

Beliefs and self-reported practices of healthcare professionals regarding electronic nicotine delivery systems (ENDS): a mixed-methods systematic review and synthesis

Daniel A Erku (BPharm)¹, Coral E Gartner (PhD)^{2, 3}, Kylie Morphett (PhD)², and Kathryn J Steadman (PhD)¹

¹School of Pharmacy, The University of Queensland, 20 Cornwall Street, Woolloongabba 4102, Queensland, Australia

²School of Public Health, The University of Queensland, Herston Road, Herston 4006, Queensland, Australia

³Queensland Alliance for Environmental Health Sciences, The University of Queensland, 20 Cornwall Street, Woolloongabba 4102, Queensland, Australia

Email addresses:

Daniel A Erku: d.erku@uq.edu.au

Coral Gartner: c.gartner@uq.edu.au

Kylie Morphett: k.morphett@uq.edu.au

Kathryn Steadman: k.steadman@uq.edu.au

Abstract

Aims:

This review explores the (1) beliefs and attitudes of healthcare professionals (HCPs) towards electronic nicotine delivery systems (ENDS) including use as a smoking cessation aid and/or harm reduction, safety and regulation, and (2) the extent and content of patient-HCP communication about ENDS.

Methods:

PubMed, Embase, CINAHL, and PsycINFO were searched to identify articles published since 2003. The Mixed Methods Appraisal Tool (MMAT) and Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklists were employed to assess the quality of studies. Thematic synthesis was employed to analyse qualitative data.

Results:

A total of 45 articles (32 quantitative, 12 qualitative and 1 mixed) were included. There was wide variation regarding beliefs about the efficacy of ENDS as a cessation aid. Although the majority of HCPs believes that ENDS are safer than combustible cigarettes, they also have concern about the short and long-term safety of ENDS, uptake by adolescents, and the potential for ENDS to act as a ‘gateway’ to smoking cigarettes. Beliefs about ENDS are influenced by media stories and experiences provided by patients. While most HCPs do not proactively recommend ENDS, they are more likely to support ENDS use among patients with smoking related co-morbidities, heavy smokers with previous unsuccessful quit attempts, or patients who express interest in trying them.

Conclusions:

Overall, HCPs hold diverse views about the efficacy of ENDS and expressed wariness over their potential health effects. HCP endorsement of ENDS use seems to depend largely on patient health status, the presence of other competing risk factors and patient preferences

Implication:

While evidence on safety and efficacy of ENDS is emerging, HCPs should be honest with their clients, stating that the long-term safety is not yet established but what is known is that they appear to be a lower risk alternative to cigarettes. Our review highlights a need for further training and support for HCPs regarding ENDS use, which would enable them to guide their clients in making evidence-based decisions.

Key words: Attitudes, healthcare professionals, practice, ENDS, e-cigarettes, systematic review

Accepted Manuscript

INTRODUCTION

Smoking cessation is key to preventing premature mortality and morbidity. Advice from healthcare professionals (HCPs) can increase the success of quit attempts¹. Smoking cessation guidelines in many countries recommend that HCPs proactively identify smokers and offer support to help them quit¹⁻³. Although there are approved pharmacological smoking cessation aids (primarily varenicline, bupropion and nicotine replacement therapies [NRT])⁴, an increasing number of smokers are using electronic nicotine delivery systems (ENDS), also known as electronic cigarettes or e-cigarettes, as a cessation aid or a lower risk alternative to conventional cigarettes⁵⁻⁸. The uptake of ENDS globally over the last decade has been rapid. A number of reviews have concluded that vaping is likely to be less harmful than smoking due to the lower levels of toxins in the emissions compared to cigarette smoke^{9,10}. However, current evidence about the role of ENDS in smoking cessation is mixed and there is debate about whether smokers should be encouraged to use them¹¹. Opponents urge caution because their long term health effects are unknown and they could be a “gateway” to smoking among young people^{12,13}. Proponents assert that because ENDS are less harmful than conventional cigarettes¹⁴, smokers should be encouraged to switch to these products to reduce their health risk. For example, Public Health England included advice about switching from cigarettes to ENDS in its annual Stoptober quit campaign from 2017¹⁵.

Many smokers report being interested in receiving information about the safety of ENDS¹⁶ and are asking their healthcare providers for evidence-based advice about ENDS¹⁷⁻²⁰. Some countries have updated their smoking cessation guidelines to incorporate advice about ENDS and emerging tobacco products²¹. Recently, the UK’s National Centre for Smoking Cessation and Training released a briefing for stop smoking services and online training for HCPs on how to incorporate ENDS into smoking cessation clinical practice^{3,22}. In the US, a number of evidence updates and practice guidelines have been published for HCPs involved in adolescent health²³, otolaryngologists²⁴, primary care providers²⁵, cardiologists²⁶ and nurses²⁷. Unfortunately, these practice guidelines interpreted the current scientific evidence inconsistently and recommendations for or against ENDS vary. In the absence of consistent and evidence-based clinical guidelines, HCPs and smoking cessation counsellors may rely on their own beliefs when discussing ENDS with their clients. Thus, it is important to review the current evidence on the

beliefs of HCPs about ENDS, to identify their gaps in knowledge and to inform future interventions.

METHODS

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline ²⁸ and the study protocol was registered on PROSPERO (CRD42018088584).

Data sources and search strategy

We searched PubMed, Embase, CINAHL and PsycINFO for studies reporting any of the following: 1) the attitudes of HCPs toward efficacy and safety of ENDS; 2) attitudes towards regulation of ENDS in terms of availability, sale and promotion; and 3) the extent and content of patient-healthcare provider communication about ENDS. We defined HCPs as practitioners who work in all branches of healthcare including medicine, surgery, dentistry, pharmacy, psychology, nursing or allied health professions that have direct contact with their patients/clients. The keywords used in the search strategy were organised to capture key concepts of the subject as: (“Electronic Nicotine Delivery Systems” OR “electronic cigarettes” OR “e- cigarettes” OR “vaping”) AND (“Health Personnel" OR "Healthcare Professional" OR "General Practitioner” OR “Smoking Cessation Counsellor”) and tailored to each database. The search included articles published in all languages since 2003 to cover the literature from when ENDS first entered the market until the third week of September 2018. Forward and backward citation searches of included articles were performed to further locate eligible articles that were not identified in the database search. Details on search terms and the number of records identified are provided in Table S1.

Eligibility screening

Studies were included if they were primary studies (quantitative, qualitative or mixed methods), conducted among HCPs and reported data on at least one of our review objectives listed above (see Figure 1). Studies were excluded if they reported only on the use of ENDS by HCPs, or if the sample was composed only of students who do not treat patients. Conference or dissertation

abstracts without the full text available for retrieval were also excluded. All titles and abstracts were screened by DAE to identify those that met the inclusion criteria. A second person (KM) screened 20% of all initial search results to ensure the screening criteria was being accurately and consistently applied. No differences between DAE and KM were identified. All full text articles were screened by two authors (DAE and KM) independently, with no differences identified.

Quality appraisal

While quality appraisal tools/checklists were employed for this review, the sole purpose was to interpret the findings in light of the quality of the included studies, rather than as an inclusion criteria. We employed the Mixed Methods Appraisal Tool (MMAT) ^{29,30} and Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklists ³¹ to assess the quality of included studies **and adequacy of reporting study details.** For this review, we used the ‘descriptive’ subcategory of MMAT and STROBE for appraising the quantitative articles, and used reporting criteria outlined in MMAT to appraise qualitative and mixed-method studies.

Data extraction and synthesis

Data on study characteristics and findings **for quantitative studies** were recorded in a custom excel spreadsheet. For quantitative studies, study characteristics (publication details, country, study design, sample size etc.) and key findings were extracted. Some items were reported in numerous articles (including perceived efficacy of e-cigarettes as smoking cessation aid, beliefs regarding the health risk and addiction potential of e-cigarettes, potential of e-cigarettes to be a “gateway” to smoking, views on the regulation of e-cigarettes use in public places, as well as recommendation for/against the use of e-cigarettes to clients as a way to quit smoking). Others (e.g., health effect of nicotine) were reported only in one or two studies. Since the included studies differed in terms of study objectives, methodological approach and survey items, conducting a meta-analysis was not appropriate. Therefore, the extracted data was grouped into subcategories based on our review objectives, organized into tables and reported narratively. For qualitative studies, a subset of the data was double coded independently by two authors (DAE and KM), and disagreement resolved through discussion until consensus was reached. All text included in the “results” section of the remaining articles were coded (by DAE) and analysed

using thematic synthesis³². Line by line coding was used to identify recurring patterns and words. We used a combination inductive and deductive approach. While codes were developed relevant to our research aims, line-by-line coding was also conducted to identify emergent themes. Codes were categorized into nine ‘descriptive’ themes (Table 2) according to thematic similarity. These descriptive themes were then combined into more overarching themes for interpretation and discussion. NVivo version 12 was used to assist with the coding process.

RESULTS

After removal of duplicates and publications that did not meet the inclusion criteria, 45 articles were included (see Figure 1), consisting of 32 quantitative cross-sectional studies^{17-20,33-60}, twelve qualitative studies⁶¹⁻⁷² and one mixed methods study⁷³. The studies were conducted between 2013 and 2018 and most were from the United States^{17,19,20,33,35,39,40,42,48,50-54,60,62-64,66-68,70,73} or the UK^{37,38,43,44,55,57,58,61,69,72}. The remainder were conducted in Australia^{34,36,56,59,71}, New Zealand⁶⁵, Belgium⁴¹, Korea⁴⁹, Italy^{18,45} and Greece⁴⁷. A total of 13,548 participants (13,262 from quantitative studies and 292 from qualitative studies; including the mixed-method study) were included. The most commonly included HCPs were general practitioners and specialists (n=20) and smoking cessation counsellors (n=6). Pharmacists (n=3) and nurses (n=1) were the least represented HCPs among the identified studies. Twelve studies included participants from more than one professional role. One article was published in Italian language⁴⁵. We used translation software to translate into English, and checked for coherence by someone whose first language was Italian. Detailed descriptions of study characteristics are shown in Table S2. Most of the quantitative studies (24 out of 33) met 18 or more of the 22 STROBE criteria (Table S3). All clearly outlined their research questions and target populations. However, they all employed simple convenience (non-probability) sampling, making it difficult to generalize findings beyond the sample. The majority of the qualitative data analyzed in this review came from seven studies^{62,64,66,69-71}. The remaining five studies contributed less relevant data because either ENDS were not the sole focus of the study⁶⁷ or the data lacked depth^{61,63,65,68}. In all qualitative studies, data were collected through in-depth interviews, focus groups or both. All studies clearly outlined their research objectives and defined their data sources

(participants and/or recruitment sites). However, there was lack of clarity across many studies in terms of researcher reflexivity, ethical considerations and/or details of interview questions.

Synthesis of quantitative findings

The measurement of perceptions of the safety and effectiveness of ENDS differed between studies. Some studies directly measured relative harm of ENDS by asking “In patients who smoke, ENDS are safer than conventional cigarettes”, with answers possible from “Strongly disagree” to “Strongly agree”^{19,38,49,50,59}. Others stated “ENDS are a safe alternative to conventional cigarettes” with a “Yes/No” option^{39,48}. Some studies also indirectly measured this by asking “In your opinion, which of the following have greater health risk?” Respondents rated the relative safety of different products such as regular tobacco cigarettes, NRTs and varenicline compared to ENDS⁴⁶, or rated the health effects of ENDS, chewing tobacco or snuff/snus compared to regular cigarettes⁵⁴ by selecting an option from “Not at all harmful”, “Moderately harmful” or “Very harmful”.

Beliefs of HCPs toward perceived efficacy of ENDS

Perceived efficacy of ENDS for smoking cessation was reported in 17 of the included quantitative studies (Table 1). Efficacy beliefs varied widely,, ranging from 10%⁷³ to 86%⁵⁵ of HCPs who believed that ENDS helped people to quit smoking. For example, 70.9% of smoking cessation practitioners in Italy believed that ENDS could be an effective smoking cessation aid¹⁸. In contrast, two studies conducted among thoracic oncology practitioners in UK and lung cancer specialist physicians in Korea reported a very low proportion with the belief that ENDS are effective for quitting smoking (13.6% and 21.6% respectively)^{38,49}.

Beliefs of HCPs toward perceived risk of ENDS

Four topics that were commonly reported across studies were the perceived relative risk of ENDS compared to cigarettes, health risk of second-hand vapour, addiction potential of ENDS, and potential for ENDS to be a ‘gateway’ to smoking (Table 1). The potential safety of ENDS were compared with combustible cigarettes, non-combustible tobacco products and/or NRTs. HCPs in the majority of the studies (11 out of 12 studies) believed that ENDS were less harmful than cigarettes, but more harmful compared to NRTs⁴⁶. The highest level of agreement that

ENDS were safer than cigarettes were reported among HCPs in Flanders (83%),⁴¹ a British thoracic oncology group (68.5 %)³⁸ and HCPs in Minnesota (65.5%)⁴². In contrast, a substantial proportion of lung cancer specialist physicians in Korea (76.7%) believed that ENDS confer a higher health risk than cigarettes⁴⁹. Similarly, nearly half (46%) of dental health professionals in the US believed that ENDS were as harmful as traditional cigarettes⁶⁰. Surprisingly in one study, 46% of HCPs wrongly perceived ENDS to be as ‘carcinogenic’⁷⁴ and nicotine was believed to have a substantial contribution to lung cancer and other smoking related diseases⁴¹. Three studies asked whether exposure to secondhand vapour is harmful^{20,41,46}. About 5% of pediatricians and family medicine physicians in the US²⁰ and 71% of quitline counselors in the U.S. and Canada⁴⁶ believed that second-hand aerosol might be harmful. Across studies, the majority of HCPs believed that nicotine containing ENDS are addictive^{39,41,46,47} and have the potential to be a “gateway” to smoking among youth^{20,42,49,50,55}.

Views on ENDS regulation

Few studies examined attitudes concerning the regulation of ENDS apart from restrictions on public use and advertising/promoting. The majority of HCPs supported banning ENDS use in public places^{20,35,41,43,45-49} and ENDS advertising⁴⁶⁻⁴⁹. HCPs also recommended to have a health warning labels for ENDS^{48,49} and restrict flavours^{47,49}.

Six studies examined attitudes towards ENDS sales to minors,^{38,41,46-49} with the majority of HCPs across and within the studies unanimously supporting banning sales to minors (e.g., approximately 93% of quitline counsellors in US and Canada⁴⁶, 73.7% of HCPs in Greece⁴⁷, and 99.5% of lung cancer specialist physicians in Korea)⁴⁹.

HCP self-reported practice regarding ENDS

Eighteen articles examined patient-provider interactions about ENDS. These studies asked about patient screening, recommendations about use, and requests for advice about ENDS from patients. While the majority of HCPs believed that it is important to discuss ENDS use in clinical practice, some reported that they were uncomfortable talking to patients^{42,49} about ENDS and believed that discussing ENDS with patients may encourage them to use these products^{42,49}.

Three studies found that while obstetricians or gynecologists screened their patients for smoking^{36,40,54}, few screened for ENDS use.

Even though a large proportion of HCPs have been asked about ENDS by their clients^{44,46}, few reported that screening and/or counselling tools were in place to record patient ENDS use⁴⁴. The majority of HCPs across and within the studies reported that they never recommended ENDS to their patients^{17,33,38,40,41,46-48,51,57,73}. For instance, only 4% of quit line counsellors in the US and Canada⁴⁶, 6.6% of general practitioners and tobacco counsellors in Belgium⁴¹ and 4.8% of thoracic oncology practitioners in the UK³⁸ reported suggesting ENDS to their clients as a smoking cessation aid and/or lower risk alternative to cigarettes. Overall, the guidance provided to patients during the patient-HCP discussion is inconsistent across studies and influenced by their beliefs regarding ENDS. HCPs often advised patients that not much is known about ENDS and therefore did not provide advice to their patients, advised against the use of ENDS, and/or recommend the use of approved smoking cessation aids^{19,48}.

Based on the limited data, the main source of information regarding ENDS were the media and internet⁶⁰ or patients^{18,57}. HCPs in majority of studies reported being uninformed regarding ENDS^{20,38,49} and wanted to see more evidence on the safety profile of ENDS use, the risks of exposure to second-hand aerosol, the role of ENDS in smoking cessation and whether ENDS was a getaway to smoking combustible cigarettes.

Synthesis of qualitative findings

Twelve studies were included in the qualitative data synthesis. Participants included primary care physicians^{62,66,73}, pediatricians⁶⁴ and tobacco cessation counsellors^{61,69}. Some studies included data from more than one type of HCP^{65,67,68}. Interview guides used across the studies differed to some extent but all studies included questions exploring general knowledge of ENDS and beliefs about their health effects. Example questions included “How do you think ENDS compare to other available tobacco products?”⁶⁶, and “What are your opinions regarding ENDS and smoking cessation?”⁶². Some studies also asked about patient-provider communication and clinical practice regarding ENDS (e.g., “Have you ever asked your patients or been asked by your clients about ENDS? If yes, how?”, “Did you ever recommend ENDS to your clients? What

is your motivation/reason behind this?")⁶⁶. All, except two studies^{63,65} employed thematic analysis. Across studies, the primary topics of discussion during interviews were their perceived efficacy and safety as well as 'clinical actions/practices.' We identified three recurring themes: (1) lack of knowledge about ENDS and its relative risk; (2) wariness about the potential short- and long-term health effects of ENDS; and (3) willingness to support patients' desire to try ENDS despite feeling wary. The topics and sub-themes identified, along with representative quotes are summarized in Table 2.

Theme 1: HCPs are poorly informed about ENDS and continuum of risk
Although HCPs were aware of ENDS and their main ingredients (such as nicotine and flavouring agents), they lacked knowledge regarding the potential health effects of ENDS, their role in smoking cessation, and current regulations. This lack of knowledge and feeling of being 'uninformed' was reported consistently by HCPs across and within studies.

Preferred information sources and needs

HCPs in most of the studies did not often cite scientific research as a source of information. Rather, their belief regarding ENDS was largely derived from media, advertising, internet, newspaper articles and patient experiences^{64,71}.

While the content and volume of information retrieved was not explored in detail, findings from some studies suggested that the information in the lay literature negatively influenced HCPs' overall perception regarding ENDS.

*"I thought they were an interesting phenomenon originally...I don't really follow the research...just what I come across in the lay literature. There are increasing concerns about what is in that vapor other than just nicotine so I am more concerned now than I was originally... It's just not steam and nicotine, there's more to it."*⁶²

Some HCPs also reported learning about ENDS from their patients^{64,67}.

*"I ask my patients all the time, they teach me."*⁶⁴

HCPs stated that they would feel more confident if the safety profiles of ENDS were determined through rigorous scientific research ^{64,72}. They also expressed that they would be more confident if they had educational resources or official guidelines from their respective peak professional bodies regarding ENDS ⁷² and indicated a need for training/support and guidance.

“I want to see a study like that, that randomizes people to e-cigarettes versus Chantix, versus patches, versus doctors just telling people to quit smoking, and when I see that, then I’ll say it’s an effective means of helping people quit, but there’s no data on that. It has to be studied” ⁶⁶.

Perceived continuum of risk

The perceived risk of ENDS were often compared with cigarettes and NRTs. When contemplating relative risk, participants in the majority of studies believed that ENDS are less harmful than cigarettes ^{62-64,66,67,71,72}, but more harmful than NRTs ⁶². ENDS were sometimes perceived to be as bad as cigarettes ⁷³. The difficulty of inferring relative safety in light of the scant and inconclusive scientific literature on the long term safety of ENDS were also discussed by some HCPs ⁷³.

“I think, on general, taken as a whole, they’re safer than smoking, chewing tobacco, pipes, cigars probably” ⁶⁶.

“I think the patch and the gum are safer, there’s no inhaling of anything and in the patch there are no other chemicals that we need to be worried about” ⁶².

While the need for more research was universally recognized by HCPs, some already believe health effects will emerge ⁷¹.

“I don’t think it would necessarily be surprising to find studies later that show that vaping has a greater chance of, you know, inducing lung symptoms in an otherwise healthy person.” ⁶⁴

“This [e-cigarettes] is going to cause lung cancer” ⁶⁴

There were concerns about nicotine addictiveness/toxicity and these influenced judgements about relative risk. Some HCPs asserted that ENDS could potentially confer a higher cardiovascular risk compared to cigarettes due to the nicotine in ENDS.

*“I wouldn’t say its (e-cigarette) safe, because nicotine can make your heart rate go up, and vaso-constrict... So I guess, in certain ways, you could have more harm to the heart than a regular cigarette, perhaps, in certain situations”*⁶⁶.

HCPs in nearly all studies did not endorse ENDS as intrinsically safe. Concerns over creating and/or continuing addiction to nicotine in ENDS and the potential toxicity of nicotine⁶³ were the main reasons cited by HCPs.

*“E-cigarettes still provide nicotine and continue to encourage physiologic addiction to that chemical”*⁷³.

Theme 2: Wariness about the long- and short-term effects of ENDS

Concerns about safety and efficacy

HCPs across different studies had mixed beliefs regarding the role of ENDS in smoking cessation and/or harm reduction^{63,64,68,73}. There were substantial differences in perceived efficacy of ENDS as a quitting aid within the studies. A US study⁷³ reported that over half of family physicians perceived ENDS as a stepping stone to quitting smoking, while an equivalent proportion of physicians asserted that ENDS are not effective for quitting smoking.

*“[E-cigarettes] can be used to taper nicotine just like patches, gum, etc. [They] provide tactile satisfaction that is so much a part of cigarette smoking.”*⁷³.

Overall, HCPs in the majority of the studies were skeptical about the role of ENDS in smoking cessation and/or harm reduction and called for more research to confirm their effectiveness^{62,64,67,68}.

Similarly, HCPs in most of the studies expressed a feeling of wariness about potential long- and short term health effects of ENDS^{61,62,64,72}. For instance, HCPs were concerned about possible cancer risk, exposure to second-hand vapour and involvement of the tobacco industry in ENDS marketing.

*“I’ve heard that there are carcinogens in the exhaled vapors. They cause problems like stimulating kids who have sensitive airways to cough and wheeze.”*⁶⁴

*“The tobacco industry has learned a lot of lessons from their first time around...” “...If their goal is to get nicotine [out] into the public, they did that without the image of a cigarette”*⁶⁴

Addressing the ‘hand-to-mouth’ habit by ENDS was also discussed. While HCPs in some studies indicated that ENDS would help smokers deal with the hand-to-mouth behaviour associated with cigarette smoking, others thought ENDS might create a new addiction⁷², renormalise smoking⁷¹ and/or make it difficult to break the addiction to smoking.

*“And then there’s the psychological process of holding the device and inhaling. To me, inherently, that would not be as good a product to get somebody off cigarettes”*⁶².

The potential health concerns expressed by HCPs appears to differ by speciality. Pulmonologists⁴⁹ were particularly worried about the detrimental effects on the respiratory system while gynaecologists and obstetricians⁵⁴ expressed concerns over the potential harmful effect of nicotine in pregnancy. Paediatricians were primarily concerned about the accidental ingestion and poisoning of children with nicotine-containing e-liquid as well as the potential to be a ‘gateway’ to smoking among adolescents⁶⁴. Similarly, HCPs involved with care of thoracic surgery patients were concerned about the effect of ENDS aerosols and flavours on the respiratory system⁷¹

The potential of youth uptake of ENDS

Advertising of ENDS was often described by HCPs as concerning, as it could encourage young people to try these products, which could create an addiction, possibly leading to more dangerous tobacco products and/or dual use of ENDS and cigarettes^{62,64,70,72}. In addition to youth-friendly flavours and the appealing nature of ENDS, the apparent targeted marketing and advertisement of these products to young people was a major concern raised by HCPs.

“It’s very appealing to children, because they’re pretty, they’re colorful, [and] they taste good.” ⁶⁴

“I am most concerned about gateway to other tobacco products and also impact on minors. I think that’s a big one and I’m very, very concerned about that” ⁶².

Theme 3: Patient-healthcare provider communication regarding ENDS

Integrating ENDS screening into routine clinical practice

The qualitative research mirrored quantitative findings that screening for and recording the use of ENDS was seldom incorporated into routine clinical practice ^{64,66,68}. Nonetheless, patient-provider discussion about ENDS was reported to be common ⁶⁴, with patients prompting the discussion by asking their HCPs for guidance and information regarding the safety and efficacy of ENDS for smoking cessation ^{62,64,66}. HCPs in most of the studies reported that the current tobacco-based screening protocols lack a comprehensive and meaningful criteria pertaining to ENDS ^{64,66}. This, coupled with the presence of other competing priorities, makes it difficult to address ENDS use in clinical practice. Furthermore, HCPs pointed out the difficulty of discussing safety concerns with patients who were enthusiastically using ENDS ⁶⁴.

HCPs who were hesitant to probe ENDS use preferred to “wait to see which way the evidence falls, and/or the regulatory agencies fall” ⁷⁰ before recommending and/or documenting ENDS use.

“I will not be planning to do anything until guidelines or regulatory agencies enforce policies to do so.” ⁷⁰

This notion was further explored in a study conducted among stop smoking services in England, where attitudes and engagement of advisors regarding ENDS were reported to be largely influenced by the scientific reports from notable public health organisations such as Public Health England (e.g. the 95% less harmful estimate) and the guidance provided by the National Centre for Smoking Cessation and Training.

“So, as a service I’d say comparatively we were cautious to perhaps some other areas that were a little bit more, I am going to say ‘gung ho’....and then as you know Public Health England have come out and endorsed them and really been quite pro-them, and more evidence has come out then, so obviously we, on the back of that, we have been a lot more e-cigarette friendly”⁶⁹

Expectedly, uncertainty about unknown long-term health effects⁷², fear of maintaining addiction to nicotine, the possibility of relapsing to smoking and/or ‘dual use’, absence of medicinal licensing and endorsement from regulatory agencies were cited as barriers to integrating ENDS into clinical practice^{69,70}. In the UK, where ENDS use is widely accepted by the public health community, the barriers to integrating ENDS into clinical practice went beyond lack of a medicinally licensed product and entailed the ‘ethical dilemma’ of engaging with consumer products that are manufactured by tobacco companies.⁶⁹

Circumstances under which HCPs are willing to recommend ENDS

In a number of studies, HCPs did not proactively recommend ENDS to their clients^{62,65,66,73}. They stated that recommending products that are not proven to be effective and/or approved by the appropriate regulatory authority would be breaching their “duty of care”.⁶⁹ Yet, concerns and uncertainties about ENDS use were less prominent for some patient populations. Central to HCPs’ endorsement and/or recommendation of ENDS for smoking cessation or harm reduction were the patient’s health status (presence of smoking related co-morbidities and other risk factors),⁶⁶ history of previous unsuccessful quit attempts with conventional smoking cessation aids⁶² and patient preferences for trying ENDS^{65,67}. In one US study, primary care physicians reported endorsing ENDS for heavy smokers and priority populations with comorbidities, among whom smoking was perceived as an ‘eminent threat’ to their health⁶⁶.

“The people who are smoking like a pack a day and really chimneys, I’m like, you want anything that you can do that’s an action that gets in the right direction. So I usually am pretty encouraging of it [recommending ENDS] in that setting”⁶⁶.

“Somebody who comes to me and specifically says, I am thinking of switching then the patient preference would be a factor in this case”⁶⁶.

Moreover, those who strongly endorsed ENDS leant towards moral discourse and justified their practice as a ‘moral obligation’ to support smokers and socially vulnerable peoples who are attempting to quit through vaping.⁶⁹ As such, ENDS were perceived as a novel approach ‘to engage the hard to reach groups experiencing health inequality’ and support priority populations with comorbidities such as people with mental health problems. While many HCPs across studies passively support their patients’ use of ENDS, HCPs in some stop smoking services proactively offers ENDS vouchers to clients who attend their clinics.⁶⁹

DISCUSSION

Principal findings

We systematically collected and synthesized published research on the beliefs and practices of HCPs regarding ENDS. HCPs hold mixed beliefs regarding the role of ENDS in smoking cessation. While the majority believed that ENDS are safer than cigarettes, they also expressed concerns over the short- and long term health effects of ENDS, use by adolescents, and the potential for ENDS to act as a ‘gateway’ to smoking. Qualitative research suggested that beliefs of HCPs regarding ENDS are influenced by information exposure from media, advertising, internet, newspaper articles and experiences provided by patients. While data were limited in terms of views about ENDS regulation, the majority of HCPs agreed with bans on ENDS advertising, use in public places and sale to minors. In some qualitative studies, HCPs called for more research to occur before legalizing the sale of ENDS as a smoking cessation aid. Screening patients for ENDS use does not appear to be routine practice, but patients sometimes request guidance and information about these products. HCP recommendations about ENDS are largely dependent upon the clients’ tobacco use status (heavy smokers) and health status (co-morbidity), prior unsuccessful quit attempts as well as patient preferences. This review focused only on studies of self-reported practice of HCPs regarding ENDS. However, evidence from the few studies that have examined what patients report about their interactions with HCPs also found

that HCPs do not regularly engage in patient-provider discussions regarding ENDS ^{75,76} despite patient interest in trying these products as quit aids ⁷⁷.

The mixed beliefs of HCPs between studies can partially be explained by the varying regulatory frameworks applied across different countries. HCPs in countries with liberal approaches to the use and marketing of ENDS, such as the UK, have more positive attitudes and provide “e-cigarette friendly” services. The Medicines and Healthcare products Regulatory Authority (MHRA) in the UK adopted a dual regulatory pathway, with ENDS being sold as either a medicinal or a consumer product. ENDS marketed as consumer products in the UK are regulated by the EU Tobacco Product Directive ⁷⁸. In this environment, the National Centre for Smoking Cessation and Training in the UK has published online training for HCPs regarding ENDS and smoking cessation ³. However, HCPs practicing in more restrictive regulatory environments, such as Australia, reported less engagement with patients regarding ENDS use⁵⁶. The variation in regulatory approaches across different countries also partially explains the observed difference in beliefs regarding ENDS and recommendation of ENDS for smoking cessation.

Implication for research and practice

Since HCPs are a trusted source of health information, practitioners need to be cognizant of the current issues surrounding ENDS. Although there has been an increase in our understanding of ENDS in recent years, the current evidence base for the long-term safety and efficacy of ENDS in smoking cessation is not conclusive. The research evidence suggests that ENDS are unlikely to be without some health risk, but they deliver fewer toxins and carcinogens compared to smoking ^{79,80}.

HCPs are currently exposed to a wide array of information regarding ENDS from a variety of sources ^{3,22,23,27,81}. The information may promote or discourage ENDS use. HCPs’ reliance on media and internet as a source of information is particularly worth mentioning as the information obtained from such sources is not always scientifically verified and emphasises anecdotal experiences. There is a growing body of literature regarding the safety and efficacy of ENDS from highly credible organisations such as Public Health England ⁹, The National Academies of Science and Engineering ¹⁰, and the Australia Commonwealth Scientific and Industrial Research

Organisation (CSIRO)⁸². However, these reports are voluminous and our research suggests that HCPs would benefit from a more efficient source of trustworthy information about the latest research on ENDS. One suggestion is providing a regular evidence-based summary of current research by peak health bodies and professional organisations. Overall, there is a need to develop and disseminate evidence-based and customized educational intervention packages for HCPs to help them guide their clients in making an informed decision regarding ENDS use. This is particularly important given the low confidence of HCPs in their knowledge of ENDS.

Despite the availability of a range of smoking cessation aids, some smokers prefer ENDS over available approved therapies, including NRTs^{79,83}. A number of reviews now confirm that ENDS are likely to be much less harmful than cigarettes and the use of ENDS by current smokers is more likely to lead to quit attempts, especially with additional behavioural support^{9,10,79}. While evidence on safety and efficacy of ENDS is emerging, HCPs should be honest with their clients, stating that the long-term safety is not yet established but what is known is that they appear to be a lower risk alternative to cigarettes. It is also essential for clinical practitioners to consider the patient's overall health status and make sensible and individualized recommendations. With this in mind, the use of less harmful products such as ENDS could be regarded as a viable strategy for those smokers unable to quit by other means. It is important that smokers using ENDS as a quit aid are encouraged to stop smoking completely rather than using ENDS as a partial substitute because even low level smoking still confers substantial health risk⁸⁴. Stopping ENDS use once they are confident of not relapsing to smoking will also minimize any residual health risks associated with vaping.

Our review also highlights some areas in the current literature that warrant further research and attention. As the majority of studies come from either the US or UK, there is a need for evidence from HCPs practicing in other countries, where the regulatory landscape and acceptance of ENDS is different, such as Australia and Canada. There was also little data from some HCPs such as pharmacists, nurses and dentists. Given the role of these HCPs in assisting patients to quit smoking, their perspective regarding ENDS is important. It is also worth noting that only few qualitative studies^{61,69,72} have been conducted in the UK despite the growth of these products in recent years and their endorsement by public health authorities and peak health

bodies such as the UK's Royal College of Physicians. Largely absent from the current literature was a detailed exploration of views of HCPs regarding facilitators and barriers to integrating patient screening for ENDS use into routine clinical practice. The advice given to clients of low socio-economic status regarding ENDS use was rarely explored and few studies reported data on advice given to women during pregnancy^{36,40,54}. Moreover, exploring the perspectives of HCPs regarding their preferred information and uptake of training activities on ENDS is essential if customised educational interventions are to be developed.

Strength and limitations

To the best of our knowledge, this is the first mixed-methods review and synthesis of research on the attitudes and self-reported practices of HCPs regarding ENDS. While we have employed rigorous and accepted approaches²⁹⁻³¹ to present the global data for the first time since ENDS were introduced to the market, our review has some limitations that should be taken into account while interpreting the findings. There are no studies identified from low and middle income countries (LMICs), despite our extensive searches of electronic databases. Hence, our findings may not adequately present the views of HCPs in these countries. **While we have strictly followed PRISMA guideline in reporting of the review process, some limitations in terms of article screening exist as title/abstract was screened by the second author (KM) only for 20% of articles.** Most of the included studies differed in terms of study objectives, methodological approach and survey items which precluded us from employing meta-analysis. Furthermore, substantial differences between studies in the way perceptions of ENDS were measured makes it difficult to directly compare findings. In a study conducted to compare differences between direct (for example, “compared to conventional cigarettes, is ENDS less harmful, as harmful or more harmful?”) and indirect (for example “...how harmful is using ENDS to one's health?”) measures of ENDS risk perceptions, it was reported that ENDS were more likely to be perceived as less harmful than cigarettes by smokers when employing indirect rather than direct measures⁸⁵. Currently, there are no standard and validated measures of risk perceptions of ENDS, particularly for HCPs, making the results of many studies on this topics difficult to compare⁸⁶. Thus, future studies should consider including validating measures of perceived risk of ENDS.

CONCLUSIONS

Overall, HCPs hold diverse views about the efficacy and safety of ENDS use. Most HCPs do not appear to be screening patients for ENDS use, or raising the issue of ENDS in routine clinical practice, despite the desire of patients for guidance and interest in trying these products. HCP beliefs regarding ENDS largely depended on information exposure from the media and anecdotal experiences provided by patients. HCP endorsement of ENDS as a smoking cessation aid or low risk alternative to combustible cigarettes seems to depend on the patient's health status and risk factor profile. This review highlights the need for further training and support of HCPs regarding ENDS use, which would enable them to guide their clients in making evidence-based decision.

Funding

DAE was supported by University of Queensland (UQ) Research and Training Scholarship. No other financial support was gained to conduct this study.

Declaration of competing interest

All authors declare that there is no any actual or potential conflict of interest

ACKNOWLEDGMENT

We would like to thank Ms. Christine Dalais for her unreserved professional guidance during electronic database searching.

Legends

Table S1: Full list of databases searched and searching terms used

Table S2: Characteristics of included studies (both quantitative and qualitative)

Table S3: STROBE and MMAT checklist for included articles

Table 1: Categories and subcategories of aggregated findings from quantitative data.

Table 2: Themes and illustrative quotes identified during synthesis of the 9 studies containing qualitative data.

Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram

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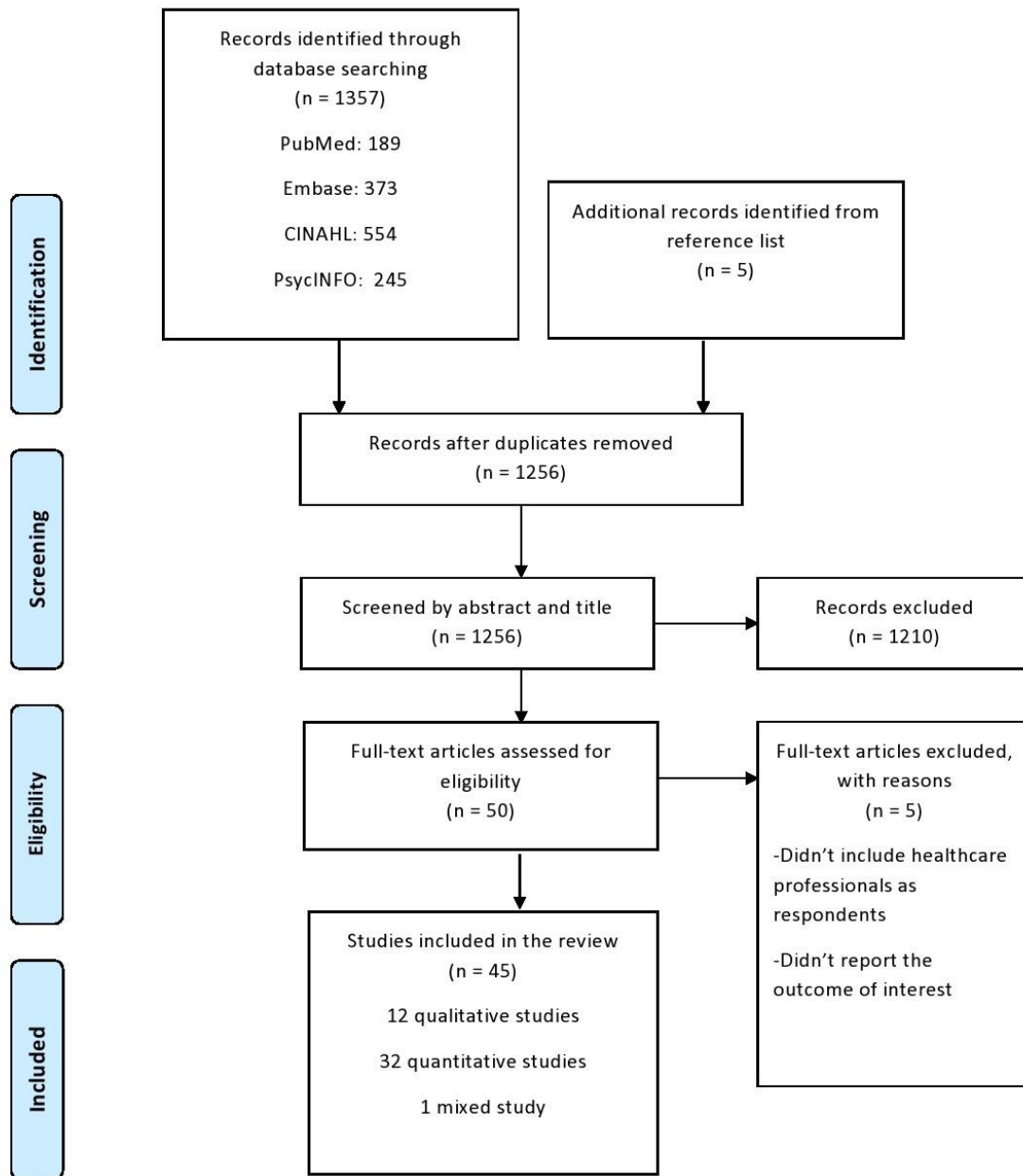


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram

Table 1. Categories and subcategories of aggregated findings (measured in four or more studies) for the studies (n=32) that collected quantitative data.

Category	Subcategories	Example measures	References measuring category
Attitude/ belief	Safety and efficacy	“ENDS are an effective quitting aid”	17-19,34,38,39,41,45-50,52,53,55,56,73
		“ENDS are lower risk/safer than conventional cigarettes”	19,38,40-42,46,47,49,50,53,54,59
		“Nicotine containing ENDS are addictive”	39,41,46,47
		“Exposure to secondhand ENDS vapor is harmful”	20,41,46
		“ENDS could be a “gateway” to other tobacco use”	20,41,42,48-50,55
	Regulation	“The use of ENDS in public places should be banned”	20,35,41,43,45-49
		“ENDS advertising should be banned”	46-49
		“Sales of ENDS to minors/youngsters should be banned”	20,41,46-49
Practices	Patient-provider	“My patients/clients ask me	17-20,46,48

discussion	about ENDS”	
Recommendation	“I recommend ENDS to my patients/clients as a smoking cessation aid”	17,19,33,38,40,41,46-48,51,57,73

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Table 2. Themes and illustrative quotes identified during synthesis of the 12 studies containing qualitative data.

Analytical themes	Descriptive themes	Illustrative quotes	References
Knowledge and risk perception	Beliefs toward efficacy of ENDS as smoking cessation aid	<p><i>“They [e-cigarettes] can be good stepping stone towards quitting smoking”</i> ⁶³.</p> <p><i>“There are lots of different ways to try to quit, I know some people use [e-cigarettes], but since you’re still doing the smoking action, it might not lead to quitting.”</i> ⁶⁴.</p>	63,64,68,73
	Information sources and needs	<p><i>“I ask my patients all the time, they teach me.”</i> ⁶⁴</p> <p><i>“I want to see a study like that, that randomizes people to e-cigarettes versus Chantix, versus patches, versus doctors just telling people to quit smoking...”</i> ⁶⁶.</p>	62,64,66,67,69
	Uncertainty and lack of evidence	<p><i>“[there] are not enough data on outcomes to recommend e-cigarettes.”</i> <i>“there needs to be more studies that are larger and randomized trials to conclude benefit....”</i> ⁷³.</p>	61,62,64,66,67,73

	Perceived continuum of risk	<p><i>“I think, on general, taken as a whole, they’re safer than smoking, chewing tobacco, pipes, cigars probably”⁶⁶.</i></p> <p><i>“While we cannot say they are safe, we can say that they are safer than smoking tobacco”⁶³.</i></p>	62-64,66,67
Wariness over short- and long-term safety	Concerns over the potential health effect of ENDS	<p><i>“I am most concerned about gateway to other tobacco products and also impact on minors. I think that's a big one and I'm very, very concerned about that.”⁶².</i></p> <p><i>“[I have] concern about effects of heated vapor.” “[There is] no proven benefit with uncontrolled liquids”⁷³.</i></p>	62-64,66,73
	Uptake of ENDS by adolescents	<i>“I am most concerned about gateway to other tobacco products and also impact on minors. I think that's a big one and I'm very, very concerned about that”⁶².</i>	62,64,70
Clinical action/practice	‘Ask’/routine screening	<i>“I don’t ask specifically about smokeless tobacco, chewable tobacco, e-cigarettes. It’s generally just ‘Do you smoke?’ or ‘Were you a smoker in the past?’ ...”⁶⁶.</i>	64,66,68

‘Advise’/patient-provider discussion	<p><i>“I’ve had questions [about e-cigarettes] come up recently, but I think it’ll come up more and more.”</i></p> <p>64 .</p>	62,64,66
‘Act’/recommendation	<p><i>“...I’m not looking to promote e-cigarettes but I would not disapprove of it especially if they have tried other products and have not succeeded.”</i> ⁶².</p>	62,64-67,73

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