

Electronic cigarette, effective or harmful for quitting smoking and respiratory health: A quantitative review papers

Gholamreza Heydari, Arezoo Ebn Ahmady¹, Fahimeh Chamyani², Mohammadreza Masjedi³, Lida Fadaizadeh⁴

Tobacco Prevention and Control Research Center, National Research Institute of Tuberculosis and Lung Diseases, Shahid Beheshti University of Medical Sciences, ¹Department of Community Oral Health, School of Dentistry, Shahid Beheshti University of Medical Sciences, ²Department of Library, National Research Institute of Tuberculosis and Lung Diseases, Shahid Beheshti University of Medical Sciences, ³Chronic Respiratory Research Center, National Research Institute of Tuberculosis and Lung Diseases, Shahid Beheshti University of Medical Sciences, ⁴Telemedicine Research Center, National Research Institute of Tuberculosis and Lung Diseases, Shahid Beheshti University of Medical Sciences, Tehran, Iran

ABSTRACT

Background: In recent years, electronic cigarettes (ECs) have been heavily advertised as an alternative smoking device as well as a possible cessation method. We aimed to review all published scientific literature pertaining to ECs and to present a simple conclusion about their effects for quitting smoking and respiratory health. **Methods:** This was a cross-sectional study with a search of PubMed, limited to English publications upto September 2014. The total number of papers which had ECs in its title and their conclusions positive or negative regarding ECs effects were computed. The number of negative papers was subtracted from the number of positive ones to make a score. **Results:** Of the 149 articles, 137 (91.9%) were accessible, of which 68 did not have inclusion criteria. In the 69 remaining articles, 24 studies supported ECs and 45 considered these to be harmful. Finally, based on this evidence, the score of ECs (computed result with positive minus negative) was -21. **Conclusion:** Evidence to suggest that ECs may be effective and advisable for quitting smoking or a safe alternative for smoking is lacking and may instead harm the respiratory system. However, further studies are needed.

KEY WORDS: Cessation, e-cigarettes, respiration, smoking, tobacco, vaping

Address for correspondence: Dr. Gholamreza Heydari, Tobacco Prevention and Control Research Center, National Research Institute of Tuberculosis and Lung Diseases, Shahid Beheshti University of Medical Sciences, Tehran, Iran. E-mail: ghrheydari@yahoo.com

INTRODUCTION

One of the six main strategies recommended by the World Health Organization (WHO) (MPOWER) for controlling the epidemic of tobacco use was providing smoking cessation services for individuals who are dependent upon tobacco. According to article 14 of the WHO Framework Convention on Tobacco Control, these services should be up-to-date and available at very low cost through a comprehensive health system.^[1] There is a wide array of smoking cessation therapies that include nicotine replacement therapy (NRT), Zyban, Champix, and behavioral interventions that do not

rely on pharmacological support, cold turkey, acupuncture, hypnotism, group therapy, and booklet.^[2]

Electronic nicotine delivery systems (ENDS), of which electronic cigarettes (ECs) are the most common prototype, are devices that do not burn or use tobacco leaves, but instead vaporize a solution inhaled subsequently by the user.^[3] The main constituents of this solution, in addition to nicotine, are propylene glycol, with or without glycerol and flavoring agents. ENDS solutions and emissions may

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contain additional chemicals, some of them are considered to be toxicants. A primary intention of manufacturing this device was to allow use in public places where smoking is forbidden. Extensive advertising and promotion included the argument that these devices would pose little risk due to passive exposure. To date, a most impressive number –460 types of this device – have been designed and marketed with additional types continually in development.^[4] The prevalence of use has shown a dramatically increasing trend.^[5] However, disadvantages and side effects have been reported in many articles,^[6,7] and the unfavorable effects of its secondhand vapor have been demonstrated in many studies.^[8,9]

Even after massive advertisements claiming the usefulness of these devices for quitting smoking, several studies found that ECs were not successful as a vehicle for smoking cessation.^[10,11] Meanwhile, some studies indicated short-term effects in reducing the smoking-related harms.^[12,13] This trend has continued during more recent years. Although there are still scientific documents indicating deleterious effects of these devices, no unified position against these devices has been established. Despite a lack of support from scientific communities such as the pulmonary associations of Europe and the USA and WHO,^[9] usage of this device are increasing steadily, especially among teenagers and nonsmoking young adults.^[14]

The current study was designed and conducted to investigate and review all scientific published literature in recent years regarding ECs and to present a simple conclusion about their effects on quitting smoking and respiratory health.

METHODS

This cross-sectional study was initiated in September 2014. All the PubMed articles containing one of these words: Electrical cigarette, EC, e-cigarette, ENDS in their title were gathered and reviewed by an expert panel. A checklist of the year of publication, number of articles, number of citations, and the conclusions of the articles was created and included the categories of effective and harmless; ineffective and harmful; and inability to draw conclusions.

In the expert panel meeting, it was suggested to accept related articles (at least their abstracts) and also it was agreed to reject unpublished and duplicate articles and also opinion papers, which were seemingly irrelevant. Articles were reviewed separately by two expert researchers who were trained and adjusted to reach a desired agreement for rating the articles. To check the reliability and inter-rater reliability, pilot assessment was carried out. Each referee randomly reviewed three articles. The inter-rater reliability was 76% before discussion; any discrepancies in answers were discussed and a consensus was achieved on subsequent review.

After the training and pilot assessment, the researchers were ready to do the literature search. The first report of the researchers was observed again by the principal investigator, who determined when the assistants were ready to work alone.

Subsequently, the researchers selected and categorized the articles according to the following criteria: Total number of articles, the number of articles whose had conclusion supported ECs as effective for quitting smoking and not harmful without side effects on respiratory health; the number of articles whose conclusions did not support these devices as effective for quitting smoking and/or harmful or with some side effects on respiratory health; and the number of articles without any definite conclusions.

Again to assess the reliability of each assistant, 10% of the articles were selected randomly and the recorded results were compared by the principal investigator. Any observed discrepancies in the results were corrected by him.

The expert panel decided not to rank articles that lacked specific conclusions. The panel summed the number of supporting and not supporting articles to determine the scores as a simple quantitative review scale for ECs effects on respiratory health.

RESULTS

One hundred and forty-nine articles were found in PubMed up to September 2014, the first one in 2009 and 4, 6, 15, 37, and 86 articles were published in the following years, respectively. One hundred and thirty-seven (91.9%) articles had attainable abstracts or full texts. Sixty-eight of the 137 had no clear result or on smoking cessation and presented news regarding ECs and called for a further investigation regarding its effects [Figure 1]. Twenty-four articles supported the device as an effective and nonharmful method for tobacco cessation. Forty-five articles did not support the use of the device due to side effects and lack of success in tobacco cessation efforts. Based on Table 1, there were 21 more articles (65.2%) that concluded ECs were not effective for quitting smoking or had some side effects on respiratory health.

DISCUSSION

This study demonstrated that the weight of evidence indicates that using ECs is harmful. A general question about electric cigarettes is whether this is an ineffective device or a proper treatment for smoking cessation. For other tobacco control methods, we could find articles both supporting and not supporting the methods. Heydari *et al.*^[15] in a comparative study on tobacco cessation methods demonstrated the use of NRT, Champix, and Zyban in combination with educational interventions as the most recommended method, but the e-cigarette, in contrast, received a score of only one among 25 articles in which

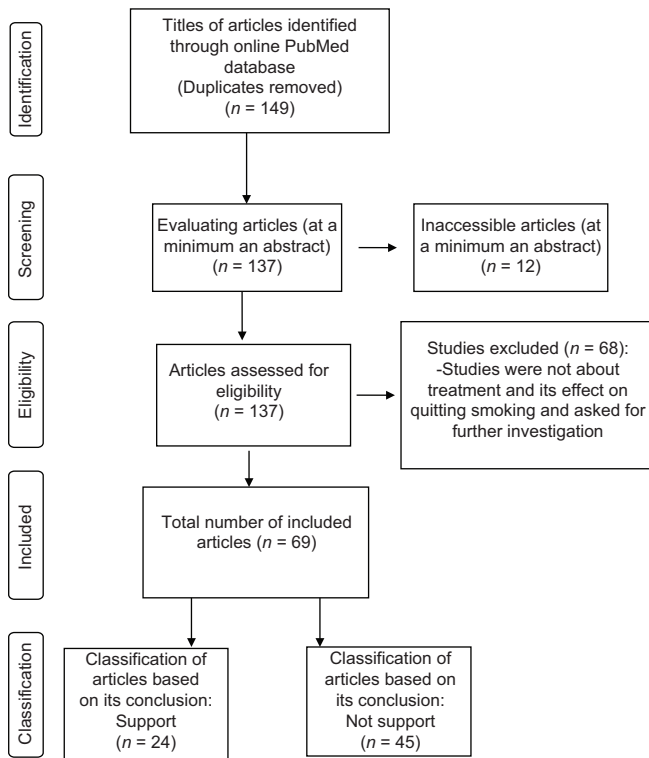


Figure 1: The study in selection steps

Table 1: Frequency of electronic cigarettes articles based on published year and the result obtained

Year	Published articles	Accessible articles (%)	Exclude	Eligible	Support	Not support	Score
2009	1	1	1	-	-	-	-
2010	4	3	-	3	2	1	1
2011	6	5	3	2	2	-	2
2012	15	14	7	7	4	3	1
2013	37	33	13	20	8	12	-4
2014	86	81	44	37	8	29	-21
Total	149	137 (91.9)	68	69	24	45	-21

14 articles were without a clear result, six were supportive articles, and five were not supportive. However, in the current study, ECs received a - 21 score. In this study, we considered suitable methods for tobacco cessation, which received higher scores based on supportive best evidence.^[2]

In recent years, the number of articles regarding ECs has increased noticeably and even doubled yearly, but the central finding is that in comparison with some other quit methods, the supportive articles are much fewer. In light of the paucity of reliable scientific support, why there is so much interest in using these devices? It is probable that ECs can act as an escape from ongoing campaigns such as the WHO Framework Convention on Tobacco Control in 177 countries and additional established campaigns against smoking and preserve dependence on nicotine.^[1] Three different studies of Corey *et al.* in USA^[16] and Lee *et al.* in Korea^[17] and Goniewicz and Zielinska-Danch in Poland showed that there were an increasing usage of ECs among smokers and nonsmokers with a excessive use of

cigarette smoking.^[18] A recent survey conducted in Britain demonstrated that the use of EC among adults had risen in 2014.^[19,20]

Recently, the transnational tobacco companies have entered the ENDS market, and some of them are aggressively competing with the independent e-cigarette companies to gain market share.^[21-23] Meanwhile, in Iran, we had no study about the prevalence of using ECs, but two studies showed that ENDS was not a recommended method employed for cigarette quitting by physicians and smokers.^[24,25]

The provisional agenda of the 6th Conference of the Parties to the WHO Framework Convention on Tobacco Control in Moscow in 2014 demonstrated that only a few studies have examined whether the use of ENDS is an effective method for quitting tobacco smoking, and evidence is limited and does not allow firm conclusions to be reached. Furthermore, it has been clearly mentioned that ECs were not recommended for smoking cessation by the WHO and any other scientific agency, so more investigation is needed in this regard.

CONCLUSION

Enough evidence to suggest that ECs are effective for quitting smoking is lacking, as is the evidence for the lack of their harm for respiratory system and thus being alternatives for smoking. However, further studies are needed.

Limitation

A potential limitation of any review (including ours) is the possibility of publication bias. Furthermore, our review suffers from the non availability of high quality randomized trials.

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Conflicts of interest

There are no conflicts of interest

REFERENCES

- World Health Organization. WHO Report on the Global Tobacco Epidemic 2015. Geneva, Switzerland: World Health Organization; 2015. Available from: <http://www.who.int/tobacco/globalreport/2015/en/>. [Last updated on 2015 May 16].
- Fiore MC. Treating Tobacco Use and Dependence: A Public Health Service Clinical Practice Guideline. Rockville, MD: U.S. Department of Health and Human Services, Press Briefing; Available from: <http://www.surgeongeneral.gov/tobacco/mf062700.htm>. [Last cited on 2007 Dec 16].
- Available from: http://www.who.int/tobacco/industry/product_regulation/toberg/consultation_electronic_devices/en/26k.

4. Zhu SH, Sun JY, Bonnevie E, Cummins SE, Gamst A, Yin L, *et al.* Four hundred and sixty brands of e-cigarettes and counting: Implications for product regulation. *Tob Control* 2014;23 Suppl 3:iii3-9.
5. Grana RA, Ling PM, Benowitz N, Glantz S. Electronic cigarettes. *Cardiology patient page. Circulation* 2014;129:e490-2.
6. Bahl V, Lin S, Xu N, Davis B, Wang YH, Talbot P. Comparison of electronic cigarette refill fluid cytotoxicity using embryonic and adult models. *Reprod Toxicol* 2012;34:529-37.
7. Goniewicz ML, Knysak J, Gawron M, Kosmider L, Sobczak A, Kurek J, *et al.* Levels of selected carcinogens and toxicants in vapour from electronic cigarettes. *Tob Control* 2014;23:133-9.
8. Czogala J, Goniewicz ML, Fidelus B, Zielinska-Danch W, Travers MJ, Sobczak A. Secondhand exposure to vapors from electronic cigarettes. *Nicotine Tob Res* 2014;16:655-62.
9. McAuley TR, Hopke PK, Zhao J, Babaian S. Comparison of the effects of e-cigarette vapor and cigarette smoke on indoor air quality. *Inhal Toxicol* 2012;24:850-7.
10. Bullen C, Howe C, Laugesen M, McRobbie H, Parag V, Williman J, *et al.* Electronic cigarettes for smoking cessation: A randomised controlled trial. *Lancet* 2013;382:1629-37.
11. Brown J, Beard E, Kotz D, Michie S, West R. Real-world effectiveness of e-cigarettes when used to aid smoking cessation: A cross-sectional population study. *Addiction* 2014;109:1531-40.
12. Etter JF, Bullen C. Electronic cigarette: Users profile, utilization, satisfaction and perceived efficacy. *Addiction* 2011;106:2017-28.
13. Polosa R, Caponnetto P, Morjaria JB, Papale G, Campagna D, Russo C. Effect of an electronic nicotine delivery device (e-Cigarette) on smoking reduction and cessation: A prospective 6-month pilot study. *BMC Public Health* 2011;11:786.
14. Giovenco DP, Lewis MJ, Delnevo CD. Factors associated with e-cigarette use: A national population survey of current and former smokers. *Am J Prev Med* 2014;47:476-80.
15. Heydari G, Masjedi M, Ahmady AE, Leischow SJ, Lando HA, Shadmehr MB, *et al.* A comparative study on tobacco cessation methods: A quantitative systematic review. *Int J Prev Med* 2014;5:673-8.
16. Corey C, Wang B, Johnson SE, Apelberg B, Husten C, King BA, *et al.* Notes from the field: Electronic cigarette use among middle and high school students – United States, 2011-2012. *MMWR Morb Mortal Wkly Rep* 2013;62:729-30.
17. Lee S, Grana RA, Glantz SA. Electronic cigarette use among Korean adolescents: A cross-sectional study of market penetration, dual use, and relationship to quit attempts and former smoking. *J Adolesc Health* 2014;54:684-90.
18. Goniewicz ML, Zielinska-Danch W. Electronic cigarette use among teenagers and young adults in Poland. *Pediatrics* 2012;130:e879-85.
19. ASH UK Fact Sheet. Use of Electronic Cigarettes in Great Britain; 2014. Available from: http://www.ash.org.uk/files/documents/ASH_891.pdf. [Last accessed on 2015 May 01].
20. West R, Brown J, Beard E. Smoking Toolkit Study. Trends in Electronic Cigarette Use in England; 2014. Available from: <http://www.smokinginengland.info/latest-statistics/>. [Last accessed on 2014 Apr 04].
21. Evans P. E-cigarettes are the future? Not so fast, says BAT's boss. *Wall St J* 2014;30:23. Available from: <http://www.blogs.wsj.com/corporate-intelligence/2014/07/30/e-cigs-are-the-future-not-so-fast-says-bats-boss/>. [Last accessed on 2014 Jul 30].
22. Prior A. Lorillard profit down as e-cigarette sales drop: Electronic cigarette sales tumble 35%, offsetting slight increase in traditional cigarettes. *Wall St J* 2014;30:24. <http://online.wsj.com/articles/lorillard-profit-down-as-e-cigarette-sales-drop-1406720447>. [Last accessed on 2014 30 Jul].
23. Wile R. Citi e-cigarettes: The e-cigarette boom is over. *Bus Insid* 2014;15:17. <http://www.businessinsider.com/citi-ecigarette-growth-slows-2014-5>. [Last accessed on 2014 May 15].
24. Heydari G, Masjedi M, Ahmady AE, Leischow SJ, Harry AL, Shadmehr MB, *et al.* Assessment of different quit smoking methods selected by patients in tobacco cessation centers in Iran. *Int J Prev Med* 2015;6:81-5.
25. Heydari G, Masjedi M, Ebn Ahmady A, Leischow SJ, Lando HA, Shadmehr MB, *et al.* Quit smoking experts' opinions toward quality and results of quit smoking methods provided in tobacco cessation services centers in Iran. *Int J Prev Med* 2015;6:74-8.