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Understanding E-Cigarette Knowledge and Use Among d/Deaf and Hard of Hearing Students and the Need for Tailored Prevention Programming: A Qualitative Study

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Electronic cigarette use has become epidemic among American youth. Little is known about the extent of use among d/Deaf and hard of hearing (d/Dhh) youth or prevention programming for this population. In a qualitative study with d/Dhh youth and school staff and administrators serving them, four focus groups were conducted with middle school students ($n = 19$) and four with high school students ($n = 15$) to assess their knowledge of and experiences with e-cigarettes and other tobacco products and exposure to prevention programming. Key informant interviews were conducted with seven school staff and administrators. Considerable awareness of and curiosity about e-cigarettes were found, and many misconceptions about vaping. Besides industry marketing, e-cigarette exposure occurred through interactions with older students, alumni, and hearing students. Most participants reported no experience with e-cigarette prevention programming, a finding that highlights the need for tailored programming for d/Dhh students.

KEYWORDS: d/Deaf and hard of hearing youth, tobacco use, e-cigarette use, vaping, prevention

The Deaf community is a culturally and linguistically distinct minority group characterized by unique communication forms, social relationships, and interactions with the hearing world. In the United

States, up to one million d/Deaf and hard of hearing (d/Dhh) individuals use American Sign Language (ASL) as their primary language (Mitchell et al., 2006). ASL is a visual-gestural language, with its own

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semantic and syntactic structure, vocabulary, grammar, and morphology (Johnston, 2006). ASL is not closely related to English linguistically, and there is no written version of the language (Mitchell et al., 2006). For many d/Dhh people, English is not their preferred language, and average English reading comprehension levels continue to be below grade level (Traxler, 2000). As a result, many in this population experience social and information marginalization resulting in difficulties obtaining access to information on health and other concerns that is widely available to hearing people (McKee et al., 2015).

For d/Dhh youth, pervasive communication difficulties may exacerbate situations and pressures that lead to experimentation and risk-taking behaviors. Extant literature has documented issues related to self-esteem, increased risk of substance use disorders, and other risk-taking behaviors among this population, as well as a heightened sensitivity to peer influences and behaviors believed to confer social acceptability (Coll et al. 2009; Guthmann, 2011; Kushalnagar et al., 2019; McKee et al., 2019; Theunissen et al., 2014; Titus, 2010; Titus & Guthmann, 2013; Titus et al., 2008). Being both d/Dhh and a member of a racial or ethnic minority compounds these challenges (Anderson & Grace, 1991; Cohen et al., 2013; Kluwin et al., 2002; Prickett & Martin, 1992; Rodriguez & Santivaia, 1991).

Despite these vulnerabilities, there is a dearth of health promotion or prevention materials and programs appropriate for d/Dhh youth. Programs designed for hearing young people may be inaccessible to d/Dhh youth, and adequately tailored materials for use by educators of this group are rarely available (Guthmann et al., 2012). Health-related public service announcements and educational videos are infrequently captioned or available

in ASL, and health information in ASL on the Internet is limited (McKee et al., 2015). Also, many in the population of d/Dhh youth experience significant difficulties obtaining needed health information not only at home, where family members may not sign (McKee et al., 2015), but also in clinical settings (McKee et al., 2015; Pereira & Fortes, 2010; Scheier, 2009; Sheppard, 2014; Shuler et al., 2014; Smeijers et al., 2011; Smith et al., 2015; Smith & Samar, 2016). Despite the clear need for health promotion interventions for d/Dhh people, challenges related to reading proficiency, data collection, translation of instruments into ASL, these instruments' administration in ASL, and other issues (Athale et al., 2010; Berman et al., 2013, 2017; Eckhardt & Anastas, 2006; Graybill et al., 2010; Guthmann et al., 2017; Jones et al., 2006; McKee et al., 2013; Meador & Zazove, 2009; Pollard et al., 2009; Zazove et al., 2013) have led d/Dhh people to be largely excluded from health intervention research (Barnett et al., 2011).

Recognizing these challenges, researchers at the University of California, Los Angeles (UCLA), partnered with the Deaf community over a decade ago to examine tobacco use among d/Dhh youth and to develop accessible, appropriate tobacco use prevention materials for this population (Berman & Guthmann, 2007; Berman, Guthmann, Liu, & Streja, 2011; Berman, Guthmann, Crespi, & Liu, 2011). However, recent, dramatic changes in the tobacco landscape have occurred, with the emergence and rapidly growing popularity among young people of e-cigarettes and other new products. E-cigarette use among middle and high school-aged youth has reached epidemic proportions. From 2017 to 2018 alone, the proportion of students in middle and high school using e-cigarettes increased 50% and 75%,

respectively (Cullen et al., 2018), and by 2019 almost half of all high school students (46.9%) and about a fifth of middle school students (19.9%) had tried vaping (Wang et al., 2019). According to the U.S. surgeon general, this is the fastest increase in substance use ever observed among American youth (U.S. Department of Health and Human Services, 2018). Calls to address this troubling public health problem have come from members of the medical and public health communities, including both the surgeon general (U.S. Department of Health and Human Services, 2018) and the commissioner of the U.S. Food and Drug Administration (U.S. Food and Drug Administration, 2018). If effective interventions are to be developed, as a first step there needs to be a better understanding of e-cigarette use and current exposure to tobacco and e-cigarette prevention programming among young people, including d/Dhh youth.

The education of d/Dhh children and adolescents occurs in two types of settings: schools for the deaf and mainstream programs. Mainstream programs are school settings in which d/Dhh youth attend with students who are hearing. In mainstream settings, it is common for state-level departments of education or school districts to centralize their programming for d/Dhh students within one or more elementary, middle, and high schools. In these settings, d/Dhh students may be accompanied by interpreters as they learn in classrooms alongside hearing students and may also have opportunities to participate in classes and programs exclusive to d/Dhh students. The nature of peer pressure, social relationships, and influences, and efforts to “fit in” with hearing peers, create particular challenges for d/Dhh children and adolescents in mainstream settings (Angelides & Aravi, 2007; Brice & Strauss, 2016; Cambra, 2002; Foster, 1987; Hatamizadeh et al., 2008;

Holcomb, 1992; Iantaffi et al., 2003; Kluwin et al., 2002; Rich et al., 2013; Stinson & Shirin, 1999; Theunissen et al., 2014). These social challenges, combined with exposure to marketing messages and barriers to adequate tailored prevention education, may well result in elevated rates of tobacco use and vaping among d/Dhh students in mainstream programs. In fact, we did observe greater tobacco use rates among mainstreamed d/Dhh students in our prior tobacco survey work (Berman et al., 2007).

However, while attendance at mainstream schools is increasingly common for d/Dhh youth, schools for the deaf continue to serve as significant educational resources for this population in California and nationwide (Titus & Guthmann, 2013; Titus et al., 2008). Schools for the deaf serve d/Dhh students from prekindergarten through high school, with ASL serving as the predominant mode of communication. Although students from elementary, middle school, and high school programs are separated for academic activities, the potential for younger students to observe and interact with older students does exist. Additionally, many students who attend schools for the deaf live on campus throughout the academic year, a living arrangement that increases the likelihood of interaction among differing age cohorts. Such arrangements may provide increased opportunities for younger students to get access to and experiment with tobacco and e-cigarette products.

Thus, not only are there rapid changes in tobacco and e-cigarette use patterns among youth generally, but there may also be particular risks for d/Dhh young people and significant barriers to their receipt of prevention guidance and other health information. Utilizing qualitative methods, we turned to students, faculty, and administrators in both of these settings, schools for the deaf and mainstream programs, to

learn more about this population's knowledge and misconceptions about tobacco and e-cigarettes, as well as their use of these products; about health education programming in schools serving these young people; and about current trends in how d/Dhh students obtain information in classroom settings and outside of school—for example, via social media.

METHOD

Research Questions

We employed qualitative methods in our formative work in order to learn from d/Dhh students, their faculty, and school administrators “in their own words,” and to answer the following research questions:

1. How familiar are the d/Deaf and hard of hearing middle and high school students in our study with tobacco and e-cigarette products?
2. Under what circumstances are the d/Deaf and hard of hearing middle and high school students in our study experimenting with and using tobacco and e-cigarette products?
3. How does health promotion and prevention programming, including tobacco and e-cigarette programming, occur at the schools serving the d/Deaf and hard of hearing students in our study?

A community advisory committee composed of experts in the education, culture, health, and literacy of d/Dhh people provided guidance for all aspects of our study. In addition, we received guidance from a group of ninth-grade students at the California School for the Deaf, Fremont, who served as “Youth Champions” for the project. The study was funded by the California Tobacco Related Disease Research Program, which stipulates that all research

activities must be conducted within the state of California.

Eligibility and Recruitment

Students

The present research was a small pilot study aimed at obtaining formative information to be used as a guide in future research. Therefore, we were limited in the number of schools and students we could ask to take part. We included students from California's two schools for the deaf (Riverside and Fremont). We also turned to two large school systems in California, the Orange County Department of Education and the San Diego Unified School District, to obtain recommendations from the leadership in these districts regarding mainstream programs for d/Dhh students in their jurisdictions. We invited participation from students in two mainstream programs, one in each of these two school systems, on the basis of the recommendations we received. Students in grades 6–8 (middle school) and 9–12 (high school) at the two schools for the deaf and all d/Dhh students in the same grades in the two mainstream programs were invited to participate. We conducted recruitment by mailing parents of these students an English/Spanish information packet that included a flyer, parent consent form, and youth assent form for minor youth (less than 18 years old). Students age 18 years or older received a flyer and consent form. The recruitment materials described the study's purpose, time commitment, and eligibility criteria. Our convenience sample consisted of 34 d/Dhh student participants enrolled in the one of the four schools, 19 from middle schools and 15 from high schools.

Students were invited to take part in one of eight focus groups held in January and

February 2018: four groups with middle school students, one at each school site, and four with high school students, one at each school site. We obtained parental written consent, written assent from minor students (i.e., those under age 18 years), and written consent from adult students (age 18 years or older). The study received institutional review board approval from UCLA.

Key Informant Interviews

Recruitment of key informants occurred at each participating school site through direct contact with study staff. We were guided by the leadership at each school as to which faculty members worked directly with d/Dhh students; were most likely to be knowledgeable about the health curriculum, including available tobacco and e-cigarette programming, offered at their schools; and could provide suggestions regarding effective strategies for delivering tobacco and e-cigarette prevention education to their students. An information sheet describing the study and a consent form were sent to potential participants via e-mail. Seven participants, four from schools for the deaf and three from mainstream programs, signed, scanned, and returned completed written consent forms via e-mail. Key informants included administrators, teachers, and other support staff members. Five of the key informants were d/Deaf, one hard of hearing, and one hearing; four were female and three male.

Study Activities

Focus Groups

Each of the four middle school and four high school focus groups included 2–7 participants, a trained Deaf moderator fluent in ASL, and a hearing ASL-English bilingual interpreter (Krueger & Casey,

2000; Morgan & Scannell, 1998). The same moderator worked with all eight focus groups. Burton Cowgill, the lead author of the present article, who has extensive experience conducting focus groups with youth, trained the moderator to conduct the focus groups with the assistance of an interpreter. During each focus group, a bilingual interpreter voiced the moderator's questions and all student responses, in English, into a digital recorder for analysis.

Each 60-to-90-minute focus group session was conducted in a private room on the school campus. Discussions were conducted in ASL. These sessions were guided by a semistructured protocol that was developed on the basis of our research questions. These questions and the resulting protocol grew out of our review of the literature on youth-focused e-cigarette and tobacco use; investigator experience with e-cigarette and tobacco prevention and control in school-based settings, including those serving d/Dhh students; suggestions from our community advisory committee; and our interest in learning about preferred methods for engaging d/Dhh students about health topics (see Appendix A). The moderator encouraged student interaction and open discussion of diverse views.

At the start of each focus group session, participants completed a brief written questionnaire that gathered demographic data (gender, age, grade level, and race/ethnicity) and information on tobacco experimentation and current use (cigarettes, chewing tobacco, e-cigarettes, hookah, and cigarillos). Eligibility for participation was based on enrollment in a school for the deaf or in a mainstream program serving d/Dhh students. Therefore, information regarding deafness characteristics was not collected. Descriptive statistics are presented in Table 1. Each focus group participant received a \$20 gift card.

Key Informant Interviews

Each key informant completed a 20-to-30-minute interview. A trained research assistant conducted the interviews by phone, using a video relay service (VRS) with d/Dhh participants. The research assistant voiced questions in English to the VRS interpreter, who translated them into ASL for the key informant and voiced the participant's responses in English for the research assistant. All conversations were digitally recorded. Through the interviews, we aimed to obtain information that supplemented and provided an additional perspective on what we had learned from the students. The interview protocol emphasized assessment of existing health education for d/Dhh students; whether tobacco and/or e-cigarette education was currently included in the middle or high school curriculum; barriers to inclusion of such programming; and preferred methods for providing health education programming to d/Dhh students in classroom settings (see Appendix B). Each key informant received a \$20 gift card.

Qualitative Analysis

The transcripts of the focus groups and key informant interviews were imported into Atlas.ti, a computer program used for qualitative data analysis. Inductive and deductive techniques were used for content analysis of the transcripts. We created a set of thematically based codes and applied them systematically to the narratives (Bernard, 2002). First, the transcripts were reviewed to identify major thematic content that either fit with a priori categories included in the focus group and key informant protocols or emerged spontaneously from the group discussions. The transcripts then were coded by a trained research assistant who was given basic operational definitions of these

themes and was instructed to identify all related text. The research team then reviewed the coding and settled any discrepancies. These procedures resulted in 537 quotations from the focus groups and 128 from the key informant interviews.

In order to assess similarities and differences by grade level (middle school vs. high school) or school type (school for the deaf vs. mainstream), we analyzed the quotations by subgroup in Atlas.ti. We then analyzed quotations from the key informant interviews and compared findings to student responses.

RESULTS

Table 1 presents demographic characteristics and self-reported tobacco and e-cigarette use among the 34 focus group participants.

Themes in relation to our three research questions are reported below, comparing and contrasting findings for each theme among key informants and focus group participants.

Familiarity With Tobacco and E-Cigarette Products and Their Marketing

Exposure to Marketing

Exposure to tobacco and e-cigarette marketing occurred through a variety of media. Both middle and high school students indicated that they observed e-cigarette displays and ads at convenience and liquor stores. A middle school student from a school for the deaf observed,

When you're in the stores you see ads there, and you see the stacks and stacks of cigarettes and racks and racks of cigarettes; and, you know, sometimes there are posters that you might see.

Table 1 Student Demographic Characteristics and Tobacco Use ($N = 34$)

<i>Gender</i>	
Female	53%
Male	47%
Mean age, years (range)	14.1 (13–18)
<i>Grade level</i>	
7th	15%
8th	41%
9th	35%
12th	9%
<i>Race/ethnicity^a</i>	
Latino	71%
White	6%
American Indian/Alaskan Native	3%
Asian American	6%
Native Hawaiian or Pacific Islander	3%
More than one race/ethnicity	12%
<i>Ever used</i>	
E-cigarettes	9%
Cigarettes	6%
Hookah	3%
Chewing tobacco, snuff, or dip	0%
Cigarillos	0%

^a Percentages total more than 100 because of rounding.

Also, students were exposed to e-cigarette advertising online and via social media, including YouTube, Facebook, Snapchat, and Instagram. High school students were more likely to view personal posts from friends or people they followed on social media than middle school students, who were exposed to more generic advertisements and posts. A middle school student from a school for the deaf described a striking commercial the student witnessed online:

Someone’s using a vape, and there’s a little boy who is sad, and someone else comes and offers it to him. And he tries it, and he becomes a lot happier. . . . People are talking about how it’s a good price. You should get it. And they make it more intriguing for people even younger.

A number of students expressed resentment that advertisements were targeting youth and encouraging them to engage in an unhealthy activity. One middle school student from a school for the deaf said, “They shouldn’t support this stuff, it’s not fair. I feel like they’re taking advantage of people.” Nevertheless, both middle and high school students acknowledged the appeal of watching people do “vape tricks” on video posts, which increased their interest in the product. One middle school student from a school for the deaf acknowledged that when they were watching vape tricks, “I know it’s not healthy, but it’s still cool. . . it’s fun, it’s cool.” Key informants agreed that advertisements increased students’ exposure to and interest in e-cigarettes because they looked “cool.”

Knowledge and Attitudes Regarding Tobacco and E-Cigarette Health Consequences

Middle and high school students expressed awareness of some of the serious health consequences associated with tobacco use, primarily focused on lung-related diseases. Knowledge about e-cigarettes was not nearly as developed, and many students held misconceptions or lacked information altogether about the implications of vaping, including the role of nicotine and addiction. Middle school students were most aware of the flavors associated with e-cigarettes. For instance, a middle school student at a school for the deaf said, “I know a lot of people that say vaping is a

lot healthier because you can do different flavors like orange.” When asked to compare the health implications of traditional cigarettes to those of e-cigarettes, high school students expressed a wide range of opinions about the safety of these products. For example, students said that traditional cigarettes were plant based and “plain-out tobacco [nothing added],” contained more chemicals, and “smelled different.” E-cigarettes were viewed as unsafe by some students because they could overheat and possibly blow up, but some hypothesized that e-cigarettes were less harmful because they were “mechanically built” and “seem a little bit less harmful than cigarettes... because the vaping pen has...liquid inside of it instead of the real tobacco.” Another high school student from a school for the deaf reflected, “Well, I think it’s safe. E-cigarettes are safer because it’s a kind of steam instead of smoke.”

Students expressed a lack of clarity regarding the health consequences of secondhand smoking or vaping. Among middle school students, perceptions about potential harm tended to focus on the smell associated with secondary exposure. In general, students believed secondhand vaping was not as harmful because it “doesn’t have as much of a smell,” “it smells good, it smells like fruit,” and there was a “lower percent risk of danger.” A contrary opinion was provided by a mainstream middle school student who posited that secondhand vaping may be worse than exposure to secondhand smoke because “it does not smell so bad and so people do not know they are taking it in.”

High school students expressed similar views on secondhand smoke and vape exposure. They too expressed varied opinions on which was worse and why. For those who viewed secondhand vaping as more harmful, some pointed to uncertainty about what users are inhaling and the

chemicals in e-liquids, while others expressed the belief that secondhand vapor is less harmful because it generates a “kind of steam” or “vape mist” rather than smoke. Some participants acknowledged that they were not even sure what the term “second-hand exposure” meant.

Students and key informants emphasized that d/Dhh youth are curious about tobacco and e-cigarette products, but there is a lack of accessible educational information. Both groups reported conversations among students, Internet searches, and questioning of teachers and family members to obtain information about e-cigarettes. At the same time, the students and key informants recognized the lack of content appropriate for d/Dhh populations, including the absence of an established ASL sign for *vape* or *e-cigarette*. In fact, one high school student from a mainstream school opened a focus group with the question, “Is this the sign for vape?”

Tobacco and E-Cigarette Experimentation and Use

Focus group participants reported low levels of tobacco product and e-cigarette use (see Table 1). Correspondingly, students and key informants reported observing limited use among d/Dhh middle and high school students. Middle school students viewed peers who vaped as “not really cool” and as seeking “attention,” although some indicated that vaping was becoming more popular. High school students observed that e-cigarettes were more likely to be used by hearing students or by older students who had repeated multiple grade levels. All students and key informants expressed concern that the use of cannabis was a larger problem than e-cigarette and tobacco use.

Students residing in schools for the deaf explained that older students who were repeating grades, students in transition

programs on campus, and alumni who had remained in the area were the groups most likely to use e-cigarettes and to offer them to other students. For example, a high school student from a school for the deaf explained that

at the Deaf school...a lot of students stay in town, and they maybe don't go off to college, and they still have friends who are in high school. And so a lot of the [tobacco products and e-cigarettes] that they get they still hand out and shoot the breeze with [recent graduates] after school, and a lot of [tobacco products and e-cigarettes] get handed down that way.

Similarly, students who attended mainstream programs described e-cigarette use as more common among hearing students than among d/Dhh students. A mainstream high school student suggested that d/Dhh students were less likely to use e-cigarettes because they were “way more focused on their community.” Another high school student, now at a school for the deaf, shed further light on the experiences d/Deaf students may have in mainstream settings, explaining,

Well, I think it's a much bigger problem...at the hearing school. I was able to have more connections with other hearing friends and the people out there. And for Deaf, it's hard for them to communicate, and they have a harder time getting things, and they probably have like maybe 30 or 40 people in this school who I know that do that kind of stuff [vape]. But at my hearing school, I mean, a lot more than that because they had a lot more access.

One key informant explained that mainstreamed d/Dhh students' exposure to e-cigarettes is compounded by difficulty with social skills:

Once they transition to the high school they're exposed to a broader set of circumstances, but they're socially immature. So in high school, there are more students who are modeling that behavior and our Deaf students are finally learning. They're getting better communication skills, and a few of them start to grow and become more aware of the broader world. And they're with more mature students, and then they have more access to tobacco products in the high school.

Several students reported familial use of tobacco and e-cigarette products and expressed awareness that e-cigarettes could be used by current smokers as a cessation tool. Tobacco product use was primarily noted among the older generations of the students' families, while e-cigarette use was associated with older siblings and cousins.

High school participants noted factors affecting exposure to and use of e-cigarettes unique to d/Dhh students. For example, several students explained that d/Deaf students who live with hearing parents struggle to communicate effectively with them, leaving their parents little opportunity to monitor engagement in risky behaviors, such as e-cigarette or tobacco use, or to discuss potential harms from using these products. Students in mainstream schools acknowledged that “hearing students have the hookups” and provide access to vaping products. Many of the student respondents also expressed uncertainty about whether or not e-cigarettes were allowed on school grounds, and few recalled being exposed to prevention messaging about e-cigarettes through school. Key informants echoed concerns that d/Dhh young people are at increased risk of vaping due to their curiosity about these products, the lack of available information on the health consequences of e-cigarette use, and limited communication about emerging tobacco products.

Health Promotion and Prevention Education

Experience With Health/Tobacco and E-Cigarette Education

A majority of middle and high school students in the present study reported that they had not received any formal prevention education about e-cigarettes. Students did indicate some exposure to more general tobacco use prevention education through events including Red Ribbon Week, D.A.R.E, health class, and workshops. As a high school student from a school for the deaf reflected, “We just had, like, one day. A presenter came in and talked to us about drugs... No one really talked about it in depth because it’s just one day.” Others recalled observing antitobacco posters on campus, viewing material on websites (e.g., the Truth Campaign), and discussing the topic with counselors. Family, TV commercials, and online pop-up ads were other sources of informal education about tobacco use mentioned by students. As the knowledge discrepancies between tobacco and e-cigarette use imply, most educational information that students observed focused on tobacco products, not e-cigarettes.

Key informants explained that health education was delivered during physical education or science classes, topics were dependent on grade level, and sessions typically focused on sexual education, information about sexually transmitted diseases, and family relationships, not tobacco or other substance use. Acknowledging a limited focus on tobacco use, the informants pointed to events, such as Red Ribbon Week or guest speakers at assemblies, as focal points of substance use prevention education. A number of barriers were identified that prevented the inclusion of tobacco and e-cigarette prevention in their health curricula, including a lack of staff

to deliver the materials, a dearth of appropriate materials, a shortage of time, and a focus on other priority health issues.

Several key informants indicated that their schools had processes for intervening with students caught using banned substances on campus, involving individual research, write-ups, and presentations about tobacco use and prevention. A key informant from a mainstream school emphasized that interventions for students caught smoking or vaping were the most prominent form of tobacco education at school, but that the process was not tailored to d/Dhh students:

The students that get busted...they have to do a lot of writing and they have to present. The d/Deaf students, when that happens, it is just over their head, their level of reading is not quite the same. It usually takes more of an expansion and more time in order for them to get it and sign it and understand it. It just takes more time.

Recommendations for Engaging d/Dhh students in Tobacco and E-Cigarette Prevention Education

Focus group participants shared a variety of ideas about how to best engage d/Dhh students in tobacco and e-cigarette prevention education. Most students urged that “boring” lectures be eliminated, calling instead for the creation of programs that would engage students through a variety of mediums. Suggestions centered on incorporating games, making videos, and including activities that were fun, such as role-playing. Students noted that videos needed to include actors using ASL as well as large captions. Also, they expressed interest in engaging in open discussions, with a middle school student from a school for the deaf suggesting “get[ting] students talking about it where everyone

can actually share their opinions and go back and forth.” Students encouraged the use of social media but warned that if content were not original and creative, the messaging would be ignored. As one high school student from a school for the deaf stated, messages about e-cigarette harms must be “visible and visual.” Some students promoted the idea of creating student-run clubs that could share prevention messaging by making dynamic posters that would include warnings about using e-cigarettes and other tobacco products. High school students suggested that sessions occur in small groups and that schools find a way to engage parents and possibly other family members in the programming.

Both middle and high school students expressed interest in hearing from “real people,” either through videos or in person, who could share their negative experiences with tobacco and e-cigarettes. Also, participants were interested in learning more about how e-cigarettes affect the body and how they are manufactured, compared to traditional tobacco cigarettes.

Key informant interviews shed further light on the specific needs of d/Dhh students and how best to design an e-cigarette and tobacco prevention curriculum for this population. Given the widely divergent reading and comprehension levels among these students, informants strongly suggested that the content be flexible so that teachers could select what was most appropriate to their students’ educational level. Like the students, these key informants indicated that videos could play an important role in engaging youth and advocated the use of video content that was signed and captioned and available on YouTube or through other social media sites. In one interview, the use of Certified Deaf Interpreters in videos was recommended, given that an individual with this background would be able to expand on

curricular content in order to meet the diverse educational needs of d/Dhh students. Reflecting on the use of captioned YouTube videos, one key informant from a school for the deaf said,

Not all the students can read English very well, so the teacher has to sign and translate into ASL. And some are signed directly, so it’s really nice. It lets us all watch it. But again, not all students may understand ASL the same because their language skills are not all the same.

Key informants echoed student suggestions that curricula should utilize up-to-date visual aids, hands-on activities, small-group discussions, role-playing, and presentations by “real people” who could share their personal experiences. They advocated that there be little homework and emphasized the need to repeat concepts throughout the program in order to reinforce the prevention messages. Lastly, key informants promoted the idea of having a single comprehensive curriculum that would start in middle school and continue in high school, with content building in detail and complexity.

DISCUSSION

Information gathered through focus groups with students and key informant interviews with educators provided valuable insights into the experiences with tobacco products and e-cigarettes of d/Dhh students included in the present study. Taken in its entirety, the feedback shared by these stakeholders demonstrates a pressing need for tobacco and e-cigarette prevention education for these young people, particularly beginning in middle school. Also, these conversations provided specific guidance as to content that such programming ideally should include.

We had expected to find multiple marked differences between students at schools for the deaf and those enrolled in mainstream schools, given the very different environments in which students in these settings live and learn. However, the information shared by students in both of these settings was surprisingly similar across all the topics we explored, with the notable exception of product exposure. Students in both educational settings most frequently reported exposure to products through social media and in retail outlets such as convenience stores. Students in both settings also reported that they were not strongly influenced by the attitudes and behaviors of hearing youth, among whom they reported greater use of e-cigarette and tobacco products. But while students at schools for the deaf reported considerable exposure to e-cigarettes and tobacco products through interactions with older students and alumni, including young adults, in the residential school setting, mainstreamed students pointed to greater accessibility of tobacco and e-cigarette products in their school settings due to the behavior of their hearing classmates. Educators in both settings should be aware of these varying influences when delivering prevention curricula to their students. As has been found with hearing populations (Wang et al., 2019), greater exposure to tobacco and e-cigarette use was reported in high schools than in middle schools.

We obtained considerable information regarding the specific knowledge gaps that needed to be emphasized in prevention programming. Our student participants' limited knowledge about the health implications of e-cigarettes was expected, and was closely consistent with that of similarly aged hearing students (Greenhill et al., 2016). However, our student participants' limited understanding of the health effects

of traditional cigarettes and other tobacco products, outside of the link between these products and lung-related diseases, was surprising, and demonstrates the need for prevention programs to continue to focus on the full spectrum of tobacco products, along with e-cigarettes and other more novel nicotine delivery devices. Through our work, we identified a number of issues of particular importance for prevention education: the dangers associated with e-liquids, properties and effects of nicotine, the risks associated with secondhand smoke and vape exposure, and the fact that the consequences of using e-cigarettes and other tobacco products extend well beyond implications for lung health. We found it encouraging that students expressed strong interest in learning more about these health implications of tobacco and e-cigarette use, risks that come with nicotine addiction, and current tobacco and about e-cigarette marketing and promotion.

Also, our student and faculty participants discussed aspects of prevention programming and made recommendations for effective program content. They noted that reading and health literacy levels among some d/Dhh individuals are lower than among the general population (McKee et al., 2015; Traxler, 2000) and that programming needs to take this into account. They reported on the widely varied levels of literacy and language development that we had witnessed in our interaction with students, emphasizing that health messages and lessons, including those relating to tobacco and e-cigarette products, therefore need to be straightforward, clear and consistent, and include flexible content. Program adaptability is key to accommodating the widely varied educational levels present among d/Dhh students who learn side by side in the same classroom setting. Additionally, to reinforce key messages and

maintain engagement and student interest, programming should make extensive use of visual content; hands-on activities; “real world” examples of the consequences of e-cigarette and tobacco exposure; and opportunities for student to share their opinions, discuss their concerns openly, and practice resistance skills. The challenge will be to create programming that balances students’ expressed interest in content that is enjoyable, interactive, and visually conveyed with educators’ messaging that curricular content needs to be simple and concise.

Limitations

The primary limitation of the present pilot study was the small number of schools and students we were able to include. Also, per study funder requirements, all participants were located in California, which has a relatively low level of tobacco use among young people, compared to the United States as a whole. An understanding of tobacco and e-cigarette use among the underserved and understudied population of d/Dhh youth should, ideally, include information gathered nationwide from a larger number of students. Nevertheless, we believe that the findings of this formative work are important to share with educators serving d/Dhh students and public health professionals, as little is currently known about tobacco and e-cigarette use among d/Dhh youth and prevention education targeting this population. Additionally, researchers conducting future studies may consider capturing hearing status to guide the tailoring of interventions for d/Deaf versus hard of hearing students.

Conclusion

The students and faculty who participated in the present pilot study pointed to

significant gaps in school-based tobacco and e-cigarette use prevention efforts. They reported that they had had limited exposure to such efforts, and that they were aware of very few—or no—school or other prevention campaigns or programs that were captioned or delivered in ASL, and therefore were ideally accessible to d/Dhh students. Likewise, it was noted that for some d/Dhh youth there also are barriers to adequate communication at home. As a result, these young people do not receive messages dissuading them from using tobacco or other substances at home. At the same time, our focus group participants and key informants emphasized the extensive exposure of d/Dhh youth to YouTube videos featuring tobacco and e-cigarette products, smoking, and vape tricks. This suggests an extremely concerning environment in which prevention messages are frequently not shared, yet messages that promote and glamorize use of these products are being received. If prevention campaigns and programs do not take steps to ensure that tobacco and e-cigarette prevention content is available to, and appropriate for, d/Dhh youth, we risk seeing increased use of these dangerous products among this group in the future.

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Appendix A

Focus Group Protocol

Tobacco and E-Cigarette Use

1. How much of a problem do you think using tobacco products, like cigarettes, cigars, chewing tobacco, cigarillos, and hookah, is among d/Dhh students today?
2. How much of a problem do you think using e-cigarettes or vaping is among d/Dhh students today?
3. Do your parents or other adult family members use tobacco products? E-cigarettes?

Perceived Health Implications

4. How can using tobacco products, such as cigarettes or cigars, affect your health? Now? In the future?
5. How can using e-cigarettes affect your health? Now? In the future?
6. How do cigarettes affect the health of people who are around smokers?
7. How do e-cigarettes affect the health of people who are around vapers?
8. What do you think are the main differences between regular cigarettes and e-cigarettes?

Perceived Social Norms

9. Do you think teens who use e-cigarettes are cool or more popular? Do they have more friends?
10. Do you agree with the new California law that prohibits sale of cigarettes and e-cigarettes to anyone under the age of 21? Why or why not?

Exposure to Marketing

11. What types of advertisements or promotions have you seen for e-cigarettes?
12. Where did you see these advertisements or promotions?
 - a. Prompts: television, Internet, social media, billboards, stores?

Exposure to Tobacco/E-Cigarette Use Prevention Programming

13. Have you participated in a program or class that addressed tobacco and/or e-cigarette prevention?
14. If so, where? Who led the program? What was it called?
15. What did you learn from the program?
16. Have you seen or read anything online about tobacco or e-cigarette prevention?
17. If so, where? What did you learn from the online material?

Methods to Communicate Tobacco/E-Cigarette Use Prevention to Deaf/Hard of Hearing Youth

18. Please tell us what the following words mean to you in your own words. vape, nicotine, e-juice, hookah.
19. What are the best ways to share important messages about tobacco and e-cigarette prevention among d/Dhh teens?
20. What are the best ways to engage and maintain the interest of d/Dhh youth in tobacco and e-cigarette prevention programming in a school setting? Incentives? Visuals (pictures, videos, social media)? Activities?

Appendix B

Key Informant Protocol

Tobacco and E-Cigarette Use

1. How much of a problem do you think using tobacco products, like cigarettes, cigars, chewing tobacco, cigarillos, and hookah, is among d/Dhh students today? Among hearing students?
2. How much of a problem do you think using e-cigarettes or vaping is among d/Dhh students today? Among hearing students?
3. Do you know of or have you seen faculty, staff, and/or parents who use e-cigarettes or tobacco products (like cigarettes, cigars, chewing tobacco) in the view of students?

School-Based Health Programming

4. What types of health-related programming are currently offered to your students at school during the school day? Outside of school hours?
5. Does your school currently offer tobacco/e-cigarette prevention programming to students?
 - a. If so, please describe what is currently offered.
 - a. If not, please describe the barriers that prevent your school from offering such programming.
6. What training, if any, does your school provide for teachers to deliver health-related programming? What suggestions do you have regarding training

of teachers to deliver health-related programming in general? Tobacco and e-cigarette prevention programming specifically?

School Tobacco and E-Cigarette Policies and Practices

7. What policies does your school have in place regarding student, faculty/staff, or guest tobacco and e-cigarette use?
8. Who reviews and enforces these policies?

Tailored Tobacco/E-Cigarette Use Prevention Programming for Deaf/Hard of Hearing Youth

9. What are the most critical components to include in a tobacco/e-cigarette use prevention program tailored for d/Dhh youth?
10. What are the best methods for communicating curricula elements to d/Dhh youth?
11. Do you think d/Dhh youth have an understanding of the following terms: vape, e-juice, nicotine, hookah?
12. What are effective approaches for engaging d/Dhh youth in tobacco/e-cigarette use prevention education programming? Use of different media (pictures, videos, social media)? Group activities?

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