Factors associated with successful tobacco use cessation among teachers in Bihar state, India: a mixed-method study

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Received on November 20, 2018; editorial decision on December 7, 2019; accepted on January 20, 2020

Abstract

Although tobacco use is declining in several countries including India (dropping from 35% in 2009–10 to 29% 2016–17 among adults)—it still poses a huge burden on India, as the world's second largest consumer of tobacco products. In Bihar state, with a prevalence of 25%, the Bihar School Teachers Study (BSTS) successfully enlisted teachers as role models for encouraging quitting and changing social norms pertaining to tobacco. The study used a mixed-methods approach to identify factors associated with teachers' quitting. Qualitative data were collected through focus groups with teachers and school principals. Quantitative data were collected through a written survey administered to school personnel post-intervention. Key findings from focus groups were that teachers and principals quit using tobacco and promoted cessation because they wanted to model positive behaviors; specific information about tobacco's harms aided cessation; and the BSTS intervention facilitated a school environment that supported quitting. Survey results indicated teachers who reported knowing people who quit using tobacco in the prior year were far more likely to quit as

were teachers who reported that their school's tobacco policy was completely enforced. The combination of qualitative and quantitative data yielded important insights with strong implications for future interventions.

Introduction

Even though tobacco use is declining in several countries including India, it is increasing in many low-and middle-income countries (LMIC's) [1, 2]. Currently 80% of the world's 1.1 billion smokers live in LMICs and unless present trends change, 10 million tobacco-related deaths are expected to occur annually in these countries by 2030 [3–6].

Despite the drop in prevalence among adults from 35% in 2009–10 to 29% in 2016–17 (with steeper declines in states such as Bihar from 54% to 26%) tobacco use in India contributes significantly to the global burden of tobacco-related disease, as the world's second largest consumer of tobacco products [7]. Approximately 99.5 million adults in India smoke and 199.4 million use smokeless tobacco [7]. In 2010 alone, an estimated one million people in India died from smoking-related illnesses [8]; from smokeless tobacco use, the death toll was

estimated at 368 127 [9]. To reduce the vast number of tobacco-related deaths in the short to intermediate term, it is critical that more tobacco users quit [10–13].

Promoting change in social norms is essential to successful cessation, since the social environment provides the context for cessation and encourages users in their quit attempts [2, 14, 15]. However, quitting tobacco use is not yet common practice in India, with only 8% of ever users reporting they quit tobacco use [16]. Studies in India that have examined predictors of cessation have mainly looked at socio-demographic characteristics of quit attempts [17] and intention to quit [18]. These studies have found higher income and socio-economic status were correlated with quit attempts [17] while higher education, advice from doctors and exposure to anti-tobacco messages were associated with intention to quit [18]; experiencing health problems related to tobacco, such as oral lesions, has also been found to predict cessation [19]. Additionally, recent studies in India have also found co-workers as well as family members and friends were likely to influence or reinforce tobacco use among adults [20–22]. Although these studies have examined different aspects of quitting, almost none have taken a social contextual approach to identifying factors associated with quitting, related both to factors in participants' broader social environment and potential cessation interventions.

In addition to older non-randomized intervention studies [23, 24], one recent randomized controlled trial of 947 teachers [21] in India that was shown to increase cessation is the 'Tobacco-Free Teachers, Tobacco-Free Society' (TFT-TFS) program, which was tested among schoolteachers in the Bihar School Teachers Study (BSTS) [25]. In Indian culture, teachers are generally highly esteemed and regarded as influential community members. Research has shown that teachers also view themselves as role models to promote cessation among students and adults as well as help change social norms related to tobacco [26–28]. The TFT-TFS program focused on adoption of tobacco control policies, educational efforts and cessation support.

Immediately after the program was completed, the 30-day quit rate was 50% in the intervention group compared with 15% in a delayed intervention control group ($P = 0.001$). At the 9-month post-intervention survey, the adjusted 6-month quit rate was 19% in the intervention and 7% in the control group ($P = 0.06$). Among teachers employed for the entire academic year of the intervention, the adjusted 6-month abstinence rates were 20 and 5%, respectively, for the intervention and control groups ($P = 0.04$).

Although we know TFT-TFS was effective in helping teachers quit, a critical gap remains in determining why they quit and what factors in their social context were associated with cessation. The purpose of this article is to present the results of a mixed-methods approach to determine factors associated with cessation among school teachers—both related to the TFT-TFS program, and factors in teachers' broader social environment. This study combines qualitative data from focus groups conducted with principals and teachers with a quantitative teachers' survey. We used the Social Contextual Model of Health Behavior Change (SCM) [29, 30] as a theoretical framework to organize potential determinants of tobacco use cessation at the individual, interpersonal and organizational levels [31].

Materials and methods

Study design

In employing a mixed-method design to identify factors related to cessation, both qualitative and quantitative data were used. Greater emphasis was given to the qualitative data, because it provided us with richer details and a deeper insight about cessation from the teachers' perspective. The study included teachers and principals from schools who received the TFT-TFS program as part of BSTS (Fig. 1). We collected and analyzed the qualitative and quantitative data separately and then integrated our findings to create a more comprehensive understanding of quitting factors related to TFT-TFS and the broader social environment [32].

Fig. 1. Mixed-methods design of the factors influencing tobacco use cessation (Adapted from Ruffin *et al.* [32]).

Bihar school teachers study

BSTS tested the TFT-TFS program—a comprehensive school-based tobacco control intervention—which resulted in tobacco use cessation among teachers and implementation of school tobacco control policies, using a cluster-randomized controlled design. We randomly selected 72 rural and urban government schools serving grade levels 8–10 from within 10 school districts in Bihar and randomly assigned them to either an intervention or delayed intervention control condition. We implemented BSTS over two separate academic years in two waves (2009–10 and 2010–11), with 36 schools assigned to each condition. BSTS was a collaboration among the Healis–Sekhsaria Institute for Public Health in Mumbai and Patna, India, (Healis) and the Dana–Farber Cancer Institute and Harvard T.H. Chan School of Public Health (Harvard Chan), Boston, Massachusetts. The Indian Council of Medical Research approved the conduct of this

study in Bihar and both Healis and Harvard Chan Institutional Review Boards reviewed and provided ethical clearance of all BSTS study procedures.

The data presented here were collected through: (i) focus groups conducted with Wave 1 school teachers and principals 1 year after the intervention was completed; and (ii) an immediate post-intervention survey completed by teachers in both waves.

Study setting, population and sample

The state of Bihar borders Nepal in northern India, has a population of ~104 million [33] and is a major tobacco producer. At the time of our study, compared with other states in India Bihar had fewer social and economic resources use and a high prevalence of tobacco use; in 2009–19, 66% of men in Bihar reported using tobacco compared with the national average of 50% [16]. Schools eligible to participate in BSTS employed eight or more

teachers and were not located in regions where access was frequently interrupted due to flooding. Study participants were school personnel, including all teachers, clerks and principals. For this article, we used data from the study participants in the 36 schools randomized to receive the BSTS intervention.

Intervention—TFT-TFS program

The TFT-TFS program was developed based on the SCM, extensive formative research and pilot testing [27, 34]. Program objectives were to increase knowledge of the health risks of tobacco and to increase motivation to quit, while building a supportive environment within the school for quitting [27, 35].

Trained study health educators and lead teachers at each school delivered TFT-TFS from September to March (over a single academic year) during school hours. Program components included: (i) group discussions with all teachers about tobacco, regardless of their tobacco use status; (ii) cessation support for tobacco users (through discussions and self-help materials); (iii) posters, calendar and educational materials; and (iv) formation of a tobacco policy workgroup. Since it is common practice in India to boldly paint important messages on school walls, we painted the tobacco policy on the schools' outside wall with the principals' permission. The policy prohibited all tobacco use and advertising on school property and supported the National law banning the sale of tobacco within 100 yards of the school. During monthly health education sessions, we addressed six themes related to cessation to: (i) emphasize teachers as role models during the program's 'kick-off'; (ii) enhance understanding of the risks associated with tobacco; (iii) increase motivation to quit; (iv) build skills to quit; (v) address withdrawal; (vi) promote skills for cessation maintenance; and (vii) cutting across all themes, build a supportive normative climate for not using tobacco. TFT-TFS program materials were in Hindi, the local language in Bihar, and activities were detailed in standardized protocols [21, 27, 36]. The program was delivered as planned with high fidelity; all schools adopted a tobacco policy [37], 33

out of 36 schools delivered the 12 health education sessions and 31 schools implemented all six program components [36].

Data collection

Focus groups

The objectives of the focus groups were to determine how the program contributed to teachers quitting tobacco and how it helped create a climate to support no tobacco use. We conducted four groups with teachers and one with school principals from Wave I schools. For the teachers' groups, we selected two rural and two urban schools. Teachers were invited through their school's principal or lead teacher to participate in a group discussion conducted at each school. For the principal's group, we invited principals from the 18 schools to participate in one focus group in Patna, the capital of Bihar.

The groups lasted between 60 and 90 min and were guided by scripts based on stated research objectives. Staff members moderated the groups and were assisted by note takers who were trained to take careful, systematic notes during each discussion. Notes were checked for accuracy and completion following each focus group. All focus group discussions were conducted in Hindi and were audio-recorded. The transcripts were professionally translated from Hindi into English and the translations were double-checked by investigators who were bilingual. Notes (in Hindi) were transcribed by the note taker and moderator following each focus group and compared with the audio-recording to assure completeness of the data. Final Hindi notes were translated into English by moderators and a translation check was performed by the research team.

Teachers survey

Surveys were administered in intervention schools from both waves immediately post-intervention (March–April) in 2010 and 2011. Study staff were trained to administer the survey in each school at a date/time arranged by the principal. We invited all school personnel who were present on the day of survey administration to complete the survey

(response rate = 72%), which was self-administered in Hindi and took ~30–45 min to complete.

Measures—*teachers survey*

Outcome

Using standard items, we measured ‘tobacco use’ and ‘cessation’ by self-report [25, 38, 39]. ‘Thirty-day quitters’ were defined as tobacco users who quit using tobacco during the intervention period and had remained quit for at least 30 days prior to taking the survey.

We defined ‘current users’ as anyone agreeing with either of the statements: ‘Do you currently use any smokeless tobacco products (includes chewing tobacco such as tobacco leaf, tobacco leaf and lime-khaini/surti/sada, gutka, panmasala with zarda or pan with zarda; applying tobacco such as gul, gudaku, tobacco tooth paste-dentobac, tobacco tooth powder and snuff such as nas)?’ and ‘Do you currently smoke tobacco in any form, such as cigarette, bidi (unfiltered cigarette), hukka, cigar or pipes?’ The most common method of using smokeless tobacco was ‘khaini,’ which is a mixture of tobacco flakes and a few drops of slaked lime, rubbed together vigorously on the palm of the hand just before putting in the mouth. Readymade khaini may also be used. Betel quid is a combination of fresh green betel leaf, slaked lime, pieces of areca nut and flakes of tobacco along with additional condiments as per user preference. An industrial manufactured product, gutka that is basically a mixture of tobacco, lime and areca nut along with flavors and other ingredients depending on brand, was also common. An interesting way of using tobacco was as an ingredient in dentrifice, that could be a tooth powder (lal dantmanjan) or in past form (gul, gudakhu). A common smoking stick was bidi, made by rolling a small amount of tobacco flakes (~0.2 g) in dried tendu leaf (*Diospyros melanoxylon*).

Covariates

We used SCM to categorize the following predictors at the individual, interpersonal and organizational level as done in prior research [21, 31]:

Individual factors. We assessed ‘material circumstances’ (an indicator of household economic

wellbeing) by adapting the National Family Health Survey-3 [40] to ask if respondents’ households had a motorized vehicle (moped/scooter/motorcycle/car) or a refrigerator. Responses were used to create two categories: (i) neither motorized vehicle nor refrigerator; (ii) either motorized vehicle, refrigerator or both.

Interpersonal factors. We asked if respondents ‘knew anyone who quit in the last year’. Additionally, we asked how many of their five closest acquaintances or ‘friends use tobacco’, the number of ‘co-workers’, and the number of ‘adult household members’ (including themselves) ‘who use tobacco’. We also asked if respondents had ‘rules at home regarding smoking cigarettes or bidis’.

Organizational factors. To assess ‘school tobacco control policies’, we adapted questions from the Global School Personnel Survey to ask teachers if tobacco could be bought within 100 yards of their school; if the school had a policy or rule specifically prohibiting smoking and smokeless tobacco use inside school; if a policy or rule about tobacco use applied to the entire school or only some areas; and how well the school enforced any of its policies (or rules) on tobacco use [41].

Sociodemographic factors. We assessed gender, marital status, religion and age using standard items. Schools were classified as rural or urban based on the Bihar Department of Education designation.

Data analyses

Focus groups—qualitative analyses

We analyzed the discussions using content analysis in stages, using a group method known as immersion-crystallization [42]. Investigators in India and the United States conducted concentrated independent reviews of the data, during which they reflected on the data and formulated independent interpretations, before collectively agreeing on the major ideas. Broad themes were generated based on recurring themes that teachers and principals mentioned. All verbatim quotes were recorded as stated to prevent any loss of interpretation. The investigators met repeatedly in person and by phone to compare and make sense or ‘crystallize’ the diverse

interpretations of the data until a final interpretation emerged [42–44].

Teachers survey—quantitative analyses

We restricted the analysis to current users and 30-day quitters. Those who never used tobacco or quit all tobacco use prior to the beginning of the intervention were excluded from this analysis. We used logistic regression analyses to test the association between the covariates and tobacco use. We first conducted preliminary descriptive analyses to examine the distribution of covariates among quitters and current users. We then conducted simple bivariate logistic models for each covariate and quitting. From these analyses, we created a saturated multivariable logistic model that included all the covariates with P -values < 0.20 . Using a backwards selection method, we eliminated covariates one by one until a final multivariable model was reached with all covariate P -values < 0.05 . All data analyses were conducted using the personal computer version of SAS (v.9.3).

Results

Focus groups

Thirty-nine school personnel (4 principals and 35 teachers) participated in the focus group discussions. Three-fourths of the participants were male and 86% of teachers and all principals were non-users of tobacco (see Table I).

Table I. Characteristics of principals and teachers ($n = 39$) participating in focus group discussions, July 2011

Characteristics	Principals ($n = 4$) n (%)	Teachers ($n = 35$) n (%)
Gender		
Male	3 (75)	26 (74.3)
Female	1 (25)	9 (25.7)
Area		
Rural	1 (25)	16 (45.7)
Urban	3 (75)	19 (54.3)
Tobacco use status		
Tobacco user	0	5 (14.3)
Non-user	4 (100)	30 (85.7)

Several themes related to tobacco use cessation emerged across the focus groups. Primarily through participation in the TFT-TFS program, teachers and principals began to understand the considerable impact of continued tobacco use on their health and on the people in their social environment. Both teachers and principals realized that when children saw them use tobacco, it sent a ‘wrong message’ and confused their students who viewed teachers as role models. The specific themes that emerged are:

- (i) Teachers and principals quit using tobacco and promoted cessation because they wanted to model positive behavior for students and the community

Role model for students. Teachers and principals across multiple groups identified a responsibility to their students to not use tobacco or to quit using it, because they considered themselves role models for youth. One principal remarked:

[Teachers] ought to practice good behavior because they influence children and society at large—using tobacco even privately is wrong! Children imitate their teachers because teachers have very high credibility—thou can do no wrong.

Given their visibility in communities, participants explained that in order to be effective role models, they could not use tobacco at all—even in private—to avoid hypocritical behavior. As one teacher commented:

It should not be used in private either, because children will learn, whatever they see us practicing. If I go to market or in any fair and I smoke a cigarette and if any student sees that, then he says that “I have seen sir smoking” and it will be advertised by him, and by this way another student will learn it. Therefore, it should not be used in private either.

There was also widespread understanding that adults, especially teachers, easily

influence students. Thus, many participants realized through the program that if teachers quit using tobacco, then perhaps children would quit or not begin using it. Teachers expressed this sentiment by saying:

They feel proud in imitating us. They think they are following us. If we write, they copy it. If teachers use tobacco in front of children, they will think that it is acceptable and will start imitating them.

To prevent tobacco [use], children will be influenced first from [their] teacher.

Role model for community. Teachers discussed why they believed they were the intended audience of the TFT-TFS program, including their ability to influence community members and change the social environment. They felt the program would have greater relevance in rural areas where the use of smokeless and chewable forms of tobacco, such as khaini, was perceived to be higher than in urban areas:

We think that most of the teachers came from society belonging mostly from village area, where the prevalence of khaini and chewing tobacco is higher. That's why teachers were selected to change the environment. Students will be influenced from us which [will] affect the coming generation to be tobacco free.

Additionally, teachers believed both users and non-users benefitted from the program, because they could use the content to help family and friends in their homes and community quit tobacco use.

(ii) Information about tobacco's harmful effects aided tobacco cessation

Prior to participating in the TFT-TFS program, principals and teachers had a general awareness and understanding that tobacco use was harmful to health [34]. But they did not fully understand the mechanisms. As teachers articulated:

We knew tobacco was harmful but did not believe. But now we do.

It [poster] gives lot of information about various diseases; I have thought it over and that's the reason I quit.

The program provided detailed, specific information about the chemicals found in tobacco and how these chemicals harmed the body, resulting in illness, disease and death. TFT-TFS intervention strategies used multiple formats to portray tobacco's harms and enabled participants to apply the information to their own circumstances. This may have created a school atmosphere in which teachers began to more deeply understand that tobacco use was extremely harmful and the need to quit.

Both teachers and principals who participated in focus group discussions emphasized a first step to quitting was understanding the harmful effects of tobacco. As one teacher stated:

Until a person thinks about the harmful effects of chewing tobacco, he cannot give it up.

The program was delivered with the help of health educators who were considered instrumental in bringing about a change in tobacco use at school. The teachers viewed the health educators as experts and had confidence in the information provided by them:

... because health educators know things practically, they tell people in a practical manner that how these things (tobacco) can bring harmful effects when using it.

They also appreciated the rapport the health educators built with participants and particularly valued several aspects of the health educators' approach, including their respect, shared cultural values, and responsiveness to teachers' questions. As teachers described:

Yes-Yes, he (health educator) was very good and played a positive role. With a friendly behavior, he helped us to get rid of this addiction.

... Health educators who are in front of us, have convinced us in a loving manner to prevent [tobacco use] and quit this habit.

Throughout TFT-TFS, principals and teachers were presented with oral and visual messages about the harmful effects of tobacco use. Armed with this information, teachers were motivated to encourage tobacco users to quit, as one teacher expressed:

We used this information to tell relatives and make them aware of [the] bad effects of tobacco chewing.

Prior to the start of the TFT-TFS program, non-users did not understand and actually questioned why they should be part of a tobacco control program. However, through participation in the program, they began to understand the important role they played. As non-users expressed:

One thing more, we never took it [tobacco], but we asked others such as our family members, friends to quit it by reminding them of the harmful effects of tobacco use. It [advice] had a very good effect. People who used tobacco around us now say that they have quit tobacco.

The program made us realize we have a role - to help and support those who are trying to quit.

(iii) TFT-TFS program components facilitated a school environment that supported quitting tobacco

Group discussions. Teachers remarked that the program created a support system for them inside the schools. The group discussions facilitated by the health educators and lead teachers and the formation of a tobacco policy workgroup in the school helped create a safe space for open dialogue about tobacco. One teacher noted:

The most beneficial thing was information that was discussed and reviewed among all, which motivated people to quit.

Teachers also expressed that the atmosphere of a free flow of opinions, the sharing of ideas and exchange of quitting stories, contributed to the discussions and helped shape the program, which made them feel that the program was truly driven by them. For example, teachers brought in newspaper clippings about tobacco, which formed the basis of discussions:

Yes, discussion is necessary. Discussion conveys so much knowledge and information. If we see any news in the paper we cut it out for discussion. Discussion is too good.

The interactive discussions also highlighted the essential role of non-users in helping users quit, which increased their receptivity to the program messages.

Tobacco policy. In addition to peer support for quitting, formally enforced policies appeared to change perspectives on tobacco use in the school itself. All schools that participated in the focus groups implemented a tobacco control policy, which was displayed on the outside school wall and prohibited all forms of tobacco use on the campus. This changed the visual environment at the school, along with posters and signs denoting tobacco's harmful effects. Most principals and teachers stated they strictly adhered to the policy and even asked visitors to follow the 'no tobacco use' rules:

An old man came and he was preparing tobacco here. I told him to read the writing on the wall, and if you want to chew tobacco then please, use it outside the gate ...

Teachers survey

Among the 357 school personnel who completed the immediate post-intervention survey, 50 were current tobacco users, and 49 were 30-day quitters. [Table II](#) presents the characteristics for the 30-day quitters and current tobacco users who were primarily male, married and of Hindu faith. Fewer quitters

Table II. Characteristics of 30-day quitters and current tobacco users ($n = 99$) from the BSTS immediate post-intervention survey Bihar, India. March/April 2010 and 2011

Characteristics	Thirty-day quitter ($n = 49$) n (%) or mean $\pm$ SD (n)	Current user ($n = 50$) n (%) or Mean $\pm$ SD (n)	P -value ^a
Individual factors			
Material circumstances			0.07
0—Neither motor vehicle or fridge	21 (43.8)	13 (26.0)	
1—Motor vehicle, fridge, or both	27 (56.3)	37 (74.0)	
Interpersonal factors			
Know anyone who has quit in the last year			0.0008
0—No	5 (10.2)	21 (42.0)	
1—Yes	44 (89.8)	29 (58.0)	
Friends who use tobacco			0.03
0—None	11 (22.4)	3 (6.0)	
1—One or more	38 (77.6)	47 (94.0)	
Co-workers who use tobacco			0.02
0—None	21 (42.9)	10 (20.0)	
1—One or more	28 (57.1)	40 (80.0)	
Household members who use tobacco			0.54
0—None	37 (75.5)	35 (70.0)	
1—One or more	12 (24.5)	15 (30.0)	
Rules regarding smoking at home			0.08
0—Smoking allowed/no rule against	9 (18.4)	17 (34.0)	
1—No smoking allowed	40 (81.6)	33 (66.0)	
Organizational factors			
Tobacco can be bought within 100 yards of your school			0.88
0—No/don't know	35 (71.4)	35 (70.0)	
1—Yes	14 (28.6)	15 (30.0)	
All tobacco prohibited inside school			0.20
0—No/don't know	6 (12.2)	11 (22.0)	
1—Yes	43 (87.8)	39 (78.0)	
Tobacco use policy applies to the entire school or only in some areas			0.54
0—No such policy/don't know	2 (4.1)	5 (10.0)	
1—Some areas	3 (6.1)	3 (6.0)	
2—Entire school	44 (89.8)	42 (84.0)	
Rules enforced			0.004
0—Not completely enforced/no tobacco use policy	8 (16.3)	22 (44.0)	
1—Tobacco policy is completely enforced	41 (83.7)	28 (56.0)	
Sociodemographic factors			
Area			0.62
1—Rural	25 (51.0)	23 (46.0)	
2—Urban	24 (49.0)	27 (54.0)	
Gender			0.99
1—Male	48 (98.0)	49 (98.0)	
2—Female	1 (2.0)	1 (2.0)	
Marital status			0.32
0—Not married	3 (6.1)	6 (12.0)	
1—Married	46 (93.9)	44 (88.0)	
Religion			0.66
1—Hindu	47 (95.9)	47 (94.0)	
2—Other	2 (4.1)	3 (6.0)	
Age	47.5 $\pm$ 12.52 (49)	47.8 $\pm$ 10.13 (48)	0.89
Wave			0.95
Wave 1	35 (71.4)	36 (72.0)	
Wave 2	14 (28.6)	14 (28.0)	

^a P -values obtained from bivariate logistic regression analysis of each predictor on quit status: Wald Chi-square for Type III effects.

reported having a motor vehicle, fridge or both (56%) compared with current users (74%; $P = 0.07$). However, many more quitters (90%) reported

knowing someone who quit tobacco compared with current users (58%, $P = 0.0008$). Current users reported having more friends ($P = 0.03$) and co-

Table III. Multivariable logistic model: 30-day quitters versus current users

Multivariable logistic model 30-day quit outcome	OR	95% CI	P-value ^a
Know anyone who has quit in last year?			
One or more (versus none)	9.29	2.60–33.23	0.0006
Rules enforced			
Completely enforced (versus not completely enforced/no tobacco use policy)	4.66	1.57–13.85	0.0056
Material circumstances			
Motor vehicle, fridge, or both (versus neither)	0.22	0.07–0.65	0.0066

^aP-values based on Wald Chi-square for Type III effects.

workers ($P = 0.02$) who used tobacco compared with quitters. The majority of quitters and current users reported that none of their household members used tobacco; more quitters than users also reported smoking was not allowed at home ($P = 0.08$). At school, the majority of quitters and current users reported that all forms of tobacco were prohibited at their schools. However, more quitters (84%) reported the tobacco control policy was completely enforced compared with current users (56%; $P = 0.004$).

Table III presents the multivariable analyses of these relationships. Teachers who reported knowing one or more people who quit using tobacco in the prior year had 9.29 greater odds (95% CI = 2.60–33.23) of quitting tobacco compared with teachers reporting that they knew no one who quit. Teachers who reported that their school's tobacco control policy was completely enforced had 4.66 greater odds (95% CI = 1.57–13.85) of quitting tobacco compared with teachers who reported that the policy was not completely enforced or did not exist. Finally, having a motor vehicle, fridge or both somewhat surprisingly was associated with 0.22 lower odds (95% CI = 0.07–0.65) of quitting tobacco compared with teachers who did not own these items.

quantitative data to determine factors related to the TFT-TFS program and broader factors in the larger social environment that were associated with quitting. The qualitative data indicate that it was important to both teachers and principals to be positive role models; that information about harmful effects of tobacco—especially from trusted sources—contributed to their quitting; and having visible school tobacco control policies created an environment supportive of quitting. Quantitative data shed additional light on the importance of social context of quitting, including knowing anyone who has quit in the past year and having rules against tobacco use that were enforced in schools. These findings illuminate three central aspects of the social context related to quitting that have relevance for future implementation research and practice.

First, social modeling appears to be an important factor that contributed to teachers' quitting—both in terms of teachers being role models for students and also being inspired by others who quit. Focus group participants expressed that youth looked up to teachers; their students imitated their behavior. Accordingly, focus group participants reported that it was critical that teachers abstain from tobacco use, even outside of school, fearing students would mirror their behavior. This corroborates formative research we conducted earlier with teachers in Maharashtra and Bihar who reported they should not use tobacco because they believed they were role models for students [28]. We also found in another study of message formats related to tobacco risk that school personnel in Bihar emphasized the need to depict teachers as role models for youth, suggesting images of teachers 'saying no' to

Discussion

The TFT-TFS program was successful in helping teachers quit tobacco and schools implement tobacco control policies. The purpose of this mixed-methods study was to collect qualitative and

tobacco and encouraging community members not to use [34]. Accordingly, we designed the first theme of TFT-TFS to highlight teachers' important role as role models for students and society [27].

Conversely, the survey data indicate knowing someone who quit was a highly significant factor related to teachers' quitting. Indian studies have found tobacco use among adults to be highly influenced by their close associates, including family, friends and work colleagues [20, 21]. This finding suggests the TFT-TFS program component of having teachers share quitting stories during discussion groups may have played a role in promoting cessation, particularly in the Indian context where quitting is not yet common [8, 45]. The group discussions in schools may have helped create a safe space for teachers to share and learn from each other. And attending these sessions with peers could have helped them gain confidence about quitting and maintaining abstinence, as was found in a UK study of a buddy-led smoking cessation program [46]. Not surprisingly, group discussions were deemed to be one of the most meaningful program components. Sharing stories of quitting was also successfully used as part of a program to promote cessation among manufacturing workers in Mumbai [47]. Furthermore, social modeling speaks to the powerful influence of social networks related to health. For example, Christakis and colleagues have extensively mapped the social networks of many health behaviors, including smoking initiation and cessation [48, 49]. They concluded that since tobacco use is a social and shared behavior, social networks can be leveraged to encourage users to quit; as one member quits, the whole cluster may move toward quitting. In other words, decisions to quit are not necessarily made by isolated individuals, but rather reflect choices made by groups of people connected to each other directly and indirectly [48].

Second, tobacco policies may have helped promote cessation. Focus group participants described the usefulness of having clearly visible tobacco control policies. In TFT-TFS we used culturally relevant means to promote the policy, such as painting it on the outside school wall (which is customary in India) and ensuring the policy appeared near the

principal's chambers, where important school information is posted [27]. In addition, having rules against tobacco use that were completely enforced was associated with cessation and may have changed norms about using tobacco on the school premises. Our findings are supported by Sinha *et al.* [50], who found the presence of tobacco control policies in schools in India was strongly associated with lower tobacco use among school personnel.

Finally, the learning environment brought the social modeling and policy changes together in support of cessation. Focus group participants overwhelmingly expressed the importance of conveying not just that tobacco use was harmful, but specifics of tobacco use harms, as others have advocated as well [2]. In prior research on message testing, teachers advocated for having detailed, scientific information about tobacco's harmful effects that they could use for themselves and to help others [34]. We therefore tailored materials and messages to be very explicit, from having a poster explaining how tobacco harms different body parts to developing handouts with the short- and long-term effects of tobacco use, and painting the chemicals found in tobacco on the school wall. Having health educators who were knowledgeable about tobacco, empathetic and respectful was also highly valued by teachers. A fundamental part of the health educators' training focused on how to communicate with teachers in a respectful manner and not stigmatize tobacco users [35]. The program was designed to be highly participatory and engage all teachers, including non-users, to support colleagues wishing to quit and serve on tobacco policy workgroups. Learning activities also tapped into the broader social environment by paying attention to media reports on tobacco and having teachers bring in newspaper clippings and use them as a peg for discussions among their peers.

It should be noted that our finding that teachers with more material assets were less likely to quit tobacco compared with teachers with fewer resources was unexpected and in contrast to the research of others [17]. It is conceivable that teachers with greater resources had more disposable income to spend on tobacco. It is also possible that teachers with fewer resources may have given more attention

and greater weight to the information received through the program. Teachers with more resources have many more channels of receiving information, such as subscribing to newspapers and magazines that generally have a 'Health' section, which can connect them with tobacco control information and updates. Future research is needed to better understand this finding.

Limitations

There are limitations to interpreting these findings, which include the retrospective nature of the focus groups. A common limitation of the focus group method is that respondents may be inclined to give socially desirable responses in the presence of their peers or the moderators. Tobacco users were somewhat underrepresented among focus group participants, and therefore these qualitative results may not have fully captured the opinions of users. There was also no biochemical verification of quitting. The generalizability of these findings may also be somewhat limited, particularly in places where teachers are not viewed as role models to the same degree as we found in Bihar.

Strengths

Despite these limitations, this study has many notable strengths. To our knowledge this is one of the very few studies to examine the impact of a cessation intervention from the participants' perspective while concurrently assessing the predictors of quitting in the participants' larger social environment. The mixed-methods design allowed us to examine and determine the factors that influence quitting in a much more in-depth, comprehensive manner than would be possible by using either method alone. For example, the qualitative data provided rich insights from the participants' perspectives into how the program worked [51], which allowed investigators to identify core components to scale up the program [52] and how it contributed to a social environment that was supportive of quitting; the quantitative data shed additional light on the social context of quitting. Our methodology of including teachers from urban and rural schools also helped ensure we

obtained diverse perspectives of teachers and principals. This study followed a cohort of teachers who participated in the intervention, thereby enhancing what can be learned from participants about factors influencing cessation.

Implications

Despite study limitations, the current findings have important practical implications for intervention design and implementation. Building on lessons learned, future programs can also capitalize on teachers' desire to be positive role models at least in India, to promote cessation and potentially be role models for other health issues. These findings suggest the importance of conveying the specifics of tobacco harms that planners can build into messages and materials, along with establishing the essential role of non-users in helping others quit. Including non-tobacco users in programmatic activities and messages should also be considered.

Health educators from local educational systems can be trained to provide tobacco control information in a respectful, non-judgmental manner and encourage participants to contribute to program content as a means of creating program ownership. Additionally, discussion groups can be facilitated to exchange information, showcase success stories of people who quit and tap the general social environment with discussions centered on tobacco news items in local media. Adopting tobacco control policies in schools and making such policies clearly visible and completely enforced would help create an environment supportive of quitting.

In conclusion, identifying factors associated with cessation is a crucial step toward helping tobacco users quit and reducing tobacco-related deaths in LMICs. These findings suggest an intervention can help to improve the social environment in support of quitting. Institutions can take specific actions to create supportive environments that can help shape social norms related to tobacco use; researchers and practitioners can also optimize these factors in future interventions to promote cessation.

Acknowledgements

The authors wish to thank the Education Department of the Bihar State Government for its support of this study. The authors also wish to thank the numerous field investigators and staff members in India and USA who contributed to this study, including Linnea Benson-Whelan, Neha Mathur, Shree Mukesh, Pratibha Pawar, Laura Shulman-Cordeira, Gupteshwar Singh, Manibala Singh, Lorraine Wallace and the Health Communication Core, Dana-Farber Cancer Institute (www.healthcommcore.org) for their contributions and assistance. In addition, this work could not have been completed without the participation of the schools, teachers and other school personnel from government schools in Bihar and the Health Educators and other support staff at the School of Preventive Oncology in Patna, Bihar.

Funding

This work was supported by the National Institutes of Health [grant numbers 5R01 CA120958-05 to G.S. and 5 K05 CA108663 to G.S.].

Conflict of interest statement

The authors declare that there are no conflicts of interest.

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