

Patterns of global tobacco use in young people and implications for future chronic disease burden in adults



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Summary

Background Tobacco use is a leading preventable risk factor for many chronic disorders, which are expected to account for an increasing share of the global disease burden. As part of the Global Youth Tobacco Survey (GYTS), we aimed to assess the effect of tobacco use by young people on global mortality.

Methods GYTS is a school-based survey of students aged 13–15 years. The survey was undertaken at 395 sites in 131 countries and the Gaza Strip and West Bank. We questioned students about current tobacco use, susceptibility to smoking among non-smokers, and exposure to secondhand smoke at home and in public places.

Findings The difference in current cigarette smoking between boys and girls is narrower than expected in many regions of the world. Use of tobacco products other than cigarettes by students is as high as cigarette smoking in many regions. Almost one in five never-smokers reported they were susceptible to smoking in the next year. Student exposure to secondhand smoke was high both at home (more than four in ten) and in public places (more than five in ten). Never-smokers were significantly less likely than current smokers to be exposed to secondhand smoke at home (prevalence 39·1% [95% CI 36·6–41·6] vs 72·8% [64·0–81·6]) and in public places (49·5% [46·7–52·3] vs 81·2% [74·2–88·2]).

Interpretation Our findings are troubling for the future of chronic disease and tobacco-related mortality. Reduction of tobacco consumption will require a redoubling of efforts to prevent initiation and promote cessation among the large proportion of young people who currently use tobacco. High exposure to secondhand smoke suggests a need for countries to pass strong and effective smoke-free policies.

Introduction

Tobacco use increases risk of developing several cancers and diseases of the cardiovascular and respiratory systems. Therefore tobacco use is one of the main preventable causes of chronic disease and death in developed countries and is the second leading cause of death worldwide.^{1–4} Estimates of the future burden of tobacco-related disease are based on lung cancer deaths and calculation of the smoking impact ratio.⁵ The global burden of disease estimates a doubling in the number of deaths every year from tobacco use, from 5 million in 2005, to 10 million in 2020.² However, a missing important determinant in calculating the future burden of chronic disease is the cumulative exposure to tobacco.

The Global Youth Tobacco Survey (GYTS) could begin to provide requisite data to allow for projection of the cumulative exposure to tobacco. This survey is a joint project of WHO, the US Centers for Disease Control and Prevention (CDC), the Canadian Public Health Association (CPHA), and most WHO member states. The survey aims to obtain standardised behavioural data from same-aged young people on prevalence of cigarette and other tobacco use; perceptions and attitudes about tobacco; access and availability of tobacco products; and exposure to secondhand smoke, school curricula, media and advertising, and smoking cessation interventions.

Detailed surveillance on prevalence of youth tobacco use was not available before the development and expansion of GYTS. In 1999, WHO and CDC initiated

the survey in an effort to provide recent, high quality, international data for youth tobacco use. Consistency and comparability across GYTS surveys were key design elements of the surveillance system. Survey sites in 131 countries and the Gaza Strip and West Bank have used similar school-based sampling strategies and field procedures; participants have answered a core set of questions; and data have been processed by consistent procedures. The resulting GYTS surveillance system is the world's largest body of comparable data for youth tobacco use.

With this report, we aimed to present findings from the GYTS on current cigarette smoking, current use of tobacco products other than cigarettes, susceptibility to smoking among non-smokers, and exposure to secondhand smoke at home and in public places.

Methods

Participants

GYTS is a school-based survey focusing on students aged 13–15 years. The questionnaire is self-administered in classrooms, and school, class, and student anonymity is maintained throughout the GYTS process. Participation in the survey by schools and students is voluntary. The GYTS research protocol was approved by WHO, CDC, and CPHA. WHO regional offices work with participating countries to ensure that the protocol is followed. All ethics committee and consent procedures are decided at the individual country level.

Published Online
February 17, 2006
DOI:10.1016/S0140-6736(06)68192-0

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The core GYTS questionnaire in English, French, Spanish, and Arabic can be accessed at <http://www.cdc.gov/tobacco/global>

Procedures

Country-specific questionnaires consist of a core set of questions and unique country-specific questions. Final country questionnaires were translated by workers in that country into local languages and back-translated to check for accuracy. GYTS country research coordinators chaired focus groups of students aged 13–15 years to further test the accuracy of the translation and understanding of the questions.

Prevalence estimates assessed in this study were for current cigarette smoking (defined as the proportion of students who answered “one or more days” to the question: “During the past 30 days, on how many days did you smoke cigarettes?”), current other tobacco use (defined as the proportion of students who answered “yes” to the question: “During the past 30 days, have you ever used any form of tobacco products other than cigarettes [eg, chewing tobacco, snuff, dip, cigars, cigarillos, little cigars, pipe]?”; countries adapt the list of other tobacco products to indicate those used by adolescents in their country), and never-smokers who reported they were susceptible to smoking during the next year (defined as 100% minus [the proportion of never-smokers who answered “definitely not” to the question: “If one of your best friends offered you a cigarette, would you smoke it?”, and answered “definitely not” to the question: “At any time in the next 12 months do you think you will smoke a cigarette?”]). Susceptibility to smoking defined this way has been strongly associated with subsequent experimentation with cigarettes among non-smoking students after follow-up of 4 years.⁶ In multivariate analyses, the susceptibility to smoking measure was a stronger predictor of experimentation than was the presence of smokers among family and best friends.⁶

Two measures of exposure to secondhand smoke are used in this study: exposure at home (defined as the proportion of students who answered “one or more days” to the question: “During the past 7 days, on how many days have people smoked in your home, in your presence?”) and exposure in public places (defined as the proportion of students who answered “one or more days” to the question: “During the past 7 days, on how many days have people smoked in your presence, in places other than in your home?”). Measures of secondhand smoke exposure are presented for current smokers and never-smokers separately.

GYTS includes defined geographic sites that can be countries, provinces, cities, or any other sampling frame, including subnational areas, non-WHO member states, or territories of other countries. It uses a two-stage cluster sample design that produces representative samples of students in grades associated with ages 13–15 years. The sampling frame includes all schools containing any of the identified grades. At the first stage, the probability of schools being selected is proportional to the number of students enrolled in the specified

grades. At the second sampling stage, classes within the selected schools are randomly selected. All students in selected classes attending school the day the survey is administered are eligible to participate. The GYTS sample design produces representative, independent, cross-sectional estimates for all sites.

Statistical analysis

GYTS data are weighted to adjust for sample selection (school and class levels), non-response (school, class, and student levels), and post-stratification of the sample population relative to grade and sex distribution in the total population. The computer program SUDAAN⁷ was used to calculate weighted prevalence estimates and SEs of the estimates (95% CIs were calculated from SEs). Differences in rates were judged significant at the $p < 0.05$ level.

Regional aggregations were calculated as means weighted by the population of the sampling frame. In many instances, the sampling frame was the country, but in areas where samples were drawn to be representative of a subnational population, estimates were weighted by the population of the city, state, or administrative region and included in the regional aggregation.

Role of the funding source

The sponsors of the study collaborated on study design and data collection procedures. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit the report for publication.

Results

Between 1999, and 2005, data for GYTS were obtained at 395 sites in 131 countries and the Gaza Strip and West Bank among students aged 13–15 years. National-level data have been gathered in 93 countries, and data at state, province, region, or city level in 38 countries. WHO counts 192 member states distributed between six regions. GYTS was undertaken at 59 sites in 25 countries in the African region, 118 sites in 37 countries in the region of the Americas, 40 sites in 20 countries and the Gaza Strip and West Bank in the eastern Mediterranean region, 99 sites in 26 countries in the European region, 36 sites in seven countries in the

	Participating schools (n=9900)	Participating students (n=747 603)
African region	1373	103 906
Region of the Americas	2899	236 687
Eastern Mediterranean region	1195	92 075
European region	2201	154 759
Southeast Asia region	1439	91 459
Western Pacific region	793	68 717

Table 1: Number of schools and students who participated in GYTS, by WHO region, 1999–2005

	Current any tobacco use*			Current cigarette smoking†			Current other tobacco use‡			Never-smokers susceptible to smoking in the next year		
	Total	Boy	Girl	Total	Boy	Girl	Total	Boy	Girl	Total	Boy	Girl
Total	17.3 (14.8–19.8)	20.1 (16.7–23.5)	14.3 (11.5–17.1)	8.9 (7.2–10.6)	10.5 (8.1–12.9)	6.7 (5.0–8.4)	11.2 (9.7–12.7)	13.8 (11.7–15.9)	7.8 (6.0–9.6)	18.3 (16.3–20.3)	20.1 (17.2–23.0)	15.8 (13.2–18.4)
African region	16.8 (14.1–19.5)	19.7 (15.8–23.6)	13.9 (10.8–17.0)	9.2 (7.0–11.4)	13.0 (9.4–16.6)	5.8 (3.5–8.1)	10.5 (8.3–12.7)	10.9 (8.0–13.8)	9.9 (7.3–12.5)	17.7 (13.7–21.7)	18.2 (12.4–24.0)	17.4 (13.2–21.6)
Region of the Americas	22.2 (19.8–24.6)	24.0 (21.0–27.0)	20.4 (17.6–23.2)	17.5 (15.2–19.8)	17.4 (14.7–20.1)	17.5 (14.9–20.1)	11.3 (9.8–12.8)	14.8 (12.6–17.0)	7.8 (6.2–9.4)	24.8 (22.3–27.3)	24.3 (21.2–27.4)	25.6 (22.3–28.9)
Eastern Mediterranean region	15.3 (12.7–17.9)	18.8 (15.2–22.4)	11.3 (8.0–14.6)	5.0 (3.3–6.7)	6.7 (4.4–9.0)	3.2 (1.1–5.3)	12.9 (10.6–15.2)	15.6 (12.4–18.8)	9.9 (7.3–12.5)	13.4 (11.2–15.6)	16.1 (13.1–19.1)	10.9 (8.1–13.7)
European region	19.8 (16.6–23.0)	22.3 (18.0–26.7)	17.0 (13.8–20.2)	17.9 (15.2–20.6)	19.9 (16.1–23.7)	15.7 (13.6–18.8)	8.1 (5.8–10.4)	10.0 (6.7–13.3)	6.0 (4.0–8.0)	30.5 (26.6–34.4)	26.9 (21.2–32.6)	33.0 (27.9–38.1)
Southeast Asia region	12.9 (10.2–15.6)	18.4 (14.3–22.5)	7.1 (4.7–9.5)	4.3 (3.1–5.5)	5.8 (4.4–7.5)	1.9 (1.0–2.8)	13.3 (12.3–14.3)	16.4 (15.0–17.8)	8.4 (6.8–10.0)	17.0 (15.9–18.1)	21.2 (19.5–22.9)	10.7 (9.1–12.3)
Western Pacific region	11.4 (9.5–13.3)	15.0 (12.2–17.8)	7.8 (5.8–9.8)	6.5 (4.9–8.1)	9.9 (7.1–12.7)	3.3 (2.1–4.5)	6.4 (5.2–7.6)	7.7 (6.1–9.3)	5.4 (3.9–6.9)	8.3 (6.8–9.8)	10.0 (7.4–12.6)	7.1 (5.5–8.7)

Data are prevalence (95% CI). *Smoked cigarettes or used other tobacco products during the past 30 days. †Smoked cigarettes on 1 or more days in the past 30 days. ‡Used other tobacco products (eg, chewing tobacco, snuff, dip, cigars, cigarillos, little cigars, pipe, bidis, waterpipe, or betel nut with tobacco) during the past 30 days.

Table 2: GYTS measures of tobacco use, by sex and WHO region, 1999–2005

southeast Asia region, and 43 sites in 16 countries in the western Pacific region. Notable countries that have not completed the GYTS include Canada, most countries in western Europe, Australia, Japan, and New Zealand.

Of the 395 sites included in this study, nearly 750 000 students from almost 10 000 schools completed the GYTS (table 1). School response rates ranged from 50.0% to 100%, student response rates from 58.0% to 99.7%, and overall response rates from 44.2% to 97.1%.

Almost two in ten students (17.3%) were still using tobacco products at the time of assessment (smoking cigarettes or using other tobacco products during the past 30 days; table 2). Current any tobacco use was highest in the region of the Americas (22.2%) and lowest in the southeast Asia (12.9%) and western Pacific (11.4%) regions. Boys were significantly more likely than girls to currently use any tobacco products in the eastern Mediterranean, southeast Asia, and western Pacific regions.

Overall, 8.9% of students were current smokers. The rate of current smoking was highest in the region of the Americas (17.5%) and the European region (17.9%), and less than 10% in the four other world regions. Boys were significantly more likely than girls to currently smoke cigarettes in the African, southeast Asia, and western Pacific regions.

More than one in ten (11.2%) students currently used tobacco products other than cigarettes. The rate was highest in the southeast Asia region (13.3%) and the eastern Mediterranean region (12.9%), and it was less than 10% in the western Pacific and European regions. Boys were significantly more likely than girls to currently use other tobacco products overall and in the region of the Americas, the European region, and the southeast Asia region.

Boys were significantly more likely to smoke cigarettes than use other tobacco products in the European region and to use other tobacco products than smoke cigarettes in the eastern Mediterranean and southeast Asia regions. Girls were significantly more likely to smoke cigarettes than use other tobacco products in the region of the Americas and the European region, and they were significantly more likely to use other tobacco products than smoke cigarettes in the eastern Mediterranean and southeast Asia regions.

Among students who had never smoked cigarettes, 18.3% reported that they were susceptible to smoking during the coming year. The rate of susceptibility was highest in the European region (30.5%) and the region of the Americas (24.8%) and lowest in the western Pacific region (8.3%). Boys were significantly more likely than girls to report susceptibility in the southeast Asia region.

More than four in ten (44.1%) students had been exposed to tobacco smoke in their homes in the past week, and that proportion was nearly eight in ten (78.0%) in the European region (table 3). More than half (54.2%) of all students reported that they had been exposed to secondhand tobacco smoke in public places; exposure was highest in the European region (84.8%). Never-smokers were significantly less likely than current smokers to be exposed to secondhand smoke at home and in public places in every world region. Despite this difference, more than a third of never-smokers in all regions except the African region (23.7%) reported exposure to secondhand smoke at home, and more than 40% of never-smokers in every world region reported exposure to secondhand smoke in public. Among students who currently smoked, more than 60% in all regions were exposed to smoke at home and more than 70% in all regions were exposed to smoke in public. Exposure to secondhand smoke was highest in the European region overall.

	Exposure to secondhand smoke at home during the past 7 days			Exposure to secondhand smoke in public places during the past 7 days		
	Total	Never-smokers	Current smokers	Total	Never-smokers	Current smokers
Total	44.1 (41.6–46.6)	39.1 (36.6–41.6)	72.8 (64.0–81.6)	54.2 (51.6–56.8)	49.5 (46.7–52.3)	81.2 (74.2–88.2)
African region	30.4 (26.6–34.2)	23.7 (20.4–27.0)	66.1 (50.9–81.3)	46.3 (42.3–46.3)	40.1 (35.7–44.5)	76.0 (74.1–87.9)
Region of the Americas	40.9 (37.6–44.2)	33.1 (29.3–36.9)	58.7 (51.0–66.4)	54.2 (50.4–58.0)	45.0 (40.3–49.7)	75.8 (69.5–82.1)
Eastern Mediterranean region	37.6 (34.1–41.1)	33.7 (30.2–37.2)	63.6 (50.2–77.0)	46.3 (41.9–50.7)	42.4 (37.7–47.1)	74.1 (63.0–85.2)
European region	78.0 (75.4–80.6)	71.9 (69.0–74.8)	86.7 (83.6–89.8)	84.8 (82.6–87.0)	79.6 (76.8–82.4)	91.4 (88.4–94.4)
Southeast Asia region	37.0 (35.4–38.6)	32.2 (30.8–33.6)	76.6 (68.9–84.3)	49.4 (47.7–51.1)	45.3 (43.8–46.8)	83.7 (78.0–89.4)
Western Pacific region	50.5 (47.3–53.7)	46.7 (43.3–50.1)	69.9 (59.9–79.9)	53.6 (50.8–56.4)	49.9 (46.9–52.9)	77.7 (69.4–86.0)

Data are prevalence (95% CI).

Table 3: GYTS measures of secondhand smoke exposure at home and in public places, by smoking status and WHO region, 1999–2005

Discussion

Tobacco use is a major worldwide contributor to deaths from chronic diseases, and findings from the GYTS suggest that current dire warnings of a doubling of the death toll to 10 million deaths per year by 2020 could be a conservative estimate, and the true toll from tobacco use could be even greater than this amount. Small differences in patterns of tobacco use between boys and girls, high use of tobacco products other than cigarettes, high susceptibility to smoking among never-smokers, and widespread exposure to secondhand smoke suggest even more morbid future outcomes caused by tobacco use.

Data obtained from GYTS between 1999 and 2005, suggest the effect of tobacco use on worldwide deaths could be even greater than expected.^{8–16} Findings from this report and previous GYTS research^{10,14,17} show that the difference in current cigarette smoking between boys and girls is smaller than the difference between men and women. Furthermore, use of other tobacco products by students is as high as, or higher than, cigarette smoking in all regions of the world except the region of the Americas and the European region. Moreover, almost one in five never-smokers reported that they were susceptible to smoking in the next year, and student exposure to secondhand smoke was high both at home and in public places.

Different methods are available for projecting the future burden of chronic diseases. No method is perfect, but prediction of the burden of disease caused by tobacco use can be improved by availability of data from the GYTS. Previous projections incorporate the effect of tobacco on death with historic observed differences in lung cancer rates among smokers and non-smokers.² This method avoids reporting bias from survey respondents who are reluctant to report their smoking

status. However, our findings in this report suggest that the sex difference in cigarette smoking and other tobacco use has changed. Results of previous studies have shown that men are four times more likely than women to smoke.¹⁷ By contrast, GYTS data have shown that boys aged 13–15 years were only 2.3 times more likely to smoke than girls, and in many countries there are no differences by sex in cigarette smoking and other tobacco use.¹⁰ No evidence is available to suggest that the difference in adults by sex is a result of higher cessation rates for women than men.¹⁸ If the similarity in smoking rates by sex persists as these students age into adulthood, this shift in behaviour compared with older groups will have important implications for the global burden of chronic diseases and should be considered in future mortality projections.

Our findings in this report are subject to at least three limitations. First, these data apply only to young people aged 13–15 years who attended school, and therefore they are not representative of all children in this age-group. However, in most countries, most young people of this age attend regular, private, or technical schools.¹⁹ Second, these data apply only to children who participated in the survey on the day the surveys were administered in schools. School response rates have been high throughout GYTS, and only 21 of 395 survey sites have recorded student response rates less than 80%. Third, findings are based on self-reports from students who might under-report or over-report their behaviour. Although the extent of potential reporting bias cannot be established in all countries that participate in GYTS, responses to questions about cigarette smoking and other tobacco use have shown good test-retest reliability in a study of US students.²⁰

Patterns reported by GYTS have led to several cross-country studies that show very important differences in tobacco use worldwide.^{9,10} Raised tobacco use by girls and narrow sex differences in tobacco use by adolescents is a recent and unexpected behavioural change in many parts of the world where tobacco prevalence in women is low compared with men. GYTS data show high prevalence of tobacco use other than cigarettes by boys and girls across all world regions. Prevalence of other tobacco use is as high as or higher than cigarette prevalence in many regions of the world. This finding suggests overall tobacco use is a major public-health problem, and prevention programmes must incorporate information about various tobacco products to be effective.

GYTS data show that more than 30% of students in every region of the world were exposed to secondhand smoke at home, and more than 45% in every region were exposed to secondhand smoke in public places. Exposure to secondhand smoke is an important health risk for non-smokers and smokers, thus reduction of this exposure should be a primary component of national comprehensive tobacco control programmes. Initiatives are underway in all six WHO regions to work

with their member states to address issues such as promotion of awareness of the dangers of secondhand smoke, introduction and strengthening of existing legislation to make public places smoke-free, banning of indoor and outdoor smoking on the premises of all educational institutions, and prohibition of smoking on the premises of all health institutions and government facilities.^{21–23} This report also notes that susceptibility to smoking by never-smokers is equal to or higher than current smoking levels in many regions of the world, suggesting further potential increases in smoking prevalence in adolescents.

Projections of death on the basis of historic tobacco use patterns probably underestimate the effect of recent cohort differences in tobacco use initiation and tobacco consumption. The continuing challenge to practitioners is to design and implement effective and comprehensive tobacco control programmes. Evidence from GYTS has shown that reduction of tobacco consumption will need a redoubling of efforts to prevent initiation and promote cessation in young people who currently smoke and use other tobacco products.

Efforts to ameliorate the current and projected harm caused by tobacco use are urgently needed. Countries need to develop and implement comprehensive tobacco prevention and control programmes. WHO is working with countries to prepare national tobacco action plans that include public education campaigns, cessation assistance programmes, enforcement of existing tobacco restrictions, and related policy efforts to support tobacco-control programmes. For many countries, the WHO Framework Convention on Tobacco Control provides a useful basis for implementation of such a comprehensive approach. This framework was unanimously adopted by the World Health Assembly in May, 2003, was signed by 168 nations, and, at the time of writing, has been ratified by 123 nations.²⁴ Full implementation of the principles and obligations contained in the WHO framework should begin to limit tobacco use, initiation of smoking, exposure to secondhand smoke, and promote cessation.

Contributors

C W Warren and N R Jones had the idea for the study, did the analyses, and with M P Eriksen and S Asma, interpreted the results and wrote the report.

Conflict of interest statement

We declare that we have no conflict of interest.

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