

Young Adult Correlates of IQOS Curiosity, Interest, and Likelihood of Use

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Objectives: Philip Morris International's heated tobacco product, Marlboro IQOS, is available internationally and soon will be marketed in the United States (US). We examined correlates of curiosity, interest, and likelihood to use IQOS among US young adults. **Methods:** Young adults ages 18-30 years (N = 346) were recruited online, viewed a description of IQOS, and completed measures of socio-demographic characteristics, perceived risks, curiosity, interest, and likelihood to use IQOS. **Results:** Males had greater curiosity, interest, and likelihood to use IQOS than females. Individuals with household income of \$50,000-\$75,000 were more curious than those with household income of greater than \$75,000. Cigarette smokers, e-cigarette and dual users had greater curiosity, interest, and likelihood of use than non-tobacco users. Non-white individuals and older young adults had greater likelihood of use. Greater perceived risks of IQOS were negatively associated with curiosity, interest, and likelihood of use. **Conclusions:** Among young adults, IQOS has greater appeal among males, non-whites, those who are older, those with household income of \$50,000-\$75,000, cigarette smokers, e-cigarette and dual users, and those with fewer perceived risks of IQOS. Research on public education communicating the potential risks of IQOS to vulnerable young adults is warranted.

Key words: young adults; new tobacco product; modified risk tobacco products; e-cigarettes

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Some of the world's largest tobacco companies have designed the next generation of non-cigarette tobacco products called heated tobacco products (HTP) or heat-not-burn tobacco products.¹ The prototype HTP is Philip Morris International (PMI)'s Marlboro IQOS (I Quit Ordinary Smoking).² Advertised as a sophisticated smoke-free product, IQOS uses an electronically rechargeable heater to heat tobacco in the form of Marlboro HeatSticks at temperatures below combustion.² IQOS is heavily marketed internationally

with storefront advertising, aggressive promotions, and a large number of retail outlets³ and is gaining momentum with sales in over 30 countries, including Canada, Italy, Germany, Japan, and Korea.³⁻⁷

In April 2019, the Food and Drug Administration (FDA) approved the marketing of IQOS through the premarket tobacco product application (PMTA) pathway.^{8,9} This action authorizes the sale of IQOS in the United States (US), but it is not an FDA decision on the separate modified risk tobacco product (MRTTP) application to

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advertise IQOS with reduced risk or reduced exposure claims.⁹ The FDA's Tobacco Products Scientific Advisory Committee (TPSAC) reviewed PMI's MRTP application for IQOS in January 2018.¹⁰ The TPSAC committee accepted PMI's claim that switching completely from cigarettes to IQOS significantly reduces exposure to harmful or potentially harmful constituents (HPHCs). However, the TPSAC committee also concluded there was insufficient evidence to support that reductions in exposure to HPHCs likely would translate to measurable reductions in tobacco-associated disease for FDA approval of reduced risk claims.¹⁰ As of June 2019, PMI's MRTP application for IQOS is still under review and FDA has not announced a determination on the application.¹¹

Consumer appeal of HTPs stems from industry claims that products such as IQOS are safer than cigarettes while maintaining the sensory experience of cigarette smoking and route of nicotine delivery.² Evidence from PMI's publicly-available data indicates IQOS may expose users to lower levels of some toxicants than cigarettes but expose them to higher levels of other toxicants with unknown risks.^{4,12-16} An analysis of PMI's MRTP application indicated PMI reported levels for only 40 of 93 HPHCs on FDA's list and for all 58 HPHCs on PMI's list. Though all HPHCs on PMI's list were lower in emissions compared to mainstream smoke of reference cigarettes, levels of 56 constituents not on FDA or PMI's lists contained unknown toxicity at levels of exposure 200% to 1000% higher than cigarette smoke.⁴ Some research shows no detectable differences between cigarette smoking and IQOS on biomarkers of potential harm.¹⁵ Additionally, some human and animal studies indicate that switching completely to IQOS from cigarette smoking may not avoid adverse pulmonary¹² and cardiovascular¹⁶ effects of smoking, and use of IQOS may be associated with pulmonary inflammation,¹² vascular endothelial impairment,¹⁶ and liver toxicity.¹³

PMI and other tobacco companies have an extensive history of intentionally advertising misleading claims about product risks (eg, Marlboro "lights").¹⁷ In a review of PMI's study results on consumer risk perceptions of IQOS, Popova et al¹⁸ concluded that PMI's data did not support its IQOS reduced risk claims; furthermore, reduced

exposure claims were misperceived by consumers as reduced risk claims or that the product was risk-free. Misperceptions about IQOS risks could have negative consequences of increased initiation among non-tobacco users including young adult never cigarette smokers.⁸ Young adults may be especially vulnerable to the influence of reduced risk claims about HTPs,^{19,20} are likely attracted to the retail marketing and sleek packaging of IQOS,^{5,19} and may be interested in experimenting and initiating use of IQOS.^{21,22}

International evidence on IQOS awareness and use among young adults provides insights on subgroups who may be most likely to try and continue to use IQOS.¹⁴ In an online cross-sectional survey 3 months following the introduction of IQOS in Korea, 38% of Korean young adults were aware of IQOS, 5.7% had tried the tobacco product, and 3.5% were current users. Most IQOS users were dual or poly users with cigarette and/or e-cigarette use; there were no young adult IQOS-only users in this study that would suggest young adult smokers were completely switching to IQOS.²³ Two studies report increasing awareness and use of HTPs in the US.^{21,22} Data from the International Tobacco Control Youth Tobacco and E-Cigarette Survey in 2017 indicate 9.1% of US youth were aware of IQOS and 41% expressed interest in trying the product.²¹ Additionally, using nationally representative data from the Tobacco Products and Risk Perceptions Survey, Nyman et al's²² findings demonstrate there were increasing trends of awareness, ever use, and current use of HTPs among US adults from 2016 to 2017, and the highest proportions of awareness (13.9%), ever use (3.0%), and current use (1.5%) were among US young adults ages 18 to 29 years. We sought to build from these findings on IQOS' appeal in the US by focusing on young adults and examining correlates during a critical developmental period for IQOS initiation and use.

The purpose of this study was to examine socio-demographic correlates and associations of perceived risks with curiosity, interest, and likelihood to use IQOS among young adults in the US. We identified these 3 outcomes as unique markers of interest in novel tobacco products among young people.²⁴⁻²⁷ Curiosity characterizes the general appeal of the product even in the absence of intentions to use it,²⁸ interest captures a willingness to

try the product, and likelihood describes the self-perceived probability of using the product. We examined these 3 outcomes as distinct from susceptibility in that they collectively measure an intention to use the product rather than the absence of a determined decision *not* to use the product.²⁹ Given the accumulating evidence between young consumer perceptions and uptake of tobacco products^{30,31} including IQOS,⁸ we hypothesized young adults with low perceived risks of IQOS will be more curious, interested, and likely to use IQOS than those with greater perceived risks of IQOS. Understanding young adults' interest in IQOS prior to it being commercially available in the US can assist with addressing marketplace concerns and proactive regulatory policymaking to prevent and monitor the use of IQOS among young adults.

METHODS

Study Design and Sample

We examined correlates of curiosity, interest, and likelihood to use IQOS as a part of an online cross-sectional study examining young adults' perceptions of IQOS branding and advertising statements.¹¹ All data were collected in June 2018 through the online-based crowdsourcing platform, Amazon Mechanical Turk (MTurk). This platform has been used to administer research studies online and has provided valid results for experimental and observational tobacco studies with young adults similar to the current study.³²⁻³⁵ We aimed to enroll 440 young adults and stratified participant recruitment into 2 "tasks" to recruit approximately equal numbers of young adult cigarette smokers (N = 200) and non-smokers (N = 220). Eligible participants were young adults 18 to 30 years who were cigarette smokers (defined as having smoked ≥ 100 cigarettes lifetime and currently smoking "every day" or "some days") or non-smokers (smoking ≤ 100 cigarettes and not currently smoking). We sampled both smokers and non-smokers because tobacco use status is a predictor of interest in using novel tobacco products including IQOS²¹ and to provide data to inform potential FDA regulatory decision-making on IQOS that affects cessation among smokers and initiation of tobacco use including IQOS among non-smokers.³⁶

Interested MTurk members residing in the US reviewed a brief study description with a link to

the online eligibility screener and consent form. Eligible, consenting participants were first randomly assigned to view either a text only or text with branding IQOS description. Text and branding elements were adapted from samples included in PMI's publicly available MRTP application. Specifically, the IQOS description included an introduction to IQOS, described evidence on potential harm reduction for smokers who switch to IQOS, and characterized its sensory experience relative to conventional cigarettes. The IQOS description was identical both conditions, but branding (eg, product images, logos) was removed in the text only condition. The text only condition displayed this information as black text on a white background with no branding elements (eg, product images, logos). The text with branding condition displayed this information with branding information, including product images, logos, and a colored background. Study stimuli are available from the authors on request.

After viewing the description of IQOS, participants responded to questions assessing study outcomes about IQOS, cigarette smoking and e-cigarette use, and socio-demographics. Participants received \$1.00 for completing study procedures.

Measures

Socio-demographic characteristics. Age, sex, race, ethnicity, household income, and education were assessed similarly to other online tobacco studies including young adults.^{35,37} We used "What is the highest level of education you have completed" and "Are you currently in college?" to create a variable with 4 mutually exclusively categories of education: (1) \leq high school; (2) college students; (3) some college; and (4) college graduates. Those categorized as \leq high school were those who completed high school or less and were not currently enrolled in college. College students characterized those who were currently enrolled in college. Some college described participants who did not receive a terminal degree but had completed some college and were not currently enrolled in college. College graduates characterized those with a terminal college degree.

Cigarette smoking and e-cigarette use. Cigarette smoking was assessed with 2 valid questions and identified those who have smoked ≥ 100 ciga-

Table 1
Sample Characteristics

| Demographics | N (%) | M (SD) |
|---------------------|------------|------------|
| Age | | 26.2 (2.9) |
| Sex | | |
| Male | 208 (60.1) | |
| Female | 124 (35.8) | |
| Ethnicity | | |
| Hispanic | 46 (13.3) | |
| Non-Hispanic | 286 (82.7) | |
| Race | | |
| White | 235 (67.9) | |
| Non-white | 96 (27.7) | |
| Household income | | |
| < \$50,000 | 182 (52.6) | |
| \$50,000 – \$75,000 | 102 (29.5) | |
| > \$75,000 | 48 (13.9) | |
| Education | | |
| ≤ High school | 41 (11.8) | |
| College students | 96 (27.7) | |
| Some college | 66 (19.1) | |
| College graduates | 128 (37.0) | |
| Tobacco use | | |
| Non-tobacco users | 91 (26.3) | |
| Cigarette smokers | 133 (38.4) | |
| E-cigarette users | 50 (14.5) | |
| Dual users | 61 (17.6) | |
| Perceived risks | | 3.0 (0.73) |

Note.

SD = Standard Deviation. Some N totals do not sum to total sample N due to sporadic missing data (< 5% for any given variable).

rettes in their lifetime and now currently smoke “every day” and “some days.”³⁷ E-cigarette use was measured with one valid question: “Have you ever used an electronic cigarette or e-cigarette, such as Blu, NJoy, or Smoking Everywhere?”³⁷ Responses included: No, I have never used an e-cigarette; Yes, but not within the past month; Yes, within the past month. We created a variable with 4 mutually exclusive categories of cigarette and e-cigarette use using these valid questions: (1) non-tobacco users; (2) cigarette smokers; (3) e-cigarette users; and (4) dual users. Non-tobacco users were those who were not current cigarette smokers and did not use e-cigarettes in the past month. Cigarette smokers

who may have used e-cigarettes but not in the past month (ie, “ever e-cigarette users”) were defined as smokers. E-cigarette users were those who used e-cigarettes in the past month and were not current cigarette smokers. Dual users were those who currently smoked cigarettes and reported using e-cigarettes in the past month.

Perceived risks. We measured perceived risks of IQOS with 2 questions drawn from prior studies.^{38–40} Participants were asked: “How harmful do you think the tobacco product shown is to a person’s health?” (1 = Not at all harmful to 4 = Very harmful) and “Overall, would you say that the tobacco product shown (IQOS) is...” (1 = Not at all addictive to 4 = Very addictive). The 2 items were summed and averaged ($r = 0.52$, $p < .001$).

Curiosity. Curiosity to try IQOS was drawn from a prior study⁴¹ and assessed as: “Overall, how curious are you about trying the tobacco product shown?” (1 = Not at all curious to 7 = Very curious).

Interest. Interest in using IQOS was drawn from a prior study²⁴ and measured as: “How interested would you be in using the tobacco product shown?” (0 = Not at all interested to 10 = Very interested).

Likelihood. We asked: “How likely is it that you will use the tobacco product shown in the next year?” to examine participants’ likelihood to use IQOS (1 = Definitely will not use to 4 = Definitely will use).^{25,39}

Data Analysis

Our data analyses included several steps. First, we summarized the sample’s characteristics with descriptive statistics. Then, we examined correlates of curiosity, interest, and likelihood to use IQOS using bivariate correlations for continuous variables. We examined bivariate associations using one-way analysis of variance or Welch’s one-way analysis of variance with Tukey-Kramer adjusted *post hoc* tests for multiple comparisons based on the results of the Levene’s test for categorical variables. Lastly, we used multivariable linear regression models to examine the associations between socio-demographic characteristics, cigarette smoking and e-cigarette use, and perceived risks with outcomes of curiosity, interest, and likelihood to use IQOS in the next year. There were no differences in curiosity, interest, and likelihood to use IQOS by the 2 randomly assigned conditions for viewing descriptions of

Table 2
Bivariate Associations for Socio-demographic Characteristics and Curiosity, Interest, and Likelihood to Use IQOS

| Variable | Curiosity | | Interest | | Likelihood | |
|-------------------------|--------------|----------|--------------|----------|---------------|----------|
| | M (SD) | r | M (SD) | r | M (SD) | r |
| Age | | 0.05 | | 0.81 | | 0.08 |
| Sex | | | | | | |
| Male | 4.4 (2.1) | | 4.3 (2.2) | | 2.3 (0.91) | |
| Female | 3.4 (2.3)*** | | 3.2 (2.3)*** | | 1.9 (0.92)*** | |
| Ethnicity | | | | | | |
| Hispanic | 4.3 (2.3) | | 4.5 (2.3) | | 2.2 (0.89) | |
| Non-Hispanic | 3.9 (2.2) | | 3.8 (2.3) | | 2.1 (0.94) | |
| Race | | | | | | |
| White | 3.8 (2.3) | | 3.6 (2.3) | | 2.0 (0.93) | |
| Non-white | 4.5 (2.0)** | | 4.5 (2.2)** | | 2.4 (0.88)*** | |
| Household income | | | | | | |
| < \$50,000 | 3.9 (2.2) | | 3.8 (2.3) | | 2.0 (0.91) | |
| \$50,000-\$75,000 | 4.4 (2.2) | | 4.3 (2.3) | | 2.3 (0.91) | |
| > \$75,000 | 3.3 (2.2)* | | 3.3 (2.3)* | | 2.0 (1.0)* | |
| Education | | | | | | |
| ≤ High school | 4.4 (2.0) | | 4.2 (2.0) | | 2.2 (0.83) | |
| College students | 4.2 (2.1) | | 4.2 (2.3) | | 2.2 (0.94) | |
| Some college | 3.4 (2.4) | | 3.3 (2.4) | | 2.0 (0.91) | |
| College graduates | 4.0 (2.3) | | 3.8 (2.4) | | 2.1 (0.93) | |
| Perceived Risks | | -0.32*** | | -0.37*** | | -0.34*** |

Note.

r indicates correlations. Means and standard deviations (SD) are reported from one-way analysis of variance or Welch's one-way analysis of variance.

* indicates statistically significant associations, $p \leq .05$

** indicates statistically significant associations, $p \leq .01$

*** indicates statistically significant associations, $p \leq .001$

IQOS, so this was not examined further in analyses. All statistical analyses were performed using SPSS 25.0 (Armonk, NY).

RESULTS

Overall, 1273 individuals were interested in participating in the study. Of these, 927 (72.8%) were ineligible due largely to age and smoking status criteria and 346 (27.2%) were eligible and completed study procedures. Table 1 shows participant socio-demographic characteristics, cigarette and e-cigarette use, and perceived risks of IQOS.

Bivariate Associations with Curiosity, Interest, and Likelihood to Use IQOS

Table 2 displays bivariate analyses examining associations between socio-demographic characteristics and perceived risks for curiosity, interest, and likelihood to use IQOS. Males had greater curiosity, interest, and likelihood to use IQOS than females. Similarly non-white individuals had higher mean scores for curiosity, interest, and likelihood than their white counterparts. Those with annual household income \$50,000-75,000 were also more curious to try IQOS and more interested in using IQOS than individuals with annual household

Table 3
Bivariate Comparisons for Cigarette Smoking and E-cigarette use and Curiosity, Interest, and Likelihood to Use IQOS

| Outcomes | Tobacco Use | | | |
|-------------------|--------------------------------|--------------------------------|--------------------------------|----------------------------|
| | Non-tobacco Users ^A | Cigarette Smokers ^B | E-cigarette Users ^C | Dual Users ^D |
| Curiosity | 1.9 (1.7) ^{B, C, D} | 5.0 (1.8) ^{A, C} | 3.6 (2.1) ^{A, B, D} | 5.3 (1.7) ^{A, C} |
| Interest | 1.7 (1.5) ^{B, C, D} | 5.0 (1.8) ^{A, C} | 3.2 (2.1) ^{A, B, D} | 5.4 (1.8) ^{A, C} |
| Likelihood | 1.3 (0.61) ^{B, C, D} | 2.6 (0.72) ^{A, C} | 2.3 (0.86) ^{A, B, D} | 2.6 (0.73) ^{A, C} |

Note.

Superscript groups indicate significant associations at $p \leq .001$ in Welch's one-way analysis of variance with Tukey-Kramer adjusted post hoc tests for multiple comparisons.

income greater than \$75,000. Those with annual household income of \$50,000-\$75,000 had greater likelihood of using IQOS than individuals with less than \$50,000 annual household income. There was an inverse correlation between perceived risks of IQOS with curiosity, interest, and likelihood to use.

Levene's test of equal variances was statistically significant ($p \leq .01$) for the bivariate models of tobacco use with curiosity, interest, and likelihood, and we subsequently used Welch's one-way analysis of variance with Tukey-Kramer adjusted *post hoc* tests to examine cigarette smoking and e-cigarette use categories as displayed in Table 3. Welch's one-way analysis of variance tests indicated differences between tobacco use groups, for curiosity $F(3, 142) = 72.3$, $p < .001$, interest $F(3, 141) = 90.1$, $p < .001$, and likelihood to use IQOS ($F(3, 141) = 91.0$, $p < .01$). Non-tobacco users were less curious, less interested, and less likely to use IQOS than cigarette smokers, e-cigarette users, and dual users. Cigarette smokers and dual users had significantly higher means than e-cigarette users for curiosity, interest, and likelihood to use.

Multivariable Associations with Interest, Curiosity, and Likelihood of Using IQOS

Table 4 displays the multivariable linear regression models examining correlations between socio-demographic characteristics and perceived risks with the outcomes of curiosity, interest, and likelihood to use IQOS. The multivariable mod-

els indicate males endorsed greater curiosity, interest, and likelihood to use IQOS than females. Those with annual household income of \$50,000-\$75,000 were more curious and interested than individuals with annual household income greater than \$75,000. Age was associated with likelihood to use IQOS. Additionally, non-white participants were more likely to use IQOS in the next year than white participants. Participants with some college education were less curious about IQOS compared to college graduates. Cigarette smokers, e-cigarette users, and dual users were more curious, interested, and likely to use IQOS than non-tobacco users. Lastly, individuals with greater perceived risks of IQOS endorsed less curiosity, interest, and likelihood to use IQOS.

DISCUSSION

Little is known about IQOS' appeal to young adults in the US. This study highlights important subgroups of young adult smokers and non-smokers with greater interest in IQOS. Our results suggest that males and those who use cigarettes and e-cigarettes are generally more curious, interested, and likely to try IQOS than their counterparts. Our findings also indicate individuals with some college education are less curious about IQOS than college graduates, and those with an annual household income of \$50,000 to \$75,000 are broadly more curious and interested in IQOS. Additionally, older and non-white young adults may be more likely to try IQOS.

Table 4
Multivariable Associations for Characteristics and Curiosity, Interest, and Likelihood to Use IQOS

| Variable | Curiosity | | Interest | | Likelihood | |
|-------------------------|-----------|----------------|----------|----------------|------------|----------------|
| | B | 95% CI | B | 95% CI | B | 95% CI |
| Age | 0.02 | -0.05 to 0.08 | 0.06 | -0.01 to 0.12 | 0.03* | -0.00 to 0.06 |
| Sex | | | | | | |
| Male | 0.47* | 0.07 to 0.87 | 0.59** | 0.20 to 0.98 | 0.20** | 0.05 to 0.36 |
| Female | REF | | | | | |
| Ethnicity | | | | | | |
| Hispanic | 0.02 | -0.54 to 0.59 | 0.20 | -0.75 to 0.35 | 0.21 | -0.02 to 0.43 |
| Non-Hispanic | REF | | | | | |
| Race | | | | | | |
| White | REF | | | | | |
| Non-white | 0.08 | -0.78 to 0.51 | 0.11 | -0.32 to 0.53 | 0.19* | 0.02 to 0.36 |
| Household income | | | | | | |
| < \$50,000 | 0.49 | -0.08 to 1.1 | 0.38 | -0.18 to 0.94 | -0.03 | -0.26 to 0.19 |
| \$50,000-\$75,000 | 0.92** | 0.33 to 1.5 | 0.73* | 0.14 to 1.3 | 0.22 | -0.02 to 0.46 |
| > \$75,000 | REF | | | | | |
| Education | | | | | | |
| ≤ High school | -0.13 | -0.78 to 0.51 | -0.05 | -0.68 to 0.58 | 0.08 | -0.17 to 0.34 |
| College students | 0.06 | -0.43 to 0.55 | 0.31 | -0.17 to 0.79 | 0.14 | -0.05 to 0.34 |
| Some college | -0.62* | -1.13 to -0.08 | -0.43 | -0.94 to 0.08 | -0.11 | -0.31 to 0.10 |
| College graduate | REF | | | | | |
| Tobacco use | | | | | | |
| Non-tobacco user | REF | | | | | |
| Cigarette smoker | 2.8*** | 2.3 to 3.3 | 2.9*** | 2.4 to 3.4 | 1.2*** | 1.0 to 1.4 |
| E-cigarette user | 1.6*** | 1.0 to 2.2 | 1.2*** | 0.66 to 1.8 | 0.40*** | 0.16 to 0.63 |
| Dual user | 3.2*** | 2.6 to 3.8 | 3.4*** | 2.8 to 4.0 | 1.2*** | 0.99 to 1.4 |
| Perceived risks | -0.55*** | -0.82 to -0.28 | -0.70*** | -0.96 to -0.44 | -0.25*** | -0.35 to -0.14 |

Note.

B indicates unstandardized regression coefficients. **CI** notes confidence intervals.

* indicates statistically significant associations, $p \leq .05$

** indicates statistically significant associations, $p \leq .01$

*** indicates statistically significant associations, $p \leq .001$

Our findings are consistent with the limited existing tobacco surveillance data on IQOS that also indicate males, cigarette smokers, and e-cigarette users have greater interest and likelihood of using IQOS.^{21,22} Although our study found individuals with some college education to be significantly less curious about IQOS, we did not observe statistically significant associations for interest and likelihood of use. Other studies also have found similar associations between education status and outcomes related to IQOS.^{22,42} Our findings suggest-

ing non-white young adults were more likely to use IQOS in the future than white young adults also align with findings from Nyman et al.²² Overall, our results indicate continued investigation into the socio-demographic correlates of the appeal of IQOS among US young adults is warranted.

Our results also suggest variation in the appeal of IQOS based on young adults' cigarette smoking status and e-cigarette use. Young adult cigarette smokers, e-cigarette users, and dual users were more curious, interested, and likely to try IQOS

than non-tobacco users. Non-tobacco user mean scores indicate some curiosity and interest toward IQOS, but relatively low likelihood of using it. This study result aligns with the FDA's review of PMI's PMTA application and the agency's summary indicating low uptake by youth and current non-smokers.⁸ Czoli et al²¹ also found comparable results for non-tobacco users, and reported that the likelihood of trying IQOS was higher among cigarette smokers than e-cigarette users. Our results build upon this evidence base by demonstrating that cigarette smokers have higher curiosity, interest, and likelihood of using IQOS than e-cigarette only users; however, no differences were apparent between cigarette smokers and dual users. This finding may be affected by our measure of e-cigarette use; we operationalized e-cigarette use as use in the past 30 days and did not distinguish between e-cigarette brands or type. Similarly, our measure of household income may have captured young adults' report of their parents' household income or of their own earnings. In future studies with young adults, it will be important to use more precise and granular measures of household income such as subjective financial situation⁴³ and e-cigarette use (eg, quantity, frequency, brand, type) to clarify the associations we observed.

We also found individuals with low perceived risks of IQOS to have greater curiosity, interest, and likelihood to use the product than those with higher risk perceptions. This finding supports the FDA's concerns corroborated by other study data¹⁹ that consumers, including young adult never smokers, may underestimate the addiction risks of IQOS.^{8,9} Our findings indicate young adults with low perceived risks of IQOS comprise a vulnerable subgroup who may use IQOS and potentially other HTPs. Perceptions about harm and addictiveness risks of IQOS may promote experimentation and uptake of this tobacco product among young adults. Currently the risks of IQOS use are uncertain; however, there is evidence indicating potential toxicant exposure,⁴ cardiovascular¹⁶ and pulmonary¹² effects, and nicotine addiction.⁴⁴ It will be important for research to examine how to communicate the potential risks of IQOS accurately to relevant populations to prevent uptake among tobacco naïve young adults and promote cessation or harm reduction among current tobacco users (eg, cigarette smokers).

The findings should be interpreted in light of important study limitations. Although our study outcomes and patterns of results are similar to other population-based studies on IQOS perceptions,²² we recruited a convenience sample of young adults using a crowdsourcing platform, which may not generate results generalizable to the overall young adult US population. Our cross-sectional online study also focuses on the influence of cigarette smoking and e-cigarette use on 3 outcomes related to IQOS: curiosity, interest, and likelihood of use. These outcomes were assessed with questions similar to those measuring susceptibility⁴⁵ and future research should consider examining our findings in relation to susceptibility measures designed to capture young people's risk of using novel tobacco products. Associations of IQOS perceptions and use with other types of tobacco products popular among young adults (eg, cigars, hookah) also should be explored.⁴⁶ We did not include measures to examine awareness and use of IQOS prior to stimuli exposure, and these may be important covariates to include in future research involving IQOS. Finally, for novel products such as IQOS "Don't know" may also be a valuable response option to include in measures of awareness in the future.

Despite these limitations, this study is among the first to examine correlates of curiosity, interest, likelihood to use IQOS. Our results highlight subgroups of young adults that may be vulnerable to the labeling and marketing with the introduction of IQOS in the US. Our findings also suggest that targeting young adult risk perceptions of IQOS may be an effective tobacco control strategy to prevent experimentation and uptake particularly among non-tobacco users. Prospective studies are needed to monitor IQOS' appeal to young adults and their perceptions and behavior related to IQOS over time.

IMPLICATIONS FOR TOBACCO REGULATION

This study is among the first to examine correlates of curiosity, interest, and likelihood of using IQOS among young adults in the US. Our results add to the literature on young adults' interest in heated tobacco products and provide insight on subgroups in which IQOS uptake may be higher. Given the

growing popularity of IQOS internationally and the FDA's authorization in April 2019 to market IQOS through the premarket tobacco product application pathway, research should examine reasons for IQOS appeal and use and IQOS use relative to other tobacco products among young adults. Research on public education messaging to communicate the potential risks of IQOS effectively to vulnerable young adults is warranted.

Human Subjects Approval Statement

The treatment of human participants was in accordance with ethical standards, all study procedures were approved as exempt research by the Institutional Review Board at the host institution (IRB # 2014-1171), and all participants provided consent online. Additionally, the current study meets the ethical standard outlines in Helsinki Declaration of 1975 as revised in 2000.

Conflict of Interest Disclosure Statement

All authors of this article declare they have no conflicts of interest.

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