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Analysing the socioeconomic gap in life expectancy in Germany

current results and new perspectives

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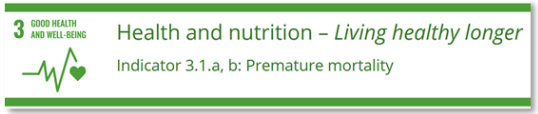
Funded by: Deutsche Krebshilfe
HELFEN. FORSCHEN. INFORMIEREN.

Background

Background

- Health data in Germany is collected through official statistics, registries, health insurance and population-based health information surveys
- These data are used for monitoring progress of the Sustainable Development Goal on Good Health and Well-being (SDG3)
  - Health monitoring at national and state level (www.gbe-bund.de)
  - Federal Statistical Office (Destatis)
  - German National Sustainable Development Goals (3.1) (http://dns-indikatoren.de/en/)

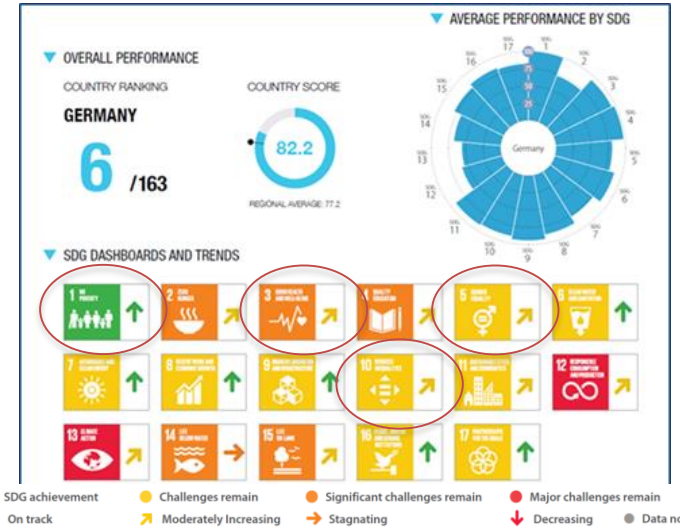
DESTATIS Statistisches Bundesamt | Nachhaltigkeitsstrategie für Deutschland



Performance by indicator

SDG3 – Good Health and Well-Being				
Maternal mortality rate (per 100,000 live births)	7	2017	●	↑
Neonatal mortality rate (per 1,000 live births)	2.2	2020	●	↑
Mortality rate, under-5 (per 1,000 live births)	3.7	2020	●	↑
Incidence of tuberculosis (per 100,000 population)	5.5	2020	●	↑
New HIV infections (per 1,000 uninfected population)	0.0	2020	●	↑
Age-standardized death rate due to cardiovascular disease, cancer, diabetes, or chronic respiratory disease in adults aged 30–70 years (%)	12.1	2019	●	↑
Age-standardized death rate attributable to household air pollution and ambient air pollution (per 100,000 population)	16	2016	●	●
Traffic deaths (per 100,000 population)	3.8	2019	●	↑
Life expectancy at birth (years)	81.7	2019	●	↑
Adolescent fertility rate (births per 1,000 females aged 15 to 19)	7.2	2018	●	↑
Births attended by skilled health personnel (%)	98.8	2017	●	↑
Surviving infants who received 2 WHO-recommended vaccines (%)	93	2020	●	↑
Universal health coverage (UHC) index of service coverage (worst 0–100 best)	86	2019	●	↑
Subjective well-being (average ladder score, worst 0–10 best)	6.8	2021	●	↑
Gap in life expectancy at birth among regions (years)	5.7	2019	●	→
Gap in self-reported health status by income (percentage points)	30.9	2019	●	↓
Daily smokers (% of population aged 15 and over)	18.8	2017	●	●

Source:
DOI 10.1017/9781009210058



SDG achievement
Challenges remain
Significant challenges remain
Major challenges remain
On track
Moderately Increasing
Stagnating
Decreasing
Data not available

Source:
DOI 10.1017/9781009210058

Socioeconomic Gap = Data Gap in Germany?

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Data availability…(e.g.: population statistics, cause-of-death statistics)

- No information on individual socioeconomic position
  - Principle of data economy, data protection requirements
- Neither a census-based mortality follow-up nor a national mortality registry

Bridging the Gap

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Options…

- Data on socioeconomic status at the individual level
  - survey data (e.g. DOI: 10.25646/58; 10.12765/CPoS-2015-16)
  - health insurance data (e.g. DOI: 10.1136/jech-2019-212966; 10.3389/fonc.2022.827028)
- Socioeconomic indicators available at spatial level (e.g.: at-risk-of-poverty rate, the unemployment rate, household income) (e.g. DOI: 10.3238/arztebl.2020.0493)
- Multidimensional composite indices combining a large number of correlating area-based indicators (e.g. DOI: 10.25646/10641)

What we are currently doing…

RKI‘s German Index of Socioeconomic Deprivation (GISD)

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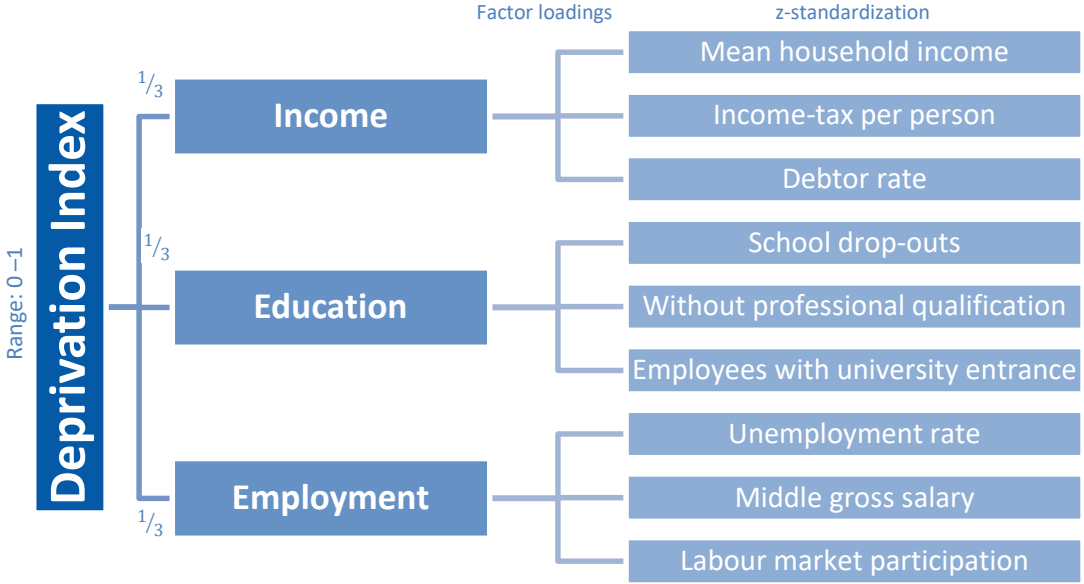
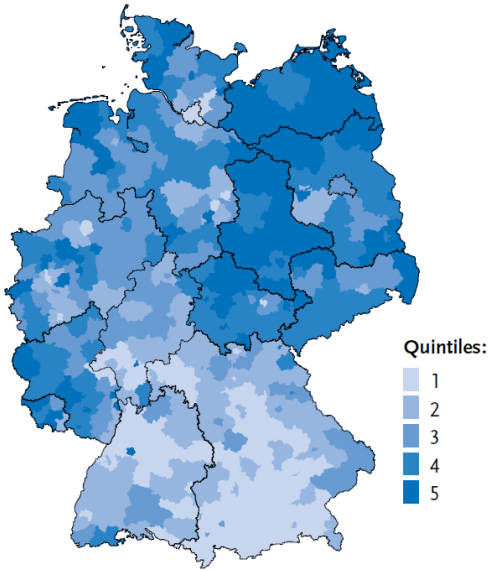
Source: Michalski N, Reis M, Tetzlaff F, et al. German Index of Socioeconomic Deprivation (GISD): Revision, update and applications. J Health Monit 2022;7:2-23.
Michalski N, Reis M, Tetzlaff F, et al. German Index of Socioeconomic Deprivation (GISD). Berlin, Zenodo 2022.





Inequality in Life Expectancy by Quintiles of Area-level Socioeconomic Deprivation, 2003 – 2021

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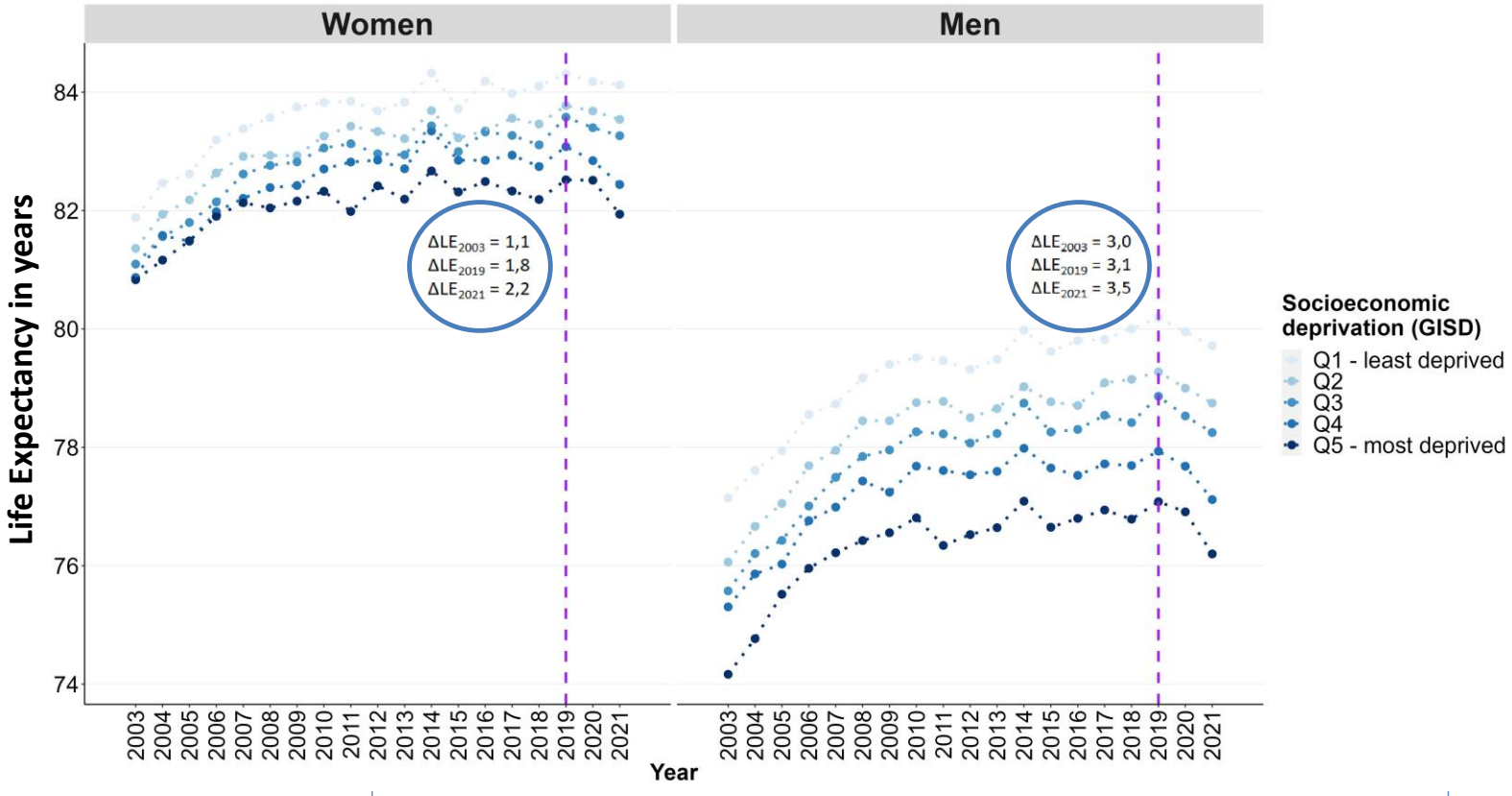
Source: Tetzlaff F, Sauerberg M, Grigoriev P, et al. Age-specific and cause-specific mortality contributions to the socioeconomic gap in life expectancy in Germany, 2003-2021: an ecological study. The Lancet Public Health 2024;9:e295-e305.



Decomposition of Inequality in Life Expectancy by Quintiles of Area-level Socioeconomic Deprivation, 2003 – 2021

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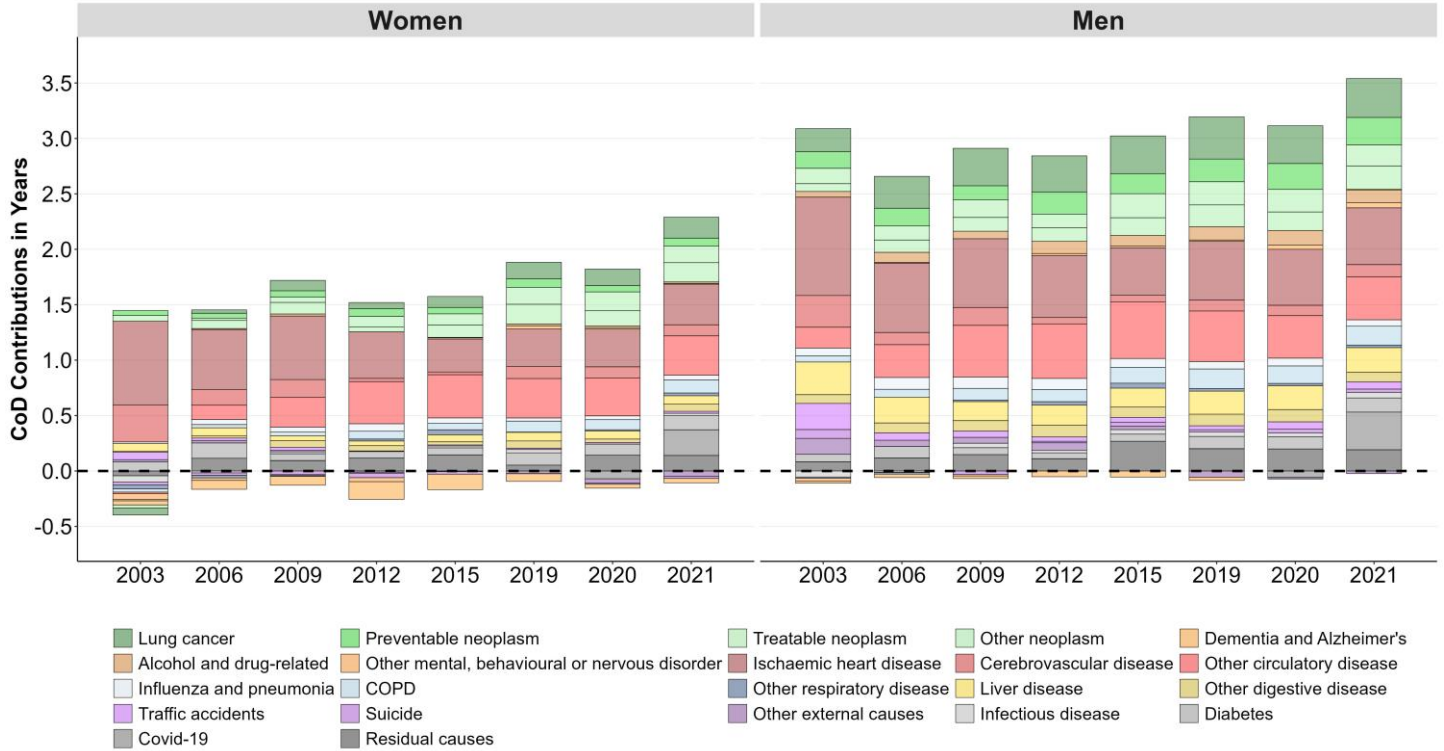
Source: Tetzlaff F, Sauerberg M, Grigoriev P, et al. Age-specific and cause-specific mortality contributions to the socioeconomic gap in life expectancy in Germany, 2003-2021: an ecological study. The Lancet Public Health 2024;9:e295-e305.



	Year	Gap - Quintile	Gap - SII Quintile	Gap - SII Districts
Women	2003	1.1	1.4	2.2
Women	2021	2.2	2.6	3.1 (2017)
Men	2003	3.0	3.5	5.4
Men	2021	3.5	4.2	5.7 (2017)

What we want to do...

Area-level Socioeconomic Inequality in Life Expectancy at District Level, 2015/2017

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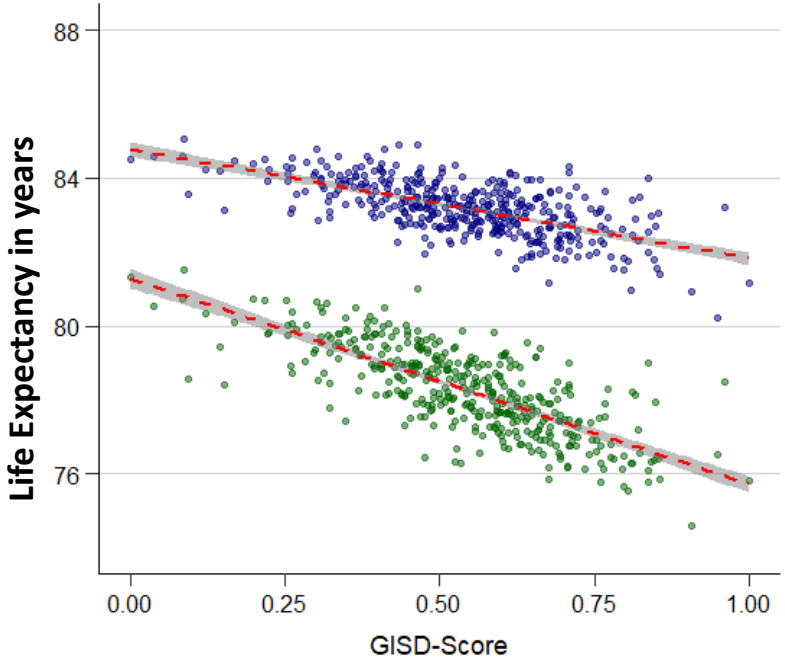
Source: Michalski N, Reis M, Tetzlaff F, et al. German Index of Socioeconomic Deprivation (GISD): Revision, update and applications. J Health Monit 2022;7:2-23.
Michalski N, Reis M, Tetzlaff F, et al. German Index of Socioeconomic Deprivation (GISD). Berlin, Zenodo 2022.



Difference (most vs. least): **-3,2 years**

Difference (most vs. least): **-6,0 years**

How could we do this?

Data and Methods

Data

- Small-scale official German population statistics
- Small-scale cause-of-death statistics

  Research data centre of the Federal Statistical Offices. Cause-of-Death Statistics [Todesursachenstatistik]. 2022.
  Doi: 10.21242/23211.2003.00.00.1.1.0 to 10.21242/23211.2021.00.00.1.1.0

- From 2003 to 2022 (ongoing)
- German Index of Socioeconomic Deprivation (release 2022v0.1)

  Michalski N, Reis M, Tetzlaff F, et al. German Index of Socioeconomic Deprivation (GISD): Revision, update and applications. J Health Monit 2022;7:2-23.
  Michalski N, Reis M, Tetzlaff F, et al. German Index of Socioeconomic Deprivation (GISD). Berlin, Zenodo 2022.

Methods

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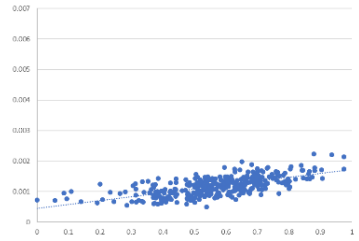
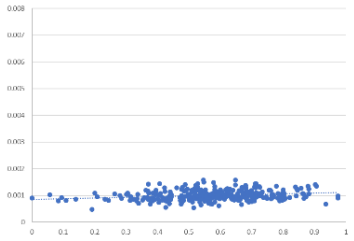
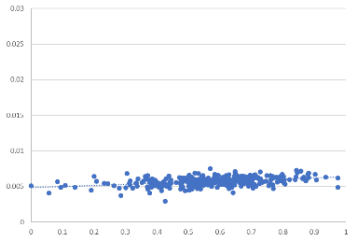
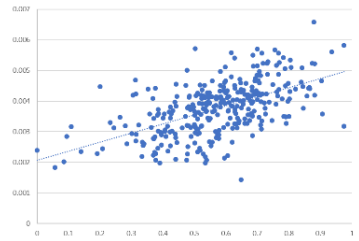
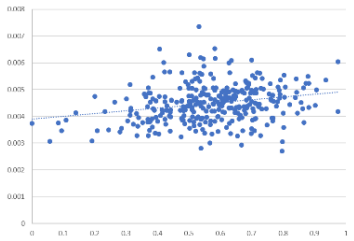
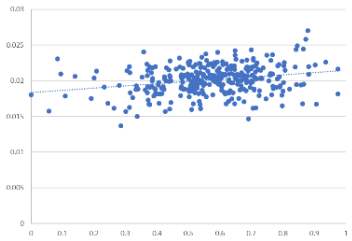
- Observed age-specific mortality rate at district level
  - Sex
  - Year

- Estimation of absolute inequalities in age-specific mortality
  - Multilevel Poisson regression models
  - First-level: age groups; second-level: districts;
    Offset: log population of districts
  - Slope Index of Inequality (SII)

How could we do this?

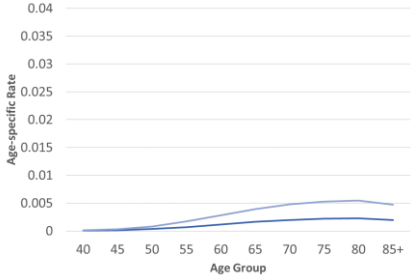
Results

(…example with cancer registry data)

Age Group	Lung Cancer		Colorectal Cancer		Other Cancer	
⋮	⋮		⋮		⋮	
40–44		+		+		
⋮	⋮		⋮		⋮	
60–64		+		+		
⋮	⋮		⋮		⋮	
85+		+		+		

= Age-specific rate Total Cancer

Lung Cancer



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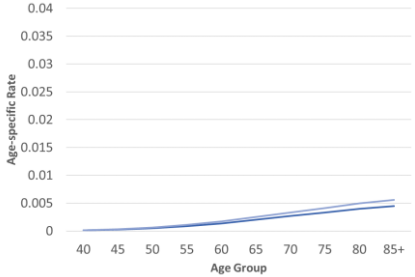
Colorectal Cancer



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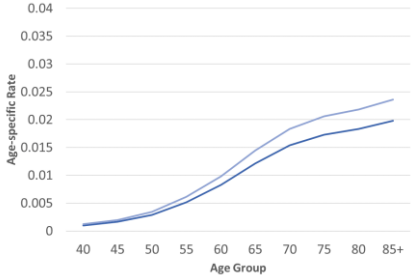
Other Cancer



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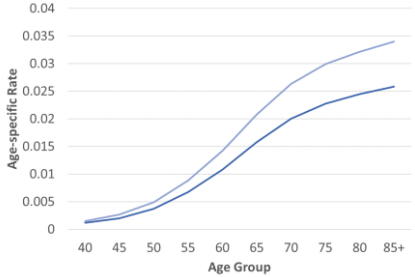
Total Cancer



Age- and Cause-specific Contribution to the Gap

Age- and Cause-specific Contribution to the Gap

Age- and Cause-specific Contribution to the Gap

Socioeconomic Gap

Outlook

Outlook – Health Information System at RKI (or BIPAM or BIÖG or what ever!?!?)

Life Expectancy

Background

Life expectancy at birth is an important summary measure of the health of a population. The indicator shows the average number of years a newborn can expect to live if the mortality conditions observed in the respective year remain constant throughout their lifetime. In Germany, life expectancy has increased significantly in recent decades, although there are considerable regional and social differences. For example, the difference in life expectancy between the lowest and highest income groups was 4.4 years for women and 8.6 years for men between 1992 and 2016. In a European comparison of life expectancies, Germany is in the middle range, but behind most western, northern and southern European countries (Nowossadeck et al. 2019 DOI 10.25646/5869, Lampert et al. 2019 DOI 10.25646/5868).

Outlook – Health Information System at RKI (or BIPAM or BIÖG or what ever!?!?)

Key Message

4.9 years…
…higher is the life expectancy of newborn females compared to males in the period 2020/2022.

3.9 years…
…higher is the life expectancy of newborn males in Baden-Württemberg compared to Saxony-Anhalt in the period 2020/2022.

3.5 years…
…is the difference in life expectancy of newborn males between socioeconomically most and less deprived districts in 2021.

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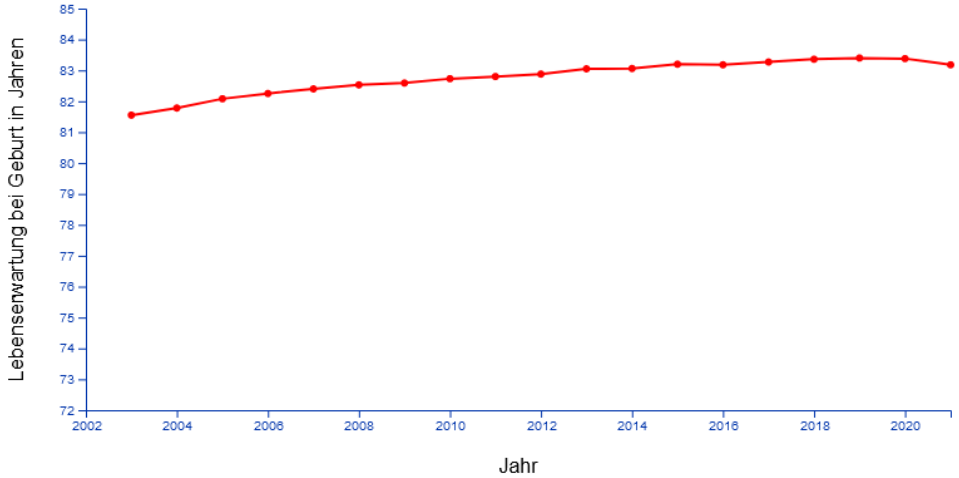
Visualisierung

Lebenserwartung bei Geburt in Jahren

Kennzahl: Mittlere Lebenserwartung | Standardisierung: beobachtet | Jahr: 2021 | Geschlecht: Männlich / Weiblich | Ansicht: Grafik / Tabelle

Im Trend



Auswahl für Trend

Klicken Sie auf die Karte oder ein Balkendiagramm, um den Trend einer Region, Altersgruppe oder Bildungsgruppe zu sehen.

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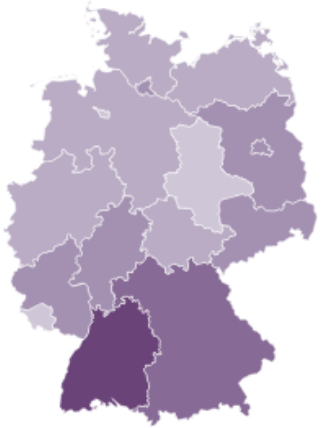
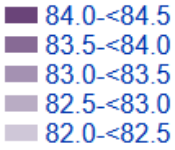
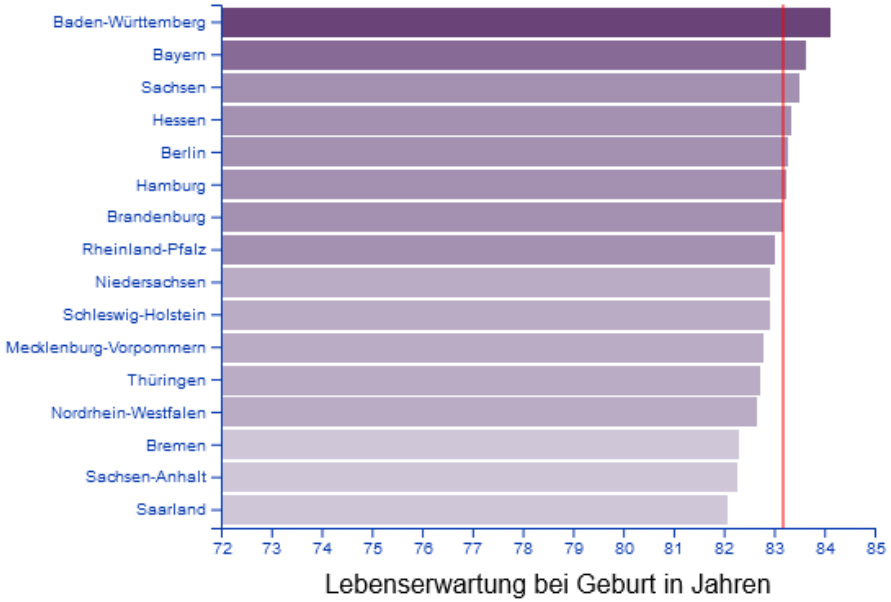
Im Querschnitt







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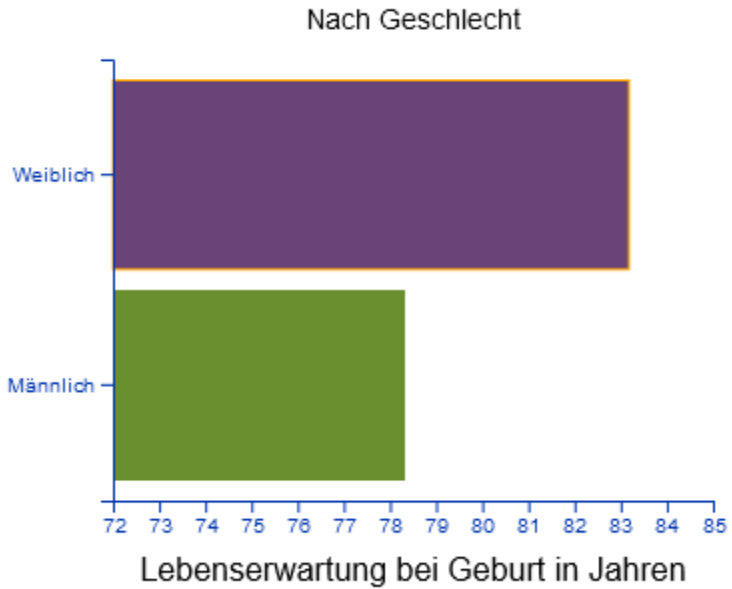

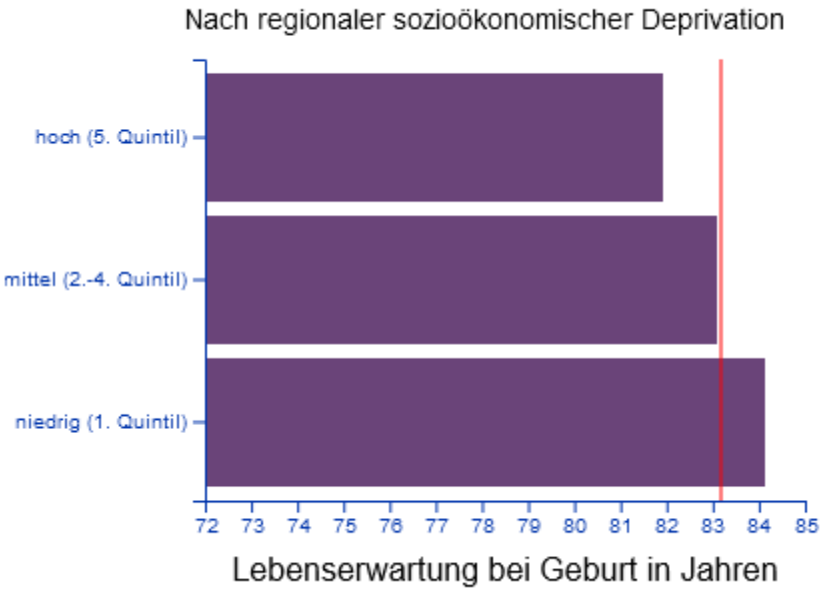

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Results

In the period 2020/2022, life expectancy in Germany was 83.2 years for newborn females and 78.3 years for newborn males. This means that the life expectancy of females was 4.9 years higher than that of males. In 2002/2004, it was still 5.7 years higher. The differences between the federal states were more pronounced for males than for females. The federal state with the highest life expectancy was Baden-Württemberg (females: 84.1 years; males: 79.7 years). Here, life expectancy for females was 1.8 years higher and for males 3.9 years higher than in Saxony-Anhalt (females: 82.3 years; males: 75.8 years).In the fifth of the regions with the highest socioeconomic deprivation (5th deprivation quintile), life expectancy in 2021 was 81.9 years for females and thus 2.2 years lower than in the fifth of the regions with the lowest deprivation (1st deprivation quintile: 84.1 years). For males, life expectancy in the regions with high levels of socioeconomic deprivation was 76.2 years, 3.5 years lower than in the regions with low levels of deprivation (1st quintile of deprivation: 79.7 years).

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Conclusion

Life expectancy for female and male newborns has increased since the beginning of the 2000s. In the course of the COVID-19 pandemic, life expectancy decreased. The differences in life expectancy between females and males have decreased in recent years. The observed inequalities in life expectancy between Germany's deprived and prosperous regions have become increasingly greater over the last 20 years, largely due to the socioeconomically unequal development of mortality from cardiovascular diseases, cancer, chronic lung diseases and the newly emerged infectious disease COVID-19 (Tetzlaff et al. 2024 10.1016/S2468-2667(24)00049-5). Socioeconomic differences are even greater when the most and least deprived districts are compared instead of the quintiles. This difference was 3.2 years for females and 6.0 years for males in the period 2015/2017 (Michalski et al 2022 DOI 10.25646/10640).

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Methods and Data

Definition
The *life expectancy* indicator shows how many years a newborn can expect to live on average at birth, assuming that the mortality conditions observed in the respective year remain constant throughout life.

Reference Population
population with permanent residence in Germany

Data source and case numbers
The data for the statistics of deaths and causes of death (1.066 million deaths in 2022) and the updated population figures (84.4 million inhabitants) come from the statistical offices of the federal states and from destatis.

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Methods and Data

Details on calculation

Discription…stratification…calculation…

Dataquality

…

Abbreviations

…

Useful web resources

…

References

…

Funded by:
Deutsche Krebshilfe
HELFEN. FORSCHEN. INFORMIEREN.

Many Thanks!

Questions…Remarks…

Scan Me ☺

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Generation procedure of the GISD

1. Data import
2. Imputation of missing values on the indicators for individual territorial units, low spatial levels and years
3. Correction of individual indicators (consideration of G8, logarithmisation, etc.)
4. Factor analysis for each of the sub-dimensions at the level of municipality years
5. Generate factor scores for the three dimensions (rotate dimensions if necessary)
6. Normalise dimensions
7. Add up dimensions to GISD score and scale to 0-1
8. Generate population-weighted GISD scores at all regional levels for all years (up-aggregate from municipality level)
9. Generate quantiles and quintiles for all regional levels and within provinces
10. (Aggregation of GISD scores to postcode 2, 3, 4 and 5 digits)

Operationalisierung des GISD

Merkmal	Indikator	Quelle	Verfügbarkeit
Beschäftigte mit (Fach-) Hochschulabschluss	Anteil der sozialversicherungspflichtig Beschäftigten am Wohnort mit akademischem Abschluss an den sozialversicherungspflichtig Beschäftigten am Wohnort in %	Statistik der Bundesagentur für Arbeit	Kreise für die Jahre 2001-2011 und 2013-2019*
Beschäftigte ohne Berufsabschluss	Anteil der sozialversicherungspflichtig Beschäftigten am Wohnort ohne Berufsabschluss an den sozialversicherungspflichtig Beschäftigten am Wohnort in %	Statistik der Bundesagentur für Arbeit	Kreise für die Jahre 2001-2011 und 2013-2019*
SchulabgängerInnen ohne Abschluss	Anteil der Schulabgängerinnen und -abgänger ohne Hauptschulabschluss an den Schulabgängerinnen und -abgängern in %	Statistik der allgemeinbildenden Schulen des Bundes und der Länder	Kreise für die Jahre 1998-2019
Arbeitslosigkeit	Anteil der Arbeitslosen an den Einwohnerinnen und Einwohnern im erwerbsfähigen Alter	Statistik der Bundesagentur für Arbeit	GVB für die Jahre 1998-2019**
Beschäftigtenquote	Sozialversicherungspflichtig Beschäftigte am Wohnort je 100 Einwohnerinnen und Einwohner im erwerbsfähigen Alter	Statistik der Bundesagentur für Arbeit	GVB für die Jahre 1998-2019**
Bruttolohn und -gehalt	Monatlicher Bruttoverdienst der Arbeitnehmerinnen und Arbeitnehmer in Euro	Volkswirtschaftliche Gesamtrechnung der Länder	Kreise für die Jahre 2000-2019

Operationalisierung des GISD

Merkmal	Indikator	Quelle	Verfügbarkeit
Haushaltsnettoeinkommen	Durchschnittliches Haushaltseinkommen in € je Einwohnerinnen und Einwohner	Volkswirtschaftliche Gesamtrechnung der Länder	Kreise für die Jahre 2000-2019
Schuldnerquote	Private Schuldnerinnen und Schuldner je 100 Einwohnerinnen und Einwohner 18 Jahre und älter in %	Schuldneratlas Deutschland des Verbands der Vereine Creditreform e.V.	Kreise für die Jahre 2004-2019
Steuereinnahmen	Einkommensteuer in € je Einwohnerinnen und Einwohner	Realsteuervergleich des Bundes und der Länder	GVB für die Jahre 1998-2019

*Datenquelle für die Anteile der sozialversicherungspflichtig Beschäftigten ohne Abschluss und mit akademischem Abschluss ist die Statistik der Bundesagentur für Arbeit [29]. Daten für die Jahre 2013 bis 2019 sind dort frei verfügbar. Daten für die Jahre 2001 bis 2012 wurden direkt über die Statistik der Bundesagentur für Arbeit bezogen.

**Für die Arbeitslosigkeit und die Beschäftigtenquote standen Werte für die GVB-Ebene erst ab 2001 zur Verfügung. Für die Jahre 1998 bis 2001 wurden den GVB die Werte der Kreisebene zugeordnet.

GVB = Gemeindeverbände und verbandsfreie Gemeinden

Empirische Gewichtung - GISD 2022

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Dimension	Variable	Faktorladung	Anteil am Teilscore	Anteil GISD
Bildung 33,3 %	Beschäftigte mit akademischem Abschluss	-0,732	34,1	11,4
	Beschäftigte ohne Abschluss (adj.)	0,771	37,8	12,6
	Schulabgängerinnen und -abgänger ohne Abschluss (adj.)	0,663	28,0	9,3
Beschäftigung 33,3 %	Beschäftigtenquote	-0,640	23,1	7,7
	Arbeitslosigkeit	0,841	39,9	13,3
	Bruttoverdienst (log.)	-0,810	37,0	12,3
Einkommen 33,3 %	Einkommensteuer (log.)	-0,911	40,6	13,5
	Haushaltseinkommen (log.)	-0,921	41,5	13,8
	Schuldnerquote	0,607	18,0	6,0

Darstellung der Faktorladungen auf der ersten Hauptkomponente für die einzelnen Dimensionen.

Eigenwerte der ersten Komponenten: $\eta_{Bildung}$=1,6; $\eta_{Beschäftigung}$=1,8; $\eta_{Einkommen}$ =2,0. Die Eigenwerte der zweiten und dritten Komponenten liegen jeweils unter 0,8.

Die Korrelationen zwischen den Scores der Teildimensionen für das Jahr 2019: $r_{Beschäftigung|Einkommen}$ = 0,66; $r_{Beschäftigung|Bildung}$ =0,52; $r_{Einkommen|Bildung}$ =0,69.

log. = logarithmiert, adj. = adjustiert