

ORIGINAL ARTICLE

Smoking and Passive Smoking Exposure in Young People

Results of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS)

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SUMMARY

Introduction: This study analyzes the prevalence and associated factors for smoking and passive smoking among young people.

Methods: The data are derived from a subsample of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS), carried out by the Robert Koch Institute between May 2003 and May 2006 (n = 6813, age = 11 to 17 years). This analysis considers current smoking status ("yes" or "no") and exposure to passive smoke ("several times a week or daily" versus "once a week or less frequently"). Social and educational status, parental smoking, and smoking status of friends were considered as associated factors.

Results: In the 11 to 17 year old group, 20.5% of boys and 20.3% of girls smoked. Of those who did not smoke, 40% reported passive smoking exposure daily or several times a week. Important associated factors for smoking are educational status, parental smoking, and in particular the smoking status of friends. For passive smoking exposure, parental smoking status was of paramount significance.

Discussion: These results show that adolescents are an important target group for anti-smoking interventions and that the main settings for these interventions are the school, the family, and the peer group.

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In industrialized countries, smoking is the single most important risk factor for disease and the most common cause of early death (1). The chronic diseases that are more common among smokers include myocardial infarction, stroke, arteriosclerosis, pneumonia, chronic bronchitis, and malignant neoplasia of the lung, oral cavity, larynx, and digestive tract (2, 3). Moreover, smoking weakens the body's self-defense mechanisms and elevates the risk of infectious disease. Regular passive smoking exposure is also associated with a considerable risk to health. The diseases and symptoms that arise largely correspond to those that are caused by active smoking (2, 4).

In the light of these facts, a lasting reduction of tobacco consumption and protection of the population against passive smoking are major goals of preventive health care policy (5, 6). Preventing young people from becoming smokers is key to the achievement of these goals, because most smokers are dependent on nicotine and thus have great difficulty quitting smoking (7). More than 80% of smokers started smoking before their 18th birthday (8), health risks are greatest when the internal organs are not yet fully developed (3), and many adolescents underestimate the consequences for health of active and passive smoking (9). For all these reasons, children and adolescents are the most important target group for smoking prevention and tobacco control policy.

Reliable data on active and passive smoking by children and adolescents are needed for the development and implementation of appropriate policy interventions. The data most often used for these purposes in Germany to date have been derived from the Drug Affinity study (9) and the Non-Smoking Promotion study (10) of the Federal Centre for Health Education (Bundeszentrale für Gesundheitliche Aufklärung, BZgA), the Alcohol and Other Drug Use Among Students (ESPAD) study of the Institute for Treatment Research (Institut für Therapieforchung) (11), and the Health Behaviour in School-aged Children (HBSC) study coordinated by the World Health Organization (12). Data from the German Health Interview and Examination Survey for Children and Adolescents (Kinder- und Jugendgesundheitsurvey,

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TABLE 1

Characteristics of the sample population of the Health Interview and Examination Survey for Children and Adolescents, age 11 to 17 (n = 6813)

Variable	Category	Number of cases (n)	Percent of sample	Percent of German population*
Age (years)	11	1058	15.5	12.8
	12	1008	14.8	13.1
	13	1010	14.8	13.7
	14	1003	14.7	15.1
	15	970	14.2	14.9
	16	905	13.3	15.3
	17	859	12.6	15.1
Sex	Boys	3492	51.3	51.3
	Girls	3321	48.7	48.7
Region	Former East Germany	2278	33.4	18.6
	Former West Germany	4535	66.6	81.4
Immigrant background	Yes	1070	15.7	17.7
	No	5740	84.3	82.3
	No data	3	0.0	
Social status	Low	1777	26.1	27.4
	Middle	3192	46.9	47.2
	High	1609	23.6	25.3
	No data	235	3.4	

* Weighted according to the regional age and sex distribution of children up to age 17 in Germany as of 31 December 2004 (complete data).

KiGGS) of the Robert Koch Institute provide additional useful information because of the relatively large number of individuals surveyed in the individual age categories and because of the wide variety of questions that were asked in the survey. This article presents the current findings of the KiGGS study with respect to the prevalence of active and passive smoking in the younger generation as well as the main factors that influence these behaviors.

Methods

A total of 17 641 boys and girls aged 0 to 17 years and their parents participated in the KiGGS study from May 2003 to May 2006 (13, 14). A stratified multi-stage probability sample was obtained for the study with the cooperation of the Centre for Survey Research and Methodology (Zentrum für Umfragen, Methoden und Analysen, ZUMA). On the first level, 167 study locations were chosen to be representative of the social structure of Germany as a whole. These locations were chosen with a probability weighting that was proportional to the size of their populations under age 17 in relation to the population under age 17 of Germany as a whole.

On the second level, target individuals were chosen by an unrestricted random drawing from the address files of the local district offices (Einwohnermeldeamt). Persons whose names were drawn in this way were invited to come to a local study center established solely for this purpose (rate of participation: 66.6%). In these centers, children, adolescents, and their parents were questioned by a study team led by a physician, and the children and adolescents were also physically examined. The main areas of questioning included mental and physical health, subjective well-being, health-related life quality, health-related behavior, and health care.

The parents also underwent a computer-assisted medical interview about their children's illnesses, vaccinations, and medication use.

In the medical examination, body measurements were made, the state of physical maturity was determined, the blood pressure was measured, visual testing and inspection of the skin were performed, and the adolescents' motor skills and physical fitness were evaluated. Blood and urine samples were also taken for laboratory testing intended to provide information about nutritional status and latent risks to health.

In addition to this core survey of all study participants, the KiGGS study also included several additional modules in which subgroups of the overall study population were studied in further detail to obtain more information about selected topics such as mental illness, environmental stress factors, motor development, and eating behavior. The suitability and practicality of the design and methods of the KiGGS study were tested and assessed in a pretest (n = 1629) that took place from March 2001 to March 2002 (15).

The analysis of active and passive smoking was restricted to young persons aged 11 to 17 years (n = 6813) (table 1). Data on active smoking were based on these young persons' own answers to the question whether and how much they currently smoked. Young people who smoked were also asked to state how many cigarettes they smoked per day and per week and at what age they started smoking regularly. Passive smoking was measured by asking the young subjects how often they spent times in rooms in which others were smoking.

The potential influencing factors for active and passive smoking that were studied included social status, the type of school that the subject attended, and the smoking behavior of parents and friends (the peer group). Social status was quantified as a multidimensional aggregate index calculated according to the parents' statements about their education and professional qualifications, their employment status, and their net household income (the net income of all members of the household taken together, after deduction of taxes and social security premia).

Social status was classified as low, intermediate, or high for the purpose of further analysis with the use of an algorithm used previously in other health surveys of the Robert Koch Institute (16).

The type of school was classified according to the four main types of secondary school in Germany (Hauptschule, Realschule, Gesamtschule, and Gymnasium, with Hauptschule being the lowest level of achievement and Gymnasium the highest).

The parents provided information about their own smoking behavior. Parental smoking, for the purposes of this study, meant smoking by at least one parent. Smoking by friends was asked about during the interviews of the young subjects. They were encouraged to think about friends whom they considered important to them when answering this question.

The statistical analyses were performed with the SPSS14 program package for Windows. Prevalences and odds ratios obtained by binary logistic regressions were calculated. The statistical significance of these figures was assessed with the aid of 95% confidence intervals calculated with the aid of techniques for complex samples (14). To improve the representative quality of the results, the analyses were performed with a weighting factor to correct any deviations of the overall sample from the structure of the entire population of Germany (as of 31 December 2004) with respect to age, sex, location of residence, and country of citizenship.

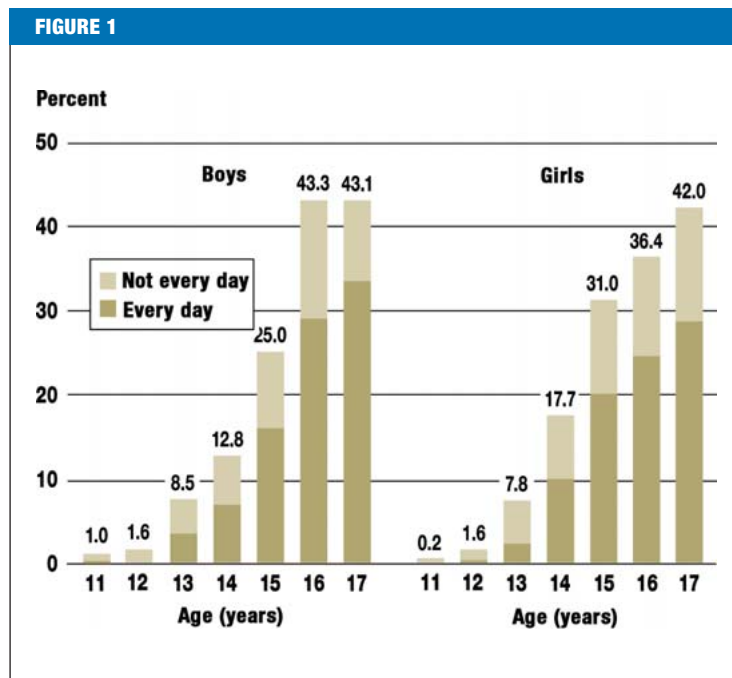
Results

According to the findings of the KiGGS study, 20.5% of all boys aged 11 to 17 smoked, as did 20.3% of all girls in the same age group. Among boys, 13.5% smoked every day, 2.8% once or more per week, and 4.2% less than once per week. The corresponding figures for girls were 12.9%, 3.2%, and 4.2%. The percentage of adolescents who smoke increases with age; by age 17, more than 40% of boys and girls are smokers. At this age, three-quarters of boys that smoked and two-thirds of girls that smoked stated that they smoked cigarettes every day (figure 1).

On average, boys who smoked consumed 9.1 cigarettes per day, and girls 7.9 cigarettes per day. The percentage of heavy smokers (10 or more cigarettes per day) among 11- to 17-year-old boys was 8.0%, that among girls 6.2%. A rise with age can also be seen with respect to the intensity of smoking: among 17-year-old smokers, the average number of cigarettes smoked per day was 10.2 for boys and 9.1 for girls. The percentages of heavy smokers in this age group were 23.6% among boys and 17.5% among girls.

The mean age at which the 17-year-old smokers had started to smoke was 14.2 years. One-fourth of young smokers had already started smoking cigarettes regularly by age 13, 40% by age 14, and about 80% by age 15. The remaining 20% of young smokers started to smoke at age 16 or 17.

Among nonsmoking 11- to 17-year-olds, 85.2% of boys and 86.9% of girls spent some time, at least occasionally, in rooms where others are smoking. 23.5% of boys who did not smoke and 26.5% of girls who did not smoke were exposed to passive smoking every day; a further 16.6% (15.1%, respectively) were



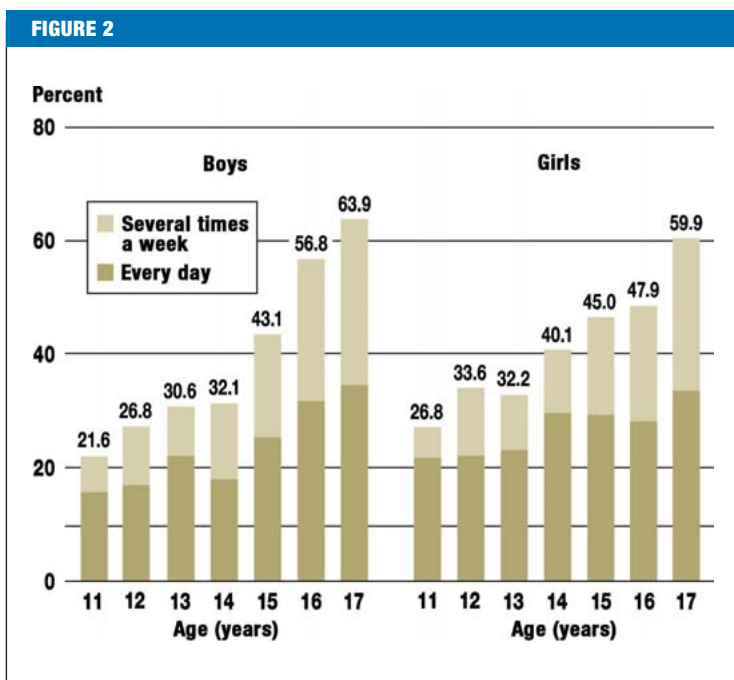
The percentage of young people who smoke, categorized by age and sex (n = 6730)

confronted by tobacco smoke several times a week. 45.0% of nonsmoking boys and 45.3% of nonsmoking girls were exposed to the tobacco smoke of others once a week or less. Just as with active smoking, the prevalence of passive smoking increases markedly with age (figure 2).

The factors influencing active and passive smoking were analyzed only for the 14- to 17-year-old age group. Binary logistic regressions were performed, taking into account the social status of the family, the type of school attended, and the smoking status of parents and friends, in order to determine the relative importance of these factors. Further variables whose influence on smoking was tested included age, immigrant background, and region of residence (former West Germany versus former East Germany).

In the multivariate analysis of factors influencing smoking, it was found that the type of school and the smoking status of parents and friends were important influencing factors for boys (table 2). These same factors were important for girls as well, but the type of school and the smoking behavior of friends had a weaker influence on girls than on boys. Only among girls did low social status have an effect independent of the other influencing factors. In the bivariate analysis, an association between social status and smoking was found among boys as well; in the multivariate analysis, however, this association was found to be attributable to other influencing factors that were correlated with low social status, i.e., the type of school and the parents' smoking status.

The findings of multivariate analysis with respect to passive smoking show a particularly strong influence by



The percentage among non-smoking young people who are exposed to passive smoking several times a week or every day, categorized by age and sex (n = 6611)

the smoking behavior of parents and friends (table 3). Independently of these factors, there is a further effect of the type of school attended, with boys and girls in Hauptschule and Realschule faring worse than those in Gymnasiums. In contrast, the effect of social status was relatively weak. Bivariate analysis indeed revealed an association of passive smoking with social status, but the association was adequately accounted for by the other influencing factors.

Discussion

The results of the KiGGS study of active and passive smoking among young people in Germany are in accordance with those of the Drug Affinity study of 2004. For the 12- to-17-year-old age group, both of these studies documented a smoking prevalence of 23% (17, 18). An immediate comparison with the results of the HBSC and ESPAD studies is not possible, because the latter studies were performed only in individual German states and their results are therefore not representative of Germany as a whole.

Nonetheless, the essential findings of all of these studies with regard to the age- and sex-specific patterns of active and passive smoking were the same:

- Smoking among children and adolescents becomes more common with increasing age.
- The age of 13 to 14 years is of decisive importance for the initiation of smoking.
- While just as many girls as boys are smokers, it is less common for girls to be heavy smokers.

The Drug Affinity, HBSC, and ESPAD studies provided no information about passive smoking; thus, the

findings of the KiGGS study in this area are all the more important. In the KiGGS study, the degree of exposure to passive smoking can be assessed not only by the self-reporting of the participants, but also by laboratory measurement of the urine cotinine content, as performed in the Child-Environment Survey that was carried out at the same time as the KiGGS study (19).

At present, it is not yet possible to draw any conclusion about developments and trends over time from the KiGGS data, but a continuation of the study is already planned for this year (2008), in which the same questions will be asked for a second time. As present, the most useful collection of data for the analysis of changes in young people's smoking habits is derived from the statistics of the Federal Centre for Health Education (BZgA). In the interval from 2001 to 2007 alone, these statistics show a drop in the percentage of smokers among 12- to-17-year-olds from 28% to 18%.

The results of the HBSC study also indicate a marked decrease of smoking among young people. In 2002, 15% of 11- to-15-year-olds smoked regularly; in 2006, the corresponding figure was 9% (20). Furthermore, both the HBSC and the ESPAD data show that a greater percentage of young people in Germany smoke than in most of the other 35 countries that were studied. Comparably high percentages of young smokers were found in Finland, Austria, the Czech Republic, and the Ukraine, while smoking is much less common among young people in Sweden, Denmark, Norway, the United Kingdom, Ireland, Israel, and the USA (21, 22).

The results of the KiGGS study are of particular importance because they show which factors most heavily influence tobacco consumption and passive smoking among children and adolescents. They thus provide concrete targets for policy interventions.

The differences that were found in the percentages of smokers among young people attending different types of schools show that the school is an important setting for smoking prevention interventions, with young people in Hauptschule being an important target group. These interventions include school-based educational programs in which young people are taught about the dangers of smoking and are motivated to behave responsibly in a way that promotes their own health, such as the "Be smart, don't start" (23), "Klasse 2000" (24), and Soester (25) programs. They also include steps taken to make the school day smoke-free, such as have been discussed in nearly all of the German states and already implemented in some of them.

The close associations between parents' smoking status and tobacco consumption, and between parents' smoking status and passive smoking, demonstrate the importance of including the parents in any program of smoking prevention. Help in difficult family situations and offering to help the parents quit smoking can both play a role here.

TABLE 2

Factors influencing smoking behavior in adolescents aged 14 to 17 (n = 3697)

	Boys				Girls			
	Prevalence (%)	(95% CI)	OR*	(95% CI)	Prevalence (%)	(95% CI)	OR*	(95% CI)
Social Status								
Low	36.4	(31.7–41.4)	0.66	(0.42–1.03)	39.1	(34.1–44.3)	1.57	(1.02–2.42)
Middle	30.1	(26.9–33.5)	0.73	(0.52–1.03)	33.0	(29.9–36.2)	1.29	(0.95–1.77)
High	25.8	(21.3–30.9)	Ref.		21.6	(18.0–25.6)	Ref.	
Type of school								
Hauptschule	42.2	(37.0–47.6)	3.76	(2.32–6.09)	46.6	(39.9–53.4)	2.21	(1.44–3.37)
Realschule	31.4	(27.3–35.9)	2.09	(1.41–3.11)	33.5	(29.5–37.9)	1.40	(1.01–1.95)
Gesamtschule	32.1	(25.1–40.0)	2.66	(1.55–4.58)	34.0	(26.4–42.5)	1.43	(0.86–2.38)
Gymnasium	17.6	(14.1–21.7)	Ref.		23.1	(20.2–26.3)	Ref.	
Parental smoking								
Yes	37.7	(34.3–41.2)	2.11	(1.58–2.81)	41.2	(37.5–44.9)	2.13	(1.57–2.88)
No	21.2	(18.2–24.6)	Ref.		19.2	(16.4–22.3)	Ref.	
Smoking in peer group								
Yes	44.9	(41.8–48.0)	7.66	(5.14–11.40)	42.9	(40.2–45.6)	4.36	(3.05–6.22)
No	7.7	(5.7–10.4)	Ref.		11.5	(8.9–14.7)	Ref.	

* Results of binary logistic regressions, taking the size of the influencing factors into account and controlling for age, immigrant background, and region (former West Germany versus former East Germany); OR (odds ratio), the likelihood that an individual in the group in question is a smoker divided by the likelihood of being a smoker in the corresponding reference group (Ref.); CI, confidence interval.

TABLE 3

Factors influencing passive smoking exposure (several times a week or every day) in adolescents aged 14 to 17 (n = 3636)

	Boys				Girls			
	Prevalence (%)	(95% CI)	OR*	(95% CI)	Prevalence (%)	(95% CI)	OR*	(95% CI)
Social Status								
Low	39.8	(34.7–45.2)	1.55	(0.95–2.52)	41.4	(36.8–46.1)	1.55	(0.95–2.52)
Middle	25.5	(22.3–29.0)	1.62	(1.12–2.36)	29.4	(25.9–33.3)	1.29	(0.89–1.87)
High	16.0	(12.8–20.0)	Ref.		15.6	(11.9–20.2)	Ref.	
Type of school								
Hauptschule	36.9	(31.8–42.2)	1.79	(1.12–2.84)	50.4	(43.7–57.1)	1.51	(0.83–2.77)
Realschule	27.7	(23.4–32.4)	1.56	(1.01–2.40)	30.1	(25.7–34.8)	1.66	(1.12–2.45)
Gesamtschule	24.5	(18.5–31.8)	1.63	(0.82–3.21)	31.9	(24.4–40.6)	1.40	(0.89–2.22)
Gymnasium	13.4	(10.6–16.8)	Ref.		17.8	(14.5–21.6)	Ref.	
Parental smoking								
Yes	41.6	(37.8–45.6)	3.78	(2.76–5.18)	45.3	(41.5–49.2)	4.61	(3.44–6.19)
No	10.0	(7.9–12.6)	Ref.		8.6	(6.6–11.2)	Ref.	
Smoking in peer group								
Yes	33.6	(30.6–36.7)	2.62	(1.90–3.59)	36.4	(33.1–39.7)	3.65	(2.61–5.12)
No	15.2	(12.4–8.5)	Ref.		16.9	(13.8–20.4)	Ref.	

* Results of binary logistic regressions, taking the size of the influencing factors into account and controlling for age, immigrant background, and region (former West Germany versus former East Germany); OR (odds ratio), the likelihood that an individual in the group in question is exposed to passive smoking at least several times a week divided by the likelihood of such exposure in the corresponding reference group (Ref.); CI, confidence interval.

The peer group seems to be even more important than the parents as a determining factor of the initiation of smoking. For children and adolescents, their peers constitute the most important social group in which modes of behavior are tested and then either reinforced or rejected. The functionality of smoking in the context of peer groups and the youth scene must therefore be a main focus of smoking prevention efforts among young people.

Practicing physicians should repeatedly inform their young patients about the risks to health of active and passive smoking and should remind the parents of their importance as role models in this respect. They should also refer not only adult smokers, but young smokers as well, to the existing programs that assist with smoking cessation.

Smoking prevention cannot, however, be limited to attempts to change the behavior and attitudes of young people and their social environment. Structural measures are also necessary so that young people have less access to tobacco products and smoke-free living spaces are created (5).

In the last few years, Germany has caught up with other countries in this respect, in the following ways among others:

- The tax on tobacco has gone up, in multiple steps.
- The EU guidelines for a ban on tobacco advertising, including a prohibition of such advertising in cinemas and of sponsoring for tobacco products, have gone into effect.
- The age at which young people can buy cigarettes and smoke in public has been raised.
- Laws for the protection of nonsmokers have been sent along the way to enactment.

If tobacco consumption and passive smoking are to be permanently reduced, however, further policy interventions will be necessary. Smoking prevention measures of multiple types will need to be implemented, directed not only at individual behavior but also at the individual's social environment, and they will need to be tailored to have a maximum effect on specific target groups, such as young people.

Conflict of interest statement

The author states that he has no conflict of interest as defined by the guidelines of the International Committee of Medical Journal Editors.

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