Expansion or Compression of Long-Term Care in Germany between 2001 and 2009:

A Small-Area Study based on Administrative Health Data

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Abstract

Background: A much-discussed question in public health research is whether the two health scenarios - expansion or compression of morbidity - are heterogeneous on the sub-national level. Further, we aim to detect if the trends in morbidity or in mortality are the decisive drivers of the CFLY and of the health scenarios.

Methods: This study uses administrative census data of all beneficiaries in Germany from the Statutory Long-Term Care Insurance 2001-2009. We compute care need-free life years (CFLY) and life years with care need (CLY) at age 65+ for 412 counties. The CFLY and CLY gains are decomposed into the effects of survival and of the prevalence of care need and we investigate their linkages with the health scenarios by applying multinomial regression models.

Results: We show an overall increase in CFLY, which is higher for men than for women and higher for severe than for any care need. However, spatial variation in CFLY and in CLY has increased. In terms of the health scenarios, a majority of counties show an expansion of any care need but a compression of severe care need. However, we detect expansion counties surrounding a compression county and vice versa. That high spatial heterogeneity is mainly caused by divergent trends in the prevalence. We show that mortality is responsible for the absolute changes in CFLY and CLY while morbidity is the decisive driver that determines the health scenarios.

Conclusion: We combine a regionalized administrative data source and advanced statistical methods to get deeper insights into epidemiological processes. Our findings demonstrate a compression of life years with severe care need, which however, depends on the region of residence. To attenuate regional inequalities, more efforts are needed that improve health by medical and infrastructural interventions. In future research, the underlying mechanisms should be investigated in more detail.

Keywords: Expansion, compression, healthy-life expectancy, regions, care need

Abstract: 300 words
Manuscript incl. abstract, footnotes, reference list and title page: 9,812 words

1. Introduction & Background

The Health Scenarios

Three hypothetical scenarios with contrasting assumptions about future developments of morbidity in populations with decreasing mortality were established and repeatedly examined. In Ernest Gruenberg's (1977) and Morton Kramer's (1980) theory of "Expansion of Morbidity", the general survival progress and the later-active (or even missing) improvements in health prevention and in recovery lead to an increasing duration of morbidity and a higher prevalence of health limitations. The contrary hypothesis is the "Compression of Morbidity" scenario by James Fries (1980; 1989), in which a general decrease in the incidence of morbidity is expected due to e.g. a healthier life style of the individuals, technological and medical advancements, and interventions in primary and secondary prevention of diseases. The morbidity shrinkage - combined with steadily improved survival rates – causes a postponement of unhealthy life years into the very last ages of life and results in a decline of the population's prevalence of chronic diseases in total. Fries (2003; 2005) later developed a modified and differentiated scenario: the absolute and the relative compression of morbidity. Absolute compression describes a situation in which the total number of unhealthy life years decreases, while there is a relative compression when the proportion of unhealthy life time to total remaining life time declines. Furthermore, relative compression is defined as a special case of absolute compression - differing in the development of the disabled life years. If the number of disabled life years is stable or shrinking, there is an absolute compression, and if there is a slight increase in the number of disabled life years (but lesser than the gain in non-disabled life years), then the situation is defined as a relative compression.

In conjunction with the compression scenarios, there are two expansion scenarios: the absolute and the relative expansion of morbidity. The total number of unhealthy life years increases in the absolute expansion scenario, while the proportion of unhealthy life time to total remaining life time gains in the relative compression scenario.

The idea of looking at relative more than at absolute changes in morbidity prevalence rates is one of the basics of the theory of "dynamic equilibrium" (Manton 1982; Manton, et al. 1997). This scenario integrates the frameworks of compression and expansion of morbidity. Manton (1982) assumes that gains in life expectancy go together with increasing years in ill-health; however, the share of unhealthy to total remaining life years remains relatively constant. Furthermore, while the total number of persons with chronic diseases is growing, the prognosis according to the theory expects a shift from more to less and moderate severe diseases and disability states. Behavioural, technological and medical progression are the causes of this redistribution and will lead to a general improvement in survival as well (Graham, et al. 2004).

To evaluate these frameworks of the future trends in population's health status, summary measures were developed that combine information about morbidity and mortality data. One appropriate concept is the above mentioned care need-free life years (CFLY). By combing the CFLY with the indicators life years with care need (CLY) and the health ratio (HR), five theoretical health scenarios can be identified (Table 1).

Until now, the CFLY indicator has been predominantly used for cross-country comparisons of time trends [e. g. Jagger, et al. 2008; Lievre, et al. 2007]. However - as mentioned above - the CFLY can equally be applied for regional comparisons within a country [e.g. Kreft 2015; Seko, et al. 2012].

Table 1: Scheme of combinations of care need-free life years, life years with care need and health ratio by scenario of future health development (given that life expectancy increase continues)

	Care Need-free Life Years	Life Years With Care Need	Health Ratio
Absolute Compression	▲	▼=	▲
Relative Compression	▲	▲	▲
Dynamic Equilibrium*	▲	▲	=
Relative Expansion	▲	▲	▼
Absolute Expansion	▼=	▲	▼

Note: ▼: decrease; ▲: increase; =: stable
* With considering the shift in the severity of morbidity, special case of "stability" that is defined by the same scenario but without considering the shift in the severity of care need

Time Trends in Morbidity

As the interest in answering the question whether the increase in life expectancy is linked with a gain healthy or unhealthy life years is still high, even so is the number of studies. We identified fourteen studies published since 2001 which analyse trends in various health dimensions of persons living in Germany (Table 2). The review draws an inconsistent picture of the trends in health in the last decades. The majority (eight) of the selected studies found a decreasing incidence (Ziegler & Doblhammer 2008), prevalence (Unger 2006) and a compression of long-term care, functional limitations and disability (Häcker & Hackmann 2012; Hackmann & Moog 2009; Klein & Unger 2002; Kroll, et al. 2008; Pinheiro & Krämer 2009; Unger 2010). The results of four studies can be interpreted as evidence for the dynamic equilibrium hypothesis (Gärtner & Scholz 2005; Pattloch 2010; Unger, et al. 2011; Unger & Schulze 2013). Two studies (Doblhammer & Kreft 2011; Trachte, et al. 2014) were not able to differentiate between compression and dynamic equilibrium, and only one study (Hoffmann & Nachtmann 2010) found a relative expansion.

Table 2: Selection of studies investigating the health scenarios in Germany, publication year 2001 through 2014.

Study	Type of health	Ages	Country/ region	Time	Results	Regional comparison	Type of data
Ziegler & Doblhammer 2008	Long-term care (incidence)	60+	West Germany	1986-2005	Decrease[1] (cohort and household perspective)	2 regions	Survey
Unger 2006	Disability (ADL), health satisfaction (prevalence)	Cohorts 1921, 1927, 1933	West Germany (until 1991), Germany (since 1991)	1984-2003	Improvements mainly for younger cohorts	no	Survey
Klein & Unger 2002	Chronic disease	Cohorts 1917, 1922, 1927	West Germany	1984-1999	Absolute Compression (cohort perspective)	no	Survey
Kroll et al. 2008	Limitations in daily activities	16+	Germany	1995-2003	Absolute Compression	no	Survey
Hackmann & Moog 2009	Long-term care (in general; incidence)	All ages	Germany	1998-2006	(Slight) **Compression**	no	Administrative
Pinheiro & Krämer 2009	Long-term care (in general and severe)	All ages	North Rhine-Westfalia/ Germany	1999-2005	Compression	no	Administrative
Unger, 2010	Disability	Cohorts 1900-1950	Germany	1984-2001	**Compression**	no	Survey
Häcker & Hackmann 2012	Long-term care	All ages	Berlin / Germany	2000-2009	**Compression** (but: policy influence assumed)	no	Administrative
Gärtner & Scholz 2005	Subjective health	45-69	West Germany	1984-1998	Relative expansion	no	Survey
	Health problems				Relative compression		
Pattloch 2010	Long-term care (by severity)	All ages	Germany	1999-2007	Dynamic equilibrium (Expansion for all types and stability for severe types of care)	no	Administrative
Unger et al. 2011	Long-term care (by severity of disability)	60+	Germany	1999-2008	Dynamic Equilibrium (Expansion for all types and stability for severe types)	no	Administrative
Unger & Schulze 2013	Subjective health problems	40-104	Germany	1989, 1999, 2009	Dynamic Equilibrium	no	Survey
Trachte et al. 2014	Subjective health, functional limitations (prevalences)	65-89	Germany	1997-2010	**Compression or dynamic equilibrium**	no	Survey
Doblhammer & Kreft 2011	Disability (ADL)	65+	Germany	1995-2001; 2005-2007	**Compression** or dynamic equilibrium	no	Survey
Hoffmann & Nachtmann 2010	Long-term care	60+	Germany	1999-2005	Relative expansion	no	Administrative

Note: Words in **bold** letters indicate that the results are interpreted with a direct link to the health scenarios

[1] Due to problems with the study design, identification of the morbidity scenario can be misleading, see

These findings for Germany match the findings for other European countries and the USA [see Christensen, et al. 2009; Crimmins & Beltran-Sanchez 2010; Freedman, et al. 2002 for reviews]. The three reviews give evidence for different trends by severity of a health problem and indicate a dynamic equilibrium with expansion in mild health problems and stability or compression in severe disability. However, the choice of the health indicator (e.g. incidence, prevalence or composed measures), the characteristics of the population under study (e.g. age groups, inclusion of institutionalized persons), the choice of the time perspective (due to societal and medical changes), and the design of the data (survey or administrative) affect the comparability of the findings of the studies.

In addition, a methodological problem occurs when the prevalence of care need - from cross-sectional data or measures based on prevalence rates - are used to analyze time trends. Because a point prevalence is defined as the prevalent population divided by the sum of the living prevalent and not the prevalent population at a particular point of time, a high prevalence can be the result of 1) a high incidence, 2) a low mortality of the prevalent persons, and/or 3) a high mortality of the non-prevalent persons. As longitudinal micro data to estimate incidences are rare and highly sensitive, Nusselder and Looman (2004) introduced a decomposition method that allows for retrospectively separation of the effect of changes in prevalence (morbidity effect), the effect of changes in survival of the population with morbidity (mortality effect on CLY, $Mort_{\Delta CLY}$), and the effect of changes in survival of the population without morbidity (mortality effect on CFLY, $Mort_{\Delta CFLY}$). The morbidity effect on CFLY and on CLY, are - by definition of a two-state decrement life table – the same in numbers but with opposite signs. A positive morbidity effect is defined as a decrease in prevalence. A positive $Mort_{\Delta CFLY}$ implies a decrease of mortality rates in the population without care need, and a positive $Mort_{\Delta CLY}$ is a decrease of mortality in the population with care need.

In sum, this study has two objectives. First, we investigate the trends in LE, CFLY, CLY, and HR on the level of counties and classify them according to the theoretical health scenarios: expansion, compression, and stability. Second, we explore whether the changes in mortality or in morbidity are the driving factors behind experiencing a specific health scenario. We examine this by decomposing the county-specific CFLY and CLY trends into the effects of morbidity and mortality.

Hypothesis 1: Based on the findings of previous studies (Breckenkamp, et al. 2007; Diehl & Schneider 2011; Dragano, et al. 2007; Kemptner, et al. 2008; Kibele 2012, 2014; Kreft 2015; Kreft & Doblhammer 2012; Kroll & Lampert 2012; Latzitis, et al. 2011; Maier, et al. 2012; Queste 2007; Razum, et al. 2008; Seko et al. 2012; Strohmeier, et al. 2007; Voigtländer, et al. 2008; Voigtländer, et al. 2010b; Voigtländer, et al. 2010a; Wolf 2004) we hypothesize that there are county-specific differences in the trends of the health indicators which may lead to a heterogeneous pattern of the health scenarios. Given the remarkable increase in life expectancy of East Germany since reunification, it is not obvious whether the distribution of county-specific health scenarios is similar to West Germany. In addition, there are large differences between life expectancy in North, Middle and South Germany which also may result in different health scenarios.

Hypothesis 2: However, based on earlier research that points towards a compression or equilibrium scenario (Hoffmann & Nachtmann 2010; Ziegler & Doblhammer 2008), we expect that this is also true in most - but not all - counties.

Hypothesis 3: Turning to the contributions of the mortality and morbidity effects to the health scenarios, we do not have a specific hypothesis. A priori it is not obvious whether the same factor drives both the absolute changes in years of life with and without care need, and the resulting health scenarios. The reason for this is that the health scenarios are the result of interfering developments in the three distinct indicators CFLY, CLY, and LE.

2. Data and Methods

Data

This study is based on the German Statutory Long-Term Care (SLTC) Censuses for the years 2001, 2003, 2005, 2007, and 2009. The SLTC Census is an official mandatory register of all long-term care and care allowance receivers living in private households and institutions in Germany. The register is updated every two years and covers more than 2 million recipients of long-term care benefits as defined by the German Social Code Book XI. The register includes individual level information about sex, age, year of observation, care level (level 1 to 3/case of hardship), and the official ID of the residential county (NUTS 3 level) on December 31st of each year; no additional socio-economic or demographic information is available. We aggregated the individual micro data by five year age groups, by sex, by year, by county, and by care level.

As participation is mandatory, the SLTC Census is not biased by non-response. Another advantage is the adequately high number of persons in need of care at the county level (A1 in appendix). To ensure data privacy, we use the total sample via remote access by the Research Data Centres of the Statistical Offices of the Federation and the Länder.

We combine the aggregated SLTC Census data with the vital data (population and death counts) of the official regional database of the National Statistical Office. Two problems with the data occur in the data management process.

First, the highest age group in the county-specific population statistics in 2001 is 75+, while in the other years there is a disaggregation in 5-years age groups until age 85+. Thus, we estimated the population for the 5-years age groups by using available data for 2003-2009 and by assuming a constant change of the population shares within persons at age 75+ by sexes and counties from 2001 to 2009. We use an extrapolation method to estimate the population at the age groups 75-79, 80-84 and 85 and older in 2001.[2]

Second, in the observation period, two large - Saxony-Anhalt in 2007 and Saxony in 2008 - and two small reforms - Hanover in 2001 and Aachen in 2009 - of the counties were carried out. Most of these reforms were fusions of counties, which are unproblematic in terms of data management. For these counties, the data of the affiliated counties are pooled. For six counties in Saxony-Anhalt[3] the reform of the counties fundamentally changed the geographical entities, which requires a more complex data management strategy. We choose an allocation of death counts and of the number of care receivers by using overall population based weights.[4] The underlying assumption of this strategy is that the deaths and the persons in need of care are equally distributed in area of the counties and are not clustered in specific parts within a county.

Care need

The care levels represent the intensity of restrictions in basis and instrumental activities of daily living (ADL and IADL) over a longer period. They are separated by the frequency and the time consumption of care assistance by non-professionals: Persons with care level 1 need assistance at least once a day that takes more than 45 minutes for essential personal care and at least 90 minutes in total for general help. Persons with care level 2 and higher need assistance for at least three times a day that takes 120 minutes or longer for essential personal care and at least 180 minutes in total for general help. The intensity of care is specified during a substantial home examination by members of the German medical service of health insurance (Arntz, et al. 2007).

Methods

Sullivan method: We calculated care need-free life years (CFLY) and defined care need in terms of receiving financial and/or personnel support from the German SLTC insurance. Hereafter, the words long-term care, disability, and care need are used synonymously. The CFLY estimation is based on the Sullivan method (Sullivan 1971) and on the Chiang method

[2] For instance: If there is a $\%P_{Men,85+,county\ 1,2003}$ (proportion of men at age 85+ to all men at age 75+ in county 1 in 2003) of 15% and a $\%P_{Men,85+,county\ 1,2005}$ of 16%, the estimation of $\%P_{Men,85+,county\ 1,2001}$ is 14%.
[3] The counties are Harz, Salzlandkreis, Jerichower Land, Anhalt-Bitterfeld, Wittenberg, and Dessau-Roßlau.
[4] The overall population weights are based on the total population counts for those years 2001-2006 in which we have information for the old and the new regional entities. For each single year, the (positive or negative) difference between the population of the new and of the old (P_{old}) entities equals the population that experienced an administrative change (P_{change}). In the last step, the population weights are computed by P_{change} divided by P_{old}.

(Chiang 1984) for life expectancy (LE). We computed prevalence rates of care need separated by sex, age group (‘under 60’, ‘60-69’, ‘70-74’, ‘75-79’, ‘80-84’, ‘85+’), year of observation (2001, 2003, 2005, 2007, 2009), county, and care level.

We use two definitions of care need: All types of care (levels 1-3) versus severe type of care (level 2 and 3/case of hardship). The life years with care need (CLY) are calculated as the remaining total LE minus CFLY. The health ratio (HR) is the proportion of CFLY in total remaining LE. We estimate yearly LE, CFLY, CLY, and HR for both sexes and care levels, and for all 412 German counties within the borders of 2009. To reduce random fluctuations in the county's death rates, we use pooled 3-year death counts for the estimation of the abridged life tables.

Trend analysis: In the first stage, we separately examine the temporal changes in the general level of the seven indicators (LE, $CFLY_{any}$, $CFLY_{severe}$, CLY_{any}, CLY_{severe}, HR_{any}, HR_{severe}). We combine the information of the indicators to classify the counties into the five established health scenarios plus regions with decreasing life expectancy (Table 1). To minimize random fluctuations in the indicators, we used pooled data for the two starting years (2001/2003) and the two final years (2007/2009). We define the trends as the estimated value in the last two years subtracting the estimated value in the first two years. An increase (a decrease) in an indicator is defined as a positive (negative) change, while, since continuous variables are used, stability is defined as an indicator change between -0.1 and +0.1.

Decomposition: In the second stage, we decompose county-specific $CFLY_{any}$, $CFLY_{severe}$, CLY_{any}, and CLY_{severe} into the effects of morbidity and mortality, which measures the life years lost or gained due to changes in mortality or morbidity rates. We use the decomposition method by Nusselder and Looman (2004), which is an extension of the Arriaga method (Arriaga 1984). We compare sex-specific CFLY and CLY in 2001/03 (t_1) versus 2007/09 (t_2). The change in the number of person-years with care need (CLY) is measured by

$$ {}_iCLY_x = {}_i\mathrm{Mort}_{\Delta\mathrm{CLY,x}} + {}_i\mathrm{Morb}_{\Delta\mathrm{CLY,x}} = \left(\frac{{}_iprev_{x_{t1}} + {}_iprev_{x_{t2}}}{2}\right) \times \Delta\ {}_iL_x + \left(\frac{{}_iL_{x_{t1}} + {}_iL_{x_{t2}}}{2}\right) \times \Delta\ {}_iprev_x, $$

where x is the age, i is the length of the age interval, ${}_iL_x$ is the product of persons-years lived, and ${}_iprev_x$ is the prevalence of care need. The number of person-years without care need (CFLY) is decomposed in the same manner.

Multinomial logistic regression: In the third stage, we estimated multinomial logistic regression models to analyze the association of the morbidity and mortality effects with the health scenarios. We used the three theoretical health scenarios (expansion, stability, compression) rather than the five categories presented in Table 1 due to the low number of counties in some of the categories. The explanatory variables are the mean centred morbidity and mortality effects in CFLY ($Mort_{\Delta CFLY}$) and in CLY ($Mort_{\Delta CLY}$), which are measured in life days. To account for county-specific uncertainty of $CFLY_{any}$ and $CFLY_{severe}$ estimation, we use weighted regression models. [5]

The general formula of the regression model is defined by

$log \frac{Pr(Y=j)}{Pr(Y=j')} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n$, where j is the particular health scenario type, j' is the reference county group, α is the intercept and the βs are the estimated coefficients.

All calculations are performed using Stata 12.1 and a decomposition tool programmed in R by WJ Nusselder and CWN Looman[6]. The results are given as relative risk ratios (RRR) on the chance of being a "stability" or a "compression" county versus being an "expansion" county (reference) for both sexes aged 65+, and for any/severe care level.

3. Results

In the period from 2001 to 2009, the number of persons in care need has increased from 2.04 to 2.34 million. Thus, the raw care need prevalence is about 2.5% in 2001 and 2.9% in 2009. Of these, nearly 50% have care level 1 (2001: 0.89 million; 2009: 1.25 million persons). The majority are female (2001: 1.40 million; 2009: 1.57 million); however, the increase between 2001 and 2009 is higher for males (+20%) than for females (+12%). About 81% (2001) respectively 83% (2009) are 65 years and older and the total increase is solely due to these ages (+18%). On the contrary, the absolute number of persons younger than 65 is nearly stable (+0.09%) over time.

Trends according to the five health scenarios

Taking the unweighted mean over all counties, remaining LE, $CFLY_{any}$, and $CFLY_{severe}$ have been continuously increasing for both sexes (Table 3). CLY_{any} also increased, while there was no significant time trend for CLY_{severe}. An analysis of the time trends in HR - separated by men and women and by severity of care need - confirms the findings. The proportion of life years free from any care level (HR_{any}) decreased, while the proportion of life years free from severe care level (HR_{severe}) remained stable or even increased slightly.

In detail, mean male LE increased from 15.97 to 17.43 years and mean female LE rose from 19.26 to 20.55 years. Thus, the gain was higher for men (0.18 life years per annum) than for women (0.16 life years per annum). While the spatial variation in LE increased for men (from interquartile range IQR=0.898 to 1.014), that of women decreased (from 0.900 to 0.808) in

[5] The county- and sex-specific precision weights are computed by 1 dividing by the variance of $CFLY_{any}$, respectively $CFLY_{severe}$ at age 65+.For further information for the calculation of the variance and the standard errors of CFLY, see Jagger et al. (2006).
[6] The decomposition tool and the user guide are available on request (contact: w.nusselder@erasmusmc.nl)

this period. CFLY shows an increase in both, $CFLY_{any}$ and $CFLY_{severe}$. Mean $CFLY_{any}$ rose from 14.39 years (IQR=1.053) to 15.60 (IQR=1.157) in men and from 16.22 (IQR=1.049) to 17.17 years (IQR=1.231) in women. $CFLY_{severe}$ has increased from 15.14 (IQR=0.956) to 16.58 years (IQR=1.082) in men and from 17.67 (IQR=0.968) to 18.97 (IQR=0.907) in women. Thus, the increase in $CFLE_{severe}$ is higher than in $CFLE_{any}$. Mean CLY_{any} of males increased from 1.58 to 1.83 years and those of females from 3.05 to 3.38 years. In contrast, male CLY_{severe} stagnated at around 0.85 and female CLY_{severe} at around 1.61 years.

Table 3: Level (measured by the county-level mean) and spatial dispersion (measured by interquartile range; IQR) of life expectancy total, with and without any care level and with and without severe care level and the health ratios, men and women at age 65+, 2001-2009

		Men					Women				
		2001	2003	2005	2007	2009	2001	2003	2005	2007	2009
LE	Mean	15.97 [15.90 - 16.03]	16.47 [16.40 - 16.54]	16.75 [16.68 - 16.82]	17.21 [17.14 - 17.28]	17.43 [17.36 - 17.51]	19.26 [19.20 - 19.32]	19.60 [19.54 - 19.65]	19.98 [19.92 - 20.03]	20.40 [20.35 - 20.45]	20.55 [20.50 - 20.61]
	IQR	0.898	0.906	0.960	0.993	1.014	0.900	0.858	0.815	0.796	0.808
$CFLE_{any}$	Mean	14.39 [14.32 - 14.46]	14.85 [14.78 - 14.93]	15.03 [14.95 - 15.10]	15.39 [15.31 - 15.47]	15.60 [15.51 - 15.69]	16.22 [16.14 - 16.29]	16.53 [16.45 - 16.60]	16.76 [16.68 - 16.84]	17.03 [16.95 - 17.11]	17.17 [17.09 - 17.26]
	IQR	1.053	1.144	1.068	1.149	1.157	1.049	1.046	1.107	1.193	1.231
CLY_{any}	Mean	1.58 [1.56 - 1.60]	1.62 [1.59 - 1.64]	1.72 [1.70 - 1.74]	1.82 [1.79 - 1.85]	1.83 [1.81 - 1.86]	3.05 [3.01 - 3.08]	3.07 [3.03 - 3.11]	3.22 [3.18 - 3.26]	3.37 [3.32 - 3.42]	3.38 [3.33 - 3.44]
	IQR	0.293	0.312	0.355	0.375	0.373	0.520	0.552	0.569	0.657	0.750
HR_{any}	Mean	90.08 [89.93 - 90.22]	90.16 [90.01 - 90.31]	89.70 [89.54 - 89.86]	89.40 [89.22 - 89.58]	89.43 [89.25 - 89.62]	84.17 [83.95 - 84.38]	84.32 [84.10 - 84.54]	83.86 [83.63 - 84.09]	83.45 [83.19 - 83.71]	83.51 [83.24 - 83.79]
	IQR	1.880	1.940	2.327	2.529	2.462	3.076	2.959	3.133	3.466	3.849
$CFLE_{severe}$	Mean	15.14 [15.08 - 15.21]	15.65 [15.59 - 15.72]	15.89 [15.82 - 15.96]	16.32 [16.25 - 16.40]	16.58 [16.50 - 16.65]	17.67 [17.60 - 17.73]	18.03 [17.97 - 18.09]	18.35 [18.28 - 18.41]	18.75 [18.69 - 18.81]	18.97 [18.90 - 19.03]
	IQR	0.956	1.055	1.043	1.081	1.082	0.968	0.931	0.909	0.914	0.907
CLY_{severe}	Mean	0.82 [0.81 - 0.84]	0.82 [0.80 - 0.83]	0.86 [0.87 - 0.87]	0.88 [0.87 - 0.90]	0.86 [0.87 - 0.87]	1.59 [1.57 - 1.62]	1.57 [1.55 - 1.59]	1.63 [1.61 - 1.66]	1.65 [1.62 - 1.68]	1.59 [1.56 - 1.62]
	IQR	0.200	0.196	0.210	0.220	0.193	0.279	0.311	0.344	0.345	0.336
HR_{severe}	Mean	94.84 [94.75 - 94.92]	95.04 [94.95 - 95.13]	94.86 [94.76 - 94.96]	94.84 [94.74 - 94.95]	95.06 [94.97 - 95.16]	91.72 [91.60 - 91.85]	91.98 [91.86 - 92.11]	91.81 [91.68 - 91.94]	91.89 [91.75 - 92.03]	92.26 [92.13 - 92.39]
	IQR	1.210	1.247	1.394	1.453	1.208	1.606	1.668	1.747	1.850	1.789

Source: Statistical Offices of the Federation and the Länder, Statutory Long-Term Care Censuses 2001-2009 & Regional database (2013); author's calculations

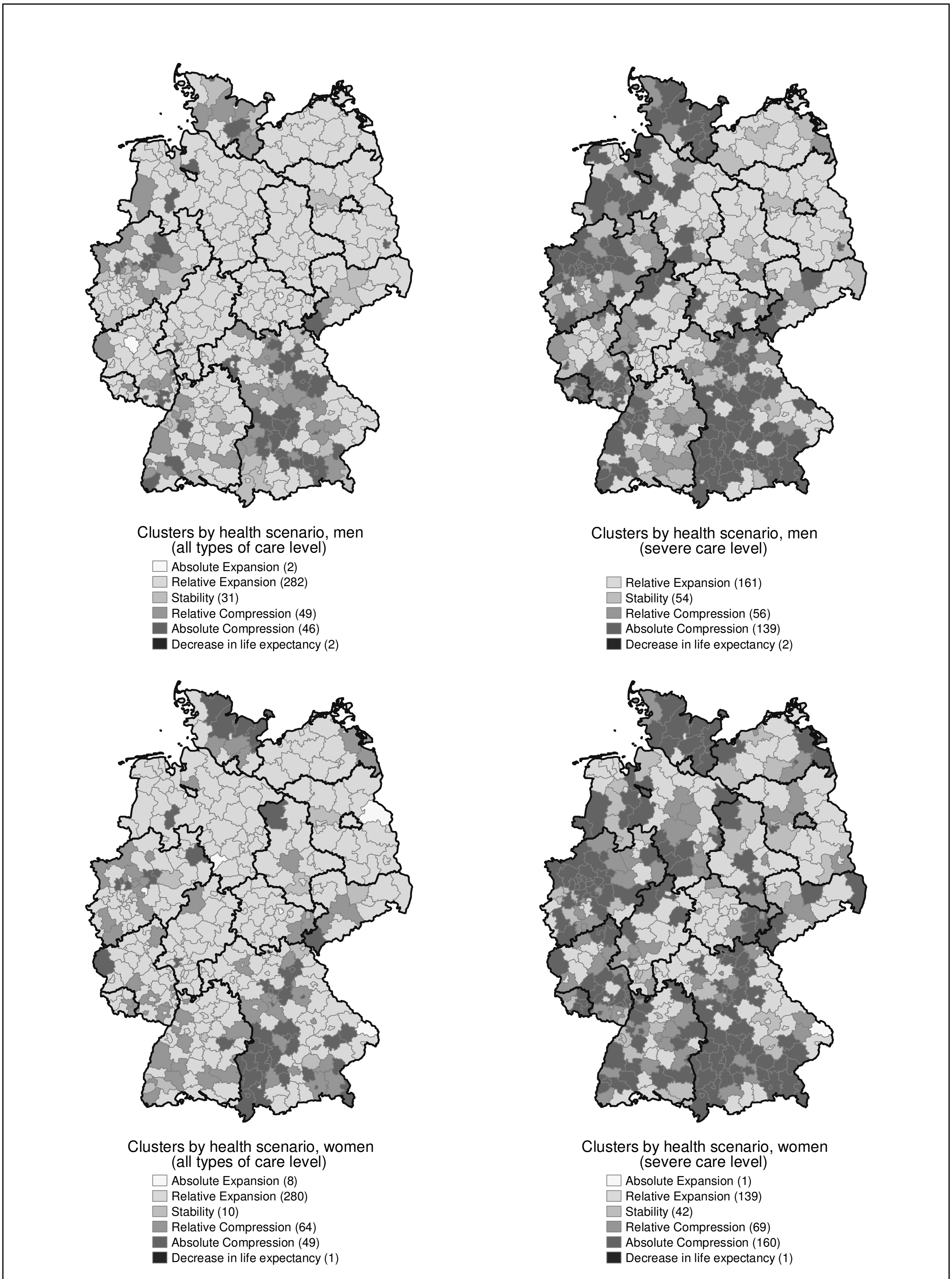
The trends are weakly correlated with the starting level in 2001/2003. While in case of male LE, there is no association of the level with the trend component (Pearson correlation = -0.07, p>0.1), the increase in female LE is lower in counties with a high LE starting level (-0.33, p<0.001). For CFLY, there are inconsistent associations. There is a weak positive correlation in case of $CFLY_{any}$ in men (0.17, p<0.001), but no correlations in male $CFLY_{severe}$ and in female $CFLY_{any}$ (both 0.06, p>0.1). However, we did find a weak negative correlation in female $CFLY_{severe}$ (-0.18, p<0.001). In CLY, there are no correlations in CLY_{any} (men: -0.07; women: 0.03, both p>0.1) and weak negative correlations in CLY_{severe} (men: -0.20, p<0.001; women: -0.11, p=0.03).

We spatially plot selected variants by the starting level in 2001/2003 and by the trends up to 2007/2009, and detect notable clusters of counties with very favourable and very unfavourable combinations. In case of LE, CFLY and HR, unfavourable combinations are defined as a low starting level and the lowest (more than one standard deviation below the county-level mean) change over the period. In case of CLY, in contrast, unfavourable combinations are defined as a high starting level and the highest (more than one standard deviation above the county-level mean) change over the period. For LE, CFLY, CLY, and HR, there is a slight but consistent gradient between the most disadvantaged counties in the North, Middle and East of Germany - including eastern Bavaria - and the most advantaged counties in the South and West (not shown).

By combining the trends in the various indictors into the health scenarios for all of Germany, we find a relative expansion for any care level for both sexes, but a stable trend in severe care level of males and a relative compression in severe care level of females.

In contrast to the picture of a nationwide consistent trend, the health scenario classification on level of counties reveals a high sub-national heterogeneity (Figure 1). Obviously, there is no clear east-west or north-south gap, but a high divergence within the particular federal states. Nevertheless, in case of any care level, the majority of the counties have experienced a relative expansion. Almost every county in the federal states Lower Saxony, Hesse, northern Rhineland-Palatinate, northern and eastern Bavaria, and the majority of the East German counties are in the relative expansion cluster. The highest spatial heterogeneity can be stated for Schleswig-Holstein, North Rhine-Westphalia, Baden-Württemberg and Saxony. The general spatial pattern of the health scenarios is consistent for men and women (Spearmans rho=0.60); however there are some exceptions (some counties in Schleswig-Holstein, Saxony-Anhalt, North Rhine-Westphalia, and Bavaria).

Figure 1: Clusters by health scenarios for any care level and for severe care level, men and women, age 65+, 2001/03-2007/09



Source: Statistical Offices of the Federation and the Länder, Statutory Long-Term Care Censuses 2001-2009 & Regional database (2013); author’s calculations and mapping

In terms of trends in severe care levels, the number of counties experiencing an expansion is lower than in case of any care level. As a consequence, there are comparatively more counties classified as counties with relative and absolute compression. However, there is a higher level of bipolarisation with counties experiencing a relative expansion and counties experiencing a compression for males than for females. This is the explanation for the stable trend for males on the national level.

Looking at any and severe care level simultaneously, the majority of counties show either an expansion in both care levels or a dynamic equilibrium, including the shift from more to less severe levels as defined by Manton (Manton 1982). In case of men, we classify 161 out of 412 counties into these two groups and, in case of women, 137 out of 412 counties. In contrast, 93 counties (men) respectively 108 counties (women) experienced a compression in both levels. An expansion/equilibrium in any care level combined with a compression/equilibrium in severe care level is detected in 154 counties (men) respectively 161 counties (women).[1]

2. Decomposition of the trends - the role of morbidity and mortality effects

Over all counties and for both sexes, the mortality trends have the highest effect on CFLY and CLY in absolute values. On average, from 81 up to 92% of the increases in CFLY are caused by mortality reductions in CFLY and only 8 to 19% by morbidity changes (Table 3). Mean $Mort_{\Delta CLY}$ is low, but the overall mean morbidity effect is even lower. The proportion of $Mort_{\Delta CLY}$ ranges between 135 and 656%. Thus, survival improvements are of higher impact on CLY trend than on the trends in CFLY, especially in case of trends in CLY_{severe}. The spatial mapping of the trends of the mortality and morbidity effects shows high heterogeneity and no clear clusters (not shown).

The results of the decomposition reveal a high variability in terms of combinations of the morbidity and the two mortality effects. We define the categories "low" ("high") as values less (more) than one standard deviation below (above) the mean, and "medium" as values close to the mean. By definition, most counties have medium morbidity and mortality effects. These counties are mostly expansion counties in case of any care level and mostly compression counties in case of severe care level.

Some combinations do not exist. These are the combinations of a low mortality effect in CLY trend ($Mort_{\Delta CLY}$) and a high mortality effect in CFLY trend ($Mort_{\Delta CFLY}$) - the most favourable trend - and vice versa - the most unfavourable trend.

[1] The remaining 4 (men) or 6 (women) counties show inconsistent combinations for both levels or a LE decrease.

Table 4: Mean absolute and relative change in life expectancy, care need-free life years and life years with care need at age 65+ by sex and care level, 2001/03-2007/09

		Mean change in			CFLY change due to		CLY change due to	
		LE	CFLY	CLY	Mortality	Morbidity	Mortality	Morbidity
Any Care Level	Men	1.179	0.965	0.214	0.890	0.075	0.289	-0.075
					92%	8%	135%	-35%
	Women	1.137	0.811	0.326	0.668	0.142	0.468	-0.142
					82%	18%	144%	-44%
Severe Care Level	Men	1.179	1.139	0.040	1.038	0.101	0.142	-0.101
					91%	9%	356%	-253%
	Women	1.137	1.100	0.037	0.893	0.207	0.244	-0.207
					81%	19%	667%	-565%

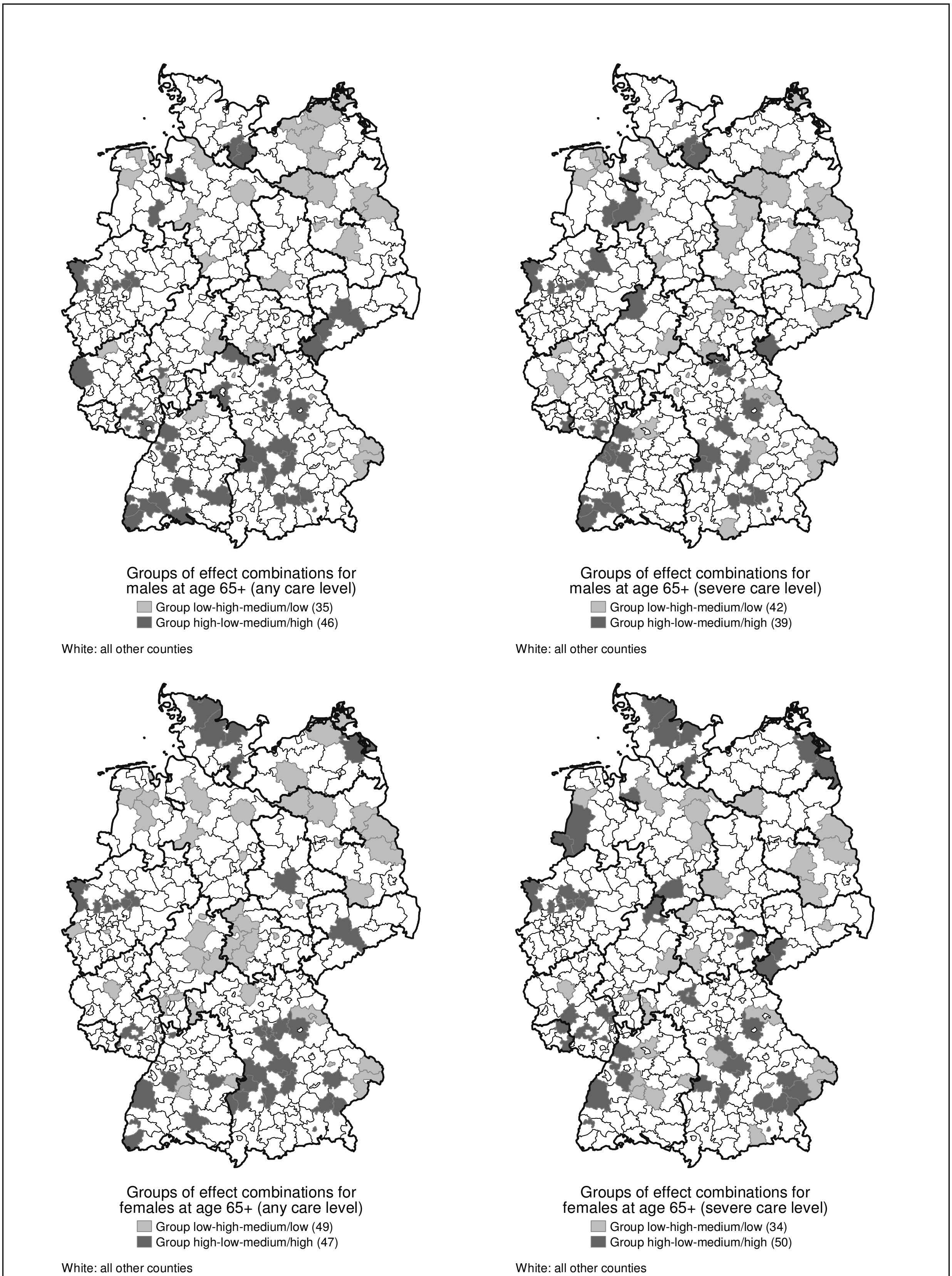
Note: All means are weighted by $1/\sum_{i=2001/03}^{2007/09}(\sigma^2\ (\mathrm{CFLY}_i))$

Source: Statistical Offices of the Federation and the Länder, Statutory Long-Term Care Censuses 2001-2009 & Regional database (2013); author's calculations

The two counties Greifswald and Barnim in northeast Germany show the most unfavourable trends and are both experiencing an expansion in any and severe care need. Almost every county with a high morbidity effect is a compression county, while nearly all counties with low morbidity effects are expansion counties. The counties with the second most unfavourable trend ("low morbidity - high $\mathrm{Mort}_{\Delta CLY}$ - medium $\mathrm{Mort}_{\Delta CFLY}$") are counties in East Germany, in Lower Saxony, and Eastern Bavaria and in case of females (any care level) in central Germany (Figure 2). The counties with the most favourable trends are located in the South German regions and in case of females in the very north of Schleswig-Holstein. These counties are merely compression counties.

More insight can be gained from the association of the morbidity effects with each of the two mortality effects. We estimated bivariate linear regressions for each combination of the three effects differentiated by compression and expansion counties (not shown). In terms of CFLY, both the morbidity and the mortality effect add up to additional healthy life years. Counties, where morbidity improvements lead to large gains in CFLY are merely compression counties. This association is weakly dependent on $\mathrm{Mort}_{\Delta CFLY}$, as indicated by the weak positive slope of the regression line (slopes = [0.040; 0.284]). The slope is similar in compression and expansion counties. The weak positive association is true for both sexes as well as for any and severe care level. In terms of CLY, the morbidity effect must be larger than the mortality effect in terms of compression countries. Thus, the correlation of $\mathrm{Mort}_{\Delta CLY}$ and morbidity effects is higher in the compression counties (slopes = [0.537; 0.632]) than in the expansion counties (slopes = [0.176; 0.391]).

Figure 2: Groups of effect combinations by sex and severity of care level



Source: Statistical Offices of the Federation and the Länder, Statutory Long-Term Care Censuses 2001-2009 & Regional database (2013); author's calculations and mapping

Turning to the multinomial regression, we find that the morbidity effect has the highest impact on the health scenarios (Table 5). An increase of CFLY due to reductions in prevalence leads to a massively higher chance of being a dynamic equilibrium county (Relative risk ratio RRR=[1.271;2.679]) and a compression county (RRR=[1.640;9.893]). Additionally, a gain in Mort$_{\Delta CFLY}$ also results in a negligibly higher chance of experiencing stability (RRR=[1.012;1.052]) or a compression (RRR=[1.011;1.098]). The influence of Mort$_{\Delta CFLY}$ is statistically significant for males only. On the contrary, an increase in Mort$_{\Delta CLY}$ leads to a significant decrease in the chance of a county to experience stability (RRR=[0.494;0.851]) or a compression (RRR=[0.205;0.722]).

Table 5: Results of the four multinomial regression models for males and females at age 65+ by care level, mean centred morbidity and mortality effects are measured in change in life days

	Sex	Covariates	Cases	Mortality effect in CLY		Mortality effect in CFLE		Morbidity effect in CFLE		Pseudo R^2	Miss-ings
				RRR	p-value	RRR	p-value	RRR	p-value		
Any Care Level	Males	**Ref: Expansion**	284	1		1		1		**0.95**	2
		Stability	31	0.531	<0.001	1.052	0.001	2.341	<0.001		
		Compression	95	0.251	<0.001	1.098	<0.001	5.980	<0.001		
	Females	**Ref: Expansion**	288	1		1		1		**0.91**	1
		Stability	10	0.851	<0.001	1.021	0.064	1.271	<0.001		
		Compression	113	0.722	<0.001	1.011	0.442	1.640	<0.001		
Severe Care Level	Males	**Ref: Expansion**	161	1		1		1		**0.95**	2
		Stability	54	0.494	0.001	1.015	0.027	2.679	0.004		
		Compression	195	0.230	<0.001	1.035	<0.001	7.464	<0.001		
	Females	**Ref: Expansion**	140	1		1		1		**0.95**	1
		Stability	42	0.613	<0.001	1.012	0.130	1.964	<0.001		
		Compression	229	0.205	<0.001	1.017	0.115	9.893	<0.001		

Note: counties are weighted by $1/\sum_{i=2001/03}^{2007/09}(\sigma^2(\text{CFLY})_i)$

Source: Statistical Offices of the Federation and the Länder, Statutory Long-Term Care Censuses 2001-2009 & Regional database (2013); author's calculations

4. Discussion

To our knowledge, this is the first study that explores trends in life years with and without care need and in the resulting health scenarios on a sub-national level. Our study confirms that there is high county-level heterogeneity in the trends of the health indicators and in the health scenarios.

Turning to our first research question, the stratified investigation of the trends by care level shows that there are different care need trends in any and in severe care level. While the majority of counties experience a relative expansion of any care level, the mean remaining life span with a severe care level shows stability or compression. For both sexes, the majority of the counties experience a similar health scenario as the whole country. One exception is males with severe care level. For those, the aggregation of the expansion and compression counties to the total country level leads to the wrong conclusion of a stable trend. By combining these trends, our findings confirm the extended theory of dynamic equilibrium that assumes an expansion of morbidity with a shift from severe to moderate types of morbidity (Manton 1982). Thus, our conclusions are consistent with previous findings (Gärtner & Scholz 2005; Pattloch 2010; Unger et al. 2011; Unger & Schulze 2013).

The diversity in the trends in the health indicators and the notable sub-national heterogeneity in terms of the health scenarios cause a disparity in the level of current and future challenges in public health and in social policy according to financial, infrastructural, socio-humanitarian, and welfare state aspects. In the most disadvantaged situation are those counties where the population shows an absolute expansion of care need. The most favourable position is found in counties experiencing an absolute compression. In contrast to the spatial pattern of LE (Kibele 2012), there was no indication for a clear northeast versus southwest gap in both, the health scenarios and the sole trends in the particular indicators.

These findings are strong evidence that there are profound differences between quantity (life expectancy) and quality (care-free life years, health ratio) of life time in the longitudinal trend of the indicators. The classification of the counties by starting level and by trend of the health indicators observed over time unfolds the expected spatial pattern showing counties with unfavourable levels and trends in the North, East and Middle of Germany versus counties with favourable levels and trends in the South and West. Hence, the vanguard counties increased their lead over the rearguard counties in 2001-2009. Furthermore, our study shows that through all counties the higher the level of female LE, of female $CFLY_{severe}$ and of CLY_{severe} for both sexes in 2001/2003, the lower the changes until 2007/2009. This is an indication for an upper level of these indicators. Only for male CFLY does there seem to be an accelerating process of increase which indicates a much higher potential of gains in life years without care need in future.

We explain these findings by a complex interference of different epidemiological processes. One the one hand, regional disparities are expected to be the result of divergent historical regional developments and current regional conditions that have joint interfering, mediating, and suppressing regional specific effects. Those can be period and/or cohort effects on the behaviour, the psycho-social capacity, and the material situation over the life course (timing and duration) of the individuals (Bartley 2004) what in turn have an indirect effect on the total population's composition. On the other hand, the disparities are the direct result of different compositions of the county's population due to the continuous processes of selectivity because of regional specific trends in mortality and migration (Kibele & Janssen 2013; Tong 2000; Zajacova & Burgard 2013).

Turning to our second research question, where we did not have a specific a priori hypothesis, we find that in absolute terms, by far the majority of the absolute increase in disability-free life years and disabled life years is caused by the increase in the survival of the non-disabled and disabled. In other words, the decrease of mortality rates is decisive for the number of additional years with and without care need. In terms of the health scenarios, however, the morbidity effects, respectively the trends in the prevalence of care need, are the decisive drivers of the chance to experience a compression or an expansion. The mortality effects on the trend in disabled life years and on the trend in disability-free life years are of much lower importance. This can be stated for both sexes and for any and severe care levels. Thus, slight absolute changes in the prevalence rates of care need have a very high impact on a county's health scenario.

One explanation for the differences between any and severe care level is that the findings are evidence for the dynamic equilibrium theory assuming a shift from severe to moderate care need. Improvements in health services, a higher awareness of health problems, increased medical knowledge, earlier diagnostics, and better and less risky surgical and medical interventions lead to an enlargement of life time with (severe) physical and mental limitations (Robine, et al. 1998; Crimmins & Beltran-Sanchez 2010). Another explanation for the expansion is that the increase is a result of a changed behaviour of the elderly in terms of acceptance of social benefits, which can be described as a shift from a 'gratitude' generation to a 'demand' generation. One indication for this argument is the disproportional increase in the initial health evaluations by the medical services of the STLC insurance. Between 2001 and 2009, there was a gain of 23% (Medical Advisory of Social Health Insurance 2014), while the population at age 65+ increased only by 9% (Statistische Ämter des Bundes und der Länder 2015). The different trends of the two care level groups may be only the result of a higher restriction in legal acceptance assuming that the higher the care level, the more intensive the medical evaluations and the higher the legal and individual barriers. Indirect evidence for the higher restrictions are the decisions of the re-evaluations of more than 40% of the care receivers conducted annually by the medical services. For example, in 2006, 45.8% (out-patient) and 69.7% (in-patient) of the re-evaluated persons in care level 1 were upgraded to a higher care level, while it was only 36.6% and 56.3% respectively of the persons in care level 2 (Medizinischer Dienst der Spitzenverbände der Krankenkassen e.V. 2007).

5. Conclusion

Our study has profound strengths. One advantage is the large number of persons included in the STLC censuses, allowing us to investigate trends on sub-national level. Because the census is mandatory for all private and public STLC beneficiaries, from an administrative and health care planning point of view, the data are not biased by missing records or problems lost to follow-up. The health outcome itself is another advantage, because it is an objective, nationally standardized evaluation by medical experts of the health insurance companies. A third strength is that we assume only a marginal bias due to cultural differences in the definition of care need, as all SLTC regulations are harmonized and binding for all counties. We used the established healthy life years measure that allows comparisons of the health situation even for small populations and only if cross-sectional data for the individuals is available. The use of the advanced method of decomposition by Nusselder and Looman (2004) provides, to our knowledge for the first time, deeper insights in the complex interactions of changes in the sub-national mortality and morbidity patterns and how these affect health scenarios in Germany. The longitudinal design of the data of the counties is an advantage in many ways; e.g. to investigate the stepwise changes and to compare baseline level with time trends.

However, there are also some limitations. Because only aggregated data was accessible, we are not able to indentify whether the disparities are the result of changes in the population's composition due to 1) (health-related) selective migration and selective mortality or are 2) causally related to the life time accumulation or coping mechanisms on the residential hazardous conditions of the individuals. There is also the restriction that we are not allowed to reveal whether specific cohort or period effects in care need cause a higher magnitude and a higher pace of the county-specific changes. Further limitations are potential county-specific differences between East and West German counties in terms of individual acceptance of social benefits as well as socioeconomic differences in terms of private financial resources to compensate public benefits. Some limitations caused by the design of the study may be the definition and the restrictions in the temporal and cross-county comparability of the health indicators. As only official registered care need is used as the health outcome, there may be undercoverage of care need in general due to a lack of knowledge or high barriers of entry - for example for persons with a migration background. However, there could also be differences (illegal, therefore hidden) in the evaluation process of the care level, as lobbyism towards the medical services and the financial resources of the insurance agencies may vary within Germany. In addition, it can be assumed that there is also a continuing (perhaps policy driven) change of assessment of the potential beneficiaries by the medical services in the observation period (Häcker & Hackmann 2012).

Another potential bias can be the quality of the data for the sex- and age specific population in the counties. Because the population information (unlike birth and death statistics) is not based on registers or a census, but rather on estimations, unregistered in- and out-migration may lead to a bias that is expected to be higher at the oldest age groups (Jdanov, et al. 2005). Post-analyses show that the county- and sex-specific proportional deviance (negative and positive) of the population aged 65+ is not correlated with the level or the trends in LE, CFLY and CLY in both sexes (not shown). Thus, the influence is expected to be marginal. Another problem is a result of a registration problem of the SLTC census for the years prior to 2009. Until 2008, an unknown number of persons with semi-inpatient care were double-counted, leading to an overcoverage of persons with care need (Statistische Ämter des Bundes und der Länder 2012). Because the share of persons in semi-inpatient care to all persons with care need is very low - in Germany in total about 2% (Statistische Ämter des Bundes und der Länder 2012) - this bias is also expected to be marginal.

Our study shows a high diversity in care need challenges on level of counties in Germany. While some counties show very positive trends in terms of a compression of care need, others are confronted with a growing proportion of persons in care need living longer with disability. Overall, the shift from severe to moderate care need is a favourable development considering the financial and emotional burden for individuals and society.

Furthermore, our study detects that the place of residence is another important influence factor of the trends in care need. The study demonstrates that there is a complex interaction between trends in care need prevalence and mortality rates. Since we found that the prevalence is the main driver of the health scenarios, higher efforts are required to reduce the prevalence rates. This is of particular importance in counties in the north and the east of Germany that already have the highest share of persons in care need. This goal can be achieved by more effective direct or indirect medical, structural and infrastructural interventions. In the short run, selected examples to promote the independent living of the elder persons by policy makers are to improve the access to and the awareness of rehabilitation measures, to encourage adequate adjustments in the build environment of the elderly and to support informal care by the elderly's relatives as long as possible and desired. In the long run, advanced medical prevention and personal coping measures should be introduced, a higher sensitization towards early symptoms of physical and mental problems, and health-related favourable changes of the socio-structural composition (e.g. by education and occupation background) and individual behaviour (e.g. smoking and physical/mental activity) of the future elderly should be promoted. In addition, the infrastructural cross-border cohesion and the exchange of insights in the efficiency of small- and large-area policy measures are essential to avoid a further increase in inequality in care need between the vanguard and the rearguard counties.

In future research it will be important to investigate the causes of the diversity in the mortality and morbidity effects. Thus, one of the emerging questions is whether the specific living conditions in the counties and their changes over time are associated with the trends in care need and mortality. Previous studies (Pickett & Pearl 2001; Kawachi & Berkman 2003; Diez-Roux & Mair 2010; Diehl & Schneider 2011; Kreft 2015) have found associations of regional characteristics with small-area health conditions, but studies about health trends are rare. Further investigations are needed to uncover the underlying mechanisms of health ageing to understand and to deal with the challenges of an increasingly more heterogeneous ageing society.

Acknowledgements

The authors gratefully acknowledge Wilma Nusselder, Viviana Egidi, and the colleagues of the Statistical Offices of the Federation and the Länder.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

DK acquired the data and carried out the analysis. DK drafted the manuscript. GD provided editorial assistance and important intellectual input and advice for this study. All authors read and approved the final manuscript.

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Supplementary material

A1: Mid-year population, deaths, and number of persons with any and severe care level by sex at age 65+ in 2001, 2003, 2005, 2007, and 2009, Germany

	Men				Women			
	Mean (SD)	Median (IQR)	Min	Max	Mean (SD)	Median (IQR)	Min	Max
Mid-year population 65+, 2001	20,483.0 21,681.0	14,893.5 13,667.0	3,960	310,397	28,029 30,789	19,849 17,854	5,464	448,450
Deaths 65+, 2001	757.5 777.9	558.5 476.5	152	10,683	992 1,137	703 633	152	17,109
Persons with any care level 65+, 2001	1,051.3 1,087.8	772.0 694.2	178	15,736	2,959 3,429	2,105 1,981	544	53,355
Persons with severe care level 65+, 2001	543.4 566.1	402.3 344.8	90	8251	1,513 1,746	1,099 964	274	27,654
Mid-year population 65+, 2003	21,244.6 22,827.1	15,388.0 14,379.0	4,029	332,812	28,393 31,307	20,159 17,921	5,525	459,847
Deaths 65+, 2003	792.0 812.6	584.0 515.0	156	11,268	1,026 1,153	703 655	184	17,109
Persons with any care level 65+, 2003	1,099.1 1,158.6	816.2 729.7	197	17,231	2,997 3,491	2,144 1,964	596	55,284
Persons with severe care level 65+, 2003	547.6 578.2	409.0 368.9	91	8,739	1,493 1,717	1,098 983	282	27,648
Mid-year population 65+, 2005	21,453.8 23,185.6	15,548.8 14,477.3	4,037	340,320	28,431 31,407	20,172 17,966	5,490	462,777
Deaths 65+, 2005	782.0 806.0	573.0 514.0	154	11,328	990 1,086	715 644	182	16,075
Persons with any care level 65+, 2005	1,166.0 1,253.8	858.5 769.4	200	19,586	3,058 3,580	2,198 2,098	598	58,148
Persons with severe care level 65+, 2005	572.0 617.1	435.4 390.0	88	9,795	1,509 1,735	1,124 1,028	274	28,532
Mid-year population 65+, 2007	21,786.4 23,653.9	15,685.0 14,983.3	3,993	348,648	28,423 31,388	20,261 18,846	5,361	462,623
Deaths 65+, 2007	791.1 807.5	570.0 530.5	144	11,375	977 1,047	700 639	211	15,299
Persons with any care level 65+, 2007	1,266.4 1,306.3	946.8 863.3	217	19,948	3,217 3,606	2,345 2,193	607	57,342
Persons with severe care level 65+, 2007	607.8 625.5	476.1 407.5	101	9,681	1,538 1,681	1,144 1,063	281	26,910
Mid-year population 65+, 2009	22,428.3 24,352.7	16,085.8 15,541.3	4,068	361,379	28,745 31,737	20,390 19,591	5,342	469,617
Deaths 65+, 2009	826.3 829.1	610.5 543.0	155	11,667	1,010 1,074	732 665	185	15,668
Persons with any care level 65+, 2009	1,367.7 1,451.6	1,020.8 935.8	238	22,455	3,328 3,721	2,431 2,389	538	58,886
Persons with severe care level 65+, 2009	630.7 649.8	486.1 424.1	103	9,970	1,527 1,614	1,171 1,045	274	25,147

Source: Statistical Offices of the Federation and the Länder, Statutory Long-Term Care Censuses 2001-2009 & Regional database (2013); author's calculations