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New data for action. Data collection for KiGGS Wave 2 has been completed

Abstract

The fieldwork of the second follow-up to the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) was completed in August 2017. KiGGS is part of the Robert Koch Institute's Federal Health Monitoring. The study consists of the KiGGS cross-sectional component (a nationally representative, periodic cross-sectional survey of children and adolescents aged between 0 and 17) and the KiGGS cohort (the follow-up into adulthood of participants who took part in the KiGGS baseline study). KiGGS collects data on health status, health-related behaviour, psychosocial risk and protective factors, health care and the living conditions of children and adolescents in Germany.

The first interview and examination survey (the KiGGS baseline study; undertaken between 2003 and 2006; n=17,641; age range: 0-17) was carried out in a total of 167 sample points in Germany. Physical examinations, laboratory analyses of blood and urine samples and various physical tests were conducted with the participants and, in addition, all parents and participants aged 11 or above were interviewed.

The first follow-up was conducted via telephone-based interviews (KiGGS Wave 1 2009-2012; n=11,992; age range: 6-24) and an additional sample was included (n=4,455; age range: 0-6). KiGGS Wave 2 (2014-2017) was conducted as an interview and examination survey and consisted of a new, nationwide, representative cross-sectional sample of 0- to 17-year-old children and adolescents in Germany, and the second KiGGS cohort follow-up.

The completion of the cross-sectional component of KiGGS Wave 2 means that the health of children and adolescents in Germany can now be assessed using representative data gained from three study waves. Trends can therefore be analysed over a period stretching to over ten years now.

As the data collected from participants of the KiGGS cohort can be individually linked across the various surveys, in-depth analyses can be conducted for a period ranging from childhood to young adulthood and developmental processes associated with physical and mental health and the associated risk and protective factors can be explored. As such, KiGGS Wave 2 expands the resources available to health reporting, as well as policy planning and research, with regard to assessing the health of children and adolescents in Germany.

📍 CHILDREN AND ADOLESCENTS · GERMANY · HEALTH MONITORING · KIGGS · COHORT



**Studie zur Gesundheit von Kindern
und Jugendlichen in Deutschland**

KiGGS Wave 2

Second follow-up to the German Health Interview and Examination Survey for Children and Adolescents

Data owner: Robert Koch Institute

Aim: Providing reliable information on health status, health-related behaviour, living conditions, protective and risk factors, and health care among children, adolescents and young adults living in Germany, with the possibility of trend and longitudinal analyses.

Study design: Combined cross-sectional and cohort study conducted as an examination and interview survey

KiGGS cross-sectional study

Population: Children and adolescents with permanent residence in Germany

Sampling: Samples from official residency registries - randomly selected children and adolescents from the 167 cities and municipalities covered by the KiGGS baseline study

Age range: 0-17 years

Sample size: Approximately 15,000 participants

KiGGS cohort study

Sampling: Re-invitation of everyone who took part in the KiGGS baseline study (2003-2006; aged between 0 and 17 at that time) and who was willing to participate in a follow-up

Age range: 10-29 years

Sample size: Approximately 10,000 follow-up participants

Survey period: September 2014-August 2017

Modules: BELLA, EsKiMo, GerES, KiESEL, MoMo

More information is available at www.kiggs-studie.de/english

1. Background and objective

Health monitoring was established at the Robert Koch Institute (RKI) in 2008 [1, 2] to continuously monitor the health of the population living in Germany from birth to old age. Data is regularly collected for various age groups on physical and mental health, psychosocial risk and protective factors, health-related behaviour and health care as well as on health-related living conditions. The German Health Interview and Examination Survey for Children and Adolescents (KiGGS) is the key source of data for assessing the health of the next generation [3, 4].

KiGGS involves the regular completion of cross-sectional surveys that are representative for the children and adolescents living in Germany. At the same time, the participants of the KiGGS baseline study are also observed into adulthood as part of the KiGGS cohort. The regular collection of representative cross-sectional data enables estimates to be made of frequency (prevalence) rates for indicators of the health status of children and adolescents living in Germany who are aged between 0 and 17. The KiGGS study also provides the opportunity to analyse trends over time and links between various aspects, such as risk factors and medical conditions. Furthermore, data from the KiGGS cohort can be individually linked and therefore used to map health developments over the course of a person's life and to analyse possible influencing factors. The transitional phases that occur within a person's younger life – such as between childhood and adolescence and between adolescence and young adulthood – are par-

ticularly interesting in this regard, as are the possible causes and conditions that lead to changes in health.

The KiGGS data reflect differences in the health status and health-related behaviour of groups of children and adolescents. Particular focus is placed on vulnerable groups in order to ensure that the results can be used to improve health equity [5]. Moreover, the findings are integrated into policy advice provided within the Federal Health Reporting, are published in scientific publications, and are made available to researchers as public use files, which can be requested at the Robert Koch Institute for scientific and non-commercial use.

The first KiGGS study was carried out between 2003 and 2006 as a combined examination and interview survey (the KiGGS baseline study) as a consequence of the previously scarce and heterogeneous data on the health of children and adolescents in Germany. It resulted in data being collected from 17,641 children and adolescents aged between 0 and 17 at 167 sample points in Germany (participation rate: 66.6%) [6]. In a new approach, children from families with a migration background were included. In order to do so, a number of different measures were taken. The aim was to reflect the migrants' distribution within the German population [7, 8]. KiGGS was initiated as a cross-sectional study and its breadth and depth remain unique in Germany. As a result of this study, many questions about the health of children and adolescents were able to be answered for the first time and new hypotheses could be developed. The first telephone-based follow-up survey (KiGGS Wave 1) was undertaken between 2009 and 2012 with a reduced and partly modified range of indicators on health

KiGGS is conducted within the Health Monitoring system at the Robert Koch Institute; it is the key source of nationwide data on the health of children and adolescents in Germany.

status and health-related behaviour [9, 10]. KiGGS Wave 1 combined a cross-sectional and longitudinal design [9]. Girls and boys who had taken part in the baseline survey and who had stated that they were willing to take part in a follow-up (they were now aged between 6 and 24) were invited to participate again (first follow-up of the KiGGS cohort: $n=11,992$; participation rate: 68.5%). In addition, follow-up participants aged between 7 and 17 were also incorporated into the cross-sectional sample ($n=7,913$; participation rate: 72.9%). Furthermore, a new sample covering 0-to 6-year-olds, which was drawn from official population registers from the KiGGS baseline sample points ($n=4,455$; participation rate: 38.8%), supplemented this population. In order to be able to provide representative conclusions from this combined cross-sectional sample, weighting factors were employed to account for the varying readiness to participate in the study and to ensure that the data reflect the current structure of the population in Germany [9].

Data collection for the second follow-up survey (KiGGS Wave 2) was carried out between September 2014 and August 2017. This article describes the study design, sample, survey methods as well as the study's content and the opportunities opened up by KiGGS Wave 2 for further analysis.

2. Methodology

2.1 Study design and sampling

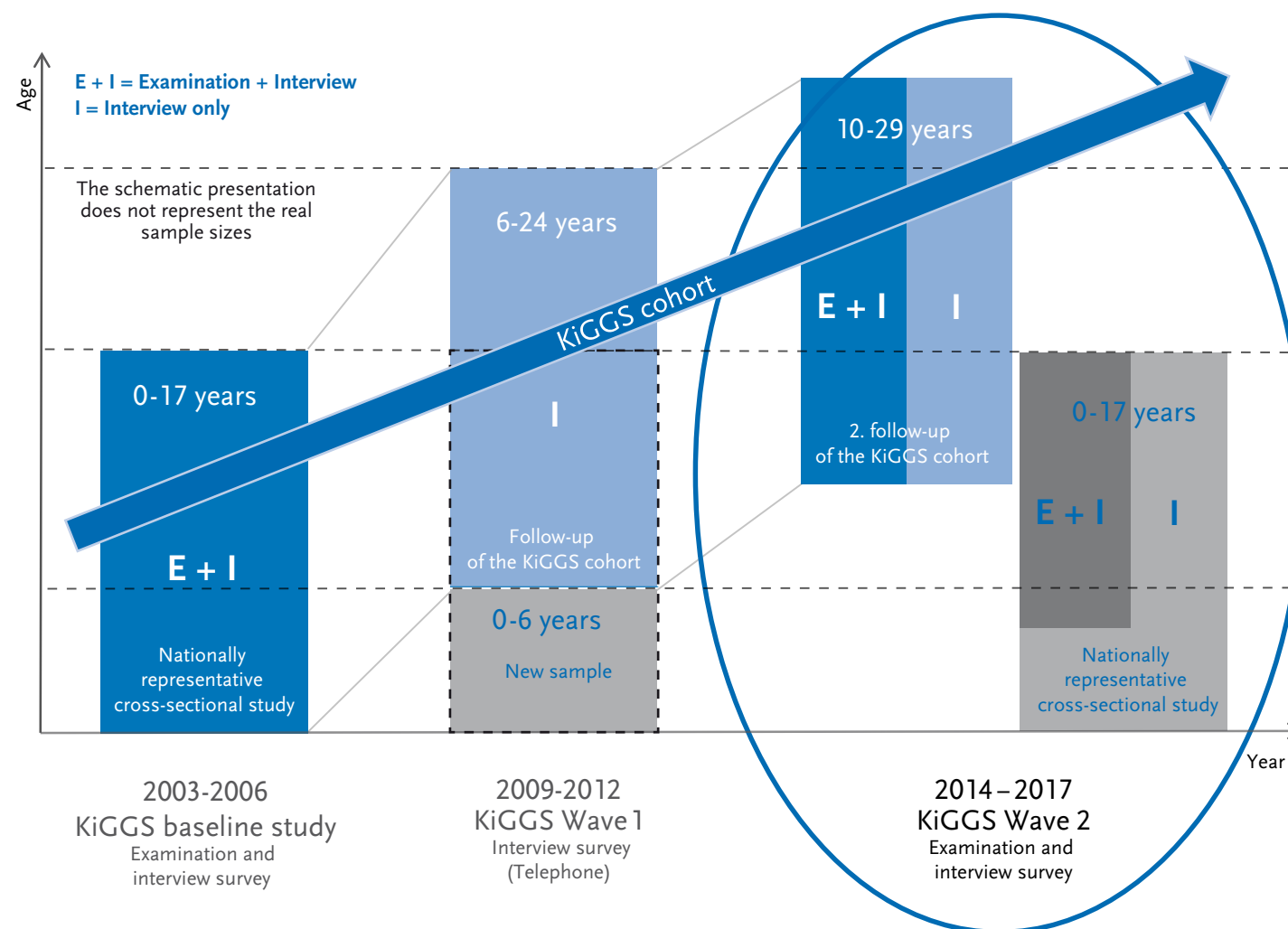
Two studies were combined within the framework provided by KiGGS Wave 2: 1) a nationwide representative cross-sectional study of 0 to 17-year-old children and

adolescents living in Germany; and, 2) the second follow-up of the KiGGS cohort. In line with the KiGGS baseline study, KiGGS Wave 2 was carried out as a combined examination and interview survey. Whereas questionnaires were sent to all participants, examinations were only carried out for a subpopulation (Figure 1).

In order to be able to provide up-to-date prevalence estimates among children and adolescents aged between 0 and 17 with a primary residency in Germany, a new sample, stratified for age was requested [11]. It was sourced from addresses held by the official population registers located in the 167 sample points of the baseline study. A randomly allocated subsample of 3-to 17-year-olds was invited to an examination and interview, a further subsample of 0-to 17-year-olds was invited to fill in a questionnaire only.

All participants of the KiGGS baseline study were invited to take part in the follow-up of the KiGGS cohort, irrespective of whether they had participated in KiGGS Wave 1. However, only participants who had stated that they were willing to be interviewed again, who could be located, and still lived in the original sample point were invited to an examination and interview for KiGGS Wave 2. Potential follow-up participants who had moved away from the original sample point were invited to an interview only. People who did not wish to or could not participate in the examination were asked to fill in the questionnaire. Participants aged 18 or above who had not yet participated by mid-May 2017, were contacted again and given the opportunity to take part in an online interview.

Figure 1
The design of the KiGGS study
Own diagram



2.2 Assessment methods and testing instruments

In order to conduct examinations for the study, three study teams working in parallel visited 167 sample points (Figure 2). The teams constructed temporary examina-

tion centres in rented rooms. In the temporary examination centre, the teams brought and built up their equipment. Each team consisted of a physician, two examiners and an assistant at the reception. The team started by providing information to parents and participants about

the study's context and content, data protection and the individual scope of the examination. All examinations were carried out by trained staff after written informed consent had been provided and as long as there were no reasons for exclusion or contraindications.

The examination routine varied depending on age and whether the participant belonged to the cohort or the cross-sectional study (Table 1). Various examinations and tests were carried out, which are described more

detailed later in this article. A computer-assisted medical interview was used to ask questions about physician-diagnosed conditions. An interview was also conducted on the use of medication to gather data on the (prescribed) medicines and food supplements that had been taken over the last 7 days preceding the interview. The participants brought their medication with them and the central pharmaceutical number on the packaging was scanned and recorded using the AmEDa drug identification database [12]. The vaccination records, which the participants also brought with them, were copied so that the information they contained could be entered into a database at a later date. Blood and urine samples were collected and analysed and serum and urine samples were stored for analysis at a later time only if further informed consent had been provided to do so. An overview of the laboratory parameters that were analysed can be found in Table 2.

KiGGS Wave 2 employed written, paper-based, age-adjusted questionnaires on health and nutrition. These were provided to the parents, children, adolescents and young adults (Table 1). The parents of participants aged between 0 and 17 were asked to complete an age-adjusted questionnaire on health, and a questionnaire on nutrition for participants aged between 3 and 10 years of age. From the age of 11, the children, adolescents or young adults themselves filled out age-specific variants of a health questionnaire and a questionnaire on nutrition. A small number of cohort participants were 10 years old during the invitation process. These participants were treated in the same manner as 11 year olds. The content of the medical interview was integrated into the

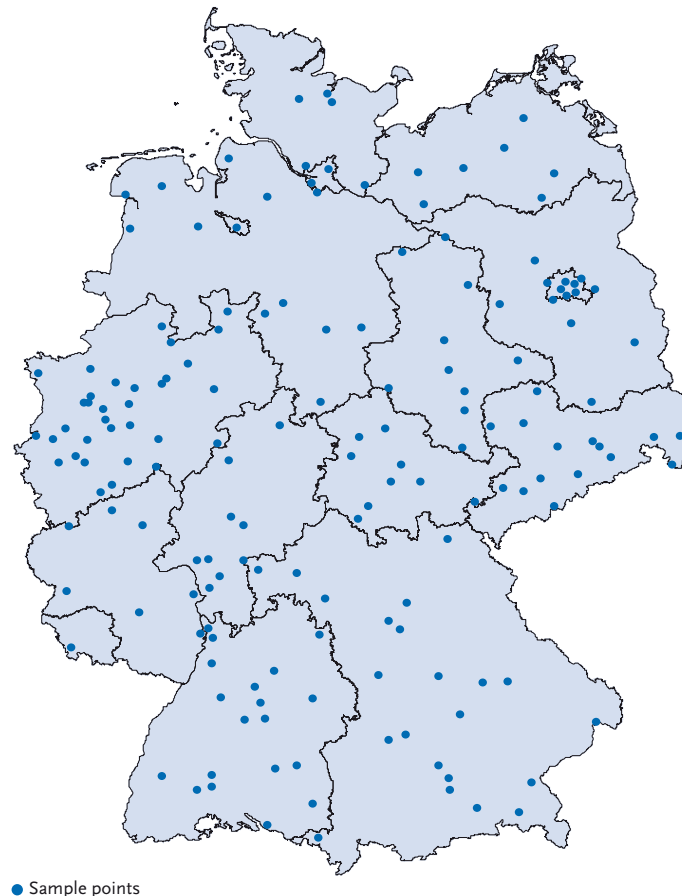


Figure 2
Sample points of KiGGS Wave 2
Source: RKI

Table 1
Survey methods of KiGGS Wave 2

	Cross-sectional study			Cohort study	
	0-2 years	3-10 years	11-17 years	10-17 years	18-29 years
Examination component					
Measurement of height, weight and waist	No examination	X	X	X	X
Bioimpedance measurement			14-17	14-17	X
Ultrasound examination of carotid artery intima media thickness (CIMT)				14-17	X
Measurement of resting blood pressure and heart rate		X	X	X	X
Blood and urine samples		X	X	X	X
Language screening		3-5			
Motor function tests		4-10			
Cycle ergometer test (lactate measurement only age 14 and over)			X	X	X
Copy of vaccination record		X	X	X	X
Accelerometry				X	X
Interviews on medication (AmEDa, standardised recording of medicines and food supplements [12])		X	X	X	X
Standardised computer-assisted medical interview		X	X	X	X
Interview component					
Health questionnaire (version for parents)	X	X	X	X	
Health questionnaire for participants			X	X	X
Food frequency questionnaire (version for parents)		X			
Food frequency questionnaire for participants			X	X	X
Questionnaire on diseases (version for parents)		X*	X*	X*	
Questionnaire on diseases for participants					X*

* Only participants who did not take part in the examination component (instead of the computer-assisted medical interview)

questionnaire on health for those who did not participate in the examination. The young adults belonging to the KiGGS cohort were also offered an online variant of the health questionnaire at a later date, as described earlier in this section (see 2.1).

2.3 Participant recruitment

Participant recruitment for KiGGS Wave 2 followed a plan drawn up at the beginning of the study. The 167 sample points were visited systematically to avoid combining seasonal and regional effects as far as possible [13]. Three sample points were visited at the same time. The participants were divided into four subgroups ('cross-sectional examination and interview', 'cross-

Table 2
Laboratory parameters analysed
in KiGGS Wave 2
(from blood, serum or plasma,
unless stated otherwise)

	Cross-sectional study			Cohort study	
	0-2 years	3-10 years	11-17 years	10-17 years	18-29 years
Sodium, potassium, calcium, phosphate, alkaline phosphatase, total protein, creatinine, liver enzymes, ferritin, hs-CRP, 25(OH)D, TSH, fT3, fT4, cholesterol, LDL and HDL cholesterol, triglycerides, hepatitis B antibodies including anti-HBs and anti-HBc, HBs antigen, hepatitis A antibodies, herpes simplex type 1 antibodies		X	X	X	X
Antibodies to herpes simplex type 2			16-17	16-17	X
Antibodies to Helicobacter pylori		8-10	X	X	X
Antibodies to hMPV and para-influenza		X*	X*		
Allergic sensitisation to various allergens, total IgE		X	X	X	X
HbA _{1c}				14-17	X
Antibodies to measles, mumps, chickenpox		X	X	X	X
Antibodies to rubella		X	X		
Antibodies to human respiratory syncytial virus and various respiratory pathogens		X			
Antibodies to influenza		X	X		
Antibodies to Borrelia		X	X	X	X
Antibodies to Toxoplasma gondii		♀	♀	♀	♀
Glucose, iodine, sodium, potassium and creatinine in urine		X	X	X	X

♀ Only for female participants * On a subsample

Hs-CRP=high-sensitivity C-reactive protein, 25(OH)D=25-hydroxy vitamin D, TSH=thyroid stimulating hormone, fT3=free triiodothyronine, fT4=free thyroxine, LDL cholesterol=low density lipoprotein cholesterol, HDL cholesterol=high density lipoprotein cholesterol, anti-HBs=antibodies to the hepatitis B-surface antigen, anti-HBc=antibodies to the hepatitis C-antigen, HBs antigen=hepatitis B surface antigen, hMPV=human metapneumovirus, Total IgE=immunoglobulin E, HbA_{1c}=glycated haemoglobin

sectional interview', 'cohort examination and interview' and 'cohort interview') and the invitations were normally sent out six weeks before examination (Figure 2). Whereas invitations to minors were addressed to parents or guardians, potential participants aged 18 or above received the invitation directly. People who did not respond to the invitation received a reminder approximately two weeks after the initial invitation letter. If this did not produce a response, the reminder was followed up by a phone call or home visit.

Parents and adult participants who were only invited to an interview received the questionnaires on paper

together with their invitation, information brochure and consent form. They were asked to return the completed questionnaires to the RKI within two weeks. In the case of children and adolescents aged 11 or above, the questionnaires were not sent out until the parents had provided written consent for an interview to be conducted with a minor. The people invited to the examination received their questionnaires together with a confirmation of their appointment as soon as a date had been agreed upon by telephone. The participants were asked to bring their completed questionnaires to the examination centres. Parents and young adults who had declined

KiGGS Wave 2 was conducted between 2014 and 2017 and is the second follow-up to have been carried out as an examination and interview survey in line with the initial KiGGS baseline study.

to participate in the study received a short non-responder questionnaire so that basic information about socio-demographic and health-related characteristics could be gathered. These data were used to compare participants with non-participants in order to identify any systematic differences between responders and non-responders.

After having received detailed information about the study, all potential participants were asked to provide their written informed consent; they either did so in the examination centre or, in the case of participants who were only surveyed via questionnaire, by post. Minors' consent forms were signed by a parent or guardian; adolescents aged 14 or above signed their own forms but had them countersigned by a parent or guardian; participants aged 18 or above signed the informed consent themselves. As an expression of appreciation, the participants were provided with an age-appropriate incentive. Everyone who underwent an examination also received a written medical report six to eight weeks later detailing their test and laboratory results.

In line with the KiGGS baseline study, measures were taken to integrate children and adolescents with a migration background into the new cross-sectional sample in numbers that reflected the structure of the German population; measures were also put in place to encourage KiGGS cohort participants with migration background to further take part in the study [8]. This included migrant-specific public relations in the sample points, improving intercultural competence among staff with direct contact to the participants, and – for potential participants invited for the first time – the offer of having their invitation material, and, if applicable, the

parents' questionnaires, provided in English, Turkish, Russian or Serbo-Croatian. A higher proportion of quality-neutral sample loss can be expected among children and adolescents without German nationality (as invitations are more likely to be returned marked with 'addressee no longer at given address' or 'address unknown') [14]. Therefore, participants with a nationality other than German were oversampled for the new cross-sectional sample by a factor of 1.5.

2.4 Quality assurance

In order to guarantee a high level of quality during the data collection phase of KiGGS Wave 2, a multi-stage quality assurance system for fieldwork, laboratory analysis, and data entry, storage and processing was implemented. Detailed manuals stipulated the standard operating procedures (SOP) and the quality assurance measures that were to be put in place at each step of the process in all of these areas.

All actors involved in the study attended a comprehensive training programme explaining the guidelines set out in the manuals before starting fieldwork. Follow-up training was regularly carried out during the data collection phase as required. The examination and interview component, which was tailored to age range and cross-sectional or cohort participation, was carried out in an SOP-compliant, standardised manner. By participating in ring trials and other pre-determined quality control measurements, which were undertaken before the actual analyses took place. It was possible to ensure a high quality laboratory testing by the RKI's accredited

KiGGS provides information on health status, health-related behaviour, psychosocial risk and protective factors, as well as health care utilisation.

Central Epidemiological Laboratory. In order to avoid errors during data input, the highest possible level of standardisation was carried out both when measurements and test results were gained in the study centres as well as during data entry from the written questionnaires at the RKI. Among other factors, automated checks were performed to identify incorrect, contradictory, and incomplete data. The questionnaires were produced as machine-readable forms that could be scanned, validated and exported to a database at the RKI. Data quality was continuously monitored by the RKI's Epidemiological Data Centre and Research Data Centre. This included entering the data from a proportion of the questionnaires twice. In addition, a large number of further quality assurance measures are to be carried out in the context of data processing before the data is to be made available for scientific evaluation.

Finally, the implementation of the study was regularly accompanied by internal and external quality assurance mechanisms. The evaluations and recommendations for action that this led to contributed to the optimisation of processes, and further training for staff.

2.5 Weighting

A weighting factor was created to ensure that prevalence estimates from the cross-sectional component of KiGGS Wave 2 are nationally representative in terms of age and gender distribution within the federal states, as well as with regard to parental levels of education and nationality ('German: Yes/No'). This weighting also accounts for the different probabilities of participants taking part

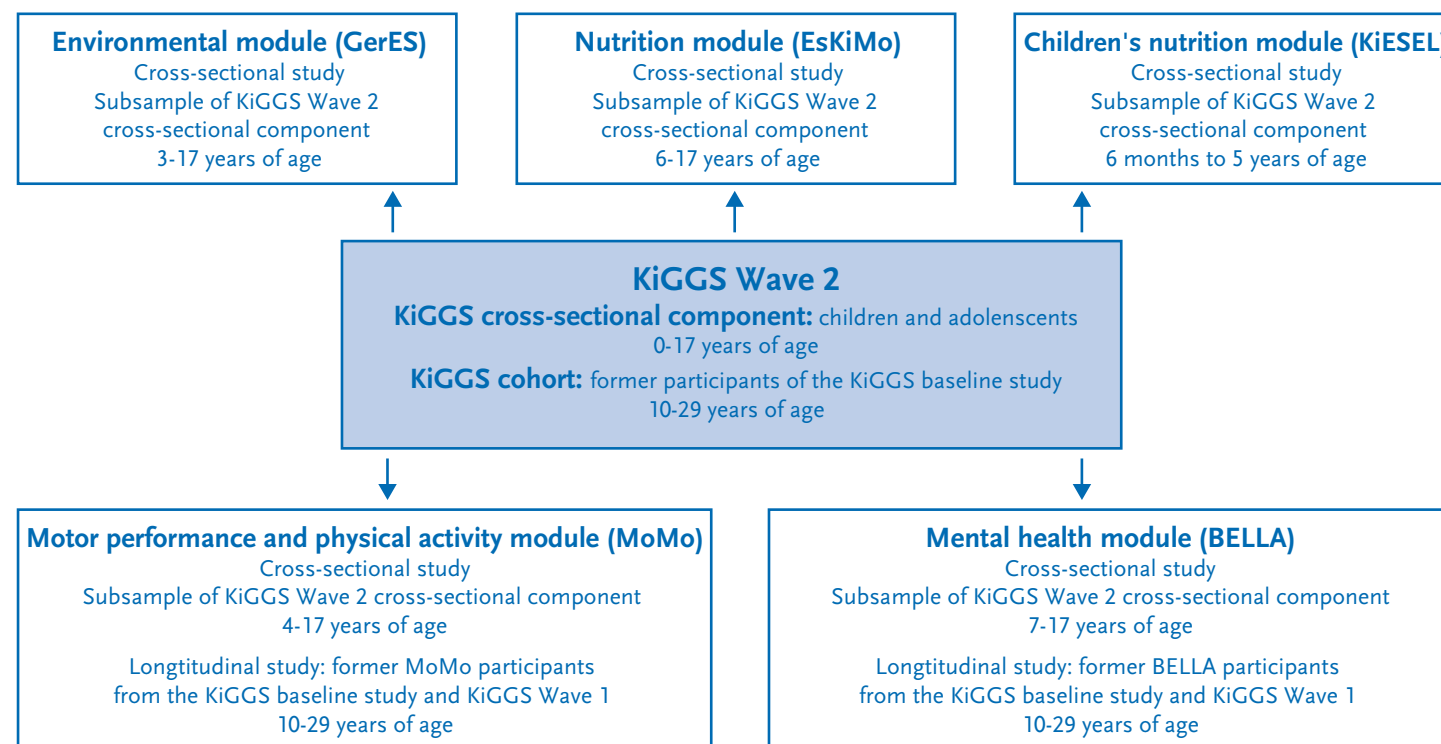
and corrects for deviations of the design-weighted net sample from the German population using demographic statistics from 2014/2015 and levels of educational attainment in accordance with the CASMIN (Comparative Analysis of Social Mobility in Industrial Nations) system of classification [15] obtained from the 2013 microcensus.

For the longitudinal component of KiGGS Wave 2 (the KiGGS cohort), the weighting procedure also accounts for differences in the study participants' likelihood to take part in the follow-up. As was the case with KiGGS Wave 1 [9], the probability that a participant would take part in a follow-up is estimated using a weighted logistic regression model with the probability of participating in a follow-up as the target variable alongside other variables from the baseline study (socio-demographic characteristics, health status and health-related behaviour) as explanatory variables. This reduces the level of bias in the study population caused by selective non-participation, at least as long as non-participation can be predicted by the data on socio-demographic and health-related indicators gathered for the KiGGS baseline study.

2.6 The modular character of KiGGS Wave 2

The core survey of KiGGS Wave 2 described here is supplemented by five independent modules conducted as subsamples of the core survey (Figure 3). Each module consists of an in-depth study focused on a particular theme; the data gathered for the modules can be linked to the data from the KiGGS cross-sectional component or the KiGGS cohort (see the articles on the BELLA,

Figure 3
Modular structure of KiGGS Wave 2
Own diagram



EsKiMo, GerES, KiESEL and MoMo modules elsewhere in this issue).

2.7 Data protection and ethics

All of the RKI surveys strictly observe the data protection regulations set out in the German Federal Data Protection Act. The Hanover Medical School's ethics committee assessed the ethical questions raised by KiGGS Wave 2 and granted it ethical approval (No. 2275-2014). The Federal Commissioner for Data Protection and Freedom of Information also had no reservations about the

study. Participation in the study was voluntary. The participants and/or their parents or guardians were informed about the study's aims and content, as well as data protection, and provided their informed consent.

3. Content and instruments of the survey

In KiGGS Wave 2, data on a wide spectrum of health-relevant topics that are related to specific phases of life were collected from birth to childhood and from adolescence to young adulthood (Tables 3-7). The instruments and methods that were applied were kept as constant

The nationwide representative cross-sectional component of the KiGGS study enables up-to-date prevalence estimates, correlation analyses and trend analyses.

as possible during the KiGGS waves, both in terms of the identification of population-related trends in the health situation of children and adolescents in Germany, as well as to allow analyses of health-related developments over the course of a person's life within the framework of the KiGGS cohort. KiGGS Wave 2 expanded the study's focus to adequately reflect recent developments relevant to public health and to enable more differentiated analyses to be conducted. This includes the addition of an in-depth module as part of the KiGGS cohort aimed at identifying family-related and health care factors associated with the development, progression and impact of psychological disorders (especially ADHD), obesity and allergic diseases (especially asthma).

3.1 Physical health

With regard to physical health the aim of the study is to assess the development of individual diseases with a high level of public health relevance, chronic disease in general, and trends in physical risk factors among children and adolescents in Germany in a lifecourse perspective (for the content of the survey and the instruments it employs, see [Table 1](#), [Table 2](#), [Table 3](#)).

The prevalence, time trends and the consequences of overweight and obesity are important parameters in child and adolescent health. As such, everyone who participated in an examination had their body height, body weight and waist circumference measured. In order to provide a detailed analysis of obesity, these measurements gathered during KiGGS Wave 2 were supplemented by bioimpedance measurements to determine

body composition (such as body fat percentage) in adolescents and young adults. As part of the in-depth KiGGS cohort module on life-course developments of chronic conditions such as obesity, data was gathered retrospectively on treatments that participants had undergone due to physician-diagnosed obesity.

The measurements set out above were supplemented by information on the period ranging from birth to adolescence. Unless this information was already known (as was the case with cohort participants), the gestational age, birth weight and size as well as parameters of pubertal maturation were recorded. A language screening test was introduced in KiGGS Wave 2 that allows an evaluation of the language development of children aged between 3 and 5 for the first time.

As a potentially modifiable cardiovascular risk factor in childhood and adolescence, resting blood pressure and heart measure were measured in a standardised manner in line with the measurements of the baseline study. In order to identify subclinical changes in the arterial walls (subclinical arteriosclerosis), carotid intima media thickness (CIMT) was measured for the first time using an ultrasound device. This was performed on cohort participants aged 14 and older. Furthermore, urine and blood samples were examined for known risk factors of cardiovascular diseases (such as disorders of lipid and glucose metabolism).

The standardised computer-assisted medical interview focused on selected physician-diagnosed diseases, time of diagnosis and treatments. Participants who did not take part in the examination part answered the questions via a questionnaire. Additional disease-specific questions

Table 3
Contents of interviews and instruments of
KiGGS Wave 2 to survey physical health

	Cross-sectional study			Cohort study	
	0-2 years	3-10 years	11-17 years	10-17 years	18-29 years
Physical health					
Participant provided information on height and weight ^A ; Perception of own body ^B ; Weight and height of parents ^C ; Weight and height of partner ^D ; Treatment received for diagnosed obesity ^E	AC	ABC	ABC	ABCE	ABDE
Size and weight at birth, gestational age ^A ; Birth by caesarean section ^B ; Parameters of pubertal maturation ^C	AB	AB C (from 7)	ABC	BC	B
Subjective health (Minimal European Health Module, MEHM [45]) ^A ; Self-reported chronic disease (MEHM [45]) ^B ; Functional limitations caused by health problems (item from: Children with Special Health Care Needs (CSHCN) Screener [46]) ^C ; Disability ^D ; Incapacity to work ^E ; Visual and hearing impairment ^F	AB C D F	AB C D F	AB C D F	AB C D	AB C D E
Questions concerning selected physician-diagnosed diseases/risk factors and their treatment (included in the medical interview or the questionnaire on diseases): hay fever, neurodermatitis, asthma, allergic contact dermatitis, heart disease, diabetes, epilepsy, obstructive bronchitis, migraine ^A ; Disorders of lipid metabolism, hypertension, cancer ^B ; Congenital malformations ^C	AC	AC	AC	AB	AB
Asthma control (asthma control test [47]) ^A ; Self-management of asthma, (self-efficiency scale [48]) ^B ; In-depth aspects of asthma treatment ^C				ABC	ABC
Familial predisposition (biological parents): Allergies ^A ; Diabetes ^B ; Hypertension, angina pectoris, myocardial infarction, stroke ^C ; Cancer ^D	A	A	A	ABCD	ABCD
Accidents requiring medical treatment ^A ; Vaccine-preventable childhood diseases ^B ; Infectious diseases ^C ; Head and back ache ^{D1} ; Other pain ^{D2} ; Reproductive health ^E ; Sleep duration and sleep disorders (from 18 years of age, adapted from [49]) ^F ; Major Health Events ^G	ABCF	ABCD1 D2 F	ABCD1 D2 F	ABD1FG	ABD1EFG

The questions were developed at the RKI unless stated otherwise.

were asked in the questionnaires on health; information on the medical treatment received in these cases can be gathered from the interviews on medication.

KiGGS also focuses on allergies and asthma, as well as the course of these conditions throughout childhood and adolescence. The survey method employed to obtain the data in these cases – information provided by the participants, and laboratory tests of their sensitivity to selected allergens – has remained unchanged across age

groups and survey periods. Therefore time trends can be analysed. The lifecourse development of atopic diseases is also the subject of an in-depth module undertaken as part of the KiGGS cohort. KiGGS Wave 2, therefore, also covers not only factors associated with asthma but also self-management of asthma, asthma control and treatment aspects.

Urine and blood samples were analysed for thyroid hormones, vitamin D and other laboratory parameters.

Table 4
Contents of interviews and instruments of
KiGGS Wave 2 to survey mental health

	Cross-sectional study			Cohort study	
	0-2 years	3-10 years	11-17 years	10-17 years	18-29 years
Mental health					
Health-related quality of life (Kidscreen-10 [50] ^A ; Kidscreen-27 [50] ^B ; General health survey (short form)-8, SF-8, [51, 52] ^C); Life -satisfaction (Personal Wellbeing Index Adults, PWI-A [53]) ^D		A (from 7)	B	B	C D
Mental health problems in childhood and adolescence (Strengths and Differences Questionnaire, SDQ [54, 55]) ^A ; Diagnosed ADHD and treatment ^B ; diagnoses of mental disorders in childhood and adolescence ^C ; Screening for eating disorders (SCOFF Questionnaire [56]) ^D		A B	A B D	A B C D	B D
Preclinical symptoms (Mental Health Inventory-5, MHI-5 + Vitality Subscale (SF-36) [51, 57]) ^A ; Screening for depressive disorders and panic disorders (Patient Health Questionnaire, PHQ-9 [58] and PHQ-D short version [59]) ^B ; Diagnoses of depression, anxiety disorders or other mental disorders in adulthood ^C					A B C
Treatment received for diagnosed mental disorders ^A ; Family predisposition (biological parents): mental illness ^B				A B	A B
Self-efficacy (Scale of General Self-efficacy, SWE [60], Personal resources [61], Social support, Social Support Scale [62]) ^A ; Personality (age 14 and over, Big Five Inventory 10, BFI-10 [63]) ^B			A	A B	A B
Adverse experiences in childhood and adolescence: Traumatization (Childhood Trauma Questionnaire, CTQ [64]) ^A ; Divorce/separation/death of a parent, including dates ^B ; Serious diseases/accidents in the family ^C ; Mental disorders/addiction/imprisonment of member of household, experience of war/terrorism/political conflicts (adapted from [65]) ^D				B C	A B C D

The questions were developed at the RKI unless stated otherwise.

Further topics of the written questionnaire were self-reported chronic conditions and associated functional limitations, as well as family predispositions to allergies or cardiovascular disease. Other issues included chronic pain, accidents requiring treatment, and – for adult cohort participants – sexual health. Adult cohort participants were also interviewed about any serious illnesses or accidents that they or their parents had experienced.

3.2 Mental health

Since the spectrum of diseases affecting children and adolescents has shifted in the last few decades towards chronic diseases and functional and mental disorders [16], it is essential that population-based epidemiological studies also monitor the mental health of this age group. The concept developed for the assessment of mental health in childhood and adolescence and its persistence into adulthood includes gathering data on

The longitudinal component – the KiGGS cohort – provides information on health-related developments while taking into account social and individual influencing factors.

subjective assessments of Health Related Quality of Life (HRQoL), psychological disorders and symptoms of mental disorders. In addition, data was also collected on self-reported and parent-reported medical or psychotherapeutic diagnoses, as well as associated risk and protective factors and aspects of health care. This data was gathered using written questionnaires based on tested, standardised instruments (Table 4).

In order to estimate current prevalence rates and to provide up-to-date information on time trends among psychopathological problems and mental disorders (e.g. attention deficit/hyperactivity disorder ADHD or eating disorders) as well as the subjective health of children and adolescents in Germany, identical instruments were used across all survey waves. The way in which psychosocial protective factors, such as self-efficacy, personal resources, family environment and social support, were surveyed as factors that positively influence health and well-being also remained largely unchanged. Trend analyses of HRQoL, in contrast, are only possible between KiGGS Wave 1 and KiGGS Wave 2, since the baseline study employed a different survey instrument.

Since KiGGS Wave 1, screening instruments and medical and psychotherapeutic diagnoses have been used to gather data from adults participating in the KiGGS cohort on symptoms of depression and anxiety disorders. In addition, data was also collected for an in-depth KiGGS Wave 2 module on the level of health care that participants had received up to this point of time for three selected mental disorders: ADHD, depression, and anxiety disorders. This information was gathered retrospectively. In addition, the survey concept drawn up

for the assessment of the mental health of participants belonging to the KiGGS cohort was expanded to include questionnaires on personality issues and a person's level of satisfaction with their life. Finally, data was also gathered on mental disorders affecting the participants' biological parents, participants' experiences of discrimination and adverse or traumatic childhood experiences.

3.3 Health-related behaviour

Healthy behaviours are frequently established during childhood and adolescence and extend into adulthood. Therefore, the KiGGS study identifies different areas of health-related behaviour using test procedures and detailed survey elements (Table 1, Table 5). It also collects information on diet, physical and sporting activity as well as the use of certain substances (such as tobacco or alcohol).

The nutritional behaviour of children, adolescents and young adults was assessed as part of the core study of KiGGS Wave 2 in line with the baseline study via the Food Frequency Questionnaire (FFQ) [17]. The data gathered via the FFQ enables key indicators of nutrition-related behaviour to be mapped, including fruit and vegetable consumption, and the consumption of sugar-sweetened beverages. It also means that nutritional indices can be created such as on healthy nutrition among children and adolescents [18]. A more in-depth study of nutritional behaviour is carried out as part of the two modules on nutrition: **KiESEL** for children between 6 months and 5 years of age, and **EsKiMo** for children and young people between 6 and 17 years of age.

Table 5
Contents of interviews and instruments
of KiGGS Wave 2 to survey health-related
behavior

	Cross-sectional study			Cohort study	
	0-2 years	3-10 years	11-17 years	10-17 years	18-29 years
Health-related behaviour					
Dietary habits (Food Frequency Questionnaire, FFQ [17]) ^A ; Breastfeeding ^B ; Detailed information on early childhood nutrition ^C	BC	AB	AB	A	A
Physical and sporting activity ^A ; European Health Interview Survey – Physical Activity Questionnaire, EHIS-PAQ [66-68]) ^B ; Daily physical activity ^C		A	AC	A	B
Smoking: tobacco use/shisha ^A ; Passive smoking ^B ; Use of e-cigarettes ^C ; Smoking among friends ^D			ABD	ABCD	ABCD
Alcohol: harmful consumption and binge drinking (Alcohol Use Disorder Identification Test, AUDIT-C [69, 70]) ^A ; Alcohol abuse (Brief Alcohol Screening Instrument for Medical Care, BASIC [71]) ^B			A	A	AB
Media usage ^A		A	A	A	A
Parental health-related behaviour: Sporting activity ^A ; Current smoking ^B ; Smoking in the presence of a child ^C ; Mother's smoking during pregnancy and breastfeeding ^D	BCD	ABCD	ABCD	ABC	

The questions were developed at the RKI unless stated otherwise.

Data was also gathered on breastfeeding and early childhood nutrition within the health questionnaire. As such, trend analyses can be carried out on the proportion of breastfed children and on the duration of breastfeeding in Germany. In addition, the longitudinal design of the KiGGS cohort can be used to investigate whether breastfeeding influences future health.

Physical activity behaviour was assessed using self-reported information on sports and exercise performed during leisure time and in sports clubs as well as on daily physical activity levels (compliance with the physical activity recommendations of the World Health Organization, WHO) and active transportation. In addition, physical activity was objectively measured among participants taking part in the longitudinal component using an accelerometer. In order to assess motor skill performance, motoric tests (such as standing on one leg) were

carried out with 4-to 10 year-old children and cardiorespiratory fitness was measured using a submaximal cycle ergometer test for children and adolescents aged 11 or above. Developments over time and trends in sporting activity can be analysed over two or three KiGGS study points, as can compliance with the WHO recommendations, and levels of motor skill performance and fitness. With respect to substance use, temporal trends and individual trend analyses are possible for smoking among young people and young adults as comparable instruments were used over three survey dates. As of KiGGS Wave 1 questions about the frequency and number of cigarettes smoked were asked as well as questions about the use of water pipes (shisha pipes), and e-cigarettes. In addition, all three KiGGS surveys included questions about the participants' exposure to passive smoking. In the case of alcohol consumption, temporal developments

Table 6
Contents of interviews and instruments of
KiGGS Wave 2 to survey health care and
prevention

	Cross-sectional study			Cohort study	
	0-2 years	3-10 years	11-17 years	10-17 years	18-29 years
Health care and prevention					
Utilisation of doctors, therapists, hospitals, ambulances ^A ; Examinations for the early detection of diseases (the so-called "U"-check-ups) ^B ; Health insurance ^C	A B C	A B C	A B C	A B C	A B C
Operations ^A	A	A	A		
Regularity of brushing teeth (adapted from [72]) ^A ; Dental check-ups ^B ; Orthodontic treatment ^C	A B	A B C	A B C	A B C	B
Health literacy (age 15 and over, Health literacy subindex [73]) ^A ; Early intervention (in line with [74]) ^B	B		A	A	
Human papilloma virus (HPV) vaccination [♀] ; Reasons for non-vaccination ^A		A	♀A	♀	♀

The questions were developed at the RKI unless stated otherwise.

♀ Only for female participants

and trends in lifetime prevalence can be examined over the three KiGGS survey waves. Trend and progression analyses can be carried out with harmful levels of alcohol consumption and binge drinking, using data from KiGGS Wave 1 and Wave 2. Furthermore, the participants' parents were questioned about their smoking habits and levels of physical activity.

3.4 Health care and prevention

As data was collected in the same manner during the various KiGGS waves, it can be used to study temporal trends in various aspects of health care, including the use of outpatient medical and therapeutic services, the use of inpatient health care facilities in the last twelve months, childhood and adolescent screening and dental check-ups.

The participants' vaccination status – an important preventive measure against infectious diseases – was also recorded in line with the method used in the KiGGS

baseline study. Once the vaccinations, as stated in the participants' vaccination records, had been entered into a database, vaccination status was defined in accordance with recommendations made by the Standing Committee on Immunisation (STIKO). The parents' questionnaire also asked questions about why vaccinations had not been carried out (if applicable). Serum samples were used to check for the presence of antibodies against vaccine-preventable diseases, such as measles, mumps, rubella, chickenpox and hepatitis A and B.

Information on survey content and the instruments can be taken from [Table 6](#).

3.5 Social, familial and environmental determinants of health

Due to the importance of socio-economic status for the health-related opportunities of children and adolescents, it is particularly important to conduct a comprehensive survey of a family's social situation [19]. Therefore, standardised questions were asked about parents' income, education and profession in order to determine a family's socio-economic status. This involved the use of a multidimensional index similar to that used for KiGGS Wave 1 [20]. In the case of adolescents, data were also collected on social factors such as the form of school they attend, the type of school-leaving certificate they have received or expect to receive and individual school achievements. Parents of children up to 10 years of age provided data on the duration and subjective assessment of the quality of care they receive outside of the family. Adolescents aged 11 or above also provided a subjective assessment of their family's social status. As with the parents, young adults belonging to the KiGGS cohort answered questions about income, education and occupation; but they also provided a subjective assessment of their own social status. In addition, data was gathered retrospectively about the educational or occupational situation of this group for each year of a participant's life from the age of 15.

In order to provide for a more differentiated form of data collection with regard to family background, the parents and participants (aged 11 or above) were asked to provide information about their current family form, household composition, (parental) marital status, the

number and order of biological siblings. Additionally, the atmosphere within their family was assessed by parents and children (aged 11 or above). The survey concept developed to gather data on familial influencing factors was expanded for the KiGGS cohort by an in-depth study about life in patchwork families, parenting style as well as the personality, well-being and stress faced by the parents as further psychosocial components of the family environment. Questions were also posed about critical events in a person's life, such as separation from or death of a parent and the exact dates that these events occurred. Finally, where applicable, data was gathered on when a participant had moved out of his or her parents' home and about the participant's partner.

The existence of a migration background was determined – as in previous surveys – using the data on the country in which the participant or his or her parents were born, and parental nationality [8, 21]. Data was also gathered on the year of immigration, residence status, the language spoken at home, and the specific group of migrants that the person belonged to. This enables a differentiated analysis to be conducted depending on a one- or two-sided migration background [8], the length of stay, the immigrant generation and a participants' legal status.

With regard to environmental determinants of health, KiGGS Wave 2 sought the participants' consent to link their current and previous addresses, including the length of time that they had lived in a specific location, to data about the condition of their (past) residential environments, such as particulate matter concentration, traffic noise, as well as how far they lived from health

Table 7
Contents of interviews and instruments of
KiGGS Wave 2 to survey social, family and
environmental determinants

	Cross-sectional study			Cohort study	
	0-2 years	3-10 years	11-17 years	10-17 years	18-29 years
Social, family and environmental determinants of health					
Basic information on participants (partly adapted from [75-77]): Age and gender ^A ; Current usual point of residence ^B ; Usual point of residence aged 15 and born in East Germany ^C ; Household composition ^D ; Education ^E ; Training and professional experience ^F ; Occupation, household net income, employment situation ^G ; Marital status, partnership ^H ; Unemployment ^I ; Transition periods (moving out of parental home, partnerships and family status changes, own children) ^J	ABD	ABD	ABDE	ABDE	ACDEF GHIJ
Basic information on parents (adapted from [76, 77]): marital status, partnership, education, occupation, household net income, employment situation ^A	A	A	A	A	
Subjective social status [78-80] ^A			A	A	A
Family climate (Family Climate Scale [81]) ^A ; Adopted parenting style (Zurich brief questionnaire on parenting style, D-ZKE [82, 83]) ^B ; Burden on parents (adapted from [84]) ^C ; Well-being and personality of the parents (Personal Wellbeing Index Adults, PWI-A [53] and Big Five Inventory, BFI-10 [63]) ^D ; Support from outside of the family (adapted from [85]) ^E ; Patchwork family (past) ^F	AE	AE	ACE	ABCDF	F
Living environment (size and type of home; humidity and mould; neighbourhood/environment) ^A ; Noise pollution ^B	AB	AB	AB	AB	AB
Migration background (adapted from [8, 21]) ^A ; Experiences of discrimination (adapted from [86]) ^B	A	A	AB	AB	AB

The questions were developed at the RKI unless stated otherwise.

care facilities and green spaces. Questions were also asked about the home environment and the neighbourhood, such as the opportunities that exist for exercise, play and sport, but also about factors such as environmental pollution (e.g. noise).

An overview of survey content and the instruments which assess social, familial and environmental determinants of health are given in [Table 7](#).

4. Discussion and outlook

The tasks of the RKI as a national public health institute include monitoring, protecting and improving the health

of the population. The RKI uses a valid database to detect health problems among the population at an early stage, assess developments and problem areas, and identify approaches to health promotion and disease prevention in line with its mission statement 'Recognition – Evaluation – Action' [4]. The RKI uses a wide range of sources for this purpose, including data from health insurance companies, service providers, disease registers, reporting undertaken in accordance with the Protection against Infection Act, official statistics (such as cause-of-death statistics), and data from hospital statistics and regional epidemiological studies. However, there are still gaps in the data, such as on social influencing factors and

their associations with health status, health-related behaviour and environmental influences. In particular, healthy people who do not require any of the above-mentioned systems of care provision constitute the remaining ‘unchartered waters’ on the health indicator atlas. The Health Monitoring system was established at the RKI to fill in these gaps – it is financed by the RKI and the Federal Ministry of Health (BMG) [1, 2, 22]. The regular implementation of population-representative health surveys in Germany that focus on the entire age range within the population in Germany enables comprehensive assessments to be made of health at the population level and of developing trends. Furthermore, the regularly conducted representative KiGGS cross-sectional surveys and the longitudinal component of the KiGGS cohort provide an indispensable source of data on children and adolescents.

Data was collected on a broad spectrum of health indicators for the KiGGS baseline study (2003-2006) using objective measurements, tests, laboratory analyses and supplementary representative surveys of children aged between 0 and 17 years living in Germany at that time. The data enabled the creation of numerous reference value tables, such as on laboratory parameters or anthropometric measurements and blood pressure levels [23, 24]. The results are highly relevant to public health. For the first time population-based prevalences of children’s accidents, allergies and bronchial asthma, mental disorders and attention deficit/hyperactivity disorder (ADHD) could be assessed [25-28]. The strong increase in levels of obesity among adolescents since the 1980s, the rise in mental disorders,

insufficient levels of physical activity and an unhealthy diet among certain risk groups of children and adolescents are particularly worrying [5, 29]. In addition, the results showed the significant influence that a family’s social situation can have on children’s and adolescents’ health [19, 30-32].

The results of KiGGS Wave 1 (2009-2012) demonstrated that the prevalence of frequently occurring chronic health conditions in children and adolescents [33-37] identified during the baseline remained largely constant. However, the study also identified positive developments. For example, a higher proportion of children had visited a paediatrician at least once in the previous year, which can be explained by the introduction of new recommendations on vaccination and check-ups, as well as a higher rate of participation in screenings [38]. The reduced smoking rates among teenagers and of maternal smoking during pregnancy, as well as the lower levels of passive smoke exposure among children and adolescents during this period were also very welcome and are demonstrative of the success of increased policy efforts to curb smoking and to improve the protection of non-smokers [39-41].

The results of the KiGGS study provide important starting points for policy measures aimed at promoting child health and improving medical care. The findings of the KiGGS study led the RKI and the German Federal Center for Health Education (BZgA) to joint recommendations for health promotion and disease prevention. The resulting age-specific recommendations were addressed in various policies and programmes including health policies [5, 42].

The statutory provisions on examinations for the early detection of diseases (“U” screening) enshrined within the Act to Strengthen Health Promotion and Preventive Health Care (Preventive Health Care Act, PräVG), which came into force on 25 July 2015, provide a more recent example of the practical implementation of findings from the KiGGS study. The Preventative Health Care Act significantly expanded the scope for action in health promotion and disease prevention among children and adolescents in line with the challenges identified by KiGGS. The study also constitutes an important source of data for the evaluation of preventive measures. In addition to the structures defined in the Preventive Health Care Act and new institutions such as the National Prevention Conference and the Prevention Forum, it is essential to promote the sharing of experiences and networking between the numerous actors involved in the large range of existing relevant activities. In order to do so, the Federal Ministry of Health, together with the BZgA, organised the ‘Forum for Promoting Health and Prevention for Children and Adolescents’ in Berlin on 22 February 2017, and launched an exchange aimed at enabling experts to anchor prevention and health promotion among children and adolescents more strongly in their respective fields and to strengthen these issues at the practical level. In the long term, these activities are aimed at establishing a platform on child and adolescent health at the Federal Ministry of Health with the special focus on disease prevention and health promotion.

The KiGGS results were also of central importance during the review and expansion of the ‘Grow up healthy’ health goal: the study’s findings led to the incorporation

of new aspects such as vaccination, accident prevention and mental health, and the goal now focuses more strongly on equity in health [43]. The health goal ‘All about birth’, which was adopted in 2017, is intended to contribute towards ensuring healthy development in later life by focusing on prenatal development and a child’s first year of life [44]. The KiGGS data will also play a major role in reviews of other health goals that are applicable to children and adolescents.

A lot of interest has already been expressed in the latest KiGGS results: Are developments heading in the right direction? Are the various efforts that are being undertaken in numerous areas of society to improve children’s health bearing fruit? What has become of the participants of the KiGGS cohort over the last eleven years?

The new representative cross-sectional component in KiGGS Wave 2 for children and adolescents aged between 0 and 17 currently living in Germany enables studies on trends in health status, health-related behaviour and the uptake of health care services to be updated. The follow-up of the people who participated in the KiGGS baseline study (KiGGS cohort) opens up the possibility of conducting genuine life-course research, as it constitutes the first population-wide cohort study in Germany that begins in childhood and adolescence. Assuming that the foundations for good health in old age are laid in childhood, the results should provide the foundation for healthy aging.

The first publication of the selected results from KiGGS Wave 2 is planned for March 2018. Evaluations of the KiGGS data are to be published in stages in the Journal of Health Monitoring as part of the RKI Federal

Health Reporting. In addition to cross-sectional and trend analyses, longitudinal analyses will be presented. The June 2018 issue of the Journal will focus on health-related behaviour, with the September issue concentrating on the physical and mental health of children and adolescents. Both issues will include analyses of social inequality in the respective subject areas. Complementary and in-depth publications are also planned for other scientific journals. The interest shown in the new study is reflected in the fact that the RKI's research data centre will be providing the data as a public use file. This should ensure that the results of KiGGS Wave 2 provide an important contribution to improving the health of children and adolescents in Germany.

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KiESEL – the children's nutrition survey module in KiGGS Wave 2

Abstract

Representative food consumption data for children are collected in KiESEL, the German nutrition survey for children aged 6 months up to five years conducted by the German Federal Institute for Risk Assessment (BfR). The data gained will update the consumption data for German children and will fill a data gap that existed for the age group of 5-year-old children. It will provide an actual and comprehensive data basis that will be used for exposure assessment, as part of risk assessment of Germany's youngest consumers. In the years 2014 to 2017, around 1,000 children will participate in the context of the KiESEL module of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). During home visits, survey staff conducts a questionnaire-based interview, measures the children's height and weight and explains the weighing records for the family and the child care workers. The data will be used for risk assessments of the BfR and provided to national and international partners such as the World Health Organization. This article describes the background and objectives of the study as well as its methodology and survey instruments.

◆ CHILD NUTRITION · EXPOSURE ASSESSMENT · CONSUMPTION DATA · HEALTH MONITORING · KIGGS

1. Background and objective

Within the context of consumer health protection, the German Federal Institute for Risk Assessment (BfR) provides scientific risk assessments of substances contained in food. Exposure assessment is part of this risk assessment and analyses the concentration of substances, but also takes into view the population's dietary habits [1, 2]. Exposure assessment is based on body weight, which often leads to higher estimates for children than for adults. This makes infants and small children a particularly vulnerable population group [3, 4]. The latest nutrition survey for children aged 6 months to 4 years with focus on risk assessment (to evaluate the acute toxicity

risks related to pesticide residues) was conducted in 2001/2002 in the context of the VELS study (Verzehrsstudie zur Ermittlung der Lebensmittelaufnahme von Säuglingen und Kleinkindern) [5]. The GRETA study (German Representative Study of Toddler Alimentation) conducted by the Research Institute of Child Nutrition (FKE) also contained representative data on dietary habits of children aged 10 to 36 months [6]. However, changes to dietary recommendations [7], the stream of new food products and changes to dietary habits make it necessary to update the data on children's food consumption. Between 2014 and 2017, KiESEL (the Children's Nutrition Survey) will collect data on children's food intake and update VELS study data. At the same time,



Kinder-Ernährungsstudie zur Erfassung
des Lebensmittelverzehrs

KiESEL

The children's nutrition survey to update the consumption data, 2014-2017

Acronym: KiESEL - Kinder-Ernährungsstudie zur Erfassung des Lebensmittelverzehrs

Implementation: German Federal Institute of Risk Assessment (BfR)

Aim: Surveying up-to-date and representative data on the food consumption of children aged 6 months to five years. This data provides the BfR with a basis for exposure estimates and improves the assessment of risks related to dietary habits.

Study design: Cross-sectional interview survey, anthropometric measures and food diaries

Population: Infants and children with permanent residence in Germany

Sampling: KiESEL study participants were selected randomly from the cross-sectional sample of KiGGS Wave 2 (registry office sample). An invitation to participate in KiESEL required the prior participation in KiGGS Wave 2.

Age range: 6 months to 5 years

Sample size: Approximately 1,000 participants

Survey period: December 2014-December 2017

More information in German is available at www.bfr.bund.de/de/kiesel-studie.html

KiESEL will seamlessly link with the EsKiMo module (the nutrition module within KiGGS) conducted by the Robert Koch Institute (RKI) [8], which assessed the food intake of children and adolescents aged 6 to 17. In addition, KiESEL is the first study to provide representative data on the dietary habits of five-year-old children [9].

Cooperation between the BfR and the RKI will ensure that the data collected in the context of KiESEL can be combined with KiGGS Wave 2 data. The resulting data set merges data on nutrition and health from a representative national sample of children and will provide a basis for further research. An external scientific advisory board [10] coordinates important aspects of the survey and advises the study leaders on methodological questions.

2. Methodology

2.1 Study design and sampling

The KiESEL sample consists of a partial sampling of the participants from the written questionnaire part of the cross-sectional sample of KiGGS Wave 2 aged of 6 months up to five years, as well as a partial sampling of the physical examinations participants of the cross-sectional sample of KiGGS Wave 2 aged 3 to 5 years.

For the KiGGS Wave 2 study population, 167 representative cities and municipalities (sample points) in Germany were identified. For these sample points a sub-sample stratified by age and sample point was randomly selected based on registry office data. The KiGGS target population and sampling is discussed in detail in the article [New data for action. Data collection for KiGGS](#)

[Wave 2 has been completed](#) in this issue of the Journal of Health Monitoring. Children and adolescents were randomly drawn from the gross sample and assigned to the KiESEL study during sampling for KiGGS Wave 2 and independently of their previous participation in KiGGS. An invitation to participate in KiESEL required prior participation in KiGGS Wave 2. KiESEL aims to collect data of 1,002 children, which amounts to about 83 participants for each age group and gender or 167 children per birth year.

KiGGS Wave 2 participants receive a written invitation to participate in KiESEL. This letter includes the KiESEL flyer as well as a consent form for personal data to be forwarded to the BfR. Following route 15 of KiGGS, the RKI contacts all participants by phone who fail to answer the invitation letter within a given time. Roughly every two weeks the RKI then provides the BfR with the addresses of potential participants who have consented to have their data forwarded. The participants of KiESEL receive a voucher, an age-appropriate toy for their child, and a booklet on child nutrition as an incentive.

The study strictly complies with the German regulations on data protection and has been approved by the Federal Commissioner for Data Protection and Freedom of Information. Participation in the survey was voluntary. Parents and guardians of the children who participated in the survey were informed about the goals and content of the survey as well as about data privacy, and provided their informed consent. The study received a positive vote from the ethics committee of the Berlin Chamber of Physicians (Ärztekammer Berlin, Eth-28/13). Moreover, as part of external quality management measures,

KiESEL provides up-to-date consumption data on the dietary habits of children aged 6 months to 5 years.

KiESEL will update the representative consumption data for German children and will fill the data gap for the age group of 5-year-old children.

KiESEL was audited by approxima Gesellschaft für Markt- und Sozialforschung Weimar mbh.

2.2 Assessment methods and testing instruments

KiESEL's methodology is based on the protocols of the EsKiMo and VELs studies [5, 8, 11]. The KiESEL study team invites families to participate in the survey, contacting them either by phone, via email or post letter, and arranges an appointment with the respective sample point for a home visit (Figure 1).

Appointments take place at the families' house or in a survey vehicle and require about one hour.

Family weighing record

Families record their child's food intake through a weighing record for three consecutive days followed later by an additional day. This allows short and long term exposure assessment [12, 13]. To ensure that these measurements are independent of each other, the single-day weighing record is scheduled to be recorded at least two weeks after the 3-day weighing record. The maximum time allowed between the two records is four to eight weeks, for infants and three to four months for elder children. To support the evaluation of risks related to the consumed amounts of food, families are asked to record in detail the amounts of food and beverages consumed (Figure 2).

To record the really consumed amounts, the survey requires participants to weigh the actual amount of food on the plate and, where applicable, leftovers as well. Besides providing information on the foods eaten,

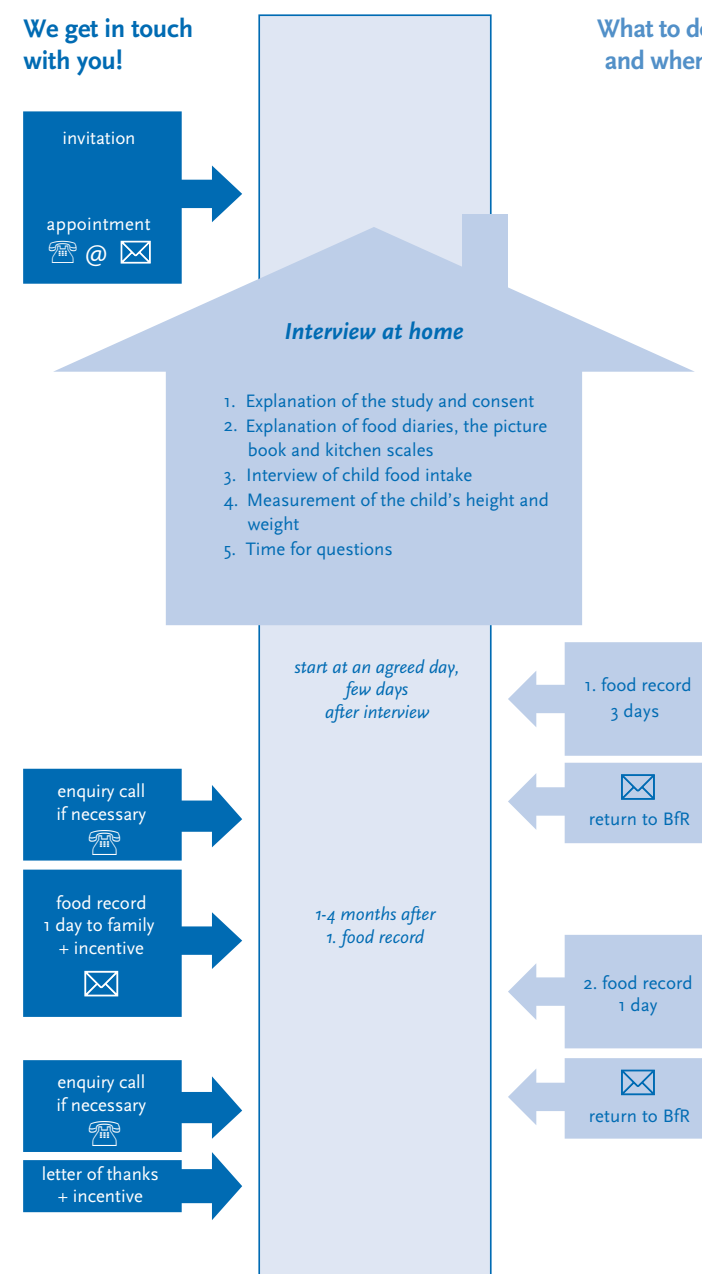


Figure 1
KiESEL study stages

Source: Modified according to [9]

Figure 2
Sample page of a weighing record
Source: Own figure (in German)


The comprehensive data will be used for exposure assessment, as part of BfR risk assessment of Germany's youngest consumers.

Data enhances food safety, consumer and child health protection.

Beispiel Ernährungstagebuch

1. Tag

Wochentag: (bitte ankreuzen) Mo Di Mi Do ☒ Sa So

Beim Verzehr		Marken-name (Firma) des Produkts	Produktbeschreibung (Fettgehalt, zugesetzte Vitamine u. Mineralstoffe)	Verpackung bei Verkauf	Zustand bei Einkauf		Zubereitung		Mengenangabe	
Uhrzeit	Ort						Art	Ort	verzehrte fertige Menge (Waage/Fotobuch)	Restmenge/ Abfall (Waage)
Über den Tag	U	Nutballs	Sorte Peanut	K	-		-	U	2 x Bild 64	-
12:15	z.H.	BioMarkt	Bio-Fischstäbchen	P+K	Tk	X	gebraten	z.H.	52g	14g
17:00	F	Frutto	Obstminis, Frischkäsezubereitung mit Früchten, $\frac{1}{4}$ Fettstufe, Sorte Aprikose, Calcium + Vitamin D	K	-		-		1 Becher, 50g	-

participants are also asked to provide the recipes of self-cooked meals. To weigh food, respondents are given kitchen scales. They are also required to record out-of-home consumption (such as ice-cream, snacks or fast food), the amounts of which they then estimate based on amounts as labelled on the food packaging or a picture book provided by KiESEL.

Estimate records for child day care facilities

A complete picture of child nutrition also includes the food consumed during the time spend in child day care. A large number of children in Germany is cared for outside their home, for example in kindergartens. According to the Federal Statistical Office this applies to around 32.7% of 0-to 2-year-olds and 93.6% of 3-to 5-year-olds [14]. In parallel with the food records kept at home of the study participants, these institutions provide a food

intake estimate for three consecutive days and an additional, unrelated day. The food record for day care workers was adapted after pre-tests in the context of the KiESEL study and now requires less detailed descriptions of food and meals.

Families and day care workers are given the KiESEL picture book to help them to estimate the amounts of food a child consumes either outside their home or in day care facilities. The book contains pictures of children's portions of different foods in varying portion sizes. Participants can also use household measures and the amounts printed on food packaging. The picture book was developed specifically for KiESEL and its specific age group. It contains 65 picture series as well as individual pictures which were provided by the FKE, the International Agency for Research on Cancer (IARC), the Max Rubner Institute (MRI) and the Pilot study for the Assess-

Info box: Focuses of the KiESEL questionnaire

General information

Gender
Month and year of birth
Year of birth of parents

Current dietary habits

Special diets
Use of salt and oils
Dietary supplements
Consumption of raw foods

Diet during first year

Breastfeeding
Infant formula
Solid foods

Out-of-home consumption

Meals and food in child care facilities

Food propensity questionnaire

Baby food
Cereals and special food for children
Milk and milk substitute products
Meat and sausages
Offal
Fish and seafood
Tea

Attitudes towards nutrition

Food Additives
Genetic engineering
Organic food

ment of Nutrient intake and food Consumption Among Kids in Europe (PANCAKE), as well as a set of silhouettes of different foods developed by the BfR. Participants were asked to only use the picture book if they were unable to judge amounts based on the weight indications on food packaging or weigh out-of-home foods [13].

Food record data are entered into a version of EATv3, a software that was adapted for the needs of KiESEL and developed in 2001 for the VELS study at the University of Paderborn [5].

Interview on food intake

The interview on child food intake is based on a questionnaire that standardises data collection on the child, dietary habits and seldom eaten foods (Info box). It supplements the food records and broadens the scope of the details already collected in the KiGGS Wave 2 questionnaire. Following the appointment, questionnaire data are stored in LimeSurvey, a web-based application.

Recording body weight and height

Reliable values for the weight and height of children require standardised measurements [15]. Height in these age groups is measured using a mobile measuring board (seca 417, Hamburg, measurement accuracy: $\pm 0.5\text{cm}$) with infants lying down. Weight is measured with mobile and calibrated baby scales (seca 336, Hamburg, measurement accuracy: up to a weight of 5kg: $\pm 0.005\text{kg}$; for 5-15kg: $\pm 0.01\text{kg}$). For children already able to stand upright, height is measured standing with a mobile stadiometer (seca 217, Hamburg, measurement accuracy: $\pm 0.5\text{cm}$). They are weighed using mobile and calibrated

scales (seca 877, Hamburg, measurement accuracy: $\pm 0.1\text{kg}$).

3. Outlook

One of the BfR's central tasks is to scientifically assess the risks related to food, feed as well as substances and products, and to use this data to enhance the German government's consumer health protection efforts. The collected data on dietary habits of children allow an estimation of the daily mean and high intake levels of contaminants [16-19], pesticide residues [20] and food additives [21] through food. These estimates are required in food safety evaluations and also to define the maximum limits for particular substances in food [9]. Beyond this, the KiESEL study also collects up-to-date data on child nutrient intake in Germany. These data sets serve to describe the nutritional status of infants, toddlers and children [22] and provide policy-makers with a scientific basis for their decisions. To help implement risk assessments at the level of the European Union and worldwide, the data are made available to the Comprehensive European Food Consumption Database of the European Food Safety Authority (EFSA) and the World Health Organization (WHO) [23, 24].

KiESEL is the first study to collect basic data on food consumption in child day care facilities and families as a basis for exposure assessment by age group [25]. Due to the high number of children in child day care, data from these facilities is essential to get a total dietary exposure of the children. Overall, the compliance of the child day care workers to participate in the survey was good. The field study phase will be completed by the end

KiGGS Wave 2

Second follow-up to the German Health Interview and Examination Survey for Children and Adolescents

Data owner: Robert Koch Institute

Aim: Providing reliable information on health status, health-related behaviour, living conditions, protective and risk factors, and health care among children, adolescents and young adults living in Germany, with the possibility of trend and longitudinal analyses.

Study design: Combined cross-sectional and cohort study conducted as an examination and interview survey

KiGGS cross-sectional study

Population: Children and adolescents with permanent residence in Germany

Sampling: Samples from official residency registries - randomly selected children and adolescents from the 167 cities and municipalities covered by the KiGGS baseline study

Age range: 0-17 years

Sample size: Approximately 15,000 participants

KiGGS cohort study

Sampling: Re-invitation of everyone who took part in the KiGGS baseline study (2003-2006; aged between 0 and 17 at that time) and who was willing to participate in a follow-up

Age range: 10-29 years

Sample size: Approximately 10,000 follow-up participants

Survey period: September 2014-August 2017

Modules: BELLA, EsKiMo, GerES, KiESEL, MoMo

More information is available at www.kiggs-studie.de/english

of 2017. Data processing will begin afterwards, and the recorded food will be categorised using the codes of the German Nutrient Database and FoodEx2, a standardised system developed by the EFSA to classify and describe food for exposure assessment. Initial results are expected for 2018. Moreover, a tender is being considered for further research to disaggregate food intakes into categories as defined in the regulation for pesticide residues.

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EsKiMo II – the Eating study as a KiGGS Module in KiGGS Wave 2

Abstract

Nutrition plays an important role for health, in particular of children and adolescents. In addition to the baseline German Health Interview and Examination Survey for Children and Adolescents (KiGGS, 2003-2006), the nutrition survey EsKiMo (Eating study as a KiGGS Module) assessed the dietary habits of children and adolescents aged 6 to 17 in detail. In KiGGS Wave 2 (2014-2017) the corresponding module is EsKiMo II. Between June 2015 and September 2017, specially trained nutritionists will visit EsKiMo II participants at their homes. The parents of 6-to 11-year-olds are instructed on how to complete food records on four randomly chosen days - three consecutive days, followed later by an additional day. Participants aged 12 to 17 are interviewed personally on their food intake during the past four weeks with the dietary interview programme DISHES. Further information, for example, regarding dietary supplements is also recorded. EsKiMo II will provide an up-to-date and representative overview of the current nutrition status of 6-to 17-year-olds living in Germany, and it allows analysing changes in dietary behaviour over time. EsKiMo II can identify shortcomings in the nutrition of children and adolescents and thus may contribute with important information to nutrition and health policy.

📌 NUTRITION · FOOD CONSUMPTION · NUTRIENT SUPPLY · HEALTH MONITORING · KIGGS

1. Background and objective

Eating and drinking are essential for our life, and individual dietary habits have great influence on our physical and mental health. An adequate diet is particularly important for the growth and health development of children and adolescents. Compared to adults, children require a higher amount of nutrients per kilogramme of body weight. Due to their lower body weight and an immune system which is still developing over the first years of their life, children constitute a particularly vulnerable group for the health implications of food contaminated with pathogens or other harmful substances. Addition-

ally, dietary habits generally develop during childhood and have implications for people's dietary behaviour at adult age [1]. Monitoring potential health risks related to food intake and improving dietary habits are important tasks of nutrition and health policy. Keeping track of population dietary behaviour on a regular basis is therefore necessary.

In the context of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) of the Robert Koch Institute (RKI), a food frequency questionnaire is used for participants aged 3 and older to obtain both the frequency and the respective portion size of certain food groups that were consumed



EsKiMo II

Second Wave of the Eating study as a KiGGS Module, 2015-2017

Acronym: EsKiMo - Eating study as a KiGGS Module

Implementation: Robert Koch Institute

Aim: Providing an up-to-date representative overview of the dietary habits of children and adolescents aged 6 to 17 in Germany.

Study design: Cross-sectional study based on a modified diet history interview and food records

Population: Children and adolescents with permanent residence in Germany

Sampling: EsKiMo II participants are randomly selected from the cross-sectional sample of KiGGS Wave 2 (registry office sample). Being invited to EsKiMo II requires participation in KiGGS Wave 2.

Age range: 6 to 17 years

Sample size: at least 2,400 participants

Survey period: June 2015 - September 2017

More information in German is available at www.rki.de/eskimo

during the past four weeks [2, 3]. While this information does provide an impression of respondents' regular dietary behaviour, it cannot, however, answer more complex questions, for example to identify deficits in respondents' nutrient supply.

This led, in the context of the RKI's KiGGS baseline study (2003-2006), to the implementation of EsKiMo (Eating study as a KiGGS Module, referred to as EsKiMo I in the following), the first representative survey of the dietary behaviour of children and adolescents aged 6 to 17 in Germany [4, 5]. Funding was provided by the Federal Ministry for Consumer Protection, Food and Agriculture, which today is the Federal Ministry of Food and Agriculture (BMEL). Given that data collection for EsKiMo I took place ten years ago, KiGGS Wave 2 (2014-2017) will include the EsKiMo II module, funded by the BMEL. The Federal Institute for Risk Assessment (BfR) will conduct in addition to EsKiMo II a further module on nutrition ([KiESEL – the children's nutrition survey module in KiGGS Wave 2](#)), assessing the dietary habits of children below six years [6].

As a module of the KiGGS study, EsKiMo II will provide the basis for differentiated analyses for example of the relation between dietary habits, socio-demographic criteria (such as size of town, social status, and education), behavioural factors (such as levels of physical activity, use of media or smoking), as well as a diverse set of health parameters (biochemical and physiological measurements) and diseases. Some of the planned analyses will require data collection on food intake to take place as soon as possible after data collection for KiGGS Wave 2, since certain parameters (such as blood values)

may be subject to change over time. Data for EsKiMo II will be collected between June 2015 and September 2017. EsKiMo II aims to provide an up-to-date overview of the dietary habits of children and adolescents aged 6 to 17 living in Germany.

2. Methodology

2.1 Study design and sampling

Participants of EsKiMo II are sampled from the cross-sectional study population of KiGGS Wave 2 (aged 6 to 17), mostly those who took also part in the physical examination of KiGGS Wave 2, and partly those who only answered the KiGGS questionnaire. The target population and sampling for KiGGS Wave 2 is described in detail in the article [New data for action. Data collection for KiGGS Wave 2 has been completed](#) in this issue of the Journal of Health Monitoring. Participants receive a written invitation to EsKiMo II three to six months after taking part in KiGGS Wave 2 and about six weeks prior to the scheduled date of the nutrition survey in their locality (routes). Participation and appointments for EsKiMo II are arranged by telephone ([Figure 1](#)). During a route, participants are visited at their homes in parallel at several KiGGS Wave 2 sample points ([Figure 2](#)) by specially trained nutritionists. Like in KiGGS Wave 2, the order of routes ensures a broad distribution of the regions visited across Germany within seasons, to account for seasonal differences. The survey aims for a net sample of at least 2,400 children and adolescents.

EsKiMo II received an approval from the ethics committee of the Hannover School of Medicine (number

Figure 1
Organisational process of EsKiMo II
field phases
Own figure

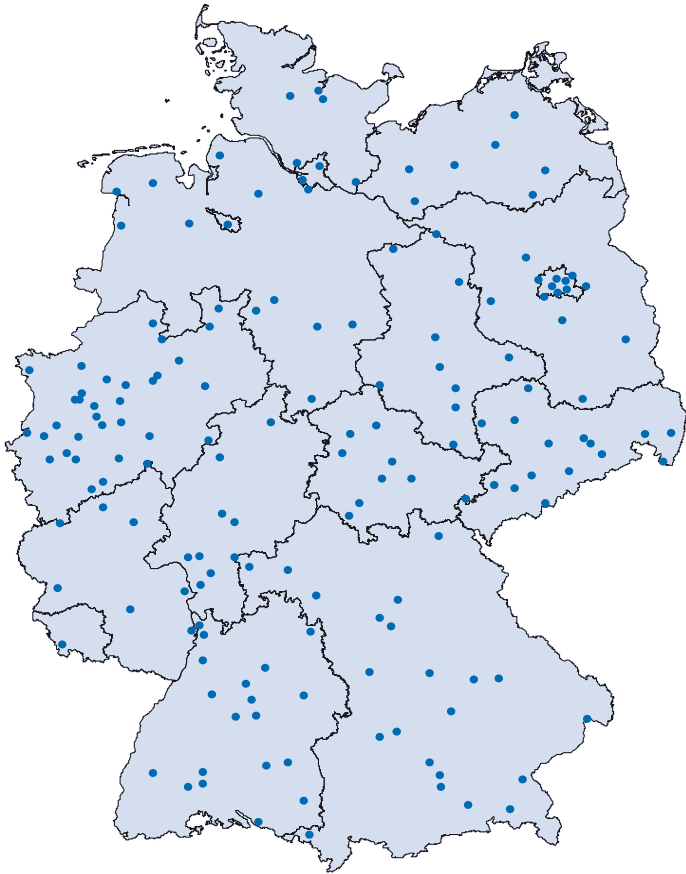
	Preparatory phase (4-6 weeks)		Field phase (1-2 weeks)	Post-processing phase (1-5 months)		
Ages 6-11	Invitations sent out to participants	Appoint- ments arranged	Instructions for the use of weighted food records	3-day food records and 1-day food record	Data processing and quality assurance	Personal nutrition analyses
Ages 12-17			DISHES interview	Data processing and quality assurance		

Adequate nutrition is essential in ensuring the healthy development of children and adolescents.

2275-2015). Germany’s Federal Commissioner for Data Protection and Freedom of Information has been informed about and has also approved the survey. Parents and guardians of all participants as well as adolescents aged 14 and older have provided their informed consent to participate in the survey.

2.2 Assessment methods and testing instruments

As in EsKiMo I, different assessment instruments are used for the specific age groups. For children aged 6 to 11, the parents (or guardians) are asked to use weighted food records to record children’s food intake on three consecutive days, followed by an additional 1-day weighted food record at a later point in time. A randomisation process is used to determine the recording days. The minimum timespan between the 3-day-weighted food record and the 1-day-weighted food record should be two weeks, the maximum timespan three months. The parents (or guardians) are instructed on how to record their children’s food intake. Entries are to include an exact description of the foods consumed as well as information on the brand, product name, fat content



● Sample points

Figure 2
Sample points of EsKiMo II
Source: RKI

EsKiMo II provides an up-to-date overview of the dietary behaviour of 6-to 17-year-olds in Germany.

(for example of cheese), the actual amount of food on the plate, and leftovers (Figure 3). Details on the time of consumption, place of food preparation/consumption, the state when purchased (for example raw), on how the meal was prepared, and what type of packaging it came in (for example plastic) are to be recorded as well. In addition, participants are asked to provide the recipes of self-prepared meals. Participants are given kitchen scales and instructions on how to use them, as well as a picture book showing portion sizes. A simplified version of the food record that children can fill out themselves is provided for situations where participants cannot weigh meals (for example in school canteens and/or restaurants). The simplified version of the

food record requires participants to describe meals as precisely as possible. Parents are asked to discuss the entries with their children at home. The amounts consumed are estimated based on the picture book or household measures. The picture book aims to improve the accuracy of participants' estimates. It was adapted for EsKiMo II and contains pictures provided by the International Agency for Research on Cancer (IARC) and the Pilot study for the Assessment of Nutrient intake and food Consumption Among Kids in Europe (PAN-CAKE) [7, 8]. Parents (or guardians) are also asked to weigh and record in advance the food and beverages that children take with them to school, as well as any leftovers. For children who have school meals, parents

Beispiel Ernährungstagebuch


1. Tag		Wochentag: (bitte ankreuzen)					Mo	Di	Mi	Do	Fr	Sa	So
Uhrzeit	Ort	Markenname (Firma) des Produkts	Produktbeschreibung (Fettgehalt, zugesetzte Vitamine u. Mineralstoffe)	Verpackung bei Verkauf	Zustand bei Einkauf		Zubereitung		Mengenangabe				
							Art	Ort	verzehr-fertige Menge (Waage/ Fotobuch)	Restmenge/ Abfall (Waage)			
7:00	z.H.	Dr. Oetker	Vitalis Knusper Schoko	K	getr		-	z.H.	63 g	-			
		+ Arla	Friche BioWeidemilch 1,5% Fett	V	gek	X	-	z.H.	127g	-			
		Becker's Bester	Orangensaft	G	kons		-	z.H.	211g	12g			
10:00	K	Demeter	Apfel, Sorte Elstar	-	fr	X	gew, geschä, geschn	z.H.	67g	-			
12:30	z.H.	Barilla	Spaghetti aus Hartweizengrieß	P	getr		geko	z.H.	112g	-			
		+	Tomatensoße mit Gemüse* (s. Rezept)	-	-		geko	z.H.	68g	-			
		Leibniz	Keks, Choco Vollmilch	K	-		-	-	15g	-			

Figure 3
Sample food record page (in German)
Source: RKI

(or guardians) are asked to provide the menu where possible.

Telephone support is available to respond to any possible question of participants. Participants return the completed food record to the RKI via a post-paid envelope.

On the scheduled date they receive the 1-day-weighted food record, which is also to be sent back after completion. After completion, survey participants receive a personal nutrition analysis and a voucher. The information provided in the food records is processed with

The data provide the basis for comprehensive analyses of trends in dietary habits over time of 6-to 17-year-olds.

Dishes Quest - Interview - Kartoffelgerichte

Name: 12.2003 Mahlzeit: Mittagessen täglich Ort: täglich

Wie häufig und wie viel dieser Kartoffelgerichte isst du zu dieser warmen Mahlzeit?

	pro Monat				pro Woche						täglich		
	nie	1	2	3	1	2	3	4	5	6			
Pell-, Salzkartoffeln [19].....												1,00	B2 Bild_2
Bratkartoffeln [19].....												0,00	
Pommes frites [20].....												0,00	
Kroketten, Herzoginkartoffeln.....												0,00	
Kartoffelpüree [21].....												1,00	B3 Bild_3
Kartoffelklöße, Kartoffelknödel.....												2,00	ST Stück
Kartoffelsalat mit Mayonnaise [18].....												0,00	
Kartoffelpuffer.....												3,00	ST Stück
Schupfnudeln, Gnocchi.....												0,00	
andere.....	<input type="checkbox"/> wählen												

2,00 ST Stück entspricht 150,00 Gramm

Figure 4
Example of a DISHES interview mask
(in German)
Source: RKI

KiGGS Wave 2

Second follow-up to the German Health Interview and Examination Survey for Children and Adolescents

Data owner: Robert Koch Institute

Aim: Providing reliable information on health status, health-related behaviour, living conditions, protective and risk factors, and health care among children, adolescents and young adults living in Germany, with the possibility of trend and longitudinal analyses.

Study design: Combined cross-sectional and cohort study conducted as an examination and interview survey

KiGGS cross-sectional study

Population: Children and adolescents with permanent residence in Germany

Sampling: Samples from official residency registries - randomly selected children and adolescents from the 167 cities and municipalities covered by the KiGGS baseline study

Age range: 0-17 years

Sample size: Approximately 15,000 participants

KiGGS cohort study

Sampling: Re-invitation of everyone who took part in the KiGGS baseline study (2003-2006; aged between 0 and 17 at that time) and who was willing to participate in a follow-up

Age range: 10-29 years

Sample size: Approximately 10,000 follow-up participants

Survey period: September 2014-August 2017

Modules: BELLA, EsKiMo, GerES, KiESEL, MoMo

More information is available at www.kiggs-studie.de/english

version 5.3 of the EAT software (Paderborn University) using the codes of the German Nutrient Database version 3.02 [9]. If necessary, discrepancies or missing information is clarified by telephone.

With participants aged 12 to 17 a personal dietary interview is conducted during the home visit using the DISHES software (Dietary Interview Software for Health Examination Studies). Developed at the RKI, DISHES is a tool to record regular dietary habits based on a modified diet history method. This method documents the frequency and portion size of meals during the past four weeks (Figure 4), the collected data are internally coded according to the German Nutrient Database version 3.02 [9]. Portion sizes are estimated using tableware and the picture book mentioned above. The instrument has been validated for adults [10]. Provided respondents give their consent, DISHES interviews are recorded digitally to allow staff to clarify cases where the data provided by participants does not seem plausible. In exchange, adolescents are remunerated and receive a personal nutrition analysis.

For both age groups, the survey also records details on school meals, diets, consumption of dietary supplements, as well as information including height and weight. This final item is important, because height and weight may be subject to change in the interval between data collection of KiGGS Wave 2 and EsKiMo II. EsKiMo II also includes participants who were not previously examined in the context of KiGGS Wave 2. The participants' current weight is required to evaluate their diet.

3. Discussion and outlook

EsKiMo II will provide again up-to-date representative data for Germany on the dietary behaviour and nutrient intake of children and adolescents aged 6 to 17. This overview is complemented by data on even younger children collected in the KiESEL survey. This means that a comprehensive data set on the dietary behaviour of children and adolescents of all ages will be available. For nutrition research, food and health policy, as well as for the implementation and evaluation of prevention measures, this data constitutes an important source of information. Besides the Federal Ministry of Food and Agriculture (BMEL) and the Robert Koch Institute, further ministries including the Federal Ministry of Health (BMG), the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), and subordinated institutes such as the Federal Institute for Risk Assessment (BfR), the German Environment Agency (UBA), as well as the European Food Safety Authority (EFSA) are greatly interested in up-to-date data on the dietary behaviour of children and adolescents in Germany. This is because this data helps to identify deficits in the nutrition situation and to develop corresponding consumer protection measures.

Because food supply and therefore also dietary behaviour are changing constantly, surveys on dietary behaviour should be conducted at regular intervals. During the past years, for example, the number of gluten-free, vegetarian, and vegan products on offer has increased significantly. The contents of products such as breakfast cereals are also regularly modified. Consumption of exotic products in Germany has increased as a result of the

EsKiMo II is an important source of information for nutrition and health policy.

globalisation of trade. This steadily expanding and changing supply of foods increases the difficulties of recording data on food consumption. Therefore, within EsKiMo II, food composition information on foods not yet included in the German Nutrient Database as well as dietary supplements is continually gathered.

The combination of EsKiMo I (2006) and EsKiMo II (2015-2017) for the first time enables a comprehensive analysis of changes in the dietary habits of children and adolescents in Germany over the past ten years. This is facilitated by the largely identical design and methods used in both surveys. The most important differences between both surveys are that in EsKiMo II data collection was one year longer and that food amounts are weighed instead of estimated. Both of these aspects ought to be considered when interpreting the results. To improve diet-related risk assessment, EsKiMo II uses a 3-day-weighted food record and an independent 1-day food record. EsKiMo is therefore now in line with the standards of other institutions such as EFSA [11]. All of the instruments used in EsKiMo II were developed in close collaboration with the **KiESEL** study team, a step that will ensure a high degree of comparability between both nutrition surveys.

The food record method produces a detailed and complete appraisal of consumed foods. Frequently, however, food consumption changes while conducting a record. This method is used for young children, in particular, because they cannot be interviewed on their dietary behaviour yet [12]. With adolescents, the willingness to keep such a diary for three consecutive days is probably significantly lower than among parents of younger chil-

dren. Moreover, adolescents in particular spend a lot of time outside of their homes, which could make filling out a food record difficult. This is why for this group the DISHES interview was used.

Home visits will be concluded in September 2017. A more detailed description of the study design and methods is available elsewhere [13]. First results for EsKiMo II will be available in 2018. EsKiMo II results will be made available to policy-makers, science, and the interested public. Corresponding publication formats are being considered, such as project reports, press releases, and German and English language publications in academic journals.

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German Environment Agency

German Environmental Survey for Children and Adolescents 2014-2017 (GerES V) – the environmental module of KiGGS Wave 2

Abstract

Health-relevant exposures to environmental pollutants, fungi, bacteria, noise, and air pollution have to be identified at an early stage. At the same time, impacts on health and their potential environmental causes need to be investigated and documented. The German Environmental Survey for Children and Adolescents 2014-2017 (GerES V) is the environmental module of KiGGS Wave 2 of the Robert Koch Institute and takes a deeper look at the sections living conditions and health status of the KiGGS study. GerES V collects up-to-date information on the exposure of children and adolescents in Germany aged 3 to 17 to chemicals and investigates chemical and physical environmental pollutants in their living environments. The survey contributes to identifying environmental hazards and measures that effectively reduce or prevent such hazards in order to protect and promote the health of the young generation.

◆ GERES · HUMAN BIOMONITORING · MONITORING OF NEIGHBOURHOODS AND LIVING ENVIRONMENTS · HEALTH MONITORING

1. Background and objective

The German Environmental Surveys are large-scale cross-sectional studies. They strive to collect representative data on the German population's health-related and domestic exposure to environmental exposures. This data is constantly updated and evaluated to provide science-based advice to policy-makers and the public. Data and analyses are made available to the scientific community and the general population. They constitute key elements in the health-related federal monitoring of the environment (GUB) and national-level environmental reporting. They provide a basis for evaluating the population's exposure to health-relevant environmental pol-

lutants and deriving basic data for exposure analyses and risk assessments [1].

The reference values for blood and urine levels of environmental pollutants are one example of how these measurement results are used. They are derived by the German Human Biomonitoring Commission of the German Environment Agency. These reference values indicate whether a person's exposure to pollutants is above average.

GerES data can reveal changes over time and regional differences in exposure. This allows the identification of regions and population groups that are particularly vulnerable (hot spots and at risk groups). Identifying the sources of pollutants and exposure pathways and analysing associations between environmental pollutants



GerES V

Fifth cycle of the German Environmental Survey 2014-2017

Acronym: GerES - German Environmental Survey

Implementation: German Environment Agency

Aim: Providing reliable information on the exposure of children and adolescents aged 3 to 17 in Germany to chemicals as well as on the exposure to chemical and physical environmental stressors of young people in their living environments.

Study design: Cross-sectional examination and interview survey

Population: Children and adolescents with permanent residence in Germany

Sampling: GerES V participants were randomly selected from the cross-sectional sample of KiGGS Wave 2 (registry office sample). An invitation to GerES V required prior participation in KiGGS Wave 2.

Age range: 3-17 years

Sample size: approximately 2,500 participants

Survey period: January 2015-June 2017

More information is available at www.uba.de/geres

Table 1
GerES survey waves
Own table

and diseases helps to develop strategies to minimise exposure and develop targeted environmental policy measures.

The data collected by GerES also provide a basis for formulating German positions on the scientific development of the European chemicals regulation REACH (registration, evaluation, authorisation and restriction of chemicals).

The German Environment Agency (UBA) has been implementing GerES cycles since 1985 in close cooperation with the health surveys of the Robert Koch Institute (RKI) [2], which is why the German Environmental Survey recently supplemented the KiGGS baseline study [3].

Table 1 shows GerES samples and response rates and the surveys that each cycle cooperated with.

KiGGS Wave 2 collected both socio-demographic data and information on health status and behaviour, living conditions, protective and risk factors, as well as on preventive healthcare. Their combination with the data collected by GerES V on the exposure of children and ado-

lescents in Germany to harmful substances allows researchers to establish new hypotheses regarding environmental health impacts. A particular analytical focus is on types of environmental hazards and their correlation with health indicators, but also on the German population's environment-related disease burden and on the analysis and evaluation of economic and social correlations.

2. Methodology

2.1 Study design and sampling

The sample of the German Environmental Survey for Children and Adolescents 2014-2017, GerES V, consists of the participants aged 3 to 17 who were examined as part of the cross-sectional sample of KiGGS Wave 2. KiGGS target population and sampling is discussed in detail in the article [New data for action. Data collection for KiGGS Wave 2 has been completed](#) in this edition of the Journal of Health Monitoring. Children and adoles-

	GerES I	GerES II a+b	GerES III	GerES IV	GerES V
Regional dimension	West Germany	a) West Germany b) East Germany	Germany	Germany	Germany
Study period	1985-1986	a) 1990-1991 b) 1991-1992	1997-1999	2003-2006	2014-2017
Age range, in years	25-69	a) 25-69 & 6-14 b) 18-79 & 6-17	18-69	3-14	3-17
Net sample (N)	2,731	a) 2,524 and 453 b) 1,763 and 359	4,822	1,790	Objective: 2,500
Response rate (%)	73.0	a) 63.1 b) 69.0	54.5	77.3	To be calculated after study concludes
Co-operation	National examination survey t ₀ 1984-1986 [4]	National examination survey t ₂ 1990-1992 [4]	Federal health survey 1998 [5]	KiGGS baseline study [6]	KiGGS Wave 2

For GerES V drinking water, urine, blood, dust and air samples are analyzed for environmental pollutants.

Particulate matter contamination and noise are measured in neighbourhoods and analysed in combination with questionnaire responses.

cents were randomly drawn from the gross sample and assigned to the GerES V study during sampling for KiGGS Wave 2 and independently of their previous participation in KiGGS. An invitation to GerES V was bound to prior participation in KiGGS Wave 2.

All GerES V participants were selected from the pool of KiGGS Wave 2 participants. At the beginning of their visit to the examination centre, they were informed about the goals and content of the survey and motivated to participate. RKI staff in particular drew on the GerES V survey flyer and invitation letter. KiGGS Wave 2 participants who showed interest in GerES V were asked to sign consent forms for their data to be shared, to allow GerES staff to contact them, and if possible also for a blood sample to be forwarded to the UBA. Families interested in participating then received a letter with an appointment for the examination and interview at their home from Kantar Health GmbH, the company commissioned by the UBA to conduct the field work for GerES V. Participants were expected to confirm the appointment in writing, which then took place about ten days later. [Figure 1](#) shows the sample points.

The study strictly complies with data protection regulations and has been approved by Germany's Federal Commissioner for Data Protection and Freedom of Information. Participation in the survey was voluntary. Participants in the survey or their legal guardians were informed about the goals and content of the survey as well as about data privacy, and provided their informed consent. The study received a positive vote from the ethics commission of the Berlin Chamber of Physicians (Ärztekammer Berlin, Eth-14/14).

2.2 Assessment methods and testing instruments

Scientific validity was the key criterion behind the selection of survey methods and instruments. Additional aspects that were also considered were: practicality of instruments in the field, the amount of time participants would have to invest, and the feasibility of ensuring contamination-free sampling and the contamination-free storage and transport of samples. The UBA successfully



Figure 1
Sample points of GerES V
Source: RKI

KiGGS Wave 2

Second follow-up to the German Health Interview and Examination Survey for Children and Adolescents

Data owner: Robert Koch Institute

Aim: Providing reliable information on health status, health-related behaviour, living conditions, protective and risk factors, and health care among children, adolescents and young adults living in Germany, with the possibility of trend and longitudinal analyses.

Study design: Combined cross-sectional and cohort study conducted as an examination and interview survey

KiGGS cross-sectional study

Population: Children and adolescents with permanent residence in Germany

Sampling: Samples from official residency registries - randomly selected children and adolescents from the 167 cities and municipalities covered by the KiGGS baseline study

Age range: 0-17 years

Sample size: Approximately 15,000 participants

KiGGS cohort study

Sampling: Re-invitation of everyone who took part in the KiGGS baseline study (2003-2006; aged between 0 and 17 at that time) and who was willing to participate in a follow-up

Age range: 10-29 years

Sample size: Approximately 10,000 follow-up participants

Survey period: September 2014-August 2017

Modules: BELLA, EsKiMo, GerES, KiESEL, MoMo

More information is available at www.kiggs-studie.de/english

tested the survey methods and instruments in a GerES V pilot study [7].

GerES V data collection consisted of a standardised interview, human biomonitoring (blood and morning urine samples), indoor monitoring (house dust, indoor air and drinking water samples), noise level measurements and – for the first time in GerES V – a measurement of the indoor concentration of ultrafine particles and a measurement of the particulate matter (PM_{2.5}) concentrations indoors and outdoors. Blood samples were taken only once after participants signed the consent form in KiGGS Wave 2.

CAPI (Computer Assisted Personal Interview) was used to collect data on the neighbourhood, flat use, equipment and furniture, use of products, amount of time spent indoors and in which rooms, pets, passive and active smoking, dental status, clothing, dietary habits, subjectively perceived levels of noise and to document the samples and measures taken. Data on potentially environment-related health hazards faced by children and adolescents were recorded in a self-administered questionnaire. A further self-administered questionnaire allowed respondents to provide feedback on the process and content of the individual examination programmes (satisfaction surveys).

The samples are tested for environmental pollutants that are known or believed to cause health impacts and may lead to exposure of the general population. Quality assured analysis methods for these substances have to be available. Tests were conducted for example for phthalates and substitute plasticisers, cosmetics ingredients such as UV filters and preservatives, heavy metals such

as lead and quicksilver, volatile organic compounds such as benzene, polycyclic aromatic hydrocarbons (PAH), per- and polyfluorinated compounds (PFAS) or polychlorinated biphenyls (PCB).

On the appointment day, participants were visited in their homes by a specially trained interviewer. The examinations and interviews took on average 90 minutes to complete and comprised the following components:

- ▶ Drinking water sample from the tap the family usually uses for drawing drinking water [8]
- ▶ A morning urine sample of participating children and adolescents
- ▶ A measurement of noise levels in front of the window of the room in which the child or adolescent sleeps
- ▶ A measurement of ultrafine particles in the room air of the child's room
- ▶ A personal interview with the parents or guardians and with those children/adolescents aged 11 and older
- ▶ A self-administered "Questionnaire on diseases and health problems suffered by the child"
- ▶ The self-administered "Satisfaction survey" questionnaire.

Moreover, in some randomly selected households:

- ▶ Additional drinking water samples
- ▶ A full vacuum cleaner bag
- ▶ Volatile organic environmental pollutants in the room air collected with passive samplers on seven subsequent days
- ▶ Suspended particulate matter collectors for active collection of indoor and outdoor particulate matter on seven subsequent days

The results provide a basis for decisions on environmental health regulations and laws.

The results help raise awareness in Germany of the young generation's exposure to environmental pollutants.

The GerES V field phase began on 15 January 2015 and ended on 21 June 2017.

3. Discussion and outlook

GerES V provides the basis to analyse a broad range of politically and scientifically relevant questions. Some examples include:

1. To which degree is the population exposed to chemical compounds for which no monitoring method previously existed? A collaboration project between the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and the German chemical industry association (VCI) launched in 2010 has been developing up to five new methods per year to measure pollutants accumulated in the body. These methods are to be pioneered in GerES. The goal is to develop up to fifty new methods over the coming years [9].
2. Which impact do room setup and use have on indoor pollution levels with carcinogenic polycyclic aromatic hydrocarbons? The increasing popularity of wood-burn fire stoves potentially increases risks, which is why analysis here focuses on particulate matter that PAH potentially adsorbs to.
3. What are the actual contamination levels of drinking water? Are the parameters of the household drinking water regulation for lead, nickel and copper being met?
4. Do social status or gender impact a person's exposure to pollutants? In terms of environmental justice,

analysis here is aimed at identifying the social factors that influence exposure to pollutants, indoor pollutants and stressors in the living environment such as noise levels.

5. How great is the loss of healthy life years and quality of life due to the population's exposure to harmful environmental impacts? Which environmental impacts on average cause greater disease burdens than others?
6. Which healthcare costs do environment-related diseases cause?

Initial results should become available around one and a half years after conclusion of the field phase. The respondents' high willingness to participate in the survey and the high share of correctly collected samples and measurements have created the basis for a successful conclusion of GerES V. The results will contribute to making the environment in Germany even more liveable and healthy for children and adolescents and their families. With the German environmental survey on health, the RKI and UBA together make an important contribution to overall efforts in protecting health and the environment.

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The BELLA study – the mental health module of KIGGS Wave 2

Abstract

The BELLA study is the module on mental health and health-related quality of life within the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). Baseline data collection took place together with KiGGS baseline data collection between 2003 and 2006. This article discusses the fourth follow-up of the BELLA study (BELLA Wave 4), which was surveyed between 2014 and 2017. The aims of the BELLA Wave 4 are to enable longitudinal analyses of health-related quality of life and mental health problems. Dynamic measurement instruments were used to enable a user-friendly and precise assessment of mental health among children, adolescents and young adults. The study's participants were a sub-sample of around 3,500 KiGGS respondents aged 7 to 29 years. For the first time, in BELLA Wave 4 data were collected exclusively online. The BELLA study targeted both the parents of younger children (aged 7 to 13 years) and adolescents and young adults themselves (aged 11 years and above). Study instruments surveying mental health problems and the use of mental health care services were supplemented by a dynamic measurement tool in the form of a computer adaptive test (CAT) to record data on health-related quality of life.

◆ BELLA STUDY · MENTAL HEALTH · QUALITY OF LIFE · HEALTH MONITORING · KIGGS

1. Background and objective

The past century has seen significant changes to the challenges facing child health. While medical progress has greatly curbed the threat of infectious diseases, mental disorders such as depression and anxiety disorders are today among the most frequent illnesses affecting children and adolescents [1, 2]. Mental health disorders affect an estimated 20% of children and adolescents in Germany [1-3], and can lead to significant limitations for families, at school and impact a person's wider social environment [4-6]. Moreover, mental health disorders in children and adolescents have a high risk of becoming chronic, and the development of comorbidities

(accompanying diseases) is frequent in this group, which means that further mental disorders might develop [7]. This underlines the high public health relevance of mental health as an important factor in strengthening healthy childhood development and ensuring social participation. Furthermore, subjective well-being and quality of life are considered important aspects for modern concepts of health, especially in terms of prevention and intervention [8].

The BELLA study on mental health is conducted by professors Ulrike Ravens-Sieberer and Fionna Klasen at the University Medical Center Hamburg-Eppendorf's Child Public Health department and has been from its start one of the supplementary modules of the German



BELLA study Wave 4

Fourth wave of the survey on the mental health and health-related quality of life of children, adolescents and young adults in Germany (BELLA study), 2014-2017

Acronym: BELLA - BEfragung zum seeLischen WohLbefinden und VerhAlten

Implementation: University Medical Center Hamburg-Eppendorf

Aim: Providing reliable information on the mental health and health-related quality of life of children, adolescents and young adults in Germany and the possibility for trends and longitudinal analyses.

Survey design: Combined online cross-sectional and cohort study

BELLA cross-sectional study

Population: Children and adolescents with permanent residence in Germany

Sampling: BELLA study participants were randomly selected from the cross-sectional sample of KiGGS Wave 2 (registry office sample). An invitation to participate in the BELLA study required prior participation in KiGGS Wave 2.

Age range: 7-17 years

Sample size: Approximately 1,400 participants

BELLA cohort study

Sampling: Renewed invitation of all participants in the BELLA baseline study (2003-2006) and BELLA Wave 3 (2009-2012) willing to take part again

Age range: 10-29 years

Sample size: Approximately 2,100 participants from the baseline survey and Wave 3

Survey period: November 2014-October 2017

More information in German is available at www.bella-study.org

National Health Interview and Examination Survey among Children and Adolescents (KiGGS). The module strives for a more in-depth study of mental health and health-related quality of life among children and adolescents in Germany. BELLA Wave 4 has been designed as both a cohort and cross-sectional study, which means that respondents from previous waves (BELLA cohort) as well as a sample of new participants (cross-sectional) is surveyed. This approach provides not only a representative assessment of mental health in German-speaking children and adolescents, but also affords insights into the development of mental health over time, as eleven years have now passed since the baseline study.

KiGGS and BELLA baseline data were collected between 2003 and 2006, followed by two subsequent BELLA study waves (Wave 1: 2004-2007, Wave 2: 2005-2008). Two further BELLA Waves took place in parallel with KiGGS Wave 1 and KiGGS Wave 2 (BELLA Wave 3: 2009-2012, BELLA Wave 4: 2014-2017) (Figure 1). BELLA Wave 4 for the first time applied a dynamic measurement instrument (computer adaptive test, CAT) to monitor health-related quality of life among children and adolescents (Kids-CAT) [9]. Therefore, the BELLA study was able to provide up-to-date reference data for a general population sample to standardise the Kids-CAT.

2. Methodology

2.1 Study design and sampling

The BELLA Wave 4 comprises a representative sub-sample of the KiGGS study population sample. It includes roughly 3,500 children and adolescents aged 7 to 17 years,

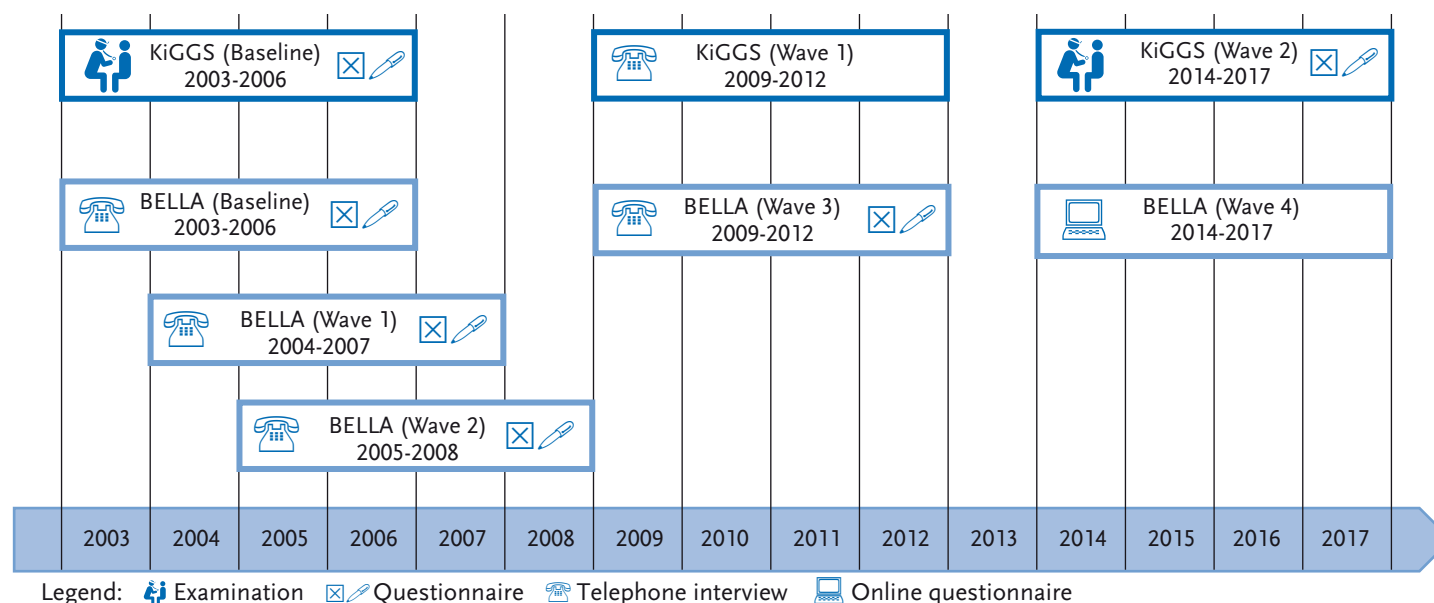
their parents as well as young adults aged 18 to 29 years. The BELLA Wave 4 cross-sectional sample is a subsample of the KiGGS Wave 2 cross-sectional sample and includes children and adolescents aged 7 to 17 years. The target population and sampling method are described in detail in the article [New data for action. Data collection for KiGGS Wave 2 has been completed](#) in this issue of the Journal of Health Monitoring. Children and adolescents were randomly drawn from the gross sample and assigned to the BELLA study during sampling for KiGGS Wave 2. An invitation to participate in BELLA Wave 4 required prior participation in KiGGS Wave 2.

The longitudinal sample of the BELLA study includes all respondents of the BELLA baseline study (2003-2006), as well as all BELLA Wave 3 (2009-2012) respondents who had in parallel participated in KiGGS Wave 1. Whether respondents had participated in BELLA Waves 1 and 2 was irrelevant.

For 7-to 10-year-olds, BELLA Wave 4 surveyed the parental assessment of the children's mental health and health-related quality of life. For children aged 11 to 13 years, it surveyed both parental assessments and the children's self-assessment, while adolescents aged 14 years and older were surveyed exclusively by self-assessment.

The Federal Commissioner for Data Protection has been informed and approved the study. The survey staff is bound by the provisions of the German Data Protection Act and subject to strict confidentiality. Survey data are treated with absolute confidentiality and pseudonymised prior to being saved and analysed. The

Figure 1
BELLA study data collection
Own figure



The BELLA study is the
KiGGS supplementary
mental health module.

survey received a positive vote from the Ethics Committee of Hamburg's Chamber of Psychotherapists on 24 September 2014. All BELLA study respondents and/or their parents are informed about the means taken to protect their data, and provide their informed consent. Participation in the study is voluntary and respondents can cancel their participation at any time without having to give reasons.

The scientific evaluation of BELLA data relies on statistical tools to analyse and visualize frequencies and correlations for larger groups of respondents only (no analyses of individual cases). In no case is data used commercially or made available to health insurance funds and insurances.

2.2 Assessment methods and testing instruments

For the first time, the forth Wave of the BELLA study was conducted as a purely online-based survey. Respondents were able to fill out the questionnaire using devices such as smartphones, PCs or laptops. After consenting to being contacted by members of the BELLA team, respondents received a letter containing the consent forms and data privacy statements. Children and adolescents aged under 18 years required a written consent by at least one legal guardian. Additionally, adolescents aged 14 years and older signed their own consent form. Respondents aged 18 years and older as well as parents were able to provide their consent either in writing or electronically. Children and parents received their login details for the online questionnaire separately. All

KiGGS Wave 2

Second follow-up to the German Health Interview and Examination Survey for Children and Adolescents

Data owner: Robert Koch Institute

Aim: Providing reliable information on health status, health-related behaviour, living conditions, protective and risk factors, and health care among children, adolescents and young adults living in Germany, with the possibility of trend and longitudinal analyses.

Study design: Combined cross-sectional and cohort study conducted as an examination and interview survey

KiGGS cross-sectional study

Population: Children and adolescents with permanent residence in Germany

Sampling: Samples from official residency registries - randomly selected children and adolescents from the 167 cities and municipalities covered by the KiGGS baseline study

Age range: 0-17 years

Sample size: Approximately 15,000 participants

KiGGS cohort study

Sampling: Re-invitation of everyone who took part in the KiGGS baseline study (2003-2006; aged between 0 and 17 at that time) and who was willing to participate in a follow-up

Age range: 10-29 years

Sample size: Approximately 10,000 follow-up participants

Survey period: September 2014-August 2017

Modules: BELLA, EsKiMo, GerES, KiESEL, MoMo

More information is available at www.kiggs-studie.de/english

respondents received a unique user name and password to access the BELLA study at www.ichbingefragt.de. The questionnaire for young children required approximately 5 to 10 minutes to fill out; the slightly longer questionnaire for adolescents and adults required 15-20 minutes. On request, respondents without internet access were provided with a paper-based questionnaire by mail.

The Wave 4 is the first Wave of the BELLA study – and presumably the first ever general German population-based sample – to use a dynamic survey method (a computer adaptive test; CAT). Based on precalculated item parameters and respondents' previous answers CATs customise the selection of follow-up items, facilitating precise data collection on specific items [10]. Compared with conventional questionnaires (static forms of data collection), CATs are characterised by greater measurement precision and a reduced number of items. The realisation of BELLA Wave 4 is based on the experiences made with previous KiGGS and BELLA study waves, cooperation with the US Patient-Reported Outcomes Measurement Information System (PROMIS project) [11], as well as self-developed CAT instruments. The following sections present the BELLA Wave 4 measurement instruments (Table 1).

Health-related quality of life

The BELLA Wave 4 applied the Kids-CAT to survey child and adolescent health-related quality of life. The Kids-CAT tool, developed by the authors of this article, measures self-reported health-related quality of life based on five items banks (physical well-being, psychological well-being, parent relations, social support & peers as well as

school well-being) [9] (Figure 2). For the first time, BELLA Wave 4 also integrated the proxy version (static) of Kids-CAT to survey the parents' perspective. The KIDSCREEN-27 questionnaire [12], the SF-12 questionnaire [13] and the SF-36 questionnaire [14] were used as supplementary instruments. The KIDSCREEN is a recognised instrument to survey health-related quality of life among children and adolescents aged 8 to 18 years. The SF-36 and its short form, i.e. the SF-12, are internationally the most widely used instruments to assess the quality of life both among adolescents aged 14 years and older and among adults; it targets to provide psychometrically sound data to survey the BELLA cohort's transition to adult age. In addition, the item banks developed by the US-based collaborative research project PROMIS [11, 23] to survey subjective well-being, family relations, physical activity, relations with peers and global health were used as validated short questionnaires. The BELLA study's parallel use of European and American instruments allows to psychometrically test and systematically compare the applied measurement tools and constructs. In the long term, they can provide important contributions towards an international standardisation of measurement instruments to assess health-related quality of life and/or well-being.




Mental health problems

Child and adolescent mental health was surveyed via the Strengths and Difficulties Questionnaire (SDQ) [16, 17] used in KiGGS. For respondents aged 18 years and older, the BELLA Wave 4 used the Composite International Diagnostic-Screener (CID-S) [19], an established adult mental health screening instrument, as well as SCL-S-9

Table 1
BELLA Wave 4 measurement instruments
 Own table

The fourth wave (BELLA Wave 4) provides data for longitudinal analyses of health-related quality of life and mental health problems.

Instrument	Age in years											
	7	8	9	10	11	12	13	14	15	16	17	18+
A. Health-related quality of life												
Kids-CAT dynamic [9]												
Kids-CAT static [9]												
KIDSCREEN-27 [12]												
SF-12 [13]												
SF-36 [14]												
PROMIS-Subjective well-being [11]												
PROMIS-Family well-being [11]												
PROMIS-Physical activity [11]												
PROMIS-Relations with peers [11]												
PROMIS-General health [15]												
PROMIS-Profil 29 [11]												
B. Mental health problems												
SDQ ^a [16]												
SDQ-Impact ^a [17]												
PHQ-Screening [18]												
CID-S [19]												
SCL-S-9 [20]												
C. Depression												
Age-specific items												
PROMIS-Depression (short form) [21]												
CES-DC [22]												
D. Care												
Identification of health-related issues & health care use												
Need for care and treatment & barriers												
E. Application												
Control items linked to the online survey												

 parent interview (proxy interview)
 children and adolescents (self-assessment)
 young adults (self-assessment); mixed: self-assessment and parent interview

^a instrument used in KiGGS Wave 2

Kids-CAT = Kids-Computer-Adaptive Test, SF-12 = Short Form-12 health questionnaire, SF-36 = Short Form-36 health questionnaire, PROMIS = Patient-Reported Outcomes Measurement Information System, SDQ = Strengths and Difficulties Questionnaire, SDQ-Impact = Strengths and Difficulties Impact Supplement, PHQ = Patient Health Questionnaire, CID-S = Composite International Diagnostic Screener, SCL-S-9 = Symptom-Checklist-short version-9, CES-DC = Center for Epidemiological Studies Depression Scale for Children

Figure 2
Kids-CAT in the online questionnaire
 (sample items)
 Source: [27]

BELLA Wave 4 relies on dynamic measurement tools to produce user-friendly and precise data on the mental health of children, adolescents and adults.



Thinking about the last week ...

Have you felt fit and well?

☐ not at all
 ☐ slightly
 ☒ moderately
 ☐ very
 ☐ extremely

→

PHYSICAL ACTIVITIES AND HEALTH

During the last week ...

I felt well at home.

☐ never
 ☐ seldom
 ☒ quite often
 ☐ very often
 ☐ always

→

FAMILY

Thinking about the last week ...

Have you felt that your life is not worth living?

☐ never
 ☐ seldom
 ☐ quite often
 ☒ very often
 ☐ always

→

GENERAL MOOD AND FEELINGS

BELLA Wave 4 data was collected online-only for the first time.

[20], a shortened form of Derogatis' (1977) SCL-90-R symptoms check list. SCL-S-9 comprises 9 items and is used to survey mental health problems of adults. All applied psychometric measurements are established and validated mental health instruments.

To survey symptoms of depression in children and adolescents, the Center for Epidemiological Studies Depression Scale, Child (CES-DC) [25] was used. The PROMIS initiative has fostered the development of pediatric item banks for depression. These were translated into German for the BELLA study, and the shortened forms were used across all age groups. In the long term, projects focused on developing an age-independent CAT to assess symptoms of depression will be able to build on BELLA study data. A corresponding CAT for adults (D-CAT) is already available [26].

Mental health care use

The items used to assess mental health care were developed based on the validated tools already available. They were adapted to the specific needs of this research project. Besides surveying the psychiatric/socio-psychiatric/psycho-therapeutic, psychological or socio-pedagogic care that respondents had used, and how happy they had been with the treatment received, the tool also assessed possible treatment needs as well as barriers that prevented people from accessing treatment.

3. Discussion and outlook

The BELLA study supplements the KiGGS survey on mental health and health-related quality of life among chil-

dren, adolescents and young adults in Germany. The BELLA study design allows data to be collected that can be used both to define the prevalence of mental disorders, analyse the corresponding developments over time and identify the determinants (risk and protective factors) linked to these developments, and to systematically assess the use of health care services during childhood and adolescence [28-31].

The BELLA study also analyses health inequalities, i.e. the differences in mental health and health-related quality of life among children and adolescents depending on their social background. The analysis of health inequalities bears a great potential to develop approaches for prevention and intervention at the level of those immediately affected (family and social environment), but also at the level of society in general (health and education system).

BELLA Wave 4 is conducted 11 years after the baseline study and therefore provides data on respondents during their passage from childhood through adolescence to young adulthood. The discussion of such transitions (for example transitions between educational institutions) and the related changes in the way people assess their health-related quality of life and mental health provide important developmental and psychological insights into childhood, adolescence and young adulthood.

In terms of methodology, the BELLA study offers an innovative and forward-thinking approach to measuring mental health and health-related quality of life across all ages. Dynamic measurement instruments such as CATs can be used in population-based cohort studies as well as in clinical practice.

As regards actual fieldwork, the online survey has proven to be highly effective both in terms of time and staff. Respondents could fill out the BELLA questionnaire on a device of their choice, ‘around the clock’, and without having to make an appointment. Respondents had easy access to the questionnaire via automatically generated user IDs, and the approach complies with data protection provisions. Data collection is set to end in autumn 2017, so initial results can be expected for the spring of 2018.

Parties interested in using BELLA study data for academic research are welcome to write to the study directors providing an outline of the planned project.

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BELLA study group

The BELLA study group consists of: Ulrike Ravens-Sieberer and Fionna Klasen, Hamburg (lead researchers); Claus Barkmann, Hamburg; Monika Bullinger, Hamburg; Manfred Döpfner, Cologne; Beate Herpertz-Dahlmann, Aachen; Heike Hölling, Berlin; Christiane Otto, Hamburg;

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Motorik-Module (MoMo) – the KiGGS Wave 2 module to survey motor performance and physical activity

Abstract

Initially, the Motorik-Module (MoMo) Longitudinal Study was surveyed between 2003 and 2006 using a sub-sample from the baseline German Health Interview and Examination Survey for Children and Adolescents (KiGGS). The federal representative sub-sample of KiGGS consisted of 4,528 children and adolescents aged 4 to 17. To date, there have been two further survey waves: 2009-2012 (Wave 1) and 2015-2017 (Wave 2). MoMo Wave 2 consists of motor performance tests, anthropometric measurements, questionnaire-based information collection on activity habits and motion sensor data. Initial results of MoMo Wave 2 will be published in the second half of 2018. The total size of the Wave 2 sample is estimated to reach 5,200 participants. As its central goal, the MoMo longitudinal survey aims to contribute towards the long-term improvement of child and adolescent health in Germany. A focus will be on developmental (age-related) and periodic (over time) trends in motor performance and physical activity, underlying factors and the impacts on physical and mental health in the development of children and adolescents.

◆ MOTOR PERFORMANCE · PHYSICAL ACTIVITY · ACCELEROMETRY · HEALTH MONITORING · KIGGS

1. Background and objective

Surveying motor performance and physical activity patterns in the development and health of children and adolescents is essential and plays a particularly important role in health promotion [1-3]. As is well-known, regular physical exercise benefits health and helps prevent diseases; good motor performance is also a protective factor for the cardiovascular system [4-6]. Inversely, experts blame the increasingly sedentary lifestyle of children, adolescents and adults for the progress of diseases such as obesity [7], cardiovascular diseases [2] and mental disorders [8]. In adults, this connection between physical activ-

ity behaviour, motor performance and health has been widely established [9]; however, there are still gaps in research involving children and adolescents [8, 10].

The MoMo (Motorik-Module) survey has been a module of the representative German Health Interview and Examination Survey for Children and Adolescents (KiGGS) of the Robert Koch Institute since the 2003-2006 baseline study [11]. MoMo collects data on motor performance, anthropometric measurements as well as levels of physical activity among children and adolescents. The MoMo module in particular aims to analyse a) the developmental (age-related) and periodic (over time) trends of motor performance and physical activity



Motorik-Modul: Eine Studie zur Fitness und körperlich-sportlichen Aktivität von Kindern und Jugendlichen in Deutschland

Motorik-Module Wave 2

Third time of data collection for the Motorik-Module Study Physical fitness and physical activity as determinants of health development in children and adolescents, 2015-2017

Acronym: MoMo - Motorik-Module-Study

Implementation: Karlsruhe Institute of Technology, Institute of Sports and Sports Science

Aim: Providing reliable data on motor performance and physical activity among children and adolescents in Germany as a basis to analyse trends and for longitudinal analyses as well the analysis of links between motor performance and levels of physical activity on the one hand and health development among children and adolescents on the other.

Study design: Combined cross-sectional and cohort examination and interview survey

MoMo cross-sectional study

Population: Children and adolescents with permanent residence in Germany

Sampling: MoMo Wave 2 participants are randomly sampled from the cross-sectional sample of KiGGS Wave 2 (registry office sample). Prior participation in KiGGS Wave 2 is prerequisite for an invitation to MoMo Wave 2.

Age range: 4-17 years

Sample size: Approximately 5.200 participants (expected)

MoMo cohort study

Sampling: Renewed invitation of all participants in the MoMo baseline survey (2003-2006; then aged 0-17) or MoMo Wave 1 (2009-2012) willing to take part again. Prior participation in KiGGS Wave 2 is prerequisite for an invitation to MoMo Wave 2.

Age range: 10-29 years

Sample size: Approximately 3,000 returning participants

Survey period: January 2015-September 2017

More Information in German is available at www.motorik-modul.de

as well as b) the underlying factors and c) the effects of motor performance and physical activity on the health development of children and adolescents. The MoMo module provides supplementary in-depth information on motor performance and physical activity for a sub-sample of KiGGS study respondents. Linking the data collected by the MoMo and KiGGS studies offers the unique opportunity to combine the representative physical and mental health and health behaviour data of children and adolescents in Germany with detailed data on physical activity and motor performance.

Based on representative data for the German population (as of 2004), the MoMo baseline survey (2003-2006, 167 sample points, n=4,528) delivered age- and gender-specific norm values of motor performance of children and adolescents aged 4 to 17, as well as data collection on activity levels based on a standardised method [12]. In order to record over time the development of motor performance and physical activity levels of children and adolescents, MoMo Wave 1 (2009-2012) and Wave 2 (2015-2017) invited the children, adolescents and young adults who had participated in the baseline survey for renewed examinations. The third survey wave is scheduled for 2018-2020. Continuing the MoMo survey, based on a cohort-sequential design, will for the first time make it possible to combine reliable cohort comparisons [13], as well as longitudinal analyses of motor performance and physical activity and the health of children and adolescents aged 4 to 28 (as of MoMo Wave 2) [11, 14, 15]. Cross-sectional analyses of different samples in the form of cohort comparisons performed at different time points can help

researchers trace changes across the total sample. In longitudinal analyses, in contrast, the same survey participants are examined and questioned at different time points. These analyses can reveal changes for a single individual and highlight causal relations between different variables.

Currently the MoMo module is in the data collection phase for Wave 2. The following sections address this phase and the methodology applied.

2. Methodology

2.1 Study design and sampling

The MoMo module consists of both a cross-sectional and a longitudinal component. The cross-sectional sample of the MoMo survey comprises a sub-sample of participants from the cross-sectional sample of KiGGS Wave 2 aged 4 to 17. The article [New data for action. Data collection for KiGGS Wave 2 has been completed](#) in this issue of the Journal of Health Monitoring contains a detailed description of the target population and sampling for the KiGGS study. Children and adolescents were randomly drawn from the gross sample and assigned to the MoMo module during sampling for KiGGS Wave 2 independently of their participation in KiGGS. Participation in KiGGS Wave 2 was a prerequisite for an invitation to participate in the MoMo survey.

The longitudinal sample for the MoMo module was comprised of MoMo baseline survey (2003-2006) and MoMo Wave 1 (2009-2012) respondents that also participated in KiGGS Wave 2. Participants examined and interviewed in the longitudinal survey were therefore

MoMo (Motorik-Module Study) has been a module of the KiGGS study since the 2003-2006 baseline study.

aged up to 23 in MoMo Wave 1 and up to 29 in MoMo Wave 2. After KiGGS respondents agreed to participate in MoMo, MoMo respondents from both the cross-sectional and longitudinal samples were invited to one of the 167 selected sample points (Figure 1) for motor performance tests, anthropometric measurements and to record data on their physical activity.

Data collection for Wave 2 of the MoMo survey began in January 2015 and will end in September 2017. Until

May 2017, 56 routes were completed; around 4,000 participants were tested and interviewed. Further thirty sample points will be visited by the end of September 2017; the total number of participants in Wave 2 is estimated to reach 5,200 respondents.

Germany's federal commissioner for data protection has been informed of and has approved the survey. A number of technical and organisational measures (including control of data carriers, data storage, users, data access and data transmission) detailed in a comprehensive procedure protocol, ensure compliance with data protection regulations. All of the data collected during the survey is pseudonymised. Participation in the survey is voluntary. Participants, and where necessary their parents or legal guardians, are informed about the goals and content of the survey as well as the measures taken to protect their data, to be able to give their informed consent. The study (funding code 01ER1503) received a positive vote from the ethics commission of the Karlsruhe Institute of Technology on 23 September 2014.

2.2 Assessment methods and testing instruments

Based on the survey's longitudinal approach, the instruments to collect data in Wave 2 are largely the same as those used in the baseline study and Wave 1. MoMo longitudinal survey instruments include a test profile to survey motor performance, anthropometric measurements, a questionnaire to collect data on physical activity, as well as use of a motion sensor (accelerometer).

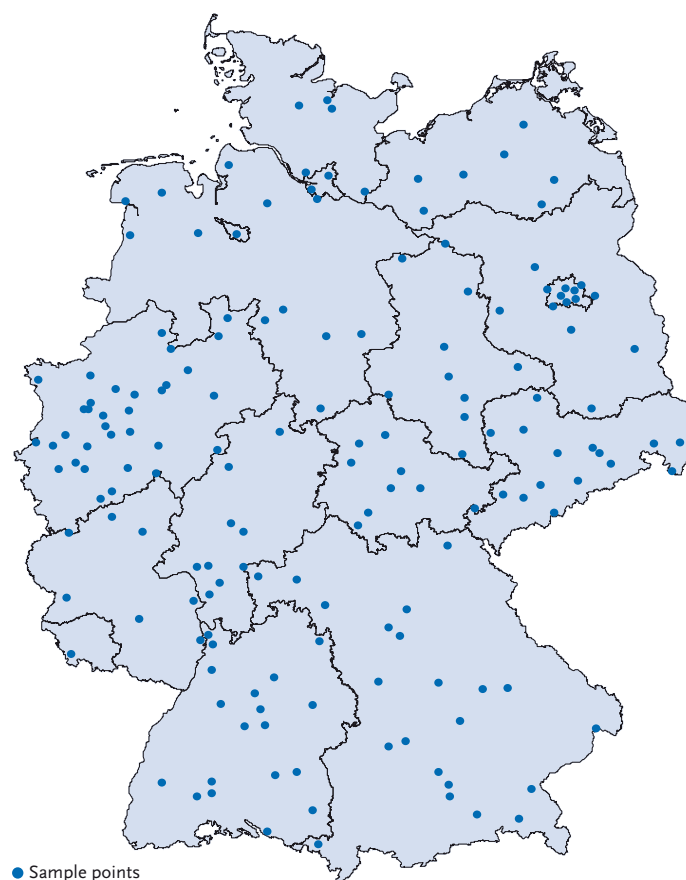


Figure 1
Sample points of MoMo Wave 2
Source: RKI

MoMo Wave 2 data collection began in January 2015 and will end in September 2017.

MoMo surveys motor performance and physical activity.

The development and basis of the MoMo motor performance test profile and the MoMo physical activity questionnaire have been extensively published and documented in test manuals [16-18]. The quality of the motor performance tests and questionnaire has been evaluated in pre-tests and supplementary studies [12, 18].

The test setup, instructions and testing itself were conducted in accordance with the instructions contained in the test manual and have already been described [16]. The test, including the filling-in of the questionnaire, takes 70-90 minutes to complete. The test teams consist of four to six trained test instructors from the Institute of Sports and Sports Science (IFSS) at the Karlsruhe Institute of Technology.

Motor performance testing and anthropometric measurements

The motor performance test profile comprises eleven tasks (Table 1). Motor performance test items were selected to suit children aged 4 to 17 and with slight modifications, adults as well.

Anthropometric measurements included height and weight, waist circumference, data on body composition (body fat percentage, body cell mass via bioelectrical impedance analysis, BIA) and blood pressure at rest. Trained survey staff used standardised and quality-controlled procedures [16].

Technological developments and new findings published in the course of the MoMo survey waves made necessary minimal changes to test tools. For Wave 2, the

Test item	Baseline study	Wave 1	Wave 2	Test item	Baseline study	Wave 1	Wave 2
Reaction time	◆ (4-10) ○ (11-17)	○ (4-23)	◆ (4-10) ○ (4-28)	Push-ups	○ (6-17)	○ (6-23)	○ (6-28)
Line tracking	◆ (4-10) ○ (11-17)	○ (4-23)	○ (4-28)	Jumping on a force plate	○ (4-17)	○ (4-23)	○ (4-28)
Inserting pins	◆ (4-10) ○ (11-17)	○ (4-23)	○ (4-28)	Jumping-sideways	◆ (4-10) ○ (11-17)	○ (4-23)	◆ (4-10) ○ (4-28)
Static Stand	◆ (4-10) ○ (11-17)	○ (4-23)	◆ (4-10) ○ (4-28)	Sit-ups	–	○ (6-23)	○ (6-28)
Balancing backwards	○ (4-17)	○ (4-23)	○ (4-28)	Stand & reach	◆ (4-10) ○ (11-17)	○ (4-23)	◆ (4-10) ○ (4-28)
Standing long jump	○ (4-17)	○ (4-23)	○ (4-28)	Ergometric endurance testing	◆ (11-17) ○ (6-10)	○ (6-23)	○* (6-28) ◆* (11-23) including lactate test

◆ KiGGS ○ MoMo

* Switch from related to bodyweight ergometer protocol to the protocol of the World Health Organization (after age 10, starts with 25 watts, with load increases of 25 watts every two minutes)

Table 1

MoMo motor performance test items

Source: Modified according to [16]

KiGGS Wave 2

Second follow-up to the German Health Interview and Examination Survey for Children and Adolescents

Data owner: Robert Koch Institute

Aim: Providing reliable information on health status, health-related behaviour, living conditions, protective and risk factors, and health care among children, adolescents and young adults living in Germany, with the possibility of trend and longitudinal analyses.

Study design: Combined cross-sectional and cohort study conducted as an examination and interview survey

KiGGS cross-sectional study

Population: Children and adolescents with permanent residence in Germany

Sampling: Samples from official residency registries - randomly selected children and adolescents from the 167 cities and municipalities covered by the KiGGS baseline study

Age range: 0-17 years

Sample size: Approximately 15,000 participants

KiGGS cohort study

Sampling: Re-invitation of everyone who took part in the KiGGS baseline study (2003-2006; aged between 0 and 17 at that time) and who was willing to participate in a follow-up

Age range: 10-29 years

Sample size: Approximately 10,000 follow-up participants

Survey period: September 2014-August 2017

Modules: BELLA, EsKiMo, GerES, KiESEL, MoMo

More information is available at www.kiggs-studie.de/english

individual body weight-related cycling endurance protocols used in the baseline study and Wave 1 were adapted to conform to comparable protocols of the World Health Organization [19]. Whereas Wave 1 used four-channel BIA measurement devices, Wave 2 switched to multi-frequency eight-channel measurements by body segment.

MoMo physical activity questionnaire

The standardised MoMo physical activity questionnaire (MoMo-AFB) takes into account the different life stages of respondents, so that different versions are available for nursery school and school children as well as for adolescents and young adults [12, 17]. Participants in the MoMo survey aged 11 and older fill out the MoMo-AFB by themselves. 4-to 10-year-olds are interviewed, with their parents or guardians filling out the questionnaire. The MoMo-AFB covers various fields of physical activity (active commutes, everyday physical activity, physical activity during leisure time, physical activity at school or at work). The intensity, type, frequency and duration of such physical activity and seasonal changes in activity levels are also taken into account. Psychosocial and environmental factors influencing physical activity are also recorded.

Motion sensor data

Since Wave 2, the MoMo physical activity questionnaire has been supplemented by data on physical activity recorded objectively by means of a motion sensor (accelerometer). The survey uses the Actigraph GT3X+/wGT3X-BT accelerometer. These accelerometers are internationally recognised and the de facto scientific standard for mea-

suring physical activity [20]. Participants in the MoMo module aged 6 and older are instructed to wear their accelerometer on eight consecutive days during the daytime. To quantify physical activity, the accelerometer is worn above the hip on the right side of the body. Currently (as of May 2017), data sets for 1,898 respondents aged 6 to 20 have been collected.

3. Discussion and outlook

The MoMo survey is among the few – in German-speaking countries the only – population-based longitudinal survey of motor performance and physical activity. Data from Wave 2 (2015-2017) will provide answers to complex questions on the developments of physical activity/inactivity and motor performance among children, adolescents and young adults in Germany, as well as on the factors influencing these developments. Data from three distinct time points enable researchers to conduct complex statistical calculations that can, for example, help model non-linear developments, for instance development curves when growth is limited, as well as the calculation of interdependencies between different factors influencing these developments. This provides the necessary basis for an assessment of the effects of physical activity and motor performance on both the objective and subjective parameters of physical and mental health. The further development of methods in Wave 2, such as the first-time use of accelerometers, promise to pave the way for more differentiated analyses.

The expected results of Wave 2 provide the basis for important health policy recommendations at numerous

MoMo Wave 3 starts in 2018.

levels. Health policy can use the knowledge available on the factors influencing physical activity and motor performance levels and their health-relatedness to identify those people potentially at risk early on and provide them with targeted support. The long-term and regular monitoring of motor performance and physical activity creates a reliable database to assess the effectivity of initiatives that have been promoting sports activities over the past years in Germany.

Initial results from MoMo Wave 2 will be made available to the interested public in the second quarter of 2018. In parallel to the evaluation phase of Wave 2, which is set to begin in September 2017, preparations for Wave 3 (2018-2020) data collection will begin.

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