


BMJ Open Cross-sectional online survey of clinicians' knowledge, attitudes and challenges to screening and counselling adolescents and young adults for substance use

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ABSTRACT

Objective To examine adolescent healthcare clinicians' self-reported screening practices as well as their knowledge, attitudes, comfort level and challenges with screening and counselling adolescents and young adults (AYA) for cigarette, e-cigarette, alcohol, marijuana, hookah and blunt use.

Design A 2016 cross-sectional survey.

Setting Academic departments and community-based internal medicine, family medicine and paediatrics practices.

Participants Adolescent healthcare clinicians (N=771) from 12 US medical schools and respondents to national surveys. Of the participants, 36% indicated male, 64% female, mean age was 44 years (SD=12.3); 12.3% of participants identified as Asian, 73.7% as white, 4.8% as black, 4.2% as Hispanic and 3.8% as other.

Primary and secondary outcome measures Survey items queried clinicians about knowledge, attitudes, comfort level, self-efficacy and challenges with screening and counselling AYA patients about marijuana, blunts, cigarettes, e-cigarettes, hookah and alcohol.

Results Participants were asked what percentage of their 10–17 years old patients they screened for substance use. The median number of physicians reported screening 100% of their patients for cigarette (1st, 3rd quartiles; 80, 100) and alcohol use (75, 100) and 99.5% for marijuana use (50, 100); for e-cigarettes, participants reported screening half of their patients and 0.0% (0, 50), (0, 75)) reported screening for hookah and blunts, respectively. On average (median), clinicians estimated that 15.0% of all 10–17 years old patients smoked cigarettes, 10.0% used e-cigarettes, 20.0% used marijuana, 25.0% drank alcohol and 5.0% used hookah or blunts, respectively; yet they estimated lower than national rates of use of each product for their own patients. Clinicians reported greater comfort discussing cigarettes and alcohol with patients and less comfort discussing e-cigarettes, hookah, marijuana and blunts.

Conclusions This study identified low rates of screening and counselling AYA patients for use of e-cigarettes, hookahs and blunts by adolescent healthcare clinicians and points to potential missed opportunities to improve prevention efforts.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This study uses cross-sectional data from adolescent healthcare clinicians (physicians and other adolescent health professionals) from a survey of faculty from 12 US medical schools and the membership of three national organisations representing adolescent health, family medicine and paediatric providers, representing the perspectives of 771 clinicians on adolescent and young adult substance use including alcohol, cigarette smoking, e-cigarettes and use of marijuana, hookah or blunts.
- ⇒ The survey did not directly query adolescent and young adult patients, and therefore, cannot compare adolescent health clinicians' perspectives of adolescents and young adults substance use with self-reported use of their patients.
- ⇒ The cross-sectional nature of this survey limits the ability to capture the full complexity of the rapidly changing landscape of tobacco products such as e-cigarettes and heated tobacco.

INTRODUCTION

Substance use and abuse remain among the most concerning and challenging public health issues in America, affecting health across the lifespan.¹ While cigarette smoking has declined among adolescents and young adults (AYA), use of electronic cigarettes (e-cigarettes) and marijuana continue to rise, and rates of hookah and alcohol use remain high.^{2–5} Substantial data exist on the health impact in the USA associated with cigarettes, e-cigarettes, other tobacco products, marijuana and alcohol.^{6–10} Ultimately, substance use remains a critically relevant issue in paediatrics and family medicine, given that the majority of adult users initiate their substance use during adolescence or young adulthood.¹¹

Clinicians play an important role in the identification, prevention and treatment of AYA substance use.^{12 13} There are published guidelines providing recommendations regarding screening AYA for substance use. The US Preventive Services Task Force recommends screening all adolescents for tobacco use including e-cigarettes (evidence level B) and screening adults for ‘unhealthy drug use’, not including alcohol or tobacco use (evidence level B).^{14 15} The American Academy of Family Physicians (AAFP) and the American Academy of Pediatrics both recommend screening and cessation support for adolescents for these substances as well as marijuana.^{12 16–19}

Despite these guidelines, studies show that while clinicians often screen adolescent and young adult patients for cigarette and alcohol use, they are less likely to screen and counsel for other substances such as e-cigarettes or hookah.^{20–23} In addition, the existing literature on clinician screening practices for adolescent and young adult substance use have focused on examining a limited number of products such as e-cigarettes, cigarettes, marijuana, or alcohol use, rather than studying screening practices for multiple substances. Studies on screening practices for e-cigarettes have shown that paediatric clinicians feel less comfortable than adult clinicians in discussing such products with patients.²⁴ In a 2021 study of paediatric tobacco screening practices, 67% of clinicians reported counselling adolescents who smoke cigarettes about the dangers of e-cigarettes while 57% counselled on the dangers of e-cigarettes to those who were non-smoking.²⁵ Studies looking at barriers to screening and counselling for alcohol and marijuana use have identified the impact of insufficient time as well as lack of training and treatment resources.^{25–27} To our knowledge, there are few studies that have comprehensively examined clinicians’ self-reported screening behaviours, attitudes and perceived challenges towards screening AYA across different substances as well as more novel products.

The aim of this study was to survey adolescent healthcare clinicians about their knowledge, attitudes, comfort level, self-efficacy, self-reported screening behaviours and challenges with screening and counselling AYA across a range of tobacco products (cigarettes, e-cigarettes and hookah), alcohol and marijuana (including blunts). The goals of this study were to: (1) assess how frequently clinicians self-report screening for and counselling about these substances during clinic visits, and (2) assess healthcare clinicians’ knowledge about, attitudes towards and comfort level with screening and counselling AYA about these products. We expect these findings will generate hypotheses on how to best support clinician education on adolescent and young adult substance use to enable further screening and counselling.

METHODS

Participants

The study population included adolescent healthcare clinicians including general internal medicine physicians,

paediatricians and family medicine physicians who care for adolescent and young adult patients. Clinicians from several sample frames were recruited and surveyed: 1203 members of the Society for Adolescent Health and Medicine (SAHM); 335 participants in a prior randomised control trial (ClinicalTrials.gov NCT01312480; post-results) of adolescent tobacco cessation conducted through Paediatric Research in Office Settings, the primary care practice-based research network of the American Academy of Pediatrics,²⁸ called the “Adolescent Health in Pediatric Practice” (AHIPP) sample; and 700 physicians from the AAFP’s Member Insight Group (currently called the Member Insight Exchange). In addition to these professional societies, substance and tobacco use researchers were identified using convenience sampling from the investigators’ research networks at 12 institutions (Stanford; University of California San Francisco (UCSF); University of Texas (UT) Health Sciences Center; University of Florida; Vanderbilt University Medical Center; University of Massachusetts, Worcester; University of California Los Angeles (UCLA); Dartmouth; Children’s Hospital of Philadelphia; Johns Hopkins; University of Michigan; Columbia University) and were asked to distribute the survey to all clinical departments serving adolescent and young adult patients. The only inclusion criterion was for the respondents to be clinicians serving adolescents and/or young adult patients. A limited number of survey participants who were members of these associations were in social work and public health, as indicated by [table 1](#). No patients were involved in this study. Electronic informed consent was required before participation in the survey. At the start of the survey, participants reviewed a consent form that included the purpose of the study, a statement that the study was voluntary, that individual participant results would be confidential and anonymous, and that participants could discontinue at any time. Contact information for the senior principal investigator (BH-F) was provided should any questions arise. All participants had to confirm they consented to participate before moving onto the survey.

Patient and public involvement

There was no public consultation or patient involvement in the planning of this study.

Procedures

The survey was fielded between February and June 2016. Participants received an email that contained a link to complete the survey. The survey for this study was conducted using Qualtrics software (Qualtrics, Provo, Utah, USA).

A staff member or representative from each sample frame sent out an introductory e-mail which included a brief description of the study and the link to the survey. These emails were sent to the divisions of adolescent medicine and to the departments of paediatrics, internal medicine and family medicine to ask clinicians who provided

Table 1 Participant demographics and practice characteristics (N=771)

	N (%)
Gender, n=771	
Males	279 (36.2)
Females	492 (63.8)
Race/ethnicity, n=685	
Asian	84 (12.3)
White	505 (73.7)
Black	33 (4.8)
Hispanic	29 (4.2)
Other (American/Indian, Native Alaskan; Native Hawaiian or Pacific Islander; multirace)	26 (3.8)
Unknown	8 (1.2)
Specialty, n=572	
Paediatrics	422 (73.8)
Family medicine	63 (11.0)
Other (internal medicine, public health and social work)	87 (15.2)
Did you complete additional training in adolescent medicine or adolescent health? n=762	
Yes	202 (26.5)
No	560 (73.5)
% Clinical time, n=561	
<25%	85 (15.2)
25%–49%	95 (16.9)
50%–75%	135 (24.1)
>75%	246 (43.8)
Do you see patients between the ages of 10 and 17 in your practice?, n=767	
Yes	710 (92.6)
No	57 (7.4)
What percentage of time do you spend seeing patients 10–17?, n=521	
<25%	178 (34.2)
25%–49%	170 (32.6)
50%–75%	114 (21.8)
>75%	59 (11.3)
Do you see patients between the ages of 18 and 26 in your practice?, n=767	
Yes	669 (87.2)
No	98 (12.8)
What percentage of time do you spend seeing patients 18–26?, n=462	
<25%	295 (63.8)
25%–49%	115 (24.9)
50%–75%	38 (8.2)
>75%	14 (3.0)

Continued

Table 1 Continued

	N (%)
Practice type, n=569	
Private solo practice	17 (3.0)
Private group practice	68 (12.0)
Public/community clinic	40 (7.0)
Free-Standing Health Maintenance Organisation	5 (0.9)
Hospital-based clinic	172 (30.2)
University-based clinic	215 (37.8)
Other	52 (9.1)

clinical care for adolescent and young adult patients to complete the survey. The survey was open for a 6-week period for each group of participants, with reminders 2 weeks and 4 weeks postsurvey launch.

Participants from SAHM, university health centres and AHIPP all received the full survey. Members of the AAFP who self-select an option to receive routine member surveys through the AAFP marketing department received an abbreviated version of the survey due to standard protocol which limits surveys to 10 questions.

Measures

The survey items were adapted from previous preventive service studies focusing on healthcare clinicians' attitudes towards and practices concerning screening and counselling AYA regarding health risk behaviours.^{13 29 30} Outcomes were measured using ordinal multiple choice responses and continuous numeric variables, as described below. We then pilot tested the survey with over 10 clinicians similar to the participants in our sample, and revised the survey based on the responses and their feedback.

Demographics and practice characteristics

Participants were asked the following questions, all of which were categorical variables unless otherwise specified: gender, age (continuous, quantitative variable), race/ethnicity, year they graduated from medical school/graduate school (categorical, ordinal variable), specialty in which they completed their primary training, whether or not they completed an adolescent medicine fellowship, in which state they practice medicine, whether the state they live in had legalised medical or recreational marijuana, their professional society memberships, setting for their clinic practice (private practice, hospital, clinic, etc), what percentage of time they engage in patient care (continuous, quantitative variable), and what percentage of the time they work with each age group (continuous, quantitative variable).

Knowledge of tobacco products and perceptions of use

Participants were asked whether they had ever heard of e-cigarettes, hookah or blunts (yes/no). Participants were also asked to estimate what percentage of all 10–17 years

old and 18–26 years old they believed were using each of the following products: cigarettes, e-cigarettes, hookah, marijuana, blunts or alcohol. They were then asked to estimate what percentage of their patients between 10–17 and 18–26 years they thought were using each of these products. These two sets of questions were treated as continuous, quantitative variables.

Health beliefs concerning each substance

Participants were asked about their health beliefs concerning each product. They were first asked to rate their perception of how addictive cigarettes, e-cigarettes, hookah, marijuana, blunts or alcohol, using five ordinal response options, from 'not at all addictive' to 'extremely addictive'. Next, participants were given a scenario in which they were asked to imagine an adolescent and young adult who used each product 2–3 times a day, every day and then asked to rate how harmful each of these products would be for their health using a 5-point ordinal response set from 'not at all harmful' to 'extremely harmful'. Participants were asked how strongly they agreed or disagreed with the statements 'E-cigarettes help addicted adult smokers quit using cigarettes' and 'adolescents/young adults who use e-cigarettes are more likely to later go on and use cigarettes'. Participants were then asked how likely they were to recommend an adolescent/young adult patient who is smoking 2–3 cigarettes a day to switch to e-cigarettes (very likely to very unlikely). They were also asked if they would recommend parents switch to e-cigarettes if they learnt that parents of an adolescent/young adult patients were smoking (very likely to very unlikely). These were all treated as ordinal measures.

Self-efficacy

Participants were asked about their self-efficacy with screening and counselling AYA about the six products in this study. They were first asked to indicate how comfortable they feel talking to adolescents about each of the six products using an ordinal measure with four response options, from 'very uncomfortable' to 'very comfortable'. They were then asked to indicate how confident they felt explaining the health effects of these products to these patients, using an ordinal measure with four response options from 'very unconfident' to 'very confident'.

Screening and counselling practices

Participants were asked to estimate what percentage of their patients between the ages of 10–17 and 18–26 years they screened, counselled and/or referred to counselling/substance use treatment for each of the six products, separately. This was analysed as a quantitative variable.

Barriers and resources

Participants were asked to indicate which of the following were their biggest challenges for screening and counselling patients about tobacco products (check all that apply): lack of support from administration; lack of knowledge about different tobacco products; do not believe screening/counselling will have any impact on

their substance use; uncomfortable talking to adolescents about substance use; lack of training in screening/counselling adolescents for tobacco products; inadequate time in office visit; and lack of place for referral/lack of cessation resources. Participants were asked about their biggest challenges for screening and counselling for marijuana products (check all that apply) with the same questions as above and the unique question of 'difficult to screen and counsel about marijuana as it is now legal in our state'. Finally, participants were asked about the resources/support they would need to increase their rates of screening/counselling patients for tobacco and/or marijuana products. These data were treated as categorical responses.

Analysis

We analysed (using χ^2 and analysis of variance (ANOVA)) whether there were significant differences among the three main sample groups (AAFP, AHIPP, SAHM) in survey responses; data not shown. Since there were no significant differences in patterns of results, we collapsed across the samples and reported findings for all participants together.

A preliminary profile of the data examined means with SD, medians with first (25th percentile) and third (75th percentile) quartiles (for quantitative data only), and frequencies with percentages (table 1). Shapiro-Wilk tests were used to determine the normality of continuous response variables. As none of the variables appeared to satisfy normal distribution requirements, we used the non-parametric Kruskal-Wallis test to compare providers' estimated prevalence of different substance use (table 2), providers' perception of harm and addiction of different substances (table 3), providers' perceptions of e-cigarette safety and self-efficacy (table 4), and providers' comfort level with screening and referral practices for different substances (table 5). Following Kruskal-Wallis test, for all possible pair comparison of different substances, we used Dwass-Steel-Critchlow-Fligner (DSCF) test (detailed in online supplemental tables 1–3).^{31–33} As opposed to the all-pairs comparison procedures that depend on Kruskal ranks, the DSCF test is an extension of the U-test as reranking is conducted for each pairwise test. All participant responses in tables are presented as medians. We also report first and third quartiles ranges for quantitative but not ordinal measures. P values less than 0.05 were considered statistically significant. SPSS V.27.0 and SAS V.9.4 (SAS Institute) were used for all statistical analyses. The p values were not adjusted for multiple comparisons.

RESULTS

Demographics

While 828 participants started the survey, 57 respondents answered fewer than half of the questions and were therefore excluded from the sample, resulting in a final N of 771 participants. For the demographic data, participants from the AAFP group were not asked to complete most

Table 2 Providers' estimated prevalence of substance use among all adolescents and young adults and among their patients (medians and IQR)

	Cigarette		E-cigarette		Hookah		Marijuana		Blunts		Alcohol		P value*	Significant post hoc test†
	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)			
10–17 years														
All adolescents	15 (10, 20)	10 (5, 15)	5 (2, 10)	20 (10, 30)	5 (3, 10)	25 (17, 45)	<0.0001	a, b, c, d, e, f, g, h, i, j, k, l, m, n						
Your adolescent patients	10 (5, 15)	5 (2, 10)	2 (1, 5)	15 (5, 25)	5 (1, 10)	20 (10, 33)	<0.0001	a, b, c, d, e, f, g, h, i, j, k, l, m, o						
18–26 years														
All young adults	20 (15, 25)	15 (10, 20)	10 (5, 15)	27.5 (15, 40)	10 (5, 20)	70 (40, 80)	<0.0001	a, b, c, d, e, f, g, h, i, j, k, l, m, n						
Your young adult patients	15 (10, 20)	10 (5, 15)	5 (2, 10)	20 (10, 39)	5 (2, 15)	60 (40, 75)	<0.0001	a, b, c, d, e, f, g, h, i, j, k, l, n						

a = alcohol vs marijuana, b = alcohol vs cigarette, c = alcohol vs e-cigarette, d = alcohol vs hookah, e = alcohol vs blunts, f = marijuana vs cigarette, g = marijuana vs e-cigarette, h = marijuana vs hookah, i = marijuana vs hookah, j = cigarette vs blunts, k = cigarette vs hookah, l = e-cigarette vs blunts, m = e-cigarette vs hookah, n = blunts vs hookah, o = blunts vs hookah. Q1/Q3 = 1st and 3rd quartiles of IQR (25th–75th percentile). P values <0.05 were considered statistically significant.
 *P values indicate comparison on providers' estimated prevalence between substance types within an age group. These were derived from Kruskal-Wallis test.
 †Dwass-Steel-Critchlow-Fligner test was used to test for multiple pairwise comparisons between substance types.

of the demographic questions due to a restriction on the number of questions asked.

Of the participants, 36.0% identified male and 64.0% identified female as their gender identity. Participants had a mean age of 44 years (SD=12.3); 12.3% of participants identified as Asian, 73.7% as white, 4.8% as black, 4.2% as Hispanic and 5.0% as other. There was a difference in the distribution for gender identity (60% female for AHIPP, 72% female SAHM and 44.9% female AAFP). However, race/ethnicity demographics distribution was similar among the three samples.

Among the respondents, 73.8% identified paediatrics as their specialty, with 11.0% in family medicine and 15.2% in other specialties such as internal medicine, public health and social work. Ninety-two per cent of clinicians provided care for 10–17 years old patients and 87.2% provided care for 18–26 years old patients. Clinicians worked in a variety of practice settings, with 30.2% working in a hospital-based clinic and 37.8% working in a university-based clinic (table 1).

Clinicians' estimated prevalence of substance use among all AYA and their patients

When asked to estimate the rates of substance use among all 10–17 years old patients, based on median response by participants, participants perceived that 25.0% (Q1/Q3=17, 45) of all 10–17 years old patients used alcohol, 20.0% (Q1/Q3=10, 30) used marijuana, 15.0% (Q1/Q3=10, 20) used cigarettes, 10.0% (Q1/Q3=5, 15) used e-cigarettes and 5.0% ((Q1/Q3=2, 10), (Q1/Q3=3, 10)) used hookah and blunts, respectively. For their 10–17 years old patients, they estimated that 20.0% (Q1/Q3=10, 33) of their patients used alcohol, 15.0% (Q1/Q3=5, 25) used marijuana, 10.0% (Q1/Q3=5, 15) used cigarettes, 2.0% (Q1/Q3=1, 5) used hookah and 5.0% ((Q1/Q3=1, 10), (Q1/Q3=2, 10)) used e-cigarettes and blunts, respectively (see table 2 for more details on rates across ages). As detailed in table 2, in general, within each age group, participants estimated higher rates of alcohol use, followed by marijuana and then cigarettes.

We conducted non-parametric Kruskal-Wallis test followed by DSCF test for pairwise comparison to determine whether participants estimated different rates of substance use among all 10–17 and 18–26 years old individuals in the general population versus their own patients (online supplemental table 1). Participants estimated significantly more use of all substances except blunts among all 10–17 years old patients compared with their own patients. In addition, there was a statistically significant difference in participants' estimates of use between all 18–26 years old and their 18–26 years old patients for all substances except for marijuana (p<0.0001). Participants estimated higher use rates across all substances except blunts for 18–26 years old patients in comparison to 10–17 years old patients.

**Table 3** Providers' perception of harm and addiction of various substances

	Cigarette	E-cigarette	Hookah	Marijuana	Blunts	Alcohol		
	Median	Median	Median	Median	Median	Median	P value*	Significant post hoc tests†
How addictive do you think these products are?‡	1	2	2	3	3	2	<0.0001	a,b,c,f,g,j,k,l,m,n
Imagine an adolescent/young adult used the products below 2–3 times a day, every day. How harmful would it be for their health §	1	2	2	2	1	1	<0.0001	a,c,d,e,f,j,k,l,m

a = alcohol vs marijuana, b = alcohol vs cigarette, c = alcohol vs e-cigarette, d = alcohol vs blunts, e = alcohol vs hookah, f = marijuana vs cigarette, g = marijuana vs e-cigarette, h = marijuana vs blunts, i = marijuana vs hookah, j = cigarette vs e-cigarette, k = cigarette vs blunts, l = cigarette vs hookah, m = e-cigarette vs blunts, n = e-cigarettes vs hookah, o = blunts vs hookah. Response rate ranged from n=470 to n=482. P values <0.05 were considered statistically significant.

*P values to compare providers' perception of harmfulness and addictiveness of different substances were derived from Kruskal-Wallis test.

†Dwass-Steel-Critchlow-Fligner test was used to test for multiple pairwise comparisons between substance types.

‡Ordinal measure, 1–5 with 1=extremely addictive to 5=not at all addictive.

§Ordinal measure, 1–5 with 1=extremely harmful to 5=not at all harmful.

Harm and addiction

The providers' response on the perceived addictiveness across the different substances was a statistically significant difference based on Kruskal-Wallis test. Each question response was measured using an ordinal measure with five response options (1—extremely addictive to 5—not all addictive). Pairwise comparison test (DSCF) showed statistically significant difference in the median response by clinicians for the perceived addictiveness of cigarettes versus e-cigarette (median 1 vs 2, $p<0.0001$), and cigarette versus marijuana (median 1 vs 3, $p<0.0001$).

Similarly, there was a statistically significant difference in the perceived harmfulness of different products (using an ordinal measure with five response options, from 1—extremely harmful to 5—not at all harmful). Pairwise comparison showed that there was a statistically significant difference in providers' perceived harmfulness for cigarette use compared with e-cigarette use (median 1 vs 2, $p<0.0001$), and cigarette use compared with marijuana use (median 1 vs 2, $p<0.001$) (see [table 3](#) and online supplemental table 1 for more details).

Utility of e-cigarettes to quit smoking

Based on an ordinal measure with four response options ((1—very unlikely to 4—very likely), the median response of providers on the likelihood that they would recommend an adolescent/young adult who was smoking 2–3 cigarettes a day switch to e-cigarettes was 1 (very unlikely). Median response of providers on likelihood that they would recommend a parent who was smoking cigarettes to switch to e-cigarettes was 1 (very unlikely).

Based on an ordinal measure with four response options (1—strongly disagree to 4—strongly agree), participant responses indicated a moderate level of disagreement (median=2, disagree) with the statement that 'E-cigarettes help addicted smokers quit cigarettes,' and a moderate level of agreement (median=3, agree) with the statement that 'Adolescents/young adults who use e-cigarettes are more likely to later go on and use cigarettes' (see [table 4](#)).

Self-efficacy and screening

The providers' response to the question, 'How comfortable do you feel talking to your adolescent/young adult

Table 4 Providers' perceptions of e-cigarette safety and self-efficacy with substance use

	Median
E-cigarettes help addicted adult smokers quit using cigarettes.*	2
Adolescents/young adults who use e-cigarettes are more likely to later go on and use cigarettes.*	3
Providers' likelihood of recommending an adolescent/young adult patient who is smoking 2–3 cigarettes a day to switch to e-cigs?†	1
Providers' likelihood of recommending that patients' parents switch from cigarettes to e-cigarettes.†	1

Response rate ranged from N=439 to N=482.

*Ordinal measure, 1–4 with 1=strongly disagree to 4=strongly agree.

†Ordinal measure, 1–4 with 1=very unlikely to 4=very likely.

Table 5 Provider comfort level with and screening and referral practices for substances (median and quartiles)

	Cigarette		E-cigarette		Hookah		Marijuana		Blunts		Alcohol		Significant post hoc P value* testst
	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)	Median (Q1/Q3)		
How comfortable do you feel talking to your adolescent/young adult patients about the following products?‡	4	4	3	4	3	4	3	4	3	4	4	4	<0.0001 a,c,d,e,f,g,h,i,j,k,l,m,n
How confident are you that you could explain the health effects of each of these products to your patients?§	4	3	3	4	3	4	3	4	3	4	4	4	<0.0001 a,c,d,e,f,g,h,i,j,k,l,m,n
What percentage of your patients 10–17 do you screen	100 (80, 100)	50 (0, 100)	0 (0, 50)	99.5 (50, 100)	0 (0, 50)	100 (75, 100)	0 (0, 75)	100 (75, 100)	0 (0, 75)	100 (75, 100)	100 (75, 100)	100 (75, 100)	<0.0001 c,d,e,f,g,h,i,j,k,l,m,n
What percentage of your patients between 18 and 26 do you screen	100 (100, 100)	75 (0, 100)	0 (0, 50)	100 (90, 100)	0 (0, 50)	100 (95, 100)	0 (0, 100)	100 (95, 100)	0 (0, 100)	100 (95, 100)	100 (95, 100)	100 (95, 100)	<0.0001 c,d,e,f,g,h,i,j,k,l,m,n
What percentage of your patients 10–17 do you counsel about:	90 (50, 100)	20 (0, 80)	0 (0, 10)	75 (25, 100)	0 (0, 10)	80 (50, 100)	0 (0, 40)	80 (50, 100)	0 (0, 40)	80 (50, 100)	80 (50, 100)	80 (50, 100)	<0.0001 c,d,e,f,g,h,i,j,k,l,m,n
What percentage of your patients 18–26 do you counsel about:	100 (50, 100)	30 (0, 100)	0 (0, 20)	90 (25, 100)	0 (0, 20)	100 (50, 100)	0 (0, 50)	100 (50, 100)	0 (0, 50)	100 (50, 100)	100 (50, 100)	100 (50, 100)	<0.0001 a,c,d,e,f,g,h,i,j,k,l,m,n
What percentage of your patients 10–17 do you refer for cessation treatment if they say they use any of the substances below	1 (0, 50)	0 (0, 3.5)	0 (0, 0)	2 (0, 25)	0 (0, 0)	5 (0, 30)	0 (0, 5)	5 (0, 30)	0 (0, 5)	5 (0, 30)	5 (0, 30)	5 (0, 30)	<0.0001 c,d,e,g,h,i,j,k,l
What percentage of your patients 18–26 do you refer for cessation treatment if they say they use any of the substances below?	5 (0, 50)	0 (0, 5)	0 (0, 0)	5 (0, 25)	0 (0, 0)	10 (0, 25)	0 (0, 5)	10 (0, 25)	0 (0, 5)	10 (0, 25)	10 (0, 25)	10 (0, 25)	<0.0001 b,c,d,e,f,g,h,i,j,k,l

a = alcohol vs marijuana, b = alcohol vs cigarette, c = alcohol vs e-cigarette, d = alcohol vs blunts, e = alcohol vs hookah, f = marijuana vs cigarette, g = marijuana vs e-cigarette, h = marijuana vs blunts, i = marijuana vs hookah, j = cigarette vs e-cigarette, k = cigarette vs blunts, l = e-cigarette vs hookah, m = e-cigarette vs blunts, n = e-cigarettes vs hookah, o = blunts vs hookah. Q1/Q3 = 1st and 3rd quartiles of IQR (25th–75th percentile), only calculated and presented for the continuous quantitative measures and not for the ordinal measures. Response rate ranged from n=431 to n=553. P values <0.05 were considered statistically significant.

*P values to compare providers' comfort level, confidence, screening and referral practices for different substances were derived from Kruskal-Wallis test.

†Dwass-Steel-Critchlow-Fligner test was used to test for multiple pairwise comparisons between substance types.

‡Ordinal measure, 1–4 with 1 = very uncomfortable to 4 = very comfortable.

§Ordinal measure, 1–4 with 1=very unconfident to 4 = very confident.

patients about the following products?' was measured using an ordinal measure with four response options (1—very uncomfortable to 4—very comfortable). The median response reported by participants was 4 (very comfortable) for cigarettes, e-cigarettes, marijuana and alcohol, whereas the median response for hookah and blunts was 3 (somewhat comfortable). There was statistically significant difference in provider's reported comfort for different substances ($p < 0.0001$, see [table 5](#)). Detailed pairwise comparison results are reported in online supplemental table 1.

When asked how confident they felt discussing the health impact of different substances, participants responded using an ordinal measure with four response options (1—very unconfident to 4—very confident). There was a statistically significant difference in provider confidence for discussing the health impact of different products ($p < 0.0001$, [table 5](#)). The median response was 4 (very confident) for discussing cigarettes, marijuana and alcohol, whereas, median response was 3 (somewhat confident) for e-cigarettes, hookah and blunts. Notably, pairwise comparisons showed participants were significantly more confident in discussing the health impact of marijuana compared with e-cigarettes (median 4 vs 3, $p < 0.0001$).

When asked to estimate what percentage of their 10–17years old patients they screen for substance use, the median response was that participants in this study screened 100.0% of their patients for cigarette use (median $Q1/Q3=80, 100$), and for alcohol use ($Q1/Q3=75, 100$) and 99.5% ($Q1/Q3=50, 100$) for marijuana use, while participants screened 50.0% ($Q1/Q3=0, 100$) of patients for e-cigarette use, 0.0% ($Q1/Q3=0, 50$) for hookah use and 0.0% ($Q1/Q3=0, 75$) for blunt use ($p < 0.0001$). For 18–26years old patients, the median number of clinicians screened 100.0% ($Q1/Q3=100, 100$) of patients for cigarette use and 100.0% ($Q1/Q3=95, 100$) for alcohol use. In comparison, the clinicians screened 75.0% ($Q1/Q3=0, 100$) of patients for e-cigarette use, 0.0% ($Q1/Q3=0, 50$) for hookah use, 100.0% ($Q1/Q3=90, 100$) for marijuana use and 0.0% ($Q1/Q3=0, 100$) for blunt use ($p < 0.0001$). There was a significant difference in clinician-estimated screening rates between products (see [table 5](#)).

When asked what percentage of their 10–17years old they counsel about substance use, the median number of clinicians counselled 90.0% ($Q1/Q3=50, 100$) of patients on cigarette use, 80.0% ($Q1/Q3=50, 100$) on alcohol use and 75.0% ($Q1/Q3=25, 100$) on marijuana use. In comparison, participants counselled 20.0% ($Q1/Q3=0, 80$) of patients on e-cigarette use, 0.0% ($Q1/Q3=0, 10$) on hookah use and 0.0% ($Q1/Q3=0, 40$) on blunt use ($p < 0.001$). For 18–26year-old patients, the median number of clinicians counselled 100.0% of patients ($Q1/Q3=50, 100$) on cigarette use and 100.0% ($Q1/Q3=50, 100$) on alcohol use, respectively, and 90.0% ($Q1/Q3=25, 100$) of patients on marijuana use ($p < 0.0001$). Participants estimated counselling 30.0% ($Q1/Q3=0, 100$) of patients on e-cigarette use; in contrast, they reported

counselling 0.0% ($Q1/Q3=0, 20$) of patients on hookah use and 0.0% ($Q1/Q3=0, 50$) on blunt use ($p < 0.0001$). Of note, there was a significant difference in clinician counselling and referral rates between products. P values to compare providers' estimated prevalence by substance type were derived from Kruskal-Wallis test ([table 5](#), online supplemental table 3).

Barriers to screening and counselling

The most cited challenges for screening and counselling patients about tobacco and marijuana were time ($N=375/771$ (48.6%); $N=366/771$ (47.4%) for tobacco and marijuana, respectively), lack of places to refer for treatment for tobacco ($N=288/771$ (37.3%)) and marijuana ($N=326/771$ (42.2%)), lack of training in screening/counselling on tobacco and marijuana ($N=102/771$ (13.2%); $N=139/771$ (18%), respectively), and lack of knowledge of different tobacco products ($N=116/771$ (15%)). When asked what resources or supports might increase screening and counselling, participants reported a need for substance use treatment referral resources ($N=303/637$ (47.5%)), increased time with patients during clinic visits ($N=270/637$ (42.3%)), increased training in screening/counselling adolescents for substance use ($N=163/637$ (25.6%)) and resources for learning more about different tobacco and marijuana products ($N=175/637$ (26.0%)).

DISCUSSION

Our study assessed healthcare clinicians' knowledge, attitudes, self-efficacy, screening and counselling practices with their adolescent and young adult patients across a range of substances, including cigarettes, e-cigarettes, hookah, marijuana (including blunts) and alcohol.

In general, clinicians believed that the most used substances among their 10–17years old were marijuana and alcohol. In contrast, the median number of physicians believed 5% of their 10–17years old patients used e-cigarettes (IQR=2–10). This reported prevalence by clinicians is an underestimation when compared with national prevalence data collected the same year (2016), which showed that 44.5% of 12th graders reported trying marijuana, 61.2% of 12th graders had used alcohol and 17.5% of 8th graders and 33.8% of 12th graders reported trying e-cigarettes.^{34 35} Even more striking is the fact that most clinicians believed their 10–17years old patients were less likely to use any of the reported substances when compared with all 10–17years old. Similar trends held true for clinicians' perceived prevalence of substance use between their and all 18 and 26 years old patients (except for marijuana). While there is limited literature documenting this phenomenon, this difference in perceived prevalence may be important for future study.

Most adolescent healthcare clinicians in our sample reported that they screen and counsel 10–17years old patients for cigarettes, marijuana and alcohol, even as use of these substances has decreased in the last decade.³⁶ In

contrast, only 50.0% report that they screen their patients for e-cigarette use and fewer for hookah and blunt use. Even fewer clinicians report counselling regarding these products. This trend is reflected in recent studies on tobacco screening where only two-thirds of clinicians reported counselling on e-cigarette use, even though e-cigarette use has continued to rise among adolescents in the ensuing years.^{25 37} For 18–26 years old patients, many clinicians in our sample screen and counsel for cigarettes, alcohol and marijuana, though rates of screening and counselling are lowest for marijuana among these three substances. Greater than half of clinicians in this cohort screen for e-cigarette use, but fewer subsequently counsel about these products.

Discrepancies between screening and counselling could reflect a variety of barriers such as decreased clinician comfort and knowledge about these products, appointment time or counselling skills as well as beliefs about utility of counselling, or whether the clinicians provided confidential, private time for these discussions to be able to proceed.^{25 38} Clinicians reported being more comfortable discussing cigarettes and alcohol use and least comfortable discussing hookah and blunts with their patients. Only half of respondents felt comfortable discussing e-cigarettes and less than two-thirds felt comfortable discussing marijuana. Similarly, participants felt most confident discussing the health impact of cigarette smoking and alcohol use and felt least confident discussing the health impact of hookah use. Clinicians in our sample did not feel as comfortable or confident discussing products that adolescents are most commonly using such as blunts, hookah, marijuana and e-cigarettes and their possible health effects. This lack of comfort addressing substances other than alcohol and cigarettes is consistent with literature documenting the need for substance use training in medical schools and may indicate the need for educational interventions to increase clinician comfort with addressing substance use.^{39 40} In addition, it is necessary to address structural barriers, such as limited appointment time in clinician visits, including limited private time with AYA patients, to ensure clinicians are able to adequately incorporate substance use screening in their clinical encounters.²⁵

This study has several strengths. These include the survey's sample size and range of primary care and adolescent clinician specialties, its national scope, mix of academic and community clinicians across the USA. Compared with the many other published surveys on adolescent and young adult substance use, our study may be unique in its querying of primary care clinicians' perspectives on a national scale and a wide range of alcohol, tobacco and marijuana products.

This study also has limitations. We acknowledge that variables used for collecting participants' gender and racial/ethnic identities have dated language and do not provide participants with sufficient options for describing their identity. While this study included a diverse sample of clinicians, data were not systematically sampled to be

nationally representative and there were missing data that could together skew its representativeness, and thus limit the generalisability of the results. Other limitations are that the study was completed in 2016, so it does not capture subsequent changes in product innovation, availability, range and co-use. Consequently, clinicians' knowledge, beliefs and behaviour may differ now from the results reported here. In addition, marijuana has continued to become more broadly legalised since study data were collected, which could also influence clinician perspectives, norms, and screening and counselling practices. Another limitation is that Bonferroni correction was not applied to the reported statistics. Therefore, it is possible that reported differences in estimates of substance use were prone to type I error. Despite these limitations, the findings provide important information on clinician knowledge, practices and concerns precisely at the time when the use of e-cigarettes escalated dramatically.

CONCLUSIONS

In our nationally distributed study, adolescent healthcare clinicians tended to underestimate use of multiple products (cigarette, e-cigarette, marijuana, hookah, blunt, alcohol) in the general population and estimate lower than population rates of use for their own patients. In addition, our study identified low rates of screening and counselling for use of e-cigarettes, hookahs and blunts by adolescent healthcare clinicians with their AYA patients as well as decreased confidence with discussing the health impacts of substances such as marijuana, hookah or blunts. As national rates of polysubstance use continue to increase, clinicians who care for adolescent and young adult patients are in a unique position to help prevent and reduce substance use by screening and counselling.

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REFERENCES

- Health Policy Institute. Substance abuse: facing the costs. Georgetown University. Available: <https://hpi.georgetown.edu/abuse/#> [Accessed 19 Jun 2021].
- Leventhal AM, Strong DR, Kirkpatrick MG, et al. Association of electronic cigarette use with initiation of combustible tobacco product smoking in early adolescence. *JAMA* 2015;314:700.
- American Lung Association. Tobacco trends brief. Available: <https://www.lung.org/research/trends-in-lung-disease/tobacco-trends-brief/overall-tobacco-trends> [Accessed 03 Sep 2020].
- Huang L-L, Sutfin EL, Kowitz S, et al. Trends and correlates of Hookah use among high school students in North Carolina. *N C Med J* 2017;78:149–55.
- Underage drinking. Available: <https://www.niaaa.nih.gov/publications/brochures-and-fact-sheets/underage-drinking>
- Centers for Disease Control and Prevention (US). Preventing tobacco use among youth and young adults a report of the surgeon General executive summary. Atlanta (GA); 2012.
- Volkow ND, Baler RD, Compton WM, et al. Adverse health effects of marijuana use. *N Engl J Med* 2014;370:2219–27.
- Hamberger ES, Halpern-Felsher B. Vaping in adolescents: epidemiology and respiratory harm. *Curr Opin Pediatr* 2020;32:378–83.
- Antognoli E, Koopman Gonzalez S, Trapl E, et al. The social context of adolescent co-use of cigarillos and marijuana blunts. *Subst Use Misuse* 2018;53:654–61.
- Lees B, Meredith LR, Kirkland AE, et al. Effect of alcohol use on the adolescent brain and behavior. *Pharmacol Biochem Behav* 2020;192:172906.
- Abuse NI on D. Principles of adolescent substance use disorder treatment: a research-based guide 2014; 2019.
- Joseph F, Hagan MD, Shaw JS. *Bright futures: guidelines for health supervision of infants, children and adolescents*. 4th ed. American Academy of Pediatrics, 2017.
- Halpern-Felsher BL, Ozer EM, Millstein SG, et al. Preventive services in a health maintenance organization: how well do pediatricians screen and educate adolescent patients? *Arch Pediatr Adolesc Med* 2000;154:173–9.
- Selph S, Patnode C, Bailey SR, et al. Primary care-relevant interventions for tobacco and nicotine use prevention and cessation in children and adolescents: updated evidence report and systematic review for the US preventive services Task force. *JAMA* 2020;323:1599–608.
- Patnode CD, Perdue LA, Rushkin M, et al. Screening for unhealthy drug use: updated evidence report and systematic review for the US preventive services Task force. *JAMA* 2020;323:2310–28.
- Jenssen BP, Walley SC. Section on tobacco C. e-cigarettes and similar devices. *Pediatrics* 2019;143:e20183652.
- Walley SC. AAP policy cites harms of e-cigarettes; urges screening. American Academy of pediatrics. Available: <https://www.aappublications.org/news/2015/10/22/E-cigarettes> [Accessed 03 Sep 2020].
- Electronic Nicotine Delivery Systems (ENDS). Available: <https://www.aafp.org/about/policies/all/electronic-nicotine-delivery-systems.html> [Accessed 05 Apr 2022].
- Ryan SA, Ammerman SD, Committee on Substance Use and Prevention. Counseling parents and teens about marijuana use in the era of Legalization of marijuana. *Pediatrics* 2017;139:e20164069.
- Jamal A, Dube SR, Babb SD, et al. Tobacco use screening and cessation assistance during physician office visits among persons aged 11–21 years--National Ambulatory Medical Care Survey, United States, 2004–2010. *MMWR Suppl* 2014;63:71–9.
- Bhatnagar A, Whitsel LP, Ribisl KM, et al. Electronic cigarettes: a policy statement from the American heart association. *Circulation* 2014;130:1418–36.
- Pepper JK, Gilkey MB, Brewer NT. Physicians' counseling of adolescents regarding e-cigarette use. *Journal of Adolescent Health* 2015;57:580–6.
- Jani SR, Brown D, Berhane Z, et al. Urban college student self-report of hookah use with health care providers. *J Am Coll Health* 2018;66:412–20.
- Pepper JK, McRee A-L, Gilkey MB. Healthcare providers' beliefs and attitudes about electronic cigarettes and preventive counseling for adolescent patients. *J Adolesc Heal* 2014;54:678–83.
- Simoneau T, Hollenbach JP, Langton CR, et al. Smoking cessation and counseling: a mixed methods study of pediatricians and parents. *PLoS One* 2021;16:e0246231.
- Johnson M, Jackson R, Guillaume L, et al. Barriers and facilitators to implementing screening and brief intervention for alcohol misuse: a systematic review of qualitative evidence. *J Public Health* 2011;33:412–21.
- Sterling S, Kline-Simon AH, Wibbelsman C, et al. Screening for adolescent alcohol and drug use in pediatric health-care settings: predictors and implications for practice and policy. *Addict Sci Clin Pract* 2012;7:13.
- Klein JD, Gorzkowski J, Resnick EA, et al. Delivery and impact of a motivational intervention for smoking cessation: a pros study. *Pediatrics* 2020;146:e20200644.

- 29 Goldstein RL, Carlson JL, Halpern-Felsher B. Contraception for adolescents and young adults in the inpatient setting: the providers' perspective. *Hosp Pediatr* 2018;8:194–9.
- 30 Vance SR, Halpern-Felsher BL, Rosenthal SM. Health care providers' comfort with and barriers to care of transgender youth. *J Adolesc Heal* 2015;56:251–3.
- 31 Douglas CE, Michael FA. On distribution-free multiple comparisons in the one-way analysis of variance. *Commun Stat Theory Methods* 1991;20:127–39.
- 32 Dwass M. Some k-Sample Rank-Order Tests. In: *Contrib to Probab Stat*. Stanford University Press, 1960: 198–202.
- 33 Steel RGD. A RANK sum test for comparing all pairs of treatments. *Technometrics* 1960;2:197–207.
- 34 Monitoring the future 2016 survey results. Available: <https://archives.drugabuse.gov/trends-statistics/monitoring-future-2016-survey-results>
- 35 Abuse NI on D. Monitoring the future study: trends in prevalence of various drugs n.d.
- 36 Jones CM, Clayton HB, Deputy NP, *et al*. Prescription opioid misuse and use of alcohol and other substances among high school students - youth risk behavior survey, United States, 2019. *MMWR Suppl* 2020;69:38–46.
- 37 Creamer MR, Everett Jones S, Gentzke AS, *et al*. Tobacco product use among high school students - youth risk behavior survey, United States, 2019. *MMWR Suppl* 2020;69:56–63.
- 38 Santelli JS, Klein JD, Song X, *et al*. Discussion of potentially sensitive topics with young people. *Pediatrics* 2019;143:20181403.
- 39 Muzyk A, Smothers ZPW, Akrobetu D, *et al*. Substance use disorder education in medical schools: a scoping review. *Acad Med* 2019;94:1825–34.
- 40 Hayes RB, Geller A, Churchill L, *et al*. Teaching tobacco dependence treatment and counseling skills during medical school: rationale and design of the medical students helping patients quit tobacco (MSQuit) group randomized controlled trial. *Contemp Clin Trials* 2014;37:284–93.

Supplemental Table 1. Providers' Estimated Prevalence of Substance Use among All Adolescents and Young Adults and Among their Patients

Pairwise Two-Sided Multiple Comparison Analysis			
Dwass, Steel, Critchlow-Fligner Method			
substance	Wilcoxon Z	DSCF Value	Pr > DSCF
10-17 Year Olds, All Adolescents			
cigarette vs. e-cigarette	6.605	9.341	<.0001
cigarette vs. hookah	15.436	21.830	<.0001
cigarette vs. marijuana	-5.157	7.294	<.0001
cigarette vs. blunts	12.234	17.302	<.0001
cigarette vs. alcohol	-13.241	18.726	<.0001
e-cigarette vs. hookah	10.110	14.297	<.0001
e-cigarette vs. marijuana	-10.069	14.240	<.0001
e-cigarette vs. blunts	6.797	9.613	<.0001
e-cigarette vs. alcohol	-16.552	23.409	<.0001
hookah vs. marijuana	-16.626	23.513	<.0001
hookah vs. blunts	-2.778	3.929	0.061
hookah vs. alcohol	-20.411	28.865	<.0001
marijuana vs. blunts	14.219	20.109	<.0001
marijuana vs. alcohol	-8.123	11.487	<.0001
blunts vs. alcohol	-18.804	26.593	<.0001
10-17 Year Olds, Your Adolescent Patients			
cigarette vs. e-cigarette	7.828	11.071	<.0001
cigarette vs. hookah	15.728	22.243	<.0001
cigarette vs. marijuana	-6.782	9.591	<.0001
cigarette vs. blunts	9.631	13.620	<.0001
cigarette vs. alcohol	-12.623	17.851	<.0001
e-cigarette vs. hookah	8.490	12.006	<.0001
e-cigarette vs. marijuana	-12.641	17.878	<.0001
e-cigarette vs. blunts	2.777	3.927	0.0612
e-cigarette vs. alcohol	-17.317	24.490	<.0001
hookah vs. marijuana	-18.523	26.196	<.0001
hookah vs. blunts	-4.941	6.988	<.0001
hookah vs. alcohol	-21.733	30.735	<.0001
marijuana vs. blunts	13.572	19.194	<.0001
marijuana vs. alcohol	-5.550	7.849	<.0001
blunts vs. alcohol	-17.461	24.694	<.0001
18-26 Year Olds, All Adolescents			
cigarette vs. e-cigarette	5.688	8.044	<.0001
cigarette vs. hookah	14.254	20.159	<.0001
cigarette vs. marijuana	-7.489	10.592	<.0001
cigarette vs. blunts	11.215	15.861	<.0001
cigarette vs. alcohol	-20.152	28.499	<.0001
e-cigarette vs. hookah	10.052	14.216	<.0001
e-cigarette vs. marijuana	-11.174	15.803	<.0001
e-cigarette vs. blunts	6.998	9.897	<.0001
e-cigarette vs. alcohol	-21.352	30.197	<.0001

hookah vs. marijuana	-16.694	23.609	<.0001
hookah vs. blunts	-2.468	3.491	0.1336
hookah vs. alcohol	-22.612	31.978	<.0001
marijuana vs. blunts	14.569	20.604	<.0001
marijuana vs. alcohol	-16.357	23.132	<.0001
blunts vs. alcohol	-21.906	30.980	<.0001
18-26 Year Olds, Your Adolescent Patients			
cigarette vs. e-cigarette	8.159	11.539	<.0001
cigarette vs. hookah	15.585	22.040	<.0001
cigarette vs. marijuana	-7.969	11.270	<.0001
cigarette vs. blunts	11.158	15.779	<.0001
cigarette vs. alcohol	-21.635	30.597	<.0001
e-cigarette vs. hookah	8.920	12.615	<.0001
e-cigarette vs. marijuana	-13.961	19.743	<.0001
e-cigarette vs. blunts	4.889	6.914	<.0001
e-cigarette vs. alcohol	-23.894	33.791	<.0001
hookah vs. marijuana	-18.883	26.704	<.0001
hookah vs. blunts	-2.693	3.808	0.0766
hookah vs. alcohol	-24.937	35.266	<.0001
marijuana vs. blunts	15.559	22.004	<.0001
marijuana vs. alcohol	-16.943	23.961	<.0001
blunts vs. alcohol	-23.699	33.515	<.0001

Supplemental Table 2: Providers' Perception of Harm and Addiction of Various Substances

Pairwise Two-Sided Multiple Comparison Analysis Dwass, Steel, Critchlow-Fligner Method			
substance	Wilcoxon Z	DSCF Value	Pr > DSCF
How addictive do you think these products are?			
cigarette vs. e-cigarette	-9.845	13.922	<.0001
cigarette vs. hookah	-17.468	24.704	<.0001
cigarette vs. marijuana	-19.671	27.819	<.0001
cigarette vs. blunts	-19.114	27.031	<.0001
cigarette vs. alcohol	-18.594	26.296	<.0001
e-cigarette vs. hookah	-9.552	13.509	<.0001
e-cigarette vs. marijuana	-11.967	16.925	<.0001
e-cigarette vs. blunts	-11.165	15.789	<.0001
e-cigarette vs. alcohol	-10.111	14.299	<.0001
hookah vs. marijuana	-1.974	2.792	0.357
hookah vs. blunts	-1.034	1.462	0.907
hookah vs. alcohol	0.601	0.849	0.991
marijuana vs. blunts	1.021	1.444	0.911
marijuana vs. alcohol	2.866	4.053	0.048
blunts vs. alcohol	1.801	2.547	0.465
Imagine an adolescent/young adult used the products below 2 to 3 times a day, every day. How harmful would it be for their health?			
cigarette vs. e-cigarette	-8.269	11.694	<.0001
cigarette vs. hookah	-7.088	10.024	<.0001
cigarette vs. marijuana	-6.585	9.313	<.0001
cigarette vs. blunts	-5.697	8.057	<.0001
cigarette vs. alcohol	0.820	1.159	0.964
e-cigarette vs. hookah	1.422	2.011	0.714
e-cigarette vs. marijuana	1.931	2.731	0.383
e-cigarette vs. blunts	2.908	4.113	0.042
e-cigarette vs. alcohol	9.026	12.765	<.0001
hookah vs. marijuana	0.514	0.727	0.996
hookah vs. blunts	1.503	2.125	0.662
hookah vs. alcohol	7.870	11.130	<.0001
marijuana vs. blunts	0.989	1.398	0.922
marijuana vs. alcohol	7.371	10.424	<.0001
blunts vs. alcohol	6.495	9.185	<.0001

Supplemental Table 3: Provider Comfort Level with and Screening and Referral Practices for Substances

Pairwise Two-Sided Multiple Comparison Analysis			
Dwass, Steel, Critchlow-Fligner Method			
substance	Wilcoxon Z	DSCF Value	Pr > DSCF
How comfortable do you feel talking to your adolescent/young adult patients about the following products?			
cigarette vs. e-cigarette	10.656	15.070	<.0001
cigarette vs. hookah	15.275	21.602	<.0001
cigarette vs. marijuana	5.524	7.813	<.0001
cigarette vs. blunts	14.458	20.447	<.0001
cigarette vs. alcohol	1.402	1.983	0.726
e-cigarette vs. hookah	6.187	8.750	<.0001
e-cigarette vs. marijuana	-5.409	7.650	<.0001
e-cigarette vs. blunts	5.430	7.680	<.0001
e-cigarette vs. alcohol	-9.365	13.244	<.0001
hookah vs. marijuana	-10.860	15.359	<.0001
hookah vs. blunts	-0.484	0.684	0.997
hookah vs. alcohol	-14.178	20.051	<.0001
marijuana vs. blunts	10.044	14.204	<.0001
marijuana vs. alcohol	-4.148	5.867	0.001
blunts vs. alcohol	-13.355	18.887	<.0001
How confident are you that you could explain the health effects of each of these products to your patients?			
cigarette vs. e-cigarette	15.233	21.543	<.0001
cigarette vs. hookah	18.278	25.849	<.0001
cigarette vs. marijuana	9.779	13.829	<.0001
cigarette vs. blunts	16.240	22.967	<.0001
cigarette vs. alcohol	1.815	2.566	0.456
e-cigarette vs. hookah	4.849	6.857	<.0001
e-cigarette vs. marijuana	-6.710	9.489	<.0001
e-cigarette vs. blunts	2.537	3.587	0.114
e-cigarette vs. alcohol	-13.888	19.641	<.0001
hookah vs. marijuana	-11.008	15.567	<.0001
hookah vs. blunts	-1.992	2.818	0.347
hookah vs. alcohol	-17.134	24.231	<.0001
marijuana vs. blunts	8.586	12.142	<.0001
marijuana vs. alcohol	-8.164	11.546	<.0001
blunts vs. alcohol	-15.005	21.220	<.0001
What percentage of your patients 10-17 do you screen for: (scale of 0-100)			
cigarette vs. e-cigarette	13.030	18.427	<.0001
cigarette vs. hookah	20.821	29.445	<.0001
cigarette vs. marijuana	3.358	4.749	0.010
cigarette vs. blunts	18.316	25.902	<.0001
cigarette vs. alcohol	1.990	2.815	0.348
e-cigarette vs. hookah	9.932	14.046	<.0001
e-cigarette vs. marijuana	-10.150	14.354	<.0001
e-cigarette vs. blunts	7.738	10.943	<.0001

e-cigarette vs. alcohol	-11.384	16.100	<.0001
hookah vs. marijuana	-18.839	26.642	<.0001
hookah vs. blunts	-1.642	2.322	0.571
hookah vs. alcohol	-19.682	27.834	<.0001
marijuana vs. blunts	16.365	23.143	<.0001
marijuana vs. alcohol	-1.400	1.980	0.727
blunts vs. alcohol	-17.170	24.281	<.0001
What percentage of your patients between 18-26 do you screen for: Cigarettes			
cigarette vs. e-cigarette	12.985	18.364	<.0001
cigarette vs. hookah	20.858	29.498	<.0001
cigarette vs. marijuana	4.126	5.836	0.001
cigarette vs. blunts	18.630	26.346	<.0001
cigarette vs. alcohol	2.070	2.927	0.303
e-cigarette vs. hookah	10.016	14.165	<.0001
e-cigarette vs. marijuana	-9.737	13.770	<.0001
e-cigarette vs. blunts	8.008	11.325	<.0001
e-cigarette vs. alcohol	-11.518	16.289	<.0001
hookah vs. marijuana	-18.668	26.401	<.0001
hookah vs. blunts	-1.406	1.989	0.723
hookah vs. alcohol	-19.938	28.196	<.0001
marijuana vs. blunts	16.341	23.110	<.0001
marijuana vs. alcohol	-2.124	3.004	0.275
blunts vs. alcohol	-17.618	24.916	<.0001
What percentage of your patients 10-17 do you counsel about:			
cigarette vs. e-cigarette	13.093	18.517	<.0001
cigarette vs. hookah	20.738	29.327	<.0001
cigarette vs. marijuana	3.332	4.712	0.011
cigarette vs. blunts	18.400	26.022	<.0001
cigarette vs. alcohol	1.182	1.672	0.846
e-cigarette vs. hookah	9.822	13.891	<.0001
e-cigarette vs. marijuana	-10.137	14.336	<.0001
e-cigarette vs. blunts	7.595	10.741	<.0001
e-cigarette vs. alcohol	-12.086	17.092	<.0001
hookah vs. marijuana	-18.568	26.259	<.0001
hookah vs. blunts	-1.645	2.327	0.568
hookah vs. alcohol	-19.877	28.111	<.0001
marijuana vs. blunts	16.171	22.869	<.0001
marijuana vs. alcohol	-2.194	3.103	0.241
blunts vs. alcohol	-17.500	24.749	<.0001
What percentage of your patients 18-26 do you counsel about:			
cigarette vs. e-cigarette	11.792	16.676	<.0001
cigarette vs. hookah	19.848	28.069	<.0001
cigarette vs. marijuana	3.981	5.630	0.001
cigarette vs. blunts	17.804	25.179	<.0001
cigarette vs. alcohol	1.232	1.742	0.821
e-cigarette vs. hookah	10.263	14.513	<.0001
e-cigarette vs. marijuana	-8.407	11.889	<.0001

e-cigarette vs. blunts	8.530	12.064	<.0001
e-cigarette vs. alcohol	-10.859	15.357	<.0001
hookah vs. marijuana	-17.581	24.864	<.0001
hookah vs. blunts	-1.070	1.514	0.893
hookah vs. alcohol	-19.123	27.044	<.0001
marijuana vs. blunts	15.524	21.954	<.0001
marijuana vs. alcohol	-2.846	4.025	0.051
blunts vs. alcohol	-17.039	24.097	<.0001
What percentage of your patients 10-17 do you refer for cessation treatment if they say they use any of the substances below			
cigarette vs. e-cigarette	7.315	10.345	<.0001
cigarette vs. hookah	10.420	14.736	<.0001
cigarette vs. marijuana	0.442	0.625	0.998
cigarette vs. blunts	6.836	9.668	<.0001
cigarette vs. alcohol	-1.140	1.612	0.865
e-cigarette vs. hookah	3.228	4.566	0.016
e-cigarette vs. marijuana	-7.327	10.361	<.0001
e-cigarette vs. blunts	-0.711	1.005	0.981
e-cigarette vs. alcohol	-8.947	12.653	<.0001
hookah vs. marijuana	-10.591	14.978	<.0001
hookah vs. blunts	-4.014	5.677	0.001
hookah vs. alcohol	-12.197	17.250	<.0001
marijuana vs. blunts	6.808	9.629	<.0001
marijuana vs. alcohol	-1.640	2.319	0.572
blunts vs. alcohol	-8.443	11.941	<.0001
What percentage of your patients 18-26 do you refer for cessation treatment if they say they use any of the substances below?			
cigarette vs. e-cigarette	8.360	11.823	<.0001
cigarette vs. hookah	12.285	17.374	<.0001
cigarette vs. marijuana	2.451	3.466	0.139
cigarette vs. blunts	8.640	12.219	<.0001
cigarette vs. alcohol	0.735	1.040	0.978
e-cigarette vs. hookah	4.380	6.194	0.000
e-cigarette vs. marijuana	-6.557	9.273	<.0001
e-cigarette vs. blunts	0.176	0.249	1.000
e-cigarette vs. alcohol	-9.037	12.781	<.0001
hookah vs. marijuana	-10.844	15.336	<.0001
hookah vs. blunts	-4.261	6.026	0.000
hookah vs. alcohol	-13.543	19.152	<.0001
marijuana vs. blunts	6.813	9.636	<.0001
marijuana vs. alcohol	-2.039	2.884	0.320
blunts vs. alcohol	-9.285	13.131	<.0001