

Healthcare professionals' beliefs, attitudes, knowledge and behaviour around vaping in pregnancy and postpartum: A qualitative study

Abby Hunter¹; Judith Yargawa¹; Caitlin Notley², Michael Ussher³, Alex Bobak⁴, Rachael L Murray¹, Srabani Nath¹; Sue Cooper⁵

¹Division of Epidemiology and Public Health, University of Nottingham, Clinical Sciences Building, Nottingham City Hospital, Hucknall Road, Nottingham NG5 1PB, UK

²Addiction Research Group, Norwich Medical School, University of East Anglia, Norwich

³Institute of Social Marketing and Health, University of Stirling, Stirling and Population Health Research Institute, FK9 4LJ

St George's, University of London, Cranmer Terrace, London SW17 0RE

⁴Alex Bobak, GP Specialist in Smoking Cessation, Wandsworth Medical Centre, London, SW18 4DD

⁵ Division of Primary Care, School of Medicine, University of Nottingham, University Park, Nottingham NG7 2RD

Address for Correspondence

Dr Abby Hunter

UK Centre for Tobacco and Alcohol Studies

Division of Epidemiology and Public Health

University of Nottingham

Room C109, Clinical Sciences Building

Nottingham City Hospital

Hucknall Road

Nottingham

NG5 1PB

UK

Tel: 0115 8231945

Abby.hunter@phe.gov.uk

© The Author(s) 2020. Published by Oxford University Press on behalf of the Society for Research on Nicotine and Tobacco. All rights reserved. For permissions, please e-mail: journals.permissions@oup.com.

Abstract

Introduction: Finding effective ways to help pregnant women quit smoking and maintain long-term abstinence is a public health priority. Electronic cigarettes (i.e., vaping) could be a suitable cessation tool in pregnancy for those who struggle to quit, however, healthcare professionals (HCP) must be informed about these devices to offer appropriate advice. This study used the Capability, Opportunity, Motivation and Behaviour (COM-B) model and Theoretical Domains Framework (TDF) to explore HCP attitudes towards vaping in pregnancy and postpartum; beliefs about the health risks of vaping; perceived barriers and facilitators of vaping in pregnancy; knowledge of current guidelines and policies; and training needs.

Methods: Interviews (n=60) were conducted with midwives (n=17), health visitors (n=10), general practitioners (GPs) (n=15) and stop smoking specialists (n=18) across the UK. Interview transcriptions were analysed thematically using the framework approach and the COM-B.

Results: Discussing vaping as a tool for quitting smoking in pregnancy was prevented by a lack of capability (limited knowledge of ECs, lack of training in smoking cessation); lack of opportunity (restricted by organisational policies and guidelines, lack of time and financial issues impacting on training), and negative social influences (sensationalist media and stigma associated with vaping in pregnancy); and lack of motivation (fear of future litigation and comebacks should adverse effects from vaping arise).

Conclusions: Factors related to capability, opportunity and motivation were identified that influence HCPs attitudes and behaviours towards vaping in pregnancy. Gaps in knowledge and training needs were identified, which could inform the development of targeted vaping training.

Implications

E-cigarettes could be suitable in pregnancy for those struggling to quit smoking. However, healthcare professionals (HCP) must be informed about these devices to offer appropriate advice. These data extend our knowledge of factors influencing HCP attitudes and behaviours towards vaping in pregnancy. Generally, vaping was perceived as safer than cigarettes but a perceived lack of evidence, health and safety risks, dependency and regulation issues were concerning. Considering our findings, greater efforts are needed to ensure HCPs are sufficiently informed about vaping and guidelines available. More importance should be placed on training for all HCPs who have contact with pregnant women.

Introduction

Smoking is the main preventable cause of adverse pregnancy outcomes^{1,2}, such as stillbirth, preterm birth and fetal growth restriction, as well as long-term effects, such as neurodevelopmental disorders³ and cancers⁴. Similar to other high income countries⁵, in England, average rates of smoking in pregnancy are 10.4%⁶, but in some areas prevalence is up to 23.3%⁶. Furthermore, nearly half of those who quit during pregnancy return to smoking by six months postnatally⁷. In addition, the child may be exposed to second-hand smoke (increasing risk of respiratory infections and sudden infant death syndrome⁸), and is more likely to become a smoker⁹. It is a public health priority to find effective ways to help pregnant women stop smoking and remain abstinent.

In England, those who smoke in pregnancy are routinely referred to National Health Service (NHS) Stop Smoking Services to receive behavioural support and nicotine replacement therapy (NRT). However, trials have reported low adherence (7-25%) of NRT in pregnancy and, in placebo-controlled trials, there is no evidence for NRT aiding smoking cessation (SC) in pregnancy¹⁰. Vaping could be an effective tool for pregnant women. There is some evidence for effectiveness in non-pregnant smokers^{11,12}, and vaping is increasingly used in pregnancy^{13,14} and for SC¹⁵⁻¹⁷.

An evidence review by Public Health England (PHE)¹⁸ states that vaping is likely to be 95% safer than cigarettes, and is preferable to smoking, even by pregnant women. The UK Smoking in Pregnancy Challenge Group (SPCG) produced a guide for health care professionals (HCP), stating that “if a pregnant woman chooses to use an EC and if it helps her to quit smoking and stay smoke free, she should be supported to do so¹⁹.”

Concerns remain about the safety of vaping particularly relating to cytotoxicity and carcinogens²⁰. Studies of vaping and health outcomes in pregnancy have been equivocal, due to small sample sizes^{21,22}. There are also concerns and misperceptions around using nicotine in any form during pregnancy²³. The controversy surrounding vaping may impact on HCP attitudes, thus influencing recommendations for their patients.

Midwives are ideally placed to support SC in pregnancy. However, there is lack of attention to SC in clinical curricula in England and insufficient training for SC relapse prevention or practical skills for delivering evidence-based interventions²⁴.

Although studies have explored midwives' and other HCP perceptions of SC treatment in general^{25,26}, no studies have explored HCP perceptions of vaping in pregnancy, but many HCP report feeling unsure how to advise on vaping²⁷. The overall aim was to explore the attitudes of HCP in England towards vaping in pregnancy; their beliefs about health risks; knowledge of guidelines and recommendations; experience and current practice regarding vaping; previous training and future training requirements.

Methods

The study protocol was reviewed by external independent researchers prior to data collection, as part of the programme for registered reports with Nicotine and Tobacco Research.

Study Design

This was a qualitative study using in-depth interviews. The COM-B model of behaviour²⁸ and the Theoretical Domains Framework (TDF)²⁹ guided the analysis. COM-B focusses on three components: capability, opportunity and motivation (COM), which influence behaviour (B). The TDF comprises 14 domains of theoretical constructs that could influence behaviour²⁹, and extends COM-B, as each domain fits within one of the three components. The study is reported according to the consolidated criteria for reporting qualitative research (COREQ)³⁰.

Participants

We aimed to conduct telephone interviews with approximately 18 each of four HCPs (midwives, health visitors (HV), general practitioners (GP), stop smoking specialists (SSS), or until reaching data saturation. Where possible, we purposively sampled across age, gender, years practicing, smoking status, ethnicity and region. Participants were entered into a prize draw for £100 vouchers.

Procedure

Recruitment involved various channels to ensure a wide range of views. We directly approached HCP through our networks and emailed contacts on our participant database and members of our Smoking in Pregnancy Steering Group. We approached people at management meetings (e.g. midwifery), to get 'buy in' from managers. For GP recruitment, we had support from the Primary Care Clinical Research Network, and as a GP, one of the authors disseminated study details to his network. The study was also advertised via staff newsletters and through social media (Twitter, Facebook). We used a snowball approach through all these channels. The University of Nottingham, School of Medicine ethics committee approved the study.

Interviews and analysis

Interviews lasted 30-45 minutes. Information sheets and consent forms were emailed to participants beforehand. Verbal consent was recorded digitally before the interview. A topic guide was referred to during the interview (Appendix A). The COM-B²⁸ and the TDF²⁹ were used to ensure broad coverage of topics. We collected participant information on gender, age, years practicing, region, SC training, smoking and vaping status. We piloted the topic guide with each HCP group.

A professional service (UK Transcription) transcribed interviews verbatim. Analysis was both deductive, through being informed by the COM-B and TDF and topic guide, and inductive, deriving from the spontaneous accounts of participants. A 'Framework' analytic approach to data analysis³¹ produced an a priori framework with matrices mapping to the TDF and COM-B. After familiarisation with the transcripts, a selection from each HCP group was independently coded by two researchers (AH, JY) who agreed a 'working' coding framework which was then refined following further coding and meetings. The matrices were discussed with the team, to identify, label and refine the themes which best explained the data. NVivo version 12 software was used for managing data coding and analysis.

Results

Participant characteristics

Sixty interviews were conducted (17 midwives, 10 HV, 15 GPs, 18 SSSs), at which point data saturation was considered to have been reached. Half the participants worked full-time, over three-quarters were aged 26-55 years, female, white British and had been practicing for at least five years. They were from all nine regions of England, in addition to Wales and Northern Ireland. One-third were ex-smokers, 3.3% were current smokers; 10% had vaped (Supplementary Table 1). Table 1 describes how the data aligns within the TDF and COM-B.

INSERT TABLE 1

Capability

Knowledge

Many practitioners were unaware of vaping guidelines, nor PHE's statement that vaping is 95% safer than cigarettes³², saying they '*didn't know very much at all*'. Those familiar with PHE's advice usually trusted it:

“Sometimes women ask... ‘I’ve heard they’re not safe in pregnancy’. At the moment I’m going along with PHE advice, that they’re 95% safer than smoking”. (Midwife, 55).

Others were sceptical about *“how they got that percentage”*. One HV said she wanted to see the evidence behind PHE’s statement before promoting the message. Most participants had not heard of the SPCG or their guidelines for HCP on vaping¹⁹. Consequently, many HCP felt there was insufficient information:

“Since e-cigarettes have come in, I don’t find there’s much out there from a midwifery point of view” (Midwife, 28).

Some incorrectly believed UK guidance discourages vaping; one GP stated that the Royal College of Obstetricians and Gynaecologists does not recommend vaping in pregnancy.

Lack of research

Participants were concerned there was insufficient research on vaping, including long-term risks, especially during pregnancy.

“...although I know they're broadly considered safe...I would reserve judgment on that until we’ve got some long-term studies.” (GP, 43)

One GP commented the *“apparent endorsement of something we don’t know about is...a concern”* and *“we are setting ourselves up for a public health disaster in the future.”* They preferred patients to use evidence-based NRT. A few HCPs also questioned the validity of current evidence. A GP expressed surprise at recent changes in guidance, despite limited evidence.

“I would be very cautious about advocating for pregnant women...do we have any evidence about which of the flavours crosses the placenta and has an impact on child development?” (GP, 48)

Confusion and conflicting advice

Limited knowledge of vaping and guidelines for staff, led to *“uncertainty”* and *“confusion”* over what they should recommend.

“There’s a lot of conflicting advice....confusion....I’ve had a midwife email me saying she’d discussed with a couple of doctors who thought the risk of using an e-cigarette was the same as smoking”. (Midwife, 55)

As a result of the confusion, it is likely patients are receiving mixed messages from the HCP they see.

“Everybody has different opinions...I think it depends which advisor they get, what sort of advice they’ll get.” (SSS, 34).

Skills

Lack of training in SC and vaping

Except for the SSSs, most participants had not received training on SC or vaping in pregnancy. One GP commented *“no one is going to do that kind of training for GPs”* and a midwife further added *“we’re just not very well informed, as a profession.”* Some HCPs reported receiving general training on SC and but not recently (e.g., when qualified). SSSs, on the other hand, received regular training, (e.g. through the National Centre for Smoking Cessation and Training (NCSCT)).

HCPs who received some training, variations were observed across Trusts with respect to content, format, whether mandatory, and frequency. Training usually included risks of smoking and appropriate referrals, rather than how to provide support, and rarely anything on vaping. However, some trusts are making good progress:

“What is pleasing is this year the trust...have agreed that brief advice on smoking is mandatory for everybody in Maternity Services...and there will be something about e-cigarettes on that. (Midwife, 55).”

Most respondents agreed they would benefit from further training on vaping, stating the importance especially as they *“become more popular”*. There was a dearth in knowledge and a perceived need for training in four areas: Vape devices, evidence and policy, health and safety risks, and advice for patients. The specific knowledge gaps and needs are summarised in Table 2.

INSERT TABLE 2

Opportunity

Environmental context and resources

Organisational policies and guidelines

Some practitioners felt there was insufficient guidance at work on vaping, or that key information is not *“filtered through”* to staff.

“I don’t think we’ve received enough information about them...We haven’t had any guidance or policies in our trust, we haven’t had any real directives about e-cigarettes in pregnancy at all.” (HV, 54)

Some were not allowed to recommend vaping because it is not NHS approved. Even if they had positive views towards vaping, they were often restricted by organisational policies.

“We had an email from work saying, we can’t recommend e-cigarettes, it’s not a replacement, they shouldn’t be using them” (Midwife, 28)

Many reported *“time is of the essence”*. There is limited time with patients and limited time to keep up-to-date with research.

“There’s so many guidelines, there’s so many things, we just don’t have the time to read every single guideline and change our practice”. [Midwife, 53]

“They have a lot of other things to do.....but, the midwives are the ideal ones to sit and talk to them, but they don’t have the time (SSS, 48).

Social influences

Participants reported conflicting media information about the safety of vaping; for example, whether it causes lung problems. Consequently, it was difficult to deal with inconsistent messages and to know what to advise.

“You read things in the news, on social media, about conditions caused by e-cigs. So now I’m thinking I don’t know, as a professional I need to be advising women on stuff that I know” (Midwife, 49)

“There’s a lot of scaremongering and obviously it’s difficult to know what’s true and what’s not” (Midwife, 32).

Social influences also include perceived stigma. Some midwives looked at vapers as smokers, and felt there was a stigma to seeing pregnant women vaping.

“They’re looked upon kind of like smoking... we’d prefer people not to be using them”. (HV, 58)

“I’ve heard some midwives say they don’t like to see women use the e-cigarettes at all, and us midwives are well known for having very strong views on things.” (Midwife, 59)

Motivation

Professional role and identity

All participants reported assessing smoking and discussing risks of smoking, however across all groups, many suggested it was the responsibility of someone else to discuss SC and provide support, saying *“it’s not down to me”*. Often, they felt their responsibility ended with referring to SC services, with no more discussions throughout pregnancy:

“We don’t go into detail because our prime goal is to get them to accept a referral... the specialists go into details of what they can offer” (Midwife, 54)

Some reasoned there was “enough information out there about smoking” and further discussion would come across as “preaching.” Others were more proactive.

“During a consultation, I will do some brief intervention and I will even make the appointment myself with one of our nurses.” (GP, 50).

Beliefs about consequences

There was no consensus on vaping, but some participants reported several positive aspects. It was generally perceived as a tool for SC. They felt it was an alternative, “something within the armoury” or “an extra tool” available to women to quit smoking. It was seen as both a positive opportunity for smokers (e.g., “a step in the right direction”, “a transition”, “pathway of stopping smoking” and “a tool to bridge smoking and non-smoking”) and as a compromise (“a less worrying option”, “the middle ground”).

“If I’ve got a woman who comes to clinic...but she doesn’t want referring anywhere, I would suggest she could purchase an e-cigarette, which would be a safer alternative.” (Midwife, 55)

Another positive theme related to vaping as safer than smoking. Respondents often reported that thousands of chemicals and harmful toxins are found in cigarettes compared with just a few in vaping; hence it is a “cleaner” way to get nicotine.

“They are much safer because tobacco has got a lot more chemicals in them...if you have one or two chemicals in something and you have 4,000 in something else, obviously by default it’s going to be safer” (Midwife, 39).

They mentioned the health risks of tobacco smoke are well-known and vaping is a better option for maternal and child health. One GP asserted the benefits of vaping outweigh the risks of smoking cigarettes, with another one similarly remarking: “anything’s better than the cigarette.” Others talked about harm reduction and that “significant gains are to be made in terms of risk reduction and harms to the patient” when using an e-cigarette.

A few success stories were reported, such as engagement with SC services increasing due to vaping; people with past unsuccessful quit attempts stop smoking by vaping; pregnant women vaping and eventually switching to NRT products and then coming off nicotine completely. Some HCPs asserted women who start vaping during pregnancy may be more likely to remain smoke-free postpartum.

While participants reported the benefits of vaping relative to normal cigarettes, they tended to qualify their statements due to the uncertainty around vaping. Some HCPs emphasised complete nicotine abstinence is preferable. One HCP commented that vaping is not necessary as there are already sufficient tools available for someone to quit:

“I always thought...it was a tool that wasn’t necessary because if they’re coming wanting to quit, they’ve got that motivation and we’ve got the NRT we can use” (SSS, 25).

Others believed vaping to be harmful and had concerns about limited evidence. While some participants acknowledged vaping was safer than smoking, they also felt *“it’s not completely safe.”* They were unclear about its harms, especially on the foetus, as well as its long-term effects on the lungs, with some HCPs bringing up the possibility of *“popcorn lungs”*.

A common concern was that long-term impacts are unknown. The flavours and perfumes in vapour were often brought up as potential risks, chemicals that *“can’t be brilliant for your chest.”* Children were also seen as vulnerable to toxicity when exposed to vapour. Dual tobacco smoking and vaping were additional concerns. Some HCPs expressed strong views:

“My opinion is I just don’t like smoking. I can’t see why you want to draw anything into your lungs other than air...they’re not designed for you to draw chemicals into. (HV, 53).

Some HCP associated the risks of vaping as the same as cigarettes, with one midwife stating *“if you have an infection it’s worse for you to be smoking [an e-cig] than it is normal cigarettes”*, and a SSS stated that people who vape have *“the same risk of getting COPD as a smoker”*. Others treated vaping the same as smoking in terms of information given:

“I usually say to my clients because of the lack of information I would treat them, at present, the same as cigarettes” (HV, 58)

Many participants felt vaping sustains an addiction and were worried about long-term dependency. They viewed vaping as *“swapping one addictive behaviour for another... without actually dealing with the addiction”*.

“It feels like I’m just sanitising what’s a bad habit...I’m not clear that the evidence on e-cigarettes in relation to pregnancy is out there to make it safe for me to say that it’s okay.” (HV, 53).

It was suggested that if people are vaping to quit smoking then they should be aiming to quit vaping as soon as possible.

Beliefs about capabilities

When considering “beliefs about capabilities” many practitioners reported feeling unconfident or uncomfortable giving vaping advice due to lack of knowledge, conflicting information seen/heard and the overall lack of evidence on the product as mentioned above.

“I don’t know enough about them. I wouldn’t feel comfortable advising...I’d rather they went down routes that have got more trials and evidence...” (HV, 44)

A few respondents appeared to be “fairly confident” or were confident in some areas, but not in others (for example in discussing efficacy but not in recommending brands); they would give advice as long as it was within the sphere of what they felt comfortable with (for instance, saying the “strap line” vaping is safer but not engaging further).

“I feel confident in the knowledge I’ve got... I don’t know what else I would say other than it’s safer than smoking... that’s the bottom line.” (Midwife, 52)

A few participants mentioned that while they feel confident, this may not be the case for other HCPs, because “not all midwives are confident to talk about quitting smoking, never mind e-cigarettes”.

Emotion

A fear of vaping

Some participants had a fear of future litigation and comebacks should adverse effects arise as a result of vaping, with one person commenting “this apparent endorsement of something we don’t know about is, a concern”.

“I’m just worried, particularly with people with existing lung conditions like COPD, what are the long-term effects of using those devices. Are we not storing up a lot more issues in 10 years’ time?” (SSS, 64).

“I have very senior consultants...telling people they shouldn’t be using an e-cig...Because I think they’re afraid of any comeback on them if they say to use an e-cig and there’s an adverse effect”. (SSS, 34)

There were also safety concerns about the liquids exploding and batteries leaking, sometimes heard from media stories, and fear that the devices might “blow up or catch on fire”. Many also had concerns about the effects on the foetus and maternal outcomes:

“I have seen some of the studies that suggest there’s a link between still birth and possible miscarriage when e-cigarettes are used, so, I do not feel happy recommending them” (SSS, 64).

Many had concerns about advising on vaping without prior training, and feared recommending vaping as it is an unregulated market.

“You can’t monitor the efficacy or the quality of those products...that’s my worry about using e-cigarettes...because I’m not clear how those places are regulated and I’m pretty certain what you buy off eBay and Amazon isn’t particularly well-regulated”. (HV, 53)

Discussion

The COM-B and TDF were used to identify and conceptualise the factors which explain or determine HCP attitudes and behaviours regarding vaping in pregnancy. We showed HCP behaviour (discussing vaping for SC in pregnancy) was facilitated by having the capability (knowledge and skills to discuss vaping); opportunity (environmental situations through appropriate organisational policies and access to training); and motivation (beliefs about consequences of smoking and/or vaping; and the belief that providing SC support is the responsibility of someone else). Conversely, this behaviour was prevented by lack of capability (limited knowledge of evidence/guidelines, and lack of confidence giving advice); lack of opportunity (restricted by organisational policies/guidelines, lack of time and financial issues impacting on training), and negative social influences (sensationalist media reporting and stigma associated with vaping); and lack of motivation (fear of future litigation).

Our findings are consistent with research showing HCP feel they have limited capability in discussing vaping. Most nurses and GPs feel ill-equipped to discuss vaping with their patients due to a lack of knowledge of risks and benefits³³. Practitioners had a lack of knowledge of appropriate guidelines, and in agreement with our study, it would seem dissemination strategies for guidelines are not effective in reaching frontline staff. Consequently, staff are often far more cautious about vaping than guidelines advise. Improved dissemination of national guidelines on tobacco harm reduction and vaping has been called for, as many HCP are overly cautious and have misperceptions about vaping³⁴. A lack of capability among HCP, to appropriately discuss vaping, is likely to impact on the consistency of information given to pregnant smokers and may undermine the patients confidence

in this advice^{33,35–37}.

A review of qualitative research identified that both the professional role of participants and the organisational context in which they worked could act as either barriers or facilitators to an individual's ability to provide SC support to pregnant or post-partum women³⁸, and these barriers might similarly relate to discussing vaping for SC. Lack of time has frequently been reported as a barrier for providing SC care for midwives^{39–41}, as they struggle to find time during busy antenatal appointments²⁶. Many participants reported lack of time to attend training, to read documents, and to discuss SC and vaping with patients.

Social factors also influenced behaviour. The media was seen to report conflicting views. A review on the beliefs and attitudes of HCPs toward EC⁴² found beliefs are influenced by media stories. Negative media about vaping tends to be more prevalent than positive messages, and since HCPs report a lack of guidance, it is likely that media sources are influential⁴³.

The fear that vaping may lead to adverse effects in years to come was shared by many participants. Similar views have also been expressed by GPs and nurses in previous interviews³³, and this is a potential barrier to discussing vaping with patients. Fears were also expressed over potential harms to the developing foetus, perhaps suggesting an over-cautious approach among HCP caring for pregnant women.

When considering attitudes towards vaping specifically in pregnancy, Cooper⁴⁴ found SSS were generally positive about vaping but still had concerns about a perceived lack of evidence. This finding supports our study in that it was the SSS who were generally most confident about discussing vaping. This is most likely due to having more training than the other practitioner groups. However, not discussing SC during pregnancy is a missed opportunity to provide Very Brief Advice (VBA).

Future research

Considering our findings, clearly, greater efforts are needed to ensure HCPs are sufficiently informed about vaping and the evidence and guidelines available. More importance should be placed on training for all HCPs who have contact with pregnant women. Indeed, a recent vaping priority setting exercise⁴⁵, inviting the public and health professionals to submit vape questions they want answering by research, resulted in two questions on pregnancy prioritised in the top 10 (health effects of vaping in pregnancy; and whether vaping in pregnancy can encourage SC and reduce relapse). This latter question is currently being addressed by a trial^{46,47}.

Strengths and limitations

The COM-B and TDF are established theoretical frameworks and their use strengthens our study. We recruited participants from many different regions across the UK, however our participants were an opportunistic sample and therefore may have been more motivated towards discussing vaping. Some GPs reported rarely seeing pregnant smokers due to working in areas of low prevalence of smoking in pregnancy. Their limited experience with this population could mean their views are different from GPs in other areas.

Conclusions

The application of the COM-B identified multiple factors influencing HCP attitudes and behaviours towards vaping in pregnancy. Generally, vaping was perceived as safer than cigarettes but a perceived lack of evidence, health and safety risks, dependency and regulation issues were dominant concerns. Although research on vaping in pregnancy is limited, there are sufficient UK guidelines available to assist HCP in supporting pregnant smokers, however this information is not filtering down to practitioners, leading to confusion. Gaps in knowledge, and training needs were identified which could inform the development of targeted vaping training for HCP.

Acknowledgements

We would like to acknowledge Nicotine & Tobacco Research for allowing our protocol to be reviewed by external independent researchers as part of the registered reports scheme, and providing useful suggestions for strengthening the protocol.

Funding

This work was funded by The Tobacco Advisory Group (TAG) at Cancer Research UK (Grant number C63535/A25752).

Pre-registration

This study was registered with the Open Science Framework on 9th October 2018, with the title “Electronic cigarettes in pregnancy and postpartum: A qualitative study exploring healthcare professionals’ beliefs, attitudes, knowledge and behaviour”.

Declaration of interests

The authors have no competing interests to report

References

1. Cnattingius S. The epidemiology of smoking during pregnancy: smoking prevalence, maternal characteristics, and pregnancy outcomes. *Nicotine Tob Res.* 2004;6(Suppl_2):S125–S140.
2. Mund M, Louwen F, Klingelhofer D, Gerber A. Smoking and pregnancy—a review on the first major environmental risk factor of the unborn. *Int J Environ Res Public Health.* 2013;10(12):6485–6499.
3. Fergusson DM, Woodward LJ, Horwood LJ. Maternal smoking during pregnancy and psychiatric adjustment in late adolescence. *Arch Gen Psychiatry.* 1998;55(8):721–727.
4. Schwartzbaum JA, George SL, Pratt CB, Davis B. An exploratory study of environmental and medical factors potentially related to childhood cancer. *Med Pediatr Oncol.* 1991;19(2):115–121.
5. Lange S, Probst C, Rehm J, Popova S. National, regional, and global prevalence of smoking during pregnancy in the general population: a systematic review and meta-analysis. *Lancet Glob Health.* 2018;6(7):e769–e776.
6. *Statistics on Women’s Smoking Status at Time of Delivery, England - Quarter 3, 2019-20.*
7. Jones M, Lewis S, Parrott S, Wormall S, Coleman T. Re-starting smoking in the postpartum period after receiving a smoking cessation intervention: a systematic review. *Addiction.* 2016;111(6):981–990.
8. Deming D. The impact of second-hand tobacco smoke exposure on pregnancy outcomes, infant health, and the threat of third-hand smoke exposure to our environment and to our children. 2012.
9. Leonardi-Bee J, Jere ML, Britton J. Exposure to parental and sibling smoking and the risk of smoking uptake in childhood and adolescence: a systematic review and meta-analysis. *Thorax.* 2011;66(10):847–855.
10. Claire R, Chamberlain C, Davey M-A, et al. Pharmacological interventions for promoting smoking cessation during pregnancy. *Cochrane Database Syst Rev.* 2020;(3).
11. Hajek P, Phillips-Waller A, Przulj D, et al. A randomized trial of e-cigarettes versus nicotine-replacement therapy. *N Engl J Med.* 2019;380(7):629–637.

12. Hartmann-Boyce J, Begh R, Aveyard P. Electronic cigarettes for smoking cessation. *Bmj*. 2018;360.
13. Kurti AN, Redner R, Lopez AA, et al. Tobacco and nicotine delivery product use in a national sample of pregnant women. *Prev Med*. 2017;104:50–56.
14. Liu B, Xu G, Rong S, et al. National estimates of e-cigarette use among pregnant and nonpregnant women of reproductive age in the United States, 2014-2017. *JAMA Pediatr*. 2019;173(6):600–602.
15. Bowker K, Orton S, Cooper S, et al. Views on and experiences of electronic cigarettes: a qualitative study of women who are pregnant or have recently given birth. *BMC Pregnancy Childbirth*. 2018;18(1):233.
16. Chiang SC, Abrams LC, Cleary SD, Pant I, Doherty L, Krishnan N. E-cigarettes and smoking cessation: a prospective study of a national sample of pregnant smokers. *BMC Public Health*. 2019;19(1):964.
17. Oncken C, Ricci KA, Kuo C-L, Dornelas E, Kranzler HR, Sankey HZ. Correlates of electronic cigarettes use before and during pregnancy. *Nicotine Tob Res*. 2017;19(5):585–590.
18. Ann M, Leonie B, Robert C, Linda B, Debbie R. Vaping in England: An Evidence Update Including Mental Health and Pregnancy, March 2020. *A Report Commissioned by Public Health England*.
19. Smoking in Pregnancy Challenge Group. Use of Electronic Cigarettes in Pregnancy Before, During and After Pregnancy. A Guide for Maternity and Other Healthcare Professionals. 2019. Accessed at: <https://smokefreeaction.org.uk/wp-content/uploads/2019/08/2019-Challenge-Group-ecigs-briefing-FINAL.pdf>
20. Grana R, Benowitz N, Glantz SA. E-cigarettes: a scientific review. *Circulation*. 2014;129(19):1972–1986.
21. Cardenas VM, Cen R, Clemens MM, et al. Use of Electronic Nicotine Delivery Systems (ENDS) by pregnant women I: Risk of small-for-gestational-age birth. *Tob Induc Dis*. 2019;17.
22. Clemens MM, Cardenas VM, Fischbach LA, et al. Use of electronic nicotine delivery systems by pregnant women II: Hair biomarkers for exposures to nicotine and tobacco-specific nitrosamines. *Tob Induc Dis*. 2019;17.

23. Thomson R, McDaid L, Emery J, et al. Practitioners' Views on Nicotine Replacement Therapy in Pregnancy during Lapse and for Harm Reduction: A Qualitative Study. *Int J Environ Res Public Health*. 2019;16(23):4791.
24. Forman J, Harris JM, Lorencatto F, McEwen A, Duaso MJ. National survey of smoking and smoking cessation education within UK midwifery school curricula. *Nicotine Tob Res*. 2017;19(5):591–596.
25. Abatemarco DJ, Steinberg MB, Delnevo CD. Midwives' knowledge, perceptions, beliefs, and practice supports regarding tobacco dependence treatment. *J Midwifery Womens Health*. 2007;52(5):451–457.
26. Condliffe L, McEwen A, West R. The attitude of maternity staff to, and smoking cessation interventions with, childbearing women in London. *Midwifery*. 2005;21(3):233–240.
27. England LJ, Anderson BL, Mahoney J, Coleman-Cowger VH, Melstrom P, Schulkin J. Screening practices and attitudes of obstetricians-gynecologists toward new and emerging tobacco products. *Am J Obstet Gynecol*. 2014;211(6):695–e1.
28. Michie S, Van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implement Sci*. 2011;6(1):42.
29. Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implement Sci*. 2012;7(1):37.
30. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007;19(6):349–357.
31. Gale NK, Heath G, Cameron E, Rashid S, Redwood S. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol*. 2013;13(1):117.
32. McNeill A, Brose LS, Calder R, Bauld L, Robson D. Evidence review of e-cigarettes and heated tobacco products 2018. *Rep Comm Public Health Engl Lond Public Health Engl*. 2018;6.
33. Stepney M, Aveyard P, Begh R. GPs' and nurses' perceptions of electronic cigarettes in England: a qualitative interview study. *Br J Gen Pr*. 2019;69(678):e8–e14.

34. Smith CA, McNeill A, Kock L, Ahmed Z, Shahab L. Mental health professionals' perceptions, judgements and decision-making practices regarding the use of electronic cigarettes as a tobacco harm reduction intervention in mental healthcare: A qualitative focus group study. *Addict Behav Rep.* 2019;10:100184.
35. Kanchustambham V, Saladi S, Rodrigues J, Fernandes H, Patolia S, Santosh S. The knowledge, concerns and healthcare practices among physicians regarding electronic cigarettes. *J Community Hosp Intern Med Perspect.* 2017;7(3):144–150.
36. Van Gucht D, Baeyens F. Health professionals in Flanders perceive the potential health risks of vaping as lower than those of smoking but do not recommend using e-cigarettes to their smoking patients. *Harm Reduct J.* 2016;13(1):22.
37. Mann R, Faflik F. Survey of smoking cessation services and pregnant women's views on use of electronic cigarettes in pregnancy. *J Health Visit.* 2018;6(1):32–39.
38. Flemming K, Graham H, McCaughan D, Angus K, Sinclair L, Bauld L. Health professionals' perceptions of the barriers and facilitators to providing smoking cessation advice to women in pregnancy and during the post-partum period: a systematic review of qualitative research. *BMC Public Health.* 2016;16(1):290.
39. Meijer E, van der Kleij R, Segaar D, Chavannes N. Determinants of providing smoking cessation care in five groups of healthcare professionals: A cross-sectional comparison. *Patient Educ Couns.* 2019;102(6):1140–1149.
40. Coleman-Cowger VH, Anderson BL, Mahoney J, Schulkin J. Smoking cessation during pregnancy and postpartum: practice patterns among obstetrician-gynecologists. *J Addict Med.* 2014;8(1):14.
41. Demmert A, Grothues JM, Rumpf H-J. Attitudes towards brief interventions to reduce smoking and problem drinking behaviour in gynaecological practice. *Public Health.* 2011;125(4):182–186.
42. Erku DA, Gartner CE, Morphett K, Steadman KJ. Beliefs and Self-reported Practices of Health Care Professionals Regarding Electronic Nicotine Delivery Systems: A Mixed-Methods Systematic Review and Synthesis. *Nicotine Tob Res.* 2019.
43. McNeill A, Brose LS, Calder R, Bauld L, Robson D. Vaping in England: an evidence update February 2019. *Lond Engl Public Health Engl.* 2019.

44. Cooper S, Orton S, Campbell KA, et al. Attitudes to e-cigarettes and cessation support for pregnant women from English stop smoking services: A mixed methods study. *Int J Environ Res Public Health*. 2019;16(1):110.
45. Hunter A, Ross L, Gronlund T, Cooper S. Research priorities for electronic cigarettes: A James Lind Alliance Priority Setting Partnership. 2020. <http://www.jla.nihr.ac.uk/priority-setting-partnerships/Electronic-cigarettes/> [accessed 17.04.2020]
46. Helping pregnant smokers quit: a multi-centre study of electronic cigarettes and nicotine patches. International Standard Registered Clinical Trial Number. ISRCTN62025374.
47. Exposure to nicotine and tobacco products during pregnancy. International Standard Registered Clinical Trial Number. <https://doi.org/10.1186/ISRCTN13835237>.

Accepted Manuscript

Table 1: Summary of key findings for each COM-B and TDF domain

Com-B	TDF	Broad Issue	Specific Issue	Barrier or facilitator
Capability	Knowledge	Lack of knowledge on vaping	There was a lack of knowledge to be able to give appropriate advice.	Barrier
	Skills	Limited skills	HCPs did not have much experience with vaping. They normally give advice about NRT.	Barrier
Opportunity	Environmental context and resources	Information not reaching health professionals	Substantial research exists but it was not filtering down to frontline staff giving advice.	Barrier
			Many staff were not provided with guidance, information or resources through work.	Barrier
			Often, training or resources for staff did not include information about vaping.	Barrier
		Lack of evidence on vaping	There was a perceived lack of research and data on vaping in pregnancy, and a worry that it might turn out to be worse than cigarettes or cause issues long-term.	Barrier
		Lack of regulation	Lack of regulation in terms of quality and usage.	Barrier
		Lack of time	Lack of time to attend training, to read documents, or to discuss SC with patients.	Barrier
			Some HCPs feel the pregnancy is not enough time to make a difference.	Barrier
			HCP have a lot to cover during an appointment, therefore their focus was not always on SC.	Barrier
		Organisational policies and guidelines	Some HCP were told at work that they cannot recommend or discuss vaping.	Barrier
			Some trusts have no real directives about vaping, therefore advice given to patients was sometimes dependent on individual views.	Barrier
			There was a heavy reliance on some staff to do smoking cessation with patients.	Barrier
			Many guidelines were available, but they were conflicting. WHO has not issued a positive stance on vaping but PHE has.	Barrier
			Mandatory training was updated to include smoking cessation and vaping.	Facilitator
			Some services tried different approaches to vaping. Examples included giving discounts to a local vape shop and offering a free voucher scheme sponsored by vaping companies.	Facilitator
			Some workplaces had an active guideline group that looked at any new documentation from the government, and then considered whether the trusts guidance needed to change.	Facilitator
			Old policies were changed based on new training that had taken place.	Facilitator
			Midwives were encouraged to do NCSCT training.	Facilitator
Commissioners pushed for services to be vape friendly, leading to change in staff attitudes.	Facilitator			
Financial issues	Offering a flexible service and allowing women to try different products.	Facilitator		
	Cascading and rolling out vaping evidence to frontline staff costs money.	Barrier		
		Face-to-face training was preferable but too expensive for the hospital to deliver.	Barrier	

	Social influences	Friends and family influences	It can be hard to stop vaping, based on perceptions of friends and families' experiences with vaping.	Neither
		Media and Google influences	The media often portrays that vaping is not healthy, causes lung problems, and encourages youth uptake. However, other media reports say vaping is less harmful.	Barrier/facilitator
			Sensationalist media reports are mostly based on very small or poorly designed studies.	Barrier
			Google and the news were used as information sources for vaping.	Barrier
			Midwives were often influenced by what was reported in the media.	Barrier
		Stigma	Some midwives considered vapers to be smokers.	Barrier
			Smoking was still generally a taboo subject.	Barrier
Motivation	Professional role / identity	Perceived responsibility	Although all reported discussing smoking and assessing the risks, there were mixed opinions over whose responsibility it was to provide stop smoking support.	Barrier
	Beliefs about consequences	Preferences	Advisors had varying views on vaping, including at both extremes of the spectrum.	Barrier
	Beliefs about capabilities	Lack of confidence	HCP had a lack of confidence to give advice, often due to their lack of knowledge on vaping.	Barrier
	Emotion	Fear	A fear of future litigation and comebacks should adverse effects result from vaping.	Barrier
			There were strong views on tobacco meaning vaping was looked upon suspiciously.	Barrier
			Midwives were frightened about advising new products especially without prior training.	Barrier

Accepted

Table 2: Areas where respondents had specific knowledge gaps and needs

Area	Specific knowledge gaps and needs
Vape devices	<ul style="list-style-type: none"> • What are the different brands available and how do they vary in terms of ingredients, strengths, effectiveness, costs, usability, popularity? • What does should they be recommending? • How do they advise someone to quit vaping without relapsing to smoking? • Are their specific shops they should be recommending?
Evidence and policy	<ul style="list-style-type: none"> • What guidelines are currently available for HCP? • What is the official position statement of vaping from authoritative organisations? • How did PHE arrive at the 95% figure of vaping reduced harm relative to cigarettes? • How does vaping compare to NRT in terms of harm and quit rates, and cost-effectiveness • What training resources are available for HCP?
Health and safety risks	<ul style="list-style-type: none"> • What are the long-term impacts of vaping, including harms to mother and baby? • Is nicotine safe in pregnancy? • What are the side effects of nicotine? • Is there a risk of harm from second-hand vaping? • Are the devices safe in terms of catching fire or blowing up?
Advice for patients	<ul style="list-style-type: none"> • Can vaping devices be obtained via prescription? • How much risk is reduced by switching? • What is the evidence for the health and safety risks of vaping?