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## Short Communication

## Associations with E-cigarette use among Asian American and Pacific Islander young adults in California

Dale Dagar Maglalang<sup>a</sup>, Cati Brown-Johnson<sup>b</sup>, Judith J. Prochaska<sup>b,\*</sup><sup>a</sup> Department of Asian American Studies, EP 103, San Francisco State University, 1600 Holloway Ave, San Francisco, CA 94132, USA & School of Social Work, Boston College, 140 Commonwealth Avenue, Chestnut Hill, MA 02467, USA<sup>b</sup> Stanford Prevention Research Center, Stanford University, Medical School Office Building, Suite 300, 1265 Welch Road, Stanford, CA 94305-5411, USA

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## ABSTRACT

With attention to the rapidly growing market of electronic nicotine delivery systems (ENDS/e-cigarettes) and the fastest growing US ethnic minority group, the current study explored associations between awareness, perceived risks, and use of ENDS among Asian American and Pacific Islander (AAPI) young adults.

AAPI young adults (ages 18–25) in California were recruited via social media, college classes, listservs for AAPI-serving non-profits, and snowball sampling to complete an anonymous survey between 2014 and 2015.

The sample (N = 501) was 57% women, 15% LGBTQIA; with a mean age of 21; 26% foreign-born; identifying as Filipino (29%), Chinese (24%), Vietnamese (14%), mixed-AAPI heritage (13%), or 21% other. Nearly half the sample (44%) reported ever ENDS use; 11% were current users. Current ENDS use was twofold greater for: Filipino and Vietnamese compared to Chinese respondents; men versus women; LGBTQIA-identified respondents; those vocationally trained; and employed. Awareness of ENDS from peers/friends was most common and was associated with ever though not current ENDS use. Most respondents perceived ENDS as harmful (62%); low compared to high risk perception was associated with a three-fold greater likelihood of ever use and six-fold greater likelihood of current use. Popular flavors were fruit (49%, e.g., lychee, taro) and candy/sweets (26%). Current users viewed ENDS as a healthier alternative or quit aid for conventional cigarettes (42%); recreation/social use (33%) also was common.

Findings indicate ENDS visibility among AAPI young adults in California with affinity for flavors and many engaging in trial and current use for harm reduction and recreational/social aims.

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## 1. Introduction

Electronic nicotine delivery systems (ENDS) are battery powered devices with a heating element used with liquid cartridges, often containing nicotine (Breland et al., 2014). Available in a wide range of flavors, many attractive to youth, e-cigarettes are now the most commonly used tobacco product among middle (5.3%) and high (16.0%) school students (Arrazola et al., 2015). In a national survey of 12 to 17 year olds, leading reasons for ENDS use were availability in appealing flavors (81.5%) and lower perceptions of harm relative to conventional cigarettes to self (79.1%) and others (78.1%) (Ambrose et al., 2015).

Differences in youth prevalence of ENDS use are seen by race/ethnicity: highest among nonHispanic Caucasians and lowest among African Americans with numbers too small to report for youth identifying as

Asian American and Pacific Islander (AAPI) (Arrazola et al., 2015). The only published study on ENDS use among AAPI youth was conducted with high school students in Hawai'i (Wills et al., 2015). ENDS ever use was more common among Filipinos (34%) and Native Hawaiians (42%) than Caucasians (23%) and Asian Americans (12%; Chinese, Japanese, and Korean). Among US adults, ENDS use has been lowest among those identifying as AAPI, with prevalence about half that of other ethnic/racial groups (Schoenborn and Gindi, 2015).

AAPI is the fastest growing ethnic group in the US, making up to 5.6% of the population nationally and 14.9% in California (Hoeffel et al., 2012). The three largest AAPI ethnic groups in California are Filipino, Chinese, and Vietnamese (United States Census Bureau, 2010). Given the expanding ENDS market and AAPI census, the current study aimed to characterize ENDS use and risk perceptions among AAPI young adults in California, a state recognized for early tobacco control legislation and declines in tobacco use, that has experienced growth in vape shops and other retail ENDS sales. Though recognizably dynamic and diverse, AAPI young adults, as a market segment generalization, tend to be tech-adoptive and responsive, comfortable with global brands, and socially connected in on- and off-line communities (Hargittai, 2010). An

\* Corresponding author at: Medical School Office Building, X316, 1265 Welch Road, Stanford, CA 94305-5411, USA.

E-mail addresses: [dalemaglalang@gmail.com](mailto:dalemaglalang@gmail.com) (D.D. Maglalang), [catibj@stanford.edu](mailto:catibj@stanford.edu) (C. Brown-Johnson), [JPro@stanford.edu](mailto:JPro@stanford.edu) (J.J. Prochaska).

exploratory descriptive study, we examined ENDS awareness, ENDS use, and risk perceptions overall and by AAPI ethnic group, nativity status, age, education, employment status, gender, and sexual orientation. An understanding of ENDS use patterns and risk perceptions among AAPI young adults can inform regulatory needs and tailored health interventions.

## 2. Materials and methods

Participants were recruited for an anonymous online survey between 7/7/2014 and 4/24/2015 in person ( $n = 163$ ) at Bay Area college classes and online ( $n = 338$ ) via AAPI-targeted social media, email listservs for non-profits serving AAPI youth, and snowball sampling. Compensation was not provided. Inclusion criteria were California resident, 18–25 years old, identifying as AAPI. Stanford University IRB approved the study protocol. Assessed demographic characteristics included AAPI ethnic group (Chinese, Filipino, Vietnamese, multi-AAPI ethnic, other), nativity (US, foreign born), age, education level, employment status, gender, and LGBTQIA status (i.e., lesbian, gay, bisexual, transgender, queer, intersex, asexual). Measures of ENDS source of awareness (friends/peers, family, television, radio, print, online, social venues, point-of-sale retail, other), risk perceptions, ENDS use, and preferences are summarized in Table 1. With a median-split, age-group was examined as 18–20 versus 21–25, relevant to state policy efforts to raise the legal age for purchasing tobacco (and in some cases ENDS) to age 21, including in California and Hawai'i.

Chi-square tests were run to examine associations for nativity and AAPI ethnicity with ENDS awareness (analyzed yes/no for each source separately), ever and current ENDS use, and risk perceptions categorized as low (1–3), neutral (4), or high (5–7). A Bonferroni correction was applied for the two tests (i.e., ethnicity and nativity) by source of ENDS awareness with statistical significance for  $p < 0.025$ . Multivariate

logistic regressions tested predictors of ever and current ENDS use, controlling for AAPI ethnic group and nativity, age, education, employment status, gender, sexual orientation, sources of ENDS awareness, and risk perceptions.

## 3. Results

### 3.1. Sample description

Reflecting California's AAPI census, participants ( $N = 501$ ) identified as Filipino (29%), Chinese (24%), Vietnamese (14%), mixed-AAPI heritage (13%), or other AAPI (21% – Asian Indian, Bangladeshi, Cambodian, Hmong, Lu Mien, Japanese, Korean, Laotian, Malaysian). Most respondents were born in the US (74%). Participants averaged 21 years of age ( $SD = 2.2$ ); 57% were women and 39% men (4% non-reported); 15% identified as LGBTQIA. Educational level of the sample was high school degree or lower (33%), some college (28%), associate's or vocational degree (7%), and bachelor's or graduate degree (32%); most of the sample was in school currently (72%), while 23% were employed, and 5% were unemployed.

### 3.2. Source of ENDS awareness

Respondents reported learning about ENDS from: friends/peers (73%), family (19%), retail point-of-sale (33%), social venues (30%), and media sources (40% online, 36% television, 18% print, 11% radio). Awareness of ENDS from peers was greatest among Filipino (86%) and mixed-Asian (83%) respondents, moderate for Vietnamese (73%) respondents, and lowest for Chinese (65%) and other Asian-ethnic respondents (59%),  $X^2 = 29.98$ ,  $df = 4$ ,  $p < .001$ ; and higher for those US-born versus foreign-born (78% vs. 22%,  $p = .004$ ,  $OR = 1.88$ , 95%  $CI = 1.22$ –2.89). Similarly, learning about ENDS from family was highest for Filipino (28%) and other Asian-ethnic respondents (22%), moderate for Vietnamese (14%) and those identifying as mixed-Asian (15%), and lowest for Chinese respondents (8%),  $X^2 = 18.51$ ,  $df = 4$ ,  $p = .001$ ; and higher for those US-born versus foreign-born (84% vs. 16%,  $p = .021$ ,  $OR = 1.99$ , 95%  $CI 1.10$ –3.61). Awareness of ENDS from social venues was more common among mixed Asian ethnic (42%) and Filipino (37%) respondents, moderate for Vietnamese (33%) and other Asian ethnic (30%) respondents, and lowest among Chinese respondents (14%),  $X^2 = 22.14$ ,  $df = 4$ ,  $p < .001$ ; and did not differ by nativity. Awareness of ENDS from point-of-sale retail and any media source (online, television, print or radio) did not differ by AAPI ethnic group or nativity.

### 3.3. Perceived risk of ENDS

Risk perception of ENDS use averaged 4.9 ( $SD = 1.6$ ) on a 7-point scale, with 21% coded as low risk perception (1–3), 17% neutral (4), and 62% harmful (5–7) (Table 1). ENDS risk perceptions did not differ by AAPI ethnic group or nativity.

### 3.4. Ever and current ENDS use

Ever ENDS use was reported by 44% of the sample, with 11% reporting current use (Table 2). Ever ENDS use was twofold greater among Filipino and Vietnamese compared to Chinese respondents with no difference by nativity. Ever and current ENDS use was more common among men than women and among 21–25 compared to 18–20 year olds. Current ENDS use was twice as high among those identified as LGBTQIA versus not; for those with vocational training or an associate's degree versus high school only or college-educated; and for those employed versus unemployed or a student.

In a logistic regression model ( $X^2 = 82.03$ ,  $df = 19$ ,  $p < .001$ ,  $R^2 = .18$ ), ever ENDS use was greater among Vietnamese ( $OR = 2.67$  95%  $CI 1.26$ –5.64) and Filipino ( $OR = 2.61$ , 95%  $CI 1.38$ –4.94)

**Table 1**  
ENDS Items, Response Options, and Frequency in an Anonymous Survey of Asian American and Pacific Islander Young Adults in California, 2014–2015.

1. ENDS Information Exposure: How did you hear about e-cigarettes? (select all that apply)						
Friends/Peers	73%	Online	40%	Television	36%	
Retail	33%	Social Venues	30%	Family	19%	
Radio	11%	Print/Magazine	18%	Other	3%	
2. ENDS Ever Use: Have you EVER used electronic cigarettes or other forms of Electronic Nicotine Delivery Systems (ENDS) such as vape pens or e-hookah?						
Yes	44%	No	56%			
3. ENDS Current Use: Do you currently use electronic cigarettes or other forms of Electronic Nicotine Delivery Systems (ENDS) such as vape pens or e-hookah?						
Yes	11%	No	89%			
4. Perceived Risk: What effect do you believe electronic nicotine delivery systems (e-cigarettes, e-hookah, vape pens) have on health? [Doesn't effect one's health = 1 to Bad for one's health = 7]						
Low risk (1–3) 21%		Neutral (4) 17%		Harmful (5–7) 62%		
1–2.2%	2–5.7%	3–13.3%	4–17.0%	5–22.7%	6–16.4%	7–22.7%
5. Flavor Preference: What is your regular flavor of e-cigarette/e-hookah/vape pen? <sup>ab</sup>						
Fruit	49%	Candy/Sweet	26%	Drinks	10%	
Menthol/Mint	8%	Tobacco	3%	No-flavor	4%	
6. Reasons for Use: What is/are your reason(s) for using e-cigarettes? <sup>a</sup>						
Quit-aid/healthier – “I used e-cigarette to quit smoking cigarettes and hookah.”						42%
Social – “Fun recreational activity to do. Enjoy doing it.”						33%
Stress – “Stress reliever.”						15%
High – “I enjoy the act of smoking, and enjoy the 'high'.”						10%
Flavor – “Enjoy the flavor.”						8%

<sup>a</sup> These open-ended questions were asked of current users only and did not require responses. Of 56 current users,  $n = 37$  responded to questions about flavor,  $n = 39$  to questions about reasons for use.

<sup>b</sup> Flavor responses were categorized based on the first listed flavor, coded as fruit; candy/sweet (e.g., custard, vanilla, dessert); drinks (e.g., “coca-cola”, coffee, milk, or “sex in the beach”); menthol/mint; tobacco; or no-flavor.

**Table 2**  
Frequency of Reported Ever and Current ENDS use by Sample Characteristics from an Anonymous Survey of Asian American and Pacific Islander (AAPI) Young Adults in California, 2014–2015.

Subgroup	n	% of sample	ENDS use			
			Ever (%)		Current (%)	
AAPI ethnic group						
Filipino	143	29%	<b>75</b>	<b>53%</b>	19	13%
Chinese	119	24%	<b>37</b>	<b>31%</b>	8	7%
Vietnamese	70	14%	<b>37</b>	<b>53%</b>	10	14%
Mixed AAPI heritage	64	13%	<b>28</b>	<b>44%</b>	7	11%
Other AAPI	105	21%	<b>44</b>	<b>42%</b>	12	11%
US born						
Yes	373	74%	171	46%	41	11%
No	128	26%	50	39%	15	12%
Age						
18–20	222	44%	<b>83</b>	<b>37%</b>	<b>16</b>	<b>7%</b>
21–25	279	56%	<b>138</b>	<b>50%</b>	<b>40</b>	<b>14%</b>
Gender <sup>a</sup>						
Men	195	39%	<b>99</b>	<b>51%</b>	<b>31</b>	<b>16%</b>
Women	284	57%	<b>110</b>	<b>39%</b>	<b>21</b>	<b>7%</b>
Identify as LGBTQIA <sup>a</sup>						
Yes	74	15%	37	50%	<b>15</b>	<b>20%</b>
No	234	85%	176	43%	<b>38</b>	<b>9%</b>
Education						
Up to high school degree	164	33%	61	37%	<b>8</b>	<b>5%</b>
In college	142	28%	63	44%	<b>15</b>	<b>11%</b>
Associates or vocational degree	33	7%	18	55%	<b>9</b>	<b>27%</b>
College degreed	162	32%	79	49%	<b>24</b>	<b>15%</b>
Employment status						
Employed	113	23%	58	51%	<b>21</b>	<b>19%</b>
Unemployed	26	5%	15	58%	<b>1</b>	<b>4%</b>
Student	362	72%	148	41%	<b>34</b>	<b>9%</b>

Note: Italicized cells indicate significant between group comparisons at  $p < .05$ .

Abbreviations: ENDS = Electronic nicotine delivery system; LGBTQIA = lesbian, gay, bisexual, transgender, queer, intersex, asexual; Other AAPI reported ethnic groups were: Asian Indian, Bangladeshi, Cambodian, Hmong, Lu Mien, Japanese, Korean, Laotian, Malaysian, Taiwanese.

<sup>a</sup> Missing Data: 22 participants did not report gender and 17 did not report LGBTQIA status.

compared to Chinese respondents; among those with low (OR = 3.51, 95% CI 2.02–6.10) versus high risk perception; and among those reporting awareness of ENDS from peers/friends (OR = 3.56, 95% CI 1.85–6.87). Awareness of ENDS from media sources (OR = 0.51, 95% CI 0.31–0.83) was associated with a lower likelihood of ever ENDS use. Nonsignificant were nativity, age, gender, education and employment status, LGBTQIA status, and ENDS awareness from family, social venues, and point-of-sale retail.

In a logistic regression model ( $X^2 = 58.47$ ,  $df = 19$ ,  $p < .001$ ,  $R^2 = .13$ ), current ENDS use was greater among men than women (OR = 2.63, 95% CI 1.18–5.90), those with an associate or vocational degree compared to high school degree or less (OR = 7.66, 95% CI 1.39–42.41), and among those with low versus high-risk perception (OR = 6.22, 95% CI 2.61–14.84). Nonsignificant were AAPI ethnic group, nativity, age, employment status, LGBTQIA status, and ENDS awareness from any source.

### 3.5. ENDS user flavors and reasons for use

Flavor preference was reported by 37 of 56 current users; 20 (54%) preferred fruit flavored ENDS including lychee, taro, mango, passion fruit, pomegranate, and melon; 8 preferred candy or other sweet flavoring (e.g., pink Starburst, vanilla, custard, bubblegum), 4 preferred drink flavors (e.g., Coca-Cola, coffee, alcohol drinks), 3 menthol/mint, and 2 others. Among 39 of 56 current ENDS users reporting reasons for use, 16 (42%) reported use as a cessation aid or healthier alternative to conventional cigarettes, 13 (33%) for recreational/social reasons, 6

(15%) for stress relief/coping, 4 (10%) for nicotine's highs, and 3 (8%) for the flavor.

## 4. Discussion

In an online anonymous survey of AAPI young adults in Northern California, 44% had tried ENDS and 11% were current users, percentages comparable to a recent pilot survey in Southern California of emerging young adults (Allem et al., 2015). Consistent with a study in Hawai'i (Wills et al., 2015), ENDS use was more common among Filipino respondents and less common among Chinese respondents. The higher reported ENDS use among men was consistent with gender differences observed for conventional cigarette use, though at a less extreme gender-gap. While AAPI women tend to have low rates of conventional smoking, our observed ENDS trial use of 39% and current use at 7% among AAPI young adult women respondents is concerning.

Similar to national studies (King et al., 2013; Pepper et al., 2014; Regan et al., 2013), our respondents reported exposure to ENDS through multiple marketing channels (television, print, online, radio, social venues, point-of-sale retail), though exposure via peers/friends was the most common. Vietnamese, Filipino, mixed-Asian, and US-born respondents in our study were much more likely to learn about ENDS from friends/peers and family compared to Chinese and foreign-born respondents. Notably, learning about ENDS from friends/peers was associated with trial use of ENDS though not current use. Social media or peer-led interventions are channels worth testing for prevention of ENDS use among AAPI young adults. Further, from a regulatory standpoint, point-of-sale regulation and television advertising bans reflective of combustible cigarette policies may be warranted to protect AAPI young adults from ENDS marketing.

A majority of respondents perceived ENDS as harmful. Notably, those with low compared to high risk perceptions of ENDS had more than three-fold greater likelihood of ever use and a six-fold greater likelihood of current ENDS use. Learning about ENDS in public media channels (online, television, radio, and print) was associated with a lower likelihood of ENDS trial use. The survey did not distinguish message types on these channels – e.g., product advertising versus news stories or public service announcements. Warning labels are expected by youth for risky products; without warning labels, research indicates youth interpret ENDS as risk-free (McDonald and Ling, 2015). Modified risk product warning labels similar to those of smokeless tobacco should be considered.

Consistent with the few studies that have examined ENDS flavor preferences (Ambrose et al., 2015), we found preference for fruit and sweet flavors. Notably, several flavors listed by study respondents were Asian culture focused (e.g., lychee, taro, passion fruit). Close to half of AAPI young adult ENDS users in our sample reported using ENDS as a healthier alternative or quit-aid for combustible cigarettes. Also reported was use in social settings, for stress relief, and for nicotine highs. Though preliminary in nature with a cross-sectional design, convenience sample, and under-representation of some AAPI ethnic groups, this study provides insight into AAPI young adults' ENDS awareness, use trends, and risk perceptions.

### 4.1. Conclusions

Our results indicate potential groups for priority monitoring of ENDS uptake and use, including Filipino and Vietnamese young adults, LGBTQIA-identified individuals, and those with associate's degrees or vocational training. The greater current use of ENDS among employed respondents also is notable, perhaps a response to workplace smoking bans. Although AAPI young adult women in our survey reported lower current and trial use of ENDS than men, the gender gap appeared smaller than that for conventional cigarettes; it is worth monitoring whether young adult AAPI women are at greater risk proportionally for ENDS use. While an exploratory study with convenience sampling, these are

the only published data assessing ENDS use among AAPI young adults. Furthermore, as a reflection of California, which has the largest US AAPI population, this study serves to identify signals for further research. Population surveys should oversample AAPI ethnic subgroups with attention to gender and sexuality influences on conventional tobacco and ENDS use to validate and expand the current findings.

#### Conflict of interest statement

Dr. Prochaska has done ad-hoc consulting for Pfizer and been an expert witness against tobacco companies. Dr. Brown-Johnson and Mr. Maglalang declare that there are no conflicts of interest.

#### Human subjects approval statement

The Stanford University IRB approved the study protocol.

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