Short Communication

Interest in Testing for Genetic Susceptibility to Lung Cancer among Black College Students ''At Risk'' of Becoming Cigarette Smokers

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Abstract

Receptivity to genetic testing for lung cancer susceptibility was assessed among African American college freshmen, who held attitudes favorable towards or had experimented with cigarette smoking. Students (n = 95) completed a telephone survey that assessed beliefs about genetics and lung cancer risk, interest in genetic testing, and expectations about the test outcome. Interest in being tested was moderately high (mean, 5; SD, 2.2; scale of 1-7) and highest among those who believed lung cancer was influenced by genetics (r = 0.22, P < 0.05) and those who expected to be at high risk (r = 0.27, P < 0.05). Overall, 34% thought if tested, the result would show high risk for lung cancer. In multivariate analyses, students' test result expectation was the only significant predictor of interest in testing. Those who believed the test would show them to be at higher risk were thrice more likely to be interested in testing than those who thought the test would show that they were at lower risk (odds ratio, 2.99; confidence interval, 1.03-8.64; P = 0.04). Future research is needed to understand how young adults will respond to genetic susceptibility feedback that confirms or contradicts their expectations about personal risks of smoking. (Cancer Epidemiol Biomarkers Prev 2005;14(12):2978–81)

Introduction

Lung cancer, the leading cause of cancer death in the United States, can be attributed almost entirely to cigarette smoking (1). Although African Americans on average initiate cigarette smoking at older ages and smoke fewer cigarettes than Whites, they are more likely to be diagnosed with and die from lung cancer (1). Among the many explanations suggested for this disparity is that African Americans may be genetically more susceptible to lung cancer than Whites because they absorb more of the carcinogenic chemicals in cigarette smoke and metabolize them more slowly (1).

African Americans who start smoking are less likely to quit smoking than Whites, making primary prevention of tobacco use an important public health priority (1). Moreover, because African American youth tend to adopt smoking at later ages, college settings may be optimal for evaluating primary prevention interventions (1, 2). Culturally targeted tobacco marketing and youth's optimistic perspectives about the chances of becoming nicotine dependent or experiencing the harms of tobacco use conspire against primary prevention efforts (1, 3). Smokers commonly perceive themselves to be less vulnerable to smoking-related harms than the generalized smoker, and this bias may be more accentuated among young smokers (4, 5).

Personalized risk feedback based on genetic markers of susceptibility to smoking-related harms could be used to dissuade young adults from experimenting with cigarette smoking. However, theoretical models of motivated reasoning and resistance to persuasion tell us that individuals are not passive recipients of risk information (6). Thus, greater personalization of risk information might increase the threat of risk messages and prompt self-defensively motivated processing of feedback. Moreover, these conceptual models suggest that smokers' interpretations of and responses to genetic susceptibility feedback will be moderated by factors, such as beliefs about the role of genetics in smoking-related disease risk, and their expectations about the test result. Smokers may respond more defensively to risk feedback, denoting higher risk if they believe that genetics plays a big role in disease development.

Although currently there are no clinically valid tests available to indicate susceptibility to lung cancer, >20 genes have been identified that are involved in the metabolism of nicotine and detoxification of carcinogens that cause lung cancer (7). The most consistent results implicate a common polymorphism in *GSTM1*, a gene in the family of glutathione *S*-transferases (EC 2.5.1.18), involved in signaling enzymes to metabolize a broad range of carcinogens (8). DNA adducts of tobacco smoke constituents in smokers with *GSTM1*-null genotype have been found to be higher than those in smokers with non-null genotype (9-11). These findings suggest that this type of genetic feedback may become available in the coming years.

This report describes data collected as part of a pilot study to explore the feasibility of evaluating a genetic susceptibility feedback intervention with African American college freshmen ''at risk'' of becoming regular cigarette smokers. The data was analyzed to assess the extent to which these young adults' beliefs about the association between genetics and lung cancer influence their expectations about test results if they were to undergo a hypothetical test for genetic susceptibility and, in turn, their interest in such testing.

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Table 1. Demographics of the screened population, study participants, and those who completed or did not complete the end-of-school year (survey 2)

Characteristics	Screened at orientation (n = 684), %	Pilot subsample (n = 150), %	Follow-up survey 2 (n = 95), %	Completed survey 1, no survey 2 (n = 31), %
African American	96	97	98	90
Female	67	68	73	68
Mean age (SD)	20.1 (3.2)	20.0 (3.4)	19.9 (2.6)	19.5 (.72)
Susceptible to smoking*	44	83	84	87
Lives on campus	88	94	96	94
Experimented with smoking†	50	58	56	71

*Susceptible if participant does not respond ''definitely not'' to either of two questions: would you smoke if friend offer you a cigarette, or do you think you will smoke a cigarette during the next year.
†Have ever smoked even a few puffs.

Materials and Methods

College students who were attending North Carolina Central University, a Historically Black College and University, were approached in a mandatory course for freshmen that occurred early in the fall 2003 semester and asked to complete a brief screening survey about their smoking attitudes and habits. A script was read to them describing the purpose of the study and instructing them to complete the survey anonymously. As part of this screening survey, students were asked if they would be willing to be contacted for another related research study that involved two additional telephone surveys (one in the coming weeks and survey 2 about 5 months later, in April of 2004). Participation included a US$50 incentive (US$20 for survey 1 and US$30 for survey 2). Students willing to be recontacted were instructed to complete a contact form that included their name, address, and telephone number. A subsample of those who gave contact information was selected for recontact as described below. All research activities were reviewed and approved by Institutional Review Boards at the Duke University Medical Center and North Carolina Central University.

Baseline Screening Survey

Demographics. Student's gender, date of birth, race, year in school, and whether or not they lived on campus were assessed.

Use of Cigarettes. Students were asked whether they had ever tried cigarette smoking, even a few puffs (no/yes), whether they had smoked in the last 30 and the last 7 days, and for each, the approximate number of cigarettes they had smoked on the days they smoked.

Susceptibility to Smoking. Three questions assessed susceptibility to smoking (12): (*a*) Do you think you will try a cigarette soon (no/yes)? (*b*) If one of your best friends were to offer you a cigarette, would you smoke it? (*c*) At any time during the next year, do you think you will smoke a cigarette? The response options for questions b and c were as follows: definitely yes, probably yes, probably not, and definitely not. Participants were deemed susceptible if they responded other than ''no'' to the first question and/or gave a response to question b or c other than ''definitely not (12).'' This screening tool has been shown in prospective studies to predict advancement in stage of adoption of cigarette smoking (12).

Genetic Measures. Three questions about genetic risk and related testing were included in the end-of-school year telephone survey (survey 2). Students were asked to rate the extent to which they believed that lung cancer was due to genetics on a scale from 0% to 100%, where 0% indicated genes are not at all involved and 100% indicated that genes were completely the cause of lung cancer. Level of interest in a ''new genetic test that can tell whether someone is at higher or lower risk of getting lung cancer if they smoke'' was assessed on a scale from 1 to 7, where 1 was not at all interested and 7 was extremely interested. Lastly, students' were asked if they were to have the genetic test, what they expected their results would show. Response options were higher risk or lower risk than other people.

Results

Sample Characteristics. A total of 684 students completed the baseline screener. Of these, 536 (78%) agreed to be recontacted for the pilot study. A subsample of 150 students was drawn to include the following: a random sample of 25 students (of the 223) who reported having never tried cigarette smoking and responded ''definitely would not'' accept a cigarette from a best friend or smoke a cigarette in the next year; all 38 students who reported never having tried smoking but responded other than ''definitely would not'' accept a cigarette from a best friend or smoke a cigarette in the next year; all 41 students who had smoked in the past 30 days but not in the last 7 days; and 46 of the 64 students who had smoked but not in last 30 days and responded other than definitely not to the question about smoking in the next year. Students who smoked in the past 30 days and the prior 7 days were excluded to lessen the chance that regular smokers would be included in the sample.

Of this 150 selected, 83% (n = 126) completed the first survey; 76% (95 of 125) completed survey 2 and comprise the sample for this report. Completion rates for survey 2 in the four ''at-risk'' groups described above were 79%, 84%, 70%, and 71%, respectively. Of those who completed survey 2, the majority was female, lived on campus, and the average age was 20 (SD, 2.6); just over half had experimented with smoking (Table 1).

Beliefs about Genetics, Interest in and Expectations for Results of Genetic Susceptibility Testing. Students believed that lung cancer risk was partially influenced by genes (mean, 46: where 0%, no genes involved and 100%, completely genes; SD, 32). Students expressed moderate to high interest in having a new genetic test that could tell whether they were at higher or lower risk of getting lung cancer if they smoke (mean, 5 on scale from 1, was not at all interested to 7, extremely interested; SD, 2.2; 41% were extremely interested). When asked what they thought their test result would be if tested, 66% expected to be at lower and 34% expected to be at higher than average risk.

Interest in testing was stronger among students who believed genetics plays a greater role in development of lung cancer (r = 0.22, $P < 0.05$) and among those who expected their result to show higher than average risk for lung cancer (r = 0.27, $P < 0.05$; Table 2). Additionally, those who believed genetics plays a greater role in lung cance $P < 0.001$).

Multivariate analyses were conducted to evaluate the effects of beliefs about the role of genetics in lung cancer and expectations about the result if tested on interest in genetic testing controlling for gender, experimentation with smoking, and attitudes favorable towards smoking (Table 3). Perceived risk if tested was the only variable that was associated significantly with interest in genetic testing. Those who expected that their test result would indicate higher than average risk were almost thrice more likely to be interested in testing than those who expected the test to show lower than average risk (odds ratio, 2.99; confidence interval, 1.03-8.64; $P = 0.04$).

Discussion

This sample of college freshmen believed that lung cancer was influenced by both genetics and environment. Although evidence is growing for the heritability of lung cancer (13), genetics is unlikely to account for 50% of lung cancer risk as endorsed by our participants. Although students may have overestimated the role of genetics in lung cancer, alternatively, their answers may have indicated belief that genetics plays a 50-50 role similar to chance in lung cancer risk (14). Regardless, these beliefs were not associated with their interest in testing. Belief that genetics played a large role in lung cancer, however, was associated with expectations that if tested, the result would show high risk. In turn, those who expected that their result would show higher than average risk were most interested in testing.

These results raise questions about how young at-risk smokers will respond to genetic susceptibility feedback if tested. Susceptibility testing for the *GSTM1* null/null variant for example will identify ~50% to 60% to be in the lower risk group. Thus, if tested, fully a quarter of these young adults would receive results, indicating that they were not at as high risk as they expected. Receipt of results discordant with expectations may motivate individuals to be biased in their processing of risk information (e.g., generalizing lower risk results for lung cancer to other smoking-related health outcomes; refs. 15, 16). Alternatively, results that confirm expectations may lead to fatalism about the benefits of not smoking, if individuals overestimate the role of genetics in determining risk.

It is notable that our sample of Black college freshmen expressed moderately high interest in undergoing the hypothetical genetic test. However, hypothetical scenarios that assess interest in or intention to be tested may overestimate interest in genetic testing (e.g., see ref. 17). It is likely that fewer of those at risk of becoming smokers would actually avail themselves of testing. It has been suggested that African Americans may be less enthusiastic about genetic testing when compared with Whites (18). However, we found that African Americans adults receiving care at a community clinic were very interested in genetic susceptibility testing for lung cancer (19). Similarly, others have found African American college students to hold generally positive attitudes towards *medical* applications of genetic testing and screening (20).

This small pilot study has several limitations. The genetic-related constructs were assessed using single items. The testing scenario was very general and did not provide specific details about the genetic test. For example, the brief narrative lacked any social contextual descriptors and, as such, may not have prompted critical review of the broader implications of such testing. Accordingly, we did not collect data on perceptions of stigmatization, insurance discrimination, or the scientific basis or validity of such testing. It is also noteworthy that more students who had experimented with smoking did not complete the end-of-year survey. This may have attenuated associations between smoking experimentation and other variables. The relatively small sample size limited power to explore interesting interactions among variables. The sample also was homogeneous with respect to race, education, and other demographics.

Despite these limitations, this study raises questions about the use of genetic susceptibility testing to motivate preventive behaviors that could be explored in future research with larger and more diverse samples. This research is important to pursue now as we anticipate the ways in which genetic susceptibility testing might be used in health promotion and public health interventions (21).

Table 3. Multivariate logistic regression model to predict interest in genetic testing (dichotomous variable)

Variable	Variable ratio (confidence interval)	*P*
Belief that genetics causes lung cancer	1.24 (0.47-3.26)	0.67
Expect high risk result if tested	2.99 (1.03-8.64)	0.04
Female gender*	1.10 (0.42-2.94)	0.84
Hold positive attitudes to smoking†	0.69 (0.17-2.72)	0.59
Experimented with smoking‡	1.01 (0.36-2.79)	0.99

NOTE: Cut point set at the mean (≤5.0, >5.0).
*Measured at survey 1.
†Susceptible if participant does not respond ''definitely not'' to either of two questions: would you smoke if friend offer you a cigarette, or do you think you will smoke a cigarette during the next year.
‡Have ever smoked even a few puffs.

Table 2. Correlations among belief and attitudes about genetics and interest in genetic testing

Questions about genetics	1	2	3
High interest in genetic testing*	1.00	0.22 †	0.27†
Belief about genetics and lung cancer‡		1.00	0.53§
Expect level of lung cancer risk if tested‖			1.00

*Level of interest in genetic testing (continuous 1-7, not at all interested to extremely interested; binary cut at mean: 0, ≤ 5.0 and 1, >5.0.
†$P < 0.05$.
‡0 (genetics not involved in lung cancer) to 100 (genes completely the cause of lung cancer). Level of risk of lung cancer if tested (0, lower risk; 1, higher risk).
§$P < 0.001$.
‖0, lower; 1, higher.

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