ORIGINAL ARTICLE

The J1 Adolescent Health Check-Up

Analysis of Data From the German KiGGS Survey

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SUMMARY

Background: We analyzed data from the Robert Koch Institute's KiGGS survey regarding the J1 adolescent health check-up in order to determine what information this check-up provides.

Methods: Descriptive statistical analysis of J1 participation with respect to social, demographic, medical and psychological factors, with logistic regression analysis of the risk associated with non-participation.

Results: 32.9% of all adolescents in Germany aged 14 to 17 had a J1 check-up. Thus, the J1 participation rate has remained low since the introduction of the J1 in Germany. The main conditions that were more commonly found in adolescents who had a J1 check-up were thyroid disorders (4.1% vs. 2.9%), and scoliosis (14.8% vs. 10.5%). Adolescents were only half as likely to have a J1 check-up if they were under the care of a general practitioner, rather than a pediatrician (odds ratio [OR] 0.46, 95% confidence interval [CI] 0.36–0.60). Foreign adolescents were only half as likely to have a J1 check-up as German ones (OR 0.51, 95% CI 0.31–0.84).

Conclusion: There is compelling evidence that scoliosis and thyroid disorders, in particular, are underdiagnosed if a J1 check-up is not performed. Thus, elevating the J1 participation rate should be a priority. If a J1-check up were performed in the nearly two-thirds of all adolescents who currently do not undergo one, many latent health problems could be recognized and treated in timely fashion.

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The J1 Adolescent Health Check-Up was introduced in 1998 for all 13- to 14-year-olds (age tolerance range ± 1 year) throughout Germany (1). It includes a history of the adolescent's entire life situation and a complete physical examination. The data are recorded on a uniform standardized questionnaire (2, 3). Information about the findings and the usefulness of this check-up rely in part on figures from the year 2000 (4, 5). According to these, around 32% of all adolescents have a J1 check-up. At present, 62% of J1s are carried out by pediatricians, 36% by general practitioners, and 2% by specialists in internal medicine practicing as family doctors (evaluation of the individual specialty groups by the Central Research Institute for Ambulatory Health Care in Germany, Zentralinstitut Berlin). Only 30% of the check-ups produced no therapy-relevant findings.

The search for up-to-date information has proven difficult, because unfortunately the documentation papers ceased to be systematically collected and evaluated after the introductory phase of the general J1 check-up. However, the German Health Interview and Examination Survey for Children and Adolescents (Kinder- und Jugendgesundheitssurvey, KiGGS), an extensive study undertaken by the Robert Koch Institute (RKI) from 2003 to 2006, contains more recent data relating to J1. While an assessment by the RKI of uptake of the U1–U9 preventive examinations does exist (6), an analysis about participation in J1 was explicitly excluded. The public use file on this subject do, however, allow evaluations relating to J1 participation. The following questions were formulated to this end:

- How high was the rate of J1 participation from 2003 to 2006?
- Are there any differences in participation between girls and boys, between various types of schools, or between other sociodemographic characteristics?
- Are there differences between the rates of certain diagnoses in J1 participants and non-participants?
- Are there differences between the diagnosis rates in 11-year-olds and in 16-year-olds?

The present article demonstrates the association between sociodemographic and medical/psychological factors and participation in the J1 check-up as revealed by the KiGGS data. It also compares the development of certain diseases between the ages of 11 and 16 together with their rates of occurrence in J1 participants

and non-participants. From this, conclusions are drawn about the particular significance of the J1 check-up for the timely diagnosis of certain diseases.

Underlying data and methods

The assessments are based on the public use file relating to KiGGS 2003–2006, which includes 17 641 cases (7). All valid answers (n = 3482) to item e08711 (participation in J1 check-up) were evaluated. The results are presented by descriptive statistics. To ensure statistical significance of the strength of a correlation between individual variables and J1 participation, a logistic regression model was used that included all clinically relevant and quantitatively significant factors.

Results

A past J1 check-up is shown for 1146 of 3482 children and adolescents (32.9%) surveyed who were between 14 and 17 years old at the time of survey (*Table 1*). As expected, the J1 participation rate was age-dependent. While only 21.7% of 14-year-olds surveyed had already had a J1 check-up, the figure among 17-year-olds was 38.5%. Male respondents had a slightly higher J1 participation rate than female respondents.

It cannot be seen from the KiGGS data which physician carried out the J1 check-up. All that can be seen is who the respondent's regular physician was at the time of the check-up. This was a pediatrician in the case of 38% of J1 participants, a general practitioner in the case of 30.5%, and a physician in another specialty group for the remaining 32.9% (*Table 2*).

Only small differences in J1 participation rates were shown between the eastern (32.2%) and the western federal states of Germany (33.3%). However, participation rates did show a correlation with the size of the local community. Participation was higher in rural areas (36.3%) and small towns (34.1%) than in larger towns (30.4%) and cities (31.6%).

In regions with a three-tier school system there were very marked differences in J1 participation rate. The rate was noticeably lower among respondents attending a *Hauptschule* (general secondary school) (28.4%) than among those at a *Realschule* (intermediate secondary school) (34.4%) or *Gymnasium* (high school) (34.5%). Those attending a *Gesamtschule* (comprehensive secondary school) also had a J1 check-up rather more often (32.7%).

Further differences are found in relation to nationality and social status. Far fewer foreign adolescents (15.9%) than non-foreigners had a J1 check-up (34.2%). Likewise, adolescents from families of lower social status showed a lower J1 check-up rate (29.3%) than those from families of middle (34.6%) or high social status (33.9%).

Analyzing the reasons for the visit to the doctor and the resulting findings, further differences are identified between those with and those without a J1 check-up (*Table 3*). Compared to non-participants, among participants the reason for the visit to the doctor was more often for a drug prescription (20.2% vs. 17.7%) or preventive examination or immunization (28.7% vs. 22.3%), less often acute illness or an accident (48.2% vs. 53.3%). Compared to those without a J1 check-up, those who had a J1 check-up more often showed pneumonia, otitis media, or scoliosis; other, unspecified diseases were also more often documented for them. On the other hand, convulsions, poor subjective health, and overweight were observed less often in them than in J1 non-participants.

Do the above-mentioned findings or diseases occur more or less often in 11-year-old children than in 16-year-olds? And how do 16-year-olds who have had a J1 check-up differ in relation to these findings from 16-year-olds who have not? To answer these questions, we investigated certain particular medical findings in relation to their documented frequency in each of these two age groups.

For most, there were no or only very slight differences. This was the case for:

- Pneumonia
- Otitis media
- Cardiac disease
- Anemia
- Convulsions
- Diabetes mellitus (very small case numbers)
- Hypercholesterolemia (*Table 4*).

TABLE 1

J1 participation according to age and sex

Age at time of survey (years)	Sex				All	
	Female		Male			
	n	%	n	%	n	%
14	95	21.2	110	22.2	205	21.7
15	141	32.1	175	37	316	34.6
16	164	38.9	160	38	324	38.4
17	157	37.7	144	39.3	301	38.5
All	557	32.3	589	33.5	1146	32.9

TABLE 2

J1 participation according to sex and physician group

Adolescent's regular physician at time of survey	Sex				All	
	Female		Male			
	n	%	n	%	n	%
Pediatrician	125	37.1	145	38.9	270	38
General physician	198	29.9	243	30.9	441	30.5
Other	234	32.2	201	33.7	435	32.9

TABLE 3

J1 participation according to reason for doctor visit and findings

Reason for doctor visit or physical/psychological findings	J1 participation					
	Yes		No		All	
	n	%	n	%	n	%
Acute illness, accident	519	48.2	1165	53.3	1684	51.6
Chronic illness	48	4.5	110	5	158	4.8
Mood disorders	64	5.9	135	6.2	199	6.1
Advice (e.g., nutrition)	50	4.6	109	5	159	4.9
Medical drug prescription	218	20.2	386	17.7	604	18.5
Preventative examination/immunization	309	28.7	487	22.3	796	24.4
Hayfever/conjunctivitis	221	19.7	406	17.7	627	18.3
Neurodermatitis/atopic eczema	161	14.3	296	12.9	457	13.4
Bronchial asthma	84	7.5	166	7.2	250	7.3
Spastic/obstructive bronchitis	134	12	241	10.5	375	11
Pneumonia	162	14.5	262	11.4	424	12.4
Otitis media	596	54.4	1145	51.2	1741	52.3
Cardiac disease	38	3.4	53	2.3	91	2.6
Anemia	33	2.9	66	2.9	99	2.9
Convulsions	29	2.6	96	4.2	125	3.6
Thyroid disorder	46	4.1	78	3.4	124	3.6
Diabetes mellitus	2	0.2	5	0.2	7	0.2
Scoliosis	151	13.5	237	10.4	388	11.4
Migraine	61	5.4	115	5	176	5.2
Other illnesses	371	33.2	700	30.6	1071	31.5
Subjective health not good	140	12.3	359	15.5	499	14.4
Overweight	182	15.1	437	18.8	619	17.9
Hypertension	35	3.1	95	4.1	130	3.7
Hypercholesterolemia	101	9.4	195	8.8	296	9
Smoking	344	30.3	734	31.7	1078	31.3
Has consumed alcohol in the past	1026	90.6	1950	84.5	2976	86.5
Emotional or other problems	50	4.5	97	4.4	147	4.4
Probable SDQ result	74	6.5	143	6.2	217	6.3

SDQ, Strengths and Difficulties Questionnaire

Basically, then, it may be assumed that these two groups have the same incidence of both acute and chronic illnesses. All the more reason, then, to pay attention to the differences that will now be described. Eleven-year-olds suffer more often than 16-year-olds from neurodermatitis, bronchial asthma, and spastic or obstructive bronchitis. Sixteen-year-olds, for their part, suffer more often than 11-year-olds from hayfever or allergic conjunctivitis, thyroid disorders, scoliosis, migraine, and other unspecified diseases. Sixteen-year-olds are less often overweight than eleven-year-olds, but have hypertension more often. Eleven-year-olds more often show emotional or developmental/behavioral problems and have an abnormal overall problem value on the Strengths and Difficulties Questionnaire (SDQ) than do 16-year-olds.

Compared to their peers who did not have a J1 check-up, 16-year-old J1 participants have lower documented rates of pneumonia, otitis media, and convulsions. The J1 participants likewise suffer less from hypertension and smoke less. On the other hand, 16-year-old J1 participants more often have thyroid disorders or scoliosis than do non-participants.

Because correlations may be assumed to exist between many of the sociodemographic and medical/psychological variables, the significance of the individual variables for J1 participation need to be evaluated by logistic regression analysis. Multivariate analysis shows that, in addition to age at the time of survey, the specialty group to which the examining physician belongs is most strongly correlated to the risk (odds ratio, OR) of non-participation (*Table 5*).

As would be expected, having a J1 check-up is documented between 2.2 and 2.8 times as often in older adolescents than in 14-year-olds (age comparison group). However, if the adolescent is in the care of a general practitioner or physician in another specialty group rather than a pediatrician, having the check-up is shown in only about half of all cases (OR 0.46 and 0.55 respectively). When the reason given for the doctor visit is for a preventive examination or immunization, the frequency of J1 check-up also rises by about 1.6 times in the multivariate model. It is also markedly higher when the reason given is for a medical drug prescription, when the adolescent is male, and when the young person lives in one of the western federal states (OR 1.45, 1.23, 1.26 respectively).

The frequency of J1 check-up is also higher in adolescents with pneumonia or scoliosis. It is much lower in young people who live in larger towns or in cities, in those of foreign nationality, and those who smoke (OR 0.81, 0.51, 0.78 respectively). It is also lower in adolescents who suffer from convulsions (OR 0.50).

Discussion

Before evaluating the results, it must be pointed out that the KiGGS survey was a survey with random sample investigation of over 17 000 children and adolescents and/or their parents. This cannot give the same validity as a systematic evaluation of the J1

documentation forms. Moreover, it is now up to 7 years ago that the survey took place. Nevertheless, the KiGGS data can lay claim to being representative and are therefore utilized by many social and scientific institutions as a basis for assessing the health status of children and adolescents in Germany. It thus appears legitimate also to use these data in an evaluation of J1 participation and the factors by which it is influenced.

Both similarities and considerable differences can be seen between the 11-year-olds and the 16-year-olds in terms of the rates of various diagnoses. Little difference exists in relation to acute illnesses such as pneumonia and otitis media. These illnesses mostly have a clear set of symptoms and are typically not diagnosed (or not for the first time) at the J1 check-up. Chronic diseases such as cardiac disease, anemia, diabetes mellitus, and the frequency of convulsions also show no notable differences between 11-year-olds and 16-year-olds. So the first thing to remark is that a number of both acute and chronic illnesses occur about equally often irrespective of age.

Hayfever/allergic conjunctivitis and migraine are more often diagnosed in the 16-year-old group. Even more marked are the differences for thyroid disorder and scoliosis, both of which, in addition, are more frequently diagnosed in J1 participants. Here the J1 appears to have a higher rate of successful diagnosis because of its more detailed history taking and whole-body examination. Thyroid disorder and scoliosis have in common that they often do not give rise to complaints and symptoms of disease, and hence their diagnosis is accessible only to a detailed examination. In doctor visits outside the J1 context, there is usually no reason to routinely examine the spine or investigate for possible thyroid problems. The much more frequent identification of these two problems must be chalked up to the J1 check-up as a gain in knowledge.

It appears highly unlikely that there is actually such a difference between scoliosis or thyroid disease rates in the J1 participant and non-participant groups. In all probability these problems are just as frequent in the non-participant group—they merely remain unidentified. The corollary of this is that without the J1 check-up, nowhere near all cases of scoliosis and thyroid disorder that manifest for the first time after the age of 11 are identified. Both these diseases increase during pubertal growth acceleration, sometimes sharply so. In the population studied here, the frequency of scoliosis goes up by a factor of 2.3 and thyroid disease by a factor of 2.4 between age 11 and age 16. The suggestion that, without the J1 check-up, a large number of new occurrences of these two conditions remain undiscovered is thus a serious cause for concern. The same tendency can be seen for hayfever and migraine, although here the differences are less marked.

Much lower rates of serious overweight, hypertension, and smoking are shown among J1 participants. In addition, the number of those who state that they have good subjective health is higher among J1 participants than among non-participants. Tempting as it is to

TABLE 4

Findings in 11-year-olds versus 16-year-olds who did (participant) or did not (non-participant) have a J1 check-up

Physical/psychological findings*	11-year-olds		16-year-olds			
			J1 non-participant		J1 participant	
	n	%	n	%	n	%
Hayfever/conjunctivitis	152	14.6	89	17.6	59	18.4
Neurodermatitis/atopic eczema	157	15.2	69	13.5	43	13.4
Bronchial asthma	75	7.2	24	4.7	19	5.9
Spastic/obstructive bronchitis	128	12.3	52	10.3	30	9.3
Pneumonia	142	13.7	71	14	33	10.5
Otitis media	520	51	282	57.3	154	49
Cardiac disease	31	3	17	3.3	11	3.4
Anemia	23	2.2	14	2.8	10	3.1
Convulsions	45	4.3	19	3.7	8	2.5
Thyroid disorder	15	1.4	15	2.9	13	4.1
Diabetes mellitus	1	0.1	0	0	1	0.3
Scoliosis	52	5	53	10.5	47	14.8
Migraine	37	3.6	30	5.9	17	5.3
Other illnesses	300	28.9	167	33.1	113	35.5
Subjective health not good	74	12.9	79	15.3	46	14.4
Overweight	220	20.9	87	16.9	60	18.6
Hypertension	0	0	30	5.8	11	3.4
Hypercholesterolemia	105	10.8	52	10.7	36	11.8
Smoking	10	1	226	44.1	113	35.2
Has consumed alcohol in the past	178	17.1	465	90.6	303	94.7
Emotional or other problems	70	7.1	26	5.2	16	5.1
Probable SDQ result	104	10	33	6.4	21	6.5

* For 11-year-olds. reasons for doctor visit are not documented. Overall frequencies for 11-year-olds: 1058. 16-year-old J1 non-participants: 519, 16-year-old J1 participants: 324; SDQ. Strengths and Difficulties Questionnaire

TABLE 5

Predictors of J1 participation (logistic regression model)

	Odds ratio Exp^B	Lower 95%CI	Upper 95% CI	p-value
Sex (male)	1.23	1.02	1.48	0.034
Age at survey (15 years)	2.22	1.70	2.89	<0.001
Age at survey (16 years)	2.79	2.12	3.67	<0.001
Age at survey (17 years)	2.61	1.96	3.49	<0.001
Domicile in eastern or western Germany (western)	1.26	1.02	1.54	0.030
Region (larger town or city)	0.81	0.67	0.97	0.022
School type (Realschule)	1.17	0.89	1.55	0.257
School type (Gymnasium)	1.11	0.83	1.48	0.483
Foreign status (foreigner)	0.51	0.31	0.84	0.008
Social status (intermediate/ high)	1.00	0.79	1.26	0.975
Physician group (general practitioner)	0.46	0.36	0.60	<0.001
Physician group (other)	0.55	0.42	0.71	<0.001
Acute illness. accident	1.16	0.86	1.57	0.341
Chronic illness	0.98	0.66	1.59	0.919
Mood disorders	1.17	0.76	1.82	0.472
Advice (e.g., nutrition)	1.22	0.78	1.90	0.394
Medical drug prescription	1.45	1.07	1.96	0.018
Preventative examination/immunization	1.62	1.19	2.19	0.002
Hayfever/conjunctivitis	1.05	0.83	1.33	0.676
Neurodermatitis/atopic eczema	1.02	0.79	1.33	0.856
Spastic/obstructive bronchitis	1.12	0.84	1.50	0.442
Pneumonia	1.35	1.03	1.78	0.030
Otitis media	1.04	0.87	1.25	0.663
Convulsions	0.50	0.28	0.88	0.017
Thyroid disorder	1.20	0.74	1.92	0.459
Scoliosis	1.33	1.01	1.75	0.043
Other illnesses	0.99	0.82	1.21	0.952
Subjective health (not good)	0.83	0.63	1.09	0.176
Overweight	0.97	0.76	1.24	0.808
Smoking	0.78	0.64	0.97	0.022
Has consumed alcohol in the past	1.31	0.95	1.80	0.096
Emotional or other problems	0.89	0.52	1.53	0.677
SDQ (possible)	1.11	0.71	1.73	0.640
SDQ (probable)	1.25	0.82	1.91	0.303

Odds ratio: Relationship between J1 participation in the comparison group vs. the reference group (1 = no difference from the reference group, <1 = lower frequency, >1 = higher frequency); Exp^B: exponent beta; 95%CL: 95% confidence interval; reference groups: sex = female, age at survey = 14 years, eastern/western: eastern, region: rural/small town, school type: Hauptschule (general secondary school), foreign status: not a foreigner, social status: low, physician group: pediatrician, no reason given, no diagnosis documented, subjective health: good, overweight: weight normal, smoking and alcohol: no consumption of either, emotional problems: none, Strengths and Difficulties Questionnaire (SDQ): unlikely

interpret these figures as showing the success of J1 (intervention and nutritional advice), the question remains whether the explanation for these differences is not in fact also to be found in the health consciousness of the adolescents and of their parents. A higher level of health consciousness presumably results equally in eating sensibly and in attending preventive medical appointments more frequently.

The drop-off in emotional disturbances and of developmental and behavioral problems and abnormalities in 16-year-olds compared to 11-year-olds raises the question of whether older adolescents actually have these problems less often, or whether, for developmental reasons, these problems are more difficult to detect in this age group. Obviously, however, there is no correlation between having a J1 check-up and the occurrence of these complaints.

Multivariate analysis is very productive in evaluating the differences between individual relevant diagnoses. The more frequent detection of scoliosis in J1 participants is statistically significant. Another diagnosis that is significantly more frequent among J1 participants is pneumonia, while convulsions occur significantly less frequently in this group. For all other listed diagnoses there is no statistically significant correlation with J1 participation once all the other variables have been taken into account. Adolescents who smoke are less likely to have a J1 check-up—a fact that most physicians will probably see as confirming their own experience in everyday practice.

In addition, some basic aspects of J1 participation are revealed by multivariate analysis. The J1 check-up is more common in male individuals, and in the western parts of Germany and in rural areas or small towns than in eastern parts and in larger towns or cities. The differences between the various types of school and between the various social strata disappear, and instead what becomes striking is the much lower level of participation among foreign adolescents. This can be explained by a high correlation between school type, social status, and foreign nationality. Foreign children and adolescents attend *Hauptschule* (general secondary school) three times as often and belong to the lower social class four times as often as their non-foreign peers. The correlations demonstrated in a series of studies (8–12) between immigrant background and lower social stratum and health behavior or health (e.g., overweight more common, but asthma or neurodermatitis less common) are only partially reflected in the comparison of J1 participants and non-participants. They cannot explain the overall low rate of participation.

In interpreting the health differences between those who have a J1 check-up and those who do not, it must be remembered that a great many possible confounding variables exist that were not analyzed in this study.

Summary

At first sight it probably appears a trivial point that the documentation of J1 participation depends heavily on the medical specialty of the examining doctor: Children

and adolescents who are (still) under the care of pediatricians have in the past had a J1 check-up more than twice as often. On the one hand this confirms the correlations outlined above based on literature published some time ago. On the other hand, however, it also shows that the time window during which children are under the care of a pediatrician can usefully be exploited for enforcing the spread of J1 check-ups.

The overall participation rate for all adolescents from around one third up to a maximum of just under 4 out of 10 among 16- and 17-year-olds has not improved noticeably since the J1 check-up was introduced more than 12 years ago. The situation in Germany is, according to recent review studies, probably similar to that in the rest of Europe, where—so far as this has been studied and reported—check-up rates are also much lower in adolescents than in children, and increased preventive efforts are also being demanded (13–16). It can only be understood as a challenge to all concerned to persist in building the J1 check-up into everyday consultation routine, and to keep reminding adolescents and their parents of the need for, and the usefulness of, this preventive examination.

The lack of J1 check-ups among foreign adolescents must be seen as a particular deficit. Clearly there is a need for stronger and more intensive education specifically in this segment of the population, about the point and use of the J1 check-up for the developmental health of adolescents.

Although the present study can make no statements about treatments carried out and final outcomes, the results presented here indicate that this early diagnostic measure can make a contribution to identifying health problems in young people. The goal must be, by markedly increasing J1 participation rates, especially among the remaining two thirds of adolescents who do not participate at present, to achieve early diagnosis of the hidden health problems in this group as well, and thus to start result-orientated treatment and counseling for all adolescents. Finally, it would be entirely desirable to have a complete, up-to-date survey of J1 participation together with a systematic evaluation of all the data collected in such a survey.

KEY MESSAGES

- Overall, 32.9% of all children and adolescents between the ages of 14 and 17 at the time of survey had a J1 check-up in the past. Check-up rates thus remain stubbornly low.
- Children and adolescents who were (still) under the care of a pediatrician at the time of the survey had a significantly higher J1 check-up rate.
- Foreign children and adolescents have a significantly lower J1 check-up rate.
- The J1 check-up appears to be particularly advantageous for early diagnosis of scoliosis and thyroid disorders.
- To raise the rate of J1 check-ups, it is advisable to use the time window during which adolescents are under the care of a pediatrician to better effect, and also to communicate better the point and the benefits of this preventive healthcare measure more strongly to foreign adolescents.

Conflict of interest statement
The authors declare that no conflict of interest exists according to the guidelines of the International Committee of Medical Journal Editors.

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