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Harm perceptions and tobacco use initiation among youth in Wave 1 and 2 of the Population Assessment of Tobacco and Health (PATH) Study

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ABSTRACT

In the US, youth attribute higher levels of harm and addictiveness to cigarettes relative to other tobacco products. Monitoring harm perceptions across a range of tobacco products is important when forecasting risk for experimentation. This study examined data from US youth (N = 10,081) ages 12–17 from the Population Assessment of Tobacco and Health (PATH) Study who completed both Wave 1 (2013–2014) and Wave 2 (2014–2015) interviews. Analyses assessed: (1) trends in perceived harm and addictiveness of products over time, (2) whether perceived harm and addictiveness of a product at Wave 1 predicted trying that product for the first time by Wave 2, and (3) whether trying a product between Waves 1 and 2 predicted a decrease in one's perceived harm and addictiveness of that product. Levels of perceived harmfulness and addictiveness significantly increased between Wave 1 and Wave 2 for all products (χ^2 (range): 7.8–109.2; p's ≤ 0.02). Compared to those with "high" perceived harmfulness of a tobacco product at Wave 1, those with "low" and "medium" perceived harmfulness had a significantly increased probability of use of that product at Wave 2. For all products, Wave 1 youth never tobacco users who tried a product (vs. did not) at Wave 2 had a significantly higher probability of being in the "low" category of perceived harmfulness at Wave 2. Among US youth, there is a bidirectional relationship between harm perceptions and product use. Understanding how changes in perceptions translate to changes in tobacco use could inform efforts to prevent tobacco initiation in youth.

1. Introduction

Longitudinal studies have shown that youth and young adult's harm perceptions of various drugs, particularly alcohol and marijuana, are predictive of use trends for those substances (*Results From the 2013 National Survey on Drug Use and Health: Summary of National Findings (NSDUH Series H-48, HHS Publication No (SMA) 14–4863) [Press Release]*, 2014; Johnston et al., 2017). Cross-sectional studies of tobacco use similarly suggest that youth harm perceptions are associated with product use, and that some products are perceived as more harmful than others (Strong et al., 2017). Given the role of harm perceptions of cigarettes in predicting future smoking initiation, as well as the expanding marketplace of other tobacco products with characteristics that differ in their appeal and may differ in their potential for harm (Song et al., 2009; U.S. Department of Health and Human Services, 2012; Moyer, 2013; Gottlieb and Zeller, 2017), it is important to understand how harm perceptions of other tobacco products predict later use in youth (Song et al.,

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2009). This is particularly important given that the use of e-cigarettes and cigars have now become more prevalent in youth than cigarette use (Anic et al., 2018). It is also timely given that new regulatory efforts (https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/UCM625-884.htm, n.d.) and media coverage of non-cigarette tobacco products may contribute to changing perceptions about these products (Tan et al., 2017; Wackowski et al., 2017; Trong Duong and Liu, 2019).

Perceptions of harm and addictiveness of tobacco products can be characterized as either comparative or absolute (Wackowski et al., 2016; Persoskie et al., 2017). Absolute perceptions measure the perceptions of each tobacco product without comparison to perceptions of another tobacco product, whereas comparative perceptions compare products to a specific tobacco product, typically cigarettes (Kaufman et al., 2016). Research on comparative perceptions across tobacco products has found that most youth and young adults think about harm and addictiveness on a continuum (Ambrose et al., 2014; Wackowski and Delnevo, 2016), with hookah (Maziak et al., 2007; Ward et al., 2007; Eissenberg et al., 2008) and e-cigarettes (Pearson et al., 2012; Dutra and Glantz, 2014; Amrock and Weitzman, 2015) rated as significantly less harmful than cigarettes. Further research can inform how trends in youth perceptions of both the absolute and comparative harm and addictiveness of tobacco use evolve in relation to differential trends in use for cigarette and other tobacco products (Delnevo et al., 2011).

Little research on the concurrent association between harm perceptions and the use of tobacco products has assessed both absolute and comparative harm, as well as the temporal directionality of this association (Strong et al., 2017; Ambrose et al., 2014). The current research analyzed longitudinal, nationally representative youth data from the first two waves of the Population Assessment of Tobacco and Health (PATH) Study to: (a) describe how youth harm and addiction perceptions of tobacco products change over time, (b) assess how these perceptions predict trying a product for the first time and, (c) assess how trying a product for the first time predicts these perceptions. The following five tobacco products were examined: cigarettes, e-cigarettes, cigars (traditional cigars, cigarillo, filtered cigars), hookah, and smokeless tobacco (including snus). We expected never users of each tobacco product with low perceptions of harm and addictiveness at Wave 1 to be more likely to try that product for the first time by Wave 2, compared to never users with high perceptions of product harm and addictiveness at Wave 1. We also hypothesized that youth who tried a product for the first time between Wave 1 and Wave 2 would have lower perceptions of the product5s harm and addictiveness at Wave 2 compared to youth who had never tried the product. Additionally, we assessed whether demographic differences in Wave 1 never users (age, sex, race/ethnicity) were related to changes in harm and addictiveness perceptions over time at Wave 2, as well as associations between these perceptions and initiation of tobacco product use.

2. Methods

The PATH Study is an ongoing, nationally-representative, longitudinal cohort study of adults and youth in the US. The PATH Study uses audio computer-assisted self-Interviews (ACASI) available in English and Spanish to collect self-report information on tobacco-use patterns and associated health behaviors. Wave 1 data collection was conducted from September 12, 2013 to December 14, 2014 and Wave 2 data collection was conducted from October 23, 2014 to October 30, 2015. The PATH Study Wave 2 data collection protocol included procedures to interview each individual as close as possible to the one-year anniversary of their Wave 1 interview.[1]

The PATH Study recruitment employed a stratified address-based, area-probability sampling design at Wave 1 that oversampled adult tobacco users, young adults (18 to 24 years), and African-American adults.

Population and replicate weights were created that adjusted for the complex study design characteristics (e.g., oversampling at Wave 1) and nonresponse at Waves 1 and 2. Combined with the use of a probability sample, the weights in the PATH Study analyses allowed for computed estimates that are robust and representative of the non-institutionalized, civilian US population ages 12 years and older.

All participants age 18 and older provided informed consent, with youth participants age 12 to 17 providing assent while their parent/legal guardian provided consent. The weighted Wave 1 household screener AAPOR (The American Association for Public Opinion Research, 2016) response rate 3 was 54.0%. Following the definition of an AAPOR response rate 3, the weighted number of selected cases for whom a screener was not completed (either due to non-contact or refusal) was multiplied by the eligibility rate among the cases that did complete the screener. This produced an estimate of the weighted number of unscreened households that were eligible for the PATH study. This estimate was included in the denominator of the weighted screener response rate. Conditioning on household response and eligibility, the overall weighted Wave 1 interview AAPOR response rate 5 for the Youth Interview was 78.4%. The denominator of the Wave 1 Youth interview response rate is all persons selected to participate. At Wave 2, the interview AAPOR response rate 5 conditioning on Wave 1 response was 87.3%. Further details regarding the PATH Study design and methods are published by Hyland and colleagues (Hyland et al., 2016) and in the User Guide to the PATH Study restricted use files, available at http://www.icpsr.umich.edu/icpsrweb/NAHDAP/series/006061. The study was conducted by Westat and approved by Westat's institutional review board.

The current study analyzed data from youth (aged 12 to 17 years) who completed the Youth Interview at both time points (N = 10,081). The specific details of these analyses are outlined below, and sample sizes are presented in the accompanying figures.

3. Measures

3.1. Demographics

We categorized youth into age groups of 12–13; 14–15; and 16–17 based on responses from the Wave 1 questionnaire. Questions assessing sex and race/ethnicity were also administered at Wave 1. Missing data on age, sex, race, and Hispanic ethnicity were imputed as described in the PATH Study Restricted Use Files User Guide (United States Department of Health and Human Services, National Institutes of Health, et al., 2017).

3.2. Tobacco products

Youth were asked about cigarettes, e-cigarette, cigars (traditional cigar, cigarillo, filtered cigar), hookah, and smokeless tobacco (including snus). Some questions differed in format for certain products. For example, questions on use of snus and other smokeless tobacco (e.g., described as moist snuff, dip, spit, chewing tobacco) were asked separately, whereas questions of harm and addictiveness perceptions included all “smokeless tobacco” (all forms combined). In addition, cigar use was assessed separately for three subtypes: traditional cigars, cigarillos, and filtered cigars at Wave 1, however, at Wave 2, perceptions of harm and addictiveness of cigars were further refined to detail each individual subtype. Due to these changes in how questions were

[1] Interviews were sometimes conducted earlier or later, due to varying circumstances including individuals' schedules, time needed to contact, and grouping of multiple individuals within a household, thus resulting in some variance in time between interviews. Of the 10,081 youth surveyed at Wave 1 who were followed up at Wave 2, the time between the Wave 1 and Wave 2 interviews was a mean of 51.5 weeks. An additional 2091 youth were recruited at Wave 2 and did not have a Wave 1 interview.

asked between Wave 1 and 2, longitudinal analysis could therefore not be performed for cigars.

3.3. Tobacco harm perception

Three items with identical question stems and response options were used to assess harm perceptions for each product at Wave 1 and Wave 2. Two items measured perceptions of absolute harm, and were asked for all products. The third item measured harm perceptions relative to cigarettes, and was asked for all products except cigarettes. For item 1, "*How much do you think people harm themselves when they [USE/SMOKE PRODUCT]?*", previously reported item response models of response options (Strong et al., 2017) suggested lack of separation for the lowest two response options, 'No harm' and 'Little harm'. These options were therefore collapsed into: '1 = No harm or little harm', '2 = Some harm', and '3 = A lot of harm'. Response options for item 2, "*How long do you think someone has to [USE/SMOKE PRODUCT] before it harms their health?*" were collapsed based on Wave 1 analyses (Strong et al., 2017) to include: '1 = 1 year or less than 1 year', '2 = 5 or more years,' and '3 = It will never harm their health'. Response options for item 3, "*Is [USING/SMOKING PRODUCT] less harmful, about the same, or more harmful than smoking cigarettes?*" were: '1 = Less harmful', '2 = About the same', and '3 = More harmful'. Those without complete responses for all three items were excluded from analyses (Cigarettes n = 7; E-Cigarettes n = 39; Hookah n = 23; Smokeless n = 35; Cigar n = 66). Youth were also categorized as either having, 'Never heard of the product', or as reporting 'I don't know' to at least one item. Previous analyses support reliability and scalability (Strong et al., 2017) of aggregated responses to the three harm perception items for each tobacco product examined in this study, with the exception of cigarettes. Levels of cigarette harm perceptions were reflected by the single global perception of harm item (item 1) with the same three-level scale as other composite indices. For e-cigarettes, cigars, hookah, and smokeless tobacco products, average responses to the three items were used to reflect individual levels of harm perception (range 1–3).

To allow the inclusion of categories, 'I don't know' and 'had not heard of product' in the analyses, we created a five-level categorical variable. Youth who completed all three harmfulness items for a product received an average item-score for that product ranging from 1 to 3. Average item-scores were used to place youth into one of three categories (1 to < 2 = 'Low', 2 = 'Medium', > 2 to 3 = 'High' harm). Cigarette harm perceptions were reflected with a single item. The same three categories were used as the three-item indices. Additional categories indicated youth who responded, 'I don't know' to any of the items ('I don't know'), and youth who had not heard of the product at baseline ('Had not heard of product'). For cigarettes, 'I don't know' responses were excluded from analyses (n = 7).

3.4. Tobacco addiction perception

We assessed perceptions of the addictiveness of each product using the following question: "*How likely is someone to become addicted to [PRODUCT]?*" Response options ranged from '1 = Very unlikely' to '5 = Very likely.' To remain consistent with the categorization of the perceived harmfulness variable, responses were divided into five categories 1) 'Very and/or Somewhat unlikely' = 'Low', 2) 'Neither Likely nor Unlikely' = 'Medium', 3) 'Somewhat Likely and or Very Likely' = 'High', 4) 'I don't know' and 5) 'Had not heard of product'.

3.5. Tobacco use

Youth who had heard of a particular product were asked, "*Have you ever tried [PRODUCT]?*" ('1 = Yes', '2 = No'). Youth who had tried the product were further asked, "*When was the last time you [USED PRODUCT]?*" Never users were defined as youth reporting never trying the tobacco product. New users were defined as youth who were never users at Wave 1 who tried a product by Wave 2.

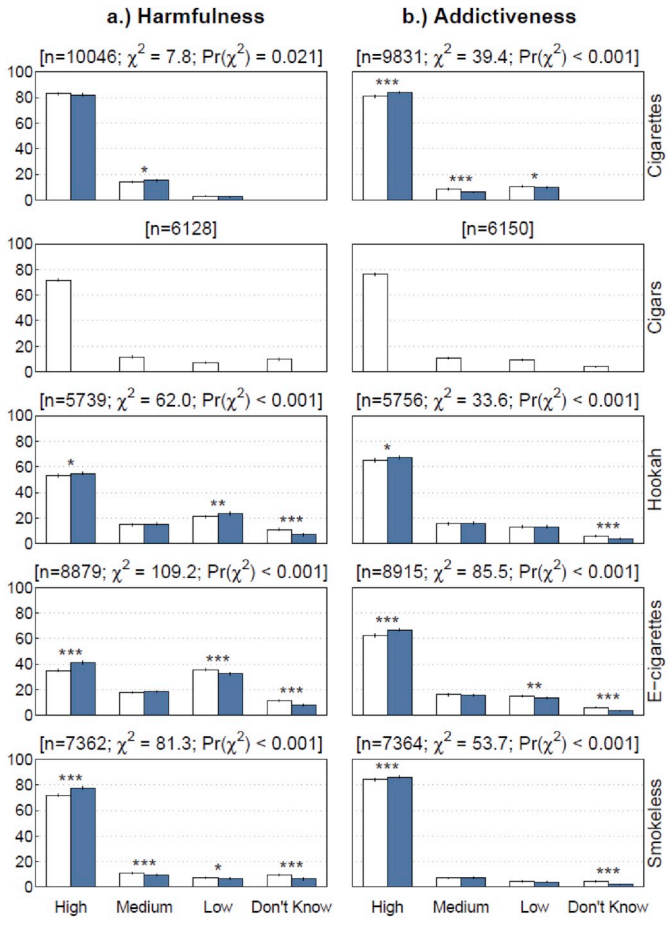

Fig. 1. Perceived harmfulness (a) and addictiveness (b) of each tobacco product at Wave 1 (white) and Wave 2 (blue) among youth who had heard of the product at Wave 1.
Note: Sample sizes for each comparison are noted above the box and all summaries use weighted data. Supplementary tables 1 and 2 detail sample sizes and estimates for each comparison. p-Values are generated from Rao-Scott adjusted Pearson χ^2 statistics. "Smokeless tobacco" here includes snus and other smokeless products. "Cigars" includes traditional, cigarillo, and filtered cigars. *** = $p < 0.001$; ** = $p < 0.01$; * = $p < 0.05$.
Perceptions of the harm and addictiveness of cigar products were refined to detail each individual cigar product at Wave 2. Wave 1 questions allowed individuals who had not heard of a specific product to respond to questions about cigars as a group. Wave 1 questions therefore were excluded from any assessments of perceptions of specific cigar products at Wave 2. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

4. Analysis plan

Our first analysis described changes in the perceived harmfulness and addictiveness of each tobacco product between waves for youth who had heard of a tobacco product (sample sizes provided in Fig. 1). Percentages were used to describe average perceptions at Wave 1 and Wave 2, with 95% CIs calculated using the beta method (Korn and Graubard, 1998). Rao-Scott adjusted Pearson's χ^2 test statistics were used to test whether there was a significant difference in the proportion of youth in each category of perceived harmfulness and addictiveness between Wave 1 and Wave 2. Additional analyses, reported in supplemental tables, describe Wave 1 to Wave 2 changes in the categorization of perceived harmfulness and addictiveness of each tobacco product for youth of different demographic sub-groups. Rao-Scott adjusted Pearson's χ^2 test statistics were used to assess if any differences in the proportion of youth in each category of perceived harmfulness and

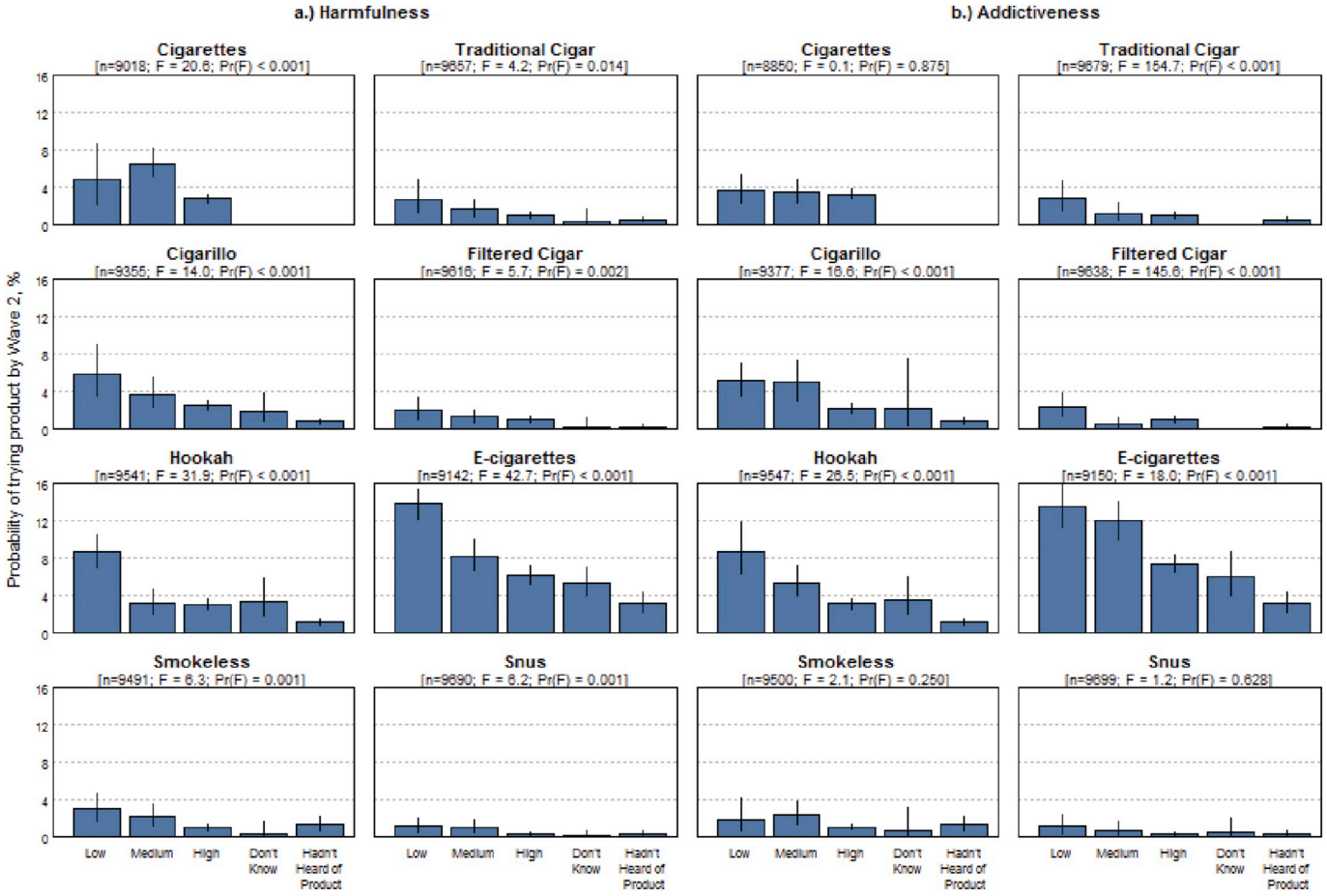

Fig. 2. Probability of trying each tobacco product by Wave 2 as a function of categories of perceived harmfulness (a) and addictiveness (b) at Wave 1 among never users of that product at Wave 1.

Note: Each box represents a separate weighted multivariable binary logistic model with adjustment for demographic characteristics (age, sex, race/ethnicity) calculated on youth who had never used the product (assessed at Wave 1), with sample sizes noted above the box. Bars and segments represent the probability of trying a product and 95% confidence intervals are based on estimates predicted from the model (see methods for details). F-statistics in notes are produced by Wald F-tests of the regression term and all p values reflect correction for multiple testing. "Smokeless tobacco" here refers collectively to forms other than snus (e.g., moist snuff, dip, spit, chew).

addictiveness between Wave 1 and Wave 2 occurred equally across these groups.

The second analysis describes how harmfulness and addictiveness perceptions were associated with trying tobacco products for the first time by Wave 2. The sample for this analysis was limited to separate subsets of youth who at Wave 1 had never used the specific product being assessed (sample sizes in Fig. 2). A series of 16 logistic models were used to predict the probability of trying each product or subcategory of product (i.e. cigars, smokeless) by Wave 2 as a function of different categories of the perceived harmfulness and addictiveness of a product at Wave 1. Adjustment of p-values was conducted using Benjamini Hochberg procedures (Benjamini and Hochberg, 1995). For cigars and smokeless tobacco, the harm and addictiveness perceptions apply to the group of products (e.g., cigars) and are also used to predict use of each subtype (e.g., cigarillo, filtered cigar or traditional cigar). A standard set of covariates, including age, race/ethnicity, and sex, were adjusted for in the analyses.

The final analysis assessed the relationship between trying a product for the first time and subsequent perceptions of the harmfulness and addictiveness of that product. To assess new use of a product, the sample was restricted to youth who never tried the product at Wave 1 (sample sizes provided in Fig. 3). A series of ten logistic models were used to predict the probability of each category of perceived harmfulness and addictiveness at Wave 2 as a function of trying that product for the first time by Wave 2 using procedures to correct for multiple tests within this aim (Benjamini and Hochberg, 1995). Each model adjusted for previous perceptions of that product at Wave 1 and a standard set of covariates, including age, race/ethnicity and sex.

Wald F tests were used to assess the significance of the predictors of interest. Conditional probabilities of each category and their corresponding 95% CIs were calculated from the multivariable model for each category of the predictor variables, while adjusting for the mean values of all covariates among the analytical sample, and by using 1000 draws from the multivariate normal distribution with the mean equal to the maximum likelihood point estimate and the variance equal to coefficient covariance matrix (King et al., 2002).

All analyses were weighted using the Balanced Repeated Replication (BRR) method with Fay's adjustment ($\rho = 0.3$) and by using the weights for Wave 2. Missing values were handled using list-wise deletion, as all variables had $\leq 1.9\%$ missing observations. All analyses were performed using R version 3.2.2, all tests were two-tailed, and the significance was assessed at the $\alpha = 0.05$ level.

5. Results

5.1. Changes in perceptions between Wave 1 and Wave 2

Fig. 1 presents perceived harmfulness and addictiveness of each tobacco product at Wave 1 and Wave 2 among youth who had heard of the product at Wave 1. Levels of perceived harmfulness (Fig. 1a) and

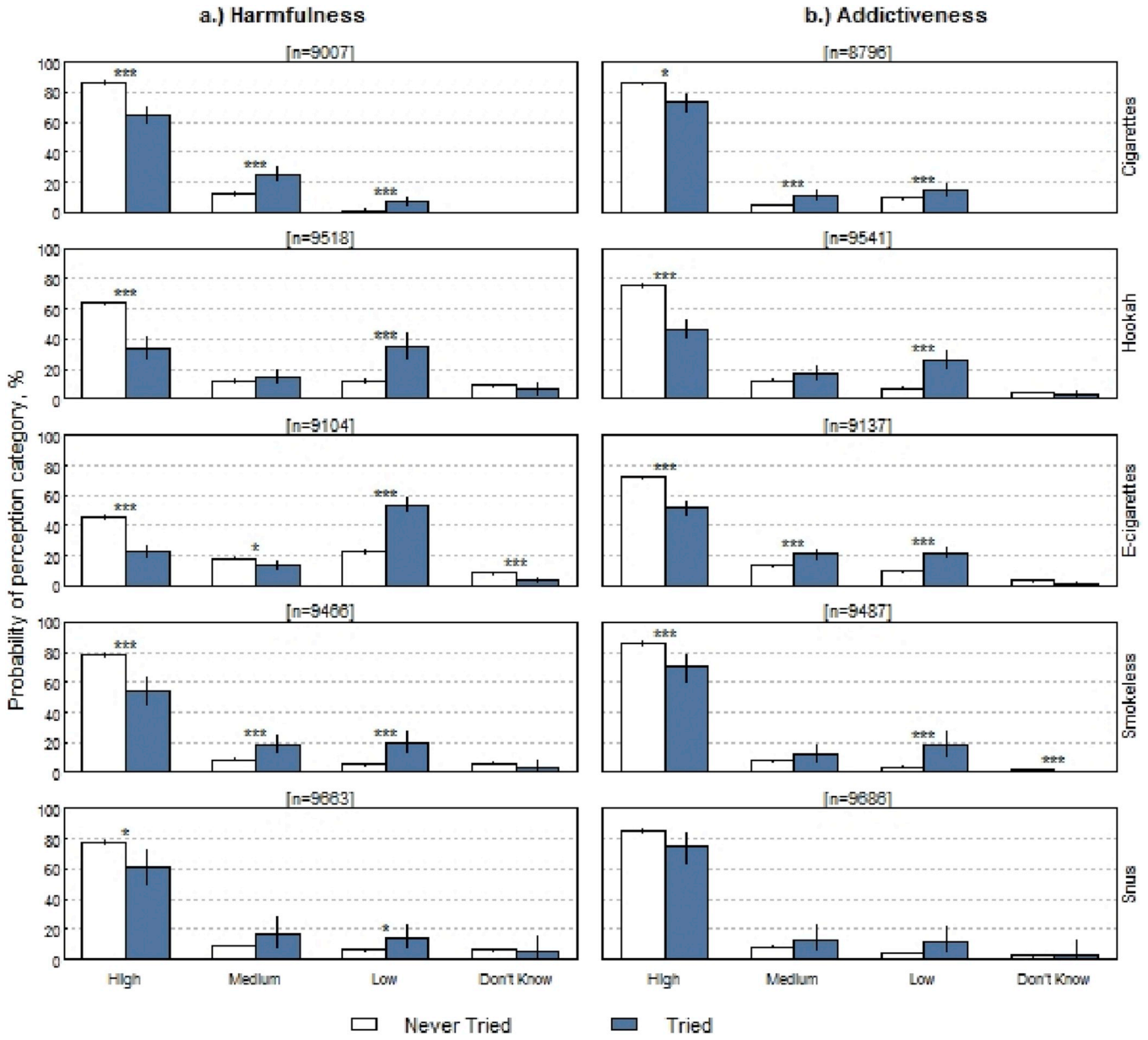

Fig. 3. Probability of each category of perceived harmfulness (a) and addictiveness (b) at Wave 2 as a function of trying a product by Wave 2 among never users of that product at Wave 1.

Note: Each box represents a separate weighted multivariable logistic model with adjustment for demographic characteristics (age, sex, race/ethnicity) calculated on youth who had never used the product assessed at Wave 1, with sample sizes noted above the box (sample sizes were reduced by exclusion of incomplete perception responses at Wave 1). Bars and segments represent the probability of each category of perceived harmfulness and 95% confidence intervals among youth who tried the tobacco product (blue), or did not try the tobacco product (white). Each cluster of bars represents a multivariable logistic model predicting each level of the outcome variable. "Smokeless tobacco" here refers collectively to forms other than snus (e.g., moist snuff, dip, spit, chew). *** = $p < 0.001$; ** = $p < 0.01$; * = $p < 0.05$. All p values reflect correction for multiple testing. Cigar products were excluded from this analysis given the discordant questions regarding perceptions of cigars asked in Wave 1 and Wave 2. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

addictiveness (Fig. 1b) significantly increased between Wave 1 and Wave 2 for all products (χ^2 (range): 7.8–109.2; Benjamini-Hochberg adjusted p's ≤ 0.02). For hookah, e-cigarettes, and smokeless, the greatest increase was in the "high" category of perceived harmfulness (p's < 0.001), while, for cigarettes, only the "medium" category increased ($p < 0.05$). Increases in the perceived addictiveness were also largest for the "high" category for all products (p's ≤ 0.05).

Increases in the perceived harmfulness of e-cigarettes, hookah, and smokeless tobacco between Wave 1 and 2 were observed across nearly every demographic group (Supplementary Table 1). The perceived addictiveness of cigarettes, cigars, hookah, e-cigarettes, and smokeless tobacco also increased between Wave 1 and Wave 2, and occurred in nearly every demographic group with minor exceptions (Supplementary Table 2). For instance, youth perceptions of harm and addictiveness of e-cigarettes were higher at Wave 2, regardless of their race/ethnicity, age or sex.

5.2. Association between perceptions and trying a product for the first time

Fig. 2a presents the probability of trying a tobacco product by Wave 2 as a function of perceived harmfulness at Wave 1 among youth who had never used the specific product at Wave 1. The probability of trying

a product differed significantly across categories of perceived harmfulness for all tobacco products assessed. The perceived harmfulness of a tobacco product assessed at Wave 1 was inversely related to the probability of using that product at Wave 2. Specifically, the probability of trying a product was typically highest among youth who were in the "low" and "medium" categories of perceived harmfulness at Wave 1, followed by: youth in the "high" category of perceived harmfulness, youth who were unsure of the product's harmfulness, and youth who had not heard of the product. For instance, the probability of trying e-cigarettes by Wave 2 was 14% (95% CI: 12–15) among youth in the "low" category of perceived harmfulness, 8% (95% CI: 7–10) among youth in the "medium" category, 6% (95% CI: 5–7) among youth in the "high" category, 5% (95% CI: 4–7) among youth who did not know if the product was harmful, and 3% (95% CI: 2–4) among youth who had never heard of e-cigarettes. The median effect size, here expressed as odds ratios (OR), reflected the 4.71 higher odds of trying a product for youth in the Low category (range = 1.62 for cigarettes to 8.76 for filtered cigars), 2.78 for Medium (range = 1.04 for smokeless to 5.91 for filtered cigars) and 2.0 for High (range = 0.76 for smokeless to 4.54 for filtered cigars) categories of harm perceptions relative to those who hadn't heard of the products.

Fig. 2b presents the probability of trying each tobacco product by Wave 2 as a function of categories of perceived addictiveness at Wave 1 among youth who had never used the product at Wave 1. The probability of trying a product differed significantly across categories of perceived addictiveness for traditional cigars, cigarillos, filtered cigars, hookah, and e-cigarettes. However, the probability of trying a product by Wave 2 did not differ significantly across categories of perceived addictiveness for cigarettes, snus or other smokeless tobacco products. For cigars, hookah and e-cigarettes, the data suggested an inverse relationship between perceived addictiveness and the probability of using a product by Wave 2. The probability of trying a product by Wave 2 was typically highest among youth who were in the "low" and "medium" categories of perceived addictiveness at Wave 1, followed by: youth in the "high" category of perceived addictiveness, youth who did not know if the product was addictive, and youth who had not heard of the product. Median effect size values (OR) reflecting the higher odds of trying a product were 4.82 for youth in the Low category (range = 1.12 for cigarettes to 10.76 for filtered cigars), 2.04 for Medium (range = 1.04 for smokeless to 6.29 for cigarillos), and 2.44 for High (range = 0.83 for smokeless to 6.29 for filtered cigars) categories of addictiveness relative to those who hadn't heard of the products.

5.3. Association between trying a product for the first time and perceptions

Fig. 3a presents the probability of each category of perceived harmfulness at Wave 2 as a function of trying a product by Wave 2 and while adjusting for Wave 1 perceived harmfulness. For all products, youth who tried a product (vs. did not) had a significantly higher probability of being in the "low" category of perceived harmfulness ($p \leq 0.05$) and a significantly lower probability of being in the "high" category of perceived harmfulness ($p \leq 0.05$). For instance, the probability of being in the "high" category of perceived harmfulness for e-cigarettes—representing youth who had the strongest perception that e-cigarettes are harmful—was only 23% (95% CI: 19–26) among youth who had tried e-cigarettes by Wave 2, but was 46% (95% CI: 45–47) among youth who had not.

Fig. 3b shows that, as with perceived harmfulness, trying a tobacco product between Wave 1 and Wave 2 was associated with lower perceived addictiveness of that product at Wave 2 for all tobacco products.

6. Discussion

The key findings in this study included observations that: 1) on average, perceptions about the harm and addictiveness of tobacco products increased over time for all youth; 2) Wave 1 perceptions predicted trying a tobacco product for the first time by Wave 2; and 3) trying a tobacco product for the first time at Wave 1 was associated with lower harm and addictiveness perceptions of a product at Wave 2.

In this study, youth perceptions of the harmfulness and addictiveness of tobacco products increased between Wave 1 and Wave 2 for all products. We also found that the vast majority of youth perceived that cigarettes were harmful and addictive, with > 80% of youth placing cigarettes in the "high" categories of perceived harmfulness and addictiveness at both Wave 1 and Wave 2. With few exceptions, the probability of trying a product increased with decreasing perceptions of the harmfulness and addictiveness of the product, which is consistent with cross sectional studies (Ambrose et al., 2014; Roditis et al., 2016) as well as health behavior theories which suggest that beliefs about the risks and benefits of behaviors may influence engaging in those behaviors. This finding suggests the importance of monitoring national trends in perceptions as well as understanding the formation and alteration of beliefs about the harmfulness or addictiveness of tobacco products.

Youth who had not heard of a product at Wave 1 tended to have the lowest rates of use of that product at Wave 2. Youth who had heard of a product and had high perceived harm or addictiveness had a median of two times higher odds of subsequent use. Youth with low perceived harm or addictiveness had a median of four times higher odds of subsequent use than youth who hadn't heard of the product. This may be because awareness of products may suggest some increased exposure to product users, marketing or other environmental influences that might also influence use susceptibility. Most youth were aware of most products, however, sources of information about products were not available to help understand how previously naive adolescents may become informed about products.

This study also provides evidence that trying a product for the first time was associated with lower perceptions of the product's harmfulness and addictiveness at Wave 2. It is unclear whether trying a product informed perceptions about the actual harmfulness of a product or whether those who try the product merely shifted their beliefs about it to justify their use. Shifting beliefs in response to using the product has been posited as a mechanism to reduce cognitive dissonance when behavioral choices conflict with perceptions of harm (Festinger, 1957; Weinstein et al., 2005). This reduction in harm perceptions may signal risk for continued use. Given the yearlong gap between interviews, it is also possible that youth changed their perception of a product between Waves 1 and 2. In this instance, the effect observed would be consistent with our finding that perceptions of a product predict future use. Maturational influences and impacts of experimenting with one product on perceptions of other products (Chaffee and Cheng, 2018) also may be reflected in the trends of reduced harm perceptions between Waves 1 and 2. The impact of new use on changes in harm perceptions may extend beyond the product being used. Future waves of the PATH Study will increase understanding of the timing and influence of harm perceptions on risk for product use.

Limitations of the current study prevented evaluation of the timing of changes in perceptions relative to product use, or the potential interacting influence of trying a combination of tobacco products on perceptions (Dutra and Glantz, 2014). In addition, due to difference in youth and adult survey instruments, older youth who aged into adulthood were not able to be included in the current longitudinal evaluation. The initial analyses did not exhaust potential individual (e.g. psychological), social (e.g. parent characteristics), or environmental (e.g. rural/urban residence) influences on both changing harm or addictiveness perceptions and trying tobacco products. Additional work would be useful to understand how perceptions of harm from non-cigarette products relative to cigarettes change from youth to adulthood among users and non-users of tobacco products (Fong et al., 2018).

7. Conclusions

Overall, we found that perceptions about the harm and addictiveness of tobacco were associated with trying a tobacco product for the

first time at a subsequent wave, and that trying tobacco for the first time was associated with lower perceptions about the harm and addictiveness of the product at a subsequent wave, particularly for non-cigarette tobacco products. While these perceptions may be influenced by educational campaigns (Duke et al., 2015), efforts to reduce tobacco use among youth will be informed by better understanding of product characteristics, marketing, and individual factors that influence changes in perceptions of tobacco products. Attention to population trends in perceptions of harm and addictiveness of tobacco products can inform assessment of risk for tobacco use among youth.

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Disclaimer

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Disclosures

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2019.03.017.

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