Nicotine & Tobacco Research Advance Access published December 11, 2009

Original Investigation

Tobacco-use psychosocial risk profiles of girls and boys in urban India: Implications for gender-specific tobacco intervention development

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Abstract

Introduction: This study examined the distribution of psychosocial risk factors and prevalence of tobacco use among youth in urban India by gender.

Methods: Data were obtained from a cross-sectional baseline survey of a group-randomized tobacco intervention trial involving 6th and 8th graders from 32 schools in Delhi and Chennai (N = 11,642). Mixed-effects regression models were used to examine differences in the prevalence of tobacco use by gender, to determine how the relationship between current tobacco use and related psychosocial risk factors varied by gender, to compare the distribution of risk factors by gender, and to determine if any of these relationships varied by grade level or school type.

Results: 14.7% of girls and 21.1% of boys reported ever-use of tobacco. The psychosocial risk profile for tobacco use was remarkably similar for boys and girls, though some differences were apparent. For example, exposure to advertising and beliefs about social effects of use were significant risk factors for girls but not for boys. Across the board, girls showed lower risk for all psychosocial risk factors, except for perceived prevalence of chewing and smoking, for which girls had higher risk compared with boys.

Discussion: While the psychosocial risk profile for boys suggests a more vulnerable population for tobacco use, the closing gap in tobacco use between boys and girls indicates a need to examine possible differences in psychosocial risk factors. This study reports that there are subtle, but important, differences in risk factors between genders, having implications for gender-specific intervention development.

Introduction

As the single most preventable cause of death in the world, tobacco use claims a life every 6 s—having a cumulative annual death toll that outnumbers tuberculosis, HIV/AIDS, and malaria combined (World Health Organization [WHO], 2008). If nothing is done to curtail the current trends in tobacco use, it is estimated that 10 million lives will be lost globally by the year 2030 (Gajalakshmi, Jha, Ranson, & Nguyen, 2001). The effects of the global tobacco epidemic will hit hardest in the developing world, where 80% of these deaths are expected to occur (Gajalakshmi et al.; WHO, 2008). As the second largest producer and consumer of tobacco in the world, India is predicted to have the fastest rate of rise in mortality due to tobacco in the world (Reddy & Gupta, 2004). It is estimated that the tobacco epidemic in India claims 800,000–900,000 lives a year (Reddy & Gupta). A growing concern is the increase in tobacco use among adolescents in parts of India (Sinha, 2006). The 2000 Global Youth Tobacco Survey estimates the tobacco use in any form to be greater than 40% in youth aged 13–15 years in nine North Indian states (Reddy & Gupta) and that nearly 5 million children younger than 15 years are addicted to tobacco in India (Bansal, John, & Ling, 2005). It is also estimated that 5,500 Indian youth start using tobacco every day (WHO, 2005).

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doi: 10.1093/ntr/ntp169
Received April 16, 2009; accepted October 16, 2009

While being born male is one of the greatest predictors for tobacco use globally (Patel, 1999), recent studies suggest that tobacco-use differences between girls and boys are becoming smaller compared with those between adult men and women (Corrao, Guindon, Cokkinides, & Sharma, 2000; Mackay & Amos, 2003; WHO, 2003). Consistent with these studies, baseline data from the Project MYTRI (Mobilising Youth for Tobacco-Related Initiatives in India) study show preliminary evidence that tobacco-use differences between boys and girls are, in fact, smaller than expected compared with the adult population in India. Adult men in India have an 11.6 times higher prevalence of tobacco use compared with adult women (WHO, 2005), while data from MYTRI show that boys have only a 1.3 times higher prevalence than girls. Globally, an increase in tobacco use in female populations has been the result of many factors, including greater spending power among female populations as the result of economic growth, changes in social norms concerning approval of women smoking or using tobacco products, increased female autonomy, and advertisements that target female populations (Bansal et al., 2005; Reddy & Gupta, 2004; Waldron, 1991; Warren, Jones, Eriksen, & Asma, 2006). In the second fastest growing economy in the world, India's female population has increased autonomy and spending power, making this population a vulnerable and ideal target for the tobacco industry (Sudarshan & Mishra, 1999). Studies have also indicated that the risk profile for female populations may be different from that for male populations, and factors such as stress, social networking, and advertisements that falsely relate smoking and weight loss play a greater role in tobacco initiation and reinforcement for female populations compared with male populations (Hamilton et al., 2006; Toll et al., 2007; Waldron; Waldron, Bratelli, & Carriker, 1988; Zakaria, 2006). The wide range of tobacco products specific to India has also produced differences in tobacco use by gender. In particular, a recent cross-sectional study (N = 81,837) reported higher use of smokeless tobacco (e.g., betel quid, mishri, creamy snuff) in women compared with men (Sorensen, Gupta, & Pednekar, 2005). The WHO MPOWER report in 2008 highlights the increased use of tobacco among younger female populations in high population countries such as India as one of the most ominous threats to combating the tobacco epidemic (WHO, 2008) and recommends that interventions be developed to ensure successful reduction in tobacco use for both sexes.

In accordance, the present study examined differences in tobacco use among urban youth in India by gender, with the intent to better understand the psychosocial risk profiles of boys and girls in this population. Data were derived from Project MYTRI, a group-randomized intervention trial whose goal was to prevent and/or reduce tobacco use among students (n = ~12,000) in Grades 6–9 (10–16 years old) for more than a 2-year period in 32 Indian schools in two cities, Delhi and Chennai. Previous studies of this project have reported that tobacco use among 6th graders is higher than that among 8th graders (Stigler, Perry, Arora, & Reddy, 2006) and that those from a lower socioeconomic status (i.e., those who attend government schools vs. private schools) have higher tobacco use and higher risk for tobacco use (Mathur, Stigler, Perry, Arora, & Reddy, 2008). This article intends to address the following research questions: (a) Is the differential in tobacco use between boys and girls significant? (b) Are there differences in the association between risk factors and tobacco use between boys and girls? (c) Are there differences in the distribution of risk factors between boys and girls using mean composite scores? and (d) Does gender play a role in tobacco use by grade and/or school type? This research hopes to shed light on intervention development, as possible differences in psychosocial risk factors between genders might affect the effectiveness of interventions for this population. Research in this area is unprecedented, and this analysis has important implications when addressing increased tobacco use in female youth in India and other developing nations that are at risk for use among female populations.

Methods

Project MYTRI was a group-randomized controlled intervention trial. Further information on the intervention and study design is detailed elsewhere (Mathur et al., 2008; Stigler et al., 2006). A total of 32 schools in Delhi (n = 16) and Chennai (n = 16) were matched according to type of school (private vs. government and coed vs. same-sex school) and randomized either to a tobacco prevention program or to serve as a delayed program control (Stigler et al.). Ethical approval was granted by the Independent Ethics Committee in Mumbai, India, and the Institutional Review Board at the University of Minnesota, Minneapolis. Three surveys were conducted to evaluate the efficacy of the intervention: one at baseline, one after the first year of the intervention, and one at the end of the intervention. The present study focuses on the baseline survey conducted in 2004, prior to implementation of the intervention, making this a cross-sectional study (Shadish, Cook, & Campbell, 2002). The survey and intervention were developed using the Social Cognitive Theory and other theories of youth health promotion (Perry, 1999; Perry, Stigler, Arora, & Reddy, 2006). The Social Cognitive Theory addresses both socio-structural determinants of health and personal determinants of health in a comprehensive approach (Bandura, 1998). Additionally, formative work was done prior to the intervention and survey to ensure that Project MYTRI's objectives were relevant to its targeted population, what intervention strategies were likely to work best given the social context in India, and to determine what survey instruments would be most effective (Mishra et al., 2005).

Participants

All students enrolled in the 6th and 8th grades (n = 12,484) were invited to participate in a self-administered paper-and-pencil survey. Consent was achieved through parental and student assent procedures; parents received letters to return for passive consent for all eligible students, and students signed active assent forms upon agreement to participate in the survey. Students were informed that their participation was confidential, and survey responses would not be shared with teachers, school administrators, or parents (Stigler et al., 2006). Student absentees (4.4%) and parent or student refusals (1.5%) were reasons for lack of response. From the 11,748 students who responded (94% response rate), inconsistent responders (<1%), absentee students (4.4%), and those who did not consent (1.5%) were excluded from analysis, making a final sample size of 11,642. Of these students, 54.9% of the analysis sample were boys, 50.6% of the students were from Delhi, 61.4% of the students were from government schools, and 52.9% of the students were 6th graders. Two schools had students who were all females, and two

Table 1. Differences in prevalence of tobacco use between girls and boys (N = 11,642)[a]

	Girls (n = 5245)	Boys (n = 6397)	Ratio[b]	p
Ever-use of tobacco[c]				
Chewing tobacco	11.6% (9.9–13.3)	16.1% (14.4–17.7)	1.39	<.001
Smoking bidis	7.0% (5.1–8.8)	9.6% (7.9–11.4)	1.37	<.001
Smoking cigarettes	7.8% (6.1–9.5)	11.3% (9.6–12.9)	1.45	<.001
Any kind of tobacco	14.7% (12.6–16.7)	21.1% (19.1–23.0)	1.44	<.001
Current use of tobacco				
Chewing Tobacco	3.4% (2.5–4.2)	4.4% (3.7–5.2)	1.29	.004
Smoking bidis	1.6% (0.9–2.2)	2.2% (1.6–2.8)	1.38	.017
Smoking cigarettes	1.7% (1.1–2.2)	2.0% (1.5–2.6)	1.18	.135
Any kind of tobacco	4.9% (3.7–6.0)	6.5% (5.5–7.6)	1.33	.001

Note. [a]Estimates are generated from mixed-effects models adjusted for age and grade.
[b]Prevalence rate ratio comparing tobacco use in boys with that in girls.
[c]Data in parentheses are 95% *CI*.

schools had students who were all males; the 28 other schools were coed. Schools were identified to represent different income strata and gender-specific schools.

Measures

A self-administered paper-and-pencil survey was used to obtain information concerning tobacco use and psychosocial risk factors associated with use and was implemented in school classrooms by two-person teams of trained staff using standardized protocols. The questionnaire was modeled from the Global Youth Tobacco Survey and results from a focus group to determine appropriate questions and measures. The multilingual survey was pilot tested using small groups of students in several schools in both cities to determine comprehension of survey. Surveys conducted in private schools in Delhi and Chennai were delivered in English while government schools received a Hindi survey in Delhi and a Tamil survey in Chennai. The primary outcome of interest, current tobacco use, was based on a student's response to three questions concerning use of any tobacco product in the last 30 days: "During the last 30 days, did you chew tobacco in any form?/Smoke one or more bidis?/Smoke one or more cigarettes?" The response categories were "yes" and "no." Students who responded "yes" to one or more of the questions were given a "1" on this variable (for current use of any tobacco), while all other students received a "0" (for no current use of any tobacco). Multiple-item summative scales were created to measure 15 psychosocial risk factors hypothesized to be related to tobacco use among youth in India (Mishra et al., 2005). These factors include exposure to advertising, knowledge about health effects of tobacco use, beliefs about social consequences, reasons to use tobacco, reasons not to use tobacco, refusal skills self-efficacy, social susceptibility (chewing), social susceptibility (smoking), normative beliefs, perceived prevalence (chewing), perceived prevalence (smoking), normative expectations of use, knowledge about tobacco control policies, support for these policies, and advocacy skills self-efficacy. Risk factors were standardized for analysis (setting the mean of each scale to 0 and its *SD* to 1) to facilitate comparisons between measures, and the scale scores can fall below 0 (Sahai & Khurshid, 2002). Reverse coding was used, and for all scales, a higher score means less risk. More details concerning the description, the reliability, and other psychometric properties of these scales can be found in Stigler et al. (2006).

Data analysis

Mixed-effects regression models were used to address the questions in this study. To determine prevalence rates and ratios of tobacco use for girls and boys, mixed-effects models were used, adjusted for age and grade. For mixed-effects regression modeling, schools were used for strata (for random-effects measures), while students were identified as clusters. It is expected that there will be variation in the dependent measures between schools, assuming that differences in teaching styles, culture, location, and other influences affect school environment. These regression models appropriately account for such variation (Raudenbush & Bryk, 2002). Regression models were stratified by gender and then adjusted for city and grade level. Additionally, univariate regression models and distribution models were also adjusted for age. Each psychosocial risk factor was independently modeled without other factors (Model 1) and controlled for the aforementioned variables. Additionally, a full model was produced using all psychosocial factors, and then reduced by eliminating factors that were not significant in relation to tobacco use (p >.05), in stepwise backwards regression (Model 2). Additionally, mixed-effects models were used to examine differences in psychosocial risk factors by gender, and absolute risk difference was calculated for each factor between genders. Finally, interactions between class and gender and school type and gender were examined for each factor to determine whether boys and girls were exposed to risk factors at different grade levels or different school types or the same. Mixed-effects models were chosen because previous research stresses the importance of accounting for variability between schools and students in a nested design such as this one using random-effects modeling (Raudenbush and Bryk; Stigler et al., 2006).

Results

Prevalence rates for ever-use and current use of tobacco products were consistently lower for girls compared with boys (Table 1). The differential between girls and boys, however, was small (Table 1). After adjustment for age and grade, the prevalence rate for ever-use of any tobacco product was 14.7% (95% *CI* 12.6–16.7) for girls compared with 21.1% (95% *CI* 19.1–23.0) for boys (p < .001). Consistent with previous reports, chewing tobacco remained the most common form of tobacco product

Table 2. Relationships between psychosocial risk factors and tobacco use, by gender adjusted for grade, city, and age (Model 1[a])

	Girls ($n = 5245$)		Boys ($n = 6397$)	
Risk factors[b]	Mean (*SE*)	*p*	Mean (*SE*)	*p*
Intrapersonal factors				
Knowledge of health effects	−0.010 (0.003)	.0007	−0.016 (0.003)	<.0001
Beliefs about social consequences	−0.016 (0.003)	<.0001	−0.015 (0.003)	<.0001
Reasons to use tobacco	−0.028 (0.003)	<.0001	−0.047 (0.003)	<.0001
Reasons to not use tobacco	−0.001 (0.003)	.9395	−0.005 (0.003)	.1488
Self-efficacy (refusal skills)	0.006 (0.003)	.04	0.005 (0.003)	.1415
Social susceptibility to chewing	−0.054 (0.003)	<.0001	−0.062 (0.003)	<.0001
Social susceptibility to smoking	−0.056 (0.003)	<.0001	−0.064 (0.003)	<.0001
Social environmental factors				
Normative beliefs about use	−0.041 (0.003)	<.0001	−0.053 (0.003)	<.0001
Perceived prevalence of chewing	−0.018 (0.003)	<.0001	−0.024 (0.003)	<.0001
Perceived prevalence of smoking	−0.015 (0.003)	<.0001	−0.020 (0.003)	<.0001
Normative expectations of use	−0.024 (0.003)	<.0001	−0.041 (0.003)	<.0001
Knowledge about public policies	−0.001 (0.003)	.8647	0.001 (0.003)	.7572
Support for public policies	−0.04 (0.003)	<.0001	−0.049 (0.003)	<.0001
Self-efficacy (advocacy skills)	−0.009 (0.003)	.002	−0.014 (0.003)	<.0001
Exposure to advertising	−0.014 (0.003)	<.0001	−0.008 (0.003)	.008

Note. [a]Model 1 represents each psychosocial risk factor independently of other risk factors.

[b]A higher score on this multiitem scale indicates less risk, which is more protective; each score is standardized so factors can be compared.

used for both boys and girls; the prevalence rate for ever-use of chewing tobacco for girls and boys was, respectively, 11.6% (95% *CI* 9.9–13.3) and 16.1% (95% *CI* 14.4–17.7). Current use of any tobacco product for boys was 1.33 times that of current use for girls (6.5% vs. 4.9%; $p < .001$). We found no significant difference in rates of current use of cigarettes between boys and girls ($p = .135$). There were significant differences in rates of current use and ever-use of all other types of tobacco products between girls and boys.

The majority of psychosocial factors evaluated were significantly ($p < .01$) related to current tobacco use for both boys and girls (see Table 2). Table 2 models each psychosocial risk factor independently of other psychosocial risk factors (Model 1), to examine the relationships between a particular factor and the outcome, current tobacco use. The risk factors that were not significantly related to current tobacco use for boys include reasons to not use tobacco (e.g., "I do not want to use tobacco because my friends do not use it"; $p = .1488$); self-efficacy refusal skills (e.g., "Could you say no if a close friend gave you tobacco?"; $p = .1415$); and one social environmental factor, knowledge about public policies (e.g., "Does your state have a law that bans tobacco sales to minors?"; $p = .7572$). Similarly, among girls, all psychosocial risk factors were inversely associated with increased use of tobacco except reasons to not use tobacco ($p = .9395$) and knowledge about public policies ($p = .8647$). In contrast with boys, however, self-efficacy refusal skills were significantly related to current tobacco use in girls ($p = .04$).

Models were also constructed to include all psychosocial risk factors in a backwards stepwise reduced regression (Table 3). The purpose of this type of modeling was to control for the correlations between the multiple psychosocial risk factors examined in this study (Model 2). For boys, the psychosocial risk factors significantly related to current tobacco use that were included in this reduced model included social susceptibility to chewing tobacco (e.g., "If someone at a party gave you tobacco, would you chew it?"), social susceptibility to smoking tobacco (e.g., "If someone at a party gave you tobacco, would you smoke it?"), perceived prevalence of chewing and smoking tobacco (e.g., "How many boys/girls your age in India do you think chew/smoke tobacco?"), normative expectations of tobacco use (e.g., "If you were to use tobacco, would your close friends like it?"), knowledge about public policies, support for public policies (e.g., "Should smoking be permitted in public places?"), and self-efficacy advocacy skills (e.g., "Do you think you could help a friend stop using tobacco?"; $p < .05$). For girls, beliefs about social effects (e.g., "If you used tobacco, would your parents get angry?"), social susceptibility to chewing tobacco, social susceptibility to smoking tobacco, perceived prevalence of chewing tobacco, perceived prevalence of smoking tobacco, support for public policies, and exposure to advertising (e.g., "Have you seen any advertisements for tobacco in movies?") were all significantly related to current tobacco use ($p < .05$). For both boys and girls, social susceptibility to chewing tobacco and smoking tobacco were the psychosocial risk factors most strongly related to current tobacco use (estimates with mean score less than −0.021).

Differences in the distribution of psychosocial risk factors between genders were also measured (Table 4). For most risk factors, there were significant differences between girls and boys observed ($p < .05$), except reasons to use tobacco (e.g., "Does using tobacco make a person appear to be more grown-up?"), reasons not to use tobacco, perceived prevalence of chewing tobacco, normative expectations of use, knowledge about public policies, and exposure to advertising ($p > .05$). Among the risk factors that were significantly different, girls had lower risk (higher scores), except for perceived prevalence

Table 3. Examining psychosocial risk factors by gender using Model 2,[a] adjusted for grade and city

	Girls ($n = 5245$)		Boys ($n = 6397$)	
Risk factors[b]	Mean (*SE*)	*p*	Mean (*SE*)	*p*
Intrapersonal factors				
Knowledge about health effects	—	—	—	—
Beliefs about social consequences	−0.007 (0.002)	.0095	—	—
Reasons to use tobacco	—	—	—	—
Reasons to not use tobacco	—	—	—	—
Self-efficacy (refusal skills)	—	—	—	—
Social susceptibility to chewing	−0.033 (0.003)	<.0001	−0.03 (0.003)	<.0001
Social susceptibility to smoking	−0.021 (0.004)	<.0001	−0.035(0.003)	<.0001
Social environmental factors				
Normative beliefs about use	—	—	—	—
Perceived prevalence of chewing	−0.008 (0.003)	.0074	−0.013 (0.003)	.001
Perceived prevalence of smoking	−0.007 (0.003)	.0315	−0.009 (0.004)	<.0001
Normative expectations of use	—	—	−0.008 (0.003)	.0127
Knowledge about public policies	—	—	0.007 (0.003)	.0195
Support for public policies	−0.014 (0.003)	<.0001	−0.018 (0.003)	<.0001
Self-efficacy (advocacy skills)	—	—	−0.008 (0.003)	.0099
Exposure to advertising	−0.011 (0.002)	<.0001	—	—

Note. [a]Model 2: All psychosocial risk factors were evaluated for significance in a full model first and then reduced to contain risk factors that were significant in only a backwards stepwise regression for both girls and boys.

[b]A higher score on this multiitem scale indicates less risk, which is more protective; each score is standardized so factors can be compared.

of smoking for which girls had higher risk compared with boys (lower scores). The largest absolute difference in risk between boys and girls was seen, in decreasing order, as social susceptibility to smoking tobacco, social susceptibility to chewing tobacco, self-efficacy advocacy skills, normative beliefs about use, knowledge about health effects, and refusal skills efficacy.

To test the hypotheses that there may be tobacco-use differences between boys and girls by grade and age, additional models

Table 4. Comparing psychosocial risk factor differences between girls and boys ($N = 11,642$)[a]

	Mean (*SE*)			
Risk factors[b]	Girls	Boys	Diff[c]	*p*
Intrapersonal factors				
Knowledge about health effects	0.029 (0.032)	−0.058 (0.030)	.087	<.0001
Beliefs about social consequences	0.020 (0.065)	−0.047 (0.065)	.067	.0013
Reasons to use tobacco	−0.036 (0.025)	−0.056 (0.024)	.02	.3416
Reasons to not use tobacco	0.060 (0.103)	0.040 (0.102)	.02	.3023
Self-efficacy (refusal skills)	0.064 (0.093)	−0.020 (0.093)	.084	<.0001
Social susceptibility to chewing	0.004 (0.035)	−0.116 (0.033)	.12	<.0001
Social susceptibility to smoking	0.031 (0.031)	−0.114 (0.029)	.145	<.0001
Social environmental factors				
Normative beliefs about use	−0.003 (0.028)	−0.102 (0.027)	.099	<.0001
Perceived prevalence of chewing	−0.100 (0.037)	−0.072 (0.035)	.028	.2187
Perceived prevalence of smoking	−0.068 (0.035)	−0.003 (0.034)	.065	.0036
Normative expectations of use	−0.012 (0.041)	−0.052 (0.040)	.04	.0651
Knowledge about public policies	−0.049 (0.032)	−0.054 (0.030)	.005	.8359
Support for public policies	−0.033 (0.027)	−0.088 (0.025)	.055	.0107
Self-efficacy (advocacy skills)	0.015 (0.049)	−0.096 (0.048)	.111	<.0001
Exposure to advertising	0.011 (0.028)	−0.018 (0.026)	.029	.1865

Note. [a]Mixed-effects regression models were adjusted for age, city, and grade.

[b]A higher score on this multiitem scale indicates less risk, which is more protective; each score is standardized so factors can be compared.

[c]Absolute difference between boys and girls.

were run. Additionally, the relationship between type of school (government vs. private) and gender on tobacco use was also examined. No significant relationships were observed for any of these tests (data not shown; $p > .05$).

Discussion

Increased tobacco use among young female populations in developing countries presents a foreboding situation for efforts aimed at reducing the effects of a growing global tobacco epidemic. The present study provides evidence that differences in the prevalence rates of tobacco use between girls and boys are smaller than what would be expected, given the large difference in tobacco use among adult men and women that has been reported in India. This suggests that there might be an ongoing increase in tobacco use among female youth in urban India. Adult men have an 11.6 times higher prevalence of tobacco use compared with adult women (WHO, 2005). However, this study reports that boys have only a 1.33 times higher prevalence than girls. The United States reports a larger gender gap in similar aged youth. In 2007, a national survey conducted by the Substance Abuse and Mental Health Services Administration (2008) revealed that the current use of tobacco products among boys aged 12 years and older was 1.6 times higher than girls. In addition, there were surprisingly no significant differences in the prevalence of current cigarette smoking between girls and boys in this study in India, and the prevalence rate ratios comparing other types of tobacco use among boys and girls show an average of 1.35:1 (Table 1). The same study in the United States also reported no significant differences between boys and girls for smoking prevalence in this age group. These ratios in India are much lower than expected, given the rates among the adult population.

As also evidenced by this study, the tobacco risk profile for girls is comparable to that for boys. When factors were modeled independently of other risk factors, girls differed from boys on only one psychosocial risk factor that was significantly inversely associated with tobacco use: self-efficacy refusal skills (e.g., "Could you say no if a close friend gave you tobacco?"). Modeling risk factors in the presence of all other risk factors, girls had seven psychosocial risk factors that were associated with tobacco use, and boys had eight. The results indicated that girls had less social environmental factors that were related to tobacco use compared with boys. Girls were also more sensitive to beliefs about social consequences (e.g., "If you used tobacco, would your parents get angry?"), which can be considered an intrapersonal factor.

The significant differences in the distribution of risk factors between boys and girls might explain the difference in tobacco use between the groups. However, there are no differences in the distribution among at least five of the psychosocial risk factors—indicating potential risk for an increase in tobacco use in girls. Of these five risk factors, all were significantly associated with tobacco use for girls except for reasons to not use tobacco and knowledge about public policies. While girls generally had higher scores for mean distribution of risk factors, indicating less risk, they did have a significantly lower score on perceptions of smoking. These factors were reported as having a significant association with tobacco use in girls.

These comparisons have two implications for interventions. Where boys and girls differ on the association between psychosocial risk factors and tobacco use, intervention developers should attempt to identify ways to include these gender-specific components in education programs aimed to reduce tobacco use in both boys and girls. However, similarities in the distribution of risk factors indicate a tobacco risk profile for girls that is comparable to that for boys. While tobacco use is generally higher among male populations, female populations who are at risk for tobacco initiation represent a vulnerable group that, with the right exposure to tobacco advertising that targets women and societal changes in norms around tobacco amidst a rapidly growing economy, may have rapid increases in tobacco use reflective of Western patterns. It has been predicted that the tobacco epidemic in women will not reach its peak until well into the 21st century, while declining in the male populations throughout the world (Mackay & Amos, 2003). In fact, it is estimated that by 2025, the prevalence of smoking among women could rise from 12% to 20% within developed and developing nations (Mackay & Amos). Female-specific education is rare particularly in areas such as India, where the need is becoming greater. To avert the predicted increase in tobacco use among women in developing nations, it is critical that interventionists, policy makers, and public health leaders preemptively strategize to prevent tobacco initiation in girls.

To reduce tobacco use in female youth in India, it is recommended that a comprehensive approach that utilizes both theory- and evidence-based researches be incorporated in intervention development. In general, school-based prevention programs have been shown to be very effective in reducing smoking initiation and decreasing tobacco prevalence in female and male youth in a 30-year meta-analysis (Dobbins, Decorby, Manske, & Goldblatt, 2008). Additionally, strong evidence from this review indicates that the most effective programs target social norms, influences, and reinforcements. As a school-based intervention that includes these components, Project MYTRI has also been shown to be effective in a developing country and among female youth (Perry, Stigler, Arora, & Reddy, 2009). To address gender-specific components in interventions, it is recommended that efforts be increased to collect and analyze gender-specific information on tobacco to assist in development of gendered education (WHO, 2007). This particular study revealed that risk factors such as beliefs about social effects and exposure to advertising were significantly related to tobacco use for girls and not for boys. This supports previous literature that reports that social identity is very important in developmental behavior in female youth, and social factors such as beliefs about social effects impact tobacco use in female populations (Michell & Amos, 1997; Skinner, Massey, Krohn, & Lauer, 1985). Additionally, girls had a significantly lower score for perceived prevalence of smoking, indicating higher risk. This may explain why there are no significant differences in smoking prevalence between boys and girls. These specific risk factors may be important to target in future interventions aimed at reducing tobacco use by Indian female youth.

While this study represents a large sample of urban Indian youth and had a high response rate, the data may not necessarily be reflective of the tobacco use in all girls and boys in India. In fact, some reports indicate higher tobacco use in rural areas of India (Rani, Bonu, Jha, Nguyen, & Jamjoum, 2003). Gender roles, expectations, and norms may be different in rural settings, which could impact tobacco-use differences between girls and boys. As this study is limited to urban youth in two cities, it may

not be generalizable to other settings. It will be important to examine these gender differences in rural settings, given the contrast in tobacco-use rates between urban and rural settings in India. Additionally, the cross-sectional nature of this study limits inference on the causal relationships between tobacco use and the risk factors presented in this population.

Conclusions

Increase in global tobacco initiation in girls has been reported by findings from the Global Youth Tobacco Survey, suggesting that the estimate of a doubling of deaths from smoking (from 5 million per year to 10 million per year) by 2020 might be underestimated. Increase in tobacco use among female youth can certainly be linked to the tobacco industry targeting this population (Mackay & Amos, 2003). Most recently, the Robert Wood Johnson Foundation has issued a report that the tobacco industry has "unleashed its most aggressive marketing campaigns" targeting women and girls in over a decade using sleek pink purse packs resembling a cosmetic package (Spivak & Dueffert, 2009). Tobacco rates among young women increased abruptly in the United States with the introduction of products that targeted women (Pierce, Lee, & Gilpin, 1994). India, unfortunately, will not be impermeable to the novel advertising tactics the tobacco industry utilizes, despite the 2004 Advertising Bans implemented in India. In addition to stepping up tight restrictions on advertisements in India, it will become necessary for public health advocates to counter the lure of false advertising with successful antitobacco campaigns as have been done in the United States, such as the "truth" campaign. The United States saw a significant decline in youth smoking prevalence during 1997–2002—a public health success.

Particular challenges for India include the navigation of cultural factors that play a role in tobacco use and the high prevalence of smokeless tobacco use among the Indian population. Understanding the need to utilize existing programs in combination with new approaches to address these challenges will promote public health success against tobacco in India. The findings from this research and other Project MYTRI studies suggest that solutions are needed urgently to reduce tobacco use among youth in India.

Funding

The research was funded by a grant from the Fogarty International Center (R01TW05952-01; CLP, principal investigator).

Declaration of Interests

None declared.

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