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The 2025 annual survey of the panel Health in Germany by the Robert Koch Institute: Background, Methodology, Panel Attrition, and the integration of the European Health Interview Survey (EHIS)

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Research Article

Keywords: Panel Study, Panel Attrition, Panel Maintenance, Public Health, Mixed-mode Survey, Selection Effects, Sample Composition, Incentives

Posted Date: September 25th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10959594/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

The RKI Panel “Health in Germany” provides a continuous data basis for population-based health monitoring in Germany. In longitudinal surveys, repeated non-participation and panel attrition may lead to selective changes in sample composition and potentially affect the validity of survey estimates. The 2025 annual survey was characterized by the integration of two refresher samples and the implementation of the fourth wave of the European Health Interview Survey (EHIS) within the RKI Panel. This study describes the methodological implementation of the 2025 annual survey and evaluates participation, panel attrition, and sample composition.

Methods

The 2025 annual survey comprised four quarterly sub-waves using a rotating questionnaire design and mixed-mode data collection combining web-based (CAWI) and paper-and-pencil (PAPI) questionnaires. Participation was assessed using AAPOR Response Rate 2 (RR2). Active and passive panel attrition were analyzed separately. Sample composition was compared with external population benchmarks using the Duncan Dissimilarity Index and standardized differences. Multi-step survey weights were applied to adjust for selective participation and differences between the sample and population structure.

Results

Active attrition remained at approximately 1% between consecutive sub-waves, whereas 14.7% of the panel members from the original gross sample for the annual survey were removed during the panel attrition procedure due to passive attrition. Although attrition was selective, particularly by age and survey mode, its overall effect on the sociodemographic composition of the remaining panel sample was small. When passive attrition was not accounted for in the denominator, the response rates declined from 73.4% in the first sub-wave to 64.7% in the fourth. Sample composition remained largely stable across sub-waves, with educational attainment representing the main exception: participants with lower educational attainment became increasingly underrepresented. Deviations in health-related characteristics from the recruitment sample remained small (Duncan indices: 0.4%–4.5%) and were reduced by weighting for most indicators.

Conclusion

Despite declining participation and attrition, the RKI Panel maintained a largely stable sample composition during its second annual survey. The increasing underrepresentation of participants with lower educational attainment highlights the need for continued monitoring and appropriate weighting. Maintaining consistent fieldwork procedures and periodically integrating refresher samples will be important for preserving the long-term analytical value of the panel.

1. Introduction

Panel-based population surveys are becoming increasingly important for health monitoring, as they allow not only the description of current population health but also the investigation of individual-level changes over time. The Panel *Health in Germany* by the Robert Koch Institute (RKI) was established to provide a continuous data basis for monitoring the health status, health-related behaviour, and healthcare of the population in Germany. Its regular survey waves enable both repeated cross-sectional analyses and the longitudinal assessment of changes at the individual level.

In the context of panel studies, changes in participation behavior over time and their effects on sample composition are key determinants of the quality and informative value of panel data. For the first annual survey in 2024, key methodological indicators were already described, including recruitment and response rates, sample composition, analyses of selective participation effects, and the application of weighting procedures for adjustment of selective dropout (1). Continuous monitoring of these indicators is essential for documenting the quality of the data collection process and for identifying potential changes in the panel population.

The present article continues this methodological reporting for the 2025 survey year: It describes the development of the gross and net samples, response rates across individual survey waves, the sample composition, and the weighting procedures applied. Extending previous analyses, this article also provides the first integration of refresher samples and a systematic assessment of panel attrition resulting from the exclusion of inactive panel members, withdrawals, deaths, and other panel exits. Panel attrition represents a major methodological challenge in longitudinal surveys, as the selective loss of panel members can progressively alter sample composition and increase the risk of nonresponse bias (2–5). Of particular interest is therefore whether selective attrition leads to changes in sample composition and thereby affects the representativeness and interpretability of panel data over time.

Furthermore, a particular feature of the 2025 survey year was the integration of the fourth wave of the European Health Interview Survey (EHIS) into the RKI Panel *Health in Germany* (6). As EHIS is a key instrument for harmonized health monitoring across the European Union, its implementation within the RKI Panel had implications for questionnaire design, supplementary recruitment activities, and data processing. These specific methodological aspects are therefore also considered when describing the development and implementation of the panel surveys in 2025.

2. Methods and Design for the 2025 annual survey

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to assist in drafting the abstract and for language editing and improving the clarity of selected passages. The tool was not used for data analysis or the generation of scientific results. All AI-generated or AI-assisted text was critically reviewed and edited by the authors, who take full responsibility for the final content.

2.1. Integration of EHIS Wave 4

The EHIS is a key instrument of European health reporting. As a harmonized, population-based survey, the EHIS provides standardized data on the resident population aged 15 and older in the member states of the European Union. The EHIS is part of the common framework for European statistics established by Regulation (EU) 2019/1700 of the European Parliament and of the Council of 10 October 2019, which provides the legal framework for the collection of harmonized individual-level data on persons and households across the European Union(7).

The first wave of EHIS was launched under a gentlemen's agreement and implemented in 17 EU member states between 2006 and 2009. The second EHIS wave 2 was conducted in all EU member states and Iceland and Norway during the period 2013–2015 on a legally compulsory basis. The third wave of EHIS was carried out between 2018 and 2020 in all Member States, as well as Iceland, Norway, Serbia, Turkey and Albania. The fourth EHIS wave was implemented within the framework established by Regulation (EU) 2019/1700 and was further specified by the Commission Delegated Regulation (EU) 2024/297 (8)and the Commission Implementing Regulation (EU) 2023/2529 (9).

The primary objective of the survey is to generate reliable evidence on the health status, the use of health care services, and health-related behaviors and determinants at the population level. By linking these epidemiological indicators with comprehensive sociodemographic characteristics, the dataset forms an essential foundation for comparative public health research. It also serves as an evidence-based decision-making instrument for the development, implementation, and evaluation of health policy strategies aimed at reducing health inequalities within Europe. For Germany, the survey represents an important source of comparable health data, enabling analyses within the national context and in comparison, with other European countries (e.g. (10–13)).

The EHIS consists of 4 modules. The European Health Status Module is a core component of the survey. It enables the assessment of the population's health status in general, rather than focusing solely on specific health conditions. The module covers various aspects and dimensions of health, including physical and mental health, chronic and temporary health problems, and specific diseases. It also captures their broader impact on functional status and limitations in the activities of daily living. The European Health Care Module collects data on the use of formal health care services, such as hospitalization, doctor visits, and medication use, as well as on unmet needs for formal health care. The European Health Determinants Module focuses on identifying specific aspects of lifestyle or health-related behaviors that have a positive or negative impact on a person's health, such as physical activity, dietary habits, smoking, and alcohol consumption. The European Background Variables Module comprises of standardized, cross-nationally comparable measures such as age, sex, household composition, educational attainment (ISCED), occupational status (ISCO), and household income (14).

The EHIS is implemented by national statistical offices or authorized national research institutes, known as "Other National Authorities", in the EU Member States. While some countries conduct the EHIS as a standalone survey, others integrate it into existing national health surveillance systems. In Germany, the EHIS is incorporated into the RKI Panel *Health in Germany* 2025.

2.2. Samples for the 2025 annual survey

Initial Recruitment and Refresher samples

Panel participants were initially recruited in the first quarter of 2024 through a random sample drawn from local population registers maintained by the respective residents' registration offices (Einwohnermeldeämter, EMA). Data collection was conducted using both a web-based survey mode (Computer Assisted Web Interview, CAWI) and a self-administered paper questionnaire mode (Paper and Pencil Interview, PAPI). Recruitment followed a two-stage sampling design. In the first stage, 359 primary sampling units (PSUs) were selected from more than 10,000 municipalities across Germany. The allocation of PSUs to the federal states was based on the population size of residents aged 16 years and older, while ensuring a minimum of 14 PSUs per federal state to achieve sufficient representation of smaller states. Within the federal states, additional stratification was applied using the BIK classification system (15), which is commonly used for regional differentiation in survey sampling. Large cities were represented by multiple PSUs proportional to their population size. In the second stage, individual addresses were randomly sampled from the population registers of the selected EMAs. For each PSU, 600 addresses were initially drawn, from which the Robert Koch Institute randomly selected 400 addresses for recruitment, while the remaining 200 addresses were retained as reserve samples. Sampling was stratified by age using eight age groups (16 years to 85 years and older) to ensure adequate representation across all age cohorts and to account for expected differences in participation rates. A more detailed description of the recruitment process is provided in the field report of the first recruitment study(16).

Due to sample aging the initial recruitment sample in 2025 no longer included participants representing the population of 15-year-olds, which forms part of the target population of the EHIS. To ensure coverage of this age group in the annual survey 2025, an additional refresher sample of individuals aged 15 to 17 years was recruited in the fourth quarter of 2024. The recruitment followed the same two-stage sampling design as the initial recruitment and was based on the identical set of 359 PSUs. In contrast to the 2024 recruitment study, data collection was conducted exclusively using web questionnaires. In addition, the incentives were changed from cash to voucher.

In addition, an error in the sampling process during the initial recruitment resulted in certain age cohorts being absent in some PSUs. This issue particularly affected the federal state of Berlin (for details see (16)). To address these gaps, the missing age cohorts were recruited in the affected PSUs during the first quarter of 2025. Participants received vouchers instead of cash incentives. In the following, this additional recruitment sample is referred to as the "2025 Refresher Sample" to distinguish it from the EHIS Refresher Sample.

Table 1 summarizes the recruitment outcomes of the different samples contributing to the 2025 annual survey.

Table 1
Recruitment outcomes and response indicators for the initial recruitment and refresher samples

Sample	Gross Sample [N]	Participants [N]	AAPOR Response Rate 1 [%]	Registered Participants [N]	Panel Consent Rate [%]	Recruitment Rate [%]
Initial Recruitment Sample 2024	166,843	62,556	37.5	47,863	79.3	28.7
EHIS Refresher Sample (2024)	11,010	2,362	21.4	1,406	59.5	12.8
2025 Refresher Sample	5,855	1,330	22.7	895	67.3	15.3

Gross sample for the 2025 annual survey

The gross sample (also called deployment sample) used in 2025 consisted of two participant groups distinguished by survey mode and registration procedure. CAWI participants registered online via the panel portal and became active panel members following a double opt-in verification process. PAPI participants were registered offline based on the contact information provided in their written consent forms and were managed as offline panel members ("offliners"). Participants remained in their respective survey mode for subsequent panel surveys, with CAWI participants completing surveys online and PAPI participants participating via paper questionnaires.

Case verification was conducted for all registered panel participants, irrespective of survey mode. In this process, the information on year of birth, month of birth, and sex at birth was compared with the information from the population register. Cases showing substantial discrepancies between the two data sources were excluded. A more detailed description can be found in the methodology report on the first recruitment study (16).

Several factors, including death, emigration, or withdrawal of panel registration during the survey year, resulted in adjustments to the deployment samples for the four survey sub-waves in 2025. In addition, between the third and fourth quarter of 2025, panel participants who had not participated in at least one of the previous four survey sub-waves were excluded from further invitations. Details of the attrition procedure are described in Chap. 2.4.

Panel participants from the EHIS Refresher Sample entered the annual survey 2025 in the first sub-wave and were therefore interviewed for the first time within the regular panel survey. As recruitment of the 2025 Refresher Sample took place during the first quarter of 2025, registered participants from this sample entered the annual survey 2025 starting with the second sub-wave.

2.3. Data collection

Survey structure

Within a regular annual survey, four waves are conducted. These waves are distributed evenly across four survey periods in order to control potential seasonal effects on prevalence estimates. In each wave, four different questionnaires are administered simultaneously across four randomized subgroups in rotating order. To implement the questionnaire rotation, the sample was randomly divided into four equal subgroups after the initial recruitment. Over the course of four survey periods, each subgroup receives each of the four questionnaires in alternating sequence. This design enables the calculation of annual estimates across a complete one-year-survey cycle. For panel participants recruited in the initial recruitment study in 2024, the assignment to the respective subgroup remained unchanged and therefore corresponded to their assignment in the annual survey 2024.

In addition to the four main questionnaires, a separate sociodemographic questionnaire (Q-SD) was administered the first time a panel participant took part in a quarterly wave. It was designed in both CAWI and PAPI modes so that it appeared as a coherent questionnaire together with the respective content of the main questionnaires (A, B, C, and D). Figure 1 illustrates the rotation of the four questionnaires A, B, C, and D, as well as the one-time collection of the Q-SD. The order of the questionnaires was deliberately arranged to reduce potential conditioning effects and thus minimize the influence of previous surveys on the responses.

EMA = Residents' Registration Office, Q = Questionnaire

Contact and Reminder strategy

The study design was consistent for each sub-wave, as illustrated Fig. 2. The contact and reminder strategy differentiates according to survey mode. CAWI panel participants initially received a written invitation letter that announced the sub-wave, which subsequently led to an email invitation being sent to the registered email address. The email invitation was dispatched approximately two days after the postal invitation letter was sent. Since sub-wave 3 2025, the online invitation for CAWI participants has also included a direct link and a QR code to the online questionnaire. Following a period of three weeks, a preliminary reminder was sent, which was both written in hard copy and transmitted electronically via email. A second reminder was sent exclusively via email a total of three weeks after the initial reminder. Detailed information on the timing of invitations and reminders is provided in Table A.1 in the Appendix. The invitation process for PAPI panel participants was conducted exclusively via post (see Fig. 2). The infas Institute for Applied Social Science was commissioned to oversee the postal distribution of participant documentation and a proportion of response Management.

CAWI = Computer Assisted Web Interview, PAPI = Paper and Pencil Interview

Incentives

As part of the regular incentive scheme, PAPI participants received €5 in cash in a thank-you letter after participating in a sub-wave. CAWI participants received virtual incentive panel points (500 points, equivalent to €5) for participating in a sub-wave (known as post-paid incentives). These could then be exchanged for vouchers of their choice in the panel incentive shop on the online panel portal.

However, in the 2025 annual wave, the funding body no longer permitted cash incentives, regardless of whether they were prepaid or postpaid. As a result, PAPI participants were rewarded with a universal voucher printed in the thank-you letter instead of cash. This change started from the first sub-wave and was explained in the invitation letter.

Questionnaire

The four questionnaires, plus the socio-demographic questionnaire, are published as preview versions (17).

For the most part, the questionnaires covered the EHIS topics already described. Specifically, the following general topics were addressed in the questionnaires:

- **Questionnaire A Chronic disease and functional health**: physician-diagnosed chronic conditions (e.g. asthma, COPD, cardiovascular disease, diabetes, hypertension, depression, cancer), functional limitations (vision, hearing, mobility, cognition, self-care and household activities), officially recognized disability and care levels, and social isolation.
- **Questionnaire B Mental health and wellbeing**: life satisfaction, sense of meaning and happiness, resilience and wellbeing scales, depression and anxiety symptoms, perceived stress, suicidal thoughts and attempts, societal and climate-related strain, coping styles, sexual orientation and partnership, and work-related strain.
- **Questionnaire C Care use, prevention and mobility**: hospital stays and physician visits, preventive and screening examinations, medication and antibiotic use, influenza and COVID-19 vaccination, care services and access barriers, behavior during respiratory illness, and everyday transport use and cycling attitudes.
- **Questionnaire D Health behavior and lifestyle**: body measurements/BMI, physical activity and sedentary time, diet, tobacco/e-cigarette and alcohol consumption, a food-surveillance block, digital health use, and social support given and received.
- **Sociodemographic**: date of birth, sex/gender, household composition, education, income, employment status and occupation, subjective social status, and citizenship/residence status.

Each questionnaire is designed to take no more than 20 minutes, resulting in a cumulative duration of up to 80 minutes across the four questionnaires per year. In the cover letters for each sub-wave, participants are informed that the survey will take approximately 15 to 20 minutes (per questionnaire).

The development of the German EHIS questionnaire followed the standardized Eurostat translation guidelines, including the recommended multi-step translation and review process. In addition, coordination with other German-speaking countries was undertaken to ensure comparability and consistency of the national adaptations.

Data processing and quality assurance

Several quality assurance procedures were implemented during the data processing phase of the EHIS. In accordance with the Commission Implementing Regulation for EHIS Wave 4, Member States are required to submit finalized, validated microdata together with comprehensive quality-related metadata, following Eurostat standards to ensure cross-national comparability. The data preparation process followed the EHIS Methodological Manual (14), the EHIS validation rules, and the EHIS data delivery guidelines. Structural and privacy-related adjustments were implemented to ensure compliance with strict confidentiality requirements. This included bottom- and top-coding procedures to prevent the identification of individuals, as well as verification of variable definitions against the official Eurostat EHIS documentation and codebooks.

Systematic data screening procedures were subsequently conducted to ensure internal consistency and data quality. Outliers and implausible values were identified and either excluded or treated as missing based on predefined plausibility criteria. Logical consistency checks were performed across survey modules to ensure coherence of responses. Duplicate records were identified and removed where necessary. Further data processing steps included the generation of derived variables, the coding of open-ended responses, and income imputation using statistical methods for missing data. All processing steps followed Eurostat standards and were fully documented to ensure traceability and reproducibility.

2.4. Panel Attrition

The number of registered panel members naturally decreases over time. Reasons for leaving the panel include the deletion of user accounts, withdrawal of consent to further participation, deaths, and reported long-term illness. Panel members may withdraw from the panel at any time, either by deleting their user account themselves or by contacting the support team by telephone or email. In the following, attrition resulting from these participant-initiated processes is referred to as active attrition.

Active attrition was assessed separately for each sub-wave. For each sub-wave t, the active attrition rate was calculated relative to the number of remaining panel members invited to participate in sub-wave t:

$$A_t^{act} = \frac{D_t^{act}}{N_{t-1}} \times 100$$

,

where A_t^{act} denotes the active attrition rate in sub-wave *t*, D_t^{act} the number of panel members who actively withdrew from the panel in sub-wave *t-1* and between sub-wave *t-1* and sub-wave *t*, and N_{t-1} the number panel members invited to participate in sub-wave *t-1*.

In addition to active attrition, a panel maintenance procedure was conducted by the research team between the third and fourth sub-wave of 2025. Panel members who had not participated in any of the four consecutive preceding quarterly sub-waves (Quarter 4 2024, Quarter 1 2025, Quarter 2 2025, and Quarter 3 2025) were excluded from subsequent survey invitations. In the following, these administratively initiated exclusions are referred to as passive attrition, as they did not result from an active withdrawal by panel members but from the removal of persistently inactive members from the survey invitation pool.

Both active and passive attrition reduce the number of panel members available for subsequent survey invitations during the survey year and therefore directly affect participation rates, as these panel members are no longer included in the gross sample. Furthermore, if attrition occurs disproportionately among particular groups of panel members, the composition of the remaining panel may change systematically over time. To assess such selective attrition, panel members subject to active or passive attrition are compared with the overall panel sample. Specifically, the distributions of sex, age, and educational attainment (CASMIN, (18)) among panel members with active and passive attrition are compared with the corresponding distributions among all panel members initially invited to participate in the 2025 annual survey.

2.5. Calculation of participation rates

This subsection describes the procedures used to calculate participation rates for the 2025 annual survey. The calculation is in accordance with the standards of the American Association for Public Opinion Research (AAPOR). AAPOR Response Rate 2 (RR2) is reported, which represents the proportion of completed and partial interviews relative to the number of panel members invited to participate. As all active panel members at the time of each quarterly sub-wave were invited to participate, they constituted the survey sample and denominator for calculating RR2 for the respective sub-wave. In this context, a complete interview was defined as a fully completed questionnaire. A partial interview was defined as a partially completed questionnaire for which consent to participate in the study had been provided and at least one questionnaire item had been answered. Detailed AAPOR disposition codes for the four sub-waves are provided in Appendices A.2–A.5.

In the panel context, no cases are classified as having unknown eligibility (AAPOR category “UE – Unknown Eligibility”). Panel members are considered to have known eligibility based on their successful registration during the recruitment study. Consequently, all panel members who remain registered at the respective time point are treated as eligible for participation and are invited to participate in the corresponding sub-wave (1).

In addition, cumulative response rates (CUMRR2) are reported. CUMRR2 was calculated as the product of the recruitment rate obtained in the initial panel recruitment study and the response rate of the respective quarterly sub-wave in 2025. Although response rates alone are not sufficient to assess nonresponse bias, CUMRR2 provides additional information on the proportion of the initial recruitment sample that participated in the respective quarterly sub-wave (16). The analysis of sample composition presented in Chap. 2.6 provides an additional insight for assessing potential selective participation.

A particular feature of the 2025 annual survey was the integration of additional refresher samples into the panel. These samples were added to the panel members initially recruited in 2024. Consequently, the initial recruitment rate of 28.7% from the 2024 recruitment survey was adjusted by proportionally weighing it with the recruitment rates of the two newly integrated refresher samples. For the calculation of CUMRR2 across all quarterly waves combined (Q1–Q4), a recruitment rate of 27.4% was used. This corresponds to the average recruitment rate obtained from the proportionally weighted recruitment rates across the individual quarterly waves. AAPOR RR2 is presented separately by age, sex, survey mode, and educational attainment (Casmin) for each quarterly sub-wave conducted in 2025.

When interpreting response rates in the context of the survey year, it should be considered that the overall panel sample, that is the initial sample comprising all active panel members at the time of each sub-wave —changes over time due to panel attrition. At the same time, the subsequent integration of refresher samples in individual survey waves increases the size of the overall panel sample. These changes in the composition and size of the panel population need to be taken into account when interpreting the development of participation rates over time.

Passive attrition in the fourth sub-wave substantially reduced the number of panel members remaining eligible for invitation. Consequently, the participation rate for the fourth sub-wave is not comparable with those of the preceding sub-waves, as panel members classified as passive attrition were no longer included in the denominator. To account for this change, the participation rate for the fourth sub-wave is presented both with and without passive attrition, with the former treating passively attrited panel members as if they had remained eligible for invitation. Given that passive attrition was defined by nonparticipation in the four preceding sub-waves, the probability of participation among these panel members would have been expected to be low. Their exclusion from the invitation sample may therefore have had only a limited effect on the number of participants while substantially reducing the denominator used to calculate the participation rate.

2.6. Assessment of sample composition

To assess the sample composition, distributions of age, sex, federal state, education attainment (CASMIN (18)), and household size (single-person vs. multi-person household) were calculated for each sub-wave and questionnaire and compared with reference distributions from population statistics (19) and the 2022 microcensus (20).

First, the Duncan dissimilarity index was calculated as a summary measure for each parameter separately for each sub-wave and questionnaire. The index can be interpreted as the proportion of observations that would need to be redistributed across categories for the sample and reference distributions to

match exactly (21). The Duncan Index is presented ass percentages ranging from 0% to 100%, where higher values indicate greater differences between the sample and the reference population. In the present study, values below 10% were interpreted as indicating only minor deviations from the reference population, whereas values between 10% and 20% were considered to reflect moderate discrepancies. These thresholds should be regarded as heuristic rather than formal criteria.

Secondly, following the approach introduced in (22), differences between the sample and reference distributions were assessed using standardized differences (Δ):

$$\Delta = \frac{p_1 - p_2}{\sqrt{(p_1(1-p_1) + p_2(1-p_2)) \times 2}} \times 100$$

, with p_1 as reference proportion and p_2 as the proportion to be compared. The calculation is based on Austin and Stuart (23). However, for ease of interpretation, we divide their standardized difference by 2, such that the resulting standardized difference is approximately equal to the absolute difference when prevalences are around 50%. Austin and Stuart (23) suggest that a standardized difference below 10% can generally be considered negligible, which corresponds to a standardized difference below 5% using the modified calculation. Standardized differences are presented separately for the 2025 sub-waves to assess potential selective changes in sample composition over the course of the survey year. In addition, comparisons with the 2024 annual survey are provided to identify potential differences in sample composition between the two survey years. While the Duncan Dissimilarity Index summarizes the overall deviation from the reference distribution, the standardized differences reveal which categories contribute to these deviations. Together, both measures provide a comprehensive assessment of changes in sample composition over time.

2.7. Drop-out analysis

In contrast to the sample composition of sociodemographic parameters, where the sample can be compared with marginal distributions from external official statistics, such reference information is generally not available for health-related indicators. However, the recruitment survey of the panel (16) collected a broad range of health-related variables, providing an internal reference for assessing changes in the sample composition.

Initial analyses of drop-out effects in the Annual Survey 2024 indicated only minor differences regarding health-related characteristics (22). To assess the stability of these patterns over time, the Duncan Index was calculated for each sub-wave, ranging from the second quarter of 2024 (Annual Survey 2024) to the fourth quarter of 2025 (Annual Survey 2025), using the recruitment survey as the reference population. The index was calculated both with and without applying the survey weights to evaluate the impact of weighting on mitigating potential drop-out effects in the distribution of the health-related indicators.

The following health-related indicators were considered in the analysis:

- BMI: Body mass index (BMI) was calculated from self-reported weight (kg) and height (m) as BMI = weight in kg/(height in m)² and categorized as follows:
    - Underweight (BMI < 18.5)
    - Normal weight (18.5 < = BMI < 25)
    - Overweight (25 < = BMI < 30)
    - Obesity (BMI > = 30)
- Chronic disease: Self-reported chronic disease (Yes/No).
- Self-rated health: Five Categories from “very good” to “very bad”.
- Self-rated mental health: Five Categories from “excellent” to “poor”.
- Paying attention to health: Five Categories from “very strong” to “not at all”.
- Satisfaction with life in general: Scale from 1 (completely dissatisfied) to 10 (completely satisfied).
- Consumption of red meat: Self-reported information in categories: Daily or several times a day, 4 to 6 times per week, 1 to 3 times per week, less than once per week, never.
- Consumption of processed meat: Self-reported information in categories: Daily or several times a day, 4 to 6 times per week, 1 to 3 times per week, less than once per week, never.
- Current smoking: Self-reported information on daily smoking, occasional smoking or non-smoking.
- Sport: Weekly duration of sporting activity during the past three months, in the following categories: No sporting activity, less than 1 hour per week, regularly 1 to less than 2 hours per week, regularly 2 to less than 4 hours per week, and regularly 4 or more hours per week.
- Subjective health risk due to climate change: Scale from 1 (not at all) to 10 (very much).
- Waited for appointment: Waited for medical appointment in the last 12 months (Yes/No).

2.8. Weighting

To minimize potential bias arising from selective participation and discrepancies between the sample and the population structure, a multi-step weighting approach was implemented. The weighting procedure follows the methodology applied for the annual survey 2024, which is described in detail in (22).

Figure 3 provides an overview of the weighting steps. The process begins with the weighting of the recruitment study, consisting of a design weighting that accounts for the two-stage sampling design and a calibration weighting that aligns the sample with known population distributions derived from official statistics. Building on this initial weighting factor, subsequent drop-out weights for both the panel registration process and participation in the individual survey sub-waves are calculated. Since participation patterns may differ across questionnaires and sub-waves, the drop-out weighting is conducted separately for each questionnaire and sub-wave. In the final step, questionnaire-specific cross-sectional weights are generated through additional calibration weighting based on official population statistics.

The construction of the annual sample weights $weight^{Q}$ for questionnaires (*Q*) A to D is therefore given by

$$weight^{Q} = wDesign \times \ AFCalibration^{RS} \ \times \ AFDrop^{Reg} \times \ AFDrop^{Q,t} \times \ AFCalibration^{Q}$$

, where $wDesign$ denotes the sampling design weight, $AFCalibration^{RS}$ the adjustment factor based on calibration weighting of the recruitment study, $AFDrop^{Reg}$ the adjustment factor accounting for drop-out during registration and $AFDrop^{Q,t}$ the adjustment factor accounting for drop-out in sub-wave *t* and questionnaire Q and $AFCalibration^{Q}$ the adjustment factor based on calibration weighting for questionnaires A to D.

Due to the integration of additional refresher samples, several modifications to the design and calibration weighting procedures were necessary compared with the weighting approach used for the annual survey 2024.

Since the 2025 refresher sample was drawn to compensate for age cohorts that were not adequately covered in the initial recruitment sample due to an error in the sampling procedure and was therefore not designed to serve as a standalone sample, the two samples are treated as if recruitment had occurred simultaneously. Accordingly, the design weights are recalculated using the selection probabilities of the sample points at the time of the original point selection (reference date: December 31, 2021 (24)) and, within the sample points, based on the population figures as of December 31, 2022 (25). For the EHIS Refresher Sample of 15- to 17-year-olds, the selection probabilities of the sample points at the time of the original point selection (reference date: December 31, 2021) are also used. Within the sample points, population figures as of 31 December 2023 (26), corresponding to the time of recruitment, are used to calculate the selection probabilities within each sample point.

The calibration weighting for the combined samples was conducted largely in line with the procedure described in (22). One modification concerned the calibration cells for Berlin: unlike in the previous weighting approach, the age groups 85 years and older no longer needed to be combined within the corresponding raking dimension, as the enlarged sample size now provides sufficient case numbers for these age groups. The five calibration levels used in the weighting procedure are presented in Table 2.

Table 2
Raking dimensions for calibration weighting of the initial recruitment/2025 refresher sample and annual survey 2025

Raking Dimension	Parameter
1	Federal State X Sex X Age Group 1
2	Federal State/Region[a] X Sex X Age Group 2 X Education
3	Federal State X Age Group 3 X BIK Classification
4	Federal State X Age Group 4 X Household Size
5	Federal State X Sex X Age Group 5
Definitions	
Federal State:	Schleswig-Holstein, Hamburg, Lower Saxony, Bremen, North Rhine-Westphalia, Hesse, Rhineland-Palatinate, Baden-Württemberg, Bavaria, Saarland, Berlin, Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt, Thuringia
Sex:	Officially recorded sex at birth (Male, Female)
Household Size:	Single-person household, Multi-person household
Education[b]:	CASMIN classification (Low, Medium, High)
Region:	North/Central-East, Northwest, Central-West, South, Berlin, Schleswig-Holstein
BIK Classification[c]:	BIK region < 20,000 inhabitants; BIK region 20,000 to < 50,000 inhabitants or BIK Region including surrounding area of city 50,000 to < 500,000 inhabitants; BIK region including core city 50,000 to < 500,000 inhabitants or surrounding area 500,000 + inhabitants; BIK region including core city 500,000 + inhabitants
Age Group 1[d]:	15–17 yrs, 18–19 yrs, 20–24 yrs, 25–29 yrs, 30–39 yrs, 40–49 yrs, ..., 80 + yrs
Age Group 2[d]:	15–17 yrs, 18–19 yrs, 20–24 yrs, 25–34 yrs, 35–45 yrs, ..., 65–79 yrs, 80 + yrs
Age Group 3[d]:	15–17 yrs, 18–29 yrs, 30–44 yrs, 45–64 yrs, 65 + yrs
Age Group 4[d]:	15–17 yrs, 18–24 yrs, 25–34 yrs, 35–49 yrs, 50–64 yrs, 65–79 yrs, 80 + yrs
Age Group 5[d].	15–17 yrs, 18–24 yrs, 25–34 yrs, 35–44 yrs, ..., 85 + yrs

[a] Recruitment study: federal state, 2025 annual survey: region.

[b] see Brauns et al (18); CASMIN set to “low” for ages below 20.

[c] see Behrens et al (15)

[d] The combined sample of the 2024 recruitment study and the 2025 refresher sample includes participants aged 17 years and older. Consequently, the 15–17-year age group is not represented, and the youngest age group starts at age 17.

Raking dimensions 2 and 4: Population totals based on the 2021 Microcensus (27) for the recruitment surveys and the 2022 Microcensus (20) for the 2025 annual survey.

Raking dimensions 1, 3, and 5: Population figures as of 31 December 2023 (26) were used for the recruitment survey and population figures as of 31 December 2024 (19) for the 2025 annual survey.

Among individuals younger than 18 years, there is only limited variability in educational attainment and household composition. Therefore, the recruitment sample of 15- to 17-year-olds is not calibrated with respect to education or household size. In addition, the sample covers only three age cohorts in this age range. Consequently, the calibration weighting for this subgroup is based solely on the following two raking dimensions (see Table 3).

Table 3
Raking dimensions for calibration weighting of the EHIS refresher sample (2024).

Raking Dimension	Parameter
1	Federal State X Sex X Age
2	Federal State X Sex X BIK Classification
Definitions	
Federal State:	Schleswig-Holstein, Hamburg, Lower Saxony, Bremen, North Rhine-Westphalia, Hesse, Rhineland-Palatinate, Baden-Württemberg, Bavaria, Saarland, Berlin, Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt, Thuringia
Sex:	Officially recorded sex at birth (Male, Female)
BIK Classification:	BIK region < 20,000 inhabitants; BIK region 20,000 to < 50,000 inhabitants or BIK Region including surrounding area of city 50,000 to < 500,000 inhabitants; BIK region including core city 50,000 to < 500,000 inhabitants or surrounding area 500,000 + inhabitants; BIK region including core city 500,000 + inhabitants
Age:	15 yrs, 16 yrs, 17 yrs
Population figures as of 31 December 2023 (26) were used in the raking dimensions.	

Dropout weighting follows the inverse probability weighting approach and is implemented in line with the methodology described in (22). However, the weighting is performed separately for the willingness to register in the combined Recruitment 2024 and 2025 Refresher sample and for the EHIS Refresher sample of participants aged 15 to 17 years.

At this stage, the two samples are combined by recalculating age using 1 July 2025 as the reference date and by normalizing the weights to the corresponding population totals. Specifically, the merged Recruitment 2024 and 2025 Refresher sample is adjusted to the population aged 18 years and older, while the EHIS Refresher sample of 15- to 17-year-olds is adjusted to the corresponding population counts for this age group. This procedure ensures that both samples contribute according to their respective population sizes rather than their sample sizes and are therefore treated independently in the combined weighting process.

Dropout weighting for participation in the annual survey 2025 is performed separately by questionnaire and sub-wave. In addition to information from the recruitment surveys, information collected in the annual survey 2024 is used to model participation probabilities. Separate lasso regression models are estimated for newly recruited panelists (EHIS Refresher and Refresher 2025) and for panelists recruited in the recruitment study 2024. For the latter group, the models include variables from both the recruitment survey and the annual survey 2024.

3. Results

3.1. Panel attrition

Of the initial panel sample of 49,628 panel members in the 2025 annual survey, 40,955 (82.5%) remained in the panel at the end of the fourth sub-wave. Overall, 1,545 panel members (3.1%) were lost due to active attrition, while 7,128 (14.4%) were lost due to passive attrition.

Table 4 provides a detailed overview of active and passive panel attrition, including the reasons for active attrition. Active attrition remained relatively stable across sub-waves, accounting for approximately 1% of the respective gross sample in each transition between sub-waves. A total of 528 panel members (1.1%) were lost to active attrition between sub-wave 1 and sub-wave 2, 543 (1.1%) between sub-wave 2 and sub-wave 3, and 474 (1.0%) between sub-wave 3 and sub-wave 4. The most common reason for active attrition was withdrawal of panel consent, accounting for 89.9% to 93.2% of all active attrition cases across sub-waves. Death of a panel member was the second most common reason, accounting for 5.5% to 8.6% of active attrition cases. Moving abroad and inability to continue participating (e.g., due to illness) accounted for only a small number of cases.

In addition to active attrition, 7,128 panel members were removed from the gross sample as part of the panel maintenance procedure conducted between sub-wave 3 and sub-wave 4, corresponding to a passive attrition rate of 14.7% relative to the sub-wave 3 gross sample. Passive attrition therefore resulted in a substantially larger reduction in the panel sample between sub-wave 3 and sub-wave 4 than active attrition.

Table 4
Active and passive panel attrition and reasons for active attrition in the 2025 annual survey

Sub-Wave	Gross Sample n.Obs	Attrition n.Obs	Reason	Reason n.Obs
Active attrition				
Sub-wave 1 → Sub-wave 2	48,722	528 (1.1%)		
			Withdrawal of Panel consent	490 (92.8%)
			Deceased	33 (6.2%)
			Moved abroad	4 (0.8%)
			Unable to participate (e.g., due to illness)	1 (0.2%)
Sub-wave 2 → Sub-wave 3	49,100	543 (1.1%)		
			Withdrawal of Panel consent	506 (93.2%)
			Deceased	30 (5.5%)
			Unable to participate (e.g., due to illness)	7 (1.3%)
Sub-wave 3 → Sub-wave 4	48,557	474 (1%)		
			Withdrawal of Panel consent	426 (89.9%)
			Deceased	41 (8.6%)
			Moved abroad	2 (0.4%)
			Unable to participate (e.g., due to illness)	5 (1%)
Passive attrition				
Sub-wave 3 → Sub-wave 4	48,557	7128 (14.7%)		

Table 5 presents the overall sample of panel members in 2025, individuals subject to active and passive attrition, and the remaining panel sample after attrition, stratified by age group, sex, educational attainment, and survey mode.

The distribution of characteristics among panel members experiencing active attrition differed from that of the overall panel sample. Offline participants accounted for 67.6% of active attrition cases, compared with 22.1% of the overall panel sample (Δ = 45.6 percentage points). Differences were also observed across age groups. Panel members aged 70 years and older accounted for 62.5% of active attrition cases compared with 21.6% of the overall panel sample (Δ = 40.9 percentage points), whereas younger age groups accounted for smaller proportions of active attrition cases. Differences were also observed by educational attainment: participants in the lowest educational group being accounted for 40.5% of active attrition cases, compared with 21.3% of the overall panel sample (Δ = 19.1 percentage points). Differences by sex were comparatively small.

For passive attrition, deviations from the overall panel composition were less pronounced. The largest differences were observed by age: participants aged 15–29 years were overrepresented among passive attrition cases (28.2% vs. 18.1%; Δ = 10.1 percentage points), whereas participants aged 70 years and older were underrepresented (11.4% vs. 21.6%; Δ = −10.2 percentage points). Smaller differences were observed for educational attainment and survey mode, while differences by sex remained limited.

Despite these differences in the composition of the active and passive attrition groups, their combined effect on the composition of the remaining panel sample was small. Across all characteristics examined, absolute deviations from the original panel sample did not exceed 1.4 percentage points. The largest differences were observed for the age groups 15–29 years (Δ = −1.4 percentage points) and 60–69 years (Δ = 1.4 percentage points), while deviations for sex, educational attainment, and survey mode were approximately one percentage point or less.

Table 5
Sociodemographic composition of the initial panel sample, active and passive attrition, and remaining panel sample

Category	Panel sample n.Obs (%)	Active Attrition n.Obs (%)	Passive Attrition n.Obs (%)	Panel sample after Attrition n.Obs (%)	Active Attrition Δ	Passive Attrition Δ	Panel sample after Attrition Δ
Total	49628	1545	7128	40955			
15–29 years	9322 (18.8)	117 (7.6)	2100 (29.5)	7105 (17.3)	-11.2	10.7	-1.4
30–39 years	7468 (15.0)	70 (4.5)	1562 (21.9)	5836 (14.2)	-10.5	6.9	-0.8
40–49 years	6253 (12.6)	73 (4.7)	1061 (14.9)	5119 (12.5)	-7.9	2.3	-0.1
50–59 years	7969 (16.1)	126 (8.2)	957 (13.4)	6886 (16.8)	-7.9	-2.6	0.8
60–69 years	8261 (16.7)	204 (13.2)	661 (9.3)	7396 (18.1)	-3.4	-7.4	1.4
70–79 years	6048 (12.2)	442 (28.6)	395 (5.5)	5211 (12.7)	16.4	-6.6	0.5
80 + years	4307 (8.7)	513 (33.2)	392 (5.5)	3402 (8.3)	24.5	-3.2	-0.4
Female	26527 (53.5)	751 (50.2)	3394 (47.6)	22382 (54.7)	-3.3	-5.9	1.1
Male	23044 (46.5)	746 (49.8)	3734 (52.4)	18564 (45.3)	3.3	5.9	-1.1
High education	15159 (30.6)	320 (21.4)	1779 (25.1)	13060 (31.9)	-9.2	-5.6	1.3
Medium education	23743 (48.0)	569 (38.1)	3689 (52.0)	19485 (47.7)	-9.9	4.0	-0.3
Low education	10559 (21.3)	604 (40.5)	1630 (23.0)	8325 (20.4)	19.1	1.6	-1.0
CAWI	38671 (77.9)	500 (32.4)	5889 (82.6)	32282 (78.8)	-45.6	4.7	0.9
PAPI	10957 (22.1)	1045 (67.6)	1239 (17.4)	8673 (21.2)	45.6	-4.7	-0.9

Note: Δ indicates the difference in percentage points compared to the original panel sample.

Education levels according to CASMIN classification (Comparative Analysis of Social Mobility in Industrial Nations).

3.2. Participation rates

A total of 48,722 panel members were invited to participate in sub-wave 1, 49,100 in sub-wave 2, 48,557 in sub-wave 3, and 40,955 in sub-wave 4 2025. The slight increase in the gross sample size between sub-wave 1 and sub-wave 2 resulted from the integration of the 2025 Refresher sample targeting underrepresented age groups (n = 895).

Figure 4 shows the timing of participation across the four sub-waves of the 2025 annual survey. Across all sub-waves, participation was highest shortly after the start of fieldwork, followed by a marked decline over the subsequent weeks. Additional increases in participation can be observed later in the fieldwork period, corresponding to the timing of reminder contacts.

Table 6 presents the response rates according to AAPOR RR2. Considerable variation in the overall response rate was observed across the four sub-waves. From sub-wave 1 to sub-wave 2, RR2 decreased from 73.4% to 67.6%, corresponding to a decline of 5.8 percentage points. This decline coincided with a

change in the conditional incentive provided to PAPI participants from a cash incentive to a voucher-based incentive. A further slight decrease was observed in sub-wave 3.

In sub-wave 4, RR2 increased to 75.9%. This increase occurred following the panel maintenance procedure conducted between sub-wave 3 and sub-wave 4, during which persistently inactive panel members were removed from the invitation pool. The removal of these panel members substantially reduced the gross sample and, consequently, the denominator used to calculate the response rate. For better comparability with the subsequent sub-waves, RR2* presents the response rates without excluding panel members affected by passive panel attrition. Overall, the response rate decreased slightly from 66.9% in sub-wave 3 to 64.7% in sub-wave 4.

The variation in RR2 across sub-waves was also reflected in the four questionnaire groups. Within each sub-wave, however, differences between questionnaire groups were relatively small. In sub-wave 1, RR2 ranged from 72.3% in questionnaire group C to 74.6% in group D. In sub-wave 2, the highest response rate was observed in group A (69.1%), whereas groups B and D showed the lowest rates (66.2% each). In sub-wave 3, RR2 ranged from 65.8% in group A to 68.1% in group D. In sub-wave 4, response rates were highest in group B (76.6%) and lowest in group A (75.1%). When considering all four sub-waves combined, differences between questionnaire groups were minimal, with response rates ranging only from 70.6% to 71.0%. Overall, these findings indicate no substantial differences in response rates between the four questionnaire groups.

Table 6
Participation rates (RR2) by sub-wave and questionnaire in the 2025 annual survey

Fragebogen	Sub-wave 1			Sub-wave 2			Sub-wave 3			Sub-wave 4				
	N	RR2 (%)	CUMRR2 (%)	N	RR2 (%)	CUMRR2 (%)	N	RR2 (%)	CUMRR2 (%)	N	RR2 (%)	CUMRR2 (%)	RR2* (%)	N
A	9,020	74.3	20.6	8,531	69.1	18.9	7,969	65.8	18.0	7,688	75.1	20.5	64.0	33,208
B	8,838	72.4	20.1	8,112	66.2	18.1	8,296	67.9	18.6	7,872	76.7	21.0	65.7	33,118
C	8,787	72.3	20.0	8,419	68.8	18.8	7,995	65.9	18.0	7,939	76.3	20.9	64.2	33,140
D	9,131	74.6	20.7	8,128	66.2	18.1	8,244	68.1	18.6	7,600	75.7	20.7	64.8	33,103
Total	35,776	73.4	20.3	33,190	67.6	18.5	32,504	66.9	18.3	31,099	75.9	20.8	64.7	
Note: Response Rate 2 (RR2) was calculated according to the AAPOR Standard Definitions (28), *RR2** is calculated without excluding panel members remov passive panel attrition process														
RR2 = Response Rate 2, CUMRR2 = cumulative response rate 2, AAPOR = American Association for Public Opinion Research														

Table 7 presents RR2 stratified by age group, sex, survey mode, and educational level. The previously described variation in response rates across sub-waves is also reflected in these subgroup analyses.

Across all four sub-waves, response rates generally increased with age, except for participants aged 80 years and older, whose response rates were approximately five percentage points lower than those of the 70–79-year age group in each sub-wave. The lowest response rates were consistently observed among participants aged 15–29 years, ranging from 53.9% to 66.2% across sub-waves. In contrast, the highest response rates were observed among participants aged 70–79 years, ranging from 73.5% to 85.5%.

Differences were also observed by sex. Female participants consistently had higher response rates across all four sub-waves, ranging from 68.6% to 76.6%, compared with 65.0% to 75.2% among male participants.

Response rates by survey mode showed a distinct pattern across sub-waves. In sub-wave 1, the response rate was higher among CAWI participants (77.9%) than among PAPI participants (72.2%). Following the change from cash to voucher-based incentives for PAPI participants in sub-wave 2, the response rate among PAPI participants decreased to 64.4%, compared with 68.5% among CAWI participants. Lower response rates among PAPI than CAWI participants were also observed in sub-waves 3 and 4, with the difference between the two modes increasing over time. In sub-wave 4, following the panel maintenance procedure conducted between sub-waves 3 and 4, RR2 was 64.9% among PAPI participants compared with 78.9% among CAWI participants.

Finally, response rates differed consistently by educational level. Across all four sub-waves, participants in the highest educational group had the highest response rates, ranging from 73.3% to 81.2%. Conversely, the lowest response rates were observed among participants in the lowest educational group, ranging from 58.9% to 70.2%. Thus, a clear educational gradient in survey participation was observed throughout the 2025 survey year.

Table 7
Participation rate (RR2) by sub-wave, sociodemographic characteristics and survey mode in the 2025 annual survey

Characteristics	Sub-wave 1		Sub-wave 2		Sub-wave 3		Sub-wave 4		
	N Interviews	RR2 (%)	*N* Interviews	RR2 (%)	*N* Interviews	RR2 (%)	*N* Interviews	RR2 (%)	RR2* (%)
Total	35,776	73.4	33,190	67.6	32,504	66.9	31,099	75.9	64.7
15–29 years	5,470	58.7	4,995	53.9	4,992	54.0	4,700	66.2	51.1
30–39 years	4,946	66.3	4,555	61.3	4,556	61.4	4,376	75.0	59.2
40–49 years	4,338	69.9	4,035	64.8	4,020	64.9	3,892	76.0	63.0
50–59 years	6,122	77.9	5,739	72.5	5,717	72.5	5,512	80.1	70.3
60–69 years	6,669	83.9	6,403	78.2	6,297	77.7	6,106	82.6	75.8
70–79 years	4,981	85.5	4,492	76.1	4,220	73.5	4,034	77.4	72
80 + years	3,250	79.2	2,971	71.5	2,702	68.1	2,479	72.9	65.3
Male	16,070	70.9	14,859	65.2	14,642	65.0	13,954	75.2	62.6
Female	19,706	75.6	18,331	69.7	17,862	68.6	17,145	76.6	66.5
PAPI	8,232	77.9	6,844	64.4	6,075	59.3	5,630	64.9	56.8
CAWI	27,544	72.2	26,346	68.5	26,429	69.0	25,469	78.9	66.7
Low education	7,302	70.2	6,332	60.9	5,984	58.9	5,632	67.7	56.6
Middle education	16,916	72.3	15,780	67.0	15,479	66.3	14,818	76.1	63.9
High education	11,492	77.8	11,022	73.3	10,988	73.6	10,601	81.2	71.4

Note: The slightly lower number of cases in the presentation of the education groups is due to missing information in the survey of educational attainment,

RR2 = Response Rate 2, *RR2** is calculated without excluding panel members removed as part of the passive panel attrition process, Education levels according to CASMIN classification (Comparative Analysis of Social Mobility in Industrial Nations (18)).

3.3. Sample composition

Figure 5 presents the Duncan Dissimilarity Indices by sub-wave and questionnaire. Overall, the smallest deviations from the reference population were observed for household size (2.5%-3.1%), sex (4.0%-4.3%), and age group distributions (6.5%-7.2%), whereas larger deviations were found for educational attainment (14.3%-16.6%), German citizenship (10.4%-11.0%), and federal state (18.9%-20.3%).

Only minor changes in the Duncan Indices were observed across both the four sub-waves and the four questionnaires (Q A–Q D) for most analyzed parameters, indicating a largely stable sample composition over time and across questionnaire types. In particular, the Duncan Indices for age, sex, German citizenship, and household size remained relatively stable throughout all sub-waves and questionnaires. More pronounced temporal changes were observed for educational attainment and federal state. The Duncan Index for educational attainment increased markedly between the first and second sub-wave and continued to rise gradually through the fourth sub-wave. For federal state, a distinct increase occurred between the first and second sub-wave.

Note

Education levels are based on the CASMIN classification (Comparative Analysis of Social Mobility in Industrial Nations (18)). Reference values for education and household size are based on the 2022 Microcensus (20). Reference values for age, sex, federal state, and German citizenship are based on population figures as of 31 December 2024 (19).

Figure 6 shows the standardized differences between the sample distributions and the corresponding population benchmarks for each of the four 2025 sub-waves and the annual 2024 and 2025 surveys. The standardized differences show that the increasing Duncan Index for educational attainment primarily reflects a growing underrepresentation of individuals with lower educational attainment accompanied by an increasing overrepresentation of highly educated individuals in the unweighted sample.

Across all sub-waves and survey years, the proportion of participants with German citizenship was consistently higher than in the reference population.

The deviations for federal state primarily reflect the sampling design, resulting in an overrepresentation of smaller federal states (e.g. Bremen and Saarland), particularly Berlin and Schleswig-Holstein, and a corresponding underrepresentation of larger states such as North Rhine-Westphalia and Bavaria. The

noticeable increase between the first and second sub-wave is mainly attributable to the additional refreshment sample, which was introduced from the second sub-wave onwards and predominantly affected Berlin.

For all remaining characteristics, standardized differences remained below ± 5 percentage points, indicating only minor discrepancies between the sample and the population benchmarks. Women, individuals aged 50–79 years, and members of multi-person households were slightly overrepresented, whereas individuals aged 15–49 years were slightly underrepresented.

Additional File 1 presents the corresponding differences in percentage points across the sub-waves.

Note

Education levels are based on the CASMIN classification (Comparative Analysis of Social Mobility in Industrial Nations (18)). Reference values for education and household size are based on the 2022 microcensus (20). Reference values for age, sex, federal state, and German citizenship are based on population figures as of 31 December 2024 (19).

3.4. Drop-out analysis

In Fig. 7, the results of the analysis of drop-out effects for health-related indicators are presented. Overall, the findings indicate only minor changes in the distribution of health-related indicators across sub-waves (Minimum: 0.4%, Maximum: 4.5%). The Duncan Index remained at a relatively low level throughout the observation period, suggesting that the composition of respondents with respect to health characteristics was largely stable over time.

Among the indicators examined, the largest deviations from the recruitment survey were observed for sport participation, satisfaction with life in general, self-rated health, smoking, health risk due to climate change, and self-rated mental health. In the unweighted data, the Duncan Index increased moderately over time for these indicators, for example from 2.7% to 4.5% for sport participation, from 2.7% to 4.3% for life satisfaction, from 1.8% to 4.2% for self-rated health, from 2.7% to 3.9% for smoking, from 2.5% to 3.5% for perceived health risks due to climate change, and from 1.4% to 3.2% for self-rated mental health. These patterns indicate modest cumulative drop-out effects across survey waves.

For some health-related characteristics, particularly sport participation, self-rated mental health, and self-rated health, a marked increase in the deviation was observed between the first and second sub-wave of the 2025 annual survey. In comparison, changes between the remaining consecutive sub-waves were comparatively small.

Applying the survey weights reduced the magnitude of the deviations for most indicators. In particular, weighting effectively attenuated the drop-out effects observed for self-rated health, self-rated mental health, life satisfaction, smoking, and sport participation. After weighting, Duncan Index values remained low and showed only limited variation across sub-waves. The largest weighted deviations were observed for health risk due to climate change, where values remained between 2.0% and 2.7%, whereas most other indicators showed Duncan Index values below 2.5% throughout the observation period.

4. Discussion

4.1. Panel Attrition

In the present study, passive attrition accounted for a substantially larger share of overall panel attrition than active attrition. Under the definition applied in this study, prolonged non-participation therefore accounted for a considerably larger proportion of panel loss than explicitly reported withdrawal or other documented reasons for leaving the panel. This finding highlights the importance of considering longitudinal participation patterns when assessing panel attrition. Analyses of panel mortality in the Zi-Praxis-Panel further demonstrate that panel dropout may be difficult to explain adequately based on observed characteristics of panel members alone (29). (.

At approximately 1% per sub-wave, active attrition was relatively low and within the range reported for other German panel studies. Previous research on panel retention in the German Socio-Economic Panel (SOEP), for example, has shown that some cases initially classified as attrition for unknown reasons were subsequently identified as deaths (30). This illustrates the importance of distinguishing between different mechanisms of panel attrition and, in particular, between explicitly identified reasons for leaving the panel and prolonged non-participation.

The analysis of reasons for active attrition showed that withdrawal of consent was the most common reason for leaving the panel. Active attrition also disproportionately affected participants using the offline survey mode and those aged 70 years and older. As offline panel members tended to be older, the descriptive results alone did not allow the associations of age and survey mode with active attrition to be disentangled. Therefore, an additional logistic regression analysis was conducted with active attrition (yes/no) as the dependent variable and age group, survey mode, and their interaction as independent variables (see Appendix X). The results indicated that the association between age and active attrition differed by survey mode.

In contrast to active attrition, passive attrition resulted from the removal of persistently inactive panel members as part of the panel maintenance procedure. Such a procedure may affect the composition of the remaining panel if prolonged non-participation is systematically associated with particular population characteristics. Compared with the overall panel sample, younger participants were overrepresented, and older participants were underrepresented among cases of passive attrition. The underrepresentation of older age groups may partly reflect their higher rates of active attrition, particularly among offline participants, meaning that some older panel members may have already left the panel before they could be classified as passive attrition. Differences with regard to sex, educational attainment, and survey mode were comparatively small. Overall, these findings provide little evidence that the panel maintenance procedure introduced substantial additional selectivity with respect to the sociodemographic characteristics examined.

When considering active and passive attrition together, their impact on the sociodemographic composition of the remaining panel was limited. Despite substantial differences between the attrition groups and the initial panel sample for some characteristics, absolute changes in the composition of the remaining panel did not exceed 1.4 percentage points for any of the characteristics examined. Thus, although attrition was selective with respect to certain characteristics, particularly age and survey mode, these selective processes resulted in only minor changes in the overall sociodemographic composition of the panel during the 2025 survey year. For the continued use of the panel, however, it is important to monitor and document active and passive attrition separately and on a regular basis and to address emerging imbalances through appropriate refresher recruitment strategies. This may help prevent the accumulation of selective attrition and associated changes in the composition of the active panel population over time.

4.2. Participation rates

The overall participation rate (RR2) across the four quarterly sub-waves of the 2025 annual survey ranged from 67.6% in Q2 to 75.9% in sub-wave 4. When panel members affected by passive panel attrition are included, response rates range from 64.7% in sub-wave 4 to 73.4% in sub-wave 1 and are therefore, on average, substantially lower than in the 2024 annual survey, where response rates across the three sub-waves ranged from 75.3% to 81.3%.(1). Nevertheless, participation rates remained at a level comparable to those reported for similar probability-based panel infrastructures (31, 32).

As the surveys were largely based on the same, already selected panel population, the changes in participation rates across the sub-waves warrant consideration in the context of methodological changes during the survey year. The decline in the participation rate from sub-wave 1 to sub-wave 2 (73.4% to 67.6%), coincided with the change in incentives for PAPI participants from cash to voucher-based incentives. This finding is consistent with evidence from survey methodology indicating that monetary incentives tend to be more effective in increasing survey participation than vouchers of equivalent value (33).

The pattern is particularly apparent when comparing survey modes. Following the change in incentives, participation rates among PAPI participants fell below those among CAWI participants, and the difference between the two modes increased across subsequent sub-waves, reaching 64.9% for PAPI compared with 78.9% for CAWI in sub-wave 4. Given that the incentive for CAWI participants remained unchanged, the divergent participation patterns across modes indicate that the incentive change may have contributed to the decline in PAPI participation. PAPI participants, for whom participation generally involves greater practical effort, may be particularly sensitive to the type of incentive offered.

Participation rates stratified by age, sex, survey mode, and educational attainment showed patterns broadly consistent with established findings in nonresponse research. Younger participants aged 15–29 years had the lowest participation rates, whereas the highest rates were observed among those aged 70–79 years, followed by a decline among participants aged 80 years and older. This pattern is consistent with findings in survey methodology indicating that survey participation generally increases with age but may decline again at very old ages, potentially due to increasing health-related or cognitive limitations (34, 35). Age-related differences in participation have therefore long been considered an important source of differential survey response, alongside contextual and fieldwork-related factors.

Differences were also observed by sex and educational attainment. Women showed slightly higher participation rates than men across all four sub-waves. However, previous research suggests that sex differences in survey participation are not consistent across survey designs and may depend on the mode of data collection. De Leeuw, for example, found mode-specific differences in the representation of men and women when comparing survey samples with register data (36). Such findings may also be relevant in the context of the mixed-mode design of the RKI Health Panel, although the present analyses do not allow mode-specific mechanisms underlying sex differences to be identified. Finally, the higher participation rates observed among participants with higher educational attainment are consistent with the well-established educational gradient in survey participation. This pattern is particularly relevant for panel surveys, as persistent differences in participation by educational attainment may contribute to selective changes in panel composition over time and should therefore be considered in weighting and interpretation.

4.3. Sample composition

Analyses of the sample composition of the first annual survey conducted in 2024 revealed no substantial deviations from the recruitment survey (22). This finding was expected, as the first annual survey took place in the same calendar year as panel recruitment, leaving limited opportunity for selective panel participation or attrition to affect the sample composition. In contrast, the 2025 annual survey was conducted approximately one year after recruitment, and by the fourth sub-wave nearly two years had elapsed since the initial recruitment. During this period, repeated non-participation as well as active and passive panel attrition could have led to changes in the sample composition of the panel. However, as shown by the attrition analyses, the combined effects of active and passive attrition on the sociodemographic composition of the remaining panel are limited. Consistent with this finding, the Duncan Index and standardized differences indicated that the distributions of most sociodemographic characteristics remain largely stable across the 2025 sub-waves. As in the 2024 annual survey, the largest deviations from the respective reference distributions were observed for educational attainment, German citizenship, and federal state.

The comparatively large deviations by federal state and German citizenship had already been observed in the recruitment sample and the 2024 annual survey. The reasons for the comparatively large deviations observed for federal state (oversampling of smaller federal states and additional samples in Berlin and Schleswig-Holstein) and German citizenship (hard-to-reach, lack of multilanguage questionnaire) are discussed in (1, 16, 22). No substantial changes in these characteristics were observed during the 2025 annual survey, suggesting that the sample composition remains stable over time and that the previously identified limitations did not become more pronounced.

Educational attainment is the most notable exception. Participants with lower educational attainment became increasingly underrepresented across successive sub-waves, whereas those with higher educational attainment became increasingly overrepresented. Consequently, differences by educational attainment are more pronounced in the 2025 annual survey than in 2024. In general, lower participation and higher attrition among individuals with lower educational attainment have been reported repeatedly in longitudinal surveys and other large-scale population-based studies (31, 32, 37).

A distinctive feature of the 2025 annual survey, however, is the comparatively pronounced decline in the proportion of participants with lower educational attainment between the first and second sub-wave. This pattern coincided with a change in the incentive scheme for PAPI participants who received vouchers in the annual survey 2025 instead of cash incentives in 2024. As shown by the response rate analyses, participation among PAPI panel members declines after this change from the second sub-wave onwards. Since older participants were more likely to choose the PAPI mode and lower educational attainment is more common in these age groups, the observed decline in the proportion of participants with lower educational attainment is plausibly explained by the reduced response among PAPI respondents following the change in incentives.

In contrast, educational attainment does not emerge as a particularly pronounced factor in the attrition analysis. This suggests that the increasing underrepresentation of lower-educated participants in the realized samples is more strongly related to non-participation in individual sub-waves than to attrition from the panel. Thus, panel members who did not participate following the change in incentives may nevertheless remain available for participation in subsequent sub-waves. Whether a return to cash incentives would increase participation among these panel members, however, cannot be determined from the present analysis and would require further investigation.

4.4. Drop-out analysis

The analyses of health-related characteristics indicate a gradual increase in selective participation over time. Similar patterns of health-related attrition have been reported in other longitudinal studies, where participants with poorer health are more likely to discontinue participation over time (38, 39).

Nevertheless, the observed deviations remain small for all analyzed health indicators and do not indicate substantial drop-out effects at the current stage of the panel. Furthermore, the weighting procedure, which incorporates information from both the recruitment survey and the 2024 annual survey, effectively reduces the observed deviations for nearly all health-related characteristics. These findings suggest that the current weighting strategy adequately compensates for the modest drop-out effects observed during the second annual survey.

As observed for the sociodemographic characteristics, a more pronounced increase in the Duncan index was found for several health-related parameters between the first and second sub-wave of the 2025 annual survey. This increase coincided with the decline in response rates among PAPI participants following the change in incentives from cash payments to vouchers. Because older participants were more likely to complete the survey in PAPI mode and poorer health is generally more prevalent among older adults, the reduced participation of PAPI respondents provides a plausible explanation for the observed increase in drop-out effects for several health-related characteristics. Although these effects remained comparatively small and were reduced by weighting, they should be considered when interpreting changes between the 2024 and 2025 annual surveys results.

A limitation is that the present analyses are restricted to health-related characteristics measured prior to the current survey wave. While this approach is appropriate for assessing selective attrition and participation, it cannot identify changes in participants' response behavior that may arise during continued panel participation, for example as a consequence of panel conditioning (40). Such effects are particularly relevant because they cannot be corrected by the weighting procedure, which relies on information collected before the current annual survey. On the other hand, for most participants the auxiliary information used for weighting was less than one year old. Consequently, any changes in response behavior between the most recent available information and the current survey are likely to be limited.

4.5. Integration of EHIS in the 2025 annual survey

A key challenge in evaluating long-term health trends in Germany stems from a series of methodological shifts across the recent European Health Interview Survey (EHIS) waves. While EHIS Wave 2 (2014/2015) relied on a self-administered mixed-mode design (online or paper-and-pencil), EHIS Wave 3 (2019/2020) was implemented as a computer-assisted telephone interview (CATI) survey within the GEDA framework. In 2025, with Wave 4 integrated into the newly established RKI Panel, the methodology transitions back to a self-administered mixed-mode design (online or paper-and-pencil) based on registry samples. These changes in the survey mode and sampling frame are likely to introduce mode effects that complicate the direct comparability of prevalence estimates over time. Methodological validation studies by the RKI indicate that data collection mode as well as sampling method significantly impacts sample composition and response behavior (41). Telephone surveys face increasing non-response bias, particularly among young adults, the elderly, and individuals with lower educational attainment. Conversely, the registry-based RKI Panel has proven more effective at capturing these hard-to-reach sub-populations.

However, this return to a self-administered approach also presents a distinct methodological advantage. While EHIS Wave 3 relied on interviewer-administered CATI, both EHIS Wave 2 (2014/2015) and Wave 4 (2025) relied on a comparable mixed-mode designs and similar sampling method. They therefore share a highly consistent methodological framework. Consequently, direct comparisons with Waves 3 and 4 should be interpreted with caution, whereas comparisons of long-term trends and health prevalence between Waves 2 and 4 may provide a more robust basis for longitudinal analysis.

Beyond national trend analyses, the EHIS permits comparing observed prevalence and time trends in health status, health determinants and health care indicators across countries at the European level and provides a vital, legally grounded foundation for evidence-based public health action. The standardized nature of the data allows German healthcare policymakers to benchmark national health outcomes directly against European peers.

5. Conclusion and Outlook

The 2025 annual survey demonstrates that the RKI Health Panel continues to provide a stable basis for population-based health monitoring, while also highlighting methodological challenges associated with a maturing panel. Participation rates varied more strongly across sub-waves than in 2024, with fluctuations closely related to methodological changes, particularly the incentive scheme and panel maintenance procedure.

Although selective participation and attrition were observed for some characteristics, their overall impact on the composition of the panel remained limited. Most sociodemographic and health-related characteristics remained largely stable across sub-waves and observed selection effects were substantially reduced by weighting. Educational attainment represented the most notable exception, with an increasing underrepresentation of participants with lower educational attainment.

The implementation of EHIS Wave 4 within the 2025 annual survey enables the continuation of European health monitoring using the RKI Health Panel. When comparing EHIS results over time, however, changes in sampling and data collection procedures between EHIS waves need to be considered, as differences in study design may affect the comparability of estimates.

Overall, the findings underline the importance of continuously monitoring participation, attrition, and sample composition and of applying appropriate weighting procedures as the panel matures. They also emphasize the importance of maintaining consistency in study design and fieldwork procedures over time. Changes to established procedures should be carefully considered, as methodological modifications may have unintended effects on participation and sample composition and consequently affect the comparability of results across survey waves.

The upcoming survey years will provide important opportunities to further evaluate the methodological processes identified in 2025. In the 2026 annual survey, cash incentives will be reintroduced for PAPI participants. This change will allow the panel to assess whether participation among PAPI participants and population groups with comparatively low participation rates in 2025 increases again after returning from voucher-based to cash incentives. At the same time, this change represents a methodological discontinuity. Differences in participation rates, sample composition, or health estimates between the 2025 and 2026 annual surveys should therefore be interpreted considering the change in the incentive scheme and should not automatically be attributed to substantive changes in the population.

A further important development will be the planned reactivation of panel members who were removed due to passive attrition. Recontacting and re-motivating these former panel members will provide an opportunity to assess whether prolonged non-participation represents permanent panel loss or, in some cases, temporary disengagement. The reactivation study may also help to reduce cumulative panel attrition and provide further insight into the characteristics and participation behavior of panel members who become inactive over time.

A refresher sample of approximately 10,000 participants will additionally be recruited in 2026 and integrated into the panel in 2027. In addition to compensating for cumulative attrition and potential changes in panel composition, this new recruitment cohort will provide an important reference for evaluating the established panel population. The recruitment will also include an experiment with multilingual survey materials to examine whether providing additional language options can improve participation among people with a history of migration. From 2027 onwards, health indicators and response patterns of newly recruited participants can be compared with those of long-term panel members who have participated repeatedly since the initial recruitment. These comparisons will provide an opportunity to assess the cumulative effects of selective participation and attrition as well as potential changes in response behavior associated with repeated panel participation.

Together, continuous monitoring, appropriate weighting, adaptations to fieldwork procedures, and periodic refresher recruitment will be central to maintaining the long-term analytical value of the RKI Health Panel. The reintroduction of cash incentives, the multilingual recruitment experiment, and the recruitment of a new panel cohort, will provide important opportunities to address limitations identified in the current panel and to further improve its coverage and representativeness as the panel matures.

Abbreviations

RKI
Robert Koch Institute
EHIS
European Health Interview Survey
CAWI
Computer-Assisted Web Interviewing
PAPI
Paper and Pencil Interviewing
AAPOR
American Association for Public Opinion Research
RR2
Response Rate 2
EMA
Residents’ registration offices (“Einwohnermeldeämter”)
PSU
Primary sampling unit
Q-SD
Sociodemographic questionnaire
CUMRR2
Cumulative response rate
BMI

Body mass index
SOEP
German Socio-Economic Panel
CATI
Computer-Assisted Telephone Interviewing

Declarations

Ethics approval and consent to participate

Individuals invited to participate in the study were required to provide informed consent prior to participation. Participation in the study was not possible without an informed consent form. The data protection officer of the Robert Koch Institute examined the data protection conformity of the study and approved the implementation of the study on the basis of a positive assessment. The ethics committee of the Berlin Medical Association (in German: “Berliner Ärztekammer”) examined the ethical requirements in accordance with the current version of the Declaration of Helsinki, assessed them positively and consequently approved the conduct of the study (application number: Eth-SB-24-077).

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Funding

The study was fully funded by the German Federal Ministry of Health (BMG).

Author Contribution

JL, JA, IÖ, and SD jointly developed the study design. JL, JA, and IÖ coordinated and monitored the implementation of the study in collaboration with the infas Institute for Applied Social Science. JA drafted the section on the integration of EHIS. JL and IÖ calculated the response rates. JL, IÖ, and SD conducted the analyses and drafted the sections on panel attrition. SD conducted the analyses and drafted the sections on weighting, sample composition, and drop-out analysis. The Discussion section was drafted by SD and IÖ and reviewed by JA and JL.

Acknowledgement

We would like to thank all colleagues who contributed to the planning, implementation, and continued development of the ‘Health in Germany’ panel. In particular, we thank the teams at the Robert Koch Institute involved in project coordination, data curation, communication, and digital infrastructure (Team Online). We also gratefully acknowledge the collaboration with infas GmbH and their support in conducting the fieldwork. Finally, we sincerely thank all study participants for their time, commitment, and continued contribution to the ‘Health in Germany’ panel.

Data Availability

The data from surveys conducted by the Robert Koch Institute is available free of charge to use by the scientific community as Scientific Use Files. Each Scientific Use File is comprised of the respective data record along with documentation and a description of the study, sample survey documents, code plan and user instructions. The data records can be obtained by submitting an application form through the Research Data Centre (Robert Koch Institute, MF4), which can be accessed at www.rki.de/fdz. Access to EHIS microdata is restricted to recognized research entities and requires the submission of a research proposal to Eurostat in accordance with established access procedures.

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Appendix

A.1: Timing of Invitations and Reminders Across the Four Sub-Waves of the 2025 Annual Survey

Sub-wave 1/Q1	**Invitations from 13 January 2025; first reminder from 28 January 2025; second reminder from 18 February 2025** **End date: 10 March 2025**
Sub-wave 2/Q2	Invitations from 9 April 2025; first reminder from 28 April 2025; second reminder from 20 May 2025 End date: 15 June 2025
Sub-wave 3/Q3	Invitations from 7 July 2025; first reminder from 28 July 2025; second reminder from 18 August 2025 End date: 1 September 2025
Sub-wave 4/Q4	Invitations from 13 October 2025; first reminder from 27 October 2025; second reminder from 17 November 2025 End date: 14 December 2025

A.2: Final AAPOR Disposition Codes in Panel Sub-Wave 1, 2025

1.0 Returned questionnaire	**Freq.**	**Percent**	**Cum.**
1.1 Interview	35570	73.01	73.01
1.2 Interview - Partial	206	0.42	73.43
2.0 Eligible, non-interview			
2.2 Eligible, non-Interview - Non-contact	11858	24.34	97.77
2.3 Eligible, non-Interview - Other	78	0.16	97.93
2.11 Eligible, non-Interview - Refusal	126	0.26	98.18
2.31 Deceased respondent	33	0.07	98.25
2.32 Eligible, non-Interview - Other	4	0.01	98.26
2.36 Someone other than respondent completes questionnaire or interview and later determined ineligible (eligibility status of actual respondent must be known)	218	0.45	98.71
2.90 Identitätsabgleich nicht durchführbar	328	0.67	99.38
2.112 Eligible, non-Interview - Refusal	297	0.61	99.99
4.0 Not eligible, returned			
4.1 Not eligible	4	0.01	100.00
Total	48722	100.00	100.00

A.3: Final AAPOR Disposition Codes in Panel Sub-Wave 2, 2025

1.0 Returned questionnaire	Freq.	Percent	Cum.
1.1 Interview	32996	67.20	67.20
1.2 Interview - Partial	194	0.40	67.60
2.0 Eligible, non-interview			
2.2 Eligible, non-Interview - Non-contact	14923	30.39	97.99
2.3 Eligible, non-Interview - Other	32	0.07	98.05
2.11 Eligible, non-Interview - Refusal	130	0.26	98.32
2.31 Deceased respondent	30	0.06	98.38
2.32 Eligible, non-Interview - Other	8	0.02	98.40
2.36 Someone other than respondent completes questionnaire or interview and later determined ineligible (eligibility status of actual respondent must be known)	170	0.35	98.74
2.90 Identitätsabgleich nicht durchführbar	265	0.54	99.28
2.112 Eligible, non-Interview - Refusal	352	0.72	100.00
Total	49100	100.00	100.00

A.4: Final AAPOR Disposition Codes in Panel Sub-Wave 3, 2025

1.0 Returned questionnaire	Freq.	Percent	Cum.
1.1 Interview	32301	66.52	66.52
1.2 Interview - Partial	203	0.42	66.94
2.0 Eligible, non-interview			
2.2 Eligible, non-Interview - Non-contact	15034	30.96	97.90
2.3 Eligible, non-Interview - Other	61	0.13	98.03
2.11 Eligible, non-Interview - Refusal	145	0.30	98.33
2.31 Deceased respondent	41	0.08	98.41
2.32 Eligible, non-Interview - Other	5	0.01	98.42
2.36 Someone other than respondent completes questionnaire or interview and later determined ineligible (eligibility status of actual respondent must be known)	168	0.35	98.77
2.90 Identitätsabgleich nicht durchführbar	240	0.49	99.26
2.112 Eligible, non-Interview - Refusal	357	0.74	100.00
4.0 Not eligible, returned			
4.1 Not eligible	2	0.00	100.00
Total	48557	100.00	100.00

A.5: Final AAPOR Disposition Codes in Panel Sub-Wave 4, 2025

1.0 Returned questionnaire	Freq.	Percent	Cum.
1.1 Interview	30920	75.50	75.50
1.2 Interview - Partial	179	0.44	75.93
2.0 Eligible, non-interview			
2.2 Eligible, non-Interview - Non-contact	9108	22.24	98.17
2.3 Eligible, non-Interview - Other	9	0.02	98.20
2.11 Eligible, non-Interview - Refusal	134	0.33	98.53
2.31 Deceased respondent	29	0.07	98.60
2.32 Eligible, non-Interview - Other	5	0.01	98.61
2.36 Someone other than respondent completes questionnaire or interview and later determined ineligible (eligibility status of actual respondent must be known)	152	0.37	98.98
2.90 Identitätsabgleich nicht durchführbar	207	0.51	99.48
2.112 Eligible, non-Interview - Refusal	211	0.52	100.00
4.0 Not eligible, returned			
4.1 Not eligible	1	0.00	100.00
Total	40955	100.00	100.00

A.6: Logistic regression results for active panel attrition and predicted probabilities by survey mode

Characteristic	Logistic regression estimates			Model-based predicted probabilities by survey mode	
	OR [95% CI]	p-value	Global p-value	Offline [95% CI]	Online [95% CI]
Age Group			< 0.001		
15–29 years	Ref.			2.3% [1.2–4.5%]	1.2% [1.0–1.4%]
30–39 years	0.42 [0.11–1.33]	0.155		1.0% [0.4–2.6%]	0.9% [0.7–1.2%]
40–49 years	1.13 [0.46–2.90]	0.797		2.6% [1.5–4.5%]	1.0% [0.8–1.3%]
50–59 years	1.75 [0.85–4.07]	0.158		3.9% [2.9–5.4%]	1.3% [1.0–1.6%]
60–69 years	3.39 [1.74–7.62]	0.001		7.4% [6.1–8.8%]	1.3% [1.0–1.6%]
70–79 years	4.71 [2.48–10.43]	< 0.001		10.0% [9.0–11.0%]	2.6% [2.0–3.3%]
80 + years	6.44 [3.40–14.27]	< 0.001		13.2% [12.1–14.3%]	4.1% [3.0–5.8%]
Survey Mode			0.099		
PAPI	Ref.				
CAWI	0.51 [0.26–1.15]	0.071			
Sex			0.005		
Male	Ref.			4.6% [3.7–5.6%]	1.7% [1.5–1.8%]
Female	0.86 [0.77–0.95]	0.005		3.9% [3.2–4.8%]	1.4% [1.3–1.6%]
Age Group * Survey Mode			< 0.001		
30–39 years * CAWI	1.89 [0.57–7.36]	0.317			
40–49 years * CAWI	0.76 [0.28–1.97]	0.583			
50–59 years * CAWI	0.61 [0.25–1.33]	0.237			
60–69 years * CAWI	0.32 [0.13–0.65]	0.004			
70–79 years * CAWI	0.47 [0.20–0.97]	0.057			
80 + years * CAWI	0.56 [0.23–1.19]	0.158			

Note: OR = odds ratio; CI = confidence interval. ORs are derived from the logistic regression model and are reported relative to the indicated reference categories. Global p-values are based on Type III Wald tests and assess the overall association of each predictor, including the age group × survey mode interaction, to the model. Predicted probabilities were derived from the fitted logistic regression model, averaged over the remaining covariates, and are presented separately by survey mode (offline and online).

Figures

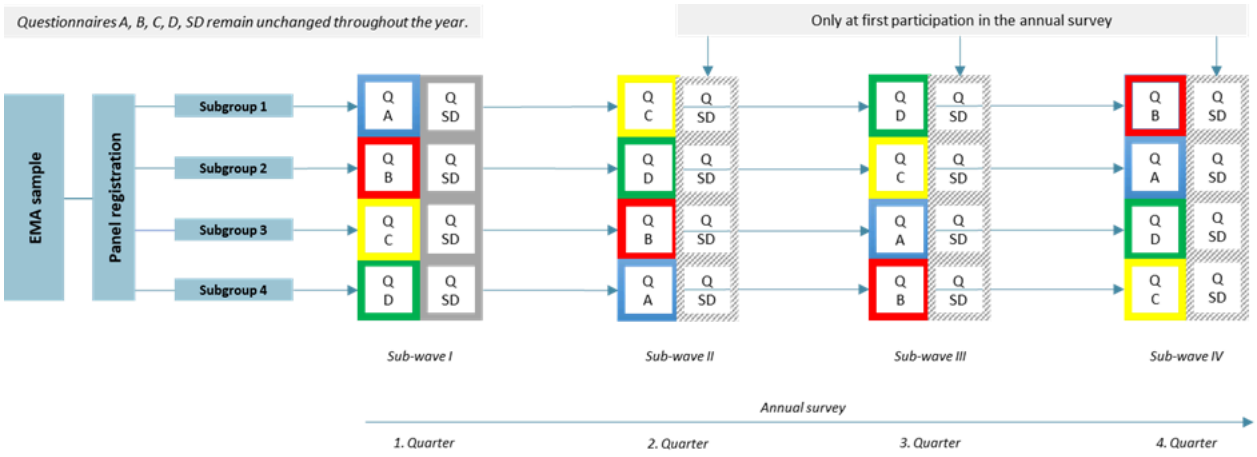


Figure 1

Wave design of the 2025 annual survey of the Panel Health in Germany

EMA = Residents' Registration Office, Q = Questionnaire

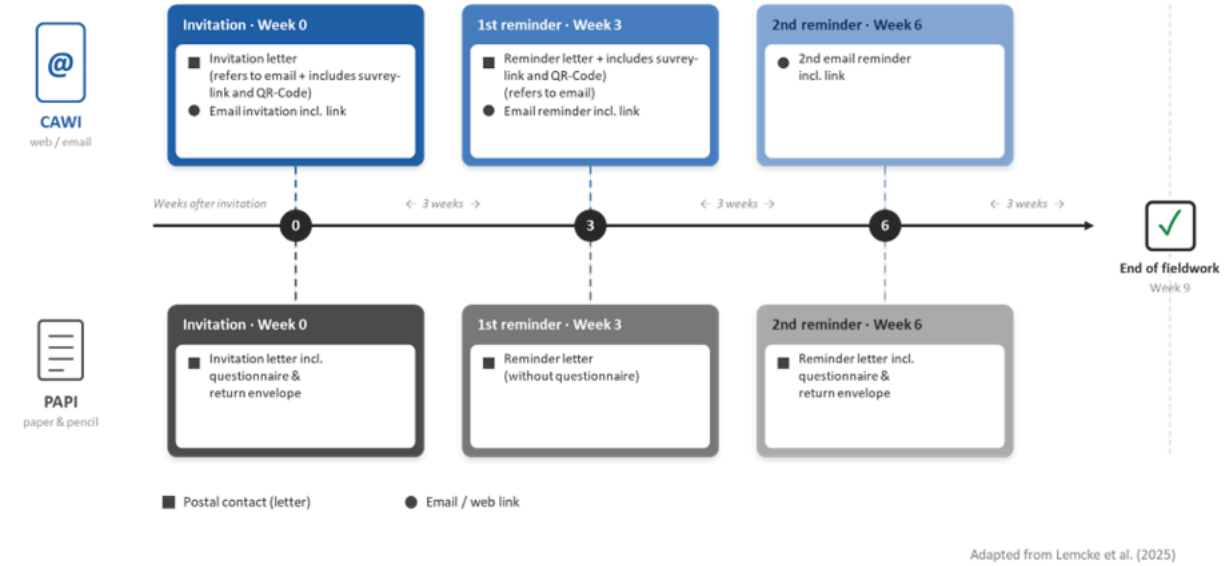


Figure 2

Sub-wave fieldwork timeline by survey mode in the 2025 annual survey

CAWI = Computer Assisted Web Interview, PAPI = Paper and Pencil Interview

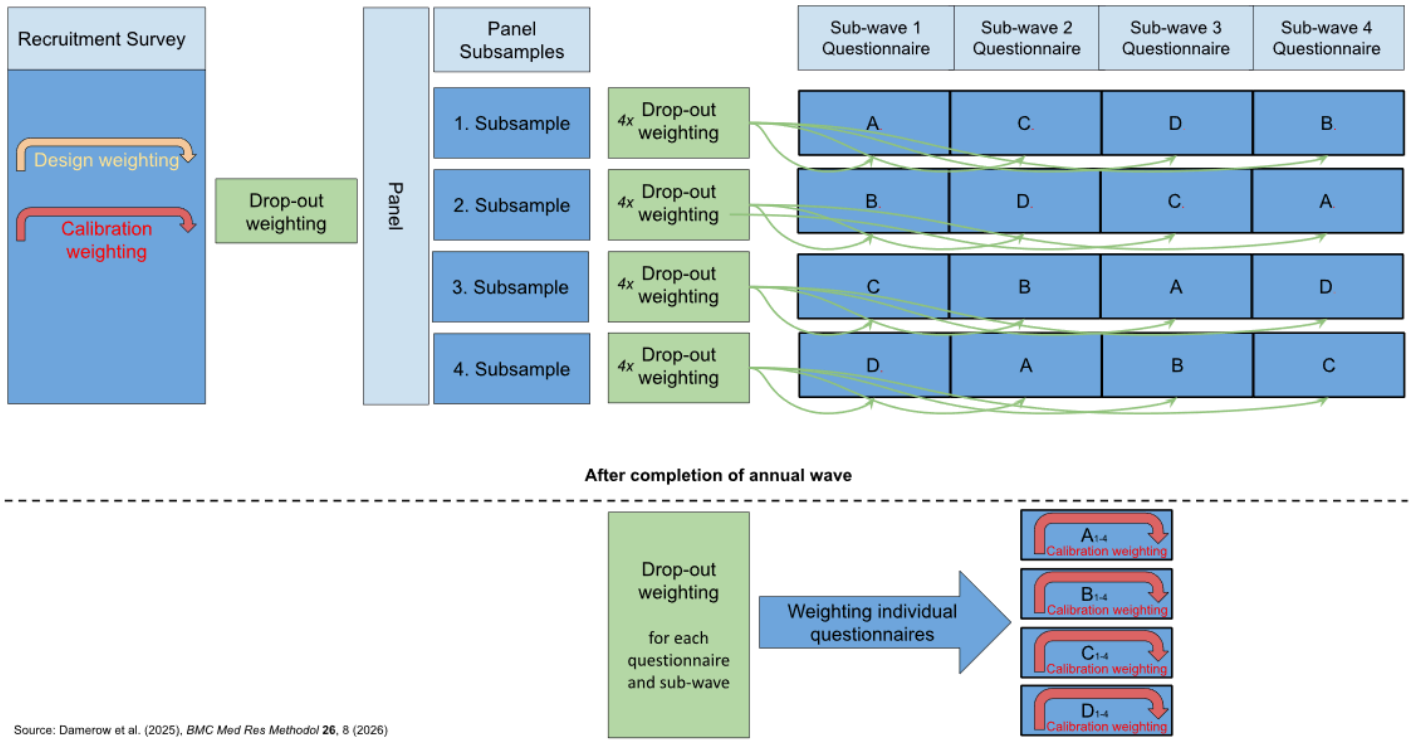


Figure 3

Weighting scheme for the 2025 annual survey of the RKI Panel

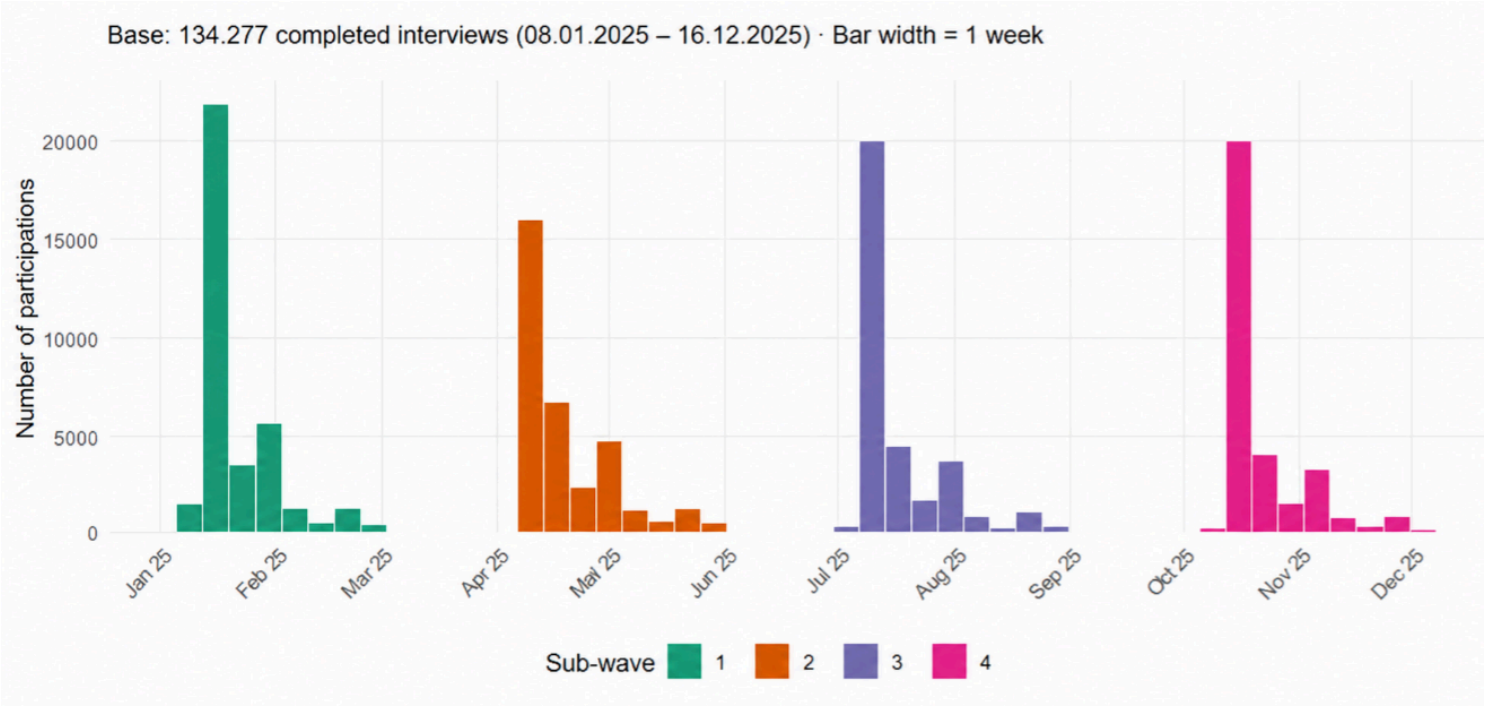


Figure 4

Timing of participation across the four sub-waves of the 2025 annual survey

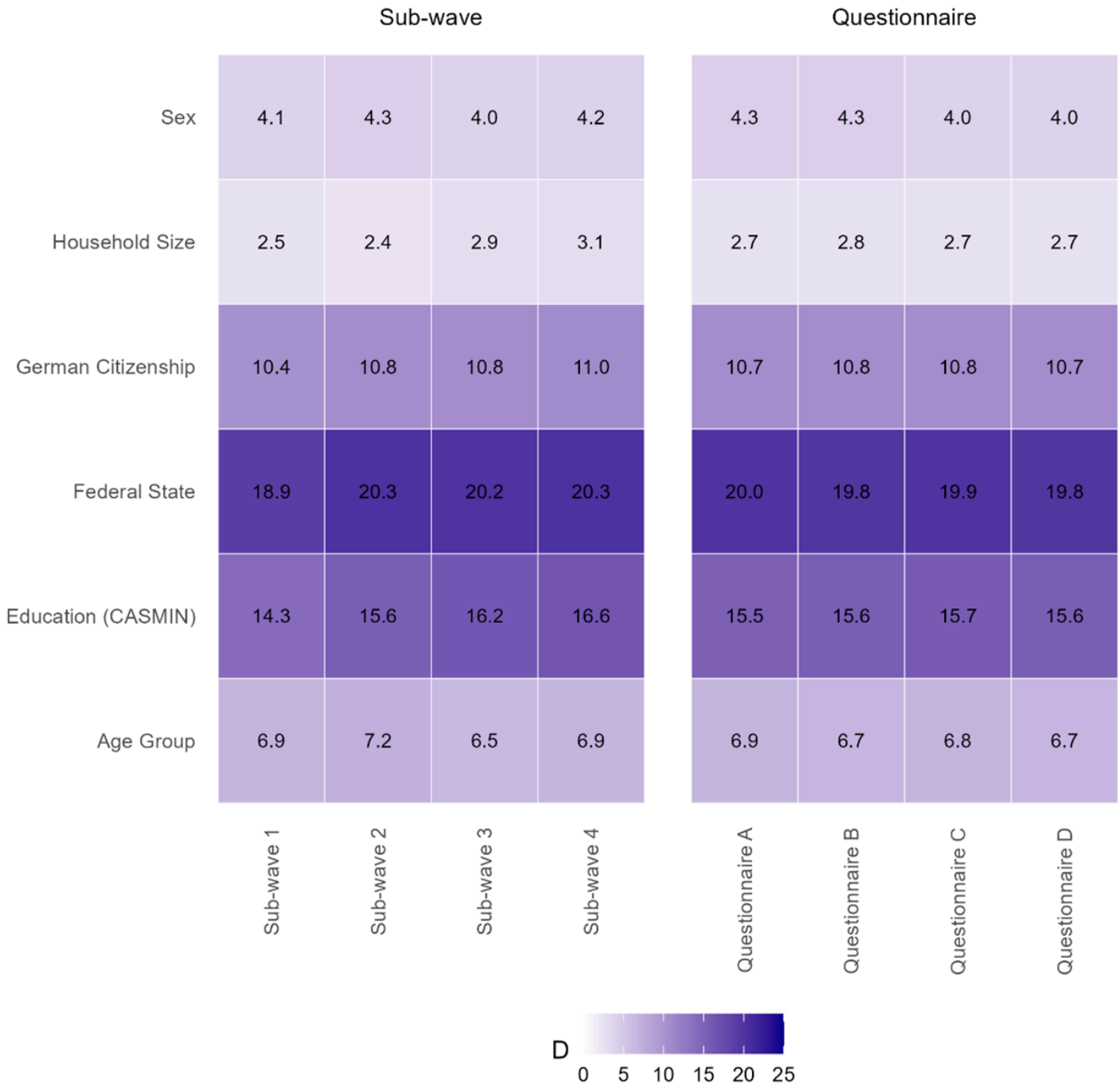


Figure 5

Duncan Dissimilarity Indices for selected sociodemographic characteristics by sub-wave and questionnaire.

Note: Education levels are based on the CASMIN classification (Comparative Analysis of Social Mobility in Industrial Nations (18)). Reference values for education and household size are based on the 2022 Microcensus (20). Reference values for age, sex, federal state, and German citizenship are based on population figures as of 31 December 2024 (19).

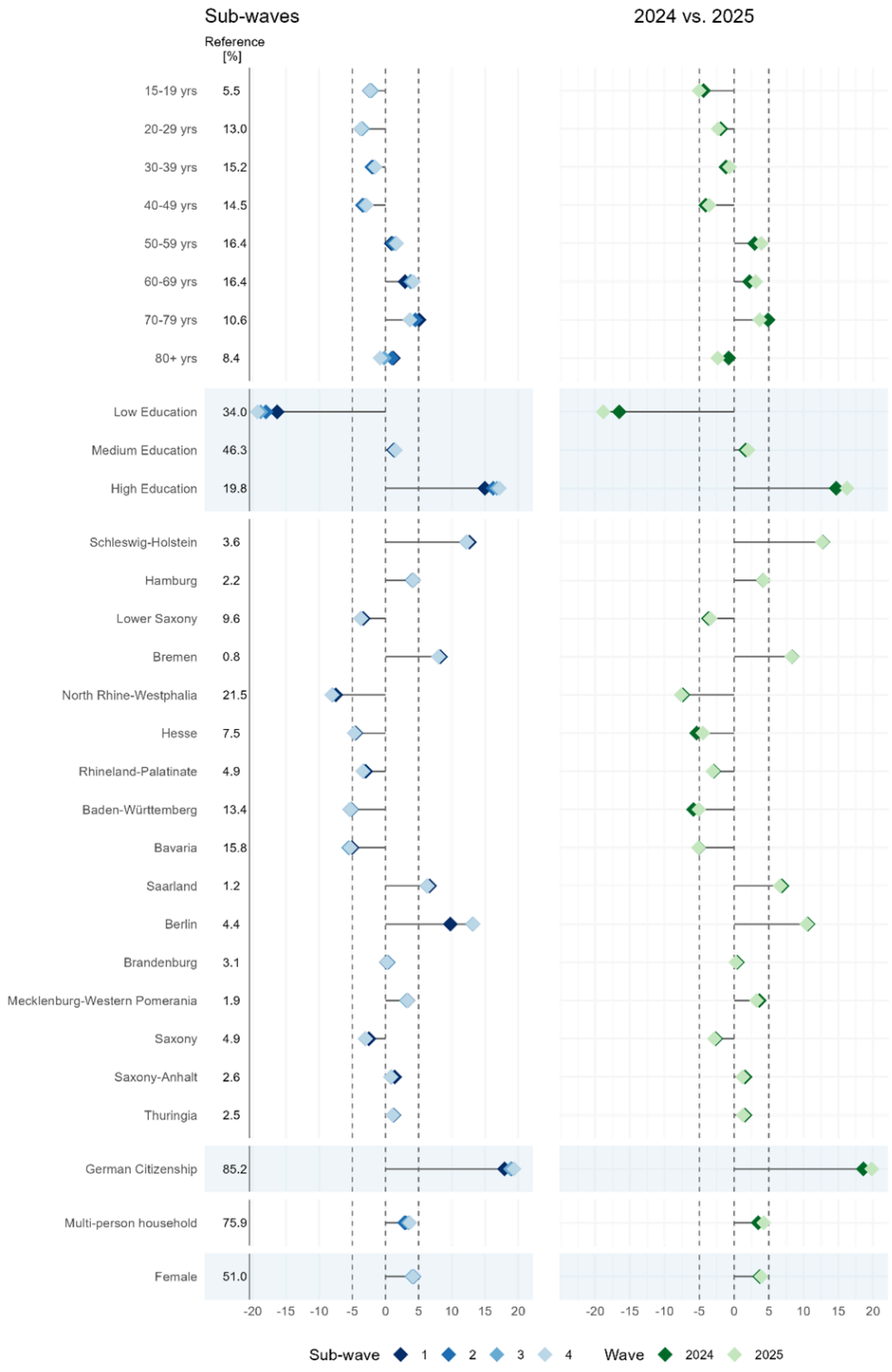


Figure 6

Standardized differences for selected sociodemographic characteristics by sub-wave and annual survey (2024 and 2025).

Note: Education levels are based on the CASMIN classification (Comparative Analysis of Social Mobility in Industrial Nations (18)). Reference values for education and household size are based on the 2022 microcensus (20). Reference values for age, sex, federal state, and German citizenship are based on population figures as of 31 December 2024 (19).

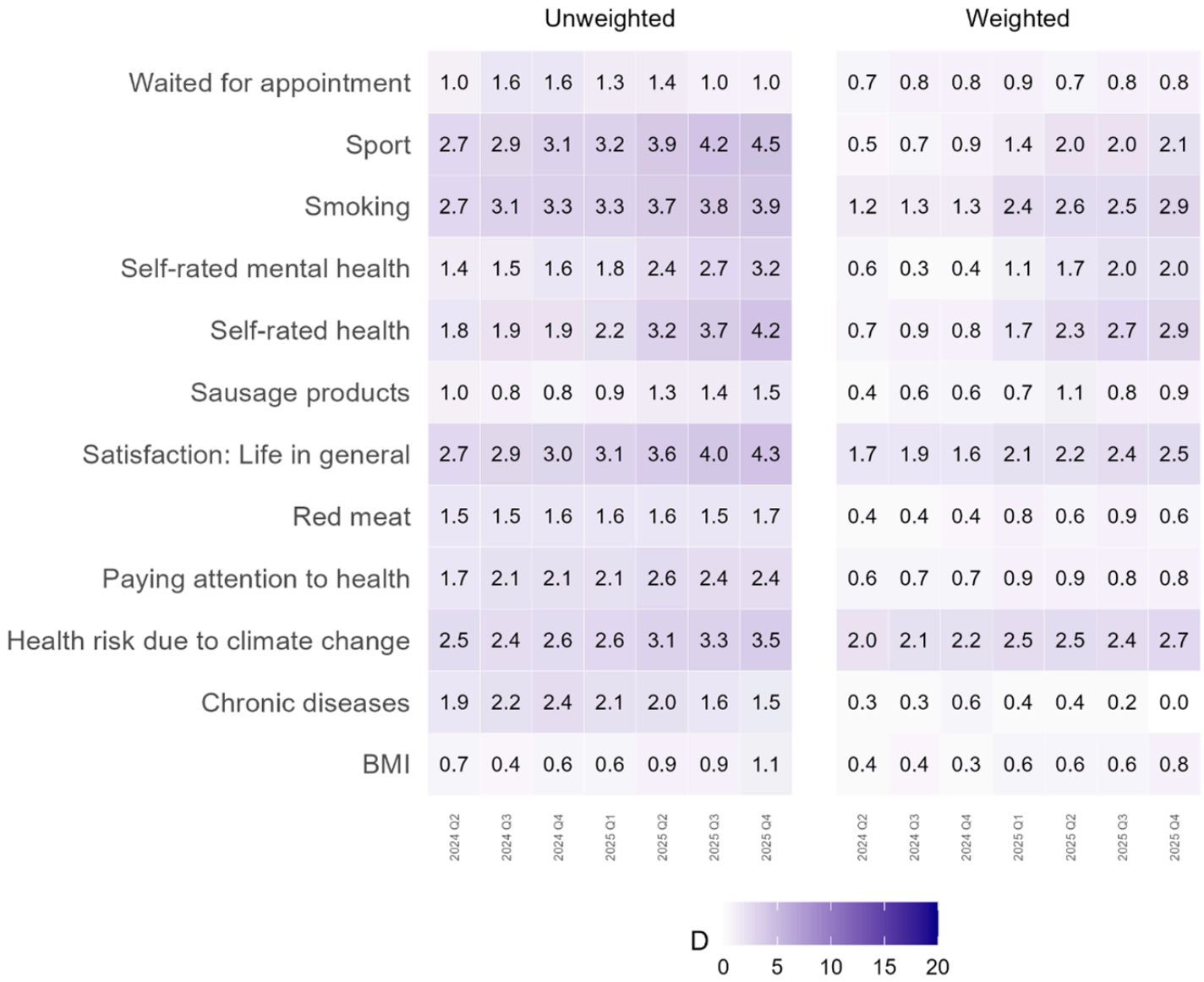


Figure 7

Duncan Dissimilarity Indices for selected health-related characteristics by sub-waves, shown for unweighted and weighted data.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- AdditionalFile1.html