

# Using the Theory of Planned Behavior to Explain and Predict Areca Nut Use Among Adolescents in India: An Exploratory Study

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**Context:** Areca nut, used alone or in combination with tobacco, contributes to the high oral cancer burden in India. Used widely by adolescents, who perceive it as a harmless substance, areca nut is addictive and considered a precursor to tobacco use. Given its serious implications for addictiveness and physical health, urgent preventive interventions for areca nut use are required in India and South-East Asia. Studies examining the role of health behavior theory in explaining and predicting areca nut use and for development of its prevention among adolescents are scarce.

**Aim:** This study explored the role of the components of Theory of Planned Behavior (TPB) such as attitudes, subjective norms, perceived behavioral control, and intention in predicting areca nut use among adolescents.

**Settings and Design:** Observational study with cross-sectional design conducted with 1884 male and female adolescents attending low-income schools in Mumbai, India.

**Methods and Material:** Self-administered surveys were used to gather data on age, gender, behavioral factors and areca nut use.

**Statistical Analysis Used:** Chi-square and Mann Whitney test for bivariate and logistic regression for multivariate analysis.

**Results:** Around 27.2% of 1884 participants were areca nut users. The mean age of users was 13.75 years. Intention-to-use and perceived behavioral control were statistically significant predictors of actual areca nut use ( $p < 0.001$ ). The components of TPB such as attitude, perceived subjective social norms, and perceived behavioral control had a statistically significant effect on the intention-to-use areca nut ( $p < 0.05$ ).

**Conclusion:** This exploratory study indicates that constructs from TPB could help us understand and predict areca nut use. However, more rigorous future research is required to generate insights that help craft effective theory-based behavioral interventions for areca nut prevention and cessation in adolescents.

**Keywords:** areca nut, supari, adolescents, India, theory of planned behavior

## Introduction

Nearly 10.3% of all cancer-related deaths in India are attributed to oral cancers.<sup>1,2</sup> Along with tobacco use and alcohol consumption, areca nut is a major risk factor for oral cancer.<sup>3,4</sup> Areca nut, used with or without tobacco, causes oral premalignant conditions such as oral submucous fibrosis, oral cancer, and cancers of the esophagus.<sup>3-6</sup> It is also associated with causing or exacerbating conditions such as myocardial infarction, hepatotoxicity, obesity, type II diabetes, and asthma.<sup>7</sup> In India, areca nut is consumed alone or mixed with several ingredients including piper betel leaf (a common vine), slaked lime (calcium hydroxide), catechu, and tobacco, to make *betel quid* (colloquially known as *paan*), which is classified as a Group 1 carcinogen.<sup>3-5,8</sup> Products with only areca nut are often marketed as mouth fresheners and sold by the names of “Paan Masala” or “Supari Mix”. While gutka, commonly used in India, is a chewing tobacco preparation made of crushed areca nut, chewing tobacco, catechu, paraffin wax, slaked lime, and sweet or savory flavourings.<sup>3</sup> Addictive, toxic and cancer-causing chemicals present in areca nut-containing products are implicated in the various disease outcomes associated with their use.<sup>3</sup> Some areca nut polyphenols, such as flavonols and tannins, possibly play a causative role in oral submucous

fibrosis. Areca-specific alkaloids such as arecoline, guvacine, arecaidine and guvacoline are responsible for both addictiveness and carcinogenicity. Arecoline, a weak activator of the same brain receptors that cause nicotine addiction, is said to prime users for the addicting effects of nicotine and encourage users to add tobacco to existing areca nut use. Physical dependence, which leads to withdrawal symptoms, comes from the nicotine-like activity of arecoline. Various other brain receptors, including those targeted by narcotic drugs, are also affected.<sup>3–6</sup>

Areca nut or betel nut usage is pervasive in many South Asian and Southeast Asian countries. India contributes 59% of the global production of areca nut.<sup>9</sup> Betel quid and areca nut chewing are considered culturally acceptable behavior in many social groups. It is integrated into routine aspects of daily life, ceremonial situations, and openly shared with family members during Indian festivals.<sup>10</sup> Almost 223.79 million people, roughly one in four adults, use areca nut in India, which is more than the estimated 199 million users of smokeless tobacco.<sup>11,12</sup> Cross-sectional studies with adolescents have found prevalence of areca nut use ranging from 23% to 32%.<sup>13–15</sup> Most adolescents are unaware of the severity of harms of areca use; they report initiating areca nut use because of peer pressure, and curiosity; and existing adolescent tobacco users report concomitant consumption of areca nut.<sup>13–18</sup> Areca nut use among adolescents has been posited as a precursor to future tobacco use.<sup>3,19–21</sup> Despite experts' assessment of areca nut as risky, adolescents ranked areca use as low risk compared to smokeless tobacco, smoking and other risky activities.<sup>22</sup> Sweetened areca nut preparations marketed to children in colorful, attractive sachets as “flavored supari” reinforces the perception of areca as harmless in contrast to the bitter-tasting smokeless tobacco products. Furthermore, parental reactions to children found using areca nut were milder compared to the higher levels of parental anger with use of tobacco.<sup>18</sup>

Cultural acceptability, perception of harmlessness among adolescents, widespread availability and consumption, and rising rates of cancer in adolescent and young adult age group makes areca nut a serious public health issue in India.<sup>3,18,22–24</sup> However, in sharp contrast to numerous policies and regulations for prevention and control of tobacco use among Indian adolescents, specific programs or policies to address areca nut use are scarce. A recent review also reported a paucity of specific cessation programs for areca nut or betel quid globally.<sup>25</sup> In India, information on areca nut or betel quid use has generally been subsumed under the category of smokeless tobacco use.<sup>3</sup> Even globally there is no policy for the control of areca nut and betel quid. In comparison, the WHO Framework Convention on Tobacco Control (FCTC) provides evidence-based policies for reducing tobacco use.<sup>26</sup> After comparing data from two rounds of Global Adult Tobacco Survey (GATS), 2009–10 and 2016–17, researchers argued that health promotion interventions around harmful effects of “betel quid with and without tobacco” are needed for all genders from poorer populations with low education.<sup>27</sup>

It is imperative to apply health behavior change theories to the design of effective behavioral interventions for prevention by identifying the determinants influencing the substance-use behavior and understanding the relationships between predictor and dependent variables.<sup>28</sup> The Theory of Planned Behavior (TPB)<sup>29</sup> is one of the leading theories applied to predict smoking and tobacco use behaviors.<sup>30–33</sup> TPB theorizes that behavioral intention (a conscious motivation to act) is the primary determinant of any given behavior. That the intention to perform a behavior can be used as a proximal measure of actual behavior is seen as an important contribution of the TPB in comparison to previous models of the attitude-behavior relationship. Another helpful aspect of TPB is that it allows mapping of alternative routes to behavior change. Intention or behavior in the TPB are guided by other considerations: beliefs about the likely consequences of the behavior (behavioral beliefs), which produce a favorable or unfavorable attitude toward the behavior; beliefs about the normative expectations of others (normative beliefs), which result in perceived social pressure or subjective norm; and beliefs about the presence of factors that may facilitate or impede performance of the behavior (control beliefs), which give rise to perceived behavioral control.<sup>34</sup> Studies have found that, consistent with TPB predictions, intention often predicts tobacco use behaviors; intentions are influenced by attitudes and subjective norms; and perceived behavioral control is related to both intention and behavior.<sup>31</sup> However the literature on the use of behavioral theories to understand and predict areca nut use is scarce. The purpose of this study was to explore whether constructs or components of TPB could help explain and predict areca nut use behavior among Indian adolescents.

## Materials and Methods

### Study Design and Site

A cross-sectional design was used to study adolescents' knowledge, beliefs, intention, and use of areca nut. Adolescents constitute roughly 20% of the 18 million people living in Mumbai, one of the most densely populated urban areas of the world.<sup>35</sup> Mumbai's local (municipal) government operates more than 1000 schools and around 400,000 children are enrolled in these primary schools and secondary schools.<sup>36</sup> These municipal schools provide services to students from lower socioeconomic communities and have the same management structure, type of teachers, curriculum, and academic indicators. Twelve of these municipal schools were selected conveniently based on willingness of principals to allow students to participate, and allocate classroom space and time required for the survey. From these twelve schools, 1884 adolescent male and female students from 7th, 8th and 9th grades were included in this study. Inclusion criteria for students were willingness to participate, enrolment in relevant grade of selected school, and consent of parents.

### Data Collection

Participants completed a structured questionnaire in their respective classrooms during a specified class-period within school-hours. Trained facilitators explained each item in either Hindi or Marathi as per the students' language requirements. School teachers were not present in the classroom at the time of the survey. The facilitator read each item aloud and respondents marked their responses on the corresponding item in the questionnaire. Facilitators were trained in rapport-building with adolescents, standardized techniques of introducing and explaining questions to the students, maintaining confidentiality of respondents, and scrutinizing filled-out questionnaires for completeness. The questionnaire, designed by the researchers, was pretested with a small sample of students of similar age and background before implementation. The pre-test revealed that students found it easy to comprehend and answer dichotomous responses to items on beliefs and attitudes rather than any Likert-type scale.

### Measures

The questionnaire had twenty items related to areca nut. These items covered respondents' socio-demographic details such as gender and age. Use of areca nut was measured as a dichotomous Yes/No response to the question: 'Have you ever used areca nut (supari)? The colloquial term "supari" was used for areca nut in the questionnaire. Constructs of the TPB namely, attitudes, perceived subjective social norms, perceived behavioral control (PBC), and intention to use areca nut were operationalized through items that measured agreement or disagreement of the respondent with the following statements. Attitude to behavior of areca nut (supari) use was measured with the statement: "Supari use is cool". The statement "People who use supari have more friends" was considered a proxy measure for subjective norm. Perceived behavioral control was measured through the statement: "It is easy for me to turn down a request, made by a friend, to use supari". Behavioral intention was measured through Yes/No responses to the statement: "I intend to use supari in the next 12 months". As mentioned above, the questionnaire was pretested with a group of students, and then translated into the local languages of Hindi and Marathi and back-translated into English for verification. Two research assistants, fluent in all three languages of English, Hindi, and Marathi, conducted the translation and back-translation activities.

### Ethics

Written consent for the study was obtained from school principals and parents of students before the recruitment of their children in the study. Additionally, student assent was obtained prior to administration of the questionnaire. The study protocol complies with the Declaration of Helsinki and was approved by the Institutional Ethical Review Board of Narotam Sekhsaria Foundation and Salaam Bombay Foundation.

### Data Analysis

Data were entered in MS Excel 2007 and analyzed using SPSS software version 16.0. The dependent variable was categorized into two groups: users of areca nut and non-users. There was concomitant use of tobacco by some areca users; however, areca use was the dependent variable of interest. Descriptive statistics were generated for all variables.

Mean and standard deviation were used to summarize the continuous variable of age; frequencies and percentages were calculated for the categorical variables of gender and the other predictor variables. The ages of the groups were compared using the Mann–Whitney *U*-test. Two logistic regression models were used. First, to study the effects of areca nut related attitudes, perceived social norms, and perceived behavioral control on intention-to-use. Second, to study the effect of these three variables along with intention on self-reported areca nut use behavior. A *p*-value of <0.05 was considered statistically significant.

## Results

Of 1884 participants in this study, 957 (50.8%) were female and 927 (49.2%) male (see Table 1). The mean age of the sample was 13.43 years; 493 (26.2%) respondents were in the age range of 10–12 years, 1278 (67.8%) between 13–15 years and 113 (6.0%) were older than 15 years. Around 332 participants (17.6%) were from 7th grade, 33.5% and 48.2%

**Table 1** Comparison of Areca Nut Users and Non-Users on Sociodemographic Questions and Items for TPB Components

Variable	Total Sample N=1884 (100%)	Non-Users N=1529 (81.2%)	Areca Nut Users N=355 (18.8%)	p-value
Mean age in years	13.43 ± 1.304	13.35 ± 1.273	13.75 ± 1.386	<0.001 <sup>a</sup>
Age categories				
10–12 years	493 (26.2)	422 (27.6)	71 (20.0)	<0.001 <sup>b</sup>
13–15 years	1278 (67.8)	1029 (67.3)	249 (70.1)	
16–18 years	113 (6.0)	78 (5.1)	35 (9.9)	
Sex				
Female	957 (50.8)	891 (58.3)	66 (18.6)	<0.000 <sup>b</sup>
Male	927 (49.2)	638 (41.7)	289 (81.4)	
Grade categories (N=1873)				
7th standard	332 (17.6)	269 (17.7)	63 (17.7)	0.149 <sup>b</sup>
8th standard	632 (33.5)	527 (34.7)	105 (26.9)	
9th standard	909 (48.2)	722 (47.6)	187 (52.7)	
Users of tobacco	147 (7.8)	18 (1.2)	129 (36.3)	<0.000 <sup>b</sup>
TPB variables				
Supari use is cool. (Attitude) (“Agree” responses)	447 (24.0)	346 (22.9)	101 (29.0)	0.018 <sup>b</sup>
People who use supari have more friends. (Perceived norms) (“Agree” responses)	840 (44.7)	666 (43.7)	174 (49.3)	0.058 <sup>b</sup>
It is easy for me to refuse <i>supari</i> from a best friend. (Disagree responses provided here) (Perceived behavioral control)	371 (19.9)	271 (17.9)	100 (28.5)	<0.001 <sup>b</sup>
I intend to use <i>supari</i> in the next 12 months. (Intention) (Yes responses here)	253 (13.5)	93 (6.1)	160 (45.3)	<0.001 <sup>b</sup>

**Notes:** <sup>a</sup>*p*-value based on the Mann–Whitney *U*-test, <sup>b</sup>*p*-value based on a chi-square test.

from 8th and 9th grades respectively. Slightly less than one-fifth ( $n=355$ , 18.8%) of the participants were areca nut users. More than one-third ( $n=129$ , 36.3%) of 355 areca nut users also reported concurrently using tobacco.

There was a significant bivariate relationship between age and areca nut use and between gender and areca nut use. Areca nut users were predominantly male ( $n=289$ , 81.4%) and 249 (70.1%) were in the age category of 13 to 15 years. Reported areca nut use showed a gradual progression with age. Only 14.4% of those in 10–12 years age category reported use as compared to 19.5% of 13–15 year olds and 30.9% of 16–18 year olds. More than half (50.2%) of all areca nut users were in the 9th grade although the relationship between grade and areca nut use was not statistically significant.

Two binomial logistic regression models helped to ascertain the effects of items that measured the components of TPB such as attitude, subjective norm, and perceived behavioral control on intention-to-use areca nut and on actual behavior. Attitude [Odds ratio (OR = 1.731), subjective norm [OR = 1.873], as well as perceived behavioral control [OR = 1.756] were found to explain 5.5% of variance in intention-to-use areca nut ( $p<0.01$ ) in the first model. The second logistic regression model showed that these TPB predictor variables along with intention explained 24.7% of actual areca nut use behavior (see Table 2). Intention was a strong predictor of actual areca nut use, with those intending to use areca nut in the next 12 months being 12.726 times more likely to report use than those who did not ( $p<0.001$ ). Whereas attitude and subjective norm did not have any significant effect on areca nut use behavior, perceived behavioral control had a significant effect on this behavior [OR = 1.588] ( $p<0.01$ ).

**Table 2** Binomial Logistic Regression Models to Explain Intention to Use and Actual Areca Nut Use Behavior

<b>INTENTION TO USE ARECA NUT (binomial dependent variable)</b>			
<b>Factor</b>	<b>Odds Ratio (OR)</b>	<b>95% confidence interval For OR</b>	<b>p-value</b>
Attitude (Supari use is cool.) [Ref=Disagree]	1.731	1.288–2.325	<0.001**
Perceived subjective social norms (People who use supari have more friends.) [Ref=Disagree]	1.873	1.419–2.471	<0.001**
Perceived behavioral control (It is easy for me to refuse supari from a best friend.) [Ref=Agree]	1.756	1.285–2.399	<0.001**
Cox & Snell R Square	0.030		
Nagelkerke R Square	0.055		
<b>ARECA NUT USE BEHAVIOR (binomial dependent variable)</b>			
<b>Factor</b>	<b>Odds Ratio (OR)</b>	<b>95% confidence interval for OR</b>	<b>p-value</b>
Attitude (Supari use is cool) [Ref=Disagree]	0.954	0.698–1.303	0.766
Perceived subjective social norms (People who use supari have more friends.) [Ref=Disagree]	0.925	0.705–1.213	0.571
Perceived behavioral control (It is easy for me to refuse supari from a best friend.) [Ref=Agree]	1.588	1.160–2.174	0.004**
Intention to use (Do you intend to use supari in the next 12 months?) [Ref=No]	12.726	9.359–17.305	<0.001**
Cox & Snell R Square	0.152		
Nagelkerke R Square	0.247		

**Note:** \*\*Significant at 0.01 level.

## Discussion

This study explored whether the use of health behavior theory, specifically TPB, could help explain and predict areca nut use among Indian adolescents. Emerging insights could help in the design of appropriate prevention programs for areca nut use among adolescents. While there is strong evidence for the usefulness of TPB in explaining a wide variety of behaviors,<sup>37–40</sup> to the best of our knowledge, this is one of the first studies that examined the role of this theory in understanding areca nut use among adolescents in India. In general, there are very few studies that have attempted to use a theory-lens to examine areca nut-use behavior.<sup>41,42</sup>

There is evidence of a strong association between intention and actual behavior in studies done on a variety of behavioral outcomes.<sup>39</sup> However, the question is whether the intention-behavior connect found in TPB studies actually holds for the specific behavior of areca use? In the present study adding the variable of “intention to use” to the logistic model helped explain nearly a fourth (Nagelkerke R Square of 0.247) of the variation in areca nut use behavior; and those who reported positive intention to use were nearly 12 times as likely to use areca nut. The present study findings are consistent with past research on TPB for other behaviors as well as a study with college students in Southern Taiwan, which examined whether the Attitudes-Social Influence-Efficacy (ASE) Model explained the psychosocial process of betel quid use among students. Their research found that the model accounted for 26.5% of the variance in betel quid use and intention to chew affected the use of betel quid.<sup>41</sup> Therefore, this present study along with other limited evidence indicates, as TPB predicts, that intention-to-use could be a strong predictor of actual areca nut use behavior.

Greater cultural acceptance and easy accessibility of areca nut provides an environmental context conducive to substance use. An adolescent with greater behavioral control is more likely to refrain from using the substance if an opportunity arises. Perceived behavioral control, often considered as important as intention in TPB, can serve as a proxy for actual control and contribute to the prediction of the behavior.<sup>43</sup> The present study, similar to findings from studies on tobacco use behavior,<sup>31</sup> found perceived behavioral control to be associated directly with actual behavior of areca nut use. These findings are similar to the study with college students in Taiwan where both social influence and refusal self-efficacy had a direct impact on intention and actual use or behavior as well as an indirect effect on use through intention.<sup>41</sup>

While TPB posits that intention influences behavior, it also states that intention is influenced by three different considerations: favorable or unfavorable attitude toward the behavior; perceived social pressure or subjective norm; and perceived behavioral control.<sup>43</sup> These three components - attitudes, subjective norms and perceived behavioral control - can be manipulated and altered while designing prevention programs in order to improve effectiveness of behavior change interventions.<sup>40,44</sup> The present exploratory study found that all three components – favorable attitude towards areca nut use (cool behavior), perceived subjective social norms (areca nut users have more friends), and low perceived behavioral control (very difficult to turn down a friend’s request to use) – were significant predictors of the intention to use areca nut. Although, these three variables explained only 5.5% of the variance in intention-to-use (Nagelkerke R Square of 0.055 in Table 2). In the present study, the low R-squared could be due to the data containing an inherently higher amount of unexplainable variability. In general, studies attempting to explain human behavior, which is hard to predict, tend to have lower R-squared values. It is also possible that additional predictors such as age or gender could increase the explanatory power of the model. However, these additional variables are not utilized because the present study explores whether the components of TPB are able to predict areca nut use behavior in Indian adolescents. Despite the magnitude of association (Odd ratios) for the TPB predictor variables being low, the significant p-values of these associations indicate a real relationship between the TPB components and areca nut use behavior. This should give us confidence that TPB could explain areca nut use behavior among Indian adolescents. However, this deserves further examination in rigorously conducted research in the future.

An important limitation of this study is the constrained manner of assessment of the components of TPB. Single items, which appear “on their faces” to measure the constructs of interest, were used to measure attitude, perceived subjective norms, and perceived behavioral control. Face validity offers weak evidence that the item is measuring what it is supposed to. For instance, the measure of perceived behavioral control assessed response to a friend’s request to use. The measure used in this study is unable to tell us the response if a family member made the request to use. Perceived subjective social norms were assessed using just one question. The statement “Supari use is cool” relies on a very general

understanding of “what is cool.” Responses may also depend on how the adolescent perceives himself or herself. The items used and the lack of use of scales could have led to confusion about what the construct exactly referred to and invalid conclusions about the relationships between variables. For these reasons, the present study should only be considered as an exploratory one paving the way for a more rigorous future study.

Scales or questionnaires that study the various determinants of areca nut use among adolescents are scarce. Future research should pay attention to item-generation and scale-construction for a theoretical study of areca use behavior. Item measures should have face, content, and construct validity. Ultimately, the item, scale, or method of measurement should match the construct of interest. Do the new items or scales truly measure the construct of attitude to areca nut use, subjective norms around areca nut, or perceived behavioral control with respect to areca nut use. Item-development, based on the appropriate definition of the conceptual domain, should be based on a combination of both deductive and inductive approaches, and use both experts and target population members.<sup>45</sup>

Future studies must also use a more appropriate questionnaire with the direct and indirect measurement of the various components of TPB.<sup>43,44</sup> Direct measures could consist of appropriate scales measuring attitude, especially evaluative, instrumental and experiential aspects of the behavior of areca nut use. Subjective norms could be measured using questions referring to the opinions of important people in general about areca nut use. Items directly measuring perceived behavioral control should assess self-efficacy and beliefs about controllability of the areca nut use behavior. Indirect measures, identified through elicitation studies with samples of 25 to 30 young people, could consist of multiple items on behavioral beliefs, normative beliefs, and control beliefs about areca nut use. Self-identity, especially stronger sense of self, has been found to be associated with greater intention to perform a behavior, and should be included as a measure in future studies.<sup>46</sup> Researchers have also pointed out limitations of TPB in its exclusive focus on rational reasoning variables and also its predictive ability for complex behaviors.<sup>47,48</sup> There is evidence that behavior may be influenced by factors that are not mediated by the TPB constructs, such as non-conscious processes or impulses.<sup>39</sup> Affect and emotions have been found to influence intentions and behavior and thus an extension of TPB framework could be used in future studies on areca nut use behavior.<sup>49</sup>

It is also important to note that this sample consisted of students attending schools serving low-income communities from a crowded urban area; they might not be representative of adolescents in the rest of the country. This study used a convenient sample of adolescents from schools that were part of a tobacco prevention program; therefore, many participants might have received education about the harms of tobacco and other substances leading to socially desirable responses.

## Conclusions

This study, while exploratory, helps to demonstrate the potential usefulness of the constructs of the TPB in predicting areca nut use among adolescents in India, while keeping in mind that the sample studied belonged to a specific socio-economic and urban category. The findings that the variables of intention and perceived behavioral control effects areca nut use behavior among adolescents in India while attitudes toward areca nut use and subjective norms have an effect on intention, are consistent with findings of TPB studies in the context of other behaviors and a few studies on areca nut use. TPB could be useful in designing future research studies and educational, preventive and cessation interventions could benefit from incorporating components of this theory. Studies have found that adolescents in India perceive areca as harmless and consider it acceptable to use areca with friends,<sup>18</sup> and while these attitudes and subjective norms have to change, perceived behavioral control in terms of tackling peer pressure can be improved through assertiveness training or refusal skills in school-based prevention programs. Legislative measures, similar to those used in tobacco prevention, such as warning labels on sachets, rigorous enforcement of ban on sales to minors, and curbs on sales near schools could also help address attitudes and reduce the opportunities to use areca nut. Community and mass media interventions that address social norms around areca nut are needed because both adolescents and parents do not perceive areca as harmful.<sup>18,22</sup> Future research using rigorously constructed items and scales to measure behavioral determinants of TPB will help craft effective interventions for the prevention and cessation of areca nut use.

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## Disclosure

The authors declare no conflicts of interests.

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