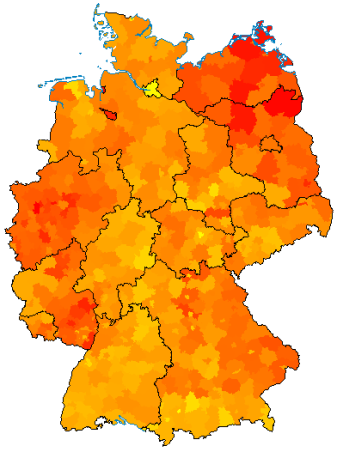
Bösartige Neubildungen der Luftröhre, der Bronchien und der Lunge



Chronische Leberkrank-heiten und Zirrhose

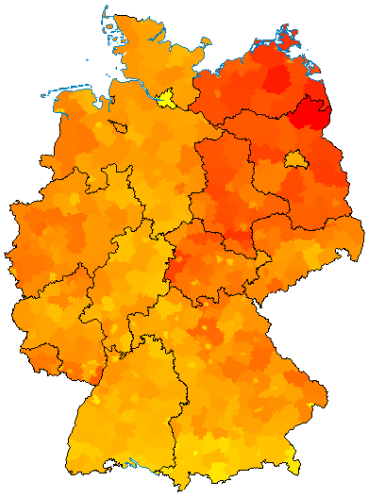


Kraftfahrzeugunfälle

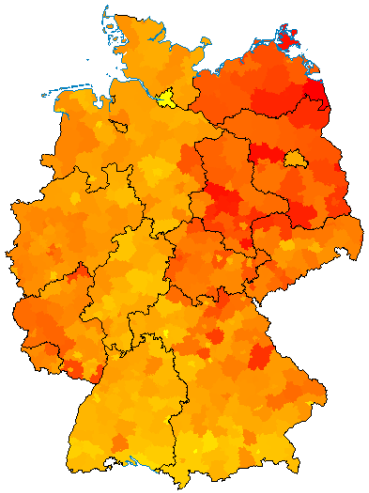


Alle anderen

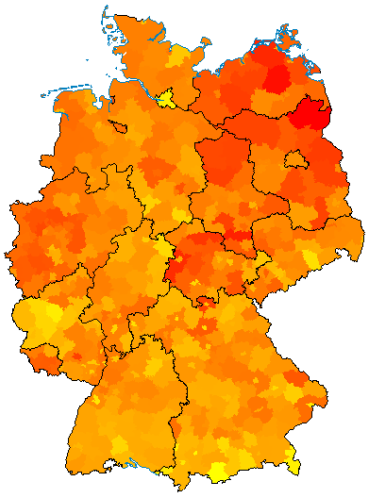
Stratification by gender and/or age cohorts?



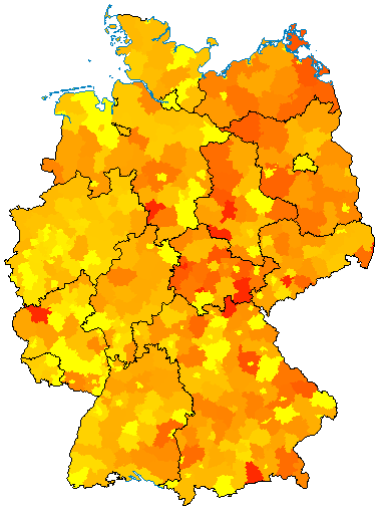
All



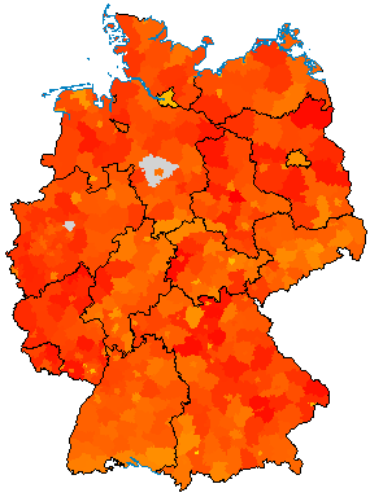
Men



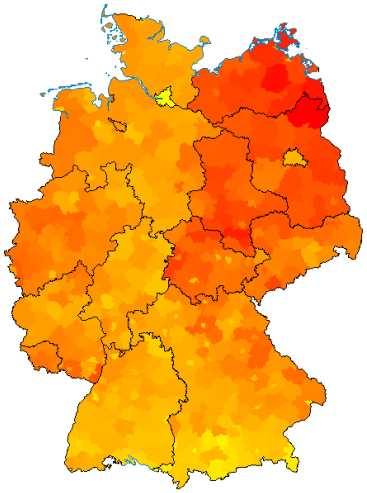
Women



Age 0-19]



Age 20-65]



Age >65

† averaged over 2000-2004

What influences avoidable mortality on county level? Health care variables

Hospital beds

(All) doctors

Reha beds

Nursing staff ambulant

GPs

Internists

Paediatricians

† averaged over 2000-2004

What influences avoidable mortality on county level? Selected covariates (1)

Percentage AVM

Unemployment rate

Without school qualification

† averaged over 2000-2004

What influences avoidable mortality on county level? Selected covariates (2)

Percentage AVM

Crime statistics as proxy for social capital

† averaged over 2000-2004

Results for the age cohorts (0-19] and (19-65], full sample

age (0-19]

N= 13,251	coefficents[a]	s.e.	z
female	-0.81292***	0.0553	-14.71
hospitalization rate all	-0.26350	-0.6108	-0.43
hurt in road accident	-0.01743	0.0324	-0.54
hospital beds	-0.01933	0.0128	-1.51
nursing staff ambulant	-0.00589*	0.0034	-1.76
doctors	-0.00067	0.0020	-0.34
GPs	0.00204	0.0058	0.35
internists	0.00919	0.0093	0.99
pediatrician	-0.04096**	0.0200	-2.04
GP outside walking distance	0.14660	0.1658	0.88
smoking 02	-0.21172	0.1930	-1.1
obesity 02	0.47609	0.5633	0.85
alcohol 02	0.20947	0.2801	0.75
waste from own country	0.00001	0.0000	0.42
crime statistics	0.00003*	0.0000	1.92
household income	0.00000	0.0000	-0.2
without qualification	0.03799	0.1117	0.34
with Hauptschul-qualification	0.08047*	0.0424	1.9
with Realschul-qualification	0.06231**	0.0283	2.2
degree of centrality	-0.00092	0.0018	-0.52
traffic areas	0.00893	0.0141	0.63
unemployment rate	0.00782	0.0110	0.71
unemployment rate for <25 age	0.00005	0.0001	0.9
rate of long term unemployed	-0.00008	0.0001	-1.16
number of all residents	0.00000	0.0000	0.6
male residents age (0-18]	-1.91130	4.4665	-0.43
Intercept	-1.67151*	0.8936	-1.87
Intraclass-coefficient	0.00000	9.11E-06	

age (19-65]

N=751,273	coefficents[a]	s.e.	z
female	-0.86994***	0.00719	-121.06
hospitalizatin rate breast cancer	-0.11718	5.12879	-0.02
hospitalizatin rate ihd	8.26940***	2.31107	3.58
hospitalization rate all	-0.15621	0.24137	-0.65
hurt in road accident	0.00233	0.00684	0.34
hospital beds	-0.00608**	0.00273	-2.22
nursing staff ambulant	-0.00061	0.00073	-0.84
doctors	-0.00147***	0.00039	-3.8
GPs	-0.00042	0.00114	-0.37
internists	0.00283	0.00183	1.55
GP outside walking distance	-0.02130	0.03587	-0.59
smoking 02	0.07796*	0.04100	1.9
obesity 02	0.01841	0.10120	0.18
alcohol 02	0.06286	0.05822	1.08
waste from own county	0.00001**	0.00001	2.5
crime statistics	0.00001**	0.00000	2.62
household income	-0.00001	0.00000	-1.47
without qualification	0.00890	0.02298	0.39
with Hauptschul-qualification	-0.00166	0.00780	-0.21
with Realschul-qualification	0.00431	0.00549	0.78
degree of centrality	0.00051	0.00020	2.57
traffic areas	-0.00121	0.00310	-0.39
unemployment rate	0.01596***	0.00219	7.29
unemployment rate for <25 age	-0.00004**	0.00001	-2.67
rate of long term unemployed	0.00002	0.00002	1.2
number of all residents	0.00000	0.00000	1.41
male residents	6.00082	1.19407	5.03
Intercept	-4.22507	0.63647	-6.64
Intraclass-coefficient	0.00185	0.00023	

[a] female is on individual level; year of death is not included in preliminary regressions; lifestyle variables standardized on number of observations in SOEPremote sample, number of all residents is in absolute terms; all other variables on county level are standardized on #residents/ county; variables are averaged over years; SES variables are time lagged, lifestyle variables only available for 2002

Discussion

- Small area analyses reveal within Länder-differences in avoidable mortality
- Certain health system variables are indeed significant:
number of paediatricians and physicians per residents decrease AVM in young age group (0-19]; number of all doctors and hospital beds per residents decrease AVM in middle age group (19-65]
- German division and associated life-style presumably still influences cardiovascular disease mortality in the East -> also visible in >65 years. East-West division less/ not visible in younger age groups.
- Socioeconomic factors explain a significant part of avoidable deaths
- Smoking proxy takes positive value in middle age group
- So far no evidence of endogeneity for variables GPs and internists in middle age group (19-65]; convenient Hausman-test fails to reject H0

Outlook

- Estimate stratified and full model including all individual-level variables on FDZ numeric server; maybe include more suitable variables for pollution in final regression
- Disease-specific analyses using disease-specific health service variables -> collected number of special departments by ownership in counties, currently collect information on secondary and tertiary prevention in cancer

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Presentation and further material at:

http://mig.tu-berlin.de

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