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DEMOGRAPHIC AGEING IN BADEN-WUERTTEMBERG, A FEDERAL STATE OF GERMANY POPULATION PROJECTION AND SMALL SCALE ANALYSIS

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ABSTRACT

Objectives: To present the ageing population of Baden-Wuerttemberg, a federal state of Germany, recent development of changes in the population structure will be shown and projected. In order to highlight regional differences, characteristics of ageing were also calculated at the district level for 2011. **Methods:** The data for the population projection and small scale analysis was provided by the Statistical Office of Baden-Wuerttemberg. **Results**: The population projection indicates a population decline. An increase in the number of old people and a decline in the age group below 60 years are obvious. The analysis of the age structure on a small scale level based on districts indicated significant regional differences in 2011. Comparatively, low age dependency ratios primarily exist in regions in which there are larger cities with universities. **Discussion**: Targeted measures are needed in several districts of Baden-Wuerttemberg to tackle these challenges and to reduce the negative impact of ageing.

INTRODUCTION

Demographic change is a major socio-political topic in politics, academia and the media [1]. In Germany, the changes are characterized by an ageing population. Ageing and decrease in population due to demographic changes in the coming decades will have various effects on the social and political development of Germany [2]. Due to the decreasing number of people in the working age bracket, and the increasing number of old people, challenges arise on many levels. These challenges affect various areas in the health sector besides the overall economic competitive ability of Germany [1]. In the health care sector, particularly the sustainability of social protection systems, the provision of an adequate care structure for the increasing number of very old and frail people [3,4] and changes in the development of the disease panorama, e.g. in relation to the increase of chronic diseases and multi-morbidity, medical expenses and employment structure in the care system [5-8], are of major importance.

The population size and structure has changed significantly in recent decades. It was previously perceived as slowly progressing, but this development will greatly accelerate in the coming years. While there were for every 100 persons of working age (20 to under 65 years) only 25 people of retirement age (65 years and more) in 1970, it went up to 34 people in 2009. On the basis of the 12th coordinated population projection, it is assumed that there will be more than 50 people of retirement age for every 100 people of working age in 2030 [9]. The results of the 2011 German Census indicate a population decline of 2.7% since 2001. In addition, the ageing of the population is illustrated by the fact that nowadays, one in five people in Germany is aged over 64 years [10].

Demographic ageing

The population of Germany shows, like most developed countries, a steadily increasing life expectancy [11]. The increase in life expectancy, in conjunction with the birth rate which has been low for many years, led to a higher demographic ageing compared to other countries [6]. This trend is also emerging in the population of Baden-Wuerttemberg. From the early 1950s until 1970, the average age was almost constantly below 35 years but after that time, it increased significantly to 42.5 years in 2009 [12].

However, the demographic ageing depends not only on the increase in life expectancy but is also dependent on certain influences that were in effect for several years or are even still taking place. In particular, the decline in fertility, which has been significantly below the replacement level in Germany for many years is one of such influences. Thus, a decrease in the younger age groups – which has already started in the past decades – will emerge in the long term. This will contribute in conjunction with the increased life expectancy to the ageing of the population. In addition, aspects of migration – albeit to a lesser extent, depending on the intensity of migration – will impact on the age structure [3].

Recognising the demographic changes and the associated impacts at an early stage requires continuous analysis and prediction of the age structure of a population [2].

Population projections provide forward-looking information based on political, social and economic decision-making [9]. Population projections thus provide information regarding the future development of the population, i.e. the rate of population growth or population reduction and the future development of the population structure.

In order to present the ageing population of the state of Baden-Wuerttemberg, recent development of the changes in the population structure and a projection until the year 2111 are shown in this article. In order to highlight regional differences in demographic ageing, characteristics of ageing were also calculated at the level of 44 urban and rural districts in Baden-Wuerttemberg for 2011. Based on these results, societal impacts and options for action are then shown to counteract the effects of ageing appropriately.

METHODS

Data were provided by the Statistical Office of Baden-Wuerttemberg. The statistical data which represent the population of Baden-Wuerttemberg on 31 December 2011, and the temporal trend at the federal state and county levels were analyzed with Microsoft Office Excel 2007. Data of the average total population of Baden-Wuerttemberg from 2011 stratified by age and sex were used. Furthermore, recent data on fertility, mortality and migration at the federal state level were used for the date: 31 December 2011, as well as over time since 1950. The data is based on the results of censuses in 1950, 1956, 1961, 1970, 1987 and beyond these population extrapolations. For the population projection, details of the life table for Baden-Wuerttemberg from 2009/11 regarding the average life expectancy at birth and the number of survivors in the single age years were also used. For the small-scale analysis of the population, ageing data were used for the districts of Baden-Wuerttemberg from 31 December 2011, by single age years.

To describe the demographic trends over time, the proportion of different age groups in the population, the natural population change based on the number of (live) births and deaths were calculated. Spatial population movements (inflows and outflows) over the borders of Baden-Wuerttemberg were used for the calculation of net migration. In order to take into account the information regarding migration in the population projection, migration was observed in 5-year age groups and the rate of migration within each age group in the total net migration was calculated. The migration statistics are based on information provided by the registry office. Age-specific fertility rates (ASFR) were calculated by dividing the number of live births of mothers at the age x (B_x) in 2011 by the number of women of each age cohort (W_x): $\mathrm{ASFR} = \frac{B_x}{W_x} \cdot 1{,}000$.

As an aggregate measure of fertility, which is adjusted for the influence of the age structure, the total fertility rate (TFR) was calculated as the sum of ASFRs of mothers in the age bracket of 15 to 49 years divided by 1,000: $\mathrm{TFR} = \frac{\sum_{x=15}^{49} \mathrm{ASFR}_x}{1{,}000}$. The total fertility rate indicates the average number of children that would be born to a woman over her lifetime if she were to experience the exact current ASFRs through her lifetime. The data were further adjusted and several indices for the 5-year age groups were calculated. The data were used to perform a population projection for Baden-Wuerttemberg up to the year 2111 using a cohort-component method based on an Excel tool by Rowland [13]. The cohort-component method represents a macro simulation in which the total population stratified by 5-year age groups and sex (cohorts) is implemented. As demographic factors, fertility, mortality and migration are considered. For these components, assumptions for individual cohorts and years of prediction have to be made. Therefore, the parameters for the population projection are based on the assumption that the demographic figures from 2011 will also be applied in future years. Two further scenarios were applied: Firstly, the TFR was raised to the replacement level of 2.1 and, secondly, the net migration was doubled.

To illustrate the results, inter alia, population pyramids were created. In addition, crude birth rates (CBR) were calculated by dividing the number of births in a year (B_y) per 1,000 inhabitants of the population for each year of the projection (P_y): $\mathrm{CBR} = \frac{B_y}{P_y} \cdot 1{,}000$. Similarly, the calculation of the crude death rate (CDR) was performed by dividing the number of deaths in a year (Dy) per 1,000 inhabitants of the population (Py): $\mathrm{CDR} = \frac{D_y}{P_y} \cdot 1{,}000$.

To demonstrate the effects of ageing on the population structure, three indicators were determined: 1) The old-age dependency ratio at the level of the federal state over time and in the population projection as well as at the level of districts within the projection; 2) the caretaker ratio and 3) the Billeter index, which were both determined at the level of the federal state as well as the districts based on the current population structure for 2011.

For the old-age dependency ratio (ADR), the number of people over the working age (over 65 years; P_{65+}) is divided by the number of people within the working age (15-64 years; $P_{15\text{-}64}$): $\mathrm{ADR} = \frac{P_{65+}}{P_{15-64}} \cdot 100$.

The caretaker ratio (CR) refers to the ratio of women between 50 and 64 years of age in relation to the population aged 80 years or more. The assumption behind this relationship is that women, especially in this age group take on informal care services for their family members: $\mathrm{CR} = \frac{P_{80+}}{P^{f}_{50-64}} \cdot 100$.

For the Billeter index (J), the population which is not yet ($P_{<15}$) or no longer in the reproductive age (P_{50+}) is considered in relation to the population in the reproductive age ($P_{15\text{-}49}$): $\mathrm{J} = \frac{P_{<15} - P_{50+}}{P_{15-49}}$. The resulting index as the difference between children and grandparents generation in relation to parents' generation yields a value between 1 and -1. The result can be interpreted as a projection of the future age structure, where a positive value indicates juvenescence and a negative value an ageing population.

RESULTS

Population size and population development in Baden-Wuerttemberg

In Figure 1 the current age structure of Baden-Wuerttemberg is represented as a population pyramid. The representation of the age structure is based on available information about the average population of Baden-Wuerttemberg on 31 December 2011. Baden-Wuerttemberg had a total population of 10,769,085 inhabitants on 31 December 2011. The age structure is similar to the overall situation in Germany.

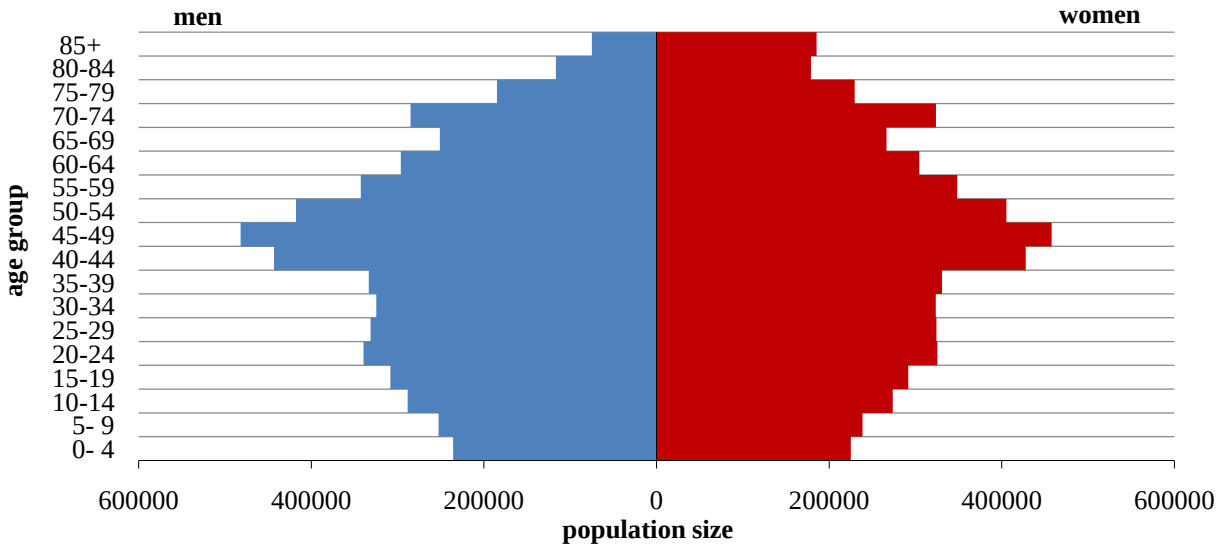

Figure 1: Population structure in Baden-Wuerttemberg, 2011

In the population structure of Baden-Wuerttemberg, besides the basic ageing, singular or historical events are also visible. In addition to the outbreak of both World Wars, the low birth rates towards the end of World War II (age 62-67 years) and baby boomers (aged 42-52 years) are recognised. The subsequent decline in birth rates can be attributed to the introduction of oral contraceptives in the second half of the 1960s. In addition, in the first half of life, a surplus of men was obvious while in older people, the number of women was higher (see Figure 1).

It can be seen in principle that the number of younger people was lower than the number of older people. Thus, the old-age dependency ratio in Baden-Wuerttemberg was 29.3 in 2011. This means a ratio of 29.3 persons aged 65 years and more to 100 persons of younger age (15-64 years). Compared to 1950 (14.1), the old-age dependency ratio more than doubled by 2011 (29.3). The change over time is shown in Figure 2. In addition, the proportion of age groups in the population can be seen in this figure.

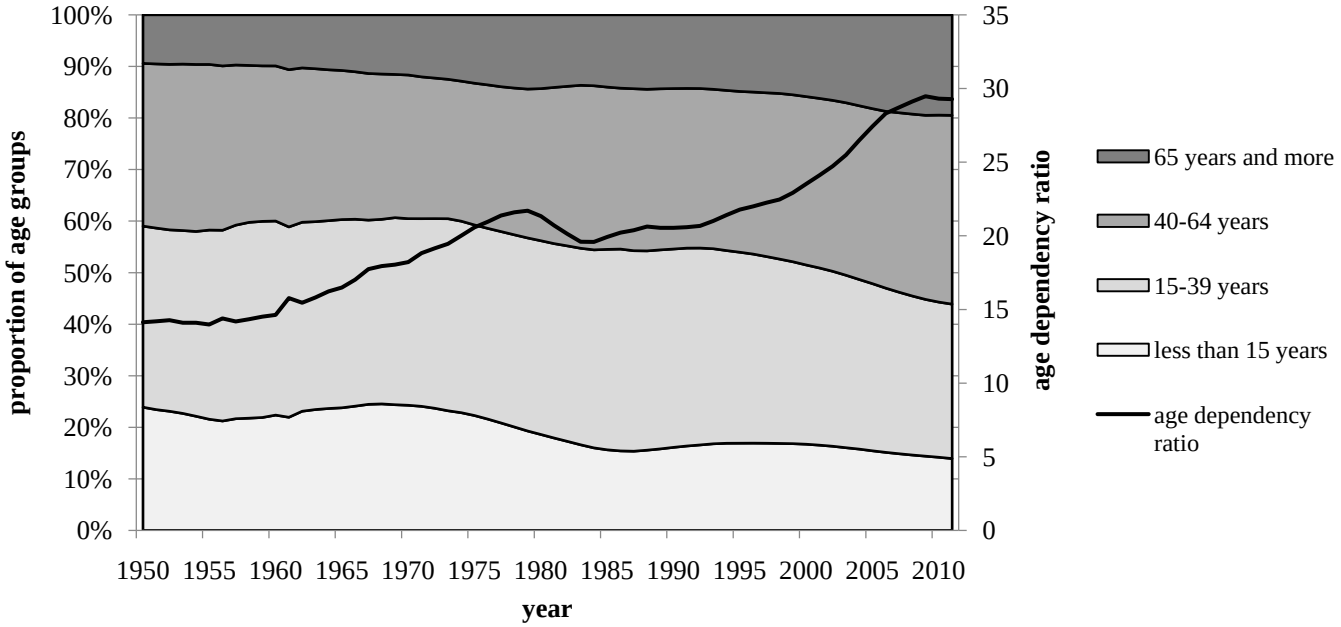

Fig. 2: Proportions of age groups and old-age dependency ratio in Baden-Wuerttemberg, 1950-2011

The balance of natural population movement, which is calculated as the difference between births and deaths within a year, shows a deficit of births since 2006 (-707). Two decades earlier, there was a surplus but it has since transformed into a well pronounced deficit of births. Thus, the birth deficit was 8,909 in 2011 (see Figure 3).

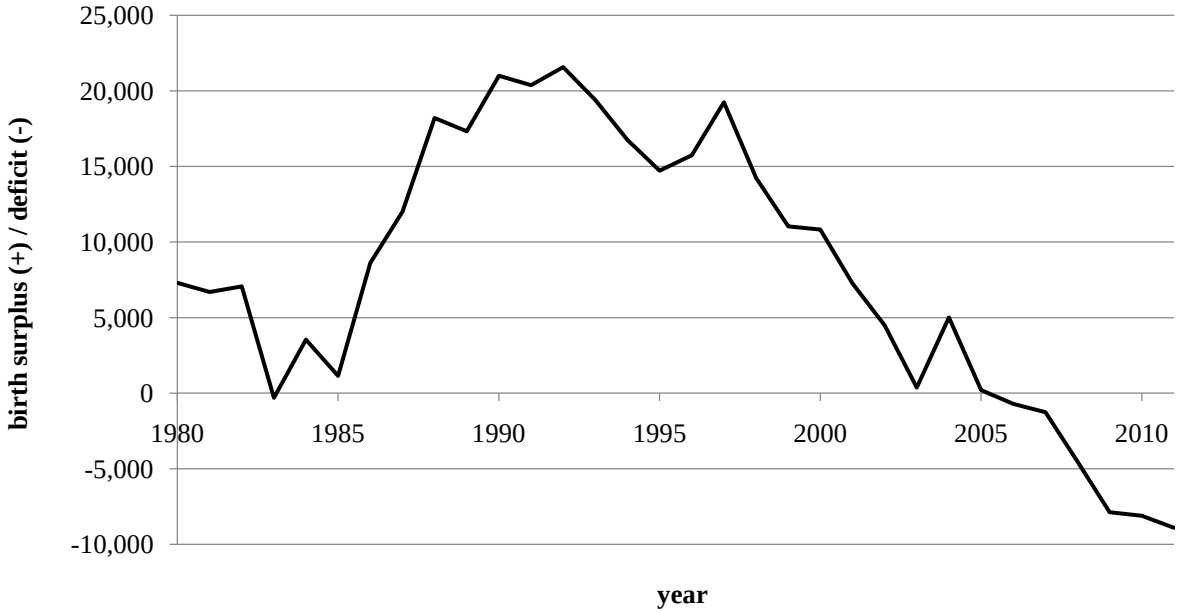

Figure 3: Natural population movement in Baden-Wuerttemberg, 1980-2011

Population structure in Baden-Wuerttemberg, 2011

The population projection is based on the population structure of Baden-Wuerttemberg as at 31 December 2011 (see Figure 1). For the prediction of the population structure of Baden-Wuerttemberg in the next 100 years, it was assumed that fertility, mortality, life expectancy and migration will not change. Therefore, the indicators of demographic processes from 2011 are presented below, which are used as assumptions for the population projection.

Fertility

For the age-specific fertility rate (ASFR), rates of live births for 5-year age groups were used. In Figure 4, both the ASFR for each year of age in the form of the line diagram and the ASFR for 5-year age groups in a column chart were plotted. The majority of children (98.6 live births per 1,000 women) are born in the age group of mothers of 30-34 years. In the age group of 15-19 year olds (4.9 live births per 1,000 women) and 45-49 year olds (0.4 live births per 1,000 women), the ASFR is very low. 65% of births were observed in women between 25 and 34 years; 83.3% of births were observed in women aged 25 to 39 years of age. The TFR was calculated as the aggregate measure of fertility with a value of 1.36 for Baden-Wuerttemberg in 2011. This means that women in the age of 15 to 49 years will on average give birth to 1.36 children, based on the assumption that the probability of the current ASFR can be applied to every future year.

age group	ASFR	proportion in %
15-19	4.9	1.8
20-24	29.3	10.8
25-29	77.1	28.5
30-34	98.6	36.5
35-39	50.7	18.8
40-44	9.1	3.4
45-49	0.4	0.1

Figure 4: Age-specific fertility rate in Baden-Wuerttemberg, 2011

Mortality and life expectancy

The information on mortality was taken from the life table for Baden-Wuerttemberg, 2009/11 stratified by gender (see Figure 1). In the life table, age-specific death rates (ADSR) and a stationary population of 100,000 people (radix) were used. The life table shows an average life expectancy at birth of 83.6 years for women and of 79.1 years for men. For the projection of average life expectancy, the number of survivors in the age years were used. The survival probability as a function of age is shown for both sexes in Figure 5.

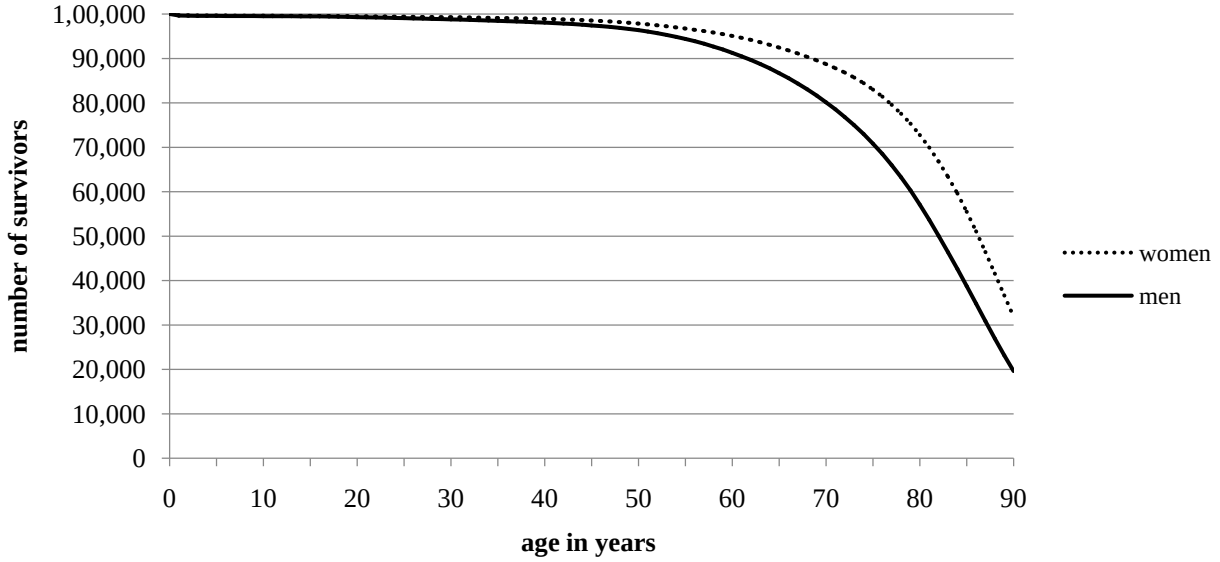

Figure 5: Rate of survival stratified by age and sex, Baden-Wuerttemberg, 2009/11

Migration

Information relating to the spatial movement of the population through migration was included in the projection based on data from the year 2011. To account for the influence of migration across the borders of the federal state of Baden-Wuerttemberg, the net migration based on 5-year age groups and stratified by gender was determined. In addition, the respective percentage of net migration was obtained in the age groups over the entire spatial population movement (see Table 1) and used for the projection. In 2011, a positive net migration of 41,458 people was observed in Baden-Wuertemberg, including 25,086 men and 16,372 women. While the net migration in the age groups up to 54 years for women and 59 years for men are positive, in higher age groups, the outflows predominate. Most migration takes place at younger ages. In the group of people aged 20 to 24 years, migration occurs most frequently both for men and women. Migration continuously decreases with rising age (see Table 1).

Table 1: Migration in Baden-Wuerttemberg, 2011

age group	men		women		net migration			
					men		women	
	immi-gration	emi-gration	immi-gration	emi-gration	total	proportion in %	total	proportion in %
0- 4	6,042	4,612	5,771	4,329	+ 1,430	3.4	+ 1,442	3.5
5- 9	4,092	3,462	3,882	3,145	+ 630	1.5	+ 737	1.8
10-14	3,184	2,312	3,117	2,342	+ 872	2.1	+ 775	1.9
15-19	7,164	4,348	7,557	5,155	+ 2,816	6.8	+ 2,402	5.8
20-24	27,839	22,417	27,947	23,847	+ 5,422	13.1	+ 4,100	9.9
25-29	29,988	24,748	23,544	21,005	+ 5,240	12.6	+ 2,539	6.1
30-34	22,624	19,186	14,558	13,140	+ 3,438	8.3	+ 1,418	3.4
35-39	16,667	13,947	9,453	8,003	+ 2,720	6.6	+ 1,450	3.5
40-44	13,746	11,441	7,936	6,595	+ 2,305	5.6	+ 1,341	3.2
45-49	10,135	8,847	6,174	5,397	+ 1,288	3.1	+ 777	1.9
50-54	7,371	6,400	4,997	4,355	+ 971	2.3	+ 642	1.5
55-59	4,369	4,006	3,193	3,219	+ 363	0.9	– 26	-0.1
60-64	2,355	2,884	2,352	2,754	– 529	-1.3	– 402	-1.0
65-69	1,557	2,294	1,488	1,843	– 737	-1.8	– 355	-0.9
70-74	1,147	1,737	1,289	1,462	– 590	-1.4	– 173	-0.4
75-79	608	918	850	988	– 310	-0.7	– 138	-0.3
80+	705	948	1,742	1,899	– 243	-0.6	– 157	-0.4
Gesamt	159,593	134,507	125,850	109,478	+ 25,086	60.5	+ 16,372	39.5

Projected population of Baden-Wuerttemberg: 2011-2111

Based on the assumptions described above that the demographic indicators of fertility, mortality, life expectancy and migration will not change in the coming decades, a population projection was carried out from 2011 to 2111, which is based on the population structure of Baden-Wuerttemberg in 2011. The detailed results of the ensuing age structure of the population in 5-year intervals are stratified for sex. In Figure 6, the population structures for the years 2021, 2036, 2061, and 2111 are illustrated. The population structure from 2011 is given as a reference respectively.

Over a long time, a population decline is evident: While the population of Baden-Wuerttemberg was still 10,769,085 people in 2011, this number will increase slightly by 2021 (10,920,162); but this will be followed by a steady decline in the population. After 50 years, the population projection shows a decline in population by about 10% (2061: 9,713,195). By 2111 (7,816,182) the population will decline by about 28% compared to 2011 (see Table 2). The increase of the population size at the beginning of the projection is characterized by an increase of the elderly population. In 2036, a significantly higher number of persons aged 60 years or more and a significantly lower number of people younger than 30 years are observed compared to 2011, although

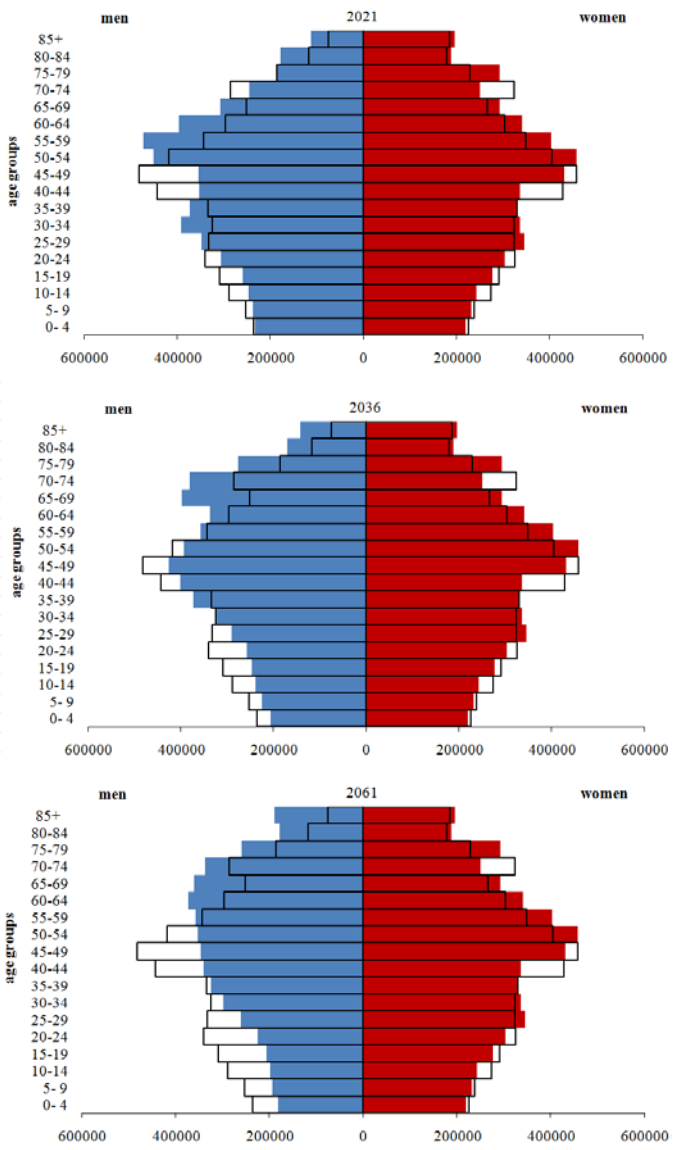

Figure 6: Population structure in Baden-Wuerttemberg, 2021, 2036, 2061 and 2111 (reference: 2011)

The total population is comparable. In the course of time, there is a clear increase in the number of older people and a decline in the age group below 60 years. The proportion of very old people – especially women – at the age of 85 years and more will also increase significantly (see Figure 6). During the first two decades of the population projection, an overall positive population change is observed due to the spatial population movements. The natural population change shows negative values over the entire projection period. The trend of the negative population change intensifies until 2046 and weakens slightly in the next few decades. The number of deaths varies significantly within each year and has values of approximately 112,000 deaths at the basis of the projection, approximately 150,000 deaths after 50 years and less than 127,000 deaths by the end of the projection. The number of births decreased continuously from approximately 90,000 in 2011 to about 56,000 births at the end of the projection. Due to the ageing of the population, the crude birth rate (CBR), which represents the number of live births in a year per 1,000 inhabitants of the population, decreases over time from 8.3 in 2011 to 7.2? The crude death rate (CDR) however, increases from 10.3 to 16.7 in 2076, until it manifests in the following decades at a slightly lower level of about 16.2 (see Table 2).

Table 2: Population projection, Baden-Wuerttemberg, 2011-2111

year	population	population change in %	Population change	births	deaths	natural population change	CBR	CDR
2011	10,769,085	0.18	19,529	90,015	111,944	-21,929	8.3	10.3
2016	10,866,732	0.10	10,686	90,907	121,679	-30,772	8.3	11.2
2021	10,920,162	-0.01	-777	89,606	131,841	-42,235	8.2	12.1
2026	10,916,277	-0.06	-6,833	85,591	133,882	-48,291	7.9	12.3
2031	10,882,111	-0.17	-18,125	80,747	140,331	-59,583	7.5	12.9
2036	10,791,485	-0.29	-30,913	76,993	149,364	-72,371	7.2	13.9
2041	10,636,919	-0.41	-42,793	74,982	159,233	-84,251	7.1	15.1
2046	10,422,955	-0.49	-50,083	73,994	165,535	-91,541	7.2	16.1
2051	10,172,541	-0.49	-48,908	72,908	163,274	-90,366	7.3	16.2
2056	9,927,999	-0.44	-42,961	71,047	155,466	-84,419	7.2	15.8
2061	9,713,195	-0.44	-42,360	68,617	152,435	-83,818	7.1	15.9
2066	9,501,395	-0.47	-44,543	66,317	152,318	-86,001	7.1	16.2
2071	9,278,681	-0.50	-46,309	64,621	152,387	-87,767	7.1	16.6
2076	9,047,138	-0.49	-44,172	63,479	149,110	-85,630	7.1	16.7
2081	8,826,276	-0.46	-40,545	62,519	144,521	-82,003	7.2	16.6
2086	8,623,553	-0.42	-36,119	61,404	138,981	-77,577	7.2	16.3
2091	8,442,958	-0.40	-33,424	60,078	134,959	-74,882	7.2	16.1
2096	8,275,839	-0.39	-31,787	58,721	131,967	-73,245	7.2	16.1
2101	8,116,903	-0.38	-30,794	57,546	129,799	-72,252	7.2	16.1
2106	7,962,931	-0.37	-29,350	56,618	127,426	-70,808	7.2	16.2
2111	7,816,182							

The ageing of the population in Baden-Wuerttemberg is also evident in the changes of the old-age dependency ratio. While in the past 60 years an increase in the old-age dependency ratio of 14.1 (1950) to 29.3 in 2011 was found (see Figure 2), this ratio will continue to increase. A strong increase is shown in the projection up to 2036, in which an old-age dependency ratio of 45.3 was calculated. In the following decades, it can be predicted that the dependency ratio will manifest at this high level with

slight variations within the years depending on the particular age structure (see Figure 7).

In addition to this projection, which was carried out with the assumptions previously described, two further scenarios and their consequences for the old-age dependency ratio are shown in Figure 7. Firstly, the TFR was changed from 1.36 to 2.1 starting in 2016. This corresponds to the replacement level of fertility in developed countries, where a generation of parents will reproduce an equally large generation of children. Secondly, the net migration of 41,458 was increased to 80,000 per year. The age structure of migrants was however maintained.

As shown in Figure 7, the increase in the TFR leads to a reduction in the old-age dependency ratio in the long term. The effects of the increase in the TFR are visible from 2036 onwards, as the young generation with a high number of children must grow to the age of child-bearing. From 2036 onwards, the old-age dependency ratio declines, so that it will reach a level which is almost equal to the current level in 2111. The doubling of net migration has direct effects on the old-age dependency ratio, albeit to a somewhat lesser extent. The highest dependency ratio under these conditions is 43.4 in 2066 (see Figure 7).

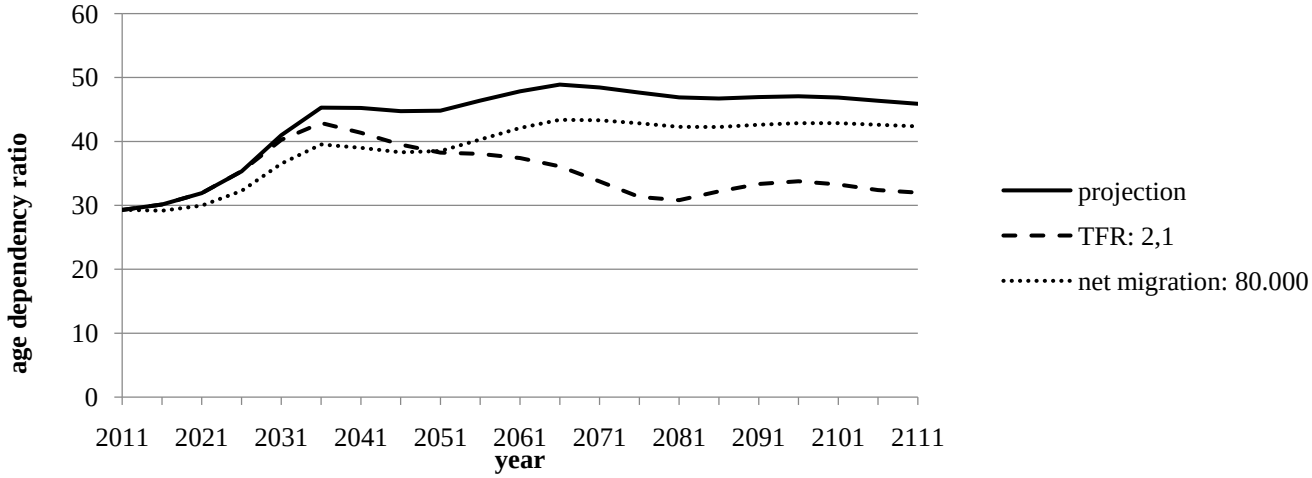

Figure 7: Projection of old-age dependency ratio, Baden-Wuerttemberg, 2011-2111

Small scale analysis of the ageing population in Baden-Wuerttemberg, 2011

The analysis of the age structure on a small scale level based on districts of Baden-Wuerttemberg in 2011 indicates significant regional differences. The differences between the districts in Baden-Wuerttemberg regarding the old-age dependency ratio are shown in Table 3. The red color indicates a higher dependency ratio and green a lower dependency ratio compared to the average of the federal state of Baden-Wuerttemberg (29.3). The districts with an old-age dependency ratio which is comparable to the average of that of the federal state are marked in white. The lowest old-age dependency ratios are found in the three traditional university cities in Baden-Wuerttemberg (Freiburg [23.6], Heidelberg [23.6] and Tübingen [24.4]). Comparatively, low old-age dependency ratios also exist primarily in regions in which larger cities with universities or industry and service companies are located – these include Stuttgart (28.7) and Ulm (28.9). The district of Baden-Baden (46.5) shows the highest old-age dependency ratio in Baden-Wuerttemberg. No other district has a similarly old age structure. Well above the national average with old-age dependency ratios higher than 35 are Schwarzwald-Baar-Kreis (37.1), Heidenheim (37.0), Bodenseekreis (35.4), Göppingen (35.2), Main-Tauber-Kreis (35.0) and Zollernalbkreis (35.0) (see Table 3).

Due to the ageing of the population, it is also important to look at the relationship between people potentially being in need of care and the presence of people who may provide informal care, such as relatives. Therefore, in addition, the caretaker ratio was calculated for the districts, which serves as a supply quotient by the number of women between 50 and 64 years of age who can potentially take over informal care services, in relation to the number of very old people (80 years and more). The highest ratio is in place once more in Baden-Baden (73.1). This can be interpreted to mean that 73.1% of the female population in the age group of 50 to 64 years have to provide informal care to one person aged more than 80 years. This is followed by Heidenheim (61.7) and Pforzheim (60.7) which also have high rates which are significantly higher than the average in the federal state of Baden-Wuerttemberg (52.6), but significantly lower than the caretaker ratio in Baden-Baden (73.1). The majority of the districts reveal caretaker ratios between 50 and 55. Low caretaker ratios are visible in Tübingen (42.6), Boblingen (47.4), Heilbronn (47.1), Karlsruhe and the Rhein-Neckar-Kreis (both 48.6), and Emmendingen (48.2) (see Table 3).As the population projection was performed only at the level of the federal state, the relevance of ageing in the single districts in Baden-Wuerttemberg is displayed by the Billeter index, which was calculated on this small-scale level. From the analysis of the population structure of Baden-Wuerttemberg, a strong ageing is revealed (-0.53); this applies to all districts in the federal state. In particular, Baden-Baden shows a very high index (-0.91) of the ageing population once more.

An index value greater than 0.6, which indicates a strong ageing of the population is found in Main-Tauber-Kreis (-0.65), Schwarzwald-Baar-Kreis (-0.65), Heidenheim (-0, 64), Rastatt (-0.63) and Zollernalbkreis (-0.63). A comparatively lower ageing is obvious in Freiburg im Breisgau (-0.40), Heidelberg (-0.42) and Tübingen (-0.44) (see Table 3).Overall, it must be noted that ageing is foreseen everywhere in the federal state of Baden-Wuerttemberg. However, the expression of ageing differs between the districts. Districts such as Freiburg, Heidelberg and Tübingen have relatively good predictions regarding the ageing of the population. Although the population age

as well, the level is much lower especially in Baden-Baden, but also in Heidenheim, Main-Tauber-Kreis and Schwarzwald-Baar-Kreis.

DISCUSSION

The analysis of the current age structure of Baden-Wuerttemberg and the population projection indicate highly relevant challenges in the coming years. Against the background of the projected steady increase in the old-age dependency ratio from 29.3 in 2011 to 45.3 in 2036, the ageing population affects social and economic developments. Therefore, different actions at the level of individuals, families, and society are required [2]. At this point, the consequences for social security systems need to be emphasized. Since insurance contribution rates cannot increase in such a way that it trades off the effects of the ageing population, further reforms of the social security system are needed. These include the current highly discussed aspects in terms of increasing the retirement age, supporting of employment opportunities for women and increasing immigration of young workers from abroad [1,3]. These approaches may also meet the impending shortage of skilled workers, particularly in the health care sector. Therefore, existing labour and innovation potentials as well as the potential of skilled immigrants has to be utilized [2].

These fields of activity show that the challenges are not only connected with the social security system, but also companies face the challenges of an ageing workforce and the associated higher work absenteeism. Therefore, the impact of ageing may weaken the economic competitiveness of Germany [3,6]. How the adaptation measures will actually look like can only be predicted with several assumptions, because there is no experience with such a pronounced change in the age structure [1]. Until now, the potential of older workers has not been adequately exploited. The wide range of competencies and expertise of the older workforce should be increasingly utilized. Therefore, age-appropriate, safe and healthy working conditions have to be implemented [2].

However, it has to be considered that these measures only contribute to the containment of the impact of an ageing population in Baden-Wuerttemberg [12]. Also, the projection with the assumption of a TFR of 2.1 indicates that even a strongly increasing fertility in the coming decades can reduce the old-age dependency rates only marginally or maintain the actual level in the next 100 years. In order to achieve a higher fertility, social changes are needed, which have to be promoted by political activities. In the context of the aforementioned increase in female employment rates, policies regarding child care have to be implemented to offer flexibility and security to families. This is especially true for single parents in order to set incentives for increased women's employment participation and to strengthen the desire for children [2].

Although the changes are minor in the projection, the adoption of a net migration of 80,000 has a visible impact on the reduction of the ageing population in the long term. In this context, the current debate regarding the unrestricted migration of workers is also referred to, which is currently expected due to the increase in immigrants from Bulgaria and Romania into Germany [14]. To meet the challenges of an ageing population, various projects have been initiated by politicians that act at different levels [2, 15].

The development of the Billeter index showed only slightly negative values until the year 1970 and thus pointed out only a slight ageing. In recent decades however, a significant increase in the Billeter index can be observed [12]. Nevertheless, there are significant regional differences between the districts of Baden-Wuerttemberg, both in predicting the severity of ageing as well as in the caretaker ratio, which gives information on whether and to what extent informal care can be offered. Ensuring adequate care at the end of life is highly important for the society. Therefore, strategies to promote formal as well as informal care and end-of-life care were implemented in the recent past [16]. These strategies need to be targeted and thus take into account the needs of individual regions. It is therefore important to take regional and economic conditions into account to develop locally adaptable solutions [2]. In particular, districts such as Baden-Baden, Heidenheim, Main-Tauber-Kreis and Schwarzwald-Baar-Kreis demand strategies to meet the local age structure requirements.

In addition to these general indicators of the age structure, aspects of the populations' health status have to be considered. It turns out though that the health status of older people has improved, but according to the expansion of morbidity hypothesis [17], it has to be considered that health restrictions occur with increasing age. During the year 2010, approximately 2.42 million people were dependent on care in Germany. Projections indicate that the number of care dependent people will increase by 2020 to 2.9 million and by 2030 to 3.37 million [2]. Due to the extension of life, the disease burden at both the individual level and at the population level will increase [11]. Therefore, the health system will be faced with rising expenses due to the increase in the proportion of older people and by declining revenues due to the reduction of contributors in the future [2].

The health infrastructure in terms of the care system was not considered in the present work. Here, it is essential for further planning and the development of strategies to consider the density of medical care and the presence of formal and informal care, particularly at a micro level, in order to allow for appropriate measures. The projection presented is based on the assumption that the current demographic indicators will also be applied in the coming decades. This projection deviates from the approach in the coordinated population projections and is only realistic to a limited extent. However, these assumptions demonstrate the effects that arise on the basis of the current situation with regard to fertility, mortality and migration. To get more targeted information about ageing at the level of different districts in Baden-Wuerttemberg, differentiated projections may be helpful.

Nevertheless, this analysis illustrates various aspects of the ageing population in Baden-Wuerttemberg. This includes not only the population decline of 10.7 million people in 2011 to 7.8 million people in 2111, but also in particular, the increasing proportion of people in older ages and the associated declining proportion of young people in the working age. Therefore, there are several requirements for both the organization of the care systems as well as for social security. Therefore, targeted measures are needed to meet these challenges and to reduce the negative impact of ageing.

Table 3: Demographic aging in districts of Baden-Wuerttemberg, 2011

district	old-age dependency ratio	caretaker ratio	Billeter index
Alb-Donau-Kreis	30.4	51.0	-0.48
Baden-Baden	46.5	73.1	-0.91
Biberach	29.4	49.6	-0.46
Böblingen	32.4	47.4	-0.53
Bodenseekreis	35.4	51.2	-0.61
Breisgau-Hochschwarzwald	34.1	51.6	-0.60
Calw	32.9	51.2	-0.58
Emmendingen	32.3	48.2	-0.57
Enzkreis	33.8	49.7	-0.59
Esslingen	33.5	51.5	-0.55
Freiburg im Breisgau	23.6	52.5	-0.40
Freudenstadt	32.1	53.1	-0.55
Göppingen	35.2	55.1	-0.60
Heidelberg	23.6	52.4	-0.42
Heidenheim	37.0	61.7	-0.64
Heilbronn, LKR	30.0	47.1	-0.51
Heilbronn, SKR	32.8	56.3	-0.53
Hohenlohekreis	30.1	52.0	-0.52
Karlsruhe, LKR	32.4	48.6	-0.60
Karlsruhe, SKR	29.5	59.7	-0.51
Konstanz	33.0	55.8	-0.57
Lörrach	32.8	50.7	-0.57
Ludwigsburg	32.1	49.1	-0.52
Main-Tauber-Kreis	35.0	58.8	-0.65
Mannheim	29.7	54.8	-0.53
Neckar-Odenwald-Kreis	32.6	51.7	-0.61
Ortenaukreis	32.8	54.5	-0.57
Ostalbkreis	32.5	53.0	-0.54
Pforzheim	34.4	60.4	-0.58
Rastatt	33.7	51.3	-0.63
Ravensburg	30.8	50.7	-0.49
Rems-Murr-Kreis	34.0	50.9	-0.58
Reutlingen	32.7	51.9	-0.55
Rhein-Neckar-Kreis	33.0	48.6	-0.60
Rottweil	34.6	54.6	-0.57
Schwäbisch Hall	29.8	50.4	-0.51
Schwarzwald-Baar-Kreis	37.1	58.6	-0.65
Sigmaringen	31.7	52.1	-0.52
Stuttgart	28.7	57.8	-0.47
Tübingen	24.4	42.6	-0.44
Tuttlingen	32.7	53.0	-0.52
Ulm	28.9	55.2	-0.47
Waldshut	34.2	54.8	-0.58
Zollernalbkreis	35.0	54.3	-0.63
Baden-Wuerttemberg	***29.3***	***52.6***	***-0.53***

CONFLICT OF INTERESTS

The Author declares that there is no conflict of interest.

REFERENCES

[1] Advisory Council on the Assessment of Developments in the Health Care System. (2011) *Herausforderungen des demografischen Wandels*. Wiesbaden: Advisory Council on the Assessment of Developments in the Health Care System.

[2] BMI. (2011) *Demografiebericht. Bericht der Bundesregierung zur demografischen Lage und künftigen Entwicklung des Landes*. Berlin: Bundesministerium des Innern.

[3] Birg H, Flöthmann EJ. (2002) Langfristige Trends der demographischen Alterung in Deutschland. *Zeitschrift für Gerontologie und Geriatrie*, 35(5), 387-399.

[4] Federal Statistical Office of Germany. (2011) *Demografischer Wandel in Deutschland. Bevölkerungs- und Haushaltsentwicklung im Bund und in den Ländern*. Wiesbaden: Federal Statistical Office of Germany.

[5] Schulz E, Leidl R, König H-H. (2004) The impact of ageing on hospital care and long-term care – the example of Germany. *Health Policy*, 67(1), 57-74

[6] Birg H. (2009) Der demografische Wandel als politische Herausforderung. Ein Resümee über Ursachen und Konsequenzen der demografischen Zeitenwende in Deutschland und Europa. *Onkologie*, 32(Suppl. 3), 3-7.

[7] Biermann J, Neumann A, Hewer A, Wasem J, Erbel R, Neumann T. (2010) Einfluss der demographischen Entwicklung auf die stationären Fallzahlen und Kosten deutscher Krankenhäuser. *Medizinische Klinik*, 105(12), 876-881.

[8] Robert Koch Institute. (2012) *Demografische Alterung und Folgen für das Gesundheitswesen*. Berlin: Robert Koch Institute.

[9] Federal Statistical Office of Germany. (2009) *Bevölkerung Deutschlands bis 2060. 12. koordinierte Bevölkerungsvorausberechnung*. Wiesbaden: Federal Statistical Office of Germany.

[10] Federal Statistical Office and the Statistical Offices of the Länder. (2013) *Zensus 2011. Bevölkerung nach Geschlecht, Alter, Staatsangehörigkeit, Familienstand und Religionszugehörigkeit*. Bad Ems: Statistisches Landesamt Rheinland-Pfalz.

[11] Christensen K, Doblhammer G, Rau R, Vaupel JW. (2009) Ageing populations: the challenges ahead. *Lancet*, 374(9696), 1196-1208.
[12] Brachat-Schwarz W. (2011) Die Alterung der Bevölkerung in Baden-Württemberg. Langfristige Trends und regionale Unterschiede. *Statistisches Monatsheft Baden-Württemberg*, 9, 16-21.
[13] Rowland DT. (2003) *Demographic methods and concepts*. Oxford: Oxford University Press.
[14] Federal Government. (2014) Freizügigkeit bringt Wohlstand für alle. http://www.bundesregierung.de/Content/DE/Artikel/2014/02/2014-02-14-freizuegigkeit-ministertreffen.html. Accessed 16 February 2015.
[15] Federal Government. (2014) Politikschwerpunkt Demografischer Wandel. http://www.bundesregierung.de/Content/DE/StatischeSeiten/Breg/ThemenAZ/DemografischerWandel/politikschwerpunkt-demographischer-wandel.html. Accessed 16 February 2015.
[16] Simon ST, Gomes B, Koeskeroglu P, Higginson I J, Bausewein C. (2012) Population, mortality and place of death in Germany (1950-2050). Implications for end-of-life care in the future. *Public Health*, 126(11), 937-946.
[17] Nusselder W. (1998) *Compression or expansion of morbidity? A life-table approach*. Erasmus University Rotterdam, Dissertation.

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