

# Tobacco and Alcohol Use Outcomes of a School-based Intervention in New Delhi

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**Objective:** To reduce tobacco use among adolescents. **Methods:** Thirty schools in New Delhi, India, were randomly assigned to 3 conditions: school-based and family-based intervention, school-based intervention only, or control group. Students were in the seventh grade at pretest (N=4,776). The smoking intervention included posters, booklets, classroom activities, debates, and a signature campaign.

The family intervention involved home activities. The survey measured tobacco knowledge, attitudes, offers, use, and intentions. **Results:** Intervention students were significantly less likely than controls to have been offered, received, experimented with, or have intentions to use tobacco. **Conclusion:** The project had a significant impact on tobacco use.

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Tobacco use in developing countries has become a focal point for the tobacco epidemic in the 21<sup>st</sup> century. As smoking rates rise in developing countries, particularly among women and youth, morbidity and mortality attributable to smoking will also rise in those countries.<sup>1</sup> It is estimated that the number of deaths due to tobacco will increase from 3 million per year worldwide to 10 million per year by 2025 and that a large

share of that increase will occur in developing countries.<sup>2,3</sup>

In India, the problem of cigarette smoking exacerbates already increasing cardiovascular disease rates. The Indian population is living longer and becoming more urbanized, and as a result, cardiovascular disease will be the number one cause of death and account for more deaths in India than infectious diseases by 2015.<sup>4</sup> Clearly, as cigarette smoking rates increase, this adds to the acceleration in cardiovascular disease rates. In addition to cardiovascular disease, India has over 2 million cancer patients and about 635,000 tobacco-related deaths each year. Tobacco-related cancers account for about half the total cancers among men and about 20% of those among women.<sup>5</sup> These rates are lower than the United States, but still clearly constitute a major and growing public health problem attributable to tobacco use. Still, the tobacco industry receives state support in India through its revenue and foreign exchange contributions.<sup>4,5</sup> Furthermore, the industry influences farming practices and markets its products aggressively in ur-

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ban India.<sup>4,6</sup> Thus, the primary prevention of cigarette smoking is critical to counter current trends in disease rates and industry practices that will likely put India in the middle of a heart disease epidemic in just over a decade.

In India, other forms of tobacco use are more prevalent than cigarette smoking, particularly among females.<sup>7</sup> According to the National Sample Survey in 1993-1994, among persons aged 10 years and older, 29.3% of rural males, 20.2% of urban males, 2.3% of rural females, and 0.7% of urban females smoked cigarettes or bidis.<sup>7,8</sup> By comparison, 19.3% of rural males, 9.9% of urban males, 9.3% of rural females, and 4.3% of urban females in that age-group used other forms of tobacco such as snuff, chewing tobacco, burnt tobacco, powder, and paste.<sup>7</sup> As income rises in India, it is expected that traditional uses of tobacco will diminish, and cigarette smoking will increase. Also, as Western culture is embraced, cigarette smoking is likely to become more fashionable, particularly in urban India.<sup>7</sup>

As with other countries, the most susceptible time for beginning to smoke in India is in adolescence and early adulthood, ages 15-24, according to the National Sample Survey.<sup>8</sup> Preventing the onset of smoking, then, requires intervention in early adolescence, prior to the time when smoking has already become addictive.<sup>9</sup> The most effective smoking-prevention programs in developed countries appear to be those that involve behavioral classroom curricula, teacher training, peer involvement, community linkages, and policy changes.<sup>9,10</sup> In addition, programs such as the Truth Campaign in Florida that directly involve students in protesting the influence of the tobacco industry have recently been shown to be effective.<sup>11,12</sup>

Project HRIDAY (Health-Related Information and Dissemination Among Youth, and a Hindi word for "heart") was a joint project of the All India Institute of Medical Sciences and the University of Minnesota. The aim of the project was to improve cardiovascular health among young adolescents, including dietary change, physical activity, and smoking prevention. Because smoking and alcohol use onset generally occurs about the same time in early adolescence, we decided to look at the impact of Project HRIDAY on alcohol use as well, even though it was not a focus on the intervention. The Project HRIDAY intervention and outcomes related to smoking and alcohol use are examined in this paper.

#### **METHODS**

##### **Study Sample**

The study was a group-randomized trial conducted with seventh grade students (12 years old) in 30 elementary schools in New Delhi. The schools were recruited systematically to ensure a representative sample. Half the schools were private schools, and half were government (public) schools. The schools were also divided among boys', girls', and coed schools. The schools were blocked by type (private, government) and gender makeup and randomly assigned to receive a school-based and family-based program, a school-based program alone, or no program (control). There were 10 schools in each condition, with equal distribution by type and gender makeup of the schools in each of the 3 conditions. Because the schools did not share educational materials, contamination was not a major concern. Table 1 provides information on the types of schools in each study condition.

Government schools are public schools that serve low-income and middle-income students. Private schools serve upper-middle income and high-income students. The 30 schools in the study were representative of all schools in the urban area of New Delhi and were randomly selected from a sampling frame of all Delhi schools, after stratification by type of schools (Government vs Private; same-sex vs coed).

Students were surveyed prior to and immediately following the intervention period. At pretest, of the 5,752 eligible students, 5,043 provided consent (88%). There were 4,776 students who participated in the pretest in the 30 schools,

**TABLE 1**  
**Project HRIDAY Study Design and Study Sample**  
**at Pretest by Gender**

	School + Family Condition (10 schools)	School-Only Condition (10 schools)	Control Condition (10 schools)
Boys Private	1 school (N=0 girls;234 boys)	1 school (N=0 girls;95 boys)	1 school (N=0 girls;152 boys)
Girls Private	1 school (N=208 girls;0 boys)	1 school (N=239 girls;0 boys)	1 school (N=140 girls;0 boys)
Coed Private	3 schools (N=320 girls;428 boys)	3 schools (N=228 girls;230 boys)	3 schools (N=187 girls;281 boys)
Boys Government	2 schools (N=0 girls;171 boys)	2 schools (N=0 girls;160 boys)	2 schools (N=0 girls;173 boys)
Girls Government	2 schools (N=221 girls;0 boys)	2 schools (N=205 girls;0 boys)	2 schools (N=201 girls;0 boys)
Coed Government	1 school (N=108 girls;159 boys)	1 school (N=118 girls;140 boys)	1 school (N=144 girls;171 boys)
<b>TOTAL</b>	10 schools (N=857 girls;992 boys)	10 schools (N=790 girls;625 boys)	10 schools (N=672 girls;777 boys)
N at pretest	N=1863	N=1439	N=1474
N at posttest	N=1769	N=1293	N=1390

Note. The total N is greater than the sum of the boys and girls in each condition because not all students reported their gender on the survey.

with 1,863 in the school and family condition, 1,439 in the school condition, and 1,474 in the control condition. At posttest, there were 4,452 students, with 1,769 in the school and family condition, 1,293 in the school condition, and 1,390 in the control condition. At pretest and posttest, 50.5% of the sample were males, and nearly 60% were in private schools. Individual students' survey data could not be matched from pretest to posttest, due to problems with the student code numbers. However, the populations of the schools were fairly stable during the study period, ensuring that the data collected represented students who took part in the entire study. The reduction in sample size from pretest to posttest was primarily due to the high dropout rate for students at this age in India. The dropout rate was similar across all 3 study conditions.

The school year in New Delhi begins in

April, closes for summer vacation in May and June, and reconvenes from July to March. The pretest took place with all seventh grade students in 28 of the schools in July and August 1997 and 2 schools in December 1997 and January 1998. The intervention took place from September 1997 to June 1998 after the pretest had been completed. The posttest took place when the students were eighth graders in July 1998 to February 1999. Students in the 2 schools with the later pretests had a shorter intervention than did students in the other schools. The students were on average 11.9 years old at pretest and 12.9 years old at posttest.

#### Intervention Program

There was little, if any, smoking education in the 30 schools prior to the HRIDAY intervention. Twenty of the schools participated in the school-based program,

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**All students in the seventh grade in the 30 study schools were asked to participate in the health survey.**

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which focused on behaviors related to cardiovascular health: diet, physical activity, and nonsmoking. Alcohol use was not a focus of the intervention. The 10 control schools did not receive any programs, but did their usual curriculum. The HRIDAY intervention program consisted of (a) a set of 10 posters promoting different aspects of cardiovascular health that were displayed at school; (b) copies of the HRIDAY project booklet for each classroom, which provided basic information on heart health and were circulated among the students; (c) classroom activities selected by teachers from a training manual of 20 activities ranging from 30 to 60 minutes each developed by the investigators; (d) debates within and between schools on banning tobacco sponsorship and follow-up focus group discussions; and (e) roundtable discussions on nutrition and food policy. Three of the 20 classroom activities concerned the influences to use tobacco, ways to refuse offers to smoke, and passive smoking. For example, students practiced ways to identify and refuse tobacco if a cigarette were offered to them by older students. Students in the intervention schools were also involved in signing a memorandum for a comprehensive government ban on tobacco advertising, which was presented by student representatives to the Prime Minister of India.

Ten schools additionally participated in the family-based program. Students in these schools brought home 6 booklets with information and activities to share with their families. These booklets were developed based on prior research with "home-team programs" in the United States.<sup>13,14</sup> The distribution of such booklets to all parents was unusual for these schools due to their relatively high cost. Booklets from the US studies were used as models, but the booklets were rewritten by the investigators to fit the cultural

context of New Delhi while retaining some of the specific activities of the prior US work, when appropriate. The students returned comment sheets indicating their participation and their parents' opinions about each booklet. One of the 6 booklets focused on tobacco use, whereas the others emphasized dietary patterns and physical activity. The booklets were distributed over a 6-month period.

Teacher training workshops were held after the pretest in September 1997 with all seventh grade teachers in the 20 intervention schools to present the background of the program and the classroom activities. The teachers suggested the idea of the debate on tobacco sponsorship, which was added to the intervention. Student peer leaders (2 from each school) were also trained in Project HRIDAY Leadership in Health workshops. The students were selected by the teachers and teacher coordinators at each school following guidelines provided by the study team to insure that student leaders were chosen. These students assisted the teacher coordinators in organizing the school-level activities. Following the intervention and posttest, focus groups were held with a sample of teachers (N=16) and students (N=52) from the intervention schools. These focus groups, led by the investigators, provided feedback from the participants on the content and implementation of the intervention.

#### **Survey Methods**

All students in the seventh grade in the 30 study schools were asked to participate in the health survey. Parents were informed of the survey and were given the opportunity to withdraw their child from the study. Students were also told that taking the survey was voluntary. The methods to protect human subjects were approved by the institutional review boards of the All India Institute of Medical Sciences (AIIMS) and the University of Minnesota.

Trained survey staff from AIIMS administered the survey in each classroom in the 30 schools. The survey took about one hour to complete. The survey included items on eating patterns, nutrition knowledge, physical activity patterns, and tobacco and alcohol use. The tobacco and alcohol items assessed knowledge, attitudes, and behavior. The tobacco knowledge scale ( $\alpha=.81$ ) involved the

question "Do the following things have tobacco?" with the responses of (yes, no, not sure) to (a) cigarette, (b) hookah, and (c) bidi. The scale involved the sum of the correct answers for these 3 substances (scale range 3-6). The second tobacco knowledge and attitude scale ( $\alpha=.61$ ) involved 9 statements such as "Cigarette manufacturing causes deforestation" and "Smoking makes one smart and popular" to which the students responded (yes, no, not sure). The scale involved the sum of the correct antitobacco answers (2 points) vs incorrect answers (1 point) for the 9 items, such as for "yes" and "no," respectively, as correct for the 2 items above (scale range 9-18). All of the tobacco and alcohol use items had 2 possible responses (no, yes). The first tobacco-use item was "Have you ever been offered a cigarette/bidi?" The second tobacco-use item assessed whether the student had ever tried a cigarette/bidi, even a puff. The third tobacco-use item was "Do you think you will use tobacco when you are an adult?" The first alcohol use item was "Have you ever had a drink of alcohol?" The second alcohol use item was "Do you think you will drink alcohol when you are an adult?" It was anticipated that there would be a low prevalence of tobacco and alcohol use, so the items primarily measured susceptibility and experimentation.

#### Data Analysis

All analyses were done using mixed effects regression models that can accommodate fixed effects, random effects, and correlated observations within assignment units typical of group-randomized trials.<sup>15</sup> The unit of randomization, the school, was specified as the nested random effect. Scores were examined at pretest for any significant differences between conditions. Scores were then examined at posttest for any significant differences between conditions. If F-tests showed that there were significant differences when the 3 conditions were compared, further t-tests examined which conditions were significantly different from each other. The differences between conditions at pretest and posttest were also examined for interactions with individual student's gender and type of school. All analyses were done using SAS GLIMMIX MACRO. This program allows specification of a non-Gaussian, binomial distribution.<sup>16</sup>

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#### RESULTS

Project HRIDAY was well received by the schools involved in the study. All 30 schools fully participated in data collection according to the stipulations of the study protocol. All 20 of the intervention schools displayed the HRIDAY posters, one at a time, and coordinated the poster theme with the classroom activities. Fourteen of the schools displayed all 10 whereas the other 6 displayed 7 to 9 of the posters. The booklet was circulated among students in 9 of the schools. Ten of the schools implemented activities from the teachers' manual that had been prepared by the investigators; 6 schools implemented all 20 activities. All of the intervention schools participated in the signature campaign. Sixteen of the schools held debates within their schools on banning tobacco sponsorship; 16 of the schools also participated in debates with other schools. The degree of implementation of the school-based intervention components did not vary by intervention condition. Among the 10 schools involved in the family-based activities, teachers in 8 schools reported having distributed at least 5 of the 6 booklets, including the booklet on tobacco and smoking. Completion of the booklet was confirmed by the teacher coordinators.

Table 2 presents the mean values and confidence intervals for the tobacco knowledge scales and the tobacco and alcohol use items at pretest and posttest by study condition. There were no differences between conditions for any of the scales or items at pretest, demonstrating that the randomization had achieved equivalent groups. There were significant differences between conditions at posttest for the tobacco knowledge and attitude scale, and all the tobacco and alcohol use items. For tobacco knowledge and attitudes, students in the school-program-

**TABLE 2**  
**Project HRIDAY: Means and Confidence Intervals for Tobacco Knowledge and Attitude Scales, Tobacco and Alcohol Use Items at Pretest and Posttest by Condition<sup>a</sup>**

	Pretest n=4,776	p-value at Pretest <sup>b</sup>	Posttest n=4,452	p-value at Posttest <sup>b</sup>
<b>Tobacco Knowledge Scale<sup>c</sup></b>				
School-and-family condition	5.31 (5.16, 5.46)		5.50 (5.44, 5.56)	
School condition	5.32 (5.17, 5.47)		5.48 (5.41, 5.55)	
Control condition	5.27 (5.12, 5.42)	p=.88	5.58 (5.51, 5.65)	p=.089
<b>Tobacco Knowledge and Attitude Scale<sup>d</sup></b>				
School-and-family condition	15.06 (14.51, 15.60)		15.79 (15.49, 16.10) <sup>a</sup>	
School condition	14.92 (14.37, 15.46)		15.13 (14.83, 15.44) <sup>b</sup>	
Control condition	14.86 (14.31, 15.41)	p=.87	15.88 (15.57, 16.18) <sup>a</sup>	p=.002
<b>Tobacco Use Item 1 "Have you ever been offered a cigarette/bidi?"<sup>e</sup></b>				
School-and-family condition	.0434 (.0275, .0680)		.0423 (.0307, .0580) <sup>a</sup>	
School condition	.0424 (.0265, .0673)		.0522 (.0376, .0720) <sup>a</sup>	
Control condition	.0523 (.0332, .0817)	p=.77	.0975 (.0758, .1247) <sup>b</sup>	p<.001
<b>Tobacco Use Item 2 "Have you ever tried a cigarette/bidi?"</b>				
School-and-family condition	.0340 (.0219, .0525)		.0366 (.0264, .0504) <sup>a</sup>	
School condition	.0416 (.0269, .0637)		.0571 (.0422, .0768) <sup>a</sup>	
Control condition	.0391 (.0251, .0605)	p=.79	.0937 (.0728, .1198) <sup>b</sup>	p<.001
<b>Tobacco Use Item 3 "Do you think you will use tobacco when you are an adult?"</b>				
School-and-family condition	.0240 (.0128, .0445)		.0107 (.0058, .0197) <sup>a</sup>	
School condition	.0155 (.0078, .0307)		.0178 (.0102, .0312)	
Control condition	.0200 (.0103, .0384)	p=.63	.0353 (.0220, .0560) <sup>b</sup>	p=.012
<b>Alcohol Use Item 1 "Have you ever had a drink of alcohol (beer, wine, whiskey)?"</b>				
School-and-family condition	.0878 (.0469, .1583)		.1447 (.1096, .1886) <sup>a</sup>	
School condition	.1131 (.0621, .1973)		.1286 (.0958, .1706) <sup>a</sup>	
Control condition	.0968 (.0520, .1730)	p=.82	.2886 (.2298, .3555) <sup>b</sup>	p<.001
<b>Alcohol Use Item 2 "Do you think you will drink alcohol when you are an adult?"</b>				
School-and-family condition	.0399 (.0196, .0797)		.0530 (.0341, .0814) <sup>a</sup>	
School condition	.0309 (.0148, .0634)		.0361 (.0219, .0588) <sup>a</sup>	
Control condition	.0338 (.0162, .0690)	p=.87	.1407 (.0964, .2009) <sup>b</sup>	p<.001

a Mean scores obtained from SAS PROC MIXED and SAS GLIMMIX MACRO with 95% confidence intervals. Each condition has 10 schools, with 30 total schools. P-values represent the F-test comparing the 3 intervention conditions (2,27) at pretest and posttest with the school as the unit of analysis.

b P-value for comparison of 3 conditions. Superscript letters (a,b) indicate which conditions are different from one another for each scale or item; those with different letters are significantly different, p<.01.

c Scale range 3-6. The question "Do the following things have tobacco?" with answers, cigarette, hookah, bidi, scored as correct (2), incorrect/don't know (1). Higher score indicates greater knowledge.

d Scale range 9-18. Nine questions regarding tobacco attitudes and facts. Higher score indicates greater knowledge and more antitobacco attitudes.

e Scale range 0-1. All tobacco and alcohol use questions scored as no (0), yes (1). Means indicate proportion of students who responded with yes.

only condition had significantly lower scores than did students in the school-and-family or control conditions. For the tobacco use items 1-2, and the alcohol use items 1-2, students in the control condition received significantly more offers to use tobacco, experimented significantly more with tobacco, used significantly more alcohol, and had significantly greater intentions to use alcohol as an adult than among students in the 2 intervention conditions. For tobacco-use item 3, intentions to smoke as an adult, there were significant differences only between the school-and-family and control conditions. There were no significant differences in these tobacco and alcohol use items between those in the school-only and those in the school-and-family conditions. None of the examined gender or type of school interactions were significant ( $p < .01$ ). Overall, the prevalence of tobacco and alcohol use was about 2 times greater in the control condition schools than in the intervention schools, even though there were no differences between conditions at pretest.

The focus groups were important as they helped to guide the demonstration phase of this research in multiple cities in India. The teachers found the teacher training workshops to be very helpful and effective, and the materials to be self-explanatory and easy to implement. The structured activities such as the debates and the signature campaign for the letter to the Prime Minister were seen as most effective. Because these were done in nearly all of the intervention schools, it is not really possible to link specific intervention components to outcomes. Teachers felt that more incentives for participation would have been useful as well as more interaction with the HRIDAY team. The students also felt that the materials were interesting and self-explanatory. They felt the program should start in the younger grades and that health-related school clubs, newsletters, computer software, and a wider array of topics would be welcomed. Students from the school-and-family condition noted that the activities in the booklets should have been done during school time, as many parents are too busy to help with homework in the evenings. Overall, the teacher and student focus groups were positive about Project HRIDAY, but wanted even more support and materials for their schools.

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#### DISCUSSION

The activities in Project HRIDAY in the 20 intervention schools appear to have made a significant impact on the prevalence of tobacco and alcohol use in this young adolescent age-group in New Delhi. Whereas students in the control schools increased their tobacco and alcohol use over the year of the study, as would be expected for this age-group, use among the students in the intervention schools remained mostly stable. Students in the intervention schools participated in behavioral classroom activities related to social influences to use and refuse tobacco, observed posters related to tobacco in their schools, participated in debates about sports sponsorship by tobacco companies, and also participated in petitioning that the Indian government ban tobacco advertising and promotions. Students in the school-and-family condition additionally discussed tobacco use and its consequences with their parents. The combination of these activities appears to have been powerful in convincing young adolescents in New Delhi not to begin to smoke.

The alcohol-use outcomes were of interest, because alcohol use was not part of the Project HRIDAY intervention program. However, because the two behaviors co-occur in most populations, it is likely that when tobacco use was significantly reduced, then alcohol use was delayed as well.<sup>9</sup> A similar outcome was observed in a previous project, Project Northland, where alcohol use was the targeted behavior.<sup>17</sup> At the end of the intervention, students in Project Northland who delayed onset of alcohol use were also sig-

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***A major strength of the study is its rigorous design.***

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nificantly more likely to reduce their tobacco use.<sup>18</sup> If the students in the intervention group were simply biased to report more positively about what they had learned, then we would have expected the tobacco knowledge and attitude scale to also reflect this same pattern, which was not the case. Additionally, there were other components of Project HRIDAY, not dealing with tobacco or alcohol use, but targeted in the intervention (diet and physical activity), where significant outcomes were not achieved, using similar self-report measures.

The intervention appears to have been successful independent of the type of school (government or private) or gender of the student, even though girls smoked significantly less than boys did. This is important as programs of this type can be disseminated throughout New Delhi and evaluated in other urban areas in India. It is unfortunate that we cannot identify which of the components of HRIDAY accounted for the outcomes observed, although the process data suggest that the combination of the classroom activities, school posters, sponsorship debates, and signature campaign was well implemented and well received. The family-based program did not appear to significantly add to the outcomes, as was the case in the CATCH study,<sup>14</sup> but the tobacco booklet may have been too small a dose to create an independent effect, particularly because incentives were not offered for completion. Clearly, more research is needed on which components are most efficacious and cost-effective.

The study had both strengths and limitations. A major strength of the study is its rigorous design. The schools were randomized to condition, after being blocked by type of school and gender, which resulted in no differences between conditions at pretest and therefore equivalent groups to compare. The data, too, were analyzed appropriately, per what is recommended for group randomized trials.<sup>15</sup> In addition, the intervention fit the needs

of the teachers in the schools, allowed the teachers to select when and which activities to teach, and was flexible in adding the teacher-generated debates and signature campaign. This insured greater buy-in from the intervention teachers. The debates and signature campaign appears to have activated students, similar to the Truth Campaign in Florida,<sup>12</sup> to take action against the tobacco industry.

There were also several limitations. The identification system that was used as data were collected did not allow us to match students from pretest to posttest. Thus we could not look at change within individuals over time. Instead, the study examined change within the school population over time, which reduced the power to detect differences between groups. The use of self-reports has been questioned for their validity in this age-group. However, using a biochemical validation system was not financially possible in this study. The surveys were handled in a confidential manner by the survey interviewers, using a code that identified the school and classroom, which should have increased accurate reporting. Also, student responses to other areas of the project did not conform to an assumption of reporting bias. Additionally, prior work with substance use in developing and developed countries showed no differences between countries in the accuracy of self-reports; students in both types of schools demonstrated the same outcomes.<sup>19</sup> In fact, in a smoking-prevention study in the north-central United States, students in the control group were more likely to underreport.<sup>20</sup> Thus, although there may have been some underreporting of use, it is not likely to be substantial or confined to students in the intervention conditions and should not change the major conclusions of this study. Finally, more extensive measures of tobacco use behavior; including smokeless tobacco use, and a longer-term follow-up would have strengthened the long-term implications of the project.

In summary, Project HRIDAY demonstrated that a systematic and coordinated health promotion program with young adolescents can delay the onset of smoking and alcohol use in New Delhi, a city with residents who are at high risk for the chronic diseases such as heart disease. Such risks for chronic disease are becoming increasingly prevalent in devel-



oping countries. The key ingredients appear to be multiple school-based activities and student anti-industry activism. The school-based activities can easily be replicated in other settings, whereas the degree and type of activism must depend on the political situation of a country or community at a given time period. Still, Project HRIDAY provides a very good example of what can be achieved in developing countries, combining a challenging research protocol and state-of-the-art smoking-prevention methods.

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