

ABOUT MORTALITY DATA FOR WEST GERMANY

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GENERAL

The region of unified Germany referred to as “West Germany” (formerly known as the Federal Republic of Germany or FRG) in the Human Mortality Database (HMD) consists of the following *Länder* (federal states): Baden-Württemberg, Bayern, Bremen, Hamburg, Hessen, Niedersachsen, Nordrhein-Westfalen, Rheinland-Pfalz, Saarland, and Schleswig-Holstein, and West Berlin. However, since 2016 West Berlin is excluded from the territory of West Germany and included in East Germany. Population statistics were created for some parts of West Germany based on the West German censuses of 1946, 1950, 1961, 1970 and 1987. Birth, death, and migration statistics were produced and published for all parts of West Germany.

The first census after reunification took place in West Germany in 2011 only. Thus, there is a 24-year gap between the preceding and the most recent census. This represents a very unusual case for a developed country.

Between 1876 and 1945, vital registration statistics in all parts of Germany had been based on the Civil Status Act (*Personenstandsgesetz*) [1]. In the period between 1876 and 1945, the Civil Status Act was subject to slight revisions. During the division of Germany in the period 1946-1989, East and West Germany implemented changes to this law independently from each other. On October 3rd, 1990, the official day of reunification, the legal situation changed again, as the Civil Status Act that had been developed by West Germany during the period of the German division was from then on also applied in East Germany.

In 1950, the *Statistische Bundesamt* (the Federal Statistical Office) was established in Wiesbaden. This office collaborates with the state statistical offices for the production and publication of statistics at the federal level and for each German state (see *Background and Documentation* file for Germany for details).

DATA SOURCES

All of the raw data used for the Human Mortality Database (HMD) were provided by the Federal Statistical Office in Wiesbaden and the Statistical Offices of the German states. The HMD Input Database (InputDB) includes death and population counts for all years since 1956.

TERRITORIAL COVERAGE

In 2001, the administrative structure of Berlin was revised. The former 23 Berlin districts were merged into 12 new districts (‘*Bezirke*’). As a result, it was no longer possible to derive data for the previous divisions of Germany into West Germany (including West Berlin) and East Germany (including East Berlin) directly from official published statistics. However, it was possible to reconstruct the old division of Berlin for the period since 2001 in a very precise manner from the available statistics using *Melderegister* data as a complementary source of information (see

Appendix 2). These data allow us to maintain the former distinction between East and West Germany until 2015. Since January 2016, the HMD data for West Germany exclude West Berlin.

DEATH COUNT DATA

Coverage and Completeness

The death statistics include deaths of all persons who were residents of West Germany. Stillbirths are not included in these statistics. With regard to the completeness of the death statistics, it should be noted that in official statistics deaths are registered at the place of occurrence. Therefore, certain criteria of inclusion and exclusion must be applied by German statistical offices to produce statistics by place of residence from statistics by place of occurrence. For instance, a person who was resident of the federal territory but died abroad is included in the federal statistics. In Germany, age reporting is highly reliable.

For the years 2018-2020, the German Statistical Office (DESTATIS) introduced a new procedure to deal with small numbers of deaths. When the number of cases is less than 3 or when there are single values identical to the marginal total, the non-zero number of death counts in that cell is suppressed for privacy protection. In addition, the relative additional non-risky cells are suppressed as well (secondary suppression or complementary suppression) to avoid re-identification of the deceased individuals, following German rules

There are many different approaches to resolving this kind of problem. We decided to use the Iterative Proportional Fitting method as it is well known, extensively used, and easy to implement. The Iterative Proportional Fitting (IPF) algorithm was initially developed by Fienberg (1970) and later revised by Bishop et al. (1975). The IPF iteratively recalculates the cell values in a contingency table so that the row and column sums of the cells become equal to the marginal totals (see details in Appendix 2 in Background and Documentation of Total Germany).

The algorithm is computed independently for each year (2018-2020) and sex and results in adjusted age-specific data cells that do correspond to the marginal totals for East Germany. Suppressed cells in the West German dataset were calculated by difference between the Total and the East German counts.

BIRTH COUNT DATA

The birth statistics include live births to all mothers whose residence is in West Germany. The definition of a live birth changed in 1958 [1, p. 14].

- Before 1958, a live birth was defined as a birth where: "there was respiration after complete expulsion or extraction."
- Since 1958, live births include all births where "there was respiration, pulsation of the umbilical cord, or a heartbeat of the child after the complete expulsion or extraction from its mother."

With regards to the completeness of birth statistics, it should again be noted that births are generally registered in the area of occurrence. Therefore, as with mortality data, certain criteria of inclusion and exclusion are applied by the German

statistical offices in order to produce statistics by place of residence from statistics by place of occurrence.

POPULATION COUNT DATA

The end-of-year population estimates include all population officially residing in West Germany. The official population estimates are derived on the basis of the results of the last census, birth, death, and migration statistics.

The first census after reunification was carried out in 2011 only and for the first time in Germany, it was a register-based census. There is some debate about whether register-based censuses can deliver results of the same quality as traditional censuses [2]. For an overview on the potential deficiencies of the 2011 census see [3]. The operation was quite challenging as demonstrated by the fact that the Federal Statistical Office decided not to use the officially published census results by age and sex as the basis for their post-censal population estimates. Instead, a modified version of the estimates was published, which used additional statistical information [4]. Like the Federal Statistical Office, for the HMD calculations we decided to rely on the modified official census data.

The difference between the population estimates previously produced by the Federal Statistical Office in Wiesbaden and the Statistical Offices of the German states and the population estimates based on the new census of 2011, as obtained for the 1st of January 2012, is quite substantial. For Germany as a whole (East plus West), there were actually 977,000 fewer males and 539,000 fewer females compared to the previously published official population estimates

DATA QUALITY ISSUES

Quality of data on population counts

As mentioned above, the differences between the population estimates constructed from the most recent census of 2011 and those constructed from the former census of 1987 are quite substantial. Unfortunately, the Federal Statistical Office decided not to recalculate back the population estimates by age and sex for the complete inter-censal period 1987-2011. Some of the discrepancies between the two series of estimates arise in part from the massive internal and international migration flows experienced by Germany in the late 1980s and in the 1990s due to the fall of the Iron Curtain and German reunification. In consequence, the standard HMD inter-censal method, which assumes that migration is uniformly distributed across the inter-censal period is not applicable in this case.

Another problem is related to substantial efforts by the statistical office to improve its estimation of the population by cleaning its registers in the years prior to the 2011 census. This was done with the help of local (regional) statistical offices which were instructed to make sure that all out-migrants had been de-registered and that no one was registered in two different areas simultaneously, using alternative sources of information such as tax records. Without these prior cleaning activities, the differences between the population estimates based on the 1987 census and those based on the 2011 census would have been even larger. Unfortunately, these adjustments were only taken into account in the year when the error was detected while the undocumented outmigration event or a multiple

registrations might have occurred years or decades before. Data cleaning operations were implemented by the State Statistical Offices in various degrees throughout the inter-censal period, but two periods witnessed substantial corrections: 2004 and 2008–2010. To our knowledge, information about the exact number of individuals removed from the registers and the exact dates of the removals from the resident population counts is unknown.

The Syrian refugee crisis and the massive migration flow into Germany during the most recent years have had a notable impact on the size and age-structure of the population. According to the 2014 official estimates, net migration in Germany reached 550,000 and it increased again in 2015, reaching one million (with two million arrivals and one million departures [5]). Most of the migrants were young males with a sex ratio particularly skewed in their favor in 2015.

Intensive in-migration eventually affected the quality of population estimates at younger ages because of problems related to the registration of refugees and asylum seekers. Though migrants are required to be registered, official estimates of the number of refugees are affected by an under-coverage which is difficult to quantify, though issues of multiple counts have also been raised as migrants could have registered each time they moved to a new area within the country¹.

REVISION HISTORY

Changes with the December 2018 revision

Since January 2016 West Berlin is excluded from the territory of West Germany and included into East Germany.

Changes with the December 2017 revision

Life tables: All life tables have been recalculated using a modified methods protocol. The revised protocol (Version 6) includes two changes: 1) a more precise way to calculate a_0 , the mean age at death for children dying during the first year of life and 2) the use of birth-by-month data (where and when available) to more accurately estimate population exposures. These changes have been implemented simultaneously for ALL HMD series/countries. For more details about these changes, see the revised Methods Protocol (at <http://v6.mortality.org/Public/Docs/MethodsProtocol.pdf>), particularly section 7.1 on Period life tables and section 6 and Appendix E, on death rates. The life tables calculated under the prior methods (Version 5) remain available at v5.mortality.org but will not be further updated in the future.

Changes with April 2017 Revision

We carried out some further refinement to the adjustment implemented with the previous revision to construct population estimates for the inter-censal period

¹ The Statistical Office acknowledges the problems related to refugee registration, stating that: “It must be assumed that the 2015 figures on people seeking refuge are affected by undercoverage which cannot be quantified because the registration authorities were unable to register all people seeking refuge in a timely manner. In addition, double counting may have occurred because of false register entries in connection with the distribution of people seeking refuge within Germany” (https://www.destatis.de/EN/FactsFigures/_CrossSection/Refugees/Refugees.html)

1987-2011 [6]. This modification resulted in very minor changes in population size (predominantly at ages above 80 years), and had a negligible impact on mortality rates.

Changes with April 2016 Revision

The inter-censal population estimates for the period 1987–2011 have been revised in the HMD to account for the results of the last census. We used a special method to redistribute the statistical error (observed in 2011) accumulated over the inter-censal period across years and birth cohorts [6]. In brief, adjustments to the population estimate were implemented in two steps. In the first step, we accounted for the corrections made by the statistical offices of Germany to their population estimates prior to the 2011 census. This adjustment accounted for errors that occurred due to multiple registrations and undocumented out-migration. The adjustments assumed that when they were implemented (in 2004 and in 2008–2010), all outmigration rates above an ‘expected’ level of outmigration could be attributed to the adjustments made by the statistical offices. Using a simple spline interpolation we estimated the ‘expected’ migration rates by cohort. The difference between ‘expected’ and ‘observed’ events in years 2004 and 2008–2010 was assumed to reflect artificial migration counts, which was then added to the accumulated error. In the second step, this error was redistributed by cohort and by sex assuming that it had accumulated in a linear manner over the inter-censal period.

In previous revisions, we applied an adjustment factor to the population older than 90 years because of the low quality of population estimates at advanced ages. With the results of the new census, which are considered to be of good quality, it is no longer necessary to carry out this adjustment. See the Revision history section in the *Background and Documentation* file for Germany as a whole for additional details.

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APPENDIX 1:

DESCRIPTION OF THE ORIGINAL DATA USED FOR HMD CALCULATIONS

DEATHS

Period	Type of Data	Age Grouping	Comments	RefCode(s)[†]
1956-1963	Annual number of deaths to residents by sex, age, and birth cohort (Lexis triangles)	0, 1, 2, 3, ..., 102+		01 02
1964-1974	Annual number of deaths to residents by sex, age, and birth cohort (Lexis triangles)	0, 1, 2, 3, ..., maximum age attained		01 03
1975	Annual number of deaths to residents by sex, age and birth cohort (Lexis triangles)	0, 1, 2, 3, ..., 105+		04
1976-2000	Annual number of deaths to residents by sex, age and birth cohort (Lexis triangles)	0, 1, 2, 3, ..., maximum age attained		03 05 06 07 14
2001-2004	Annual number of deaths to residents by sex, age and birth cohort (Lexis triangles)	0, 1, 2, 3, ..., maximum age attained	Reconstructed data (see Appendix 2)	15 16 24 25
2005-2015	Annual number of deaths to residents by sex, age and birth cohort (Lexis triangles)	0, 1, 2, 3, ..., 108+	Reconstructed data (see Appendix 2)	28 31 35 38
2016-2017	Annual number of deaths to residents by sex, age and birth cohort (Lexis triangles)	0, 1, 2, 3, ..., 110+		41
2018-2020	Annual number of deaths to residents by sex, age and birth cohort (Lexis triangles)	0, 1, 2, 3, ..., 106+		49, 55, 56

POPULATION

Period	Type of Data	Age Grouping	Comments	RefCode(s)[†]
1955-1986	Annual population estimates (as of December 31 st) by sex and age	0, 1, 2, 3, ..., 95+		08
1987-2011	Annual population estimates (as of December 31 st) by sex and age	0, 1, 2, 3, ..., 95+	Reconstructed data (see Background and Documentation file for Germany and Appendix 2 for this document)	33
2012-2015	Annual population estimates (as of	0, 1, 2, 3, ..., 100+	Reconstructed data (see Appendix 2)	34 37

	December 31 st) by sex and age			
2016-2020	Annual population estimates (as of December 31 st) by sex and age	0, 1, 2, 3, ..., 100+		40, 48, 53, 54

BIRTHS

Period	Type of Data	Comments	RefCode(s)[†]
1946-2000	Annual live birth counts by sex		12 13
2001-2015	Annual live birth counts by sex	Reconstructed data (see Appendix 2)	20 21 22 23 29 32 36 39
2016-2020	Annual live birth counts by sex		42 47, 52

BIRTHS BY MONTH

Type of data: Annual live birth counts by month

Period covered: 1946–2020

RefCodes: 43, 44, 45, 46, 50, 51

† The reference code is used to link 'Input Data' with the primary data source

APPENDIX 2

RECONSTRUCTION OF POPULATION, DEATHS, AND BIRTHS COUNTS DATA FOR EAST AND WEST BERLIN FOR THE PERIOD 2001-2015

Between 1949 and 1990, Berlin consisted of two parts: West Berlin with 12 districts and East Berlin with 11 districts. The two parts of Berlin were re-unified together with East and West Germany in 1990. After the “district reform” of January 1st, 2001, Berlin was divided into 12 new districts, and a division into districts that formerly belonged entirely to either West or East Berlin was no longer possible as many of the new districts overlap the border between the former West and East sections of the city. The old and the new administrative divisions of the districts of Berlin are showed in Table 1. Since 2014, official populations statistics for Berlin-Brandenburg are no longer tabulated at the district level².

To extend the time series for East and West Germany in the Human Mortality Database, the MPIDR has created separated datasets (for the years since 2001) for the two parts of Germany that include very precise estimates for East and West Berlin which have been derived based on official data from the statistical office and the registry office (*Melderegister*) in Berlin.

The individual level data from the *Melderegister* are based on the original addresses of registered inhabitants of Berlin and can be broken down according to the old district structure. Therefore, the population, death, and birth counts can be separated into eastern and western counts by sex, age, and Lexis triangles. Although the total counts by year from the *Melderegister* and the statistical office should be identical, we found some differences between the two sources. Therefore, in order to be consistent with the counts from the statistical office, for each year, sex and age combination, we multiplied the relative distribution (East versus West) based on the *Melderegister* by the counts derived from the official statistics from Berlin.

For cases with an odd number of deaths (births, or population) for a given sex and age, the residual remaining after dividing evenly was alternately assigned to the East and to the West of Berlin. For cases where the regional statistical office reported at least one death while the *Melderegister* showed no death for a given sex and age, we allocated the former data into eastern districts, western districts and mixed districts death counts. In most cases, it was then possible to identify the region (East or West) to which the death should be allocated.

² https://www.statistik-berlin-brandenburg.de/Publikationen/metadaten/MD_19211_2014.pdf

Table 1: Old and new districts of Berlin

<i>Berlin districts (new) since January 1st, 2001</i>		<i>Berlin districts (old) until December 31st, 2000</i>	
No.	Name	Region	Name
1.	Mitte	East West West	Mitte (01) Tiergarten (02) Wedding (03)
2.	Friedrichshain-Kreuzberg	East West	Friedrichshain (05) Kreuzberg (06)
3.	Pankow	East East East	Prenzlauer Berg (04) Weißensee (18) Pankow (19)
4.	Charlottenburg-Wilmersdorf	West West	Charlottenburg (07) Wilmersdorf (09)
5.	Spandau	West	Spandau (08)
6.	Steglitz-Zehlendorf	West West	Zehlendorf (10) Steglitz (12)
7.	Tempelhof-Schöneberg	West West	Schöneberg (11) Tempelhof (13)
8.	Neukölln	West	Neukölln (14)
9.	Treptow-Köpenick	East East	Treptow (15) Koepenick (16)
10.	Marzahn-Hellersdorf	East East	Marzahn (21) Hellersdorf (23)
11.	Lichtenberg-Hohenschönhausen	East East	Lichtenberg (17) Hohenschönhausen (22)
12.	Reinickendorf	West	Reinickendorf (20)

Source: Regional statistical office, Berlin