Original article

Adolescents' Perceptions of Risks and Benefits of Conventional Cigarettes, E-cigarettes, and Marijuana: A Qualitative Analysis

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A B S T R A C T

Purpose: Although rates of adolescent cigarette use have remained constant or decreased, rates of marijuana and e-cigarette use are rising. Knowledge and perceptions of risks and benefits of tobacco products impact adolescents' decisions to use these products. However, little is known regarding adolescents' knowledge and perceptions of risks of e-cigarettes and marijuana nor how these perceptions are formed. This study uses qualitative techniques to assess and compare adolescents' perceptions of the risks and benefits of cigarettes, e-cigarettes, and marijuana.
Methods: Twenty-four adolescents (nine females and 15 males) from Northern California participated in six small-group discussions. Adolescents were asked what good or bad things might happen from using these products. To assess how perceptions and knowledge of risks and benefits were formed, participants were asked where and from whom they had learned about these products.
Results: Adolescents described negative consequences of cigarette use but were much less sure regarding risks of marijuana and e-cigarette use. Conversely, they described few benefits of cigarettes but described a number of benefits of e-cigarette and marijuana use. Adolescents described learning about these products from the media, from family and friends, and from the school environment.
Conclusions: Adolescents have learned from multiple sources about risks of using cigarettes, but they receive much less and often incorrect information regarding marijuana and e-cigarettes, likely resulting in their positive and often ambivalent perceptions of marijuana and e-cigarettes.

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IMPLICATIONS AND CONTRIBUTION

This study highlights the need for clinicians, prevention campaigns, and interventions to explicitly address risks of marijuana and e-cigarettes use along with risks of cigarette use. Additionally, there needs to be a stronger connection between formal messages that adolescents are getting regarding the risks of these products and their daily experiences.

Although rates of tobacco cigarette use among adolescents have remained constant or declined [1], rates of e-cigarette and marijuana use are on the rise [2,3]. E-cigarettes are electronic devices containing a solution of propylene glycol or glycerol and contain nicotine and flavorings, which are heated to create an aerosol that is inhaled [4]. Between 2011 and 2013, there was a threefold increase in e-cigarette use among high-school students (with rates increasing from 1.5% to 4.5%) [2]. According to the

most recent Monitoring the Future report, rates of past 30-day use of e-cigarettes and marijuana among adolescents were consistently greater than past 30-day use of conventional cigarettes. For 10th graders, past 30-day use rates for e-cigarettes, marijuana, and conventional cigarettes were 16.2%, 17.6%, and 7.2% , respectively; and for 12th graders, rates were 17.1%, 22.6%, and 13.6%, respectively [3].

Conventional cigarette use is known to cause a number of short-term and long-term negative health conditions [5], and smoking conventional cigarettes negatively impacts the health of those in proximity of this smoke [6,7]. Smoking marijuana, as is the case for smoking any type of biomass, carries many of these same risks [8,9], and recent studies confirm similar negative

consequences for secondhand smoke from marijuana smoke [10]. E-cigarettes are a relatively new product; thus, there is less evidence regarding possible consequences related to use. Recent studies, however, suggest that use of e-cigarettes may negatively impact cardiovascular health [11], and flavorants in e-cigarettes present potential hazards such as risk of bronchial obliterans, an obstructive lung disease [12]. Additionally, evidence shows that nicotine alone confers a series of risks, including affecting development of the hippocampus and cerebral cortex among adolescents [13]. While varying by product, clearly there are significant risks associated with the use of cigarettes, e-cigarettes, and marijuana.

Understanding adolescents' perceptions of the risks and benefits of using these products is important as it has been established that holding low perceptions of risks and high perceptions of benefits of use of tobacco or marijuana is related to and predictive of future substance use [14—17].

Perceptions of risks and benefits are key constructs in a number of health behavior models [18,19] that are used to conceptualize and explain why individuals engage in healthy and unhealthy behaviors. Perceptions of risk are also dependent on social principles that situate risk in specific temporal and cultural contexts [20]. Perceptions of risk are formed via a number of channels, such as one's own experiences, the experiences of others in one's community, and the messages that are given from authority figures regarding risk [21]. For example, Morrell et al. [22] found that perceptions of risks related to smoking decrease as the number of friends one has who smoke increases, illustrating the impact that intrapersonal relationships can have on perceptions. Additionally, studies show that adolescents traditionally gather health information from personal sources such as family and peers; impersonal sources such as mass media venues like movies and television, and social media; and the Internet [23]. Kurtz et al. [24], for example, found that television is often used by children and adolescents as a venue for obtaining health information about smoking.

Little research has been conducted to understand intrapersonal and cultural factors that influence adolescents' perceptions of e-cigarettes, marijuana, and conventional cigarettes. Research is needed to better understand how youth perceive the risks and benefits of e-cigarettes, marijuana, and tobacco in relationship to one another and to better understand how perceptions regarding these products are formed.

This study fills these gaps by using qualitative techniques to assess and compare adolescents' perceptions of risks and benefits of conventional cigarettes, e-cigarettes, and marijuana. Additionally, this study assesses how information from the media, family, friends, and the school environment helps form adolescents' perceptions of these beliefs, positioning discussions of risk and benefit into larger cultural contexts to gain a richer understanding of adolescent beliefs. Such findings can be utilized in public health campaigns and interventions aimed at educating adolescents about the harms and misperceptions associated with each of these products, with the ultimate goal of reducing use.

Methods

Participants and recruitment

A total of 24 adolescents (nine females and 15 males) participated in six small-group discussions ranging from two to six participants in each group. The mean age of the sample was 17.5 years (±1.2 years). Of the sample, six (25%) were white, eight (33.3%) were black or African-American, five (20.8%) were two or more races, four (16.7%) were Asian, and one (4.2%) was American Indian or Alaskan Native; 33.3% of participants identified as Hispanic. Among the participants, seven (29.2%) had ever tried a cigarette, 12 (50%) had ever used marijuana, eight (33.3%) had used a blunt (marijuana wrapped in a tobacco leaf), four (16.7%) had ever used an e-cigarette, and two (8.4%) had ever used an e-cigarette with marijuana.

Procedures

Adolescents were recruited from after-school programs in an urban Northern California school district. The school district was purposefully selected for its high rates of substance use to increase the likelihood that participants we talked with were familiar with conventional cigarettes, marijuana, and e-cigarettes. Researchers visited the after-school programs and described the research to students. Students were given a packet including informed consent forms for parents and assent forms for students. The packets were returned to the school, and students who agreed to participate were contacted to schedule small-group discussions. Such small-group discussions are an effective way of allowing both in-depth conversations and a variety of voices to be heard [25,26]. Students were given a short survey before the small-groups began, which asked about their age, sex, use of cigarettes, e-cigarettes, marijuana and blunts, and questions regarding how easy it was to access these products. The first author led the discussions, which ranged from 45 to 75 minutes in length. Participants were compensated for their time with a $50.00 iTunes gift card. All procedures for this study were approved by the institutional review boards at the University of California, San Francisco and Stanford University.

Small-group discussion protocol

Small-group discussions were conducted using a semi-structured guide. The guide was created to assess adolescents' perceptions of the risks and benefits related to using conventional cigarettes, e-cigarettes, and marijuana. Adolescents were also asked questions to better understand how they formed these beliefs. Adolescents were asked where, what, and from whom they had learned about these products. They were then asked to describe why someone may decide to use one product over another product. Small-group discussions were conducted until the researchers found a saturation of themes expressed by participants about where they learned about these products, risks and benefits of these products, and relationships among these products. The researchers defined saturation as hearing the same risks and benefits related to use being mentioned repeatedly in the different discussions and not hearing new risks and benefits being discussed [27].

Qualitative analysis

Small-group discussions were transcribed using a transcription service; transcripts were then read alongside the original recording to assess accuracy. The first author closely read a subset of transcripts and created an initial codebook of themes, using the thematic analysis approach outlined by Braun and Clarke [28]. The creation of the codes was an iterative process. Two transcripts were read, and a codebook was created; after

Table 1
Themes and example quotes

Themes	Illustrative quotes
Perceived risks and benefits associated with conventional cigarettes versus marijuana	Example 1: "I think because people have a perception that it's [marijuana] healthier than tobacco. Like I don't know. Whenever I've heard people talk about it or if I've kind of discussed it with people, people say there's no point in smoking cigarettes and tobacco, because it doesn't get you high; so they think it's pointless just to smoke just to smoke. But also they say it's more addictive and like the long-term will be more bad for you. And they say that marijuana's like the only point to smoke it is to get you high, and also they claim it's like not as addictive. And like someone who smokes weed doesn't necessarily smoke cigarettes. So they say it's like it won't like have as bad an effect on you in the long-term I think. That's like what I've heard from people." Example 2: "Yeah. I mean, cigarettes are worse [than weed], because they have all the chemicals in there which kill your body." Example 3: P1: "Some people would be like, 'It [conventional cigarettes] can give you cancer.' But weed can also give you cancer, too, if you use blunts." P2: (Shaking head no) P1: "Yes it can, because the blunts is made of tobacco—" P2: "Nobody never ain't gotten cancer from smoking weed. Nobody ever died from smoking weed. You've gotta smoke a certain amount of pounds at one time to die from it…Three times your body weight. You can't die from smoking weed." P1: "But you can still get it, though—" P2: "You can't get cancer from smoking weed." P1: "Yes you can." P3: "Can I say something real quick? I do remember reading somewhere—I don't remember exactly where but it said that in most cases with marijuana, it wasn't that just smoking by itself causes problems; it was usually because the person who was smoking it was mixing marijuana and tobacco together. That's what usually causes those problems. 'Cause marijuana by itself, as long as it's in moderation, it's not gonna hurt you." P1: "Okay, but I never said that just weed can give you cancer. I said that weed rolled with blunt, like the blunt that can give you cancer. I didn't say by itself can give you cancer. I'm just saying you can get cancer."
Perceived risks and benefits associated with conventional cigarettes versus e-cigarettes	Example 4: "People always tell you smoking's bad, and cigarettes and tobacco's bad, but if you take those out and you just smoke regular with just water, it's not bad. Because you take out the tobacco and the cigarette stuff in there. That's what people think. It's better than smoking." Example 5: "E-cigarettes—they're not worse than cigarettes, but they're more or less equal in how bad it is. So, really not much difference…I don't really know that much about e-cigarettes."
Formation of beliefs from the media	Example 6: "I'd see commercials on TV saying, 'Smoking is bad for you.' It was this one—this lady was holding a little box—a voice box—to her throat. She had a hole in her throat, and that's what she gets from 20 years of smoking. She had, like, a robot voice—I couldn't even understand what she was saying." Example 7: "I learned about it [cigarettes] during commercials. I remember tobacco's bad for you, and I remember one commercial, just a man was smoking and it mentioned—he was smoking downstairs but eventually it hurt the baby upstairs. Yeah, and it tells that tobacco is bad…Yeah, 'cuz it's so repetitive. Every time I see it. I think it's engrained in my mind. Now I know tobacco is bad, but—I don't know. It's just so engrained. When I think of tobacco, the first thing that pop up is that commercial, and it's bad. That's how I see it." Example 8: "There [are] commercials talking about how cigarettes and marijuana's bad, but they never talk about e-cigarettes. I remember this one commercial that—there's one guy on a beach who's smoking it. It said, 'Try it.' It's an advertisement. It's Blu, like that brand. Blu, yeah. I think it talk about how good it was, but I never seen a commercial that it was bad. Like a hookah pen, I never saw them—negative about it. That's about it."
Formation of beliefs from the family	Example 9: "Yeah. There's one—my uncle smoked 'cuz he's really stressed out at work and everything. And also in China—that's what I heard. They smoke a lot. My uncle came over from there, and he started smoking. I remember, it was so long ago. I remember that day, because my dad bought me ice cream. I remember my uncle was there, and my dad was like, 'Don't smoke.' That's why—he never talked about smoking ever again. That was like long ago. I think he'd never talk about it, 'cuz it's kinda awkward with my dad, especially because he don't understand our generation. So I think expect the school to teach us about that." Example 10: "Yeah, and my aunties, they smoke a lot of cigarettes. They smoke cigarettes every day and I always tell them, 'Why are you smoking cigarettes? You guys aren't supposed to smoke cigarettes.' But they still do it anyways…Even my auntie, she had bought an e-cigarette, or her husband bought her an e-cigarette, she don't even use that. She'll still buy her regular cigarettes."
Formation of beliefs from school	Example 11: Moderator: "And so, what are some instances where a person your age might decide to smoke weed?" P1: "As soon as they get to high school." P2: "Just experiencing—experiencing it. Peer pressure—you have peer pressure. 'Just try it—just try one, real quick, just real quick.' Like they need a smoking partner or something." Moderator: "Is there a lot of peer pressure to smoke weed in high school?" P2: "It's too much." M: "And is there peer pressure to smoke cigarettes?" P1: "I hope not." P2: "There's not—if somebody was like, 'Oh, I'd punch them in their face.'" P3: "They ain't no good partner if they're encouraging you to smoke cigarettes." P2: "To be honest, I think like, 50 percent of—I don't know—or more—people smoke weed [in our town] to be honest." Example 12: P1: "Yeah, they would puff smoke out of their mouth [using e-cigarettes]. I've seen a couple people do that a couple times." P2: "And the teachers are outdated. They don't know these—" P1: "Yeah, some teachers are completely oblivious to what they are…They [the teachers] would be like, 'Oh, that was really cool.'"

this, the additional transcripts were read, and the codebook was changed as necessary to better fit the themes that emerged. Because an analytical goal of this research was assessing perceptions of risks and benefits across products and determining how these perceptions contribute to the formation of adolescents' perceptions of these risks and benefits, small-group discussions were analyzed and mined for themes with these analytical questions in mind. Themes were then added, changed, or combined as the study authors analyzed the remaining transcripts. Researchers met to discuss the coding of each of the small-group discussions, and discrepancies in coding were dealt with by the researchers coming to consensus. Some quotes illustrating these themes are presented within the results section, whereas others are presented in Table 1.

Results

Perceived risks and benefits associated with conventional cigarettes compared to marijuana

Adolescents were asked what good or bad things might happen if they used conventional cigarettes, e-cigarettes, or marijuana. Youth either stated that there was nothing good about using conventional cigarettes or stated that using cigarettes could help someone relax. In contrast, students easily recited a long list of negative consequences related to conventional cigarette use such as the yellowing of teeth, bad breath, and cancer.

Although participants had difficulty coming up with benefits of conventional cigarette use, they were able to describe a number of benefits and reasons for using marijuana. For example, one student stated, "To get high, or to calm yourself down, or relieve stress, or pain—you can smoke weed for many reasons." Participants also identified a number of risks related to marijuana use such as getting in trouble because it is illegal and getting into dangerous situations because you are high.

Students directly compared the risks and benefits of using conventional cigarettes and marijuana, describing conventional cigarettes as "pointless" to smoke as they do not get you high, and described marijuana as safer and less addictive (Table 1, Ex. 1 and 2).

In another example, a participant described how smoking marijuana in a way that resembles a conventional cigarette is actually viewed as bizarre as conventional cigarettes are so bad for you. The participant explained,

> "Sometimes you might be laughed at if you use some papers. It's like—it's not the cool thing to do, you know…I guess it just looks like you're smoking a cigarette, it's just weird to see someone smoking a cigarette. Like, you hardly ever see—you'll see one every once in a while, but it's mostly just the e-cigarettes and shit."

When asked to explain why smoking a cigarette would be viewed as laughable, the student further explained, "Cause people just laugh at you when you smoke a cigarette. It's like, 'What are you doing? Don't, bro—you're smoking a cigarette, you could die, cancer kills.'"

Although there was general consensus regarding the negative effects of conventional cigarettes, there was debate about possible health risks related to using marijuana. In one small group, there was a great deal of discussion and confusion regarding whether smoking marijuana could lead to cancer. They came to a tenuous consensus by deciding that the combined use of marijuana and tobacco could lead to cancer; thus, keeping tobacco as the risky product and not having to directly answer the question of whether smoking marijuana alone could lead to cancer (see Table 1, Ex. 3).

Perceived risks and benefits associated with conventional cigarettes versus e-cigarettes

Participants were also asked about potential risks and benefits regarding using e-cigarettes compared with conventional cigarettes. Participants noted a number of benefits related to e-cigarette use stating, "Oh, e-cigarettes are classy, because you can walk around with them. They do not have any vapor that goes around and they look nice. It's really hyped up, like, 'No nicotine.' That's what everybody's saying. 'There's no nicotine.' 'It's good for you. Cuz it's vapor.' The water vapor." Participants were generally unsure about the possible risks of using e-cigarettes, describing e-cigarettes as brand new products that they had little knowledge of. For example, one student stated, "I mean, now I see a lot of people carrying them around. But I really don't know if they're bad or good."

Participants also directly compared e-cigarettes with cigarettes (see Table 1, Ex. 4 and 5). For example, one student stated, "I don't know how to say it, but usually the regular cigarettes you know how your lungs—you got problems and stuff like that but the e-cigarettes it doesn't affect that much for you does it? I mean I heard it I mean I don't know if it's true." Other participants however were skeptical of the claims that e-cigarettes were less dangerous than cigarettes, stating that, "apparently people think that, 'Oh, it's electronic—it won't hurt 'em.' They're too stupid to realize it's almost the same thing."

Formation of tobacco beliefs: The role of media, family, friends, and the school environment

Adolescents learned about conventional cigarettes, e-cigarettes, and marijuana through the media, via commercials warning against use and commercials promoting use; through the experiences of family and friends, including parents talking with them about not using products, particularly in the case if cigarettes; and during school, via formal lessons describing risks of use and informal discussions and experiences that happened among peers.

Media. The media, including commercials promoting products, warning about risks related to use, and news stories about products, was described as a major source of information.

Adolescents readily recalled specific commercials regarding the negative health effects of cigarette smoking (see Table 1, Ex. 6 and 7). In contrast, participants had difficulty recalling media messages for marijuana or e-cigarettes. For example, one student expressed frustration over seeing commercials' warning against the risks of cigarettes but not seeing commercials warning against the risks of marijuana despite the fact that cigarettes are legal, and marijuana is not. The student explained, "That's the thing I don't understand—you know—like, commercials and stuff, they come to your school and talk about cigarettes, but they don't talk about weed. But weed is illegal, and cigarettes is not. And so I think that's kind of backwards." Another student described seeing commercials promoting use of e-cigarettes but

never seeing anything negative about these products (see Table 1, Ex. 8).

Participants brought up learning about products on the news, but this media format was primarily discussed with regards to learning about e-cigarettes. For example, one participant explained, "I heard that the only reason they were made is to help people get off from cigarettes for people that want to quit. You would use an e-cigarette to help you quit supposedly. It was on the news."

Family and friends. Participants also learned about these products from the experiences of family and friends. Many participants had family members dealing with health complications related to tobacco use. For example, one student explained, "like I say, my grandpa—he started at 14 and now he's 60 something and he already got lung cancer." Parents also used these experiences to talk about using tobacco with their kids (see Table 1, Ex. 9).

Participants described conversations they had with their parents about marijuana. For example, one participant explained "I mean, my older brother smoked weed, so she [my mother] just told me, 'Don't be like him, smoking weed.' But I mean, like, weed is around me all the time, so it's gonna be hard to not smoke weed. Not trying to be a follower or anything, but I mean—it just happened."

Participants reported not talking about e-cigarettes with their parents. They did, however, describe experiences that their family members and friends had with e-cigarettes, with a number of participants describing a parent or other family member trying to quit conventional cigarettes by switching to e-cigarettes. For example, one participant explained how, "My grandpa, he smokes a lot of cigarettes but I think he is using the e-cigarette now and it's making him think that he's—it's like he's actually smoking a real cigarette." (see Table 1, Ex. 10).

School

Formal lessons about these products. Participants described learning about conventional cigarettes, e-cigarettes, and marijuana at school through both formal and informal channels. Adolescents recalled formal programs in their schools that described harms related to tobacco, cigarettes, and marijuana. As was the case with parents, schools did not have formal classes with discussions regarding the risks of using e-cigarettes.

With regards to conventional cigarettes, participants recalled specific moments and lessons they learned about the dangers of smoking conventional cigarettes. For example, one student recalled being shown "a little replica of how your lung's gonna look when you smoke a lot." Another student described being told "if you smoke cigarettes than, I don't know, you get like a hole in your neck or something."

Participants said they learned about marijuana at school although the messages they received were not as believable. For example, one participant stated, "My teacher told us that we could possibly die the first time we did it but I think she was just saying that 'cause I haven't really heard of someone that died the first time they tried marijuana."

Although students were able to recall being told about the risks related to marijuana and conventional cigarettes at school, some stated that this information might make people more interested in trying these products. For example, one student explained "The class mainly is to discourage kids and teens to not take drugs but there are some kids that are curious what it would be like to get high so that's when they would take it." With another student adding, "Sometimes they take it as a joke sometimes. It depends on who you are."

Informal school environment. Participants described use of these products in their high-school environment. Participants described school as a place where they dealt with pressure to use these products, with students primarily describing marijuana as a product that there was the most pressure to use. For example, one student compared the transition from middle to high school, stating, "Like, you know in middle school, people ain't thinking about getting high. People are thinking about going to high school—in high school, that's all people think about is something to get high, or who's got weed." Students expanded in the pressure of using marijuana in high school, describing how much pressure they felt to use marijuana in high school and described how prevalent marijuana use was in their city in general. Interestingly, although they seemed to except the peer pressure to use marijuana as a given, they were angry at the idea that a peer would push them to use conventional cigarettes (see Table 1, Ex. 11).

Participants also described the use of e-cigarettes in the high-school environment, explaining that they were viewed as "hyped up" new products, and described scenarios in which students used these products in the classroom without their teachers noticing (see Table 1, Ex 12).

Discussion

Although rates of adolescents' use of conventional cigarettes have flattened or declined, rates of use of e-cigarettes and marijuana have been increasing [1–3]. Although studies have shown that perceptions of risks and benefits are predictive of cigarette and marijuana use [16,17], few studies have identified perceived risks and benefits associated with e-cigarettes, nor how and the extent to which perceptions vary across conventional cigarettes, e-cigarettes, and marijuana. This study adds to this literature by using qualitative methodology to ascertain adolescents' perceptions of risks and benefits across these products. Additionally, this study assesses how messages from media, family, friends, and the school environment inform these perceptions.

Adolescents stated that there was almost nothing good about smoking conventional cigarettes, with relaxation being the only reported benefit. Although adolescents described few benefits related to conventional cigarettes, they described a number of health risks related to this product. In contrast, they were generally unsure regarding the health risks related to marijuana and e-cigarettes. However, adolescents described a number of benefits of using marijuana, including getting high stress relief and reducing pain. Adolescents also stated that e-cigarettes had a number of benefits, including looking good and being good for you.

Adolescents described learning about these products from the media, their family and friends, and schools. Participants readily recalled media messages warning against conventional cigarette use but did not see warnings regarding e-cigarettes or marijuana, and the media messages they did recall regarding e-cigarettes were either commercials promoting the product or news reports describing e-cigarettes as a possible means for quitting conventional cigarettes.

Participants described receiving information from their parents about conventional cigarettes and marijuana, as their parents often told them not to use these substances, but stated they did not talk to their parents about e-cigarettes, possibly because e-cigarettes are such a new product, and there is such limited educational information available. Participants are receiving no formal education about e-cigarettes from their schools, but they are seeing and learning about e-cigarettes informally, for example, by seeing family members try to quit using conventional cigarettes through using e-cigarettes and watching their peers use e-cigarettes inside a classroom.

Participants are getting a series of formal educational messages from their schools about the risks of marijuana and conventional cigarettes that are often in opposition to their daily lives in which they are, for example, experiencing pressure to use marijuana from their high-school peers and are also living with a sense that almost everyone they know uses marijuana. These findings highlight that perceptions of risks are not created in a vacuum but are formed by a number of personal, intrapersonal, and cultural experiences [20—22]. It seems clear that there needs to be a stronger connection between formal messages that adolescents are getting regarding the risks of these products and their daily experiences.

There are limitations to this study. It took place with a small sample of students from an urban area in Northern California. Thus, it is possible that the results are not applicable to larger populations. Despite these limitations, this is one of the first studies to qualitatively assess the relationship between adolescents' perceptions of risks and benefits of e-cigarettes, conventional cigarettes, and marijuana.

There are a number of prevention, education, and policy implications from these findings. First, adolescents in this study generally described cigarette smoking negatively, reporting many short-term and long-term health risks related to using conventional cigarettes and recalled seeing commercials that warned against using conventional cigarettes. These findings illustrate how well public health campaigns have done in messaging about the negative health effects and changing social norms around conventional cigarette use [5,7,29]. Although adolescents in this study held strong views regarding the risks of cigarettes, they were generally less sure about the risks of e-cigarettes and marijuana, instead citing more benefits to using e-cigarettes and marijuana. This may be reflective of the fact that there is less known regarding the risks of e-cigarettes and marijuana [9,11,30,31], and messages warning against these products are either nonexistent, vague, and/or less abundant than those warning against conventional cigarettes. It is also possible that a lack of information regarding e-cigarettes and marijuana may be resulting in a false sense that these products are risk free, especially when contrasted with the vast amount of messages regarding risks of conventional cigarettes. More work needs to be done to assess both how the presence and absence of information regarding e-cigarette and marijuana risks effects perceptions of risks and actual behavior.

Adolescents' uncertainty regarding the risks of e-cigarettes and marijuana may also be reflective of the regulatory landscape of these products. Although conventional cigarettes are heavily regulated [32], there is currently no federal regulation for e-cigarettes [30]. Marijuana is technically a banned substance at the federal level; yet, 20 states have legalized marijuana for medical purposes, and 16 states have decriminalized marijuana [33]. These new regulations for marijuana at the state level are paralleled by a general increased support by the public for making marijuana legal [31]. This study suggests the need to revisit regulation of marijuana and develop and enforce e-cigarette regulation. Additionally, there is a need for messaging campaigns and interventions regarding the risks of marijuana and e-cigarettes use, as well as addressing the many misperceptions held by adolescents. Similarly, clinicians should talk with their adolescent patients regarding the risks and misperceptions of e-cigarette and marijuana use along with the risk of conventional cigarettes use. When creating messages and interventions to reduce or prevent the use of any of these products among adolescents, clinicians and public health workers should also consider the larger cultural context that the adolescents live in and ensure that such interventions address the specific needs of youth and their social surround.

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