The Betel Quid Dependence Scale: Replication and extension in a Guamanian sample

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Abstract

Background—Betel quid is the fourth most commonly consumed psychoactive substance in the world. The Betel Quid Dependence Scale (BQDS) is the first instrument designed specifically to measure betel quid dependence. The three factor structure of the BQDS consists of "physical and psychological urgent need," "increasing dose," and "maladaptive use." The BQDS initially was validated in a sample of male prisoner ex-chewers in Taiwan.

Objective—To replicate and extend the original validation research on the BQDS in a sample of male and female current betel quid chewers in Guam.

Methods—A survey containing the BQDS was administered to 300 current betel quid chewers in Guam. Participants were compensated for their time with a gift card worth $25.

Results—Confirmatory factor analysis revealed an adequate fit with the hypothesized three-factor measurement model. ANOVAs and structural equations modeling revealed that betel quid dependence is associated with the inclusion of tobacco in the quid, number of chews per day, years of chewing, and education.

Conclusions—The BQDS is valid for current English-speaking male and female chewers in Guam. Overall levels of betel quid dependence were high, and most chewers included tobacco in their betel quid. The results suggest that levels of dependence for betel quid are similar to those observed for nicotine dependence. Future research should explore other important psychological and behavioral aspects of betel quid chewing such as health risk perceptions and motivation to quit chewing.

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Conflict of interest

All authors declare that they have no conflict of interest.

Keywords

Areca nut; Betel quid; Dependence; Betel nut

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1. Introduction

Betel quid is the fourth most commonly consumed psychoactive substance in the world, following only alcohol, nicotine, and caffeine in prevalence (Boucher and Mannan, 2002; Warnakulasuriya and Peters, 2002). Although betel quid is chewed by approximately 600 million people globally, its use is concentrated in South Asia, Southeast Asia, and Pacific islands (Gupta and Warnakulasuriya, 2002). The primary ingredient of betel quid is areca nut, which is the seed of the palmaceous *Areca catechu* tree. The areca nut often is referred to colloquially as "betel nut" in Guam. The term "betel quid" refers to a combination of ingredients that most typically includes areca nut, piper betel leaf (a common vine), slaked lime (calcium hydroxide), and tobacco, though the ingredients of quid vary considerably by region, country, ethnicity, and personal preference (IARC Working Group on the Evaluation of Carcinogenic Risks to Humans, 2004; Winstock, 2002). In Guam, the term "betel nut" can refer to the areca nut chewed as the sole ingredient of the quid or as a betel quid containing piper betel leaf, slaked lime, tobacco, and potentially other ingredients. The term "betel quid" is used in the current manuscript to refer to any preparation of chewed areca nut, including the nut alone and all admixtures involving betel leaf, slaked lime, tobacco, and other ingredients.

Betel quid chewing is an important behavior from a public health perspective because it is associated with a variety of health issues, most notably oral cancer and precancerous conditions such as leukoplakia and oral submucous fibrosis (Trivedy et al., 2002). Consequently, betel quid has been classified as a Group 1 carcinogen by the International Agency for Research on Cancer (IARC Working Group on the Evaluation of Carcinogenic Risks to Humans, 2004; Lin et al., 2006). The research literature on betel quid mostly has focused on the epidemiological and biological aspects of chewing betel quid (Ghani et al., 2011; Lee et al., 2012a). Despite the global pervasiveness of betel quid, little progress has been made in understanding the behavioral and psychological aspects of betel quid chewing. This is unfortunate, because behavioral and psychological research is essential for the purposes of designing interventions to reduce betel quid chewing and to decrease its global disease burden.

1.1. Betel quid dependence

Drug dependence, also known as addiction, is an essential construct in behavioral and psychological investigations of addictive substances. Research about betel quid dependence has been limited. A few studies (Benegal et al., 2008; Chandra et al., 2003; Lee et al., 2012a; Mubeen et al., 2010) have assessed betel quid dependence using approaches based upon the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychiatric Association, 2000) and the ICD-10 (World Health Organization, 1992). These studies involved generic assessments of dependence rather than measuring aspects of dependence specific to betel quid. Alternatively, a few studies have assessed betel nut dependence using

adapted versions of dependence scales that were designed for substances other than betel quid such as opioids (Winstock, 2002) or tobacco (Bhat et al., 2010).

1.2. Betel Quid Dependence Scale (BQDS)

Lee et al. (2012b) recently developed, and provided initial validation for, the first instrument designed specifically for measuring betel quid dependence: the Betel Quid Dependence Scale (BQDS). The BQDS is comprised of three factors: "physical and psychological urgent need," "increasing dose," and "maladaptive use." The BQDS was found to have good internal consistency ($a = .92$) and construct validity. However, the scale development and initial validation was limited in several respects. The BQDS was developed and evaluated in a sample of male prisoners in Taiwan with a history of betel quid chewing behavior prior to incarceration (Lee et al., 2012b). As a result, the scale has not been evaluated employing a sample of current chewers, nor has it been evaluated among women. In addition, the scale was originally developed and evaluated in Chinese, and the results were translated into English for purposes of publication. Thus, the psychometric properties of the scale have not been evaluated in English and other languages. Before the BQDS scale can be used for clinical or research purposes in English, the hypothesized factor structure should be validated in a sample of English-speaking chewers of both genders. In the current study, we aimed to validate the BQDS among a sample of English-speaking male and female betel quid chewers living in Guam.

1.3. Betel quid chewing in Guam

Betel quid chewing customs vary throughout the world by country, region, and ethnicity. The current analyses employ a sample of betel quid chewers from the Micronesian island of Guam, which is a United States territory in the Western Pacific. The most populous ethnic group on Guam is the native Chamorros. However, recent years have witnessed a substantial influx in non-Chamorro Micronesians from neighboring islands such as Chuuk, Yap, Palau, and others (Office of the Governor of Guam, 2009). The different ethnic groups of Guam have different practices regarding betel quid chewing (Paulino et al., 2011). Some Chamorro chewers favor chewing a mature "red" variety of areca nut with the husk of the seed removed. Non-Chamorro Micronesian chewers prefer the young green nut with the husk attached. Further, some Chamorros prefer chewing the areca nut as the sole ingredient of the quid (i.e., without slaked lime, betel leaf, tobacco, or other additives). Most non-Chamorro Micronesian chewers add slaked lime, betel leaf, tobacco, and other ingredients. Although Guam represents a unique betel quid chewing environment with ethic differences in chewing practices within the island, the results of the current study are likely to be informative to betel quid researchers globally.

1.4. Research objectives

The primary objective of the current research is to replicate and extend the original validation research on the BQDS in a sample of male and female current betel quid chewers in Guam. In addition, associations between betel quid dependence and several key variables (e.g., inclusion of tobacco in the quid, number of chews per day, years of chewing, education) will be examined. This research contributes to an incipient research literature that

examines psycho-social and behavioral aspects of betel quid chewing. Ultimately, this research could inform efforts to develop efficacious betel quid cessation and risk reduction programs in Guam and elsewhere in the Asia-Pacific region.

2. Methods

2.1. Procedure

The current analyses are part of a larger study that examines psychological, behavioral, and cultural issues related to areca nut and betel quid chewing among self-identified betel quid chewers and ex-chewers in Guam. Adult participants were recruited via newspaper advertisements, flyers, and community events in Guam. Potential participants were asked a series of questions at the initial screening to determine chewer status. For the current analyses, participants ($N = 300$) were limited to self-identified chewers who reported chewing for at least three years, and at a current rate of at least once per week. Informed written consent was obtained prior to participation in the study. Most surveys (98%) were administered in-person at community events. A small percentage of surveys (2%) were distributed through the mail. Mail respondents also received stamped and addressed return envelopes. Upon receipt of completed questionnaires, all participants were provided with a $25 gift card. The research protocol for this study was approved by the University of Guam Institutional Review Board and the University of Hawaii at Manoa Institutional Review Board.

2.2. Participants

A total of 300 adult betel quit chewers were included in the analyses. Table 1 provides the demographic characteristics of the sample. The mean age of the sample was 35.3 years old (SD = 21.7). The sample was 51.7% male, and 56.7% had completed high school. The ethnic distribution of the sample was as follows: 33.1% Chamorro, 30.1% Chuukese, 23.8% Palauan, 6.0% Yapese, and 7.0% other (e.g., Carolinian, Filipino, Marshallese). Participants reported chewing for a mean of 14.9 years (SD = 12.7) and 12.5 times per day (SD = 14.5). Only 10.4% of participants reported chewing areca nut alone (i.e., as the sole ingredient of the betel quid), whereas 69.9% reported adding tobacco to their betel quid. As expected, most "nut alone" chewers were Chamorro, whereas most non-Chamorro chewers chewed betel quid with tobacco added (see Table 2).

2.3. Measures

2.3.1. Demographics—Information related to age, gender, education, and ethnicity was collected. Ethnicity was assessed by an open-ended item asking participants to indicate "the one ethnic group you most identify with."

2.3.2. Betel Quid Dependence Scale (BQDS) (Lee et al., 2012b)—The BQDS is a 16-item scale assessing betel quid dependence (see Table 3). Each item in the BQDS employs a dichotomous outcome (No = 0 and Yes = 1). The factor scores and total BQDS score were coded to range from zero to one so that each score represented the proportion of items endorsed (e.g., a score of .50 would mean that half of items were endorsed). Research by Lee et al. (2012b) revealed a three-factor structure for the BQDS, including "physical and

psychological urgent need" (seven items), "increasing dose" (five items), and "maladaptive use" (four items).

2.3.3. Betel quid consumption—Betel quid consumption was assessed through three items: number of chews per day, number of years as a chewer, and the type of betel quid (i.e., areca nut alone, betel quid without tobacco, or betel quid with tobacco).

2.3.4. Data analysis—Data analysis was performed in several phases. Percentages of "yes" responses to each item of the BQDS were calculated. Next, a confirmatory factor analysis was performed to test the factor structure revealed by Lee et al. (2012b). Based on the exploratory factor analysis conducted by Lee et al. (2012b), a CFA was conducted on a hypothesized measurement model which included "physical and psychological urgent need" as a latent variable with seven indicator items, "increasing dose" as a latent variable with five indicator items, and "maladaptive use" as a latent variable with four items as indicators (see Fig. 1). To assess the hypothesized factor structure of the BQDS, a CFA was conducted using weighted least squares estimation. This approach is preferred when employing categorical observed variables and sample sizes of 200 or larger (Flora and Curran, 2004; Muthén et al., 1997).

To test the measurement invariance of the hypothesized model across genders, equivalence of the configural model and factor-loadings was tested across genders using nested-model chi-square difference tests within the multiple-group comparison framework. First the hypothesized model was tested in the overall sample. Next, the configural model was tested for equivalence across genders by estimating the model separately by gender. Next, gender equivalence of factor-loadings was tested by comparing the nested model (i.e., the model with factor loadings constrained across genders) to the base model (i.e., the model with factor loadings freely estimated across genders) using the nested-model chi-square difference test. Significant chi-square difference represented acceptable fit of the less restrictive model (Meredith, 1993).

Next, the BQDS was assessed with regard to differences in the type of betel quid chewed. Lastly, the demographic and betel-nut related predictors of the BQDS were assessed using structural equation modeling. Structural equation modeling was conducted using maximum likelihood estimation to assess the associations of the chewers' characteristics with BQDS constructs. Specifically, we examined age, gender, education, ethnicity (i.e., Chamorro versus others and Chuukese versus others), years of betel quid use, average rate of daily chewing, and inclusion of tobacco in betel quid as predictors of BQDS constructs. Thus, the predictors were specified as exogenous variables and the BQDS were specified as criterion variables.

To ensure adequate fit of the models, rigorous evaluation criteria were adopted. A chi-square test was chosen as the statistical test of model fit ($a = 05$). Because this test can be sensitive to minor deviations in model fit in large samples (Ho, 2006), the comparative fit index (CFI), Tucker–Lewis Index (TLI), root mean square error of approximation (RMSEA), and weighted root mean square residual (WRMR) also were used to evaluate the model fit (Bentler, 2007; Yu and Muthén, 2002). The following cut-offs were employed for

establishing adequate fit: CFA   .95 (Hu and Bentler, 1999); TLI   .95 (Hu and Bentler, 1999); RMSEA < .05 (Ho, 2006); WRMR < 1.0 (Yu and Muthén, 2002). Analyses were conducted in MPLUS (6.11).

3. Results

3.1. Percentage of participants endorsing each BQDS item

Table 3 displays the items that comprise the BQDS. The items are grouped according to the factor structure revealed by Lee et al. (2012b). The percentage of participants who endorsed each item in the current study is presented in addition to rank order of each item (the most frequently endorsed item is ranked as "1"). The proportion endorsed and rank of each item for the Lee et al. study also is presented for comparison. The results reveal relatively high levels of endorsement for "physical and psychological urgent need" (mean percentage = 61%) and "increasing dose" (mean percentage = 61%), whereas endorsement levels for "maladaptive use" were lower (mean percentage = 31%). The results also indicate that item endorsement levels were systematically higher for the current sample as compared to Lee et al. (2012b).

3.2. Confirmatory Factor Analysis (CFA)

The hypothesized model fit reasonably well to the data (see Table 4, Model 1). Model fit indices were as follows: $\chi^2 = 238.89$, df = 101, $p < .0001$; RMSEA = 0.07, 90% CI = 0.06, 0.08; CFI = 0.98; TLI = 0.98; WRMR = 1.21. However, as seen in Fig. 1, two of the three latent factors, "physical and psychological urgent need" and "increasing dose," were strongly correlated ($r = .92$, $p < .0001$). Thus to find out whether the items indicating these two factors represented a single factor, we conducted a chi-square difference test of nested models comparing the three factor model with a two factor model where items hypothesized to indicated "physical and psychological urgent need" and "increased does" were allowed to load on a single factor. We found that although the two-factor model showed an acceptable fit to the data, the fit was not significantly better than the fit of the three-factor model (see Table 4, Model 2).

The multi-group comparison of the three-factor model across genders suggested that the model was invariant across genders. The chi-square difference test indicated that the fit of the model when the factor loadings were constrained to be equal across gender was not significantly different from the fit of the model when factor loadings were estimated freely across genders (Chi-square difference [13] = 13.03, $p = .45$; see Table 4, Models 3 and 4).

3.3. Mean BQDS factor scores by quid type

Table 5 displays the means for the BQDS factors by type of quid chewed. Analysis of variance (ANOVA) was conducted with Least Squares Mean (LSM) comparisons to assess mean differences of the overall BQDS and each of the BQDS subscales across quid type groups. Significant differences across quid type groups were found for the overall BQDS, $F(2, 294) = 27.51$, $p < .0001$, "physical and psychological urgent need," $F(2, 294) = 29.57$, $p < .0001$, and "increasing dose," $F(2, 294) = 43.34$, $p < .0001$, but not for "mal-adaptive use." Multiple comparisons across quid type groups using Tukey's Studentized Range

(HSD) test revealed that chewers who used quid plus tobacco had significantly higher rates of dependence on the overall BQDS and on the "physical and psychological urgent need" and "increasing dose" scales compared to the other two groups. There were no significant differences between chewers who reported chewing the nut alone and quid without tobacco.

3.4. Structural equation modeling

A structural equation model (SEM) was employed to provide a more comprehensive analysis of the correlates of betel quid dependence (see Fig. 2). The hypothesized model provided an adequate fit to the data ($\chi^2 = 349.12$, df = 187, $p < .0001$, RMSEA = 0.05, 90% CI = 0.05, 0.06, CFI = 0.98, TLI = 0.98, WRMR = 1.05). Age and gender were not significantly related to any of the BQDS constructs (ps > .10). Education was protective against "physical and psychological urgent need" and "increasing dose," but positively associated with "maladaptive use." "Chews per day" was significantly associated all three constructs of betel quid dependence. Adding tobacco to the betel quid was positively associated with "physical and psychological urgent need" and "increasing dose," whereas a longer history of use was positively associated with "physical and psychological urgent need" but negatively associated with "maladaptive use." Ethnicity was not included in the SEM due to its strong association with "adding tobacco." For ease of interpretation, nonsignificant paths appear as dashed lines and covariances are not shown in Fig. 2. A polychoric correlation matrix of the variables included in the SEM appear in Table 6.

4. Discussion

The current study replicates and extends previous findings about betel quid dependence by employing the BQDS (Lee et al., 2012b) in a multivariate analysis of betel quid chewers in Guam. The results reveal that the BQDS has good convergent validity and construct validity in an English-speaking sample of male and female chewers. Previously, the BQDS had been validated only with a sample of male ex-chewer prisoners in Taiwan. Mean BQDS scores of the current sample were consistently higher as compared to the Lee et al. (2012b) sample. This result is not surprising, given that our sample consisted of chewers reporting on their current experiences of betel quid dependence rather than ex-chewers reporting retrospectively. Each category of chewer in our sample evinced substantial levels of betel quid dependence. However, chewers who add tobacco to their betel quid revealed the highest overall dependence levels. Frequency of chewing also was a consistent correlate of greater betel quid dependence.

The results of the study revealed an association between the ingredients of betel quid and the ethnicities of chewers. The Chamorros in our sample were notable for their diversity of chewing practices. Among Chamorros, 30% chewed the "nut alone," 32% chewed betel quid without tobacco, and 39% chewed betel quid with tobacco. The other ethnic groups represented in the study demonstrated a strong preference for chewing betel quid with tobacco added. The structural equations model revealed that adding tobacco to the quid, higher rates of chewing, ("chews per day") and greater number of years chewed, were associated with betel quid dependence. Education was protective against betel quid dependence, except in the case of the "maladaptive use" factor.

The structural equations model revealed generally straightforward findings with regard to the "physical and psychological urgent need" and "increasing dose" factors. In contrast, the "maladaptive use" factor produced some findings that were more difficult to explain. For example, it is not clear why education was positively associated with "maladaptive use," or why a longer history of betel quid use was negatively associated with "maladaptive use." These findings could involve complex interactions among such factors as ethnicity, type of areca nut chewed, dental hygiene, access to dental services, and other variables.

4.1. Measurement of betel quid dependence

The measurement of betel quid dependence is likely to undergo continued development as behavioral and psychological researchers focus more on betel quid as a global public health issue. Thus far, measurement of betel quid dependence has employed the strategy consistent with the DSM (American Psychiatric Association, 2000) and the ICD-10 (World Health Organization, 1992), whereby a chewer ultimately is categorized either as dependent or not dependent. The current study assessed betel quid dependence as a continuous variable, which is consistent with current approaches to measuring dependence in more developed research literatures such as the nicotine and tobacco research literature. Future research should continue to assess betel quid dependence as a continuous construct, consistent with the tobacco research literature. The current analyses provided support for the BQDS as a valid instrument. However, researchers also should investigate alternative measures that could be useful for assessing betel quid dependence in clinical and research settings. For example, a brief instrument adapted from the Fagerström Test of Nicotine Dependence (FTND; Heatherton et al., 1991) could be developed that would allow researchers and clinicians to assess betel quid dependence quickly with a few items.

4.2. Public health implications

The results of the current study have important public health implications. The most important finding is the generally high levels of betel quid dependence revealed in our sample of chewers. Although dependence was associated with the type of betel quid consumed, it is worth emphasizing that dependence levels were substantial among all categories of chewers in our sample. These findings suggest that betel quid cessation will not be easy to achieve, and that parallels with tobacco and nicotine dependence are likely to be valid. Further, understanding betel quid dependence is an important intermediate objective toward the ultimate goal of developing effective betel quid cessation and harm reduction programs. The specific chewing context of Guam may require some tailoring of cessation interventions based on quid ingredients, given the differences in dependence observed related to both quid type and ethnicity (Paulino et al., 2011). For example, chewers who add tobacco to their quid might benefit from a more intensive dependence treatment as compared to those who chew the "nut alone." Developers of betel quid cessation programs in other parts of the world will need to carefully consider the many cultural, religious, and economic aspects that affect chewing practices, beliefs, and customs in each region.

4.3. Limitations

The current study has limitations. The sample was limited to the Micronesian island of Guam. However, the current study builds upon a previous study based in Taiwan (Lee et al.,

2012b). Thus, the BQDS now has been validated in two distinct cultures and two languages. A convenience sample was employed. As such, the results of the current study may not be representative of Guam chewers generally. However, the sample included a broad range of chewers in terms of ethnicity, gender, and age. The cross-sectional design of the study precludes conclusions regarding causality. Future longitudinal research is needed to assess the predictive validity of the BQDS.

4.4. Future research

The current study presents novel data regarding betel quid dependence in an ethnically diverse sample of chewers in Guam. More international research is needed to assess betel quid dependence globally using the BQDS and other continuous measures of betel quid dependence. The current study and others add to the incipient research base addressing psycho-social and behavioral aspects of betel quid chewing. Despite the global prominence of betel quid as the fourth most consumed psychoactive substance in the world, very little data exists for such topics as: motivation to quit chewing betel quid, self-efficacy to quit chewing, health risk perceptions for betel quid chewing, and other variables. Assessment and analysis of these variables should be a precursor to the development of culturally tailored betel quid cessation and risk reduction programs. Development of such programs may help to assist some betel quid chewers to quit as well as bring attention to the often neglected issue or oral cancer, which is one of the most common and lethal cancers affecting the Asia Pacific region.

Acknowledgments

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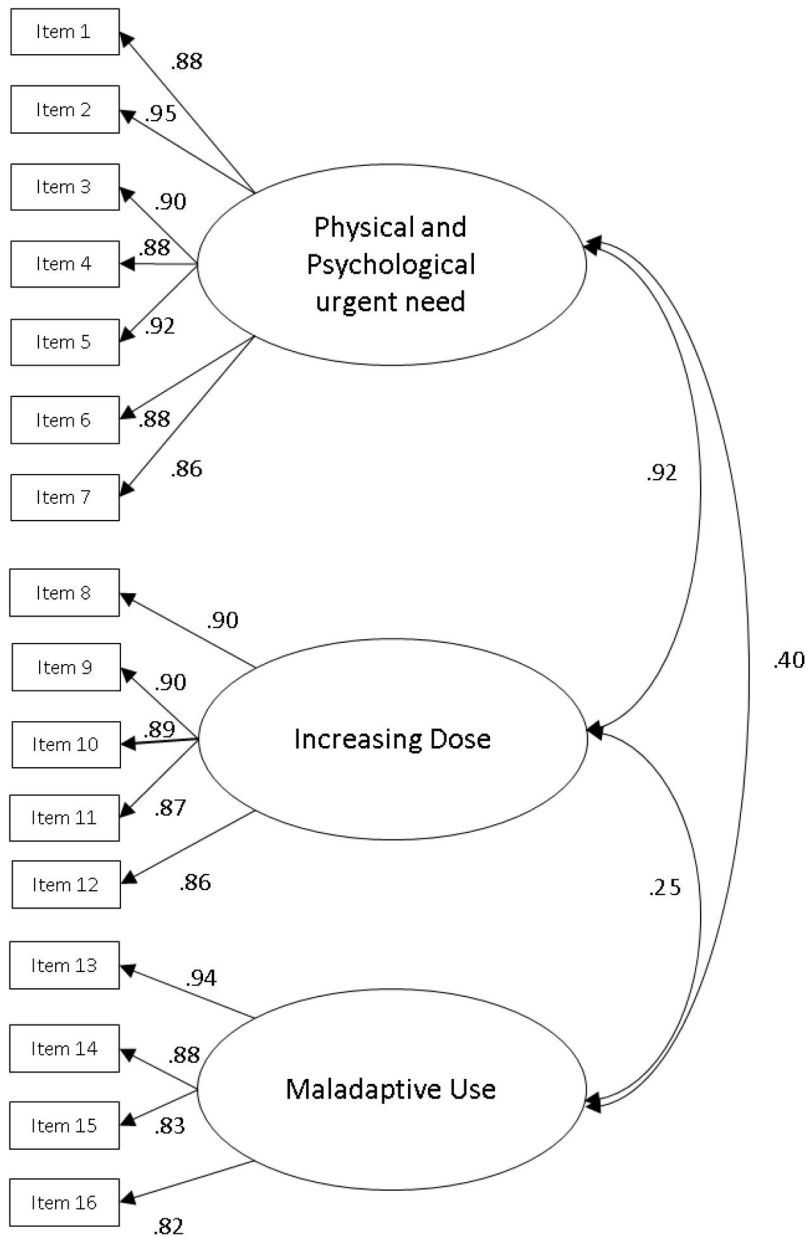**Fig. 1.**
Three-factor betel nut dependence measurement model. *Note*: Ellipses represent latent constructs and rectangles represent measured variables. Standardized parameter estimates are presented. All parameters are significant at *p* < .001.
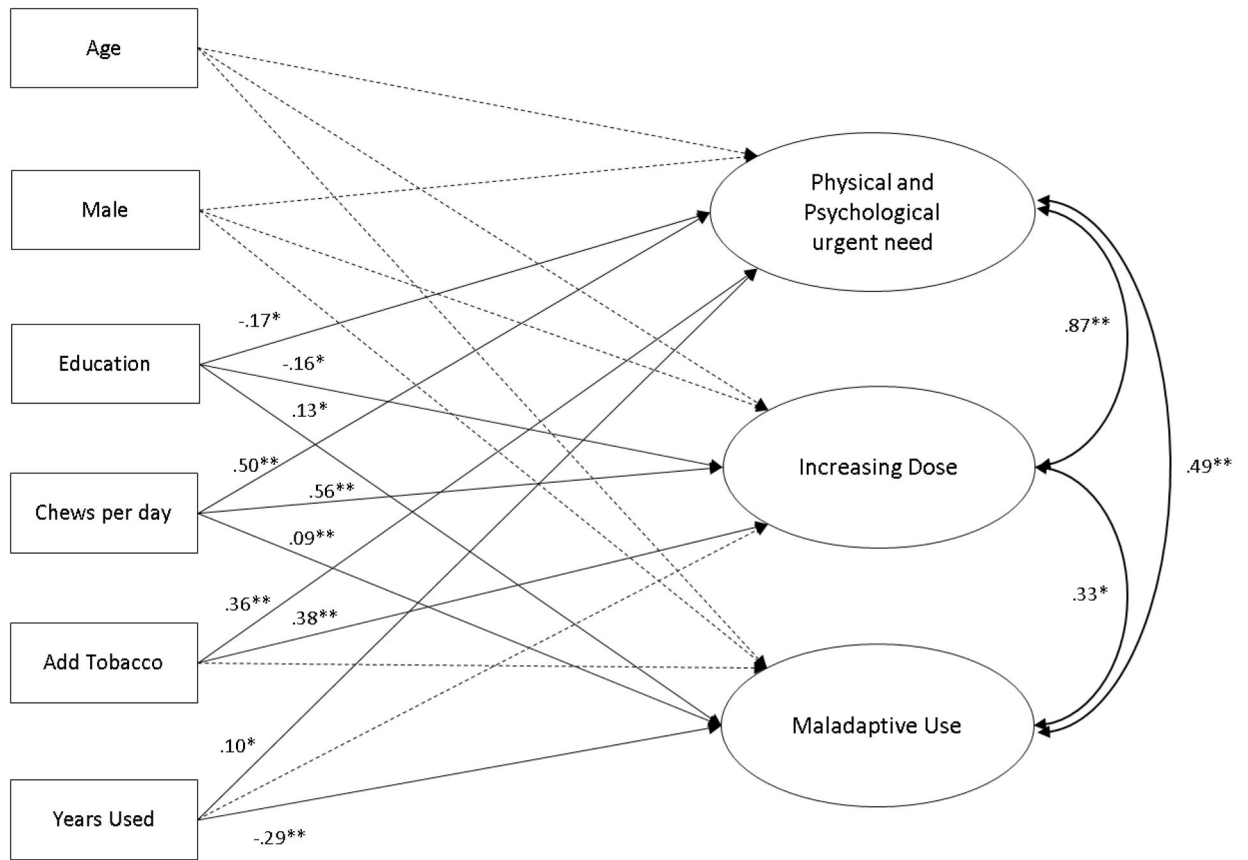
Fig. 2.
Structural equations model validating betel nut dependence. Note: Ellipses represent latent constructs and rectangles represent measured variables. Standardized parameter estimates are presented. Non-significant paths and covariance are represented by dashed lines. Significance: *$p < .05$, **$p < .0001$.

Table 1

Descriptive statistics for CFA sample ($N = 300$).

Characteristic	Frequency/mean (SD)
Age (SD)	35.3 (21.7)
Male	51.7%
Completed high school	56.7%
Ethnicity	
Chamorro	33.1%
Chuukese	30.1%
Palauan	23.8%
Yapese	6.0%
Other	7.0%
Years chewing (SD)	14.9 (12.7)
Chews per day (SD)	12.5 (14.5)
Add tobacco to quid	69.9%

Table 2

Ingredient use by ethnicity.

Ethnicity						
Ingredients	Chamorro	Chuukese	Palauan	Yapese	Other	Totals
Nut alone	29	1	1	0	1	32
Quid w/out tobacco	31	12	5	1	8	57
Quid w/tobacco	38	78	66	17	12	211
Totals	98	91	72	18	21	300

Note: *N*s reported in table.

Table 3

Betel Quid Dependence Scale item frequencies, grouped by factor ($n = 300$).

Current study			Lee et al.	
Item	**%**	**Rank**	**%**	**Rank**
Factor 1: Physical and psychological urgent need				
1 Can't go on without betel nut/quid	62.4	5	17.0	11
2 Difficulty concentrating after reducing use	56.7	10	16.2	13
3 Experienced depression or drowsiness	52.0	11	13.5	15
4 Strong craving after reducing/stopping to chew	73.3	1	26.0	7
5 Spend time to find when not available	64.1	3	22.0	9
6 Travel great distance to find when not available	58.3	9	20.6	10
7 Felt agitated, irritated, or anxious after reducing	59.8	8	12.2	16
Factor 2: Increasing dose				
8 Trouble stopping once started chewing	66.7	2	31.4	4
9 Ever chewed non-stop	61.2	7	57.4	1
10 Increased the amount of use after first use	63.8	4	38.9	2
11 Felt the need to increase amount of use periodically	52.2	12	25.2	8
12 Often chewed betel nut/quid more than expected	61.6	6	33.2	3
Factor 3: Maladaptive use				
13 Continue chewing after teeth loosen or wiggle	39.3	14	26.5	6
14 Continue chewing if you had sensitive teeth	43.1	13	31.4	4
15 Continue chewing if experienced mouth ulcers	25.5	15	14.3	14
16 Reduced or given up activities because of chewing	17.0	16	16.6	12

Table 4

Fit indices for confirmatory factor analyses ($N = 300$; $n_{males} = 155$; $n_{females} = 145$).

Model	χ^2 (d.f)	CFI	TLI	RMSEA (90% CI)	WRMR	χ^2 Difference test
Full Sample						
Hypothesized measurement model	238.89 (101)*	.98	98	.07 (.06, .08)	1.21	$\chi^2 = 21.98$, d.f. = 2, $p < .0001$
Two-factor model	265.01 (103)*	.98	.97	.07 (.06, .08)	1.31	
Gender multi-group analysis						
Base model	334.98 (202)*	.98	.98	.07 (.05, .07)	1.42	$\chi^2 = 13.03$, d.f. = 13, $p = .45$
Nested model	347.48 (215)*	.98	.98	.07 (.06, .08)	1.44	

Note: CFI: comparative fit index; RMSEA: root mean-square error of approximation; and WRMR: weighted root mean square residual.

*
$p < 05$.

Table 5

BQDS subscales as a function of quid type.

BQDS		Mean (SD)		
		Physical and psychological urgent need	Increasing dose	Maladaptive use
Quid type				
Nut alone	$0.34 (0.26)^a$	$0.34 (0.34)^a$	$0.28 (0.30)^a$	$0.40 (0.36)^a$
Quid (lime, leaf, nut)	$0.36 (0.32)^a$	$0.39 (0.38)^a$	$0.36 (0.37)^a$	$0.30 (0.34)^a$
Quid plus tobacco	$0.61 (0.27)^b$	$0.71 (0.34)^b$	$0.73 (0.33)^b$	$0.30 (0.35)^a$
Total sample	0.53 (0.30)	0.61 (0.38)	0.61 (0.38)	0.31 (0.35)

a, b, c Presence of the same superscript letters between a pair values across a column indicate a lack of statistically significant difference, different letters indicate a significant difference. Significance at $p < 0.05$ based on two tailed *t*-test.

Table 6

Correlation matrix of variables used in the structural equation model.

	1	2	3	4	5	6
Age						
Chews per day	0.04					
Years used	0.37	0.19				
Male	−0.14	−0.03	−0.06			
Education	0.13	0.14	0.21	−0.03		
Add tobacco	−0.22	0.16	−0.21	0.12	−0.04	

Notes: Correlations are standardized