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by

Antonio Aurelio Faz

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¡No Smoking Por Vapor!

**Systematic Literature Review Examining the Attitudes Toward, Beliefs
About, Perceived Risks and Benefits of Electronic Cigarettes and
Toward Their Use Among United States Youth**

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**Systematic Literature Review Examining the Attitudes Toward, Beliefs
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Toward Their Use Among United States Youth**

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¡No Smoking Por Vapor!

**Systematic Literature Review Examining the Attitudes Toward, Beliefs
About, Perceived Risks and Benefits of Electronic Cigarettes and
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Publication No. _____

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The University of Texas Medical Branch, 2017

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Electronic cigarettes are an emerging topic of discussion and debate in Public Health. Their ability to deliver nicotine in the form of vapor gave rise to the idea of electronic cigarettes being used as nicotine replacement therapy. However, the risks to health that electronic cigarettes pose remain in question and are under study. For example, some constituents of the electronic cigarette's vapor are known to contain certain compounds that have been documented to cause health-related complications, such as negative respiratory symptoms. Worse, electronic cigarette use was associated with progression to use of conventional cigarettes, particularly among youth.

This systematic literature review examines the attitudes toward, beliefs about, perceived risks and benefits of electronic cigarettes and toward their use among United

States youth. The primary aim is to compile this information from previous literature, and use it to gain insight into the general attitudes and beliefs of American youth on electronic cigarettes and their use. Using the formulated search strategy on OVID(Medline) database, 11 articles were identified as being relevant to this study given the inclusion and exclusion criteria applied.

Most commonly, participants across studies reported a perception that electronic cigarettes are less harmful to one's health. Further, the literature reported that United States youth perceive that electronic cigarettes can be or have been used to quit smoking conventional cigarettes, but with varied perception of success. Findings from this capstone may help to guide clinical, practice, and policy discussions around the use and distribution of electronic cigarettes, as well as contribute to the foundation of evidence used by health care providers addressing patient-related concerns about electronic cigarettes.

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LIST OF ABBREVIATIONS

CDC	Centers for Disease Control and Prevention
FDA	U.S. Food & Drug Administration
ENDS	Electronic Nicotine Delivery System
NRT	Nicotine Replacement Therapy
NYTS	National Youth Tobacco Survey

CHAPTER 1: INTRODUCTION

Electronic cigarettes continue to grow in popularity in the United States. However, as the trends over time of how electronic cigarette use changes amongst various populations continue to be mapped out, there remains limited information regarding the reasons we see those changes. This holds true when focusing on the adolescent population in the United States. This has prompted various institutions like the Centers for Disease Control and Prevention (CDC) and U.S. Food & Drug Administration (FDA) to inquire more about them in general and regarding their health outcomes. A goal for institutions like the FDA is to establish a foundation of knowledge that could guide future policy and practices regarding electronic cigarettes.

This systematic literature review will examine the attitudes toward, beliefs about, perceived risks and benefits of electronic cigarettes and toward their use among United States youth. The primary aim is to compile objective and subjective information about electronic cigarettes, specifically the attitudes toward, beliefs about, perceived risks and benefits of using electronic cigarettes among United States youth, from previous literature. The compiled information will be used to gain insight into the general attitudes and beliefs of American youth on electronic cigarettes and their use. The secondary aim is to use the gained insight to help explain the contemporary trends of increasing electronic cigarette use in the United States and to provide more evidence to the foundation of knowledge, hopefully serving to guiding policy discussion.

CHAPTER 2: BACKGROUND

Basic Information

Electronic cigarettes are an emerging topic of discussion and debate in Public Health. They are one of the products considered to be an Electronic Nicotine Delivery System (ENDS), and are often referred to by common names like E-Cig, Vape Pen/Stick. Although a variety of styles and brands of electronic cigarettes now exist, the devices all work off the same basic concept. An internal power source heats a chemical solution, aerosolizing it and creating an inhalable vapor [1]. The chemical solution and its aerosolized form are known to contain nicotine, propylene glycol, glycerin, and flavoring compounds that are known to lead to health-related complications, such as negative respiratory symptoms [2]. There are currently studies being done to further analyze the constituents of electronic cigarettes, the chemical solution, and vapors emitted while being used. Immediate and long-term health effects are also of interest to many working in health care.

Electronic cigarettes became available to United States consumers in 2007. Their ability to deliver nicotine in the form of vapor gave rise to the idea of electronic cigarettes being used as nicotine replacement therapy (NRT) [2]. However, their efficacy in successful smoking cessation is still debated. Studies show electronic cigarettes to not be superior to nicotine patches or non-nicotine electronic cigarettes for smoking cessation [3], and one study of North Carolina High schoolers showed that electronic cigarette use was not associated with abstaining from use of conventional cigarettes [4]. In fact, electronic cigarette use is associated with progression to smoking conventional cigarettes,

especially among adolescents and never users of tobacco products [5, 6]. This may be due to an incongruence between actual risk to health (which is still under debate) and attitudes and beliefs related to the perceived risks and benefits of electronic cigarettes, which is the focus of this capstone.

Electronic Cigarettes are not considered to be a conventional tobacco product, and thus have not been regulated to the same extent as combustible cigarettes. Because of this, the production method of the device, nicotine delivery method, and amount of nicotine delivered is not standardized across brands [1]. Also, conventional tobacco products that are under federal scrutiny also have limitations on how they are advertised. Since they are unregulated, electronic cigarette brands may reach younger consumers (currently off limits to advertising for conventional tobacco products) in various settings and attract potential users. In one trial, adolescents in the treatment group who viewed TV advertisements for electronic cigarettes reported a greater likelihood than the control group of using electronic cigarettes in the future, agreed that electronic cigarettes can be used in places conventional cigarettes cannot, and felt electronic cigarettes were safer for themselves and others [7].

It should be noted that the U.S. Food & Drug Administration (FDA) has implemented more regulations on ENDS products effective August 2016. They believe this is a first step in setting a foundation for future activity related to these tobacco products. However, these products continue to grow in popularity because of the assumption that they are a safer alternative to their combustible counterparts. This has brought some attention to the concept that electronic cigarettes effect smoking “de-

normalization” and could be undermining public health efforts to encourage a smoke free America [8].

Epidemiologic Description of Electronic Cigarette Use

The rise in the popularity of electronic cigarettes in the United States has been measured in numerous studies and reports. One national consumer based survey of United States adults showed that ever use of electronic cigarettes increased from 3.3% to 8.5% from 2010 to 2013, as well as noting an increase in current electronic cigarette use [9]. When examining any health trend, special consideration should be given to vulnerable populations, and younger populations are especially vulnerable in this case. A 2014 analysis by the National Youth Tobacco Surveys showed that electronic cigarettes were the most used products among middle and high school students, with a current use rate of 3.9% and 13.4% respectively (regardless of previous smoking status) which represented a more than 300% increase in use from 2011 to 2014 [10]. Though a decrease in current use of electronic cigarettes among United States middle and high schoolers was noted between 2015 and 2016, electronic cigarettes remained the most commonly used nicotine product in 2016 in that population [11].

Within United States youth, males have higher prevalence of electronic cigarette use as compared to females. A Southern California survey of 11th and 12th graders found that males had double the odds to be multi-tobacco product (including electronic cigarettes) users as compared to females [12]. At the national level (National Youth Tobacco Surveys 2016), the CDC found that a higher proportion of males used any tobacco product compared to females, and this includes smokeless tobacco and ENDS

products [11]. As noted before, amongst vulnerable populations, electronic cigarette use was associated with progression to use of conventional cigarettes [5, 6].

CHAPTER 3: METHODS

This Capstone will be a systematic literature review on the attitudes toward, beliefs about, perceived risks and benefits of electronic cigarettes and toward their use among United States youth. I conducted this systematic review following the standard PICO approach. *Figure 1* (see page 19) outlines the process from database search to article selection that is detailed later.

Database Search Strategy

Access to OVID (Medline) database was obtained through The University of Texas Medical Branch Galveston, Moody Medical Library and Academic Resources website. A search strategy was created in OVID Advanced Search. Keywords relating to the capstone's objectives were placed into four groups that were combined with "OR" (*Table 1*). The keywords of Groups 1, 2, 3, and 4 were then combined across using "AND" to produce the final search framework. I then applied the inclusion and exclusion criteria discussed later to these initial results. No other criteria such as requirements on publication date or language, were applied; and OVID (Medline) was the only database that was searched for this capstone.

Table 1: OVID (Medline) keyword search organization

	Keywords	Combined with:
Group 1	Electronic cigarette e-cigarette	OR
Group 2	Adolescent Adolescent development Adolescent health Adolescent hospitalized Adolescent medicine Adolescent psychology Adolescent psychiatry Adolescent health services Adolescent institutionalized Adolescent behavior Youth	OR
Group 3	United States US	OR
Group 4	Perception Attitudes Beliefs Risk Risk factors Risk adjustment Risk reduction behavior Risk assessment Risk management Risk-taking Behavioral Risk Factor Surveillance System Benefit Curiosity Exploratory behavior	OR

Article Screening with Inclusion Criteria

The articles from the initial database search were sorted by ascending PubMed unique identifier number to efficiently identify the duplicates and exclude them. After duplicates were removed, the remaining articles were first screened by their titles. The

titles were screened for keywords relevant to the objective of examining the attitudes toward, beliefs about, perceived risks and benefits of electronic cigarettes and toward their use among United States youth. Articles not dealing with the capstone's objective, United States populations, adolescent/youth populations, or that mentioned a measure/outcome not relevant to the objective were excluded. Articles that were commentaries, editorials, letters to journal/editor, or submitted anonymously were excluded as well.

After preliminary title screening and first exclusions were made, an abstract review was conducted to determine relevance of articles to the capstone objective. The same inclusion and exclusion criteria used during preliminary title screening were applied. Full text of articles that remained after abstract review were accessed through The University of Texas Medical Branch Galveston, Moody Medical Library and Academic Resources website. Those for which the full text was available for were retained for synthesis in the literature review.

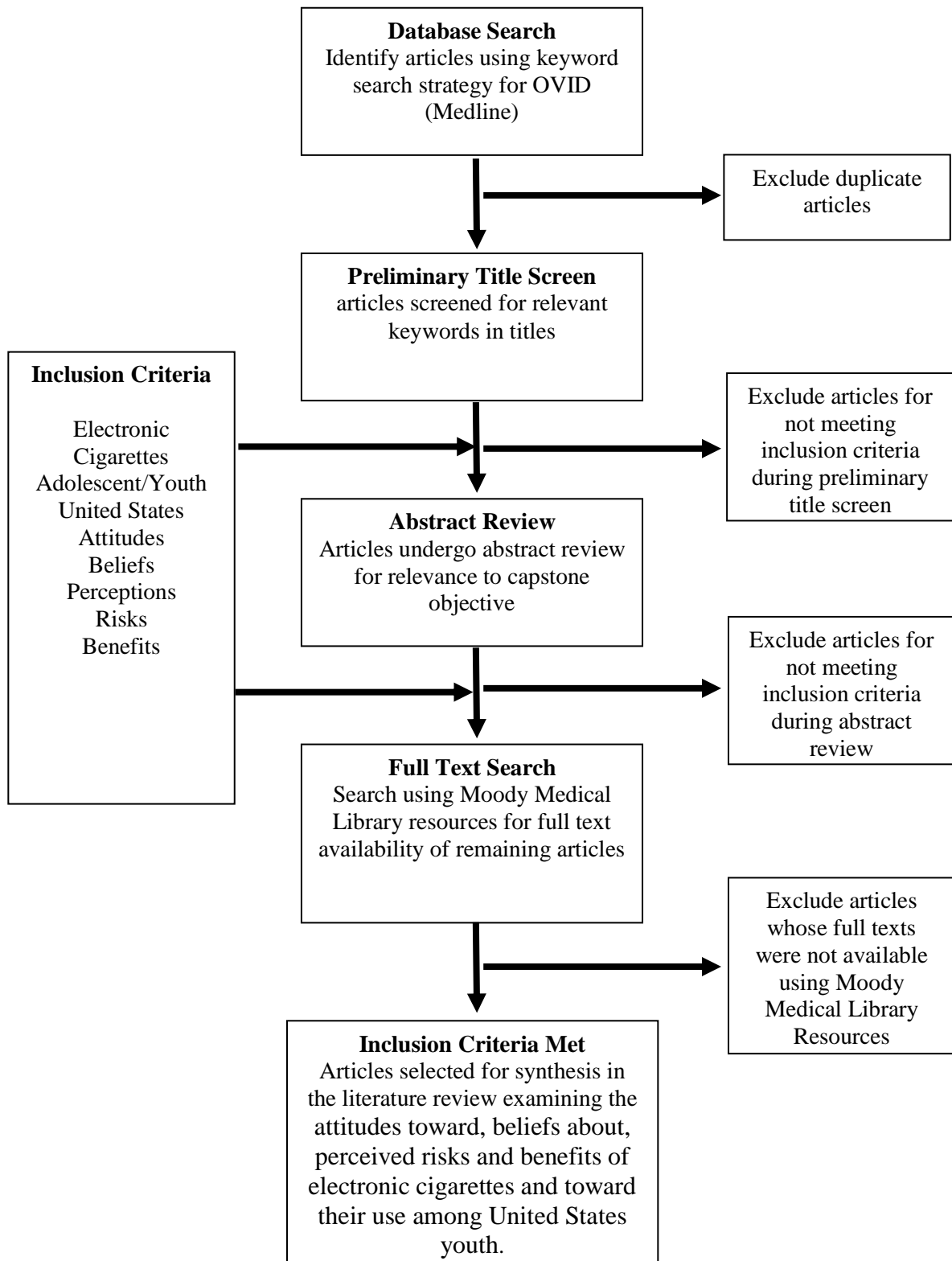
Data Extraction and Quality Assessment

Full text of articles retained were individually reviewed the data relative to the objective was compiled. These include epidemiological measures of perceptions and beliefs of electronic cigarettes like prevalence among adolescents, and measures of association analyzed from observational studies. Qualitative studies provided overarching themes and verbatim transcripts from their study participants. Thematic analysis was conducted to identify common and divergent themes across the studies relevant to

youth's attitudes, beliefs, and perceptions of risk and benefits towards the use of electronic cigarettes.

Information specific to the study were also retained as to help assess the quality of the article. The type of study helped with whether temporality and causality could be established. Number of participants of each study and study design gave an indirect inference on the strength of the study. General and specific study limitations were acknowledged as well; these were considered when assessing their individual quality and in the capstone limitations.

Figure 1: Outline of the decision process for article selection in literature review on examining the attitudes, beliefs, perceived risks and benefits of electronic cigarettes and their use among United States youth



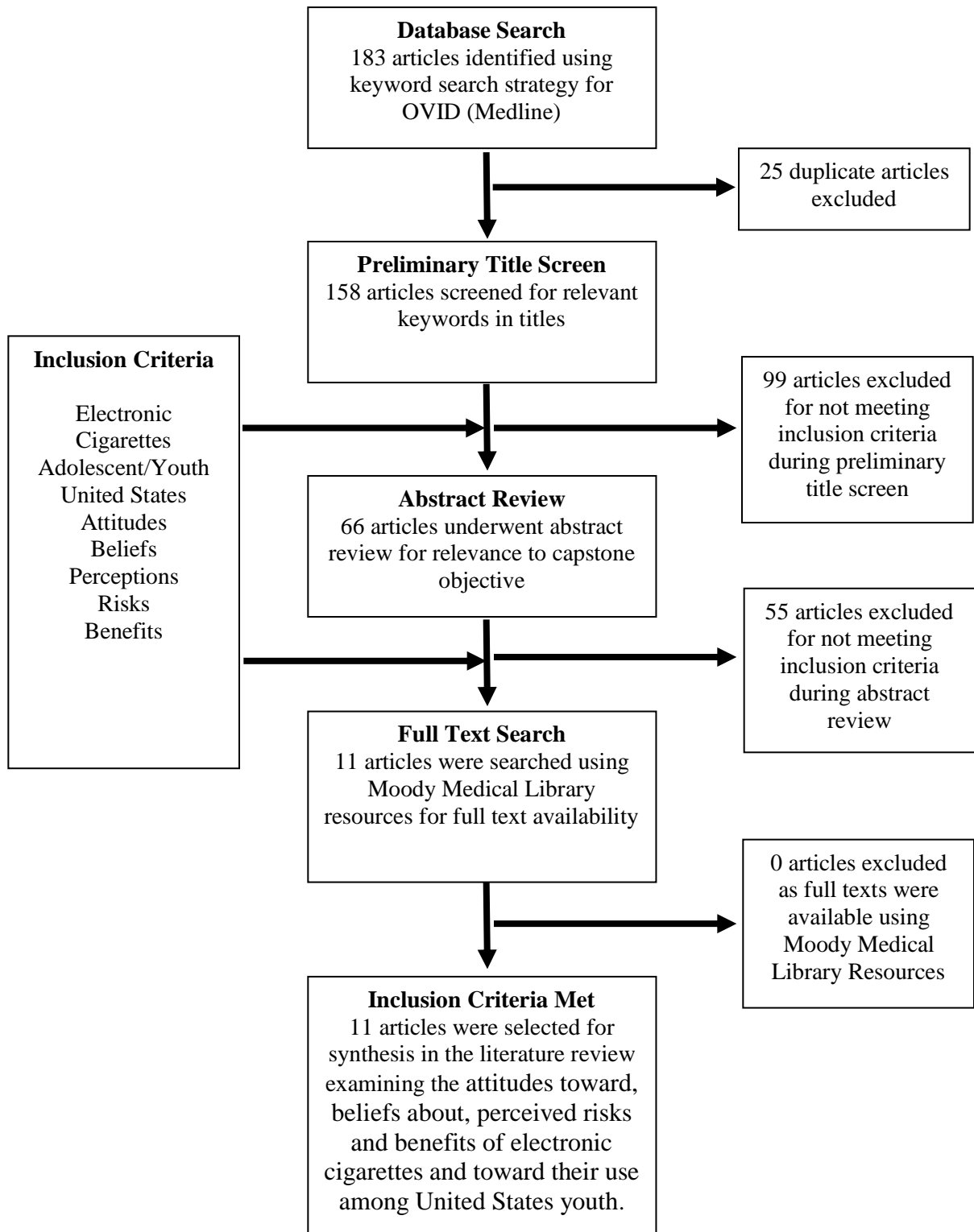
CHAPTER 4: RESULTS

Search Results and Article Selection

Figure 2 shows the results from database search to selection for literature review detailed below. The OVID (Medline) database search using the strategy in the methods section identified 183 articles. After the results were sorted by ascending unique identifier number, 25 duplicates were identified and excluded. This left 158 articles that then entered preliminary title screening. Application of inclusion and exclusion criteria during title screening resulted in 99 articles being excluded, leaving 66 articles. Reasons for not meeting inclusion criteria varied and included those not pertaining to United States populations, and studies not done on an adolescent population. The remaining 66 articles were carried on to abstract review.

Application of inclusion and exclusion criteria during abstract review resulted in an additional 55 articles being excluded. Reasons for exclusion were similar to those during title review, but also included the reporting of measures not contributing to the objective of this capstone. At the end of the search and selection process, I was left with 11 articles relevant to the capstone research question. The Moody Medical Library website and resources provided access to the full text of all articles. These 11 articles were selected for synthesis in this literature review examining the attitudes toward, beliefs about, perceived risks and benefits of electronic cigarettes and toward their use among United States youth [13-23].

Figure 2: Decision process with results for article selection in literature review on examining the attitudes, beliefs, perceived risks and benefits of electronic cigarettes and their use among United States youth.



Description of the Studies

The articles selected range in publication dates between 2013 and 2016. Eight of these articles were observational studies utilizing cross-sectional surveys [13-15, 18, 19, 21-23], and two were qualitative studies utilizing focus groups and small group discussions [17, 20]. One study utilized qualitative small group discussions to inform questions/administration of a cross-sectional survey [16]. The number of participants varied since it was dependent on the type of study and the scope of the study. A qualitative small group discussion study utilized the least number of participants with 24 [20], while cross-sectional survey studies using the National Youth Tobacco Survey (NYTS) from 2012 had 24,658 participants [14, 15, 22]. The search strategy used was designed to yield articles with participants in the United States, but the studies varied in their geographic scope. While some included national samples[13-15, 21-23], others were more localized, including studies examining populations within schools in Connecticut [16, 17], a private school in the San Francisco Bay Area [18], a county in North Carolina [19], and a Northern California school district [20]. *Figure 2* below summarizes descriptions and findings of the 11 articles.

Table 2: Summarization of literature descriptors and findings

Authors, Year, Reference	Type of Study	Number of Participants	Topic(s)	Correlated Findings	Geographic Scope
Pepper et al. 2013 [13]	Cross-Sectional, Survey	N=228	Adolescent males' awareness/willingness to try e-cigarettes	-Most males were aware of e-cigarettes -Those willing to try e-cigarettes had fewer negative beliefs about c-cigarettes -Willingness associated with current cigarette smoking	National
Ambrose et al. 2014 [14]	Cross-Sectional, Survey	N=24,658	Harm perceptions of cigarette smoking, Harm perceptions of e-cigarette vs conventional, Tobacco use, and Susceptibility to smoking	-1 in 3 reported believing e-cigarettes being less harmful -Half of sample reported to not knowing enough about e-cigarettes to make a judgement -All strata were more likely to perceive e-cigarettes as less harmful than cigarettes	National
Amrock et al. 2015 [15]	Cross-Sectional, Survey	N=24,658	E-Cigarette use, Tobacco related covariates, Beliefs about the harm of tobacco and potential harms of electronic cigarettes	-Awareness and ever use increased with age -34.2% perceived e-cigarettes less harmful than cigarettes -Perception of e-cigarettes as less harmful was associated with being more likely to have ever used e-cigarettes	National
Kong et al. 2015 [16]	Qualitative, Focus Group Cross-Sectional, Survey	N=127 (Focus Groups) N=1175 (Survey)	Reasons for electronic cigarette experimentation and discontinuation	-Common reasons for experimentation were curiosity, appealing flavors, friend influence -Common reasons for discontinuation were perception of "uncool", health risks, loss of interest	Middle/High Schools and Colleges in Connecticut
Camenga et al. 2015 [17]	Qualitative, Focus Group	N=127	Perceptions of E-cigarette use for smoking cessation	-perception of limited success with using e-cigarettes for smoking cessation -nonsmokers perceived parental disapproval with e-cigarette use	Middle/High Schools and Colleges in Connecticut
Chaffee et al. 2015 [18]	Cross-Sectional, Survey	N=104	Measuring adolescent risk and benefit perceptions related to electronic cigarettes	-Ever use of e-cigarettes associated with lower perceived probability of health/social risks, and higher perceived probability of possible benefits	Private High School in San Francisco Bay Area

Anand et al. 2015 [19]	Cross-Sectional, Survey	N=2769	Electronic cigarette use and beliefs among high school students in an urban county of North Carolina	<ul style="list-style-type: none"> -Perception of lower negative outcomes with e-cigarettes compared to cigarettes -Majority reported e-cigarettes less harmful than cigarettes -Majority did not have knowledge of the constituents of e-cigarettes 	Urban county of North Carolina
Roditis et al 2015 [20]	Qualitative, Small Group Discussions	N=24	Perceived risks and benefits associated with conventional cigarettes, e-cigarettes, and marijuana	<ul style="list-style-type: none"> -E-cigarettes were “classy” “look nice” “no nicotine” “it’s good for you” -E-cigarettes did not carry the negative health outcomes cigarettes did 	Northern California school district
Margolis et al. 2016 [21]	Cross-Sectional, Survey	N=22,007	Combustible and electronic cigarette use, Curiosity about e-cigarettes, E-cigarette harm perceptions, and Exposure to e-cigarette advertising	<ul style="list-style-type: none"> -Higher perceptions of absolute/relative harm compared to cigarettes was associated with lower levels of curiosity -Lower perceptions of absolute/relative harm compared to cigarettes was associated with higher levels of curiosity 	National
Amrock et al. 2016 [22]	Cross-Sectional, Survey	N=24,658 (2012) N=22,007 (2014)	Perceptions of relative harm and addictiveness of several tobacco products compared to traditional cigarettes	<ul style="list-style-type: none"> -Majority of respondents felt e-cigarettes were less harmful than cigarettes 	National
Lippert et al. 2016 [23]	Cross-Sectional, Survey	N=22,007	Association between school level prevalence of electronic cigarette use and student level use behaviors, pre-use intentions, and perceived addictivity/harm	<ul style="list-style-type: none"> -Students attending schools with medium/high prevalence of e-cigarette use were more likely than those at low prevalence schools to view e-cigarettes as less addictive and less harmful -Willingness to try e-cigarettes amongst abstainers was higher in those attending medium/high prevalence of use schools 	National

Limitations of the Studies

The articles used in this systematic review carry several limitations that were considered in the quality assessment of each one. One must consider the publication date and date at which data was collected in assessing limitations and quality of the study. Results of studies correlate to the timeframe in which data was collected. Cross-sectional study designs [13-16, 18, 19, 21-23] have the limitation of being able to show associations, but not establish causality. These studies also utilized surveys for data collection which are self-report and can carry recall bias. The qualitative studies [16, 17, 20] carry the limitations of their results not being confirmed/verified, and causality cannot be established.

Geographic scope of each article was collected because it factors into the results generalizability. Those whose scope were at the national level [13-15, 21-23] could have their results be more generalizable than the others, with how the sample was chosen being one of only a few limitations in terms of generalizability. Example, the NYTS data (used in [14, 15, 21-23]) is collected through schools, so it is representative of youth that are enrolled and attending school. As the scope narrows, with the most narrow being a study of only males at one high school [18], it is very difficult to generalize the results to the rest of the nation.

Also, there are some limitations specific to articles that should be noted. In the Pepper et al. 2013 article, bivariate and multivariate analysis showed that males who smoked were much more likely to be willing to try electronic cigarettes than non-smokers. This study had 228 participants, and this association was drawn from only 2 participants that were current smokers [13]. In the Margolis et al. 2016 article, the discussion section

noted that there was no baseline measurement for curiosity so it could be possible that the ages studied could be more curious in general about electronic cigarettes [21].

Thematic Analysis

This systematic review yielded several common themes through the literature selected. An overarching theme shared by all articles was perceptions and beliefs of electronic cigarettes on health and health outcomes. Most commonly, participants reported a perception that electronic cigarettes are less harmful to one's health. This perception applied to both electronic cigarettes alone and when compared to conventional cigarettes. The literature also reported how the perception of electronic cigarettes being less harmful was associated with other measures like willingness to try electronic cigarettes, prevalence of ever use of electronic cigarettes, and curiosity towards electronic cigarettes. Another theme that emerged from the literature was perceptions of electronic cigarettes as a tool for smoking cessation. Previous literature has provided insight on the efficacy (or lack thereof) of electronic cigarettes on smoking cessation [3, 4], and whether electronic cigarette use was associated with an increased likelihood of conventional cigarette use [5, 6]; but youth in the United States generally perceive that electronic cigarettes can be or have been used successfully for smoking cessation.

Another overarching theme yielded by the literature were perceptions related to social constructs surrounding electronic cigarettes. Specifically, this theme dealt with awareness and knowledge about electronic cigarettes. Majority of youth in the articles were aware of the existence and use of electronic cigarettes, even though some proportions felt as though they did not have sufficient knowledge to give an informed

opinion on them. The literature also reported on other social factors (such as appeal, availability, curiosity) and external influence on use/knowledge/perceptions of electronic cigarettes.

Electronic Cigarettes are Less Harmful

The overwhelming common theme across the included studies is that electronic cigarettes are perceived to be less harmful in general and when compared to conventional cigarettes. This perception was measured at different proportions from roughly one third of participants [14, 15], to as high as 73% of participants who felt they could provide an opinion about the safety of electronic cigarettes [22]. The literature reported on the associations this perception had with other factors. Perception of being less harmful was associated with being more likely to have ever used electronic cigarettes [14, 15, 18], more willing to try electronic cigarettes [13], higher levels of curiosity about electronic cigarettes [21], and attending a school with medium to high prevalence of electronic cigarette use [23]. Amrock et al. 2016 found using NYTS data that between 2012 and 2014, there was an increase in the number of United States youth who perceived electronic cigarettes to be less harmful than conventional cigarettes [22]. The qualitative studies also reported this perception relating electronic cigarettes to be a better alternative to conventional cigarettes, even with a participant going so far to state that electronic cigarettes are “good for you” and contain “no nicotine” [16, 20]. Objections to the theme are the mentions in the literature about participants reporting not to have enough knowledge to give an informed opinion on the safety or risks regarding electronic cigarettes. Also, in the Kong et al. 2015 article, the words “health risks” were noted as one of the top three reasons for discontinued use of electronic cigarettes [16].

Electronic Cigarettes and Smoking Cessation

The literature reported that United States youth perceive that electronic cigarettes can be or have been used successfully to quit smoking conventional cigarettes. One article showed 31% of participants believe electronic cigarettes helped conventional smokers quit [19]. This sentiment was echoed also in the qualitative studies. Roditis et al. 2015 had small group participants report that this information was obtained from media and family/friends that emphasized the positive effects dealing with smoking cessation [20]. The association with smoking cessation was reported as one reason for experimentation/initiation of electronic cigarettes [16]. Though the general perception of the potential electronic cigarettes has regarding smoking cessation is present in relevant studies, some adolescents reported that success is very limited. They state anecdotal evidence about a family member or friend using electronic cigarettes to eventually quit smoking conventional cigarettes, but with little success [17].

Social Perceptions and Beliefs about Electronic Cigarettes

Awareness and knowledge were also assessed in most of the literature in this review. The lowest that awareness was reported was at 50.3% of study participants [15], while another study had 94.5% of focus group participants report to have heard of electronic cigarettes [16]. Although similar to awareness, knowledge about electronic cigarettes was measured separately and provided more insight. Specifically, study participants could state a level of awareness, but also claim to not have enough knowledge to give an opinion on electronic cigarettes [14, 15, 19, 20, 22]. Echoing ongoing research currently being conducted on this issue, Anand et al. 2015 reported that

61% of their participants stated to have no knowledge of what makes up an electronic cigarette and/or its vapor [19].

The literature also gave insight on other social perceptions youth have on electronic cigarettes. Novelty that comes with it being a relatively new product carries an appeal that was noted in studies. Availability, perception of being “cool”, flavor variety, having a “classy” and “nice” look were stated as reasons for electronic cigarette experimentation and use [16, 20]. Appeal of electronic cigarettes was associated with curiosity and a reason for experimentation [16], and we noted how higher level of curiosity was associated with lower perception of absolute/relative harm with electronic cigarette use [21].

CHAPTER 5: DISCUSSION

Summary of Results

This systematic literature review was conducted to examine the attitudes towards, beliefs about, perceived risks and benefits of electronic cigarettes and toward their use among United States youth. The current literature showed that United States youth overwhelmingly perceive electronic cigarettes to have less negative health outcomes and are less harmful than conventional cigarettes. This perception was associated with increased curiosity and willingness to experiment and/or initiate use of electronic cigarettes. Even though youth seem to perceive the role electronic cigarettes may have in successful smoking cessation, which may not be an effective method of smoking cessation, the perceptions of this do not seem to drive the trends of use like the perceptions of less harm and social appeal. Due to their novelty, awareness of electronic cigarettes is widely present amongst our youth; however, there are still portions that report to not have enough knowledge about electronic cigarettes to give an informed opinion on aspects such as safety, risks, or benefits.

Public Health Implications

The result that United States youth perceive electronic cigarettes as less harmful than conventional cigarettes may be obvious, it still carries significant weight when it comes to the future of electronic cigarettes as a consumer product. Literature relating to electronic cigarette safety and health outcomes is just beginning to emerge and will only get more robust with interest and time, thus providing evidence supporting or

contradicting the perception. These findings could be integrated into public health messaging and health promotion-related advertising efforts to reduce the use of electronic cigarette use among younger populations.

Findings from this capstone may also help to guide the policy discussion around regulating the use and distribution of electronic cigarettes. As mentioned earlier, the FDA took more control over regulation effective late 2016. Eventually, this agency could expand their efforts to include regulation of media content relating to electronic cigarettes (similar to what is currently in place for conventional tobacco products).

There are other potential public health approaches that could utilize these results. Targeting the appeal and curiosity that comes with novelty could be one approach aimed at tempering perceptions about a lower risk to health, a perception that may ultimately be unfounded. Recognizing that these perceptions potentially drive trends in electronic cigarette use amongst United States youth will likely be one key element guiding future policy discussions. Finally, the findings from this capstone can help to contribute to the foundation of evidence used by health care providers addressing patient-related concerns about electronic cigarettes.

Limitations

The findings from this literature review on the attitudes toward, beliefs about, perceived risks and benefits of electronic cigarettes and toward their use among United States youth are subject to several limitations. First, the literature was chosen from a search using only one database. Initial search using more databases and resources could have yielded a more comprehensive list of literature. Second, because electronic

cigarettes are a relatively new product, especially considering the history of conventional cigarettes, the amount of literature was limited. This is especially true when accounting for the fact that this capstone had the scope of youth in the United States. Third, research on this topic is only recently emerging. The oldest publication was in 2013 and oldest dataset was from 2012. Although currently within 5 years of the date this capstone was written, other studies have shown that prevalence of use amongst youth has varied and changed within those 5 years. Results using older data only speaks for when those data were collected. Fourth, the articles reviewed showed that in most cases, prevalence of electronic and conventional cigarette use increased with age. There were less adolescents of middle school age using electronic cigarettes as compared with those of high school age. This is important considering that perceptions and beliefs concerning electronic cigarettes could be a function of their use status. Fifth, this review carries all the limitations that the individual articles had. The literature was only cross-sectional designs or qualitative designs. These inherently carry the limitations of not being able to establish causality, problems with bias related to surveys used, and the inability to verify results in qualitative study designs.

Even with these limitations considered, the literature reviewed reported appropriate measures and associations that are within the boundaries of what that study design can do. Also, the initial database search used here yielded a small number of articles in comparison to the typical systematic literature review. Searches using other databases could result in increased duplicates and few additional articles. Furthermore, regardless of the limitations each article had, the overarching theme of electronic

cigarettes being perceived as less harmful was present in nearly all reviewed, providing weight to the notion that this perception could hold true amongst United States youth.

Gaps to be Addressed in Future Research

Considering the theme of perceptions of electronic cigarettes on one's health is at the forefront amongst youth in America, studies establishing the harms and benefits related to electronic cigarette use should be a priority. This review analyzed literature that were basic observational and qualitative study designs. Study designs tasked to establish causality and risk/protective factors regarding electronic cigarettes will benefit health practitioners and policy makers greatly. Because the FDA has taken a more regulatory position on electronic cigarettes, knowledge about the constituents of the device, vapors, and production will assist in guiding the future regulations. Also, considering the novelty of electronic cigarettes, more literature of any kind may prove fruitful. Time and interest will make the literature base more robust for future reference and reviews.

Conclusions

This systematic literature review found the common perception amongst youth in the United States of electronic cigarettes being less harmful in general and when compared to conventional cigarettes. This perception is compounded by a number of other factors related to perceptions, attitudes, and beliefs among younger populations. These perceptions may also be driven by a lack of current regulation in terms of accessibility and marketing, but this issue has gained recent attention by the FDA.

Results from this capstone can be used to support the conversation around policy, patient care, and future public health research efforts.

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