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Abstract

Electronic cigarette use and vaping have reached epidemic proportions among youth in the United States. The extent of use among Deaf and Hard-of-Hearing (Deaf/HH) youth is unknown. Furthermore, little tobacco and e-cigarette use prevention programming exists for Deaf/HH students. To better understand knowledge and use of e-cigarettes and other tobacco products among Deaf/HH students, we conducted a qualitative study with these youth, as well as school staff and administrators who serve this population. We conducted eight focus groups with Deaf/HH students (four with middle school students and four with high school students) at Schools for the Deaf (n=17) and in mainstream programs (n=17) to assess their experience with e-cigarettes and other tobacco products and exposure to school-based e-cigarette and tobacco use prevention programming. Key informant interviews were conducted with seven staff and administrative representatives to further explore material addressed in the student focus groups. Findings from student focus groups and key informant interviews indicated that there is considerable awareness of and curiosity about e-cigarettes and vaping. Many misconceptions about vaping were held among students. In addition to industry marketing, exposure to e-cigarettes occurred through interactions with older students/alumni at Schools for the

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Deaf and through hearing students at mainstream programs. Most participants reported no experience with e-cigarette prevention programming at school. In that e-cigarette use, including the use of JUULs, continues to increase among youth, tailored e-cigarette and tobacco use prevention programming is needed to prevent and address vaping among Deaf/HH students.

Keywords: Deaf/Hard-of-Hearing youth, tobacco use, e-cigarette use, vaping, prevention

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Understanding e-cigarette knowledge and use among Deaf and Hard-of-Hearing students and the need for tailored prevention programming: A qualitative study

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 U.S., up to one million Deaf and Hard-of-Hearing (Deaf/HH) individuals use American Sign Language (ASL) as their primary language (Mitchell, Young, Bachleda, & Karchmer, 2006). ASL is a visual-gesture language, with its own 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 Deaf/HH 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 the Deaf/HH community experience social and information marginalization resulting in difficulties accessing health and other information that is widely available to the hearing community (M. M. McKee et al., 2015).

For Deaf/HH 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 Deaf/HH youth, as well as a heightened sensitivity to peer influences and behaviors believed to confer social acceptability (Coll, Cutler,

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Thobro, & Haas, 2009; Guthmann, 2011; Kushalnagar, Simons, & Guthmann, 2019; M. M. McKee et al., 2019; Theunissen et al., 2014; Titus, 2010; Titus & Guthmann, 2013; Titus, Schiller, & Guthmann, 2008). Being both Deaf/HH and from a racial or ethnic minority group compounds these challenges (Anderson & A. Grace, 1991; Cohen, Fischgrund, & Redding, 2013; Kluwin, Stinson, & Colarossi, 2002; Prickett & Martin, 1992; Rodriguez & Santivaia, 1991).

Despite these vulnerabilities, there is a dearth of health promotion or prevention materials and programs appropriate for Deaf/HH youth. Programs designed for hearing youth tend to be inaccessible for the Deaf/HH community, and adequately tailored materials for use by educators of this group are rarely available (Guthmann, Lazowski, Moore, Heinemann, & Embree, 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 (M. M. McKee et al., 2015). Also, Deaf/HH people experience significant difficulties in obtaining needed health information in clinical settings (M. M. McKee et al., 2015; Pereira & Fortes, 2010; Scheier, 2009; Sheppard, 2014; Shuler, Mistler, Torrey, & Depukat, 2014; Smeijers, Ens-Dokkum, Van Den Bogaerde, & Oudesluys-Murphy, 2011; Smith, Kushalnagar, & Hauser, 2015; Smith & Samar, 2016; Steinberg, Barnett, Meador, Wiggins, & Zazove, 2006) and at home (M. M. McKee et al., 2015). Over 90% of Deaf children are born to hearing parents and over 70% of families with a Deaf child do not sign in the home (M. M. McKee et al.,

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2015; Steinberg et al., 2006), which contributes to the gaps in health knowledge among Deaf/HH youth (Prickett & Martin, 1992; Smith et al., 2015; Smith & Samar, 2016). Despite the clear need for health promotion interventions for the Deaf/HH community, challenges related to reading proficiency, data collection, translation and administration of instruments into ASL and other issues (Athale et al., 2010; Berman et al., 2013, 2017; Eckhardt & Anastas, 2006; Graybill et al., 2010; Guthmann, Titus, Embree, & Wilson, 2017; Jones, Mallinson, Phillips, & Kang, 2006; M. McKee, Schlehofer, & Thew, 2013; Meador & Zazove, 2009; Pollard, Dean, O'Hearn, & Haynes, 2009; Zazove, Meador, Reed, & Gorenflo, 2013) have led Deaf/HH people to be largely excluded from health intervention research (Barnett, McKee, Smith, & Pearson, 2011).

Recognizing these challenges, UCLA researchers partnered with the Deaf community over a decade ago to develop accessible, appropriate tobacco prevention materials for Deaf/HH youth (Berman & Guthmann, 2007; Berman, Guthmann, Liu, & Streja, 2011). This early work culminated in the development and evaluation of *Hands Off Tobacco!*, a prevention program for Deaf/HH youth which had significant impacts on current cigarette (28% to 8%) and smokeless tobacco use (7.5% to 2.5%) at two different study schools (Berman, Guthmann, Crespi, & Liu, 2011). Educators working with Deaf/HH youth report that they are still using components of the curriculum today.

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However, recent, dramatic changes in the tobacco landscape have resulted in the *Hands Off Tobacco!* curriculum becoming outdated. E-cigarette use among middle and high school aged youth has reached epidemic proportions, and is continuing to increase at alarming rates. From 2017-2018 alone, the proportion of middle and high school students using e-cigarettes increased 50% and 75%, respectively (Cullen et al., 2018). According to the US Secretary of Health and Human Services (USHHS), this is the most rapid increase in substance use ever observed among American youth (US Department of Health and Human Services, 2018). Calls to address this new and growing public health problem have come from both the US Surgeon General (US Department of Health and Human Services, 2018) and the Chief of the US Food and Drug Administration (US Food and Drug Administration, 2018); there is a need for comprehensive tobacco prevention strategies for youth that address e-cigarettes and all tobacco products. School-based educational programs have a recognized place in tobacco use prevention and control efforts (Sussman, Unger, Rohrbach, & Johnson, 2005; US Department of Health and Human Services, 2012). Steps to develop and test such programs are already underway in the general youth population (CATCH Coordinated Approach to Child Health, 2017; Massachusetts Tobacco Cessation and Prevention Program, 2019; Orange County Department of Education, 2016; Stanford Medicine Tobacco Prevention Toolkit, 2019). For Deaf/HH youth however, up-to-date, tailored

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school based tobacco and e-cigarette prevention programs have not yet been developed or assessed.

Schools serve as a uniquely important resource for information and services in the Deaf community, for young people as well as the community overall (Titus & Guthmann, 2013; Titus et al., 2008). Deaf/HH youth may be educated at a School for the Deaf or in mainstream settings. Attendance at mainstream schools is increasingly common, yet Schools for the Deaf continue to serve as significant educational resources for this population in California and nationwide. In mainstream settings, it is common for Departments of Education or School Districts to centralize their programming for Deaf/HH students within one or more elementary, middle and high schools. In these settings Deaf/HH 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 Deaf/HH students. Schools for the Deaf serve Deaf/HH students, from pre-K through high school, with many students boarding at the campus throughout the academic year.

The nature of peer pressure, social relationships and influences, and efforts to “fit in” with hearing peers creates particular challenges for Deaf/HH youth in mainstream settings (Angelides & Aravi, 2007; Brice & Strauss, 2016; Cambra, 2002; Foster, 1987; Hatamizadeh, Ghasemi, Saeedi, & Kazemnejad, 2008; Holcomb, 1992; Iantaffi, Jarvis, & Sinka, 2003; Kluwin et al., 2002; Rich, Levinger, Werner, & Adelman, 2013; Stinson & Shirin, 1999;

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Theunissen et al., 2014). Exposure to marketing messages and barriers to adequate tailored prevention education, combined with the aforementioned social challenges, may result in elevated use rates among Deaf/HH youth in mainstream schools. In fact, we did observe greater tobacco use rates among mainstream students in our prior tobacco survey work (Berman et al., 2007). However, students at Schools for the Deaf are commonly in mixed-age, residential settings, which may provide increased opportunities for younger students to access and experiment with tobacco products.

Recognizing the risks for use in this population, the significant barriers to receipt of prevention and other health information, and the rapid changes in tobacco use patterns, we identified a critical need for research to modify, update and disseminate our evidence-based, tailored educational program. As a first step, we used qualitative methodologies to learn more about: Deaf/HH youth's knowledge, misconceptions and use of e-cigarettes and tobacco products; ongoing health education programming in schools serving Deaf/HH youth; and current trends related to how Deaf/HH youth obtain information in classroom settings and outside of school, such as via social media. To get a clearer sense of the unique challenges facing Deaf/HH students in academic settings, we sought input from students, faculty and administrators in the diverse setting serving Deaf/HH youth, Schools for the Deaf and mainstream programs.

Methods

Eligibility and Recruitment

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Students. Our sample consisted of 34 Deaf/HH students enrolled in two California Schools for the Deaf and two mainstream programs for Deaf/HH students in large school districts in Southern California. We conducted recruitment by mailing parents 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 18 years or older received a flyer and consent form. The recruitment materials described the study's purpose, time commitment, and eligibility criteria.

Students were invited to participate in one of eight focus groups 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 (< 18 years), and written consent from adult students ($\geq$ 18 years). The study received institutional review board approval from UCLA.

Key informant interviews. Recruitment of key informants occurred at each school site through direct contact with study staff. Key informants included administrators, teachers, and other support staff members who worked directly with Deaf/HH students and who were able to complete a telephone or videophone interview aided by an ASL interpreter. Participants were sent an information sheet describing the study and a consent form via email. Participants signed, scanned, and returned completed written consent forms via email.

Focus Groups

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We recruited 34 students, 19 in middle school and 15 in high school. Each focus group included 2-7 participants, a trained Deaf moderator who is fluent in ASL, and a hearing ASL-English bilingual interpreter. Dr. Cowgill, who has extensive experience conducting focus groups with youth, trained the moderator to conduct the focus groups with an interpreter present. 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 60-90 minute focus group session was conducted in a private room on the school campus. Discussions were conducted in American Sign Language (ASL). These sessions were guided by a semi-structured protocol that was developed based on a review of the youth-focused e-cigarette and tobacco literature and investigator experience with e-cigarette and tobacco prevention and control in school-based settings, including those serving Deaf/HH students (see Appendix 1). Likewise, the protocol addressed preferred methods to engage Deaf/HH students about health topics. The moderator encouraged student interaction and open discussion of diverse views.

At the start of each group session, participants completed a brief written questionnaire including demographic information (gender, age, grade level, and race/ethnicity) and tobacco experimentation and current use (cigarettes, chewing tobacco, e-cigarettes, hookah, and cigarillos).

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Descriptive statistics are presented in Table 1. Focus group participants received a \$20 incentive.

Key informant Interviews

Seven participants completed 20-30 minute key informant interviews: four from Schools for the Deaf and three from mainstream programs. Six of the seven participants were Deaf/HH. A trained research assistant conducted the interviews by phone using a video relay service (VRS) with Deaf/HH participants. The research assistant voiced questions in English to the VRS interpreter, who translated questions into ASL for the key informant and voiced the participant's responses in English for the research assistant. All conversations were digitally recorded. The interview protocol emphasized assessment of existing health education for Deaf/HH students, whether tobacco and/or e-cigarette education was currently included in the middle or high school curriculum, and preferred methods for providing health education programming to Deaf/HH students in classroom settings (see Appendix 2). Participants received a \$20 incentive.

Qualitative Analysis

Focus groups and key informant interview transcripts were imported into Atlas.ti. Content analysis of the transcripts was conducted using inductive and deductive techniques. We created a set of thematic-based codes and applied them systematically to the narratives (Bernard, 2002). First, the transcripts were reviewed to identify major thematic content that

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either fit with a priori categories included in the focus group and key informant protocols or emerged spontaneously from the group discussions. The transcripts were then 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/e-cigarette use among the 34 focus group participants.

<insert table 1 near here>

Five major themes emerged: product exposure, knowledge and attitudes, experimentation and use, health education, and engagement of Deaf/HH students in tobacco/e-cigarette prevention education. We compare and contrast findings related to each theme among key informants and focus group participants.

Exposure to Tobacco and E-cigarettes

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

“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.”

Also, students were exposed to e-cigarette advertising online and via social media, including via YouTube, Facebook, Snap Chat and Instagram. High school students were more likely to view personal posts from friends or people they followed on social media compared to 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 witnessed online in which...

“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 shared, “they shouldn’t support this stuff, it’s not fair. I feel like they’re taking advantage

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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 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 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, with primarily a focus 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, as mentioned by a School for the Deaf middle school student; “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 e-cigarettes, high school students expressed a wide range of opinions about their safety. Perceptions about cigarettes included that they are 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

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possibly blow up, but some hypothesized 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 second hand 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 second hand 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 counter opinion provided by a mainstream middle school student posited that second hand vaping may be worse than exposure to second hand 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 second hand smoke and vape exposure. They too expressed varied opinions on which was worse and why. For those who viewed second hand vaping as more harmful, reasons included uncertainty about what you are inhaling and the chemicals in e-liquids, while others believed second hand vapor was less harmful because it involved a “kind of steam” or “vape mist” as opposed to smoke.

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Some participants acknowledged that they were not even sure to what the term “second hand” exposure alluded.

Students and key informants emphasized that Deaf/HH youth are curious about tobacco and e-cigarette products, but lack access to Deaf/HH-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, they recognized the lack of content appropriate for Deaf/HH 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

Tobacco product and e-cigarette use was low among focus group participants, with 9% reporting trying e-cigarettes, 6% cigarettes, and 3% hookah (Table 1). Correspondingly, students and key informants reported observing limited use among Deaf/HH middle and high school students. Middle school students viewed peers who vaped as “not really cool” and 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 use of cannabis was a larger problem than e-cigarette and tobacco use.

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Students residing in Schools for the Deaf explained that older students who were repeating grades, in transition programs on campus, or alumni who 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,

“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 them after school, and a lot of [tobacco products and e-cigarettes] gets handed down that way.”

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

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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 mainstream Deaf/HH student 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 older generations of family members 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 Deaf/HH students. For example, several students explained that Deaf students who live with hearing parents struggle to effectively communicate with them, leaving 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 hook ups” and

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provide access to vaping products. Many 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 Deaf/HH are at increased risk of vaping due to their curiosity about these products and the lack of available information on the health consequences of e-cigarette use and limited communication about emerging tobacco products.

Experience with Health Education among Deaf/HH Students

A majority of middle and high school students reported 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 anti-tobacco posters on campus, viewing material online through websites (e.g., the Truth Campaign), and discussing the topic with counselors. Family, TV commercials, and pop-up ads online 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 students observed focused on tobacco, not e-cigarette, products.

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Key informants explained that health education was delivered through 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 on substance and tobacco use. They acknowledged a limited focus on tobacco use and 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 lack of staff to deliver the material, a dearth of Deaf-appropriate materials, a shortage of time, and a focus on other priority health issues.

Several key informants discussed that their schools had a process 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 are the most prominent form of tobacco education at school, but the process is not tailored to Deaf/HH students:

“The students that get busted ... they have to do a lot of writing and they have to present. The 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.”

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Recommendations for Engaging Deaf/HH Students in Tobacco and E-Cigarette Prevention Education

Focus group participants shared a variety of ideas about how to best engage Deaf/HH students regarding tobacco and e-cigarette prevention education. Most students urged that “boring” lectures should be eliminated, instead calling for the creation of programs that engage students through a variety of mediums. Suggestions centered around incorporating games, making videos, and including activities that were fun, such as role playing. They noted that videos need to include actors using ASL as well as large captions. Students also expressed a desire to engage in open discussions, with a middle school student from a School for the Deaf asking to, “get 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 content needs to be original and creative or students would ignore the messaging. As one high school student from a School for the Deaf stated, messages about e-cigarette harms need to be “visible and visual.” Some students also promoted the idea of creating student-run clubs that could share prevention messaging by making dynamic posters that include warnings about using e-cigarettes and other tobacco products. High school students suggested that sessions occur in small groups and that schools should find a way to engage parents and possibly other family members in the programming.

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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 about tobacco and e-cigarette use. Also, participants were interested in learning more about how e-cigarettes affect the body and how e-cigarettes are manufactured compared to traditional tobacco cigarettes.

Key informant interviews shed further light on the specific needs of Deaf/HH 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 Deaf/HH students, informants strongly suggested that the content be flexible so that teachers could select what was most appropriate for the educational level of their students. Similar to students, they indicated that videos could play an important role in engaging youth and advocated for video content that was signed and captioned and available on YouTube or through other social media sites. In one interview, the use of Deaf Certified Interpreters within videos was recommended, given an individual with this background would be able to expand on curricular content in order to meet the diverse educational needs of Deaf/HH students. As one key informant from a School for the Deaf reflected about the use of captioned YouTube videos:

“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

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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 can share their personal experiences. They advocated for little homework and emphasized the need for repetition of concepts throughout the program in order to reinforce the prevention messages. Lastly, key informants promoted the idea of having a single comprehensive curriculum that started in middle school and continued 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 and information regarding Deaf/HH students’ experiences with tobacco products and e-cigarettes. Taken together, the feedback shared by these stakeholders demonstrates a pressing, unmet need for tobacco and e-cigarette prevention programs for Deaf/HH youth, particularly beginning at the middle school level. These conversations also provided us with specific guidance for educational program development and delivery, which we are drawing upon to inform the development and assessment of our revised school-based tobacco and e-cigarette prevention curriculum for Deaf/HH youth.

We had expected to find multiple marked differences between students at Schools for the Deaf and those enrolled in mainstream schools,

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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 of the topics that we explored, with the notable exception of product exposure. Students in both settings most frequently reported exposure to products through social media and in retail outlets such as convenience stores. Students in both educational settings 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. Similar to hearing populations (Cullen et al., 2018), greater exposure to tobacco and e-cigarette use was reported in high schools compared to middle school campuses.

Deaf/HH students' limited knowledge about the health implications of e-cigarettes was expected, and is in close keeping with that of similarly aged hearing students (Greenhill, Dawkins, Notley, Finn, & Turner, 2016). Their limited understanding of the health effects of tobacco and traditional cigarettes outside of their link to lung-related diseases, however, was

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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. We recognize that reading literacy and health literacy among Deaf/HH students are lower than among the general population (M. M. McKee et al., 2015; Traxler, 2000). Given the widely varied levels of literacy and language development that we witnessed in our interaction with students, and that were reported by key informants, it is important that messages and lessons delivered through such programs are straightforward, clear, consistent, and include flexible content. We found it encouraging that students expressed strong interest in learning more about the health implications of tobacco and e-cigarette use. Through our work we have identified a number of knowledge gaps that need to be emphasized in our curriculum: the dangers associated with e-liquids, properties and effects of nicotine, the risks associated with secondhand smoke and vape exposure, and that the consequences of using e-cigarettes and other tobacco products extend well beyond implications for lung health.

This research underscored the fact that existing prevention messages and programs are not reaching Deaf/HH youth. On the one hand, students, educators and administrators alike reported awareness of very few, or no, prevention campaigns or programs that had been captioned or were delivered in ASL. Additionally, Deaf/HH youth commonly reported limited communication with hearing parents and, as a result, that they were not receiving messages dissuading use from their parents. On the other hand,

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Deaf/HH youth commonly reported exposure to YouTube videos featuring smoke and vape tricks. This reflects a concerning environment for Deaf/HH youth in which prevention messages are not received but there is exposure and awareness of messages that promote and/or glamorize use of these products. If prevention campaigns and programs do not take the step of ensuring that tobacco prevention content is available to and appropriate for Deaf/HH youth, we risk seeing increasing rates of e-cigarette product use among this group in the future.

Our work to update and adapt our *Hands Off Tobacco!* curriculum is the first effort that we are aware of to address the observed gaps and make tobacco and e-cigarette prevention programming relevant and accessible to Deaf/HH middle school students. The guidance regarding curriculum development that we received through our key informant interviews with teachers and administrators proved invaluable for this process. A clear and pronounced need was expressed for adaptability in order to accommodate widely varied educational levels present among Deaf/HH students who learn side by side in the same classroom setting. Additionally, we received a strong message about the need for hands-on activities to reinforce key lessons and maintain engagement among the students. The challenge in creating programming will be to balance this interest with educators' messaging that curricular content needs to be simple and concise, and students' expressed desire for enjoyable and interactive lessons that are conveyed visually.

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The findings from our formative work in both Schools for the Deaf and mainstream settings are being applied to the revision and testing of *Hands Off Tobacco!*, as we craft what is now the program, *Hands Off Tobacco and E-cigarettes!* The revised curriculum includes background about e-cigarettes and other emerging tobacco products, their health implications, risks that come with nicotine addiction, and current tobacco and e-cigarette marketing examples. The activities included in the updated curriculum provide “real world” examples of e-cigarette and tobacco exposure shared by our study participants and provide opportunities for Deaf/HH student to discuss their opinions and practice ways to resist use. Upon completing the evaluation of our pilot implementation of *Hands Off Tobacco and E-Cigarettes!*, we plan to further revise the curriculum based on student, teacher, and administrator feedback and to seek funding to develop more advanced video content that was not possible through pilot funding. With the continued rise of e-cigarette use and nicotine addiction among adolescent populations, dissemination of the curriculum to schools serving Deaf/HH students throughout the country is of critical importance.

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Table 1. Student Demographic Characteristics and Tobacco Use (N=34)	
Gender	
Female	53%
Male	47%
Mean age in years (range)	14.1 (13-18)
Grade level	
7 th grade	15%
8 th grade	41%
9 th grade	35%
12 th grade	9%
Race/ethnicity	
Latino	71%
White	6%
American Indian/Alaskan Native	3%
Asian American	6%
Native Hawaiian or Pacific Islander	3%
More than 1 Race/Ethnicity	12%
Ever used	
E-cigarettes	9%
Cigarettes	6%
Hookah	3%
Chewing tobacco, snuff, or dip	0%
Cigarillos	0%

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Appendix 1Focus 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 Deaf/Hard of Hearing (Deaf/HH) students today?
2. How much of a problem do you think using e-cigarettes or vaping is among Deaf/HH 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, bill boards, 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?

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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 Deaf/HH teens?
20. What are the best ways to engage and maintain the interest of Deaf/HH youth in tobacco and e-cigarette prevention programming in a school setting? Incentives? Visuals (pictures, videos, social media)? Activities?

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Appendix 2

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 Deaf/Hard of Hearing (Deaf/HH) students today? Among hearing students?
2. How much of a problem do you think using e-cigarettes or vaping is among Deaf/HH 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.
 - b. 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 Deaf/HH youth?
10. What are the best methods for communicating curricula elements to Deaf/HH youth?

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11. Do you think Deaf/HH youth have an understanding of the following terms: vape, e-juice, nicotine, hookah?
12. What are effective approaches for engaging Deaf/HH youth in tobacco/e-cigarette use prevention education programming? Use of different medias (pictures, videos, social media)? Group activities?