# Validation of Perceptions and Behavioral Intentions Survey: Psychometric Evaluation of Tobacco-Related Behavioral Intentions to Try, Use, Dual Use, and Switch

Altria Client Services

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## Abstract

**Significance**. Establishing reliable and valid survey measures is critical to reduce measurement error, increase sensitivity, and allow for researchers to draw accurate conclusions from results. Currently reliable and valid measures of behavioral intentions to try, use, dual use and switch to a new tobacco product do not exist. In response to this gap in the literature, we developed and validated a Perceptions and Behavioral Intentions (PBI) survey. The primary purpose of this study was to evaluate the psychometric properties of the PBI survey. **Methods.** A total of 2,943 participants (adult smokers planning to quit, adult smokers not planning to quit, EV users, former tobacco users, never tobacco users) were recruited to participate online. Cognitive interviewing was first conducted to ensure that try, use, dual use, and switch items were being interpreted by the participant as intended. Items were then subjected to quantitative psychometric analyses, including evaluation of: rating scale functioning, item fit, dimensionality, model fit, item parameters, Rasch derived reliability, person-to-item targeting, internal consistency reliability, test-retest reliability, convergent/discriminant validity, and ability to detect change. Data were randomly split into Validation and Cross-Validation datasets. The psychometric analyses were performed on each dataset separately and results were compared to ensure stability across sampling

**Results.** Results across the four behavioral intention constructs revealed that the 6-point rating scales were functioning as expected. Rasch modeling revealed unidimensionality, adequate fit and discrimination, and excellent reliability. Item difficulties indicated that items were ordered as expected, and person-to-item maps revealed excellent person-to-item targeting. Factor analytic approaches suggested that the scales were unidimensional and that the structures were similar across participant sub-groups. Pearson correlations coefficients provided strong support for convergent and discriminant validity. Details of results will be presented. These data support the PBI survey as a reliable and valid tool to assess behavioral intentions.

## Background

- The tobacco industry and the Food and Drug Administration (FDA) are interested in understanding how evapor/e-cigarette labeling claims and advertisement materials may impact current smoker's and non-tobacco user's intentions to use these products.
- A reliable and valid instrument is needed to accurately quantify intentions to try, use, switch, and dual use e-vapor/e-cigarette products across different groups of tobacco users and non-users.
   Currently, a published reliable and valid instrument to measure behavioral intentions related to e-cigarettes
- Currently, a published reliable and valid instrument to measure benavioral intentions related to does not exist.
- The FDA has published guidance for industry (2009) for how to adequately develop and validate patientreported outcome measures, such as behavioral intentions.

# Objective

- In accordance with these FDA guidelines for PRO development (2009)<sup>1</sup>, the purpose of this study was to construct and validate a self-report instrument to measure behavioral intentions. Specifically, behavioral intentions include try, use, switch, and dual use.
- This psychometric functioning of the Perceptions and Behavioral Intention (PBI) instrument was evaluated separately across 5 different sub-groups of tobacco users and non-users, including: smokers not intending to quit, smokers intending to quit, e-vapor/e-cigarette users, former users, and never users. Evaluating functioning of the instrument across these different groups of tobacco users and non-users is consistent with FDA PRO guidance (2009), which indicates that for an instrument to be credible it must be evaluated within the target population(s).

# References

- 1. U.S. Department of Health and Human Services Food and Drug Administration Center for Drug Evaluation and Research, Center for Biologics Evaluation and Research, Center for Devices and Radiological Health (2009). Guidance for industry: Patient-reported outcome measures: Use in medical product development to support labeling claims. https://www.fda.gov/downloads/drugs/guidances/ucm193282.pdf
- 2. Waltz, C.F., Strickland, O.L., & Lenz, E.R. (2010). Measurement in nursing and health research, 4th ed. Springer Publications, New York, NY.

## Methods

The PBI instrument development and validation process is depicted below.



#### Item Development

An initial pool of items was developed by a team of subject matter experts, drawing from previous research.
 Importantly, published items were modified and new items were developed in order to adequately capture behavioral intentions regarding e-vapor/e-cigarette products.

### **Cognitive Interviews**

- Cognitive interviewing was used to establish construct validity and improve psychometric functioning of the PBI instrument.
- Interviewers (n=3), following a semi-structured interview script, conducted cognitive interviews in-person
  with participants over a 2-day period.
- Participants were recruited by marketing research organization located in Richmond, Virginia.
- Inclusion criteria for participation included: (1) be of legal age to purchase tobacco or older, (2) provide voluntarily consent, (3) acknowledge willingness and ability to comply with all study requirements, and (4) meet criteria for inclusion in one of the 5 study sub-groups.

#### **Psychometric Evaluation**

- PBI items were subjected to psychometric analyses, including evaluation of: rating scale functioning, item fit, dimensionality, model fit, item parameters, Rasch derived reliability, person-to-item targeting, internal consistency reliability, test-retest reliability, convergent/discriminant validity, and ability to detect change across a Validation and Cross-Validation sample. Psychometric functioning of the scales, including internal structure, reliability, and validity, were evaluated across the 5 study sub-groups, and bias for gender, race, age, and sub-group membership was estimated using the Full Sample.
- Participants were recruited from an online community of panelists (PollingPoint, which is owned and operated by YouGov).
- Interested panelists completed a screener to determine eligibility. Inclusion criteria for this part of the study were the same inclusion criteria used during cognitive interviewing.

#### **Cognitive Interviews**

- 23 cognitive interviews
- Mean age was 43.7 years (SD=12.3)
- Mostly male participants (73.9%)
- About half reported full-time employment; 43.5% completed some college
- Items were removed or revised based on results from cognitive interviews.

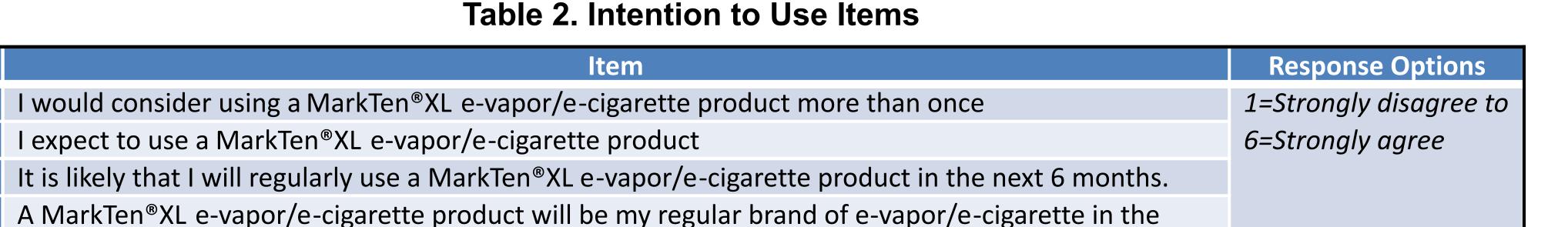
#### **Psychometric Evaluation**

- 600 individuals from 5 sub-groups (N=2943)
- 110 individuals from each subgroup (N=560) completed the PBI instrument three days after initial administration to assess test-retest reliability and ability to detect change
- Demographics are presented in Table 1
- Results for the Intention to Use scale are presented here. As results
  were analogous across sub-groups and across the Validation and
  Cross-Validation samples, only results using the Validation Sample are
  reported here. Similar methods were utilized to evaluate functioning of
  the Intention to Try, Switch, and Dual Use scales, and similar results
  were found to establish reliability and validity of these measures.
  Results for these scales can be obtained from the first author.
- Analyses were conducted in WINSTEPS, SPSS, and AMOS.

## Table 1. Psychometric Evaluation Participants' Demographic Characteristics (N=2943)

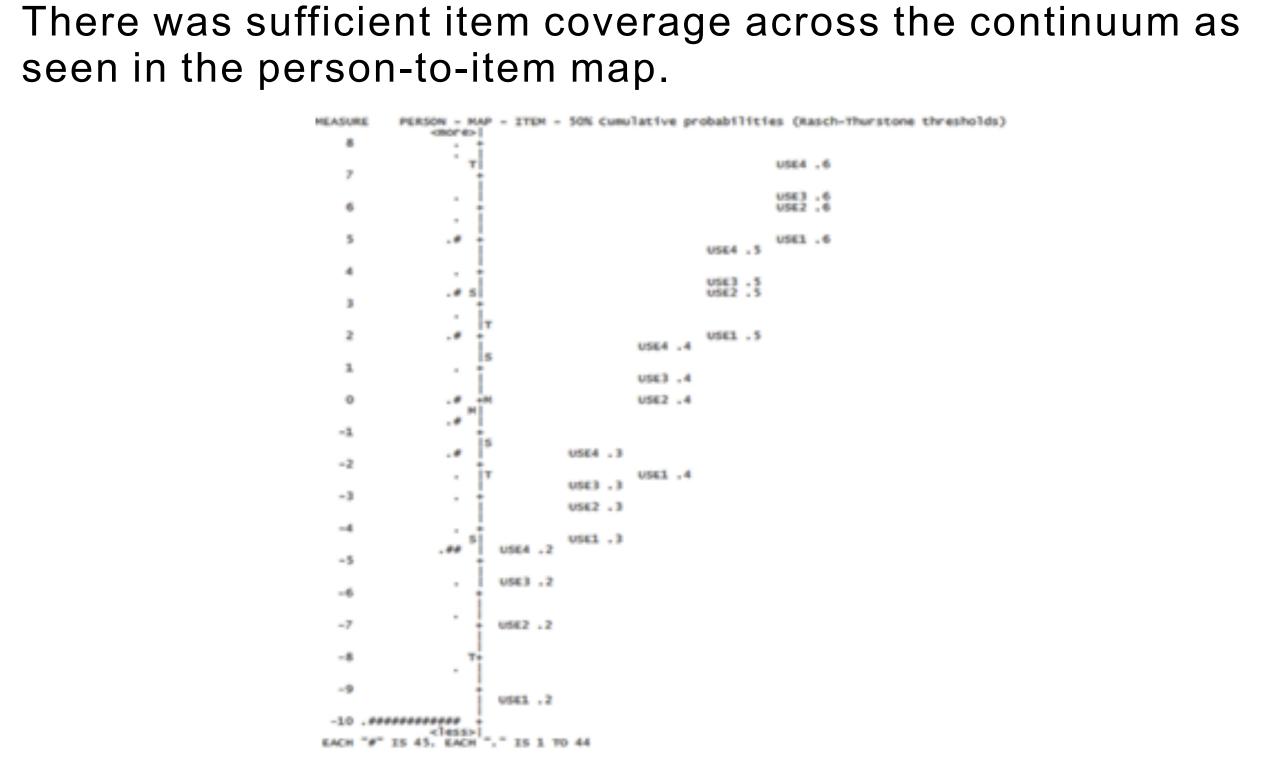
Demographic Characteristic	Percent
Gender	
Female	56.2%
Male	43.8%
Ethnicity	
Non-Hispanic	92.7%
Hispanic	7.3%
Race	
White/Caucasian	86.2%
Black/African American	8.5%
Asian	2.4%
Native Hawaiian/Pacific Islander	0.5%
American Indian/Alaska Native	2.6%
Other	3.4%
Region	
Northeast	22.9%
Midwest	21.6%
South	31.8%
West	23.2%
Age	
Mean (SD)	52.5 (14.1)
Range (years)	18-90

## Results

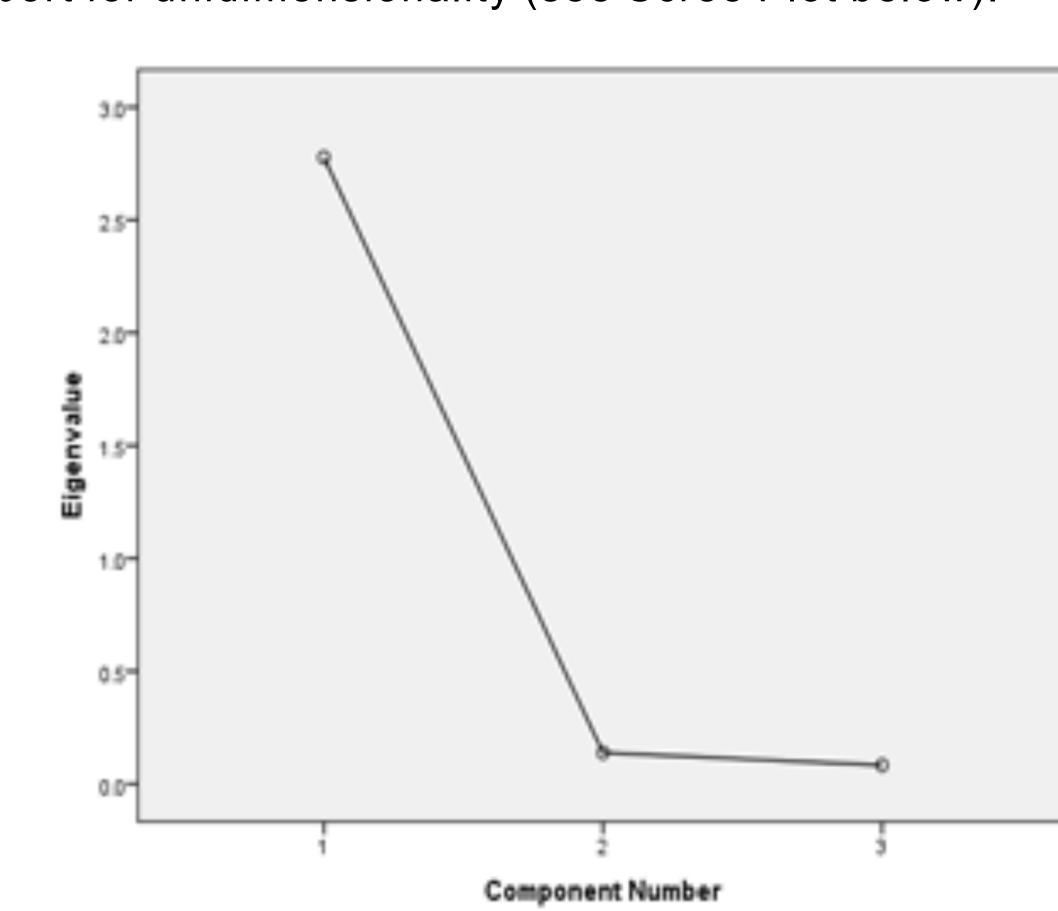


The items functioned as expected, as evidenced by the ordered Andrich thresholds.

next 30 days.



A Monte Carlo technique ("parallel analysis") revealed only one significant eigenvalue. Similarly, an exploratory factor analysis using the principal components extraction method (eigenvalue=3.71, 92.82% variance explained) provided strong support for unidimensionality (see Scree Plot below).



- Internal consistency reliability ( = .973) and test-retest reliability (ICC=.886) coefficients exhibited excellent levels of internal consistency
- As evidence of convergent validity, Pearson correlation coefficients revealed a strong positive relationship between participants' Intention to Use and their selection of the tobacco product on a Behavioral Selection Task (r= .681, p<.001). Conversely, as evidence of discriminant validity, there was a weak non-significant relationship between participants' Intention to Use and their geographic location (r= -.036, p=.169).
- Ability to detect change was evaluated by correlating residualized change scores<sup>2</sup> between Intention to Use and Behavioral Selection. As expected, change in Intention to Use scores over a 3-day test-retest period corresponded with change in selection of the e-vapor product on the Behavioral Selection task (r=.322, p<.001).
- Bias was evaluated via differential item function. The Intention to Use items did not exhibit bias for gender, race (White/non-White), or age (18-24 years vs. >24 years).

## Discussion

- This study represents the successful development of PBI items to capture intention to try, use, dual use, and switch. Primary reasons for success of these scales include:
- Cognitive interviewing was conducted across heterogeneous groups of tobacco users and non-users
- Validation and cross-validation samples were used to ensure stability of findings

There was a large, diverse sample size for the psychometric evaluation phase

- Use of Item Response Theory

# Limitations

- While relying on a convenience sample is a limitation, it should be noted that the sample consisted of diverse group of individuals across key demographic variables.
- The PBI items were tested specifically with respect to an e-vapor product. It is assumed that the functionality
  of the items would be similar across different tobacco product categories given the concept of the items
  would not change.

## Conclusion

• Results from this study provide evidence for reliable and valid measures to assess behavioral intentions to try and use e-vapor products. Future tobacco research on intentions should consider using these items so that data can be compared across different contexts and products.