ORIGINAL CONTRIBUTION

Ulrike Ravens-Sieberer
Bärbel-Maria Kurth
and the KiGGS study group
and BELLA study group

The mental health module (BELLA study) within the German Health Interview and Examination Survey of Children and Adolescents (KiGGS): study design and methods

Members of the BELLA study group: Ulrike Ravens-Sieberer (Principal Investigator), Claus Barkmann, Susanne Bettge, Monika Bullinger, Manfred Döpfner, Michael Erhart, Beate Herpertz-Dahlmann, Heike Hölling, Franz Resch, Aribert Rothenberger, Michael Schulte-Markwort, Nora Wille, Hans-Ulrich Wittchen.

Prof. Dr. U. Ravens-Sieberer, MPH (✉)
Dept. of Psychosomatics in Children and Adolescents
Centre for Obstetrics and Paediatrics
University Clinic Hamburg-Eppendorf
Martinistraße 52, W29
20246 Hamburg, Germany
Tel.: +49-40/42803-7378 or -7585
Fax: +49-40/42803-5105
E-Mail: ravens-sieberer@uke.uni-
     hamburg.de

Dr. B.-M. Kurth
Dept. of Epidemiology and Health Reporting
Robert Koch-Institute
Berlin, Germany

■ **Abstract** The BELLA study on mental health and well-being in children and adolescents is the mental health module of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). The cross-sectional KiGGS survey collected comprehensive data on the health status of 17,641 children and adolescents, aged 0–17 years, living in Germany. The survey included physical examinations and tests, questionnaires filled in by parents and equivalent questionnaires for children aged 11 years or older. A computer-assisted personal interview was conducted by study physicians, and various laboratory tests, e.g. on blood and urine samples, were performed. The longitudinal BELLA study collected initial cross-sectional data from a representative KiGGS sub-sample of families with children aged 7–17 years. Of the 4,199 randomly selected families invited to participate in the BELLA study, 2,863 took part. A total of 48.5% of the participating children and adolescents were girls, 51.5% were boys. Within the BELLA study, trained interviewers conducted standardised telephone interviews with one parent and also the child, if it was at least 11 years old. Afterwards the families received additional questionnaires. The interviews and questionnaires included various standardised and ICD-10-oriented instruments examining overall mental health problems and associated burden, depression, anxiety, attention deficit-/hyperactivity and conduct disorders. Furthermore they covered a broad spectrum of aspects related to mental health and well-being, such as risk and protective factors and health-related quality of life. An analysis of the non-responders showed that the families who agreed to participate form a representative sample with respect to the German population. The sample deviated only slightly from the KiGGS sample structure regarding socioeconomic status and regarding parent-reported mental health problems. No such difference was observed for the children's self-reported mental health. A weighting procedure was applied to correct for deviations from the sociodemographic and socioeconomic structure of the target population.

■ **Key words** mental health – children and adolescents – survey – methods – study design

U. Ravens-Sieberer et al.
Study design and methods of the BELLA study

11

Introduction

Mental health problems in children and adolescents are an increasingly important issue. The results of several studies indicate that a substantial number of children and adolescents are affected. Furthermore, mental health problems are associated with a strong burden on the individual. Devoting greater attention to the care of children and adolescents with mental health problems is a key demand regarding child public health [51, 52].

Nevertheless, a lack of data for Germany was noticed concerning the prevalence of mental health problems across different sociodemographic and socioeconomic groups. Furthermore, little data was available about major risk and resilience factors as well as the access to health care of those affected. Against this background, the BELLA study was initiated in order to provide detailed information regarding mental and subjective health in children and adolescents in Germany. The BELLA study is the module on mental health within the German Health Interview and Examination Survey of Children and Adolescents (KiGGS), which for the first time precisely assessed the health status of young people in Germany on the basis of a representative population sample.

Objectives

The German Health Interview and Examination Survey of Children and Adolescents (KiGGS), conducted by the Robert Koch-Institute, aimed to obtain generalisable data on the health status and situation of children and adolescents aged 0–17 years [29]. In order to provide relevant information for prevention and intervention planning purposes, information was collected on somatic as well as mental health, while at the same time examining living conditions as well as health-related behaviours and health care utilisation.

The aim of the BELLA study [36], as the mental health module within the KiGGS study, was to acquire deeper insights into the mental health situation of children and adolescents in Germany between the ages of 7 and 17. One of the main targets was to estimate prevalence rates of overall mental health problems and specific disorders, as well as determining their effects on daily functioning and well-being. A further important aim of the module was to examine various individual, familial and social risk and protective factors, which are discussed as potential determinants of mental health and quality of life [3, 31]. This detailed knowledge about the occurrence, determinants and consequences of mental health problems, as well as information on the health-care situation of the children concerned, was intended to provide a scientific basis for planning mental health-related prevention measures and for identifying target groups for interventions.

Study design: the modular connection between KiGGS and BELLA

The BELLA study is one of four modules connected to the German Health Interview and Examination Survey of Children and Adolescents (KiGGS), which was conducted by the Robert Koch-Institute in cooperation with national and international experts in the field of paediatrics, survey methods, psychology, prevention and public health. The KiGGS study was designed as a cross-sectional study, collecting data over a period of 3 years, between May 19th 2003 and May 6th 2006, and financed by the Federal Ministry of Health (BMG), the Federal Ministry of Education and Research (BMBF) and the Robert Koch-Institute [29]. However, in order to minimise the burden on individual participants, it was not feasible to collect sufficiently detailed data regarding all health issues of interest. It was therefore decided to establish additional modules which would examine specific health issues in more detail and which would be carried out on representative subpopulations of the core survey [28]. In addition to the BELLA study on mental health, other modules dealt with physical performance, environmental burdens and nutrition (Fig. 1). All modules were conceptualised and financed by external partners [27]. The BELLA study was financed by the German Science Foundation (C.D. Foundation).

This modular structure of the KiGGS core survey meant that the available resources could be utilised very effectively. The modular studies, such as BELLA, were able to use the information already collected in the core survey and thus avoid redundant data collection. In order to prevent putting to great a strain on the participants, children were not meant to participate in more than one additional module.

The BELLA module is a cross-sectional study with a longitudinal 2-year follow-up. The data for the first measurement point of the BELLA study was collected immediately following the KiGGS examination. Data collection was therefore carried out between May 2003 and June 2006. For the two follow-up measurements for the BELLA study, the families were approached again 1 and 2 years after the first data collection. The second round of data collection was therefore conducted between May 2004 and June 2007, and a third round between May 2005 and June 2008. Long-term

Fig. 1 The modular structure of the KiGGS study
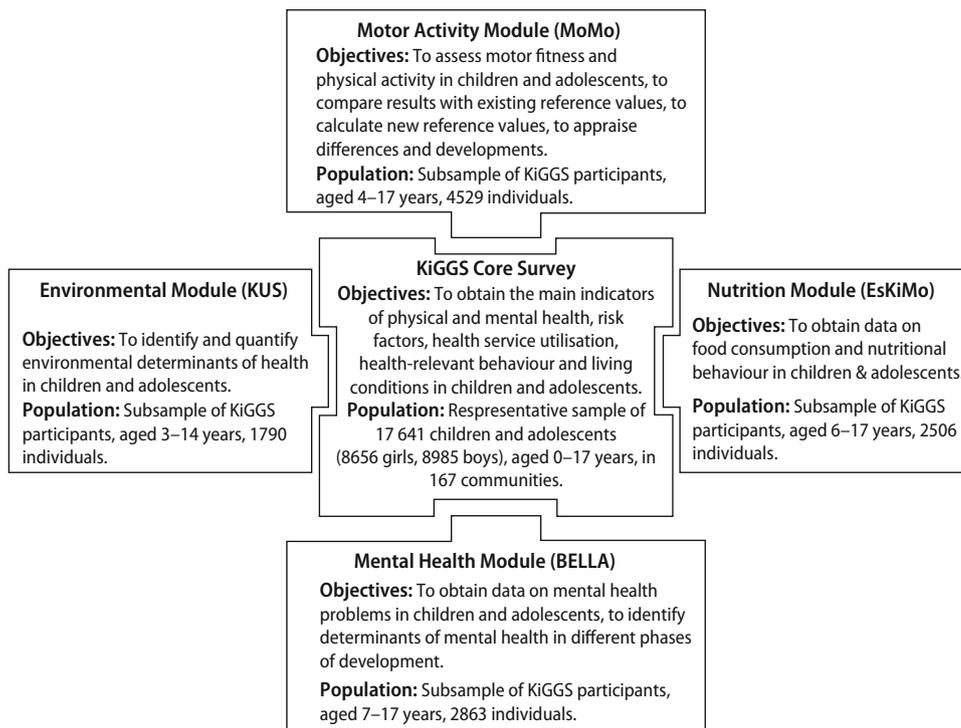
data from this BELLA cohort will provide a deeper understanding of the development of mental health problems and can support causal interpretations regarding risk and protective factors.

Sampling

■ Sample recruitment

Since the participants of the KiGGS survey served as the basis for the BELLA study recruitment, the sample selection for the KiGGS survey will be briefly outlined below. A detailed description of the KiGGS sampling procedure has been published elsewhere [29]. The target study population in the KiGGS survey consisted of children and adolescents living in the Federal Republic of Germany, whose main residence is listed in the official registers of residents of the local residents' registration offices. The study participants, children and adolescents aged 0–17 years, were selected using a stratified multi-stage probability sample.

Sample selection was performed in two steps: in the first step, the sample points were selected (a total of 167 sample points from all the communities in Germany). A stratified sample selection was conducted on the basis of Federal States and community types. In order to obtain results of comparable accuracy using representative samples from East and West

Germany, more sample points were drawn in the former German Democratic Republic ('East Germany') than would have actually been necessary to represent the population size. In the second step, 24 personal addresses were drawn for each age group at each sample point using the local residents' registry. Depending on the size of the community, eight, nine or ten children and adolescents were selected in each age group, resulting in a total of 144, 162, or 180 subjects being invited to the examination centre at each regional sample point [25].

Since the BELLA study focused on a population of children and adolescents between the ages of 7 and 17, only families with children in this age range were considered for participation. A random sample of 4,199 families who participated in the KiGGS survey and had children between the ages of 7 and 17 was invited to take part in the BELLA study during their visit to the KiGGS examination centre. If they agreed to take part, the families received basic information about the BELLA study and were also asked to consent in writing to being contacted again by the study team at a time of their choice.

■ Sample participants

A total of 26,899 children and adolescents were randomly selected from the local residents' registries at the 167 sample points (Fig. 2), and invited to

U. Ravens-Sieberer et al.
Study design and methods of the BELLA study

13

Fig. 2 Sample points of the German Health Interview and Examination Survey of Children and Adolescents (KiGGS) and the BELLA study (taken from Kamtsiuris et al. [25])

participate in the KiGGS study (unadjusted base gross sample). On account of resident alien over-sampling, an additional 1,400 study subjects were selected and invited to participate, resulting in a total of 28,299 invitations being sent out. Of these 28,299 study subjects invited to participate in the core survey (KiGGS), 1,512 (5.3%) were later classified as quality-neutral drop-outs (QND). In the sample without resident alien oversampling, the proportion of quality-neutral drop-outs was only 4.8% (1,297/26,899). Of the 28,299 families, a total of 17,641 took part (including 585 from the resident alien booster sample) (Table 1). This corresponds to a response

rate of 66.6%. It should be pointed out, however, that the response rates varied greatly depending on the location of the sample point: in Nuremberg and Kassel the response rate was as low as 52%, whereas in Röthenbach in Allgäu and Wittenberge it was as high as 83% [25]. Detailed information on the 33.5% non-responders (n = 9,146) will be provided below.

For the BELLA study, 4,199 families with children between the ages of 7 and 17 were randomly selected and invited to participate. A total of 70% (n = 2,942) of them gave their consent. A total of 97% (n = 2,863) of those who agreed to participate, actually took part

Table 1 Number of participants in the German Health Interview and Examination Survey of Children and Adolescents (KiGGS) according to age and gender (modified from Kamtsiuris et al. [25])

Age in years	Boys (n)	Girls (n)	Total (N)
0	480	455	935
1	457	468	925
2	479	466	945
3	461	473	934
4	480	502	982
5	493	460	953
6	516	490	1,006
7	528	498	1,026
8	516	521	1,037
9	547	520	1,067
10	536	482	1,018
11	539	519	1,058
12	513	495	1,008
13	536	474	1,010
14	537	466	1,003
15	505	465	970
16	451	454	905
17	411	448	859
0–17	8,985	8,656	17,641

Table 2 Number of participants in the BELLA module according to age and gender (unweighted and weighted number of cases)

| Age in years	Unweighted			Weighted		
	Boys (n)	Girls (n)	Total (N)	Boys (n)	Girls (n)	Total (N)
7	148	123	271	120	115	235
8	147	133	280	125	117	242
9	158	134	292	119	111	230
10	157	133	290	124	120	244
11	139	127	266	123	124	247
12	143	104	247	134	110	244
13	134	130	264	128	127	255
14	108	109	217	145	131	276
15	136	133	269	150	152	302
16	108	131	239	149	141	290
17	96	132	228	149	150	299
7–17	1,474	1,389	2,863	1,466	1,398	2,863

in the BELLA study. The BELLA sample is uniformly distributed with respect to the age and gender of the participants: At the time of the visit at the KiGGS examination centre 1,142 families had children between the ages of 7 and 10, 780 families had children aged 11 to 13, and 941 families had children between the ages of 14 and 17. At the time of the additional BELLA data colletion 1,133 children were aged 7 to 10, 777 were aged 11 to 13, and 953 were aged 14 to 17 (unweighted data). A total of 48.5% of the participating children and adolescents were girls, 51.5% were boys (Table 2). Since it was not possible to collect data in different languages, the families with a migratory background cannot be treated as being representative of migrant families living in Germany.

■ **Non-response analysis**

A total of 9,146 families (600 of which resulted from resident alien oversampling) did not participate in the KiGGS study (=non-responders) [25]. There were various reasons for non-participation, the most frequent being the failure of the non-responders to appear at the appointed time (6.0% of the adjusted gross sample). A total of 5.7% of the families did not participate because the child did not wish to or was afraid of the examination. In 4.2% of the cases, the parents were not interested in participating in the study. Further reasons for not participating were lack of time (3.2%), health reasons (2.5%), no time available for an appointment (2.0%), receiving treatment from a physician (1.3%), the potential strain on the child (1.1%), family not at its place of residence

(0.8%) and other reasons (0.5%). An absolute refusal to participate accounted for only 3.5% of non-responders, while another 2.6% of the families could not be contacted at all. Compared with other studies, however, this is a fairly low percentage [25].

In order to determine the effects of non-response, the KiGGS core survey administered brief questionnaires collecting information on sociodemographic as well as health-relevant characteristics. These questionnaires were filled out by around two-thirds of the non-participants, thus providing basic information on about 89% of the gross sample. A comparison between responders and non-responders regarding health-related characteristics showed hardly any differences. Among the families who participated in the survey, 93.7% rated the health of their child as being either good or very good, compared with 92.5% of the non-participating families. A total of 6.1% of the participating families and 6.8% of the non-participating families rated the health of their children as being either average or poor, and 0.3% of the participating families and 0.7% of the non-participating families even considered their children's health to be very poor. With regards to the 'smoking status' of the mother, there were virtually no differences between participants and non-participants, nor were significant differences apparent in the Body Mass Index of the children and adolescents (calculated using the self-reported height and weight) [25].

The BELLA study was able do draw on very comprehensive information when conducting its non-response analyses. Since data from the KiGGS core survey was available for all families that were invited to participate in the BELLA module, non-responders could be described not only in terms of sociodemographics and selected health indicators, but also regarding their mental health and health-related quality of life, as well as risks and resources.

U. Ravens-Sieberer et al.
Study design and methods of the BELLA study

15

Fig. 3 Participation in the BELLA study (consent, telephone interview, questionnaire)
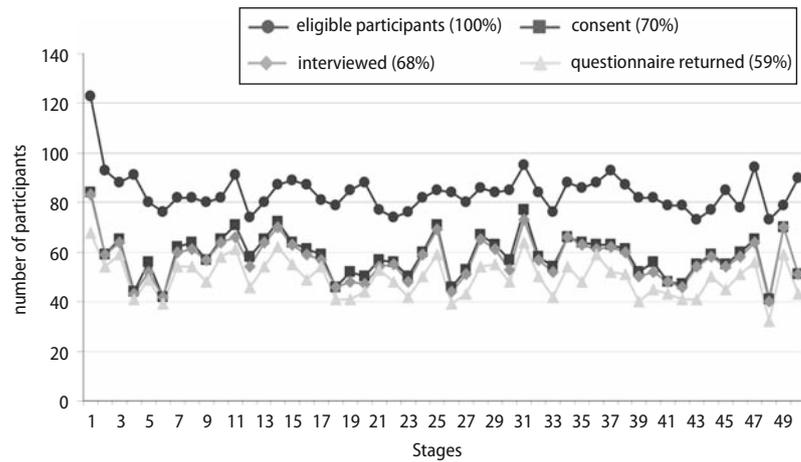
On average, the families who responded reported a statistically significant better socioeconomic situation: 27% of them had a high, 48% a medium and 25% a low socioeconomic status compared with 21% (high), 43% (medium) and 36% (low) in the non-responders. While the parents of the non-responders reported slightly lower overall health-related quality of life on average, no statistically significant difference was seen in the children's self-report. Based on the information supplied by parents in the Strengths and Difficulties Questionnaire (SDQ) [21], a higher percentage of non-responders was classified as displaying borderline (8.6%) or abnormal (9.2%) mental health problems than responders (6.5% borderline and 7.8% abnormal). No statistically significant difference was observed in the children's self-reported SDQ. The children who responded reported slightly higher familial resources on average than non-responding children.

■ Data collection

During the field phase, three or four medical teams travelled through Germany and set up a local examination centre for 2 weeks at each sample point. This meant that 167 sample points could be visited in 50 stages. The data collection for the KiGGS core survey included a general physical examination of the child/adolescent and a computer-assisted personal interview with the physician. A wide range of blood and urine tests were carried out by central laboratories. Questionnaires were administered to the parent accompanying the child, designed for the child's specific age by taking into account developmental, health and health care issues that are relevant to children and young people in certain age groups (0–2, 3–6, 7–10, 11–13, 14–17 years of age). Children and adolescents from the age of 11 years onwards also completed one questionnaire by themselves.

In the BELLA study, if children were 7–10 years old, only the parent was asked to respond. In those families with a child aged 11 or older, both the parent and the child were asked to participate. Data collection comprised two parts. The first part consisted of a standardised computer-assisted telephone interview (CATI) which took about 30 min. Prior to the data collection phase, the interviewers were extensively trained using a standardised training programme. Furthermore, regular training courses took place during their employment. Supervision was provided by a psychologist to ensure the quality of the interviews. The digital support (CATI) helped to minimise random and systematic errors since incorrect or contradictory entries were avoided by means of programmed routine checks and filter management procedures.

Subjects who agreed to participate were contacted by the interviewers of the BELLA study at a time the participant had indicated as being convenient. In each case, one of the parents was asked to participate in the telephone interview. If the child was at least 11 years old, the child was also asked to take part. Great care was taken that the interviews with the parents and the children were conducted separately to ensure that their responses were independent of each other.

The second stage of data collection involved a paper and pencil questionnaire which was administered after the telephone interviews. The questionnaires were sent to the families within 2 weeks after the telephone interview. The letters containing the questionnaires included the promised incentive for study participation. Children who had already participated themselves were given a gift certificate worth 5 € for a department store of their choice. Families whose children were between 7 and 10 years old received small gifts, such as a drawing book, puzzles or magnets. In addition, the families were sent a stamped and self-addressed envelope as well as additional envelopes, so that the parent and child

questionnaires could be returned independently of each other.

Of the 2,863 families participating in the BELLA study, 1,133 had children aged from 7 to 10 years. Full data sets (telephone interview and questionnaire) are available for 89.1% of these families. In 10.6% of the families, the parent participated in the telephone interview but failed to send back the questionnaire afterwards. Four families did not have the opportunity to participate in the telephone interview but did complete a questionnaire.

Full sets of data (telephone interview with child and parent, as well as questionnaires completed by child and parent) are available for 80.6% of the 1,730 families having children aged 11 or older. In 12.0% of these families, both the parent and the child conducted the telephone interview; however both failed to return the questionnaire afterwards. In the remaining 7.4% of the families, ten different combinations of available data were found (i.e. only the child interview or only the parent interview was not available, only complete parent data available but no self-reported data by the child or vice versa, etc.) with a small number of cases in each category. Figure 3 shows the response across the sampling period.

■ Instruments

The KiGGS study collected basic information covering broad aspects of health. In terms of physical health, the child's general health status and complaints were examined. This included acute and chronic illness or disability of the child, accidents, but also health problems such as being overweight or obese. Health behaviour was not only assessed regarding risk behaviour or nutrition but also with respect to the use of medical services and vaccination status. Regarding mental health, the KiGGS survey screened for symptoms of emotional or behavioural problems and asked about problematic eating behaviour. Basic information was obtained on subjective health (health-related quality of life) as well as children's resources. Furthermore drug abuse, smoking and alcohol consumption were assessed.

The BELLA study expanded upon this information by examining mental health problems, such as depression, anxiety, attention deficit-/hyperactivity disorder, conduct disorder as well as suicidal tendencies, in depth and by assessing the burden associated with existing mental health problems. In order to obtain reliable information, validated screening instruments were administered guided by the criteria listed in the diagnostic manuals. In addition to using these instruments, parents were asked whether a mental health problem had been diagnosed and

whether their child was receiving some form of treatment on account of that diagnosis. In order to identify relevant predictors of children's mental health status, a variety of possible risk factors and resources were assessed, linked to the child's family (e.g. parental strain, parental mental disorders, parental quality of life, parental support, family climate), the broader social environment (psychosocial strain, school atmosphere, social competence) or individual attributes of the child (self-concept, self-efficacy, optimism). Furthermore, the child's and parent's well-being were comprehensively assessed by means of several quality of life instruments.

The adequacy of all instruments was confirmed beforehand in a pre-test. Various methods of 'cognitive debriefing' were used to test the practicability and the comprehensibility of the questionnaires [24]. Where necessary, the wording of the questions was modified. Apart from examining the characteristics of the instruments applied in the BELLA study in the light of test theory, the diagnostic quality of the individual methods was also analysed and, depending on the results, a decision was made for or against their use [7, 8].

■ Sociodemographics

The KiGGS study collected basic information such as age and gender of the child/adolescent, family set-up, school grade or completed level of education of the child/adolescent, migration status (according to [41]), and socioeconomic status using the Winkler Index [30, 50].

■ Mental health

The 25-item SDQ [21] was used to assess emotional problems, conduct problems, hyperactivity/inattention, peer relationship problems and prosocial behaviour. Each item is scored on a 3-point scale. A total difficulties score (0–40) is generated by summing the items for the four problems areas. Using cut-off scores, it is possible to build categories comprising normal, borderline and abnormal problem scores. To gain a deeper understanding of the impact of certain symptoms, the BELLA study administered the SDQ impact supplement [22] in the parent as well as in the self-report questionnaire. The impact supplement inquires about the presence of difficulties regarding emotions, concentration, behaviour, and getting along with others, and in case of their presence, also assesses the chronicity, distress, social impairment and burden for others associated with them. Reported impairment was classified as being either normal,

U. Ravens-Sieberer et al.
Study design and methods of the BELLA study

17

borderline or abnormal. Combining the information from both instruments, each child can be placed into one of three categories, indicating whether a psychiatric disorder is unlikely, probable or likely [22].

Beyond this psychometric assessment, the BELLA study asked in the parent's interview whether the child had a mental disorder. Depending on the answer, the parent was further asked whether the child was receiving treatment.

Attention deficit-/hyperactivity disorders (ADHD) were assessed as specific mental health problems. In the KiGGS study, lifetime prevalence of ADHD was assessed by asking parents if their child had ever been diagnosed by a physician or a psychologist as having ADHD. Furthermore, behavioural observations were carried out by trained observers during the medical and physical testing of children between the ages of 3 and 11. Beyond this, the BELLA study administered the 10-item Conners' Scale [12] in the parent's and child's interview. Furthermore, the BELLA study administered the 'hyperkinetic disorders' questionnaire (FBB-HKS) [16] from the DISYPS-KJ [17] to the parents. This 29-item inventory focuses strongly on diagnostic criteria and differentiates between three subscales: attention disorder, hyperactivity, and impulsiveness. The questionnaire asks firstly about the degree to which the given descriptions apply to the child and secondly assesses the extent to which this is considered a problem.

Depressive symptoms were assessed in the BELLA study using the Centre for Epidemiological Studies Depression Scale for Children (CES-DC) [18] and the Depression Inventory for Children and Adolescents (DIKJ) [45]. The CES-DC is a 20-item depression inventory which was used in the interviews both with the parent and with the adolescent. The DIKJ was used in the children's self-report questionnaires only and functions as a measure of the severity of depressive symptoms. It contains 26 items covering emotional, cognitive, motivational and somatic symptoms of depression.

Symptoms of anxiety were assessed using the Screen for Child Anxiety Related Emotional Disorders (SCARED) instrument [9, 10]. This instrument was administered in both the self-report as well as the parental telephone interviews. It encompasses 41 questions focussing on five areas: panic disorder, generalised anxiety disorder, social phobia, school phobia, and separation anxiety disorder.

The German version of the Child Behavior Checklist (CBCL) [4]; original by [1, 2] was used to assess externalising problems in the BELLA study. Social behaviour problems were assessed by means of the 20-item subscale 'aggressive behaviour' and the 13-item subscale 'delinquent behaviour' administered in the parent's questionnaire.

In order to determine suicide ideation and suicidal behaviour, the BELLA study also included two further items from the CBCL. These items were: 'I think about killing myself' and 'I deliberately harmed myself or attempted suicide', and were asked during the interviews with the adolescents as well as with modified wording in the parent interviews.

Problematic eating behaviour was assessed using the SCOFF questionnaire [33]. The SCOFF questionnaire comprises five items covering deliberate vomiting (Sick), loss of control over eating (Control), weight loss (One stone ~ 7.7 kg), body image distortion (Fat) and the impact of food on life (Food). It has been validated in university students and adolescents [39, 40] and is considered to rule out an eating disorder when there are less than two abnormal responses.

Alcohol, tobacco and drug consumption were measured using single questions on whether these substances are/were consumed, and if so, how frequently and in what quantities. Furthermore, the age of initial contact to these drugs was determined. The substance-related items were only included in the adolescents' questionnaires with the exception of alcohol, which was also included in the questionnaires for parents of 11–17 year olds.

■ Risk factors

Within the KiGGS core survey, data was collected on various risk factors, such as SES, early parenthood, perinatal complications, tobacco and/or alcohol consumption during pregnancy and inadequate living conditions. These items were integrated into the parent questionnaires for all age groups (0–17 years old). Items on the children's experience of violence and sexual harassment were included in the children's and adolescents' questionnaires (11–13 and 14–17 year olds). The BELLA study extended the details about risk factors by additionally exploring issues such as chronic diseases of parents, parents' alcohol consumption, unemployment, mental health problems of parents, parental strain, and parents' quality of life, but also family conflicts, conflicts between the partners or lack of social support.

Risk factors, such as chronic diseases of parents or lack of social support, were examined using categorical questions in the parent's interview. Regarding alcohol consumption, interviewees were asked whether they thought about cutting down on their alcohol consumption or were angry about criticism concerning their alcohol consumption. Similar questions were asked about the partner. Regarding unemployment, the parent's interview included a question asking whether the family had been affected by unemployment during the child's

lifetime and whether this situation was perceived to be a burden. Furthermore, the parent was asked how well the family gets along and how happy the relationship between the partners is. If the parent rated the family's ability to get along or the relationship as being 'not good' or worse, this was considered to be a risk factor.

Parental mental health status was assessed not only by asking about current or former mental disorders in the interviewed parent or his/her partner, but also by administering the 9-item SCL-K-9 [11] considering dimensions such as somatisation, depression, anxiety, hostility, paranoid ideation, and psychoticism. This is a short form of the SCL-90-R [20] and correlates with the longer 90 item version with $r = 0.93$.

Parental strain was assessed on the basis of 12 items in the parents' questionnaires. These covered various aspects of daily life, including household, job, financial worries, lack of recognition from others, etc. The parent's health-related quality of life was assessed using the SF-12 [46], an abridged 12-item version of the SF-36 [32, 47].

■ Resources, protective factors

In order to assess social resources, the German translation of the 8-item Social Support Scale [15] was administered. Peer competence was measured by means of a scale previously employed in the international Health Behaviour in School-Aged Children study [13].

Personal resources were assessed by means of the self-efficacy scale for children developed by Schwarzer and Jerusalem (1999) (WIRKALL-K) [43], as well as items for assessing optimism taken from the Berne questionnaire on adolescents' subjective well-being (BFW) [23], and one item from the Sense of Coherence Scale [26] (CSOC). An aggregate score of personal resources was calculated from these items, constituting a 5-item scale developed in the pre-test phase of the survey [7].

Overall, perceptions of and satisfaction with one's health and one's self were assessed by administering the satisfaction domain of the Child Health and Illness Profile – Adolescent Edition (CHIP-AE) [44]. An additional measure of self-concept in the BELLA study was the 6-item global self-worth subscale of the Self-Perception Profile for Children – German Version (SPPC-D) [5].

Family climate was assessed using an adapted version of the 12-item family climate scale developed by Schneewind et al. [42]. Furthermore, parental support was measured using an 8-item scale from the international Health Behaviour in School-Aged Children study [13].

■ Health status

Aside from assessing the general health status and presence of a disability by means of the KiGGS parents' and adolescents' questionnaires, the BELLA study also asked about the number of sickness days and the presence of a chronic illness and/or disability. To determine whether the health status had changed during the short time between the core survey examination and the BELLA study data collection, participants were asked about changes in their state of health.

In the KiGGS study, the need for special health care (which serves as an indicator for a chronic illness) was determined in the parent questionnaires for all age groups (0–17 years) using the Children with Special Health Care Needs (CSHCN) screener [6]. It comprises questions on the intake or the need for prescription medication, an increased need for medical, psychosocial or pedagogical support, functional limitations, and the utilisation of or need for special therapies. This instrument classifies children into those without and those in need of special health-related services. Information regarding health care/medical services utilisation was collected in the parent questionnaires for the age group from 7 to 13 years and in the adolescent questionnaires for the age group of 14–17 years.

In order to assess health-related quality of life (HRQol), the generic KINDL-R [34] was administered to parents and adolescents in the KiGGS study. It comprises six dimensions [physical well-being, psychological well-being, self-esteem, family, friends and everyday functioning (school)] and a total of 24 items. In addition, the BELLA study administered the KID-SCREEN instrument [35] which was developed in a cross-cultural approach to assess relevant dimensions of HRQoL in children and adolescents in the age range of 8–18 years. The longer KIDSCREEN-52 instrument was included in the adolescents' questionnaires and provides profile information for the dimensions physical well-being, psychological well-being, moods and emotions, self-perception, autonomy, parent relations and home life, financial resources, social support and peers, school environment, social acceptance (bullying). The shorter KIDSCREEN-27, which covers five dimensions (physical well-being, psychological well-being, autonomy and parent relations, social support and peers, school environment) was used in the interviews with the parents and the adolescents only.

U. Ravens-Sieberer et al.
Study design and methods of the BELLA study

19

Since a very broad range of constructs was assessed, not every issue can be described here in detail. However, it should be mentioned that information regarding school climate or self-perceived body image was also obtained from the adolescents. Also the developmental process of the child was assessed in detail, e.g. by asking about the age of important stages in development.

■ Data processing

Details of data processing and analysis within the KiGGS study have been published elsewhere [29]. In the BELLA study, questionnaire data was entered by an external contractor once the data collection for the first measurement point had been completed. Double entry of the questionnaires was carried out in order to avoid bias. The information from the BELLA parent and child telephone interviews and from the BELLA parent and child questionnaires were merged into a single data set comprising all the data collected in the BELLA study. Afterwards this data set was merged with the data for the BELLA families from the KiGGS survey. Data processing was carried out using SPSS 14 and 15 and is described in detail elsewhere [14].

To assure a high quality of the data, the individual procedures of data collection, data entry, data preparation and data processing were monitored by the Robert Koch-Institute during all phases of the main study [14]. Quality management was conducted using both internal (RKI) and independent external quality controls carried out by the National Research Centre for Environment and Health, Institute of Epidemiology, Neuherberg [19].

■ Sample weighting

In order to obtain representative results for all children and adolescents in Germany, a weighting factor was used in the analyses of the BELLA study. This weighting factor was calculated in cooperation with ZUMA Mannheim using a two-step procedure. In the first step, the sample weights took into account the sample design. These design weights are inversely proportional to the probability of selecting a subject, this being the probability of selecting the community (proportional to the number of 7 through 17 year olds in the community) multiplied by the probability of selecting a study subjects within that community (i.e. the net number of subjects per gender and age group divided by the total number of children in the community of this gender and age group). The following age groups were used: 7–10, 11–13 and 14–17 year

olds. The design weighting was done separately for the three regions: former East Germany, former West Germany and Berlin. In the second step, an adjustment weighting was done, i.e. deviations of the design-weighted net sample from the structure of the overall population (as of 31 December 2004) were corrected in terms of the cross-classification of age (in years), gender, region (East/West/Berlin) and citizenship (German vs. non-German). Due to the relatively small number of study subjects and the small number of resident aliens (foreigners) living in former East Germany, the calculation for the resident aliens living in Berlin and in former East Germany was not done on the basis of age in years, but was weighted on the basis of the above-mentioned age groups (in order to avoid empty cells in the weighting). The end result was calculated by multiplying the design weights by the adjustment weights. Finally, the weights were standardised so that the sum of the weights corresponds to the sample size of 2,863. The main effect of the weighting lies in adjusting the age structure of the BELLA study subjects to the population, as well as in adjusting for the disproportionately higher number of study subjects in former East Germany. Table 2 shows this effect for the age and sex profile.

Summary

The KiGGS study, with a sample size of almost 18,000 children and adolescents between the ages of 0 and 17 years and living in Germany, was conducted to collect representative and comprehensive data on children's health status in terms of physical, social and mental health issues. This collection of basic information on the health status of children and adolescents was extended and deepened by means of specific modules, such as the BELLA study on mental health. The purpose of the BELLA module was to collect further and more detailed representative data on mental health problems of children and adolescents in Germany, as well as to assess additional risk and protective factors in a sub-sample of over 2,800 children and adolescents and their families. The described methods and measures for quality assurance reveal a very satisfactory response rate and at the same time ensure the high quality standards that are essential for the analysis and processing of the data.

Both the KiGGS and BELLA data enable a comprehensive health report on children and adolescents in Germany and furthermore supply information that was previously missing. KiGGS and BELLA strengthen epidemiology in Germany by providing data for epi-

demiological research and by helping to advance its methods. On account of their public health orientation, these studies provide the foundations for establishing priorities in health policies with regard to prevention, intervention and health promotion in children and adolescents. Furthermore, both studies offer the general public information about important aspects of children's and adolescents' health, e.g. the prevalence of general and specific mental health problems [38], psychosocial risks and resources [49] as well as the consequences for the individual [37, 48].

■ **Conflict of interest** All authors declare no conflict of interest.

References

1. Achenbach TM (1991) Manual for the Child Behavior Checklist/4–18 and 1991 Profile. University of Vermont, Department of Psychiatry, Burlington, VT
2. Achenbach TM (1991) Manual for the Youth Self-Report and 1991 Profile. University of Vermont, Department of Psychiatry, Burlington, VT
3. Antonovsky A (1987) Unraveling the mystery of health. Bass, San Francisco
4. Arbeitsgruppe Deutsche Child Behavior Checklist (1998) Elternfragebogen über das Verhalten von Kindern und Jugendlichen; deutsche Bearbeitung der Child Behavior Checklist (CBCL/4–18). Einführung und Anleitung zur Handauswertung, 2. Auflage mit deutschen Normen. Arbeitsgruppe Kinder-, Jugend- und Familiendiagnostik, Köln
5. Asendorpf JB, Aken MAG v (1993) Self-Perception Profile for Children—deutsche Fassung (SPPC-D). Humboldt-University, Institute for Psychology, Berlin
6. Bethell C, Read D, Stein RE, Blumberg SJ, Wells N, Newacheck PW (2002) Identifying children with special health care needs: development and evaluation of a short screening instrument. Ambul Pediatr 2:38–48
7. Bettge S, Ravens-Sieberer U (2003) Schutzfaktoren für die psychische Gesundheit von Kindern und Jugendlichen—empirische Ergebnisse zur Validierung eines Konzepts. Gesundheitswesen 65:167–172
8. Bettge S, Ravens-Sieberer U, Wietzker A, Hölling H (2002) Ein Methodenvergleich von Child Behavior Checklist und Strengths and Difficulties Questionnaire. Gesundheitswesen 64:119–124
9. Birmaher B, Brent DA, Chiappetta L, Bridge Monga S, Baugher M (1999) Psychometric properties of the Screen for Child Anxiety Related Emotional Disorders (SCARED): a replication study. J Am Acad Child Adolesc Psychiatry 38:1230–1236
10. Birmaher B, Khetarpal S, Brent D, Cully M, Balach L, Kaufman J, Neer SM (1997) The Screen for Child Anxiety Related Emotional Disorders (SCARED): scale construction and psychometric characteristics. J Am Acad Child Adolesc Psychiatry 36:545–553
11. Brähler E, Klaghofer R (2001) Konstruktion und teststatistische Prüfung einer Kurzform der SCL-90-R. Zeitschrift für klinische Psychologie. Psychiatrie und Psychotherapie 49:115–124
12. Conners CK (1973) Rating scales for use in drug studies with children. Pharmacotherapy of children (Special issue). Psychopharmacol Bull 9:24–29
13. Currie C, Samdal O, Boyce W, Smith R (eds) (2001) Health Behaviour in School-aged Children: a WHO Cross-National Study (HBSC), Research Protocol for the 2001/2002 Survey. Child and Adolescent Health Research Unit (CAHRU), University of Edinburgh
14. Dölle R, Schaffrath Rosario A, Stolzenberg H (2007) The German Health Interview and Examination Survey for Children and Adolescents (KiGGS): data management. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz 50:567–572
15. Donald CA, Ware JE (1984) The measurement of social support. Res Community Ment Health 4:325–370
16. Döpfner M, Steinhausen H-C, Coghill D, Dalsgaard S, Poole L, Ralston SJ, Rothenberger A, Study Group ADORE (2006) Cross-cultural reliability and validity of ADHD assessed by the ADHD Rating Scale in a pan-European study. Eur Child Adolesc Psychiatry 15(Suppl1):46–55
17. Döpfner M, Lehmkuhl G (2000) Diagnostik-System für Psychische Störungen im Kindes- und Jugendalter nach ICD-10 und DSM-IV (DISYPS-KJ), 2nd edn. Huber, Bern
18. Faulstich ME, Carey MP, Ruggiero L, Enyart P, Gresham F (1986) Assessment of depression in childhood and adolescence: an evaluation of the Center for Epidemiological Studies Depression Scale for Children (CES-DC). Am J Psychiatry 143:1024–1027
19. Filipiak-Pittroff B, Wölke G (2007) External quality assurance in the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). Procedure and results. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz 50:573–577
20. Franke G (1995) SCL-90-R. Die Symptom-Checkliste von Derogatis. Deutsche Version. Z Klin Psychol 26:77–79
21. Goodman R (1997) The Strengths and Difficulties Questionnaire: a research note. J Child Psychol Psychiatry 38:581–586
22. Goodman R (1999) The extended version of the Strengths and Difficulties Questionnaire as a guide to child psychiatric caseness and consequent burden. J Child Psychol Psychiatry 40:791–799
23. Grob A, Lüthi R, Kaiser FG, Flammer A, Mackinnon A, Wearing AJ (1991) Berner Fragebogen zum Wohlbefinden Jugendlicher (BFW). Diagnostica 37:66–75
24. Kamtsiuris P, Bergmann KE, Dippelhofer A, Hölling H, Kurth BM, Thefeld W (2002) Der Pretest des Kinder- und Jugendgesundheitssurveys: Methodische Aspekte und Durchführung. Gesundheitswesen 64(Sonderheft 1):S99–S106
25. Kamtsiuris P, Lange M, Schaffrath Rosario A (2007) The German Health Interview and Examination Survey for Children and Adolescents (KiGGS): sample design, response and nonresponse analysis. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz 50:547–556
26. Kern R, Rasky E, Noack RH (1995) Indikatoren für Gesundheitsförderung in der Volksschule. Forschungsbericht 95/1. Karl-Franzens-Universität, Graz
27. Kurth B-M (2007) The German Health and Examination Survey for Children and Adolescents (KiGGS): an overview of ist planning, implementation and results taking into account aspects of quality management. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz 50:533–546

U. Ravens-Sieberer et al.
Study design and methods of the BELLA study

21

28. Kurth B-M, Bergmann KE, Hölling H, Kahl H, Kamtsiuris P, Thefeld W (2002) Der bundesweite Kinder- und Jugendgesundheitssurvey: Das Gesamtkonzept. Gesundheitswesen 64:3–11

29. Kurth B-M, Kamtsiuris P, Hölling H, Schlaud M, Dölle R, Ellert U, Kahl H, Knopf H, Lange M, Mensink GBM, Neuhauser H, Schaffrath Rosario A, Scheidt-Nave C, Schenk L, Schlack R, Stolzenberg H, Thamm M, Thierfelder W, Wolf U (2008) The challenge of comprehensively mapping children's health in a nation-wide health survey: design of the German KiGGS-Study. BMC Public Health 8:196

30. Lange M, Kamtsiuris P, Lange C, Schaffrath Rosario A, Stolzenberg H, Lampert T (2007) Messung soziodemographischer Merkmale im Kinder und Jugendgesundheitssurvey (KiGGS) und ihre Bedeutung am Beispiel der Einschätzung des allgemeinen Gesundheitszustands. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz 50:578–589

31. Masten AS, Hubbard JJ, Gest SD, Tellegen A, Garmezy N, Ramirez M (1999) Competence in the context of adversity: pathways to resilience and maladaptation from childhood to late adolescence. Dev Psychopathol 11:143–169

32. McHorney CA, Ware JE Jr, Raczek AE (1993) The MOS 36-Item Short-Form Health Survey (SF-36). II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. Med Care 31:247–263

33. Morgan JF, Reid F, Lacey JH (1999) The SCOFF questionnaire: assessment of a new screening tool for eating disorders. Br Med J 319:1467–1468

34. Ravens-Sieberer U (2003) Der Kindl-R Fragebogen zur Erfassung der gesundheitsbezogenen Lebensqualität bei Kindern und Jugendlichen—Revidierte Form. In: Schumacher JKA, Brähler E (eds) Diagnostische Verfahren zu Lebensqualität und Wohlbefinden. Göttingen, Hogrefe, pp 184–188

35. Ravens-Sieberer U, KIDSCREEN the European Group (2006) The KIDSCREEN Questionnaires—Quality of life questionnaires for children and adolescents—handbook. Papst Science Publisher, Lengerich

36. Ravens-Sieberer U, Wille N, Bettge S, Erhart M (2007) Mental health of children and adolescents in Germany. Results from the BELLA study within the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz 50:871–878

37. Ravens-Sieberer U, Erhart M, Wille N, Bullinger M, BELLA study group (2008) Health-related quality of life in children and adolescents in Germany: results of the BELLA study. Eur Child Adolesc Psychiatry 17(Suppl1):148–156

38. Ravens-Sieberer U, Wille N, Erhart M, Bettge S, Wittchen H-U, Rothenberger A, Herpertz-Dahlmann B, Resch F, Hölling H, Bullinger M, Barkmann C, Schulte-Markwort M, Döpfner M as the BELLA study group (2008) Prevalence of mental health problems among children and adolescents in Germany: results of the BELLA study within the National Health Interview and Examination Survey. Eur Child Adolesc Psychiatry 17(Suppl1):22–33

39. Rueda GE, Diaz LA, Campo A, Barros JA, Avila GC, Orostegui LT, Osorio BC, Cadena Ldel P (2005) Validation of the SCOFF questionnaire for screening of eating disorders in university women. Biomedica 25:196–202

40. Rueda GE, Diaz LA, Ortiz DP, Pinzon C, Rodriguez J, Cadena LP (2005) Validation of the SCOFF questionnaire for screening the eating behaviour disorders of adolescents in school. Aten Primaria 15:89–94

41. Schenk L, Ellert U, Neuhauser H (2007) Children and adolescents in Germany with a migration backround. Medical aspects in the German Health Interview and Examination Survey for Children and Adolescents (KiGGS). Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz 50:590–599

42. Schneewind K, Beckmann M, Hecht-Jackl A (1985) Familienklima-Skalen. Bericht. Institut für Psychologie—Persönlichkeitspsychologie und Psychodiagnostik der Ludwig Maximilians. Universität München, München

43. Schwarzer R, Jerusalem M (1999) Skalen zur Erfassung von Lehrer- und Schülermerkmalen. Dokumentation der psychometrischen Verfahren im Rahmen der Wissenschaftlichen Begleitung des Modellversuchs Selbstwirksame Schulen. Institut für Psychologie, Freie Universität Berlin, Berlin

44. Starfield B, Riley A, Ensminger M, Green B, Ryan S, Kim-Harris S, Johnston D, Vogel K (1994) Manual for the Child Health and Illness Profile-Adolescent Edition (CHIP-AETM). The Johns Hopkins University, Baltimore, MD

45. Stiensmeier-Pelster J, Schürmann M, Duda K (1989) Depressionsinventar für Kinder und Jugendliche. DIJK, Hogrefe, Göttingen

46. Ware JE, Kosinski M, Keller SD (1996) A 12-Item Short-Form Health Survey (SF-12): construction of scales and preliminary tests of reliability and validity. Med Care 32:220–233

47. Ware JE, Sherbourne CD (1992) The MOS 36-item short-form health survey (SF-36). Med Care 30:473–483

48. Wille N, Bettge S, Wittchen H-U, Ravens-Sieberer U, BELLA study group (2008) How impaired are children and adolescents by mental health problems? Results of the BELLA study. Eur Child Adolesc Psychiatry 17(Suppl1):42–51

49. Wille N, Bettge S, Ravens-Sieberer U, BELLA study group (2008) Risk and protective factors for children's and adolescents' mental health: results of the BELLA study. Eur Child Adolesc Psychiatry 17(Suppl1):133–147

50. Winkler J, Stolzenberg H (1999) Der Sozialschichtindex im Bundes-Gesundheitssurvey. Gesundheitswesen 61(Sonderheft 2):S178–S183

51. World Health Organization (2003) Caring for children and adolescents with mental disorders: setting WHO directions. WHO, Geneva

52. World Health Organization (2005) Atlas: child and adolescent mental health resources: global concerns. WHO, Geneva