THE ONTARIO TOBACCO RESEARCH UNIT
UNITÉ DE RECHERCHE SUR LE TABAC DE L'ONTARIO

E-Cigarette Use for Smoking Cessation

Scientific Evidence and Smokers' Experiences

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Background

The use of e-cigarettes—or vaping to quit—has become one of the most frequently used cessation methods among smokers trying to quit smoking cigarettes. In 2017, 32% of current or former smokers in Canada reported using an e-cigarette as a cessation aid in the past 2 years.[1]

As part of the Health System Research Fund—Research on E-Cigarettes and Waterpipe (RECIG-WP)—the Ontario Tobacco Research Unit (OTRU) conducted a knowledge synthesis of reviews regarding the effectiveness of e-cigarettes for smoking cessation. We also conducted a study of experiences among Ontario smokers who have tried vaping to quit smoking cigarettes. Preliminary findings from these initiatives are highlighted in this report.

Key Findings

- Vaping to quit smoking is now one of the most frequently used methods tried by smokers wanting to quit
- The evidence to support e-cigarettes as an effective smoking cessation aid remains inconclusive
- Newer e-cigarette devices may be more effective for smoking cessation than earlier generation devices
- Future research regarding the efficacy of e-cigarettes with combination cessation therapies, such as behaviour therapy and prescription medication, is needed
- Smokers' experiences with vaping to quit were reflected in 7 key themes: positive attributes, positive outcomes, relationships, vaping devices, limitations to vaping, health concerns, and social challenges
- Research is needed to determine how smokers' experiences can inform future cessation programming

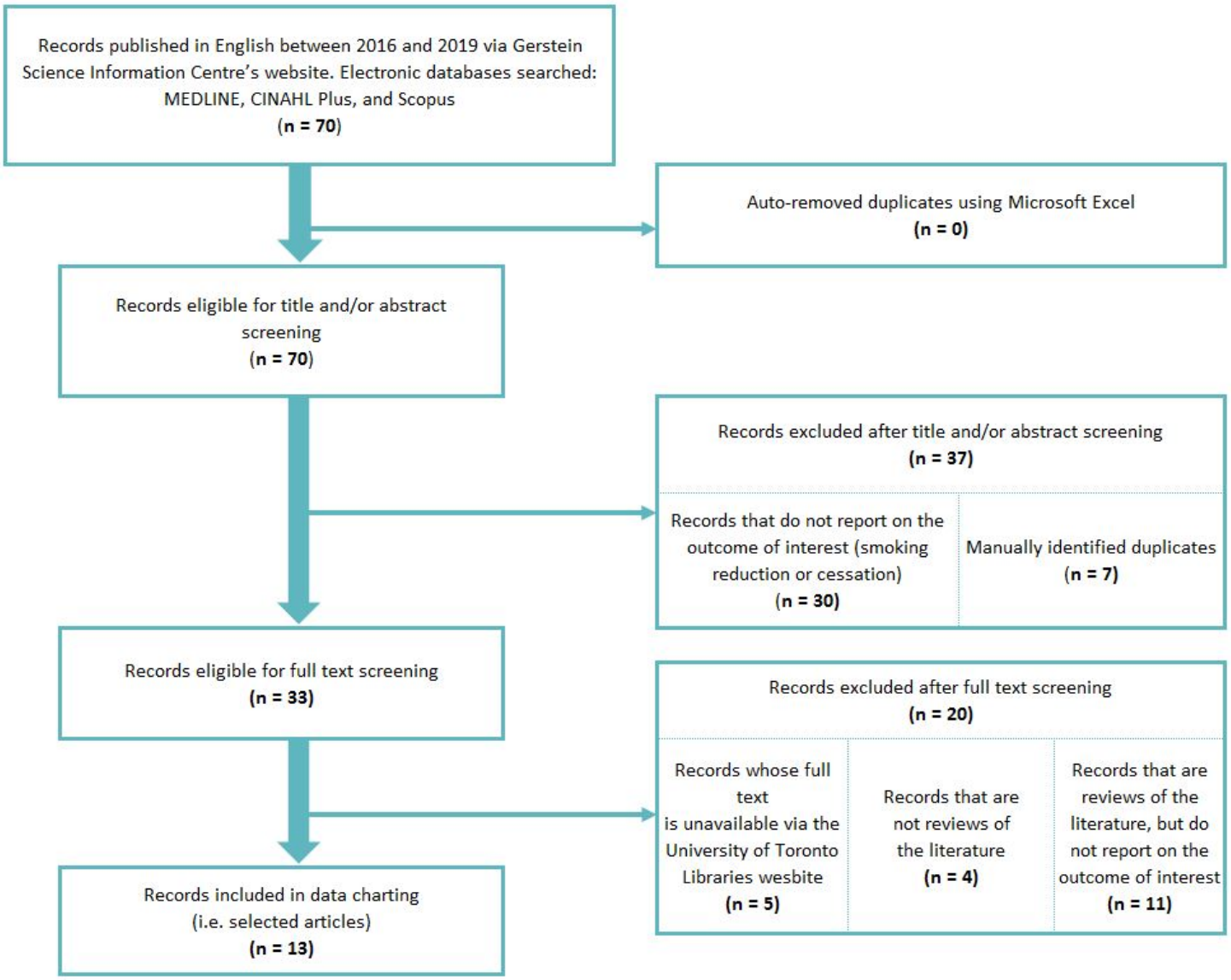
An Overview of Scientific Reviews Examing the Effectiveness of E-Cigarettes for Smoking Cessation

Methods

In January 2019, we developed a search strategy to retrieve academic reviews examining the effectiveness of e-cigarette use as a smoking cessation or reduction aid. Three key databases were searched: MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL) Plus, and Scopus. All reviews published in English between 2016 and 2019 were considered. Titles, abstracts, and keywords were searched using these search terms and subject headings: ("e-cig*" or "electronic cigarette*" or "vape" or "vaping" or "e-juice" or "e-liquid") and ("smoking cessation" or "smoking reduction" or "tobacco use cessation" or "stop smoking" or "quit smoking"). Relevant MeSH terms were selected from each database, and the search was further filtered to select reviews and meta-analyses only. A total of 70 records were identified and 57 records were excluded. The remaining 13 records (hereinafter referred to as the 'reviews') were included in this review. Full citations and texts of the selected reviews were managed and organized using EndNote Web. The study selection process is summarized in Figure 1.

The 13 reviews included in this knowledge synthesis reported on quantitative and qualitative data. While it is widely accepted that randomized controlled clinical trials (RCTs) produce the highest quality of evidence, the included reviews also reported results from longitudinal (with and without comparison groups), cross-sectional, prospective, observational, population-based studies and non-randomized clinical trials.

Figure 1: Selection Process for the Smoking Cessation Knowledge Synthesis



Results

The majority of reviews (n=9) presented inconclusive evidence about the effectiveness of e-cigarettes as a smoking cessation or reduction aid. Although small, short-term studies indicated that e-cigarettes are potentially somewhat effective for smoking cessation, high quality evidence supporting this finding continues to be lacking.[2] In line with this finding, a quantitative review of 69 studies found that 65% of included studies did not support e-cigarette use for smoking cessation among regular smokers.[3] Reviews that included various study designs re-iterated that there is inconclusive evidence about the effectiveness of e-cigarettes as a smoking cessation aid. RCTs were able to show that nicotine-containing e-cigarettes were associated with an increased likelihood of reducing the frequency of cigarette smoking compared to nicotine-free e-cigarettes.[4,5] Nevertheless, the review conducted by Khoudigian and colleagues found no statistically significant difference between intervention (i.e. those using nicotine e-cigarettes) and placebo groups (i.e. those using nicotine-free e-cigarettes) in terms of long-term smoking cessation outcomes.[6] Mixed results were also reported by other study methodologies conducted among adults and young adults.[7] Prospective cohort and longitudinal studies found that e-cigarette use resulted in either no change or negative correlations with smoking cessation among adults[4] and young adults.[8] Reviews with studies that compared e-cigarettes with nicotine replacement therapy (NRT) found that those using e-cigarettes were more likely to quit smoking than those using NRT.[5] This is further supported by a recent RCT study that compared the efficacy of smoking cessation between e-cigarettes and NRT, combining both products with in-person behavioural support: when both products were paired with behavioural counselling, e-cigarettes were more effective for smoking cessation than NRT.[9]

The lack of conclusive results may be partially attributed to the large variability of existing e-cigarette devices. In our own review conducted in 2016, we found some evidence that suggested newer generation e-cigarette devices may be more effective as a smoking cessation or reduction aid than first generation devices.[10] Additionally, inconclusive findings may also be caused by stratifying results according to cigarette and e-cigarette use characteristics. Liu and colleagues' reported that smokers who vaped a dose of nicotine greater than or equal to 16 mg/mL per day found it easier to quit cigarette smoking than those who used less.[11] However, the same review

found that the occurrence of adverse events was higher among those vaping nicotine doses greater than or equal to 16 mg/mL per day than those who vaped less.[11] They also found that among smokers using e-cigarettes, those who have been smoking for more than 20 years found it more difficult to quit or reduce cigarette smoking compared to those who have been smoking for less than 20 years.[11]

Three reviews (which included studies that recruited adolescents and young adults) found that e-cigarette use may not be associated with smoking cessation or reduction. In fact, Chatterjee's and colleagues' review of longitudinal studies found that e-cigarette use was associated with combustible tobacco product use initiation.[12] Similarly, passive exposure to e-cigarettes was found to stimulate young adults' desire to smoke cigarettes.[13] In a review that included real-world observational studies and two clinical trials, those using or have been using e-cigarettes had 28% lower odds of smoking cessation than those who did not use e-cigarettes.[14]

Only one review supported the use of e-cigarettes as a smoking cessation or reduction aid, which included 76 studies examining dual users of e-cigarettes and regular cigarettes.[15] This review found that not only is daily e-cigarette use more strongly associated with smoking cessation among current smokers, it also has the capacity to contribute to "relapse prevention in former smokers".[15]

Summary

This review of reviews attempted to capture a comprehensive overview of the recent literature reporting on e-cigarettes as a smoking cessation or reduction aid. The included reviews reported a wide range of results that do not definitively close the gap in knowledge about the effectiveness of using e-cigarettes for smoking cessation. This may be attributed to the lack of high-quality evidence that ought to take into consideration the following:

- Heterogeneity of e-cigarette devices and e-juice nicotine concentrations/doses available in the market today
- Different lengths of time of e-cigarette use among smokers
- Smokers' intentions to quit or reduce cigarette smoking prior to and during their e-cigarette use

Such variables, although not closely examined, play a significant role in the smoking cessation journey. Additional research is needed to better understand the efficacy of e-cigarettes for smoking reduction and cessation, including additional studies exploring combination therapies within a smoking cessation program.

Smokers' Experiences with Vaping to Quit Smoking: A Concept Mapping Study

Methods

We conducted a concept mapping study in order to help understand smokers' experiences while vaping to quit. Concept mapping is a mixed method strategy, providing a structured approach to collect qualitative and quantitative data to generate ideas and establish a common framework.[16] Concept mapping invites participants to complete three key tasks:

- Brainstorming by answering a statement about their experiences
- Sorting a final list of brainstorming statements from all participants into meaningful piles and assigning a label to each pile
- Rating each of the final statements on how much each statement reflects their own experience

In 2018, we recruited a convenience sample of 98 participants who had quit or had tried to quit smoking cigarettes by vaping. Participants completed a brief survey about their vaping and smoking behaviours while vaping to quit before being invited to participate in the concept mapping component of the study. An online platform, The Concept System Global MAX, was used to conduct each of the concept mapping study tasks and analysis. Participants were asked to respond to the following probe and could provide as many responses as they wished (open ended):

> "A specific experience I've had while using e-cigarettes for trying to quit smoking – either positive or negative – is…"

Results

Participants

The study participants were:

- An average of 36 years of age
- Predominately female (59%)
- Half of participants were married
- Almost one-third of participants had completed high school or had less than high school education
- 44% of participants self-reported that vaping helped them quit smoking cigarettes while 56% reported that vaping did not help them quit
- 64% of participants were current smokers (43% smoked daily and 21% smoked occasionally) and 36% were no longer smoking cigarettes at the time of the study

Brainstorming

Respondents provided almost 300 statements describing a wide range of experiences about vaping to quit. These included positive and negative comments about cravings, quitting, flavours and smells, physical outcomes, cost, and stigma. A final list of 92 unique statements was identified; participants were then asked to complete the sorting and rating activities with these 92 statements.

Themes of Smokers' Experiences When Vaping to Quit

Following analysis of the sorting and rating data, a seven cluster model was generated. These clusters reflect the main themes of experiences smokers had while trying to quit. Three themes related to positive experiences and four themes related to negative experiences.

The main themes from positive experiences include:

- Positive Attributes: describes positive things about e-cigarettes that smokers liked when vaping to try to quitting smoking

> "When I vape I can take as many or as few puffs as I want. With cigarettes I often smoked more than I wanted because I was trying to finish the whole cigarette"

- Positive Outcomes: this theme reflects results smokers experienced when vaping to quit

> "I don't smell like cigarettes all the time"
>
> "I feel better"

- Relationships: this theme represents feelings of social acceptability when vaping to quit

> "My family members prefer me vaping because of the health benefits"
>
> "I prefer vaping because I don't like the stigma of smoking"

The main themes from negative experiences include:

- Vaping Devices: this theme includes negative experiences with vaping devices and a learning curve to vaping.

> "There was a learning curve to vaping and finding what juice/nicotine/device worked best for me"
>
> "Cheap devices do not work as well"

- Limitations to Vaping: this theme reflects some experiences where vaping was an insufficient replacement for smoking a cigarette.

> "I felt like I had to constantly vape to feel satisfied"

- Health Concerns: this theme included statements related to health concerns about vaping and negative physical outcomes with vaping.

> "I worried about the effects of vaping on my health"
>
> "Vaping makes me feel dizzy"

- Social Challenges: this theme reflects negative experiences about feeling stigmatized for vaping and other's perceptions about secondhand vape

> "People judge you for vaping"

Summary

Smokers have a range of experiences while vaping to quit, which was classified into seven key themes: positive attributes, positive outcomes, relationships, vaping devices, limitations to vaping, health concerns, and social challenges.

Many smokers liked the characteristics of vaping such as the taste, flavours, and ease of vaping; however, it is not unexpected that the positive outcome experiences, such as improved health and controlled nicotine cravings, were rated higher among those who had some level of success while vaping to quit smoking. Other smokers reported limitations such as constant nicotine cravings, even while vaping. Similarly, some smokers also noted that vaping was confusing and had a steep learning curve to find the device, e-juice, and nicotine levels that worked best.

The social environment plays both positive and negative aspects for smokers' vaping to quit. Many smokers like vaping because they don't have the stigma of smoking; however, many also noted social challenges such as feeling judged while vaping, and being confused about where they were allowed to vape. Some smokers also experienced negative health effects from vaping, such as being dehydrated or feeling dizzy. In general, smokers are moderately concerned about the effects of vaping on their health.

These experiences can help inform why some people succeed and others do not. More information on how these experiences relate to cessation outcomes may help inform e-cigarette cessation programming.

Discussion

In general, the scientific literature regarding the effectiveness of e-cigarettes as a smoking cessation aid remains inconclusive. However, emerging evidence suggests that newer e-cigarettes might be more effective for smoking cessation than earlier devices. While there continues to be a need for more research and high-quality studies regarding the effectiveness of e-cigarettes, many smokers are trying vaping to quit smoking cigarettes. Smokers have reported positive and negative experiences related to vaping attributes, vaping outcomes, health

outcomes, and the social environment. Understanding how these experiences relate to cessation outcomes and subsequent quit attempts has the potential to inform smoking cessation programming. High quality studies that further assess the cessation effectiveness of behavioural therapy in combination with e-cigarettes will be important to recommend effective cessation programming. Continued research to understand the long-term health effects of prolonged vaping is also imperative. Helping users to stop vaping should also be considered as part of a comprehensive smoking cessation program.

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