

# Responses to Public Service

# Announcements About Tuberculosis and Its Comorbidities

Findings From a Message Testing Study  
in India

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## **Responses to Public Service Announcements About Tuberculosis and Its Comorbidities: Findings from a Message Testing Study in India**

### **Authors:**

Meena Maharjan, Nalin Singh Negi, Vaishakhi Mallik Sandra Mullin, and Nandita Murukutla

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## Abstract

**Background:** India is at the center of the global tuberculosis (TB) epidemic, having the world's highest annual TB incidence in 2019. Mass media campaigns can help to deliver information, raise risk perceptions, shift attitudes and encourage behavior change to address TB. While there are TB-related mass media campaigns in India, to date, there are no published message testing studies for such a campaign. Message testing potential public service announcement (PSA) concepts can help to solicit important feedback from priority audiences, which can inform the development of effective mass media campaigns for TB.

**Objectives:** The aim of this study is to assess the comprehension, acceptability and potential effectiveness of PSA concepts about TB prevention and treatment.

**Methods:** Four TB-related concepts entitled *Annu*, *Cough*, *Sunil*, and *Manoj* were developed with different execution styles, messages and stimuli, but the same objectives: to deliver information, reduce stigma, and encourage people to seek care for TB. A total of 234 focus group participants ages 18 to 40 rated the four different concepts, using 12 statements and a five-point Likert scale, and then discussed the concepts. Principal component analysis was used to reduce the 12 rating items to a small set of outcome variables that yielded five outcome measures. These included three composite scales: "message credibility and persuasive ability" (Cronbach's  $\alpha = 0.81$ ), "message acceptance" (Cronbach's  $\alpha = 0.61$ ), and "effectiveness of PSAs"; and two standalone measures, "understanding" and "negative emotion." Lastly, to compare the outcome measures across PSAs and demographic characteristics, we performed multivariate logistic regression analysis, with robust standard errors to control for the same individuals rating multiple concepts.

**Results:** A significant main effect of the PSAs was found on all the five outcome measures. The PSA *Cough* was rated highly on two outcome measures, "message acceptance" and "negative emotion," followed by the PSA *Sunil*. For the outcome measures "message credibility and persuasive ability" and "effectiveness of PSAs," the PSAs *Cough*, *Sunil*, and *Manoj* were less likely to have positive ratings, compared to *Annu*. All four potential TB-related PSAs rated well, with feedback to modify certain elements.

**Discussion:** Findings from this study demonstrate the need for message testing of TB PSA concepts, which can help researchers to develop effective TB campaigns. Among the tested concepts, those that focused on the health consequences of TB and used an execution style depicting strong graphic and negative emotions were rated highest by participants. These findings are consistent with the literature on messaging on health promotion and likely to apply to campaigns beyond TB.

## **What This Paper Adds**

- To date, there is no published study on message testing of TB mass media campaigns, including in India.
- This paper presents results of a message testing study of potential PSA concepts for a TB campaign in India.
- Among the tested concepts, we found concepts that focused on the health consequences of TB and used an execution style depicting strong graphic and negative emotions were rated highest by participants.
- In addition, this study elucidated the importance of the following aspects for TB-related PSA concepts:
  - The need for clear explanations of medical concepts and terminologies so that the audience can easily understand them.
  - The importance of visualization, which can help to present complex information to the audience.
  - The preference for personally relevant and relatable stories, which can help to connect and engage the audience.
  - The necessity of limiting the number of messages in a single PSA; too many messages can lead to failure in delivering the intended message to the audience.
- These findings are consistent with the literature on messaging on health promotion and likely to apply to campaigns beyond TB.

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### Background

Tuberculosis is one of the top 10 causes of infectious disease, morbidity and mortality worldwide, and India is at the center of this global epidemic [1]. In 2019, the estimated annual TB incidence in India was about 2.6 million, accounting for a quarter of the world's TB cases [1]. In India, control of TB is challenging, in part because there is a large burden of multidrug- and rifampicin-resistant TB (MDR/RR-TB), with an estimated annual incidence of 124,000 [1]. Another challenge is the dual burden of human immunodeficiency virus (HIV) and TB, with an annual incidence of 71,000 [1]. Tobacco use also increases the risk of TB and contributes to the TB epidemic in India—about 14% (192,107) of TB patients in India use tobacco [2].

The government of India has taken steps to address the TB epidemic, including forming a National Tuberculosis Elimination Program and drafting a National Strategic Plan for TB Elimination 2017-2025 [3]. For the strategic plan's goal of TB elimination by 2025 to be achieved, TB incidence should decline by 10% to 15% each year. To make progress on this ambitious target, evidence-based public health interventions that can help to control TB in India are urgently needed.

Public health mass media campaigns, appearing in the form of public service announcements (PSAs) on television, radio, social media, in print, and on out-of-home channels such as billboards or posters, are an effective public health tool to deliver information, raise risk perceptions, and shift attitudes about health issues [4, 5]. Evidence suggests mass media campaigns, by themselves or in combination with other programs, can significantly influence health behaviors [4]. In addition, mass media campaigns can support policy change for addressing health issues [6]. In tobacco control, there is more than a decade of research demonstrating the effect

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of mass media campaigns, especially those featuring strong graphics and negative emotions [7, 8]. Effective mass media campaigns typically feature well-designed messages, and those messages are delivered to their intended audience with sufficient exposure [9].

Mass media campaigns can be a powerful strategy for addressing the global TB epidemic by delivering information, reducing stigma and encouraging treatment for TB. Research shows there is a lack of public knowledge and awareness about TB, including transmission, signs and symptoms of the disease [10]. Mass media campaigns have been proven to be effective in raising awareness of the signs and symptoms of other diseases; for TB, campaigns involve communicating health information to the public so as to raise awareness on TB-related issues and problems, and have the potential to assist in generating knowledge about TB [11-13]. In addition, TB-related stigma has been found to be a barrier to health-seeking behavior at the pre-diagnosis, treatment and post-cure levels [14]. Targeted and well-executed campaigns have been shown to address and alleviate such deeply grounded social stigma for other health issues, and can be useful for TB [15, 16]. To control the spread of TB, people also need to be able to access health care and complete treatment, which can be challenging, especially for people who have low health literacy levels [17]. Mass media campaigns can help to improve health-seeking behavior, health service utilization, and adherence to treatment, including for TB [13, 18, 19].

It is important to conduct message testing studies with target audiences prior to the launch of a campaign to ensure that campaigns will be effective and media budgets optimally utilized [8, 20, 21]. Message testing helps researchers to solicit feedback from audiences, identifying which messages are most likely to

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resonate and be perceived as credible. In addition, message testing can help uncover any problematic content and language. Most importantly, message testing can help identify which features need to be modified in order to succeed in making information relevant for the audience for future campaigns.

In India, substantial funding has been devoted to tackling TB, including for TB mass media campaigns [3]. However, to the best of our knowledge, to date, there is no published study on message testing of PSA concepts for TB, and it is unclear what message content and execution style work well in TB campaigns. Rigorously tested mass media campaigns are critical to reduce the burden of TB and make progress toward the country's ambitious goal of eliminating TB by 2025.

The present study aims to assess the comprehension, acceptability and potential effectiveness of four TB concepts—*Annu*, *Sunil*, *Cough*, and *Manoj*—developed by Vital Strategies. This study also demonstrates the method used to message test the four concepts with targeted audiences to identify the aspects of execution that could be improved to ensure effectiveness of the selected PSA.

## Methods

A mixed quantitative and qualitative methodology was used to collect the data. To optimize efficiency, TB PSAs were tested with 20 focus groups at which anti-tobacco television PSAs were also being tested. The 234 participants included smokers, smokeless tobacco users, and nonsmokers. The four TB concepts (*Annu*, *Manoj*, *Cough*, *Sunita*) were tested with each of the 20 groups in which the anti-tobacco concepts were tested: smokers (six groups), smokeless tobacco users (eight groups), and nonsmokers (eight groups). This paper focuses on the four TB-specific



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PSAs that were part of the message testing protocol developed by Vital Strategies. In-person focus group discussions were conducted from April 14 to 19, 2016.

### Tested Materials

The PSA scripts were written in English, translated into Hindi and then back-translated to check the consistency of the translations. The concepts were then converted into four animatics, each addressing one of the following four issues: (1) multidrug-resistant TB (*Annu*); (2) smoking and secondhand smoke (*Cough*); (3) HIV and TB (*Manoj*); and (4) TB only (*Sunil*).

Appendixes I and II describe the four PSAs and show stills from each one. The PSA *Annu* is the story of a 29-year-old woman and focuses on MDR-TB. *Manoj* presents the story of a 29-year-old man and shows the link between HIV and TB. *Sunil* is the story of a 25-year-old man, featuring only TB. The three concepts *Annu*, *Manoj*, and *Sunil* focus on advising and encouraging positive behavior change. The PSA *Cough* features TB and smoking, including secondhand smoke, and focuses on providing information about the health consequences of TB. Among the four, three PSAs (*Annu*, *Manoj*, and *Sunil*) used testimonials as the execution style to convey their messages, and *Cough* used strong graphic images and negative emotion as the execution style. All four PSAs addressed TB symptoms, the urgency of seeking treatment when TB symptoms occur, availability of treatment, and the need for adherence to complete treatment.

### Participants

Participants were selected from Uttar Pradesh state since it has the highest burden of TB in India [22], and focus group discussions were conducted in

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Lucknow, a city in Uttar Pradesh. An international research agency (Kadence International) used convenience sampling to recruit adults ages 18 to 40 who knew how to read and write in the Hindi language. Excluded from the study were people who were dual tobacco users (tobacco smokers and smokeless tobacco users), people from the high socioeconomic class, or those involved in any health promotion activities, market research, advertising or the tobacco industry. Participants who were or had been smokers/smokeless tobacco users for at least one year were considered to be tobacco users. Those who reported, "I have never been a smoker/smokeless tobacco user" or "I have smoked/consumed smokeless tobacco fewer than 100 times in my lifetime" were considered to be non-tobacco users.

### **Procedure**

Twenty focus group discussions were conducted with 10 to 12 participants in each group, which resulted in a final sample size of 234. Participants were first asked to complete a form that asked for demographic information. After that, an unrelated commercial advertisement for a local product was shown to the participants to ensure that the television was visible and audible and to familiarize them with the rating statements and process.

Each participant was given a rating sheet to rate each of the four TB-related concepts using a five-point Likert scale. Participants viewed each PSA twice and then rated it immediately using the rating sheet. To counterbalance any potential effects of PSA viewing order, half of the groups viewed the PSAs in the reverse order. After the rating exercise, the group moderator led a structured discussion on each PSA one by one, playing the PSAs once again for ease of discussion. The

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participants were not allowed to discuss among themselves during the entire process. The discussion focused on perceived efficacy of the PSAs, message comprehension, acceptability and cultural appropriateness. The entire process lasted for two hours on average, and appropriately valued incentives were provided to the participants.

### **Measures**

The PSA rating sheet included 12 items repeated for each PSA. The items were adapted from previous PSA rating studies [23-29]. The items measured the effectiveness of the PSA based on how strongly the participants agreed or disagreed with statements such as, “The PSA was easy to understand,” “believable,” “relevant,” and “effective.” Similarly, participants rated their level of agreement with TB-specific statements such as, “The PSA made me concerned about the symptoms of TB,” “made me feel sympathetic to those with TB,” “increased my confidence to take TB medication if I get sick,” and “motivated me to visit a doctor in case of TB symptoms.” Participants also indicated whether the PSA taught them something new, made them stop and think, or made them feel uncomfortable, and whether they would discuss the PSA with others.

A five-point Likert scale was used to measure each of the rating items. The choices were: 1) strongly disagree; 2) somewhat disagree; 3) neither agree nor disagree; 4) somewhat agree; and 5) strongly agree. An iterative process of translation and back translation of the PSA rating materials was undertaken before the study, ensuring that the rating items were meaningfully translated into Hindi.

Demographic measures collected included sex, age, parental status, level of educational attainment, socioeconomic status, residential location, daily

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cigarette/bidi/smokeless tobacco consumption, information on other smokers in the participant's home, and whether smoking was allowed indoors at home.

### Data Analysis

Data were analyzed using IBM SPSS version 25.0 and Stata/SE 14.0. Descriptive statistics and principal component analysis using oblique rotation were performed in SPSS version 25.0 to reduce the 12 rating items to a small set of outcome variables.

First, to avoid reiteration of principal component analysis for each concept, the rating of each individual concept on each statement was averaged, which yielded three composite scales and two standalone items. The first composite scale was labeled "message credibility and persuasive ability" (*Cronbach's alpha* = 0.81) and comprised four TB-specific items: made me feel sympathetic to those with TB, made me feel concerned about symptoms of TB, made me more likely to visit a doctor if I have TB symptoms, and made me confident to take TB medication if I get sick. The second composite, "message acceptance" (*Cronbach's alpha* = 0.61) comprised three items: made me stop and think, was believable, and was relevant to me. The third composite, "effectiveness of PSA" comprised two items: is an effective TB ad, and I would be likely to discuss this ad with someone else. Two standalone items that did not load on any component were: the ad was easy to understand (labeled "understanding") and made me feel uncomfortable (labeled "negative emotion"). The solution for principal component analysis accounted for 72% of the variance; the items which loaded above the cut-off point of 0.4 were excluded from the analysis.

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Second, the scores on the three composite scales (message credibility and persuasive ability, message acceptance, the effectiveness of the PSA) and two individual items (understanding and negative emotion) were binary coded to allow for logistic regression analysis. The three multiple-item constructs were dichotomized by using the average of the scale items, with averages  $>3.5$  classified as a positive response and  $<3.5$  as a negative/neutral response. For the two standalone items, ratings of somewhat agree/strongly agree were coded as a positive response toward the PSA, while ratings of somewhat disagree/strongly disagree and neither agree nor disagree were coded as negative/neutral responses.

Lastly, we performed a multivariate logistic regression analysis to compare outcome measures across PSAs and demographic characteristics using Stata/SE. Robust standard errors were used to control for individuals rating multiple ads. A backward selection method with a cut-off point  $p \geq 0.2$  was used to select the variables and to adjust in the logistic regression model for each of the five outcome measures.

## Results

### Demographics

Table 1 presents demographic characteristics of study participants. Among the 234 participants, 46% were women, and more than half (56%) were from the age group 18 to 29. Almost two-thirds of the participants had up to higher secondary school education. The majority of participants (85%) were tobacco users, and, among them, more than half (51%) consumed tobacco six times a day or more. Almost 72% of tobacco users thought about quitting in the next 12 months and

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more than two-thirds (66%) of tobacco users stated that they had made a quit attempt previously.

**Table 1.** Demographics Characteristics of Participants

	Frequency	Percentage
<b>Ad order</b>		
Order A	117	50%
Order B	117	50%
<b>Gender</b>		
Women	107	46
Men	127	54
<b>Age</b>		
18 - 29 years	132	56%
30 - 40 years	102	44%
<b>Parental status</b>		
Parent	74	32%
Not a parent	160	68%
<b>Education</b>		
Up to higher secondary school	148	63%
Above higher secondary school	86	37%
<b>Tobacco consumed daily (n = 199)</b>		
Up to five times per day	97	49%
More than five times per day	102	51%
<b>Thinking about quitting in the next 12 months (n = 199)</b>		
Yes	143	72%
No	56	28%
<b>Previously tried to quit (n = 199)</b>		
Yes	132	66%
No	67	34%

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### PSA Ratings

Table 2 shows the significant main effect of the PSAs on all the five outcome measures. Logistic regression analysis revealed that the PSA *Cough*, followed by *Sunil*, had the highest odds of positive responses on two outcome measures—“message acceptance” and “negative emotion,” compared to *Annu*. The PSA *Sunil* had the highest significant positive response on the outcome measure “understanding,” followed by *Cough*. Conversely, for the outcome measures “message credibility and persuasive ability” and “effectiveness,” *Cough*, *Sunil*, and *Manoj* tended to show lower odds of positive ratings in comparison to *Annu*. In addition, when asked which PSA made them feel most concerned about TB, the participants rated PSA *Cough* highest (35%), followed by *Manoj* (30%), *Sunil* (21%), and *Annu* (14%).

In addition, the differences in outcome measures by demographic characteristics showed that women were significantly more likely to give a positive rating on the outcome measures “message acceptance” and “negative emotion” compared to men. The participants in the older age group (30 to 40 years) were more likely to give a positive rating in the outcome measures “message acceptance,” “effectiveness of PSA,” “understanding,” and “negative emotions,” and less likely to give positive rating on the outcome measure “message credibility and persuasive ability.” The participants who had a lower level of education (up to higher secondary school) were significantly more likely to give a positive rating on the outcome measures “message acceptance,” “understanding,” and “negative emotion.” Parents were significantly less likely to rate positively on the outcome measure “message acceptance,” and “understanding” compared to non-parents. The participants who consumed tobacco more than five times a day rated

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significantly lower on the outcome measure “effectiveness of PSA.” And the participants who had tried to quit tobacco previously rated significantly higher on the outcome measure “negative emotion.”

**Table 2.** Multivariate Logistic Regression of Positive Ad Rating by Message Credibility and Persuasive Ability, Message Acceptance, Effectiveness of PSA, Understanding, Negative Emotion.

	Message credibility and persuasive ability	Message acceptance	Effectiveness of PSA	Understanding	Negative emotion
	Adj. OR (95% CI)	Adj. OR (95% CI)	Adj. OR (95% CI)	Adj. OR (95% CI)	Adj. OR (95% CI)
<b>Ad</b>					
Annu (ref)	1.00	1.00	1.00	1.00	1.00
Cough	0.24 (0.23, 0.25) **	1.50 (1.50, 1.56) **	0.69 (0.68, 0.70) **	2.11 (2.03, 2.20) **	4.32 (3.97, 4.70) **
Manoj	0.50 (0.50, 0.50) **	0.84 (0.84, 0.85) **	0.40 (0.39, 0.40) **	1.54 (1.49, 1.58) **	0.82 (0.80, 0.85) **
Sunil	0.50 (0.49, 0.50) **	1.14 (1.12, 1.16) **	0.50 (0.50, 0.51) **	6.31 (5.92, 6.72) **	1.99 (1.85, 2.14) **
<b>Gender</b>					
Women (ref)	1.00	1.00	1.00	1.00	1.00
Men		0.15 (0.08, 0.28) **			0.06 (0.01, 0.40) **
<b>Age</b>					
18-29 years (ref)	1.00	1.00	1.00	1.00	1.00
30-40 years	0.28 (0.08, 1.02) *	1.87 (1.48, 2.36) **	3.28 (0.56, 19.07)	2.86 (0.71, 11.43)	6.32 (2.96, 13.52) **
<b>Education</b>					
Up to higher secondary school (ref)	1.00	1.00	1.00	1.00	1.00
Above higher secondary school		0.24 (0.12, 0.51) **		0.42 (0.14, 1.23)	0.52 (0.13, 2.01)
<b>Parental status</b>					
Not a parent (ref)	1.00	1.00	1.00	1.00	1.00
Parent	6.02 (0.48, 75.40)	0.44 (0.33, 0.60) **	0.67 (0.37, 1.22)	0.27 (0.11, 0.67) **	
<b>Tobacco consumed daily</b>					
Up to five per day (ref)	1.00	1.00	1.00	1.00	1.00



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More than five times per day 1.92 (0.91, 4.01) 0.14 (0.02, 0.98) \*

### Previously tried to quit

No (ref)	1.00	1.00	1.00	1.00	1.00
Yes					2.35 (1.19, 4.62) **

### Order

A (ref)	1.00	1.00	1.00	1.00	1.00
B	0.27 (0.04, 1.71)				

\*Significant difference at  $p < 0.05$ ; \*\* Significant difference at  $p < 0.01$

Abbreviations: Adj. OR, Adjusted Odds Ratio; CI, Confidence Interval; ref, Reference Category

## Key Qualitative Findings

Among the four PSAs, the PSA *Cough* was the most well received PSA in the group discussion. Participants said they were able to relate to the character in *Cough*, having friends and family members who were tobacco smokers. After seeing *Cough*, almost all of the participants reported that a smoker is at high risk of having TB and that their smoking can harm not only them, but also their families and children: “It is very well shown in the PSA that children get to know what smoking is and people doing it are wrong people and they are doing a wrong thing.” (Woman, age 18–29, non-tobacco user).

Likewise, the statistics shown in *Cough* caught the participants’ attention—many said they were shocked to hear the dramatic and negative statistics about TB in India: “65%? They are saying India has nearly one-third of the TB patients in the world, and 65% among them are males who smoke.” (Woman, age 30–40, non-smoker).

The PSA *Sunil* received mixed reactions—some participants felt the concept was rich in information, while others criticized the concept for having no story and showing too many messages. Participants reported *Sunil* imparted new information, for example, that TB not only affects the lungs, but other body parts

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as well. However, other participants pointed out that *Sunil* did not provide enough detailed information; for instance, some said the PSA did not clearly state which body parts are affected by TB. Participants suggested adding more pictures to the PSA so that it can be better understood, particularly for people who do not speak English and are not literate: *“While showing the symptoms of TB, pictures should be added simultaneously and whenever there is a usage of English words there should be an addition of pictures so that everyone could understand it easily.”* (Woman, age 18–29, smoker).

Most of the participants felt that the PSA *Manoj* was confusing because it discussed two diseases (HIV and TB) together: *“They have talked about the two diseases together in this PSA, but this can be confusing for the people.”* (Man, age 18–29, smokeless tobacco user).

In addition, participants did not find *Manoj* personally relevant or relatable to their own lives: *“The PSA is not meant for everyone and is only for people suffering from HIV.”* (Woman, age 30–40, smokeless tobacco user). However, many participants said *Manoj* imparted new knowledge as they did not know about the link between HIV and TB.

The PSA *Annu* was the least well received PSA among the participants in the group discussion. Most participants felt that *Annu* used terminology, including MDR-TB, which was not explained clearly. Almost all of the discussions in all the groups for this PSA revolved around the question of what MDR-TB is. Although many participants did not understand the terminology, *Annu* seemed to raise risk perceptions of MDR-TB as participants reported they assumed MDR-TB is more dangerous: *“MDR-TB looks like more dangerous than normal TB, but it does not explain what MDR-TB is.”* (Man, age 18–29, smokeless tobacco user).

## **Discussion**

Over time, research has underscored the importance of message testing PSAs to identify the parts that are strong and the elements that need refinement before reaching the final stage of media production [8]. We used hybrid approach that included quantitative and qualitative measures that allowed for a comprehensive and synergistic use of data.

The quantitative findings from this study showed that overall, participants were likely to positively rate the PSAs as “easy to understand.” However, while further exploring the qualitative findings, we found that participants were not able to understand some of the terminology used in the PSAs, such as MDR-TB. This finding suggests that a PSA with new and complex medical concepts needs to include a simple explanation of terms or be complemented by other communication efforts that build public knowledge of these terms. Also, as suggested in one of the focus group discussions, adding pictures to explain complicated issues can help audience members understand the PSA more easily, especially when the PSA’s priority audience includes people with lower levels of literacy.

Research shows that fear-appealing mass media campaigns can induce behavior change among the priority audiences [30]. Even though the PSA *Annu* was rated low on other outcome measures by participants, it was rated high on “message credibility and persuasive ability” and “effectiveness of PSA.” Participants may have felt more sympathetic towards those with TB and concerned about TB, because, as revealed in the focus group discussions, participants believed MDR-TB is more dangerous than normal TB and this might have induced fear.

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The PSA *Sunil* was rated highly on the outcome measure “understanding.” Notably, the other PSAs showed the links between TB and other diseases (HIV) and risk factors (e.g., smoking), while *Sunil* focused just on TB itself. *Sunil* provided information about TB symptoms and the need for timely diagnosis and completion of treatment, while the other PSAs focused on more complex issues (e.g., MDR-TB), which might explain why participants were more likely to rate the *Sunil* as easy to understand.

In addition, participants rated the PSA *Manoj* low on the outcome measure “message acceptance” and “effectiveness of PSA.” This finding was in line with the group discussion, in which participants said that they were not able to relate the PSA *Manoj* to their lives, and the PSA showed HIV and TB together, which created confusion.

The quantitative findings showed that the PSA *Cough* performed highly on the outcome measures “message acceptance” and “negative emotion.” Participants also rated the concept highly when asked which PSA made them most concerned about TB. *Cough* focused on the health consequences of TB and used the execution style of graphic images and negative emotion. These findings are consistent with the literature on messaging for health promotion, which find mass media campaigns that focus on realistic situations, learning, and negative emotions are most effective in encouraging behavior change [31]. In addition, the participants might have rated the PSA *Cough* high compared to the other PSAs because the majority of the participants were tobacco users and they were able to relate to the concept, and the concern that their smoking harms not only themselves but also their families and friends, as indicated in the qualitative findings. This is in line with previous findings that mass media campaigns that use tailored messages,

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making information relevant to their intended audience, are more effective than those that do not [32].

Significant differences in the rating of the PSAs was found by gender, age group, education status, parental status, and tobacco users. Women were more likely to give positive ratings to the PSAs, compared to men. Likewise, the participants with lower levels of education were significantly more likely to give positive response to the PSAs compared to those with higher level of education. This suggests that the PSAs didn't require a high level of education for the participants to understand it, and that the PSAs effectively delivered the intended message. Those consuming tobacco more than five times a day were significantly less likely to give positive responses to statements about the effectiveness of PSAs, which suggests the need for hard-hitting messages in campaigns focusing on tobacco users.

There exist some limitations to this study. Since the majority of the participants were smokers or smokeless tobacco users, the study findings may not be generalizable or applicable for the population at large. Our study findings indicate this potential limitation as participants were more inclined toward the PSA *Cough*, which focused on TB and tobacco use, compared to other three PSAs. Another potential limitation of this study is that we tested only two execution styles, "testimonial" and "graphic and negative emotion"; however, there exist several other execution styles that should be tested in future studies, including instructional, emotional/love, and aspirational.

## Conclusion

While participants rated all four potential TB-related PSAs highly on attributes of message effectiveness, they also provided feedback to strengthen elements of the PSAs. This study found that the PSA *Cough* was most highly rated by participants, and made the participants feel more concerned about TB. As a result, *Cough*—the first-ever campaign we are aware of to link tobacco with TB—was developed into a 30-second television PSA and was launched by India’s Ministry of Health and Family Welfare, first in May 2017, and again in March 2018, aired nationally to warn people of how smoking and secondhand smoke exposure increase the risk of TB and mortality from TB.

Rigorous message testing of media campaigns is important to determine the most well-designed messages for the intended audience. Our quantitative and qualitative results showed that for PSAs to be effective, they should provide an adequate explanation of unfamiliar terminology and conditions, and should be relatable to the audiences. In addition, too much information in one PSA may create confusion and may cause the PSA to fail to deliver the intended messages. More research is required to gain a better understanding of what kinds of messages and execution styles work well for TB mass media campaigns.

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## Authors' Contributions

MM: writing of the original paper, data analysis, data interpretation. NSN: writing of the paper, direction of data analysis, data interpretation. VM: review of the paper and overall guidance. SM: overall guidance. NM: study design and overall guidance. All authors contributed to the drafts and approved the final version of the paper.

## Conflict of Interest

The authors declare no conflict of interest.

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## Appendix I

### Images of the PSAs about TB



*Cough*



*Annu*



*Manoj*



*Sunil*

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## Appendix II

### Brief Descriptions of the Concepts Tested

PSA Name	Description
<p data-bbox="293 737 407 814"><i>Annu</i> (MDR-TB)</p>	<p data-bbox="526 499 1502 1056">PSA <i>Annu</i> is a testimonial of a 29-year-old MDR TB survivor. The first shot of the PSA starts with a young woman starkly lit against a dark background while a female voiceover states, “you don’t want to get a multidrug-resistant or MDR-TB. I got it...and now I’m blind.” The second shot starts with a PSA showing a popular Bollywood actor and TB spokesperson, Amitabh Bachchan, talking to camera and stating “you have less chance of survival with MDR-TB. The treatment is long, you can’t work, and the side effects can last forever. But you can prevent the suffering and long-term effects of MDR-TB by simply doing these two things (camera holds on Annu): when symptoms first appear—coughing for two weeks or more, rapid weight loss or fever—go in for a test...and make sure you complete your treatment!.” Camera zooms into extreme of Annu’s eyes with dramatic lighting and the PSA ends with the voiceover of Amitabh Bachchan stating that TB is treatable, and people should get tested early and complete treatment.”</p>
<p data-bbox="228 1415 472 1539"><i>Cough</i> (Smoking, secondhand smoke and TB)</p>	<p data-bbox="526 1083 1502 1877">PSA <i>Cough</i> is a strong, graphic and visceral (disgust-provoking) advertisement. The PSA starts with a close-up of a starkly lit man against a dark background. Smoke comes billowing out of the man’s mouth and he starts to cough uncontrollably, while the voiceover states, “most smokers know about smokers’ cough. It’s is the body’s way of telling them something’s wrong.” As the man continues to cough uncontrollably, the cigarette is seen in his hand; it smolders with the smoke clearly seen against the black background, and the voiceover continues, “but a persistent cough lasting for two weeks or more may be the sign of something more serious.” The PSA shows the image of lungs with a black clot forming over one of the lungs as the voiceover continues, “as well as the risk of lung cancer, a cough, if left untreated, can lead to TB.” The lungs dissolve to map of India with small black graphics of people over the map, while voiceover states, “India has nearly one third of all TB cases in the world. Most alarming is the fact that the many men with TB, also smoke.” The PSA shows the same man smoking in domestic setting with his wife and children nearby. While the young child rubs her eyes, she looks up to her father, and the voiceover states, “smokers have an increased risk of getting TB, and dying from it.” The camera pulls back as the man in domestic setting starts to cough as he uncomfortably looks to his little girl sitting by his side and the voiceover states, “children and other non-smokers exposed to secondhand smoke also share these risks.” The</p>

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PSA ends stating, “every bidi/cigarette brings you and your family closer to TB... and lung cancer...(voice begins to fade down as the coughing and ominous tone builds over with a reverb)...and emphysema...and heart disease...and stroke...(voice continues to fade into background).” The final PSA *Cough* can be viewed at:

<https://www.youtube.com/watch?v=shxmwMSu8e8>

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*Manoj*  
(HIV and TB)

PSA *Manoj* is a testimonial of a 29-year-old health professional who is an HIV and TB survivor. It talks about two diseases, HIV/AIDS and TB, together and depicts that both of them are deadly. The PSA starts with a young man starkly lit against a dark background, while a voiceover states, “you don’t want to get TB if you are suffering from another serious disease like HIV/AIDS. I got it...and I almost died.” A Bollywood celebrity, Amitabh Bachchan, talking to the camera states, “surviving TB-HIV co-infection is difficult as your body’s ability to fight infection is already weakened. You can’t work, the treatment is life-long, and it can have serious side effects.” The camera holds on Manoj and the Amitabh Bachchan voiceover continues, “but you can prevent the suffering of TB-HIV co-infection by simply doing these two things. When TB symptoms first appear—coughing for two weeks or more, rapid weight loss or fever—go straight in for a test. If you have TB, make sure you complete your treatment, and also take your HIV medicines. Camera zooms into extreme of Manoj eyes with dramatic lighting and PSA ends with the voiceover stating that TB and HIV is treatable, and that people should get tested early and complete the treatment.”

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*Sunil*  
(TB only)

PSA *Sunil* is a testimonial of 25-year-old TB patient. The concept starts with uncontrolled coughing into handkerchief and a young male wheezing to get a breath of air between coughs while the voiceover says, “Tuberculosis is a disease caused by bacteria, spread through the air. TB usually attacks the lungs but can also attack other parts of the body.” Sunil coughs again without his handkerchief, a small droplet from his cough emits into the air while the voiceover states, “If you breath in TB bacteria you can become infected. If left untreated TB can lead to more severe lung infections, and death. The longer you leave treatment, the more difficult the cure.” Further, *Sunil* voiceover explains about TB symptoms and the need for timely diagnosis and completion of treatment saying, “if symptoms appear—coughing for two weeks or more, rapid weight loss or fever—go straight to a TB clinic or your doctor for a test.” Camera holds on Sunil as his coughing subsides and he looks directly to camera while the voiceover states, “TB is treatable, and drugs are free at government clinics. So, remember: Get tested early, complete the treatment and prevent TB.”

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