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## Surveillance of Tobacco Use Among South Asians in the US: Are We Underestimating Prevalence?

Michelle T. Bover Manderski<sup>1</sup>, Michael B. Steinberg<sup>2</sup>, Kimberly N. Rahi<sup>1</sup>, Smita C. Banerjee<sup>3</sup>, and Cristine D. Delnevo<sup>1</sup>

Michelle T. Bover Manderski: michelle.manderski@rutgers.edu

<sup>1</sup>Center for Tobacco Studies, School of Public Health, Rutgers, The State University of New Jersey, 683 Hoes Lane West, Piscataway, NJ 08854, USA

<sup>2</sup>Division of General Internal Medicine, Robert Wood Johnson Medical School, Rutgers, The State University of New Jersey, Clinical Academic Building (CAB), 125 Paterson Street, Suite 2304, New Brunswick, NJ 08901, USA

<sup>3</sup>Department of Psychiatry and Behavioral Sciences, Memorial Sloan Kettering Cancer Center, 641 Lexington Avenue, 7th Floor, New York, NY 10022, USA

### Abstract

This study employed a randomized split sample survey to assess the accuracy of standard tobacco surveillance measures among South Asians living in the US. 219 South Asian adults completed a web-based survey of “standard” tobacco use questions, as they appear in national surveillance surveys, and half were randomly assigned to also receive questions about South Asian tobacco products. Prevalence of tobacco use was compared by experimental condition, assessed by only the standard questions for the control group (N = 116) and by both standard and South Asian questions for the experimental group (N = 103). Among the experimental group, sensitivity and negative predictive value (NPV) of the standard use definitions were calculated, considering the inclusive definitions as the “gold standard.” Prevalence of any tobacco product use was higher among the experimental group, as was prevalence of smokeless tobacco (SLT) use, relative to the control group (34.7 vs. 17.2 % and 21.2 vs. 4.3 %, respectively). 70.6 and 33.3 % of true tobacco users (any product) and SLT users were correctly classified by the respective standard product questions. A majority of gutka, paan with tobacco, and supari with tobacco users (69, 86, and 75 %, respectively) did not otherwise endorse the standard SLT questions. Current tobacco surveillance measures may underestimate the use of tobacco in the South Asian population residing in the US. These results indicate that careful consideration must be given to how tobacco-related questions are presented to minority populations.

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Correspondence to: Michelle T. Bover Manderski, michelle.manderski@rutgers.edu.

**Conflict of interest** The authors declare that they have no conflicts of interest.

#### Compliance with Ethical Standards

**Research Involving Human Subjects** This study was approved by the Health Sciences Institutional Review Board at Rutgers, The State University of New Jersey.

## Keywords

South Asians; Tobacco surveillance; Survey; Measurement

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## Introduction

Tobacco is the single most preventable cause of death in the world today. In South Asian countries like India, the second largest consumer of tobacco in the world [1], chronic diseases such as cancer and diabetes have surpassed infectious disease as the leading causes of death [2]. Tobacco use is rooted in South Asian culture, and in India tobacco consumption is characterized by a large proportion of indigenous tobacco products, both smoked and smokeless. Smoked forms include bidis, cheroots, chuttas, dhumti, hooklis, chillum, and hookah, whereas smokeless forms include paan (betel quid) with tobacco, paan masala with tobacco, tobacco powder, supari (areca nut) and slaked lime preparations with tobacco, mainpuri tobacco, mawa, khaini, and gutka [3]. These popular South Asian tobacco products are readily available in ethnic enclaves in the United States (US), where South Asians are the second largest Asian group and are among the fastest growing ethnic groups [4]. Yet, there is limited research on tobacco use among South Asians in the US, and these studies have been limited in scope, focusing primarily on manufactured cigarettes and/or a specific community, city, or state [5–9]. However, studies conducted in the UK suggest that immigrant South Asians may have high rates of tobacco use and may continue use of their native tobacco products [10, 11]. Moreover, the Global Adult Tobacco Survey estimates that 25.9 and 27.2 % of adults from India and Bangladesh, respectively, are current smokeless tobacco users, often favoring local and cultural tobacco products [12].

The paucity of research on tobacco use behaviors among South Asians in the US may be due in part to the fact that, despite a distinct cultural and geographical background, South Asians are almost always aggregated into a broad “Asian” category, potentially masking subgroup differences. Additionally, research suggests that South Asians choose a wide variety of racial descriptors on surveys, which is partially dependent on the question options [13], including which race groups are presented as response options and whether or not respondents can choose multiple races. However, with respect to tobacco use, this is not the only or arguably most important methodological challenge. Health surveillance measures of tobacco use are designed to capture usage of traditional “Western” tobacco products, such as manufactured cigarettes and moist snuff. As a result, these traditional survey measures may yield biased estimates of tobacco use among South Asians in the US, who may continue to use various indigenous tobacco products but may not consider and report their use when asked about “western” tobacco products. Indeed, two local community studies of South Asians in New York City and San Francisco found tobacco use prevalence rates exceeding 25 % when questions addressed indigenous products such as bidis, gutka and paan [7, 8]. However, the extent to which the traditional tobacco survey measures may underestimate tobacco use among South Asians living in other areas of the US has not been studied.

Given the health risks of tobacco, in the context of the explosive growth of South Asians in the US, underestimating tobacco use prevalence in this population has important public

health implications. For example, tobacco control measures may not adequately address use in this population if the perceived need is underestimated. As such, to assess the accuracy of traditional health surveillance tobacco measures among South Asians living in the US, we conducted a web-based randomized split sample survey of South Asian adults that included traditional “standard” tobacco use questions, as well as questions about indigenous South Asian tobacco products.

## Methods

### Sample

The majority of survey participants were sampled from the GfK Group’s (formerly Knowledge Networks) KnowledgePanel® [14]. KnowledgePanel members are recruited via probability-based sampling of the United States Postal Service’s Delivery Sequence File, which covers approximately 97 % of U.S. households. Because members are initially contacted via postal mail, KnowledgePanel membership is not restricted to people with internet access, as is the case with typical web-based panels. Full details about GfK Group’s methodology are available on their website.

Based on their demographic profiles (i.e., believed to be aged 18 to 64 years and of South Asian ethnicity), 514 KnowledgePanel members were selected to be screened for eligibility. Of those sampled, 312 (61 %) completed the screening questions, of which 194 (62 %) qualified for and completed the main survey. In efforts to increase sample size, survey participants were asked to forward a link to the survey to other South Asian adults living in the U.S.; this yielded an additional 25 completed surveys for a total sample of 219. This study was approved by the Health Sciences Institutional Review Board at Rutgers, The State University of New Jersey.

### Instrument

Survey development was informed by review of national and state surveys, as well as the feedback from a series of focus groups [15]. The first draft consisted of ever and current use questions for six “standard” products (i.e., cigarettes, cigars, snuff, chew, pipe, e-cigarettes) and five South Asian products (i.e., bidi, gutka or pan masala, paan or betel quid with tobacco, hookah, supari with tobacco). Question wording was modeled after that found in the 2010 National Health Interview Survey Cancer Control Supplement.

The survey underwent 2 rounds of cognitive interviews with 16 participants, recruited from New Jersey, Illinois, and California through email and social media. Participants were between the ages of 18 and 64 and were of South Asian ethnicity. A key insight from the first round of interviews was the potential need for a “rarely” option for each current use question, as participants were reluctant to choose “some days” but felt that “never” was not accurate. This is consistent with the revised tobacco use definitions for non-cigarette tobacco products found in the National Adult Tobacco Survey [16]. After the first round of eight interviews, revisions were made to the survey (based on what was learned in the interviews) before a second round of eight interviews was conducted to confirm that the final version was universally interpreted by the target demographic.

## Measures

This study employed a split sample design in which participants were randomly assigned to either control (N = 116) or experimental (N = 103) group. All respondents (both control and experimental groups) were asked about ever and current use of cigarettes, cigars, snuff, chew, pipe, and e-cigarettes (“standard product questions”). Subsequently, respondents in the experimental group only were then also asked about ever and current use of bidis, gutka or pan masala, paan or betel quid with tobacco, hookah, and supari with tobacco (“South Asian product questions”). For all products, current users were defined as those now using a product every day, some days, or rarely. See Table 1 for details.

Outcomes of interest were current use of any tobacco product, current cigarette product use, and current smokeless tobacco (SLT) product use. Indicator variables for each outcome were created using both standard (i.e., based on the standard product questions only) and inclusive (i.e., based on both standard and South Asian product questions) definitions; however only the standard definitions applied to the non-experimental group, which was not exposed to the South Asian product questions. Any tobacco product use was defined in the standard way as current use of any standard product and inclusively as current use of any standard or South Asian tobacco product. Cigarette product use was defined in the standard way as current use of cigarettes and inclusively as current use of cigarettes or bidis. SLT product use was defined in the standard way as current use of snuff or chew and inclusively as current use of snuff, chew, gutka (or pan masala), paan (or betel quid) with tobacco, or supari with tobacco.

## Analysis

Prevalence of current use of cigarette products, SLT products, and any tobacco products were compared by experimental condition, where use was defined in the standard way for the non-experimental group and inclusively for the experimental group. Differences in rates by experimental condition were assessed with *T* tests, where *p* values <0.05 were considered statistically significant.

Among the experimental group only (N = 103), the accuracy of the standard product questions in this population was assessed by comparing how respondents were classified under the standard definitions versus the inclusive definitions. Considering the inclusive definition as the gold standard, sensitivity (i.e., the proportion of “true” users identified correctly by the standard definitions), negative predictive value (NPV) (i.e., the probability that a respondent identified as a non-user by the standard definitions is truly a non-user per the inclusive definitions), and false negative rates (i.e., 1-Sensitivity, 1-NPV) were calculated to gauge validity and extent of misclassification. All analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC).

## Results

The participant population was 47 % male with a mean age of 41.5 years (SD = 14.3). In general, the population was well-educated, with 77.6 % having attained a Bachelor’s degree. The majority (84 %) identified as Indian, with smaller proportions identifying as Pakistani

(12.8 %) or other ethnicities. Neither demographic characteristics nor current use of standard tobacco products differed significantly by experimental condition (all  $p$  values  $>0.1$ ) (Table 2).

Prevalence of any product use was significantly higher for the experimental group (34.7 vs. 17.2 %,  $p < 0.01$ ; Fig. 1). As well, prevalence of SLT product use was significantly higher for the experimental group (21.2 vs. 4.3 %,  $p < 0.001$ ). Prevalence of cigarette product use was also higher for the experimental group, although this difference was not statistically significant (19.6 vs. 12.9 %,  $p = 0.18$ ).

Sensitivity and Negative Predictive Value (NPV) for each standard product use definition relative to definitions inclusive of South Asian products are presented in Table 3. While the standard cigarette product question was found to be accurate (100 % sensitivity and NPV), defining smokeless tobacco users by only snuff and chew questions resulted in notable misclassification, such that only 33.3 % of true SLT users (i.e., based on the inclusive definition) were correctly classified by the standard product questions. As well, 15.2 % (1-NPV) of those classified as non-users according to the standard questions would be instead classified as smokeless tobacco users by the inclusive definition. The discrepancies are less dramatic when classifying any tobacco product use, however 30.4 % (1-Sensitivity) of true tobacco users under the inclusive definition were misclassified as non-users by the standard definition.

When comparing definitions of any tobacco product use, the discrepancies are largely driven by use of hookah and 2 indigenous smokeless products, as 46, 43, and 25 % of gutka (or pan masala), paan (or betel quid) with tobacco, and hookah users did not report use of any standard tobacco products. Comparing SLT definitions, a majority of gutka (or pan masala), paan (or betel quid) with tobacco, and supari with tobacco users (69, 86, and 75 %, respectively) did not report use of a standard SLT product.

## Discussion

This randomized split-sample study found significantly higher tobacco use rates among the experimental group, whose use was assessed by both standard and South Asian tobacco product questions, relative to a control group, whose use was assessed by standard tobacco product questions only. Specifically, the experimental group produced estimates of current SLT use that were nearly 5 times those produced by from the control group. As well, use of any tobacco product was twice as prevalent among the experimental group relative to the control group. These findings suggest that tobacco use estimates based on the standard tobacco surveillance questions may be underestimating tobacco use, especially SLT use, among South Asians living in the US.

Misclassification was evident when standard (i.e., based on standard product questions only) and inclusive (i.e., based on both standard and South Asian product questions) definitions of tobacco use were compared within the experimental group. Only one-third of inclusive SLT users were correctly classified as such by the standard questions. A more modest discrepancy was observed for classification of any tobacco product use, where nearly 30 %

of inclusive tobacco users were misclassified as non-users by the standard questions. These findings provide further evidence that the standard tobacco surveillance questions are not accurately identifying South Asian tobacco users.

Examination of specific products suggests that users of indigenous SLT products do not consider their use relevant when confronted with the standard SLT surveillance questions, as the majority of gutka (or pan masala), paan (or betel quid) with tobacco, and supari with tobacco users did not report use of snuff or chew. This issue may be compounded in surveys that include “western” descriptions and brand names within the SLT questions, which may further discourage users of indigenous products to report use. Additionally, a disconnect in understanding the socio-cultural aspects of tobacco use among South Asians may be attributing to this underrepresentation. For example, a shared belief in the South Asian community ascribes oral and digestive benefits to the areca nut; a common ingredient added to indigenous smokeless tobacco during preparation. This results in healthy benefits being associated with tobacco consumption among this population [17]. Furthermore, studies have indicated that South Asians, who consume high rates of indigenous tobacco products, typically have minimal or inaccurate knowledge of the risks associated with tobacco use [18]. Careful consideration of these cultural beliefs when developing tobacco-specific survey questions may avoid misclassification pitfalls in future tobacco surveillance efforts.

There are several limitations to this study that warrant notation. This study employs a small sample, which limited our ability to conduct stratified analyses. As well, although the majority of participants were selected from a nationally-representative panel, these unweighted results may not be generalizable to the overall population of South Asian adults in the US. Larger nationally-representative studies are required to gauge how modification of tobacco surveillance measures would impact national prevalence estimates. Additionally, because not all eligible KnowledgePanel members agreed to complete the survey, the findings are subject to selection bias. Finally, as is the case with any prevalence survey, these results are subject to self-reporting bias.

Despite these limitations, this study has several strengths. To our knowledge, this is the first study to assess the extent of tobacco health surveillance misclassification among South Asians living in the US. Additionally, this study employed a randomized split-sample design, thus minimizing confounding when comparing prevalence by experimental condition. Finally, this study’s survey instrument was informatively developed and pretested prior to fielding.

In conclusion, our findings suggest that the current tobacco surveillance measures may be underestimating tobacco use among South Asians living in the US and highlight a need to consider indigenous tobacco products when assessing tobacco use prevalence among this population. By neglecting to consider culturally-specific tobacco products, it is difficult if not impossible to assess potential contributions of South Asian tobacco products to tobacco-related disparities [7, 8]. Given the large influx of South Asian immigrants to the US, roughly doubling every decade to reach 2.04 million in 2013 [19], it is imperative to have a solid grasp on native customs, behaviors, and beliefs in order to create appropriate survey

constructs that will accurately measure the prevalence and influence of these socio-cultural factors on tobacco use.

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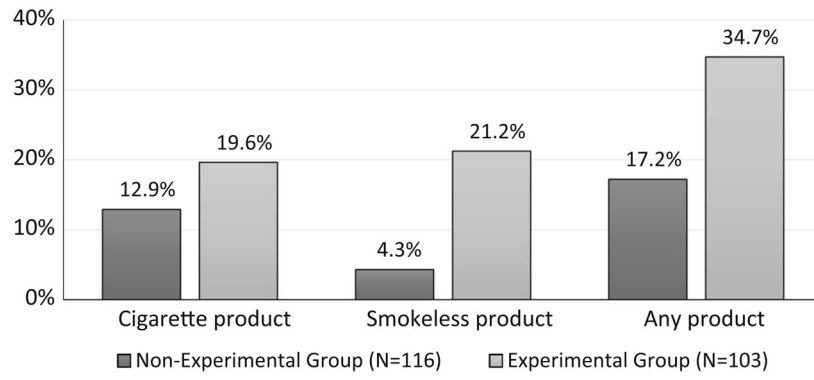
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**Fig. 1.**  
Prevalence of tobacco use by experimental condition (N = 219)

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**Table 1**

## Standard and South Asian tobacco product questions for assessing ever use

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*Standard product questions*

Have you smoked at least 100 cigarettes in your entire life?

Have you EVER smoked a cigar EVEN ONE TIME?

Have you EVER used snuff or snus, such as Skoal, Grizzly, Copenhagen, or Camel Snus EVEN ONE TIME?

Have you EVER used chewing tobacco, such as Redman, Levi Garrett, or Beech-Nut EVEN ONE TIME?

Have you EVER smoked tobacco in a pipe EVEN ONE TIME?

Have you EVER used electronic cigarettes, often called e-cigarettes, EVEN ONE TIME?

*South Asian product questions*

Have you EVER smoked a bidi or beedi, EVEN ONE TIME?

Have you EVER used Gutka (or Gutkha) or Pan Masala, EVEN ONE TIME?

Have you EVER used Paan with tobacco or Betel Quid with tobacco, EVEN ONE TIME?

Have you EVER smoked a water pipe or hookah pipe filled with tobacco, EVEN ONE TIME?

Have you EVER used Supari with tobacco, EVEN ONE TIME?

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To assess current use, participants who responded 'Yes' to an ever-use question were subsequently asked "Do you use [tobacco product] every day, some days, rarely, or not at all?" with responses of "every day," "some days," or "not at all" considered indicative of current use

Demographic characteristics and use of standard tobacco products overall and by experimental condition (N = 219)

Table 2

	Overall		Non-experimental group (n = 116)		Experimental Group (n = 103)	
	n	%	n	%	n	%
<i>Demographics</i>						
Age (mean, SD)	41.5	14.3	41.0	14.0	42.1	14.6
<i>Gender</i>						
Male	103	47.0 %	55	47.4 %	48	46.6 %
Female	116	53.0 %	61	52.6 %	55	53.4 %
<i>Ethnicity<sup>a</sup></i>						
Indian	184	84.0 %	99	85.3 %	85	82.5 %
Pakistani	28	12.8 %	15	12.9 %	13	12.6 %
Sri Lankan	5	2.3 %	3	2.6 %	2	1.9 %
Bangladeshi	6	2.7 %	2	1.7 %	4	3.9 %
Maldivian	3	1.4 %	3	2.6 %	0	0.0 %
Nepali	4	1.8 %	3	2.6 %	1	1.0 %
Bhutanese	1	0.5 %	1	0.9 %	0	0.0 %
<i>Education</i>						
<HS	11	5.0 %	3	2.6 %	8	7.8 %
HS/GED	13	5.9 %	9	7.8 %	4	3.9 %
Some college	25	11.4 %	13	11.2 %	12	11.7 %
Bachelor's+	170	77.6 %	91	78.5 %	79	76.7 %
<i>Current tobacco use</i>						
Cigarettes	35	16.1 %	15	12.9 %	20	19.6 %
Snuff or Chew	12	5.6 %	5	4.3 %	7	7.0 %
Any standard product <sup>b</sup>	44	20.5 %	20	17.2 %	24	24.2 %

<sup>a</sup> Percentages may total >100 % where participants selected multiple ethnicities

<sup>b</sup> Cigarettes, cigars, snuff, chew, pipe, or e-cigarette

**Table 3**

Sensitivity and Negative Predictive Value of the “standard” tobacco use definitions among the experimental group (N = 103), treating “inclusive” definitions as “gold standard”

	<b>Sensitivity</b>	<b>Negative predictive value</b>
<i>Current use<sup>a</sup></i>		
Cigarette product	100.0 %	100.0 %
Smokeless product	33.3 %	84.8 %
Any product	70.6 %	86.5 %

<sup>a</sup>Now use product every day, some days, or rarely

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