



UNIVERSITY OF LINCOLN

**How do midwives' knowledge and attitudes of all aspects of electronic
cigarettes influence the recommendation for their use as a smoking
cessation strategy in pregnancy?**

Amy Broadfield

15595202

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School of Pharmacy, College of Science

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Amy Broadfield

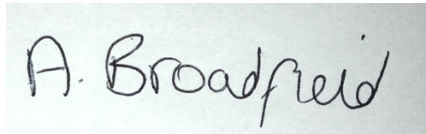
A thesis submitted in partial fulfilment of the requirements of the University of Lincoln for the degree of M.Sc. by Research Pharmacy and Pharmaceutical Sciences awarded by the University of Lincoln, September 2020, supervised by Dr. Keivan Ahmadi, Ms Helen Ayre and Dr. Josie Solomon.

September 2020

Certificate of Originality

This is to certify that I am responsible for the work submitted in this thesis, that the original work is my own, except as specified in the acknowledgements and references, and that neither the thesis nor the original work contained therein has been previously submitted to any institution for a degree.

Signature:

A rectangular box containing a handwritten signature in black ink that reads "A. Broadfield".

Amy Broadfield

Date: 24/09/2020

Abstract

Background:

Electronic cigarettes are rapidly becoming the most common form of nicotine replacement therapy, but their long-term effects are still unknown, especially surrounding effects on a fetus. Currently, organisations such as Public Health England and the Royal College of Midwives support the use of electronic cigarettes during pregnancy, as they are deemed a safer alternative to conventional cigarette smoking. The defining purpose of this research was to explore the knowledge and attitudes held by midwives regarding electronic cigarette use in pregnancy, and whether this affected their likelihood of recommendation as a smoking cessation strategy. Midwives were chosen as they have most likely had the most frequent contact with pregnant smokers, and their roles encompass a strong element of health promotion. This is important as professional bodies such as the Royal College of Midwives recommend electronic cigarettes as a smoking cessation strategy in pregnancy; a very recent development in midwifery practice.

Methods:

A survey was distributed amongst qualified midwives in England in which participants were scored on their knowledge and attitude towards electronic cigarettes and their use in pregnancy. The survey was anonymous and took approximately 10-15 minutes to complete. 264 participants were required for the research. The final sample size was 103. Participants had to be a qualified midwife employed at participating NHS Trusts or elsewhere in England.

The study was cross-sectional as this allowed different variables to be explored at one time, and due to the closed-ended and open-ended, QUANTI-quali questions, the responses allowed for both analytical and descriptive statistical analysis.

Qualitative data was analysed using conventional content analysis. The theoretical framework used when developing the survey was the knowledge, attitude, practice (KAP) theory model.

Results:

The survey tool developed was found to be valid and reliable.

Bivariate analysis was completed to determine the association between the dependent variable i.e., the attitude a participant had to the recommendation of electronic cigarettes as a smoking cessation strategy in pregnancy, and covariates such as likelihood of recommendation, knowledge and history of care for a pregnant woman using electronic cigarettes. Multivariate analysis was performed using linear regression modelling. The reliability for the attitude score test was 0.84. The reliability for the knowledge score test was 0.70.

Both smoking status and history of care for a pregnant woman using electronic cigarettes had a statistically significant association with likelihood of recommendation.

The odds of recommending electronic cigarettes in midwives who had previously cared for women with a successful quit attempt using this method, were almost three times higher in comparison to midwives who had not cared for women with successful quit attempts using this method. The difference was statistically significant (Odds Ratio = 2.70, 95% Confidence Interval = 1.09 – 6.71).

The odds of recommending electronic cigarettes by midwives who do not currently smoke or vape was lower in comparison to midwives who currently smoke or vape. The difference was statistically significant (OR = 0.07 95%CI = 0.01-0.56).

For bivariate analysis, there was a significant indirect association between knowledge and attitude, an increase in knowledge led to a more negative attitude ($\beta = -0.27$, 95%CI = -0.42 - -0.12).

The findings of multivariate analysis showed a significant association between attitude, knowledge and personal practice. The multivariable linear regression model showed a significant association between attitude towards vaping, knowledge and personal practice. The combination of knowledge and personal practice is indirectly associated with attitude. The model represented the KAP model, which stated that by increasing an individual's knowledge there would be a change in attitude, which would be reflected in their overall practice.

The categories identified from the qualitative data highlighted that midwives felt that “not enough or no training/information/resources [are] provided” and “not enough research has been done”.

Discussion:

The KAP model was found to be a suitable framework as it was reflected in the multivariate logistic regression model of attitude against knowledge and likelihood of recommendation. Therefore, participants who had more knowledge regarding electronic cigarettes had a more negative attitude, so were less likely to recommend them as a smoking cessation strategy during pregnancy in their practice.

Participants who had previously provided care for a pregnant woman who had successfully quit smoking due to the use of an electronic cigarette had a more positive attitude towards vaping in pregnancy and were therefore more likely to recommend them as a smoking cessation strategy during pregnancy.

In the qualitative responses, it is evident that some participants felt they had not received enough resources to advise pregnant women on the use of electronic cigarettes in pregnancy. Some participants also felt there had not been enough research on electronic cigarette use during pregnancy to confidently advise pregnant mothers.

Conclusion:

Overall, these findings suggest that midwives' practice in relation to recommending electronic cigarettes as a smoking cessation strategy in line with current professional guidelines, is influenced by their knowledge and attitudes. Qualitative findings illuminated that participants felt they did not have enough resources to accurately advise pregnant women, and they felt more research was needed on the use of electronic cigarettes in pregnancy.

There is therefore a clear need for further research into how midwives can be supported to increase their knowledge and attitudes towards electronic cigarettes in order to support them to feel comfortable and confident implementing national recommendations. This research also clearly highlights the need for more research regarding potential risks and benefits of electronic cigarettes use during pregnancy as well as more resources for midwives to help them have informed discussions with respect to electronic cigarettes as a smoking cessation strategy in pregnancy.

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Firstly, I would like to thank my supervisors, Dr. Keivan Ahmadi, Ms Helen Ayre and Dr. Josie Solomon. Their endless support and patience throughout the year has been really appreciated. They provided excellent words of wisdom, invaluable knowledge and helped me keep on track. I hope my deep gratitude to them does not go unnoticed, and I look forward to our future research together.

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Finally, I would like to dedicate this thesis to all front-line healthcare staff and key workers. In the year of writing my thesis, 2020, the world faced a global pandemic, and you helped keep the country afloat.

Thank you for keeping us safe and healthy, so that I could complete my education in the best environment possible. You are the true heroes throughout this crisis.

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List of Abbreviations

- CO: Carbon monoxide
- E-cigarettes: Electronic cigarettes
- EVALI: E-cigarette or vaping product use associated lung injury
- IRAS: Integrated Research Application System
- KAP: Knowledge Attitude and Practice
- LEAS: Lincoln Ethics Apply System
- NCSCT: National Centre for Smoking Cessation and Training
- NICE: National Institute for Health and Care Excellence
- NIHR: National Institute for Health Research
- NRT: Nicotine replacement therapy
- PCA: Principal component analysis
- PHE: Public Health England
- R&D: Research and development
- RCM: Royal College of Midwives
- RCP: Royal College of Physicians

Background

Despite electronic cigarettes (E-cigarettes) first being introduced in China, 2004 (Dockrell *et al.*, 2013), they have only recently become widespread. An electronic cigarette is a device that delivers nicotine to the lungs in the form of a vapour and can also be referred to as vaping (Hartmann-Boyce *et al.*, 2016). The prevalence of electronic cigarettes is ever-increasing, with around 3.6 million electronic cigarette users, a rise from the 700,000 vapers in 2012 (Action on Smoking And Health, 2019). Euromonitor, a market research group have predicted that the rapidly expanding e-cigarette market will have around 55 million users by 2021 (British Broadcasting Company, 2018).

The World Health Organization (WHO) defines epidemiology as the study of the distribution of health-related events, including disease (World Health Organisation, 2020b). It has been found that England has one of the lowest smoking rates in the world, and a high rate of successful quit attempts (Beard *et al.*, 2020). In addition to this, licensing of nicotine replacement therapies, such as electronic cigarettes, for harm reduction purposes had a temporary positive impact on successful quit attempts (Beard *et al.*, 2020). However, it has been stated that electronic cigarettes are a 'public health crisis' (Walley *et al.*, 2019), because of the increase in use amongst youth. It is claimed that the increase in use amongst young adults is due to the effective marketing and promotion of electronic cigarettes.

In 2019, it was estimated that over 3.6 million adults in Great Britain use electronic cigarettes, which is around 7% of the population (Action on Smoking And Health, 2019). Over half of these are ex-smokers, and the main reason given for the use of electronic cigarettes is to help them quit (31%). Only 45% of the population agreed that electronic cigarettes were less harmful than smoking, compared to 50% in 2018. Similarly, around a quarter of adults stated that they did not know how harmful electronic cigarettes are compared to smoking. According to data published by the NHS, around 10.6% of pregnant woman conventionally smoke at the time of delivery (National Health Service, 2018). There is a rising popularity of e-cigarette use during pregnancy, however the long-term effects on both mother and fetus are still unclear (Bruin *et al.*, 2010).

There have been many recent papers discussing the effects e-cigarettes have on a fetus in comparison to conventional smoking to investigate whether the switch is safer for pregnant women. For this thesis, the knowledge and attitudes held by a midwife regarding electronic cigarettes was explored, as well as whether this affected their recommendation to expectant mothers. The results were analysed to see if there was a relationship between knowledge, attitude and likelihood of recommendation as a smoking cessation strategy.

Due to their frequent contact with pregnant smokers, and a strong element of health promotion in their practice, it seems inevitable to further investigate the knowledge and attitudes a midwife holds surrounding e-cigarette recommendation in pregnancy and their use as a smoking cessation strategy.

Within my undergraduate dissertation, the topic of electronic cigarettes as a smoking cessation strategy was explored, with the focus being around the knowledge and attitudes of University of Lincoln students. This was because the main reason smokers used e-cigarettes was as a substitute for conventional smoking. A question was also included which asked respondents whether they felt that electronic cigarettes should be used in pregnancy, and whether healthcare professionals such as midwives should recommend them to pregnant women.

The results of this previous research indicated that participants held attitudes around vaping in pregnancy, and it was noted that there was a recent push for vaping to be recommended in pregnancy (Royal College of Midwives, 2019), leading to further exploration regarding electronic cigarette use during pregnancy and the role healthcare professionals play in their recommendation. This then posed the question of whether e-cigarettes are recommended during pregnancy as a smoking cessation strategy, and if so, how does the knowledge and attitude a midwife holds influence their recommendation of electronic cigarette use during pregnancy?

Literature Review

The review sought to identify and summarise ‘what is known about midwives’ recommendation of electronic cigarettes during pregnancy?’

A systematic literature search was undertaken to identify relevant publications on Google Scholar, and electronic databases Web of Science and Scopus.

These were considered most likely to produce pertinent results due to their broad range of publishers available, hence adding breadth to the review.

The terms were used initially to search databases with a number of results detailed below.

What is known about midwives’ recommendation of electronic cigarettes during pregnancy?

Research question: How do midwives’ knowledge and attitudes of all aspects of electronic cigarettes influence the recommendation for their use as a smoking cessation strategy in pregnancy?

Places to search for information: Google Scholar, Web of Science, Scopus.

Search Term	Results
“Electronic Cigarettes”	55300
“Electronic cigarettes” and “smoking cessation”	6950
“Electronic cigarettes” and “England”	3600
“Electronic cigarettes” and “epidemiology”	2880
“Electronic cigarettes” and “Pregnancy”	1870
“Electronic cigarettes” and “Pregnancy” and “smoking cessation”	1290

“Electronic cigarettes” and “healthcare professionals”	618
“Electronic cigarettes” and “healthcare professionals” and “pregnancy”	211
“Electronic cigarettes” and “midwives”	126

Table 1: Table to show search terms during literature search

Post-hoc development and application of inclusion and exclusion criteria was utilised. Papers were considered relevant if they were primary research articles, studying electronic cigarettes and/or their effects on pregnant women. As the review developed, studies examining midwifery practice and guidelines on e-cigarette use during pregnancy were also considered relevant and thus included, due to the intrinsic role of government bodies in recommendation. Papers were mostly limited to 2016 or later; however, some earlier papers were included if they were deemed imperative or relevant. 50 relevant papers were chosen due to year of publication, relevance, and country of publication. The title and abstract of each paper were read, and the most suitable papers were added to a list. Exercises were undertaken to ensure the most relevant papers were being utilised, for example; “list the top 10 most relevant papers that you have read; and provide us with the summary of the main points in no more than 50 words”. The result of this exercise can be found in appendix 1.

Reports from manual searches were also included such as Public Health England reports and the Royal College of Midwives position statement. Further searches were conducted using periodic public dissemination by the UK Electronic Cigarette Research Forum (UKECRF), consistent with an iterative approach to ensure comprehensive exploration of the literature (Boulanger, 2017). An iterative approach is where the content or methodology of the search is adapted and refined after repeated analysis. Iterative analysis is more appropriate than only searching the literature once, as it ensures the search is up to date because of the continual addition of publications. UKECRF was used due to publications focusing on electronic cigarettes. Further papers were identified in this manner plus additional papers via backward chaining, resulting in a total of 41 selected for review. This

allowed more recent publications to be included in the search and ensured that no relevant papers were missed due to the contemporary and fast-paced nature of this specific area of research.

It is important to note that a narrative review has been peer reviewed and published in the British Journal of Midwifery alongside this thesis that explores many of the following pieces of literature relating to electronic cigarettes as a smoking cessation strategy in pregnancy (Broadfield et al., 2021). A copy of the publication can be found below.

Midwives' recommendation of electronic cigarettes as a smoking cessation strategy in pregnancy

Abstract

Introduction Electronic cigarettes have been described as a public health crisis. Approximately 10.6% of pregnant women smoke conventional cigarettes at the time of delivery, but the prevalence of e-cigarette use during pregnancy is unknown. **Objectives** To assess the extent of midwives' current knowledge and attitudes on electronic cigarettes as a smoking cessation strategy during pregnancy. **Methods** Electronic databases were searched. These were supplemented by manual searches, which were completed to include reports from Public Health England and the Royal College of Midwives. **Results** A total of 22 papers were identified, reviewed and are presented as a narrative literature review. Topics such as epidemiology, organisational stances, opinions of smoking cessation in pregnancy and opinions from stop smoking services were explored. There have been conflicting ideas regarding the use of electronic cigarettes in pregnancy and women who have recently given birth. **Conclusions** Whilst the current literature regarding electronic cigarettes as a smoking cessation strategy during pregnancy is well explored, there is no literature that investigates the attitudes of midwives and how this may affect their recommendation of e-cigarettes. The results of this study could serve as a point of reference for future clinical research, as well as clinical practice, by bringing to light the knowledge and attitudes midwives have regarding electronic cigarette use in pregnancy, and may be able to suggest some changes to improve the current practices.

Keywords

smoking cessation | pregnancy | midwives | narrative review | electronic cigarettes

Amy Broadfield
MSc student, School of Pharmacy, University of Lincoln, UK
15595202@students.lincoln.ac.uk

Dr Keivan Ahmadi
Professor of Pharmacology and Therapeutics, Lincoln Medical School, Universities of Nottingham and Lincoln, UK

Helen Ayre
Lecturer, School of Midwifery, University of Lincoln, UK

Electronic cigarettes (e-cigarettes) were first introduced in China in 2004 (Dockrell et al, 2013); however, their use has only become widespread in recent years (Bareham et al, 2016). An e-cigarette is a device that delivers nicotine to the lungs in the form of a vapour and can also be referred to as vaping. The prevalence of electronic cigarettes is ever-increasing, with around 3.6 million electronic cigarette users, a rise from the 700 000 vapers in 2012 (Action on Smoking And Health, 2019). Euromonitor, a market research group, have predicted that the rapidly expanding e-cigarette market will have around 55 million users by 2021 (British Broadcasting Company, 2018). According to data published by the NHS, the prevalence of e-cigarette use among pregnant women is unknown; however, approximately 10.6% of pregnant woman smoke conventional cigarettes at the time of delivery (NHS, 2018).

Background

The World Health Organization (2001) defines epidemiology as the study of the distribution of health-related events, including disease. There are few papers that discuss the epidemiology and incidence of electronic cigarette use in the United Kingdom (Beard et al, 2020). It is important to explore the success rates of smoking quit attempts in England. For example, it has been found that England has one of the lowest smoking rates in the world, and a high rate of successful quit attempts (Beard et al, 2020). In addition to this, it was found that the licensing of nicotine replacement therapies, such as e-cigarettes, for harm reduction purposes had a temporary positive impact on successful quit attempts (Beard et al, 2020). However, it has been stated that e-cigarettes are a 'public health crisis' (Walley et al, 2019), because of the increase in use amongst youth. It is claimed that the increase in use amongst young adults is the result of effective marketing and promotion of e-cigarettes.

In 2019, it was estimated that over 3.6 million adults in Great Britain were e-cigarette users, which is around 7% of the population (Action on Smoking And Health, 2019). Over half of these were ex-smokers, and the main

reason given for the use of e-cigarettes was to help them quit (31%). It was estimated, based on survey findings, that only 45% of the population agreed that e-cigarettes were less harmful than smoking, compared to 50% in 2018. Similarly, around a quarter of adults stated that they did not know how harmful e-cigarettes are compared to smoking (Action on Smoking And Health, 2019).

Methods

For this narrative review, Google Scholar and the electronic databases Scopus and Web of Science were searched. Manual searches also occurred for specific reports published by organisations such as Public Health England (PHE) and the Royal College of Midwives (RCM). To ensure that no relevant papers were missed, relevant databases, periodic publication dissemination by the UK Electronic Cigarettes Research Forum and search terms were used (Table 1).

An iterative approach was taken when searching databases (Boulanger, 2017), which is where the content or methodology of the search is adapted and refined after repeated analysis. Iterative analysis is more appropriate than only searching the literature once, as it ensures the search is up-to-date because of the continual addition of publications.

The search was mostly limited to papers published in 2016 or later; however, some earlier papers were included. Many of the papers were published in 2020.

A total of 50 papers were chosen from these searches. The title and abstract of each paper were read, and the most suitable papers were listed. A summary sentence was extracted from each paper, to further reduce the list to the most relevant papers. An activity was completed in which 10 relevant papers were taken and a summary of each was written in around 50 words (Table 2). Overall, 22 papers were used when writing the review. Reports from manual searches were included, such as PHE reports and the RCM position statement.

It was important that the chosen papers could be grouped together with results or themes so that similarities and differences could be identified between the papers. The papers in this review include both quantitative and qualitative methods.

Results and discussion

Organisational stances

Several relevant professional bodies advocate vaping as an alternative to conventional smoking because there is no 'safe level' of smoking during pregnancy (National Centre for Smoking Cessation and Training, 2019). The National Centre for Smoking Cessation and Training also state that if a pregnant woman chooses to use an e-cigarette to replace conventional smoking, she should not be discouraged from doing so by her midwife, as it is safer

Table 1. Search terms and respective number of results

Search terms	Results
'electronic cigarettes'	55300
'electronic cigarettes' and 'smoking cessation'	6950
'electronic cigarettes' and 'England'	3600
'electronic cigarettes' and 'epidemiology'	2880
'electronic cigarettes' and 'pregnancy'	1870
'electronic cigarettes' and 'pregnancy' and 'smoking cessation'	1290
'electronic cigarettes' and 'healthcare professionals'	618
'electronic cigarettes' and 'healthcare professionals' and 'pregnancy'	211
'electronic cigarettes' and 'midwives'	126

for an expectant mother than continuing to smoke. This raises the ethical question of whether they should be used for smoking cessation in pregnancy, as whilst they are not 100% safe, they are still safer than conventional cigarettes. Whilst some argue there remains a lack of evidence surrounding the effects of long-term use in pregnancy (Li et al, 2019), the NHS also take a similar stance in supporting electronic cigarette use in pregnant women as they state that current evidence indicates that e-cigarettes are much less risky than conventional cigarettes. Those advocating e-cigarette use in pregnancy appear to be of the opinion that whilst the vapour contains some of the harmful chemicals found in cigarette smoke, they are present at much lower levels than in conventional cigarettes, and whilst not completely risk free, the levels are significantly less harmful to a pregnant woman and her baby than smoking tobacco (NHS, 2019a). Also, if a pregnant woman reports that she has stopped using conventional cigarettes completely and has started using an e-cigarette, she should be congratulated in doing so (NHS 2019a; RCM, 2019).

Similarly, both the National Institute for Health and Care Excellence (NICE) and the NHS have published guidelines on smoking cessation interventions in England. NICE suggest that an e-cigarette starter pack within the stop smoking services would increase their attractiveness as a cessation strategy and may also increase their efficacy (NICE, 2018). These starter packs would include an e-cigarette device that would enable an individual to begin to use an e-cigarette as a smoking cessation strategy, in the hopes that they could continue this use by themselves. Overall, they highlight the duty of healthcare professionals to introduce smokers to e-cigarettes as a quit attempt, despite the unknown long-term risks. The NHS plan highlights the strategies they are implementing to tackle nationwide issues

Table 2. Ten most relevant papers

Title and author(s)	Summary of main points
Views on and experiences of electronic cigarettes: a qualitative study of women who are pregnant or have recently given birth <i>Bowker et al (2018)</i>	Vapes viewed positively by pregnant women. Seen as less harmful than smoking. Perceived social stigma means that some feel uncomfortable using vapes in public, especially during pregnancy. Concerns about safety and nicotine dependence. Midwives should provide pregnant women with up-to-date info and advice, and consider influence of social stigma
Attitudes to E-cigarettes and cessation support for pregnant women from English stop smoking services: A mixed methods study <i>Cooper et al (2019)</i>	Overall, 8.3% of stop smoking services were likely/very likely to advise the use of e-cigarettes in pregnancy; 56.9% were unlikely/very unlikely to advise using them. Interviewees were positive about the potential of e-cigarettes for cessation in pregnancy. Concerns about perceived lack of evidence for safety were expressed
Smoking and quit attempts during pregnancy and postpartum: a longitudinal UK cohort <i>Cooper et al (2017)</i>	A total of 850 pregnant women who were current smokers or had smoked self-reported their smoking behavior, quit attempts and quitting intentions. Intention to quit fell as the pregnancy progressed. Within 3 months of giving birth, one third of women who achieved abstinence during early pregnancy had returned to smoking
Impact of maternal e-cigarette vapor exposure on renal health in the offspring <i>Li et al (2019)</i>	Maternal exposure to nicotine-containing and nicotine-free vapour differentially altered inflammatory markers, suggesting nicotine is not solely responsible for harmful effects on a developing fetus. The impact of e-cigarettes on an offspring's health outcomes would not be fully elucidated by human epidemiological studies for at least 50 years
Survey of smoking cessation services and pregnant women's views on use of electronic cigarettes in pregnancy <i>Mann and Fallik (2018)</i>	Overall, 69% reported they advise pregnant women that e-cigarette use during pregnancy is a personal choice; 28% of pregnant women considered using e-cigarettes, 76% were unsure of the potential harms compared to smoking, and 62% were unsure if women should have the choice to use electronic cigarettes during pregnancy
Vaping in England: an evidence update February 2019 <i>Public Health England (2019)</i>	Stand by statement that vaping is 95% less harmful than smoking. Report that English stop smoking services have small proportion of quit attempts using a vape. Combining e-cigarette use and stop smoking services support should be a recommended option available to all current smokers. Midwives should receive education/training on using a vape in quit attempts
Impact of electronic cigarette aerosols on pregnancy and early development <i>Orzabal and Ramadoss (2019)</i>	Nicotine can permanently alter the intrauterine environment, and could compromise the physiological development of major fetal organ systems. Report outlines potential harm that exposure to e-cigarette aerosols during early life may have on offspring development. Pregnant women should not be advised to use e-cigarettes or any tobacco product during pregnancy
Perceived threats, benefits and barriers of e-cigarette use during pregnancy. A qualitative analysis of risk perception within existing threads in online discussion forums. <i>Schilling et al (2019)</i>	Subthemes were severe nicotine related health risks, potential health risks of additional ingredients, relative risks and lack of knowledge and research studies. Perceived benefits were possibility and facilitation of smoking cessation, harm reduction and financial benefits. Perceived barriers were lack of satisfaction and social stigma
Flavored electronic cigarette use, preferences, and perceptions in pregnant mothers: A correspondence analysis approach <i>Stroud et al, 2018</i>	Pregnant women may be vulnerable to the appeal of flavourings because of alterations in taste and cravings. Lack of differences in harm perceptions across flavours may relate to public health and education campaigns regarding dangers of tobacco use during pregnancy. E-cigarettes were perceived as less harmful than conventional cigarettes
Is it safe to vape? Analyzing online forums discussing e-cigarette use during pregnancy <i>Wigginton et al (2017)</i>	Analysis of discussion forum threads discussing use in pregnancy. Three distinctive ways in the debates; quitting nicotine cold turkey is unsafe, vaping is the lesser of two evils, vaping is not worth the risk. Need to educate and support women about harm reduction options

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such as obesity and smoking (NHS, 2019b). Within this plan, they state that all hospital admissions should be offered NHS-funded tobacco treatment services, to contribute to a smoke-free hospital environment. The plan will also be adapted for pregnant women, to ensure a smoke-free pregnancy, which includes focused sessions and treatments for both the pregnant woman and their partner, to contribute to a smoke-free home.

Both the RCM and the Royal College of Physicians (RCP) have released position statements regarding electronic cigarettes. The RCM statement emphasises that e-cigarettes contain toxins, but at a much lower level than toxins in tobacco smoke (RCM, 2019). In addition to this, the RCM state that there is no reason to believe that using an e-cigarette has adverse effects on breastfeeding, and whilst nicotine from vaping can cross the placenta, e-cigarettes do not contain as many toxic ingredients as conventional cigarettes do. Thus, e-cigarettes carry a smaller risk of harm to the health of the fetus. In fact, the RCP (2018) have estimated that e-cigarettes carry, at most, 5% of the risk of conventional tobacco. Overall, the position is that e-cigarette use should continue if it is helping a pregnant woman quit smoking and stay smoke-free. Despite this, the RCM believes that there is strong reasoning for testing the efficacy and safety of e-cigarettes as a stop-smoking treatment for pregnant women. The RCP position statement is particularly notable, as they released their first report on tobacco in 1962, wherein they alerted the public to the dangers of smoking (RCP, 1962). Their position statement concludes that despite not being completely risk free, vaping is still far less harmful than smoking tobacco, so should be favoured over conventional cigarettes (RCP, 2016).

Smoking cessation

E-cigarettes are particularly popular amongst young people, and there has been a slow increase in e-cigarette users that have never smoked conventional cigarettes (Action on Smoking And Health, 2019).

Studies that have investigated the role e-cigarettes have on smoking cessation have concluded that dual use is the most common activity; wherein a conventional cigarette smoker also vapes (Kasza et al, 2017). This could indicate that e-cigarettes may in fact be more popular as a complement to cigarette smoking rather than an effective alternative (Doyle et al, 2015).

Some research focuses on the change in smoking habits over time. Findings from a survey show that almost 14% of those who vape had attempted to quit e-cigarettes, whereas more than 50% of smokers had attempted to quit smoking (Jankowski et al, 2019), which is a similar conclusion to that of another study (Jackson et al, 2020). The rate of quit attempts was lower amongst dual users of e-cigarettes compared with other nicotine

replacement therapies such as nicotine patches; however in comparison with conventional cigarette smoking, quit attempt rates were higher (Jackson et al, 2020). This could reflect that people do not consider e-cigarettes as a smoking cessation tool, as they are reluctant to attempt to quit smoking when using vapes. On balance, it appears that users find e-cigarettes to be a safer alternative, hence the lower smoking rate in comparison with conventional cigarettes. However, some research suggests that participants felt nicotine patches were a more effective method (Jankowski et al, 2020).

There is conflicting evidence regarding the efficacy of e-cigarettes as a smoking cessation tool, when compared to nicotine patches. Several studies indicate that nicotine patches are a more effective method of smoking cessation (Walker et al, 2020; Jankowski et al, 2020; Jackson et al, 2020), whereas some research suggests the opposite (Hajek et al, 2019), finding that e-cigarettes were a more effective smoking cessation method than patches as they were more effective in alleviating withdrawal symptoms.

An emerging focus point in research explores the effectiveness of combining nicotine patches with e-cigarette use for smoking cessation (Walker et al, 2020; Hajek et al, 2019). One randomised study compared groups of participants allocated to receive either patches, patches and a nicotine e-cigarette, or patches and a nicotine-free e-cigarette (Walker et al, 2020). Overall, the researchers concluded that the best combination for smoking cessation were nicotine patches alongside a nicotine e-cigarette, as this group had a modest improvement in smoking cessation with 6 months smoking abstinence, suggesting that the combined use of e-cigarettes and nicotine patches as a smoking cessation method is worthy of further exploration.

However, it could be argued that whilst e-cigarettes as a smoking cessation tool promote harm reduction, they could also be used as a gateway to conventional cigarette smoking. Tobacco control assessed this and found evidence for the latter (Liu et al, 2020). Amongst those that regularly used e-cigarettes, the number that either started or re-started smoking conventional cigarettes when using e-cigarettes significantly exceeded those that quit smoking when using e-cigarettes. Therefore, it can be deduced that a higher proportion of the population are either turning to (or returning to) smoking conventional cigarettes because of the introduction of e-cigarettes into their lifestyle (Wang et al, 2020).

Another problem with the promotion of e-cigarettes as a smoking cessation strategy is the prevalence of e-cigarette, or vaping, product use-associated lung injury (Stanbrook and Drazen, 2020). It was found that lung injury is mainly a concern in people who are already suffering with chronic disease, such as chronic obstructive pulmonary disease or cardiovascular

disease. Patients who died from e-cigarette or vaping product use associated lung injury were nine times as likely to have chronic obstructive pulmonary disease and five times as likely to have cardiovascular disease than those who survived. It has recently emerged that vitamin E acetate was the main contributor to this type of lung injury, which is used in vapes as a thickening agent (Blount et al, 2020). The unknown effects of the mixture of different chemicals in e-cigarette vapour is harmful and can contribute to pulmonary toxicity. The conclusion is that e-cigarettes need to have strict regulation on manufacture and quality control to prevent another lung injury outbreak because of the vast use of e-cigarettes and the use of unregulated chemicals in the manufacturing process (Chand et al, 2020).

E-cigarettes are currently governed by general product safety regulations, which means the products can be put on the market without prior testing (PHE, 2016). Although e-cigarettes are not licensed medicines, they are regulated by Tobacco and Related Product Regulations 2016 (PHE, 2019). Currently, there are manufacturing standards that highlight the maximum tank capacity, container capacity and nicotine strength allowed. The Medicines and Health Regulations Authority must be notified prior to a product going on the market. At present, the manufacturing standards for e-cigarette ingredients are limited to no colourings, caffeine or taurine (PHE, 2016).

When looking at how vapour affects the kidneys, it has been suggested that there is an association between maternal smoking during pregnancy and the presence of proteinuria in their offspring at 3-years-old (Li et al, 2019). The report states that nicotine is considered a major contributor to kidney disease because of its ability to accumulate in the kidneys and secrete through glomeruli. They also found an association between maternal smoking during pregnancy and the presence of proteinuria in 3-year-old offspring, which is indicative of impaired kidney function. Many toxins in conventional cigarette smoke can pass the blood-placenta barrier and have a direct effect on foetal organs, including the kidneys (Li et al, 2019). Interestingly, research has also found that material exposure to vapour, both nicotine containing and non-nicotine containing, were associated with differentially altered inflammatory markers. This indicates that nicotine in e-cigarettes is not the only sole responsibility for the harmful effects on the developing fetus (Li et al, 2019).

A similar study published in 2019 explored the impact of e-cigarette aerosols on early development (Orzabal and Ramadoss, 2019). It was found that whilst no effects on early human development are currently understood, the effects of nicotine can permanently alter the intrauterine environment, which could compromise the physiological development of major fetal organ systems. The researchers

concluded that pregnant women should not be advised to use e-cigarettes, or any tobacco product, during their pregnancy, and that byproducts can pose a threat to non-users, such as newborn babies, through second-hand exposure (Orzabal and Ramadoss, 2019).

Smoking cessation in pregnancy

Based on the available evidence, PHE (2019) have released an evidence update regarding e-cigarettes, stating that vaping is 95% less harmful than smoking conventional cigarettes. PHE (2019) have also confirmed that e-cigarette use in young people has been gradually increasing in recent years, and just over a third of all current smokers in the UK have never tried an e-cigarette. They conclude that combining e-cigarette use and stop smoking service support should be a recommended option available to all current smokers, including those who are pregnant. PHE also state that all health professionals, including midwives, should receive education and training on using an e-cigarette in quit attempts.

However, there is some evidence that health professionals working in smoking cessation services are reluctant to advise e-cigarette use in pregnancy because of a perceived lack of evidence (Cooper et al, 2019; Mann and Faflik, 2018). The NMC express that midwives should always practise in line with the best available evidence, and that any advice given must be evidence-based, which may explain why some may feel a reluctance to advise in the perceived absence of evidence (NMC, 2020), though it should be noted that many of the professionals within these studies were not midwives and as such were likely to be registered with other professional bodies.

Preference and perceptions of flavoured e-cigarettes have been explored using a correspondence analysis approach (Stroud et al, 2019). The results found that because of alterations in taste, cravings and nausea during pregnancy, pregnant women may be vulnerable to the appeal of e-cigarette flavourings. The researchers completed a study exploring the use and preferences of e-cigarettes and found that 69% of users used menthol or mint flavours, as this closely mimicked the taste of menthol cigarettes. There was a lack of differences in harm perceptions across flavours, and this may relate to public health and education campaigns regarding the dangers of tobacco use during pregnancy (Stroud et al, 2019). Overall, the researchers concluded that pregnant women in the study perceived e-cigarettes as less harmful than conventional cigarettes.

Stop smoking services

In one mixed-methods study exploring the use of e-cigarettes as a cessation strategy for pregnant women in stop smoking services in England, which surveyed

managers of smoking cessation services about cessation support for pregnant women, it was found that only 2.2% of pregnant clients who had engaged with smoking cessation services were using e-cigarettes (Cooper et al, 2019). The low proportion of pregnant women using e-cigarettes within this study suggests that stop smoking services were not actively recommending e-cigarettes as a smoking cessation strategy. Only 8.3% of stop smoking services were 'likely' or 'very likely' to advise the use of e-cigarettes in pregnancy, whereas 56.9% of stop smoking services were 'unlikely' or 'very unlikely' to advise using them. The opinions of smoking cessation services are important, as they are usually responsible for providing services to pregnant women regarding smoking cessation. These findings are particularly significant because PHE recommends that stop smoking services should advise the use of e-cigarettes, including in pregnant women. In a similar study, it was established that 60% of stop smoking services reported that they did not have a specific policy on the type of e-cigarette advice they give to pregnant women using their services (Mann and Faflik, 2018). Almost 70% of stop smoking services reported that they advise pregnant women that the use of e-cigarettes during pregnancy is a personal choice, which suggests that they adopt a neutral stance, as opposed to following guidance to promote the practice of vaping over conventional smoking. In the same study, women completed a self-report questionnaire, which found that 28% of pregnant women had considered using e-cigarettes during pregnancy as a smoking cessation strategy, more than three quarters of pregnant women were unsure of the potential harms in comparison to conventional smoking, and 62% were unsure if women should even have the choice to use e-cigarettes during gestation. The researchers state that the main limitation to this study was the small number of services that responded to the survey compared to the overall number of stop smoking services in England. They also state that there is some self-selection bias in this study. These limitations show that further research is needed into the practices surrounding smoking cessation advice given to pregnant women.

Women's opinions and behaviours in relation to electronic cigarette use in pregnancy

There are conflicting opinions, presented within the literature regarding e-cigarette use in pregnancy and women who have recently given birth. For example, in an analysis of online discussion forums, it transpired that whilst the majority of opinions concluded that e-cigarettes contained fewer toxicants than cigarettes, there was little knowledge regarding long-term safety of use during pregnancy (Wigginton et al, 2017). Also, the paper concluded that as a result of the lack of knowledge,

it would be safer for a pregnant woman not to vape (Wigginton et al, 2017).

In a study that explored smoking and quit attempts during pregnancy and postpartum, it was found that 50% of women reported attempting to quit across all three trimesters (Cooper et al, 2017). All of the pregnant women involved were current smokers or had smoked previously. It also emerged that the intention to quit fell as the pregnancy progressed, and within 3 months of giving birth, one third of women who had previously achieved abstinence during early pregnancy had returned to conventional smoking (Cooper et al, 2017). The study concluded most smokers seemed less likely to continue to make quit attempts after giving birth, and many women who quit during early pregnancy returned to smoking. The main limitation highlighted in this study is that data were self-reported and so cannot be validated. Similarly, BMC Pregnancy and Childbirth published a qualitative study of women who were pregnant or who had recently given birth (Bowker et al, 2018). Unlike the first study, where a proportion of women returned to conventional smoking, in this paper, most participants believed that there was a harm reduction when using e-cigarettes during pregnancy in comparison to smoking, and so would prefer to use e-cigarettes than return to smoking. Despite this, many expressed a need for more safety information as well as further studies on the toxins and carcinogens in e-cigarettes and how these specifically affect mother and fetus. Moreover, perceived social stigma associated with vaping during pregnancy and feeling uncomfortable vaping in public were amongst the main reasons for these pregnant women not to use e-cigarettes while pregnant. This social predicament is an indicator of the complexity of the multifaceted problem of quitting smoking during pregnancy. Pregnant women are unsure about the use of e-cigarettes in pregnancy and want more information regarding this topic, but it can be argued that midwives and professionals working in smoking cessation services do not have the knowledge to provide this information. Many women are reporting that they do not understand the risks of using e-cigarettes during pregnancy and many smoking cessation services confirm that they do not have enough evidence on which to base their practice (Bowker et al, 2018). As there were only 123 participants in this study, it cannot be said that the results are representative of a wider population, because of the sample characteristics, hence they are not transferable.

In a similar vein, in a qualitative analysis on online discussion forums of perceived threats, barriers and benefits of e-cigarette use during pregnancy, a number of perceived benefits and barriers were identified (Schilling et al, 2019). The 'threat' subthemes pinpointed were severe nicotine-related health risks, relative risks, potential health risks of ingredients, and lack of knowledge and

Key points

- There is no present literature that investigates the attitudes of midwives and how this may affect recommendation of e-cigarettes.
- Existing research suggests that current recommendations are not translated into practice.
- It is essential to assess current midwifery attitudes and practice.
- Future work will explore how knowledge and attitudes held by a midwife may influence the likelihood of recommending electronic cigarettes in pregnancy.

research studies. The 'beneficial' subthemes pinpointed were the possibility and facilitation of smoking cessation, financial benefits, and possibility of harm reduction. The 'barrier' subthemes were social stigma and lack of nicotine satisfaction. Overall, the perception of e-cigarette use during pregnancy varied according to the perception of relative risks compared to conventional cigarettes (Schilling et al, 2019). A number of limitations were identified, including the lack of information of the participants because posts were anonymous. Therefore, the statements made could not be validated and so the study is not seen as representative.

Conclusions

To conclude, whilst the current literature regarding e-cigarettes as a smoking cessation strategy during pregnancy is well explored, especially surrounding the effects on fetal health and opinions of pregnant women, there is no present literature that investigates the attitudes of midwives and how this may affect their recommendation of e-cigarettes. This is an area of interest, as existing research suggests that current recommendations are not translated into practice by smoking cessation services, who are specialists within the area of practice. Therefore, it is essential to assess current midwifery attitudes and practice to identify if and how perceptions around vaping in pregnancy affect advice given to pregnant smokers and whether this is consistent with current professional recommendations on the subject.

Further study conducted by the authors aims to explore how the knowledge and attitudes held by midwives influence the likelihood of recommending e-cigarettes in pregnancy and investigates the factors that would influence midwives' recommendation of e-cigarettes as a smoking cessation strategy in pregnancy. It is important to identify the knowledge and attitudes held by this group of professionals in relation to vaping, and the influence that this has on their practice, as midwives are in regular direct contact with pregnant women who choose to smoke or vape, and as such may significantly impact upon the informed decisions made by pregnant women in relation to smoking cessation practices during pregnancy.

There is a clear gap for this research, which will potentially add more depth to the current literature on e-cigarettes as a smoking cessation strategy in pregnancy. The results of this study could serve as a point of reference for future clinical research as well as clinical practice by bringing to light the knowledge and attitudes midwives have regarding e-cigarette use in pregnancy, and thus may be able to suggest some changes to improve current practices. **BJM**

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Following on from my research regarding students' opinions on electronic cigarettes as a smoking cessation strategy, I found it was important to explore the opinions of midwives on the use of electronic cigarettes during pregnancy as I noted there was a recent push for vaping to be recommended in pregnancy.

There are different types of literature currently available, including those that view electronic cigarettes as an effective smoking strategy (Walker et al., 2020), those that view electronic cigarettes to be almost as harmful as conventional smoking (Liu et al., 2020), and those that explore the use of electronic cigarettes during pregnancy (Kreyberg et al., 2019). Recent evidence suggests that electronic cigarettes are safer than conventional cigarettes, so they may be a useful smoking cessation strategy for pregnant mothers who currently smoke (Royal College of Midwives, 2019).

The current literature surrounding the use of electronic cigarettes during pregnancy focuses mostly on the chemical effects on the foetus (Li et al., 2019). In addition to this, there are a number of studies that explore the perceptions held by mothers of e-cigarettes as a smoking cessation strategy in pregnancy, with most papers using surveys to determine this (Wigginton et al., 2017). However, there was no literature regarding the knowledge and attitudes of midwives on the topic of electronic cigarettes as a smoking cessation in pregnancy, hence why it is important to focus on this throughout this thesis.

Smoking Cessation

Electronic cigarettes are particularly popular amongst young people, and there has been a slow increase in e-cigarette users that have never smoked conventional cigarettes (Action on Smoking And Health, 2019).

The majority of previous studies that investigated the role e-cigarettes have on cessation have concluded that dual-use is the most common activity; wherein a conventional cigarette smoker also vapes (Kasza *et al.*, 2017). This could indicate that e-cigarettes may in fact be more popular as a complement to cigarette smoking rather than an effective alternative.

Most research focuses on the change in smoking habits over time (Jankowski *et al.*, 2020). 14,352 participants completed a questionnaire on smoking habits. It was found that more than half of these participants had attempted to quit smoking,

however only 13.9% of vapers had attempted to quit e-cigarettes. On average, cigarette smokers made three attempts to quit smoking, whereas electronic cigarettes users only made 1.5 attempts to quit vaping. The most popular cessation aid was nicotine patches, especially with dual users. Overall, it is evident from this paper that electronic cigarettes are not the chosen method of smoking cessation, as participants felt that nicotine patches were a more effective method.

In a similar study, nearly 1500 smokers participated in a survey investigating dual use and quit attempts (Jackson *et al.*, 2020). The paper found that the rate of quit attempts was lower among dual users of electronic cigarettes compared to other nicotine replacement therapies such as nicotine patches, however in comparison to conventional cigarette smoking, quit attempt rates were higher. This suggests that electronic cigarettes are a more effective smoking cessation strategy when an individual is a sole cigarette smoker, however other nicotine replacement therapies such as patches are more effective when an individual is a dual user.

Another focal point in research explores the effectiveness of combining nicotine patches with electronic cigarette use for smoking cessation (Walker *et al.*, 2020). The randomised groups had either patches, patches and a nicotine electronic cigarette, or patches and a nicotine-free electronic cigarette. Overall, the paper concluded that the best combination for smoking cessation were nicotine patches alongside a nicotine electronic cigarette, as this group had a modest improvement in smoking cessation with six months smoking abstinence. They also conclude that the combination of patches plus a nicotine electronic cigarette led to between three and seven in one hundred more smokers quitting long-term than the combination of patches and a nicotine-free electronic cigarette. These findings indicate that the replacement of a conventional cigarette with a nicotine electronic cigarette increases the likelihood of a successful quit attempt, suggesting that electronic cigarettes are an effective smoking cessation strategy.

In addition to this, Tobacco Control assessed whether electronic cigarettes were more used as a harm reduction tool or a gateway to conventional cigarette smoking; the results were the latter (Liu *et al.*, 2020). The paper conducted a survey in Italy of over fifteen thousand participants to investigate the effects of electronic cigarettes on smoking behaviour. The study showed that 1.1% of participants use electronic cigarettes regularly, which is an increase from the 0.4% in 2015. Among those that regularly used electronic cigarettes, the number that either started or re-started

smoking conventional cigarettes due to the use of electronic cigarettes significantly exceeded those that quit smoking due to the use of electronic cigarettes. Therefore, it can be deduced that a higher proportion of the population are either turning to (or returning to) smoking conventional cigarettes due to the introduction of electronic cigarettes into their lifestyle. Similarly, among those participants who were current smokers at the time of starting to use electronic cigarettes, only 17% reported stopping smoking. The paper also states that quitting smoking was 28% less likely in those that used electronic cigarettes than in those that did not use them. Finally, more than 80% of participants that started using electronic cigarettes continued to smoke conventional cigarettes. The paper concluded that electronic cigarettes seem to be a gateway to conventional cigarette smoking rather than a smoking cessation tool.

In addition to this, in a cohort study of e-cigarette use that had a four year follow up, it was found that a complete switch to e-cigarette use seemed to help conventional cigarette quitters to remain abstinent (Flacco *et al.*, 2019). They also found that after four years, 63.6% of the 228 e-cigarette users were still abstinent from smoking. In regard to dual users, the study found that the use of e-cigarettes in addition to conventional cigarettes did not improve smoking cessation or reduction. Similarly, less than one fifth of conventional smokers made an attempt to quit or to use an e-cigarette. In contrast, the vast majority of dual users and almost half of e-cigarette users changed their smoking status at least once throughout the study. Despite most dual users and e-cigarette users relapsing to conventional smoking alone, mainly within the first twelve months of the study, once an attempt to quit was made, the attempt was successful (Flacco *et al.*, 2019). Overall, the study concludes that dual use does not increase the likelihood of smoking reduction or cessation. The main limitation was that part of the information was self-reported so this cannot be validated.

Health Effects

Whilst electronic cigarettes are starting to be favoured over other nicotine replacement therapies such as patches (Hajek *et al.*, 2019), they have not yet been established as a completely safe alternative. The safety of electronic cigarettes has

been considerably researched, yet the long-term effects are still unclear (Li et al., 2019).

For example, there have been case clusters of respiratory syndromes related to electronic cigarette use. Pulmonary lipid-laden macrophages were explored in a subject that vaped, and it was found that the subject had acute respiratory distress syndrome (Maddock *et al.*, 2019). Lipid-laden macrophages could be seen with oil red O staining. The pathophysiological significance of these macrophages is not known, nor how they relate to the cause of the syndrome. His condition improved within seven days once he stopped using an electronic cigarette. The report concluded that the presence of lipid-laden macrophages could potentially suggest a vaping-related injury as diagnosis. Another problem with the promotion of electronic cigarettes as smoking cessation strategy is the prevalence of e-cigarette, or vaping, product use-associated lung injury (EVALI) (Stanbrook and Drazen, 2020). It was found that patients who died from EVALI were nine times as likely to have chronic obstructive pulmonary disease as those who survived EVALI, and five times as likely to have cardiovascular disease. It has recently emerged that vitamin E acetate was the main contributor to EVALI. The unknown effects of the mixture of different chemicals in electronic cigarette vapour is harmful and can contribute to pulmonary toxicity. The conclusion is that electronic cigarettes need to have strict regulation on manufacture and quality control to prevent another EVALI outbreak due to the vast use of electronic cigarettes (Stanbrook and Drazen, 2020).

In a review of the use, content, safety and effects of electronic cigarettes in Addiction, it was found that electronic cigarette aerosols contain similar toxins to conventional cigarettes, but at lower levels (British Broadcasting Company, 2018). There are a number of adverse effects associated with using e-cigarettes, such as throat irritation, dry cough, increase in blood pressure and lipid pneumonia. These adverse effects are further exemplified in an investigation by the British Medical Journal, who found that e-cigarettes emit reactive oxygen species and metals, all of which are toxic to the lungs (Gotts *et al.*, 2019). They found that users have reported negative symptoms involving their throat, airways and nose, and that e-cigarette use in the past month was associated with increased odds of reporting chronic cough or increased production of phlegm. The uncertainty of the health risks poses a challenge to clinicians as conventional cigarette smokers who are attempting to quit will be looking to clinicians for advice and support (Gotts et al., 2019). It is deduced

that vapers will be likely to have varying susceptibility to lung injury, influenced by genetic and environmental factors, and so it would be important to explore whether e-cigarettes alter the susceptibility to both bacterial and viral lung infections (Gotts et al., 2019).

As of October 2019, there have been over 1000 cases and 18 deaths in the United States of America related to the use of e-cigarettes (Thanavala and Goniewicz, 2019). The majority of the 1000 cases were related to gastrointestinal symptoms or respiratory symptoms. They found that e-cigarettes contain potentially harmful chemicals such as ultrafine particles and formaldehyde. Overall, they concluded that a single causative agent in e-cigarettes needs to be identified so that it can be banned (Thanavala and Goniewicz, 2019). However, there is uncertainty in this due to the huge variability in products and solvents, as well as the frequency of vaping.

E-cigarettes are currently governed by general product safety regulations, which means the products can be put on the market without prior testing (Public Health England, 2016a). Although e-cigarettes are not licensed medicines, they are regulated by Tobacco and Related Product Regulations 2016. (Public Health England, 2019). Currently, there are maximum manufacturing standards, which highlights the maximum tank capacity, container capacity and nicotine strength allowed. The Medicines and Health Regulations Authority must be notified before prior to a product going on the market. At present, the manufacturing standards for e-cigarette ingredients are limited to no colourings, caffeine or taurine (Public Health England, 2016b).

It is also important to explore the possible risks of increasing smoking initiation with the potential benefits of increasing smoking cessation (Warner and Mendez, 2019). The researchers created a background simulation model which concluded that the positive contributions of smoking cessation outweigh the negative impacts of smoking initiation (Warner and Mendez, 2019). They state that if electronic cigarettes help a small number of smokers to quit conventional cigarette smoking, even at the risk of additional young people becoming cigarette smokers, the benefits of public health will greatly exceed the potential costs of vaping-induced new smokers. Despite this, they say that public messaging should still strive to reduce their exposure to all nicotine and tobacco products. (Warner and Mendez, 2019).

Therefore, they conclude that e-cigarettes have a potential to improve public health, and that intensive vape use is associated with quitting rates. There were several limitations to this study, the main limitation being that there was limited evidence used to build the model. In future, there needs to be large longitudinal studies with large samples used. Also, more research is needed to determine whether e-cigarettes aid in smoking cessation, and if so, by how much (Warner and Mendez, 2019).

In addition to this, in a cohort study of e-cigarette use that had a four year follow up, it was found that a complete switch to e-cigarette use seemed to help conventional cigarette quitters to remain abstinent (Flacco *et al.*, 2019). They did not observe a lower rate of smoking related diseases or an improvement on self-reported health among e-cigarette users when compared with dual users or conventional smokers. Overall, the study concludes that the use of e-cigarettes alone or dual use did not significantly decrease the rate of tobacco-related diseases, nor did it improve health. There were some limitations to this study, such as there was no four-year data for at least one third of the initial sample. This was either due to losing contact with the participant, or that the participant was reluctant to be involved in the study for four years, which impacted the validity of reduction in smoking related illness (Flacco *et al.*, 2019).

Opinions of smoking cessation in pregnancy

Despite the differing views regarding the safety of vaping, electronic cigarettes are still used during pregnancy as a smoking cessation strategy even though their long-term effects on both mother and baby are unclear (Bowker *et al.*, 2018).

Online discussion forums have been analysed regarding electronic cigarette use in pregnancy, and it was found that the majority of opinions concluded that electronic cigarettes contained fewer toxicants than cigarettes (Wigginton *et al.*, 2017).

However, it was highlighted that there is little knowledge about the safety of use during pregnancy. Therefore, this study concluded that there were two main opinions; vaping is less harmful than smoking conventional cigarettes, or that vaping is not worth the risk to the unborn baby. This paper is specifically important as these two opinions highlighted are the common theme running throughout the research surrounding vaping during pregnancy (Wigginton *et al.*, 2017). It seems that on the

one hand, people agree that vaping is the lesser of two evils and should be encouraged rather than conventional smoking. However, it also seems that some believe that due to the lack of knowledge regarding electronic cigarettes and the unknown effects on a foetus, it would be much safer for the pregnant mother to neither smoke nor vape. They concluded that it was important to educate and support women regarding harm reduction options during pregnancy (Wigginton et al., 2017).

In a mixed-method study exploring the attitudes to electronic cigarettes as a cessation strategy for pregnant women in English stop smoking services, which surveyed managers of smoking cessation services about cessation support for pregnant women, it was found that 2.2% of pregnant clients were using electronic cigarettes (Cooper *et al.*, 2019).

8.3% of stop smoking services were 'likely' or 'very likely' to advise the use of electronic cigarettes in pregnancy, whereas 56.9% of stop smoking services were 'unlikely' or 'very unlikely' to advise using them. Overall, those interviewed were mostly positive about the potential for electronic cigarettes to be used as a cessation strategy, however the main concern expressed was the perceived lack of evidence for safety regarding electronic cigarettes, especially their use during pregnancy (Cooper et al., 2019). It was important to seek the opinions of smoking cessation services as they are responsible for providing services to pregnant women regarding smoking cessation. There were a number of limitations in this study. Researchers stated that the findings may not be representative of all stop smoking services in England. Similarly, they found that those that did respond to the survey may have misinterpreted some of the questions, as there seemed to be a lot of uncertainty in the results regarding whether to advise electronic cigarettes to pregnant women, and some of the responses were hard to interpret.

A similar survey was conducted on smoking cessation services and the views of electronic cigarette use during pregnancy (Mann and Faflik, 2018). An internet survey was conducted to assess the stop smoking services, and a self-report questionnaire was sent to pregnant women who were accessing a smoking cessation service. 60% of stop smoking services reported that they did not have a specific policy on the type of electronic cigarette advice they give to pregnant women using their services. 69% of stop smoking services reported that they advise pregnant women that the use of electronic cigarettes during pregnancy is a personal

choice. In relation to the self-report questionnaire, 28% of pregnant women have considered using electronic cigarettes during pregnancy as a smoking cessation strategy, 76% of pregnant women were unsure of the potential harms in comparison to conventional smoking, and 62% were unsure if women should even have the choice to use electronic cigarettes during gestation. The researchers state that the main limitation to this study was the small number of services that responded to the survey compared to the overall number of stop smoking services in England (Mann and Faflik, 2018). They also state that there is some self-selection bias in this study. In a longitudinal UK cohort study, which explored smoking and quit attempts during pregnancy and postpartum in which 850 pregnant women self-reported their smoking behaviours and quit attempts, it was found that 50% reported attempting to quit across all three trimesters (Cooper *et al.*, 2017). All of the pregnant women involved were current smokers or had smoked previously. It was found that the intention to quit fell as the pregnancy progressed, and within three months of giving birth, one third of women who had previously achieved abstinence during early pregnancy had returned to conventional smoking. The study concluded that those who quit smoking before pregnancy would be less likely to return to smoking postpartum than those who quit after learning they were pregnant (Cooper *et al.*, 2017). The main limitation highlighted in this study is that it was all self-reported data, so cannot be validated. Also, the survey occurred in only two hospitals so the results cannot be generalised. BMC Pregnancy and Childbirth published a qualitative study of women who were pregnant or who had recently given birth (Bowker *et al.*, 2018). The study consisted of telephone interviews to determine motivations for electronic cigarette use during pregnancy, as well as social stigma attached and harm perceptions. Most of the women interviewed believed that electronic cigarettes were less harmful to both mother and baby than smoking. However, most stated that they would feel uncomfortable about using electronic cigarettes in public due to the fear of being judged. Overall, most participants believed that there was a harm reduction when using electronic cigarettes during pregnancy in comparison to smoking, however many expressed a need for more safety information as well as further studies on the toxins and carcinogens in electronic cigarettes and how these specifically affect mother and fetus (Bowker *et al.*, 2018). The limitations to this study included that as there were only 123 participants, it cannot be said that the results are representative of a wider population. There is also a potential for bias due to the research only

being carried out in the UK. The researchers discuss that as electronic cigarettes have been widely advocated for as a safer alternative to smoking, this may introduce unconscious bias (Bowker et al., 2018).

It is also important to consider the perceptions and behaviours of cigarette and electronic cigarette use amongst pregnant smokers (McCubbin et al., 2020). Within this study, nearly 50% of participants stated they did not view e-cigarettes as a health hazard, but 50% of participants stated that e-cigarettes were harmful to both women and fetus. Similarly, most participants viewed e-cigarette use among women to be acceptable, however, far less viewed e-cigarette use among pregnant women as acceptable behaviour. The papers concluded that pregnant women should be given a clear message that most e-cigarettes contain nicotine, and there is no safe level of nicotine consumption during pregnancy.

Organisational stances

It is pivotal to take into account how maternity care providers are briefed on the topic of electronic cigarette use during pregnancy.

The Royal College of Physicians have released a position statement regarding electronic cigarettes (Royal College of Physicians, 2019). This statement is particularly important as the Royal College of Physicians released their first report on tobacco in 1962, wherein they alerted the public to the dangers of smoking (Royal College of Physicians, 1962). Their position statement concludes that despite it not being completely risk free, vaping is still far less harmful than smoking tobacco, so should be favoured over conventional cigarettes.

The National Centre for Smoking Cessation and Training (NCSCT) released a briefing for midwives in collaboration with Public Health England (National Centre for Smoking Cessation and Training, 2019), which states that women who stop conventionally smoking before 15 weeks of pregnancy can reduce their risk of spontaneous premature birth and low birth weight to the same as a non-smoker. They also state that as there is no 'safe level' of smoking during pregnancy, they advise midwives to promote nicotine replacement therapies to pregnant women. In regard to the briefing, if a woman reports that she uses electronic cigarettes only, she should be recorded as a non-smoker in her notes (National Centre for Smoking Cessation and Training, 2019). The NCSCTs' position in relation to electronic

cigarettes is that if a pregnant woman chooses to use an electronic cigarette to replace conventional smoking, she should not be discouraged from doing so, as it is safer for an expectant mother than continuing to smoke. Despite the lack of evidence surrounding the effects of long-term use in pregnancy, it is of their opinion that the toxicants in electronic cigarette vapour are at much lower levels than in conventional cigarettes, and whilst not completely risk free, the levels are significantly less harmful to a pregnant woman and her baby than smoking tobacco (National Centre for Smoking Cessation and Training, 2019). Similarly, if a pregnant woman reports that she has stopped using conventional cigarettes completely and has started using an electronic cigarette, she should be congratulated in doing so. However, the NCSCT still recommend licensed nicotine replacement therapies such as nicotine patches and gum (National Centre for Smoking Cessation and Training, 2019).

In addition to this, Public Health England have released an evidence update regarding electronic cigarettes (McNeill *et al.*, 2019). Within this update, they stand by their statement that vaping is 95% less harmful than smoking conventional cigarettes. They also found that electronic cigarette use in young people has been gradually increasing in recent years, and just over a third of all current smokers in the UK have never tried an electronic cigarette. Public Health England have reported that English stop smoking services have a very small proportion of quit attempts using an electronic cigarette, with only 4.1% of people using the services attempting to quit with a vape. They conclude that combining electronic cigarette use and stop smoking service support should be a recommended option available to all current smokers (McNeill *et al.*, 2019). Public Health England also state that all health professionals, including midwives, should receive education and training on using an electronic cigarette in quit attempts.

The National Institute for Health and Care Excellence (NICE) have published a guideline on smoking cessation interventions in England (National Institute for Health and Care Excellence, 2018). They have found that an increase in vaping is in correlation with a decrease in conventional cigarette smoking, suggesting that electronic cigarettes are an effective cessation strategy. NICE suggest that an electronic cigarette starter pack within the stop smoking services would increase their attractiveness as a cessation strategy and may also increase their efficacy. These starter packs would include an electronic cigarette device that would enable

an individual to begin to use an electronic cigarette as a smoking cessation strategy, in the hopes that they could continue this use by themselves (National Institute for Health and Care Excellence, 2018). However, they conclude that there is limited evidence that electronic cigarettes are effective in smoking cessation in England, and there are no long-term benefits or harms published as of yet. Overall, they highlight the duty of healthcare professionals to introduce smokers to electronic cigarettes as a quit attempt, despite the unknown long-term risks.

Furthermore, the National Health Service (NHS) have released a guide to stopping smoking during pregnancy (National Health Service, 2019a). They state that current evidence indicates that electronic cigarettes are much less risky than conventional cigarettes, and whilst the vapour contains some of the harmful chemicals found in cigarette smoke, they are at much lower levels. They also express that if using an electronic cigarette helps a pregnant woman stop smoking, then it is much safer for both mother and baby for her to do this than to continue smoking tobacco (National Health Service, 2019a). Unlike other nicotine replacement therapies, electronic cigarettes are not available on prescription from the NHS. However, expecting mothers are still offered free advice regarding electronic cigarettes.

The NHS have also released a long-term plan, highlighting the strategies they are implementing to tackle nationwide issues such as obesity and smoking (National Health Service, 2019b). Within this plan, they state that all hospital admissions should be offered NHS funded tobacco treatment services, to contribute to a smoke free hospital environment. The plan will also be adapted for pregnant women, to ensure a smoke-free pregnancy, which included focused sessions and treatments for both the pregnant woman and their partner, to contribute to a smoke free home. This strategy is particularly important because the NHS currently estimates that nearly a quarter of women in the UK smoke during pregnancy (National Health Service, 2019b).

Similarly, the Royal College of Midwives released a position statement to aid pregnant women in quitting smoking (Royal College of Midwives, 2019). The position statement highlights that electronic cigarettes contain toxins, but at a much lower level than toxins in tobacco smoke. Therefore, if a pregnant woman who conventionally smokes chooses to switch to an electronic cigarette to aid quitting smoking during pregnancy, she should be supported in doing so. Policymakers agree that women who exclusively use electronic cigarettes should be recorded as

non-smokers (Royal College of Midwives, 2019). In addition to this, the Royal College of Midwives state that there is no reason to believe that using an electronic cigarette has adverse effects on breastfeeding, and whilst nicotine from vaping can cross the placenta, electronic cigarettes do not contain as many toxic ingredients as conventional cigarettes do, so therefore carries a smaller risk of harm to the health of the foetus. In fact, the Royal College of Physicians have estimated that electronic cigarettes carry, at most, 5% of the risk of conventional tobacco (Royal College of Physicians, 2019). Overall, the position is that electronic cigarette use should continue if it is helping a pregnant woman quit smoking and stay smoke-free. Despite this, the Royal College of Midwives believe that there is strong reasoning for testing the efficacy and safety of electronic cigarettes as a stop-smoking treatment for pregnant women, and so a randomised control trial is currently underway (Royal College of Midwives, 2019).

Health concerns during pregnancy

An update on prevalence and risk of nicotine replacement therapies during pregnancy and breastfeeding found that the rapid increase in the use of electronic cigarettes ran parallel with the falling rates of conventional smoking (Kreyberg *et al.*, 2019). There were no prevalence data found on the use of nicotine replacement therapies during pregnancy and breastfeeding, and no evidence of an increased risk of stillbirths. Nicotine can be detected in human foetal circulation and amniotic fluid, showing that it can cross the placental barrier. Many of the adverse effects of smoking are mediated by nicotine, which suggests that electronic cigarettes are not safer than conventional cigarettes for the unborn child. Overall, the paper concludes that whilst the risk of adverse health effects on the offspring exposed to nicotine replacement therapies in pregnancy are conflicting, other ways to consume nicotine such as electronic cigarettes should be discouraged as they do not appear to be safe for the health of the foetus (Kreyberg *et al.*, 2019). The main limitations of this study were that there was limited detailed knowledge available, and that the results are based on old data, collected more than ten years ago.

In a similar vein, in a qualitative analysis on online discussion forums of perceived threats, barriers and benefits of electronic cigarette use during pregnancy, a number of perceived benefits and barriers were identified (Schilling *et al.*, 2019). The 'threat'

subthemes pinpointed were severe nicotine related health risks, relative risks, potential health risks of ingredients, and lack of knowledge and research studies. The 'beneficial' subthemes pinpointed were the possibility and facilitation of smoking cessation, financial benefits, and possibility of harm reduction. The 'barrier' subthemes were social stigma and lack of nicotine satisfaction. Overall, the perception of electronic cigarette use during pregnancy varied according to the perception of relative risks compared to conventional cigarettes (Schilling *et al.*, 2019). A number of limitations were identified, including the lack of information of the participants due to posts being anonymous. Therefore, the statements made could not be validated and so the study is not seen as representative.

Despite the Royal College of Midwives stating that there is no adverse effects on breastfeeding (Royal College of Midwives, 2019), there is still ongoing research surrounding vaping and breastfeeding, and it seems that safety opinions are conflicting, research shows that women are concerned about possible transfer of harmful products via breastmilk (Johnston *et al.*, 2019). It appears that little is known about women's opinions on using electronic cigarettes during the postpartum period, particularly when breastfeeding. The report identified four main themes in their qualitative study of online discussions; use, perceived risk, evidence, and social support. They found that the majority of women who were using electronic cigarettes were doing so to prevent a return to conventional cigarettes, but concerns were surrounding the possible transfer of harmful products via breastmilk (Johnston *et al.*, 2019). However, they concluded that the use of electronic cigarettes could potentially reduce the number of women who return to smoking postpartum as well as improve breastfeeding rates, if mothers had access to relevant and reliable information. Therefore, the report states that healthcare providers should consider discussing electronic cigarettes with pregnant mothers who are at risk of returning to conventional smoking after giving birth (Johnston *et al.*, 2019). There were several limitations to this report, the main one being that the responses came from only two different parenting forums, so there may be limited transferability. In addition to this, validity could not be established due to the posts being anonymous.

Effects on fetal health

Whilst long-term effects of electronic cigarettes on early human development are not currently understood, the effects of nicotine can permanently alter the intrauterine environment, which could compromise the physiological development of major fetal organ systems (Orzabal and Ramadoss, 2019). The paper concluded that pregnant women should not be advised to use electronic cigarettes, or any tobacco product, during their pregnancy, and that by-products can pose a threat to non-users, such as new-born babies, through second-hand exposure (Orzabal and Ramadoss, 2019). They have found that there is a perception that electronic cigarettes are safer than conventional cigarettes due to a reduced exposure to hazardous chemicals and tar, which may lead conventional cigarette smokers to switch to electronic cigarettes during gestation. This would explain the increasing numbers of electronic cigarette users during pregnancy. The main limitation in this paper was that there was limited data regarding electronic cigarette use in pregnancy.

There is also evidence that prenatal nicotine exposure causes a significant decrease in lung exposure and a slight increase in pulmonary resistance (Spindel and McEvoy, 2016). The use of electronic cigarettes during pregnancy exposes the fetus to nicotine, of which the developing lung is partially sensitive to. They also concluded that electronic cigarette use during pregnancy will be harmful to the fetal lung development. It was predicted that due to the addictive nature of nicotine, use of electronic cigarettes amongst pregnant women who usually conventionally smoke will increase. According to the study, around half of conventional cigarette smokers continue to smoke whilst pregnant (Spindel and McEvoy, 2016). They are confident that the data is strong enough to raise major concerns for electronic cigarette use during pregnancy, and that expecting mothers need to be educated on the effects to their unborn baby.

Similarly, it has been explored that many toxins in conventional cigarette smoke can pass the blood-placenta barrier and have a direct effect on foetal organs, including the kidneys (Li *et al.*, 2019). Therefore, electronic cigarettes are starting to become the favourable alternative for pregnant women. However, they have not yet been established as a completely safe alternative to conventional cigarettes. The results of the report showed that there was an increase in inflammatory responses in off-spring lungs in response to maternal vapour exposure (Li *et al.*, 2019). The conclusions drawn from this report state that smoking cessation during pregnancy is pinnacle in

optimising foetal health outcomes, and that continuous electronic cigarette use during pregnancy is detrimental to foetal development, exhibited by increased kidney markers of oxidative stress and fibrosis, independent of nicotine (Li *et al.*, 2019). The main issue regarding the use of electronic cigarettes during pregnancy is that the long-term health effects are unclear. The impact of electronic cigarettes on an offspring's health would not be fully understood by epidemiological studies for at least another fifty years. The limitations of this study included the fact that a low dose of electronic cigarette vapour was used, which would be representative of a light smoker. Also, the study only assessed offspring up to 13 weeks. The researchers suggest that using a range of temperatures and investigating offspring at older ages would further improve the study (Li *et al.*, 2019).

Another highly debated issue regarding electronic cigarette use in pregnancy is their effect on birthweight. When electronic cigarette users were compared to conventional smokers, it was found that infant birthweight was significantly higher in those that used electronic cigarettes (McDonnell *et al.*, 2020). The mean birthweights of babies born to smokers was similar to that for dual users. This could suggest that even reduced levels of smoking, due to the addition of an electronic cigarette, could positively affect the growth of the fetus during pregnancy. There were a few limitations to this study; the data on smoking status was collected only once, so participants could have changed their smoking status, therefore affecting results. Also, all data was self-reported, and smoking status was not verified by carbon monoxide testing. Conversely, in a report exploring the use of electronic nicotine delivery systems (ENDS) by pregnant women, it was found that that ENDS use can increase the risk of small-for-gestational-age-birth (Nguyen *et al.*, 2019). This was found by comparing the birth weights of ENDS users with conventional cigarette smokers, those exposed to second-hand smoke, and those that are completely unexposed (Nguyen *et al.*, 2019). Contrastingly, it could be argued that whilst concern remains over electronic cigarette use in pregnancy, due to the lack of data and knowledge on safety, the use of electronic cigarettes is not associated with low birth weight or preterm delivery (McDonnell *et al.*, 2019). Nicotine crosses the placenta and has an effect on both the foetus and the placental vasculature. Nicotine has been labelled a neuro-teratogen for its negative effects on foetal brain development. The report found that the babies born to electronic cigarette users had

a similar mean birth weight to non-smokers, and gestation was similar (McDonnell *et al.*, 2019). There were no cases of morbidity in this study. The research concluded that, in contrast to the previous study, electronic cigarette use in pregnancy does not cause low birth weight or preterm delivery. This shows that evidence surrounding birth weight is conflicting.

Studies in mice suggest that exposure to electronic cigarette aerosols resulted in both physiological and behavioural changes. (Nguyen *et al.*, 2019). Whilst it was found that maternal exposure to electronic cigarette aerosols after smoke exposure had no effect on litter size, it was found that offspring from mothers that switched to electronic cigarette aerosol exposure, or was exposed to continuous cigarette smoke during pregnancy, had a low birth weight and changes in offspring memory and hyperactivity (Nguyen *et al.*, 2019). Overall, the results confirmed that electronic cigarette use during pregnancy is not a safe option, despite electronic cigarettes being 'safer' than conventional cigarettes (Nguyen *et al.*, 2019). Abstinence from all nicotine delivery products should still be advised above all else. The main limitation of this study was that the results regarding DNA methylation was an overview and did not show specific methylated genes.

To conclude, whilst there is a growing body of continually emerging research in relation to the safety and efficacy of electronic cigarette use in pregnancy, much uncertainty appears to remain in the form of conflicting research findings and lack of evidence surrounding long-term effects on individual e-cigarette users and the developing fetus. Existing research suggests that this lack of evidence translates into uncertainty amongst smoking cessation professionals and services regarding how to best advise pregnant women.

Given the recent publication of UK guidance from both PHE and RCM recommending e-cigarettes as a smoking cessation strategy for pregnant women, it seems pertinent to further investigate the knowledge and attitudes midwives hold surrounding e-cigarettes and their use as a smoking cessation strategy during pregnancy. The results of this study may affect future clinical practice by bringing to light the knowledge and attitudes midwives have regarding electronic cigarette use in pregnancy, and thus may bring a change in recommendation.

Research question

The research seeks to explore how a midwives' knowledge and attitudes of all aspects of electronic cigarettes influence the recommendation for their use as a smoking cessation strategy in pregnancy.

It is important to deduce whether there is a link between these variables as there is a clear gap in the present literature for this research, and so could potentially add more depth to the current material. The results of this study may affect future clinical practice by bringing to light the knowledge and attitudes midwives have regarding electronic cigarette use in pregnancy, and thus may bring a change in personal practice and recommendation.

Aims and objectives

Aims:

Explore how the knowledge and attitudes held by a midwife influence the likelihood of recommending electronic cigarettes in pregnancy.

Objectives:

To measure midwives' knowledge and attitudes of all aspects of electronic cigarettes as a smoking cessation strategy in pregnancy.

To investigate the factors that would influence midwives' recommendation of electronic cigarettes as a smoking cessation strategy in pregnancy.

Methodology and Methods

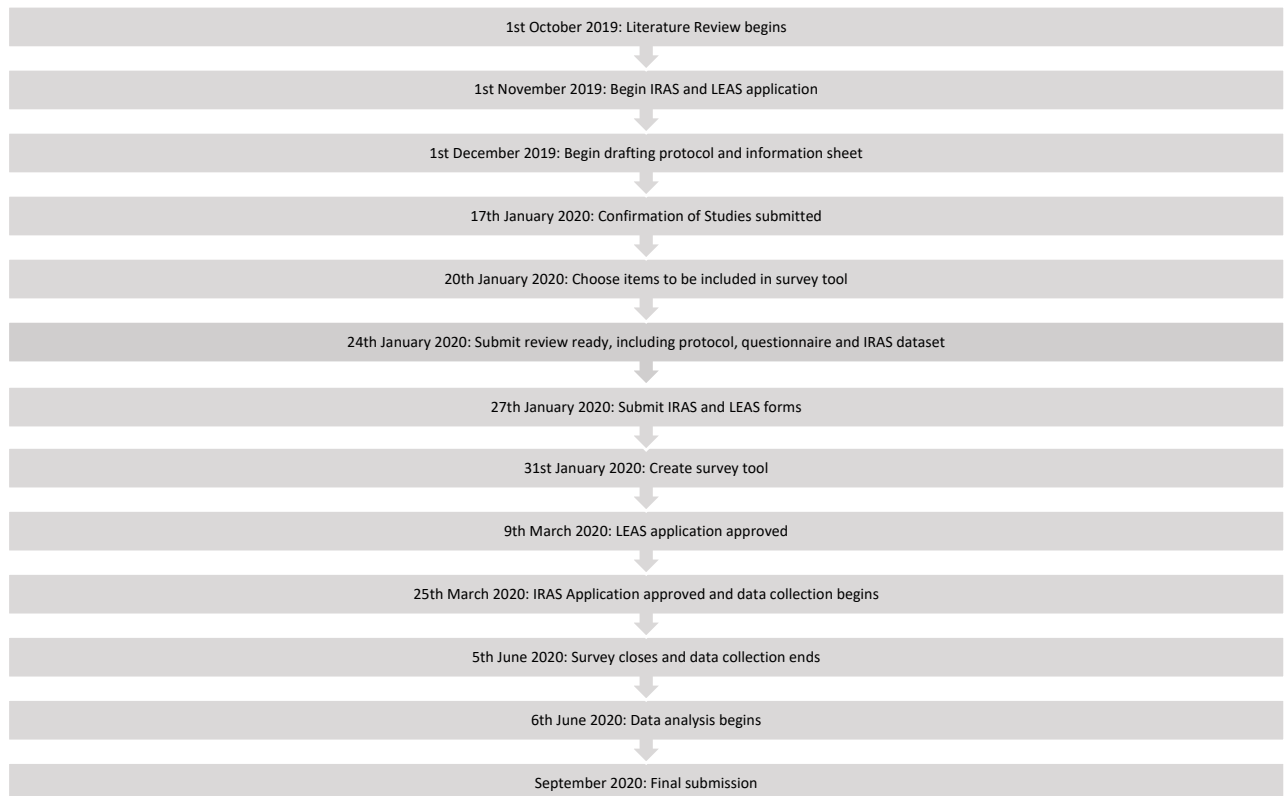


Figure 1: Workflow diagram to illustrate Masters process

Introduction to methods

Due to the uncertainty in practice of the recommendation of electronic cigarettes in pregnancy, it seems inevitable to further investigate the knowledge and attitudes midwives hold surrounding e-cigarettes and their use as a smoking cessation strategy. The hypothesis states that knowledge would be associated with a change in attitude towards pregnant women using e-cigarettes as a smoking cessation strategy. The thesis also seeks to find the influence knowledge and attitude has on practice.

The study was a mixed-methods QUANTI-quali. Mixed methods were chosen to gain a broader and deeper understanding of the research question (Creswell, 2009). This was so there was a complex approach to the research question that allows different perspectives to be compared. Mixed methods also allowed participants to have a voice and their answers were more specific as they were not confined to the given answers, like in the quantitative section, when completing the qualitative section.

This was due to the qualitative section being a free-text response, so participants had the opportunity to include as much information relevant to the question as they wanted. This was a contrast to the quantitative section as the participants could only respond with the selected responses, choosing the most suitable response if their choice was not available. The study was cross sectional with qualitative elements. Both quantitative and qualitative questions were implemented in the same questionnaire so that the data could be collected and analysed at the same time. This was a requirement in this study as it meant the survey was a one-time only survey and all results were collected in one place. Priority was given to the quantitative section, QUANTI-quali. This priority was given due to the qualitative research being used to support the findings produced from the quantitative section (Kroll and Neri, 2009). Also, quantitative data allowed for numerical analysis so that patterns and relationships could be identified.

Theoretical Framework

When designing the survey tool for this study, a number of theoretical models were considered before a suitable framework was chosen.

The theory of pragmatism was considered as this framework recognises that preliminary judgements are made with evidence at hand. This theory, also known as the 'theory of truth', states that if an idea works adequately and is efficient, the idea can be claimed as 'true' (Parvaiz *et al.*, 2016). However, there were some limitations to this framework, the most important being bias. Those that practice pragmatism and focus on action and practice therefore promote a utilitarian approach, and thus each individual has their own approach of interpreting (Garces, 2020).

Another framework considered for this survey tool was the theory of reasoned action, which predicts how individuals will behave based on their pre-existing attitudes and behavioural intentions (Dillard and Pfau, 2002). Decisions to engage in behaviours is based on the outcomes the individual expects will occur as a result of performing said behaviour. The theory ultimately states that the attitude towards a behaviour is a good predictor of that behaviour (Montano and Kasprzyk, 2015). The main limitation to this framework is that it does not consider that individuals can act on emotion and may not always make rational decisions (Coleman *et al.*, 2011).

The theoretical framework used when developing the survey was the knowledge, attitude, practice (KAP) theory model. The KAP theory model was developed in the 1970's, with one of the first examples of use being a critique of KAP studies (Cleland, 1973). The model states that by increasing an individual's knowledge there will be a change in attitude, which will be reflected in their overall practice (World Health Organisation, 2008). In the context of the hypothesis, this would mean that a midwife with more knowledge on e-cigarettes would have a change in attitude towards pregnant women who wish to use them, and this would therefore be represented in their practice. Ultimately, the model states that knowledge and attitudes are the driving force of behaviour change. The model assumes that the only obstacle to a change in attitude and practice is ignorance, and that acquiring knowledge alone is enough to influence behaviour and consequently alter practice (Hou, 2014). Therefore, the questionnaire fits the framework as a knowledge section and attitude section were included, as well as questions specific to practice.

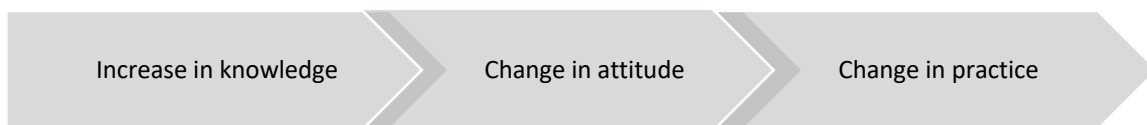


Figure 2: Illustration of KAP model

The KAP model was used to develop questionnaire items, as questions needed to measure the knowledge and attitudes of a participant. This was done by choosing potential contributing factors to a midwives' practice such as age and experience as a midwife, as well as history of successful care for a pregnant woman using an electronic cigarette and basing questions around these factors.

Sample Size Calculation

The sample size was calculated by considering the total number of midwives in England, as well as margin of error and confidence interval. The total number of midwives in England is around 21,000 (Royal College of Midwives, 2018). With a confidence interval of 95% and a margin of error of 6%, the sample size was 267.

Necessary Sample Size = $(Z\text{-score})^2 * StdDev * (1-StdDev) / (\text{margin of error})^2$

Necessary Sample Size = $((1.96)^2 * .5(.5)) / (.06)^2$

Necessary Sample Size = $(3.8416 \times .25) / .0036$

Necessary Sample Size = $0.9604 / 0.0036$

Necessary Sample Size = 267

Finite population correction factor = $n = N \times X / (X + N - 1)$

Finite population correction factor = $n = 21000 \times 267 / (267 + 21000 - 1)$

Finite population correction factor = $n = 264$

Final sample size = **264**

Due to the final sample size being 264, it was decided that twenty NHS trusts should be approached to ensure that the sample size was met. Therefore, twenty trusts were selected by a simple randomisation approach. All acute NHS trusts in England were assigned a number from one to one hundred and thirty-six in alphabetical order, and the twenty trusts were chosen using a random number generator. The following table shows the original randomly selected list of trusts and their respective randomly assigned numbers.

Assigned Number	NHS Trust
4	Barnsley Hospital NHS Foundation Trust
8	Birmingham Women's and Children's NHS Foundation Trust
17	Chesterfield Royal Hospital NHS Foundation Trust
23	Doncaster and Bassetlaw Teaching Hospitals NHS Foundation Trust
26	East Cheshire NHS Trust
34	George Eliot Hospital NHS Trust
35	Gloucestershire Hospitals NHS Foundation Trust
48	Lancashire Teaching Hospitals NHS Foundation Trust
55	Maidstone and Tunbridge Wells NHS Trust
71	Northumbria Healthcare NHS Foundation Trust
77	Poole Hospital NHS Foundation Trust
82	Royal Free London NHS Foundation Trust
93	South Tees Hospitals NHS Foundation Trust

95	South Warwickshire NHS Foundation Trust
97	Southport and Ormskirk Hospital NHS Trust
113	United Lincolnshire Hospitals NHS Trust
114	University College London Hospitals NHS Foundation Trust
117	University Hospitals Birmingham NHS Foundation Trust
119	University Hospitals Coventry and Warwickshire NHS Trust
131	Wirral University Teaching Hospital NHS Foundation Trust

Table 2: Table depicting original randomly selected NHS trusts

Simple random sampling was the chosen technique as it meant each trust had an equal chance of being chosen in the study, therefore reduces bias as there was no preference in trusts (Trivedi, 2017). Simple random sampling is also an example of probability sampling. Probability sampling was evident in the random selection of trusts, followed by an email being sent to all midwives employed there. Each NHS trust had an equal probability of being chosen, reducing bias and allowing for generalisability. (Acharya et al., 2013).

The study used a tool that was in the form of an anonymous questionnaire and gaged the knowledge and attitude midwives hold regarding electronic cigarettes. A survey tool was developed by adapting items from an already available, validated questionnaire to measure knowledge and attitudes of midwives regarding electronic cigarettes and their use as a possible smoking cessation strategy in pregnancy. The pre-validated questionnaire was taken from an undergraduate research project which explored knowledge and attitudes of university students regarding electronic cigarettes as smoking cessation strategy (Broadfield, 2019). Therefore, the questionnaire was re-validated by adapting the questions to be relevant to midwives in order to align with the context of the research. The questionnaire underwent face and content validity, as well as reliability testing. Content validity ensured that the questions represent what they were supposed to measure (Kumar, 2019). Face validity ensured that the questionnaire was covering and measuring what it was stated to, as well as pinpointing any errors to be corrected (Hardesty and Bearden, 2004). This was done by having multiple people, one expert and a number of

members of the public, check over the survey to highlight any errors or inconsistencies. Face validity gives a general measure that allows any obvious mistakes to be corrected. The items were edited to allow for the comments from face validity. Examples of how the questions were edited are evident in the table below.

Original Question	Change
“Do vapes contain formaldehyde?”	Question was removed from survey
“Are electronic cigarettes licensed?”	Question was replaced with “Are you aware of any NHS hospital that is encouraging pregnant women to quit smoking by using electronic cigarettes?”
“Electronic cigarettes are harmful to the fetus”	Statement was replaced with “E-cigarettes are 95% less harmful than smoking”

Table 3: Table to show edited questions after validity

An anonymous, forty-four question, internet-based survey was created using Qualtrics, and was distributed amongst NHS trusts in England by their respective research and development (R&D) departments. The study was sent to the research and development departments via email, which can be accessed on the NHS website. Twenty trusts were randomly selected to take part in the survey. The R&D departments were then asked to forward the email on to the midwives in their trust, meaning that participation remained anonymous and no work email addresses were known. After 6 weeks, the R&D departments were sent a reminder email, asking them to forward the email to the midwives in their trust, if they hadn't already done so.

An alternative recruitment method was proposed in the study protocol, to be used in the event of a low number of responses from midwives in NHS trusts, in order to

maximise recruitment and aim to ensure an adequate sample size was reached. This non-probability sampling method is outlined below and received approval from the research sponsor, the University of Lincoln Research Ethics Committee and the Health Research Authority. Participants were introduced to the study and invited to participate via closed Facebook midwifery groups and encouraged to share the survey information with other eligible contacts. It was anticipated that 3-4 closed professional Facebook groups would be identified, and an introductory post was drafted and approved. The questionnaire contained eligibility questions to maximise the likelihood that those participating meet the inclusion criteria. Permission was gained from group administrators to post the survey link, including the participant information sheet, to these groups. Those involved in the Facebook groups were encouraged to share the survey with eligible participants to increase response, an example of snowball sampling, which meant that whilst the survey was introduced in closed Facebook groups, recruitment was maximised by sharing outside of these, again an approach which was approved by the research sponsor, the University of Lincoln Research Ethics Committee and the Health Research Authority. The main drawback of this type of sampling is that, as a form of non-probability sampling, it can produce biased results, as not all members of the population have the same probability of being chosen (Acharya et al., 2013). The snowball sampling strategy, whereby a specific target for the sample study were encouraged to share the survey link and recruit those in their social network, can result in participants having homogenous characteristics (Etikan, 2016), as compared to a random probability sample. However, in this case it could be argued that this is advantageous as we are targeting a specific group with this study and it would increase responses from midwives. It could also be arguable that using social media to distribute the survey could increase responses from only a particular type of midwife, for example those that are younger, as they are more likely to use social media. However, in a recent article that analysed the statistics of Facebook users, it was found that 80% of thirty to forty-nine-year-olds and 72% of fifty to sixty-four-year-olds are active on Facebook (Aslam, 2020). This is compared to 88% of eighteen to twenty-nine-year-olds. Therefore, it is evident that there is opportunity for a wide demographic response. Also, it is beneficial for those that want to target a hard-to-reach sample group. This approach was included in the original IRAS and HRA documentation, which gained ethical approval in March 2020. It became necessary to utilise the Facebook

group approach as the primary recruitment method, due to the low number of responses received from NHS organisations due to the COVID-19 pandemic. 2 closed professional Facebook groups were identified and permission to post was sought from the administrators of the groups. Permission was obtained from one group ('Save Independent Midwifery' – a closed group with approximately 3500 midwifery and non-midwifery members) and not received from the other (Midwifery Education Facilitators), therefore only 1 closed group was used in the final recruitment strategy. These closed groups were chosen for pragmatic reasons (existing membership by the research team meant that invitations to participate could be posted in an accurate and timely manner in accordance with research approvals) and due to their membership of midwives nationally, which aimed to have a wider and more representative reach than recruiting via local closed groups. There were inclusion questions at the beginning of the survey to maximise the likelihood that those that were not eligible did not continue with the survey. Participants had to be qualified midwives currently practising as a midwife in England.

The survey questions were developed to include sociodemographic questions, knowledge questions, attitude questions, and three open-ended questions, and were divided into four sections respectively. There were 122 responses to the survey over a period that finished 5th June 2020. The questionnaire took approximately 15 minutes to complete. Qualtrics is a platform that enables users to create, adapt and distribute surveys, as well as gather and analyse results, and export the data (Barnhoorn *et al.*, 2015). Creating and editing surveys is extremely easy, and data from the surveys are saved directly to Qualtrics, so there was no potential for error in data entry. Also, Qualtrics allows users to create a multitude of question types, allowing flexibility for the researcher (Molnar, 2019).

The first section of the questionnaire contained sociodemographic questions, and these were included as a means of exploring whether independent variables such as age and years of practice influence the knowledge of electronic cigarettes and/or the attitudes and practice of electronic cigarette use in pregnancy.

The knowledge questions had 'yes' or 'no' responses which had a score of zero or one attached to it, 'one' for the correct answer and 'zero' for the incorrect answer.

The participants received a score on the fifteen knowledge questions asked; there was a minimum score of zero and a maximum score of fifteen. The knowledge questions were included in order to find the participants' knowledge regarding electronic cigarettes, which can then be compared to attitudes and variables to see if there is a relationship.

The attitude questions had 5 responses as a Likert scale from strongly agree to strongly disagree, and each response had a respective score from 4 to 0. Overall, there was a maximum score of seventy-two and a minimum score of zero. These were included for comparison to sociodemographic elements and knowledge to understand if there was an association. The two scores were analysed against several variables such as age and educational history to understand if there was a link between the attitudes and sociodemographic elements. The qualitative section was at the end of the questionnaire in the form of three open-ended questions. This allowed the participants to include more information and expand on any topics suggested in the fixed quantitative questions and were especially useful when seeking opinions and attitudes (Kumar, 2018). The qualitative responses were analysed by conventional content analysis to identify any key words or phrases. The study was cross-sectional as this allowed different variables to be explored at one time, and due to the QUANTI-quali questions, the results were both analytical and descriptive. The complete survey can be found in appendix 2.

The study was approved by the School of Pharmacy Ethics and Governance Committee.

COVID-19 Crisis

On 23rd March 2020, The UK government announced a lockdown in order to slow the spread of a new strain of Coronavirus, COVID-19 (Johnson, 2020). This followed on from the announcement on 12th March 2020 by the World Health Organisation that named COVID-19 a pandemic (World Health Organisation, 2020a). Consequently, on 19th March 2020 the NIHR Clinical Research Network announced that they were pausing the set-up of any study at NHS sites that did not prioritise COVID-19. Whilst the final decision was down to the NHS sites, this announcement meant that many of the initial selected NHS trusts declined involvement in the study (seventeen out of the initial twenty). Provision to include Facebook group recruitment

was always in the original protocol and IRAS application, however, the participant information sheet was edited to reflect this, allowing trusts who may decline participation to be taken into account. This allowed further sites to be chosen. The participant information sheet was edited to allow for additional sites to be randomly selected and for the recruitment via Facebook groups to occur concurrently with the recruitment via NHS trusts. This allowed for a larger population to participate. A further seventeen trusts were randomly selected to replace those that had previously declined involvement.

Ultimately, the most important matter was to follow government guidelines and respond to regulations in a way that least affected the research, whilst still staying safe. The promotion of safety of both participants and researchers can be further explained in the Declaration of Helsinki wherein it is the duty of the researcher to safeguard the health of participants and those involved in the research (The World Medical Association, 1964).

RStudio

The chosen programme for statistical analysis was RStudio (R Core Team, 2019). RStudio is a free integrated development environment that has many statistical features to aid data analysis (Komperda, 2017). The main advantage of using this particular software is that the user can analyse statistics at a beginner level using basic packages or at a higher level by downloading additional packages directly in the software (Racine, 2012). Users can also create their own codes and commands, which aids the overall skills development of the user and knowledge gained in data coding and analysis. Analysis on RStudio included chi squared tests, principle component analysis, bivariate analysis and multivariate analysis. Graphs can also be produced to enhance the visual effect of statistical presentation. It is free to download on public domain.

Reliability testing

The questionnaire underwent reliability testing to analyse internal consistency. Reliability testing measures the degree at which a procedure is replicable and whether the survey tool is consistent in what it is measuring (Taber, 2018). This was done using Cronbach's alpha in RStudio to find the reliability of the survey, and the

higher the reliability score, the more reliable the tool (Vaske *et al.*, 2016). The code for reliability testing can be found in appendix 3.

Statistical analysis

The data was exported from Qualtrics to Excel. The data was cleaned to remove any questions that had not been completed which could affect the results. If any of the participants answered 'no' to the questions, 'are you a practising midwife' and 'do you currently work in England', they were immediately taken to an end-of-survey page, wherein they were thanked for their time. However, their responses were still recorded, so these needed to be removed from the data as they were incomplete datasets. The data could then be imported into RStudio. Then, the data underwent statistical analysis. The data was presented using descriptive analysis in the form of tables, as well as inferential analysis using bivariate and multivariate analysis.

Bivariate analysis

Bivariate analysis was done to analyse the relationship between knowledge and attitude scores against covariates such as age, experience and smoking status.

Bivariate analysis analyses the relationship between two variables and the significance, if any, of an association between the two (Norušis, 2006). The result was binary.

Bivariate analysis gave a result using the chi square analysis to test relationships. A chi square test can be performed in RStudio using the function 'chisq.test'.

Attitude was analysed against knowledge, likelihood of recommendation, age, smoking status, and experience, and graphs of these were produced. A steeper slope on the graph suggests a stronger relationship between attitude and the variable.

Odds ratios were also used to measure the association between an exposure and an outcome (Norton *et al.*, 2018). In this case, odds ratios measured the outcome, likelihood of recommendation, and exposure to a risk factor, such as experience and age. It was important that the risk factors were dichotomous, so that the outcome of a particular exposure could be compared to the absence of that exposure. Hence, the risk factors knowledge, attitude, experience, age, status, training and care were

converted into dichotomous factors. An odds ratio of '1' shows that the odds of the outcomes are the same in each group (Loux et al., 2017). An odds ratio of '>1' shows that the rate of the outcome is increased in the exposed group. An odds ratio of '<1' shows that the rate of the outcome is reduced in the exposed group. These are presented with related confidence intervals.

Multivariate analysis

Multivariate analysis was done using linear regression models that presented predictors, interactions and covariates. The following covariates were used; Model 1 was used as a base model with no predictors present. This model instead explores the covariates of electronic cigarette use in pregnancy. The covariates were 'knowledge' and 'likelihood'. An explanation of these terms are further represented in appendix 4. All other models were compared to model 1. Model 2 had an added covariate of 'experience'. Model 3 had the covariates 'knowledge', 'likelihood' and 'care'. Model 4 had 'knowledge', 'likelihood', 'status' and 'care'. Model 5 has all of the covariates as well as 'care', 'training'. An explanation of these terms are further represented in appendix 4. Other models were created, however due to their insignificance they did not describe the data well, and therefore were not included.

The scores for each question were calculated using a downloadable RStudio package called FactoMinR, which allows the user to code questions to give a specific score for each answer (Molnar, 2019). This package was especially useful for multivariate analysis and can produce principal component analysis. The attitude answer categories were presented in a Likert scale from 'strongly agree' to 'strongly disagree', with answers ranging from 0-4. Therefore, the maximum attitude score that can be achieved is 72. A high attitude score meant a more positive attitude towards vaping. The knowledge answer categories were either 'yes', 'no', or 'don't know', with the correct answer scoring 1, and 'don't know' and the incorrect answer scoring 0. Therefore, the maximum knowledge score that can be achieved is 15.

Multivariate analysis was chosen due to the outcomes being binary, wherein the final outcome of the survey was that the participant either agreed or disagreed with the

final statement that electronic cigarettes should be recommended as a smoking cessation strategy in pregnancy (Evans and Li, 2005). This analysis tested the relationship between more than two variables in one data set and whether there was a significant association between them. Multivariate analysis also allowed for patterns to be found within a data set. Logistic regression considered the relationship between one dependent variable and one or more independent variables. Logistic regression can be done in RStudio using the (lm) function (Loraine et al., 2015).

Principal component analysis

The data was presented in scree plots and principal component analysis (PCA) plots. PCA analysed statistical patterns within data by the estimation of eigenvalues (Aït-Sahalia and Xiu, 2019). PCA also reduced the dimensionality of datasets and presented the patterns in an orthogonal graph (Jolliffe and Cadima, 2016). A scree plot determined the number of factors required in a principal component analysis by plotting factor numbers against eigenvalues (D'agostino and Russell, 2005). The elbow of the curve was indicative of the number of factors created by the analysis.

Open-ended questions

Conventional content analysis was used to analyse three open-ended questions at the end of the survey. Conventional content analysis allowed the researcher to design and develop categories based on the responses from participants (Hsieh and Shannon, 2005). Conventional content analysis was appropriate for this research because it allowed all of the participants' responses to be considered as they are not limited to specific, pre-written categories; an inductive approach to analysis. Key messages were identified from the responses and categories were developed.

Examples of questions

The following figures show examples of knowledge questions, attitude questions, and open-ended questions, respectively.

Is nicotine's metabolism (through inhalation) faster in pregnancy?

Yes

No

Don't know

Figure 3: Example of knowledge question included in survey; 'yes' scoring one point and 'no' or 'don't know' scoring zero.

Midwives should advise pregnant women to use electronic cigarettes to stop smoking during pregnancy.

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

Figure 4: Example of attitude question included in survey; 'strongly agree' scoring 0, 'agree' scoring 1, 'neither agree nor disagree' scoring 2, 'disagree' scoring 3, and 'strongly disagree' scoring 4

Please include any additional comments on the resources given to midwives regarding electronic cigarette use as a smoking cessation strategy in pregnancy.

Figure 5: Example of open-ended question included in survey which underwent content analysis

Ethical considerations

Due to the study recruiting NHS staff, an IRAS application was required (see appendix 5), as well as ethical approval from the University of Lincoln via the Lincoln Ethics Apply System, LEAS (see appendix 6). The supporting documents were prepared alongside the IRAS and LEAS applications. The supporting documents included protocol, participant information sheet and questionnaire. IRAS and LEAS applications were submitted 12th February 2020. LEAS approval was received on 9th March 2020. IRAS approval was received on 25th March 2020.

The consent form was incorporated into the questionnaire, after the participant information sheet and privacy notice. Participants were asked to give consent by checking a box to confirm they had read and understood the information sheet and privacy notice and were happy to continue onto the survey. Participants could not continue with the survey if they had not given consent to.

Although the design of the study and the research questions did not pose any risks to participants, one could argue that the participants may have felt they could not express their opinions if it went against what they were told to advise. They also may have felt reluctant to admit they had a lack of knowledge or understanding about this area of practice, so may have felt uncomfortable reporting if they did not follow current recommendations for practice. To address this, participants were assured that any opinions or comments they made remained completely anonymous, which hopefully increased the likelihood of honest responses and protected respondents from fear of professional repercussions.

Ethical Theory

When creating the approach to sampling and recruitment it was important to keep in mind the four pillars of medical ethics; which are autonomy, beneficence, non-maleficence and justice (Beauchamp et al., 2001).

These concepts helped inform the ethical approach in a number of ways. For non-maleficence, 'do no harm', it was explicit in the participant information sheet and protocol that the questionnaire was completely anonymous, and participants were assured that no comments or participant responses (including those related to knowledge or attitudes) would be shared with their trust, nor identifiable or

attributable to any individual in subsequent reports or publications. This enabled participants to respond in confidence. This maximised the likelihood that no harm was done to the participant as a result of participating in the research as they could suffer no professional backlash due to their comments. Additionally, it was made clear that participation was optional, therefore participants were free to decline to take part if they felt uncomfortable about doing so in any way. The anonymous nature of the invitation to participate, both an indirect and open invitation to participate via Facebook group, or by invitation received directly to potential participants, but via work email sent from NHS Research and Development department as the 'gatekeepers' (as opposed to directly via the researchers) further supported this principle by aiming to ensure that potential participants felt under no pressure to participate.

For beneficence, although there was no direct benefit to individuals, there was a duty to do good as the results could inform practice and improve future practice.

The research gained ethical approval from the Health Research Authority, showing that independent panels were confident in the ethical approach to the research.

Other key concepts of research ethics are consent and confidentiality. Informed consent was obtained prior to participants completing the questionnaire, and this was approved by the Lincoln Research Ethics Committee and the Health Regulation Authority. Consent could be withdrawn at any point by the participant simply exiting the questionnaire. Confidentiality was maintained by anonymity throughout the survey, as well as ensuring data protection and appropriate storage.

Data protection and storage

All study staff and investigators complied with the principles of the Data Protection Act 2018 by protecting the rights of study participants with regards to the collection, storage, processing and disclosure of personal information.

Data are kept in a secure, password-protected folder on University of Lincoln systems. Research data and the linking code were stored in separate locations. When stored electronically, this included using encrypted digital files within password protected folders and storage media.

Data will be stored for five years following the end of the study, so that the Chief Investigator may provide participants with a summary of the research should they wish to receive a copy.

Data generated as a result of this study was available for inspection on request by the participating physicians, the University of Lincoln representatives, the REC, local R&D Departments and the regulatory authorities. Data were collected between March 2020 and June 2020.

Results

The following figures are represented in the table below. More than one quarter of participants were likely or very likely to recommend e-cigarettes (27.8%), whereas more than half were undecided /neither likely nor unlikely to recommend e-cigarettes as a smoking cessation strategy (62.2%). Almost half of the participants stated they had received training on smoking cessation during pregnancy (47.5%). The most common age group were 30-49 (41.0%). More than half of the participants were neither a smoker nor a vaper, (53.3%), and 12.4% were currently vaping, compared to only 5.0% who were currently smoking.

Variable	Percentage of Participants
Age	
Below 25	21 (17.2%)
25-29	14 (11.5%)
30-49	50 (41.0%)
50-59	15 (12.3%)
60 or above	3 (2.5%)
Has received smoking cessation training	
Yes	58 (47.5%)
No	45 (28.6%)
How long a participant has been working since their graduation	
Less than 1 year	17 (13.9%)
1-5 years	30 (24.6%)
6-10 years	14 (11.5%)
11-15 years	23 (18.9%)
16-20 years	4 (3.3%)
21-25 years	3 (2.5%)
26-30 years	8 (6.6%)
More than 30 years	4 (3.3%)
Smoking status	
Neither a smoker nor a vaper	65 (53.3%)
Ex-smoker and currently vaping	9 (7.4%)
Ex-vaper and currently smoking	0 (0.0%)
Ex-smoker only	16 (13.1%)

Ex-vaper only	0 (0.0%)
Ex-smoker and ex-vaper	1 (0.8%)
Smoking only	6 (5.0%)
Vaping only	6 (5.0%)
Smoking and vaping	0 (0.0%)

Whether a participant has provided care for a pregnant woman who has successfully quit smoking due to the use of electronic cigarettes

Yes	56 (46.0%)
No	47 (38.5%)

Likelihood of recommending e-cigarettes

Very likely	5 (4.1%)
Likely	29 (23.7%)
Neither likely nor unlikely	32 (62.2%)
Unlikely	24 (19.7%)
Very unlikely	12 (9.8%)

Table 4: Description of study population

Quantitative Data Analysis

The following results section will present the findings of bivariate and multivariate analysis. Bivariate analysis was completed to determine the association between the dependent variable i.e., the attitude a participant has to the recommendation of electronic cigarettes to a pregnant woman as a smoking cessation strategy, and covariates such as likelihood of recommendation, ‘experience’, ‘age’, ‘training’ and ‘care’. An explanation of these codes can be found in appendix 4. Finally, multivariate analysis was performed using linear regression modelling, wherein four regression models were created.

Reliability testing

The questionnaire underwent reliability testing to analyse internal consistency. This was done using Cronbach’s alpha in RStudio to find the reliability of the survey, and the closer the reliability score is to 1, the more reliable the tool (Vaske *et al.*, 2016). It has been widely received that a score above 0.70 should be strived for (Nunnally and Bernstein, 1994), (Bolarinwa, 2015).

Score calculations for the knowledge and attitude domains

Knowledge and attitude scores were calculated to help with creating two variables, knowledge and attitude.

Attitude was interpreted as the attitude towards e-cigarette use during pregnancy as a smoking cessation strategy. The attitude answer categories were presented in a Likert scale from 'strongly agree' to 'strongly disagree', with answers ranging from 0-4. Therefore, the maximum attitude score that can be achieved is 72. The reliability for the attitude score test was 0.84. The desired reliability is 1 however a score of 0.84 shows that the attitude score test was a reliable model to use (Bolarinwa, 2015).

Knowledge was interpreted as knowledge of different aspects of e-cigarettes, vaping, safety information and practice. The knowledge answer categories were either 'yes', 'no', or 'don't know', with the correct answer scoring 1, and 'don't know' and the incorrect answer scoring 0. Therefore, the maximum knowledge score that can be achieved is 15. A summary of the responses to the knowledge questions can be found in appendix 7. The reliability for the knowledge score test was 0.70, which is an acceptable reliability. Scores were then expressed as percentage to make comparisons more readable for the bivariate and multivariate analyses. The RStudio statistical commands can be found in appendix 3.

Knowledge domain

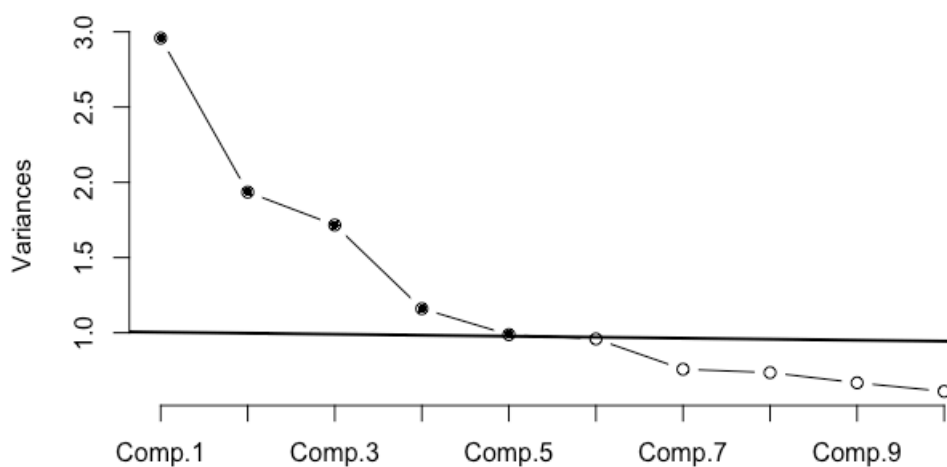


Figure 6: Scree plot to represent variance in knowledge survey data

The knowledge scree plot had an “elbow” at the fifth component, indicative of a five-component solution for the knowledge question.

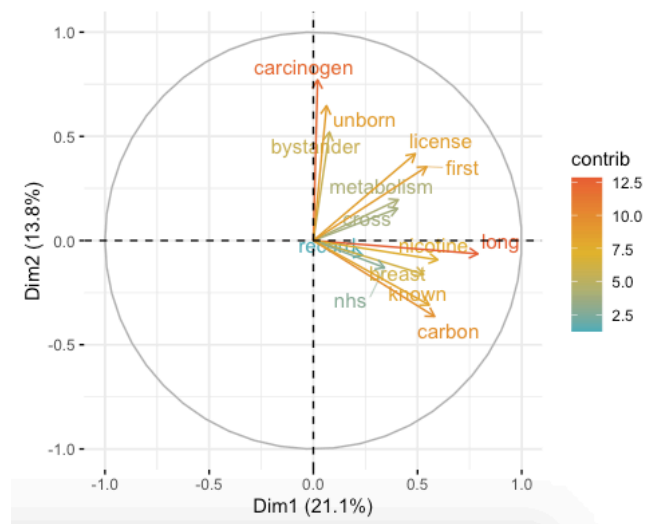


Figure 7: PCA showing dimensionality of the knowledge survey questions

Five components emerged from PCA with eigenvalues greater than one. The first component accounted for approximately 21% of the variance. The second component accounted for approximately 14% of the variance. Evident in the PCA plot, the knowledge questions consisted of two dimensions. Similarly, the two dimensions can be categorised into ‘scientific’ questions and ‘practice’ questions. The questions in the upper right quadrant were of a scientific nature, and the question marked ‘carcinogen’, which asked if electronic cigarette vapour contained carcinogens, had the most significant contribution to the knowledge domain in this quadrant.

The questions in the lower right quadrant more specifically involved practice, and the question marked ‘long’, which asked if there was evidence regarding the effects of long-term use of electronic cigarettes to unborn babies, had the greatest contribution to the knowledge domain in this quadrant. The question marked ‘record’, which asked participants if a pregnant woman who has switched completely to vaping

should be recorded as a non-smoker, had the least contribution to the knowledge domain in this quadrant.

Attitude domain

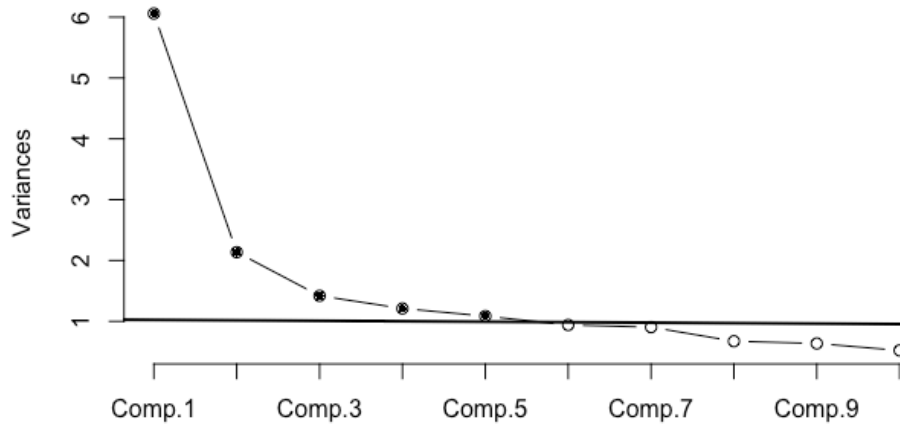


Figure 8: Scree plot to represent variance in attitude survey data

The attitude scree plot had a clear “elbow” at the fifth component, indicative of a four-component solution for the attitude question.

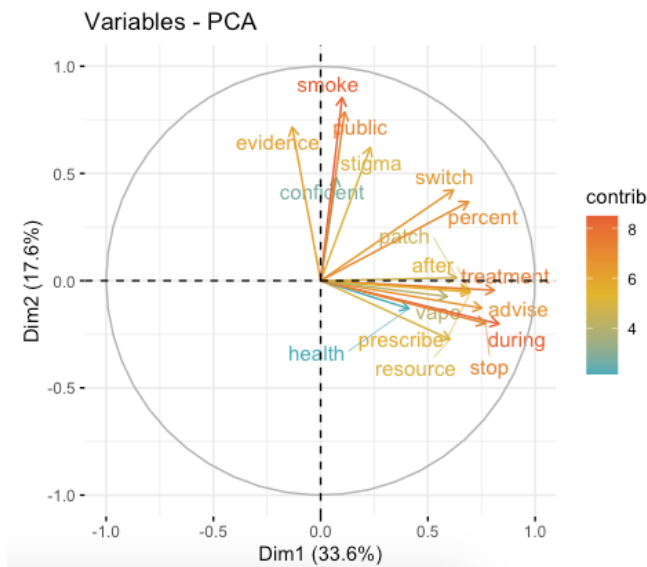


Figure 9: PCA showing dimensionality of the attitude survey questions

Two components emerged from PCA with eigenvalues greater than one. The first component accounted for approximately 34% of the variance. The second component accounted for approximately 18% of the variance. Evident in the PCA plot, the attitude questions consisted of two dimensions. The two dimensions can be further categorised into 'attitude' questions and 'practice' questions. The questions in the upper right quadrant were examples of 'attitude' questions, and the question marked 'smoke', which asked if it was socially unacceptable for a pregnant woman to smoke in public, had a significant contribution to the attitude domain in this quadrant. The question marked 'confident' which asked if participants were confident in advising women on the potential risks of using an electronic cigarette during pregnancy, had the least contribution to the attitude domain in this quadrant. The questions in the lower right quadrant more specifically involved practice, and the question marked 'during', which asked whether electronic cigarettes should be suggested as a smoking cessation strategy for women during pregnancy, had the greatest contribution to the attitude domain in this quadrant. The question marked 'health', which asked if potential health effects of electronic cigarettes are known, had the least contribution to the attitude domain in this quadrant.

Bivariate analysis

Bivariate analysis analyses the relationship between two variables and the significance, if any, of an association between the two (Norušis, 2006). Results of bivariate analyses of the relationship between attitude of recommendation and knowledge, likelihood, age, experience, training, care and status are presented in table 3. Significant associations are marked with an asterisk.

p value

In bivariate analysis, the p value determines whether the relationship observed in the data would exist in a larger population, by testing the null hypothesis (Perinetti, 2019). If the p value is higher than the significance level, the null hypothesis must be accepted as the data is not statistically significant, therefore it can be concluded that there is no relationship between experience, training and age regarding electronic cigarettes.

Table 5: Bivariate analysis comparing likelihood to covariates

Variables	Attitude			
	β	SE ²	95% CI	p
Covariates:				
Knowledge	-0.26***	0.076	-0.42 - -0.12	>0.001
Likelihood	-11.78***	2.73	-17.20 - -6.34	>0.001
Age	-0.74	3.38	-1.16 – 1.84	0.828
Experience	-1.57	2.88	-7.30 – 4.15	0.586
Training	-1.05	1.89	-4.82 – 2.72	0.581
Care	-3.97*	1.85	-7.65 - -0.30	0.035
Status	14.55***	3.91	6.75 – 22.34	>0.001

β is the regression coefficient i.e. the slope of the graph. SE² is standard error.

Knowledge had significant moderating effects on attitude. Figure 10 shows the negative association between attitude and knowledge, evident from the steep slope of the line, showing the strong association (-0.26, $p = >0.001$). That is knowledge reduced the attitude towards electronic cigarettes by 0.26 standard deviation, i.e. as knowledge increases, attitude towards e-cigarettes becomes more negative.

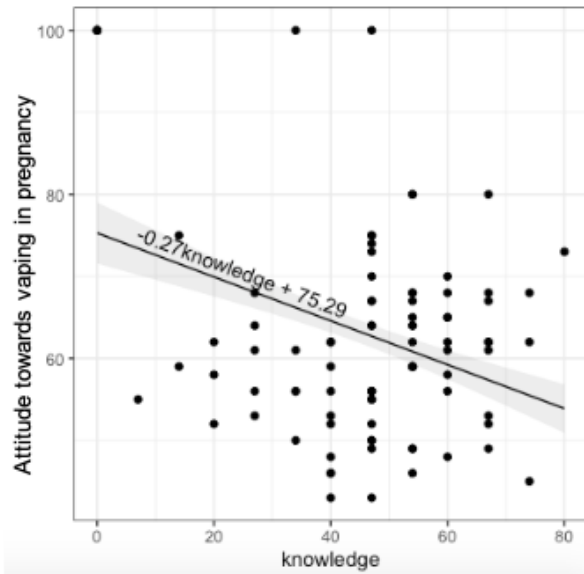


Figure 10: Bivariate analysis comparing attitude and knowledge

Likelihood of recommendation had significant moderate effects on attitude (-11.78, $p = >0.001$). That is likelihood of recommendation reduced the attitude towards electronic cigarettes by 11.78 standard deviation.

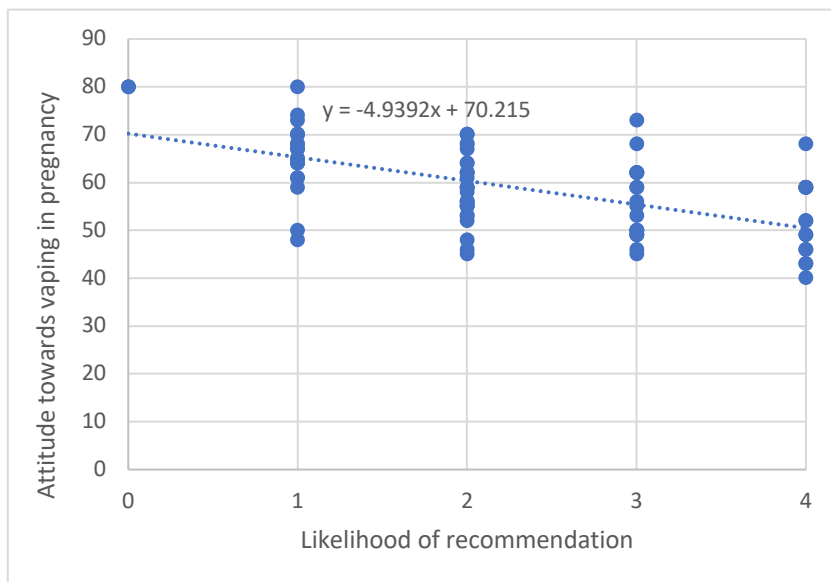


Figure 11: Bivariate analysis comparing attitude towards vaping in pregnancy and you

Care had significant moderating effects on attitude (-3.97, $p = 0.035$). That is care reduced the attitude towards electronic cigarettes by 3.97 standard deviation.

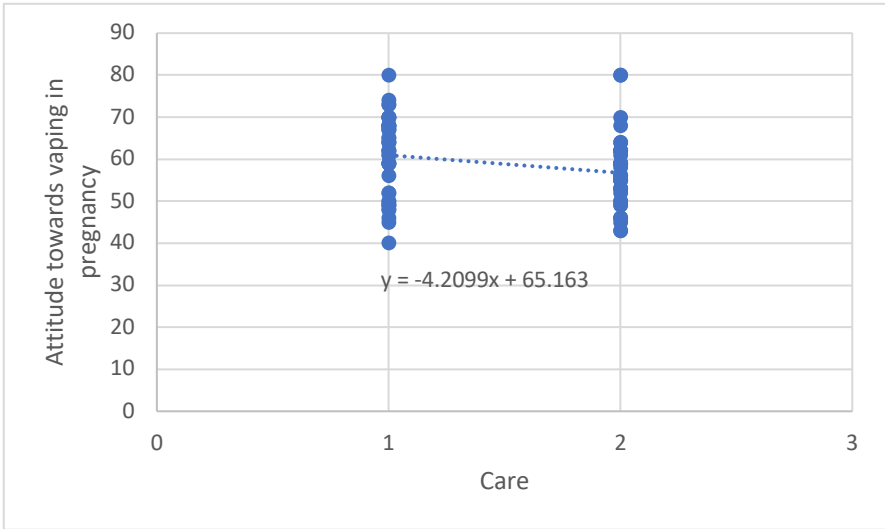
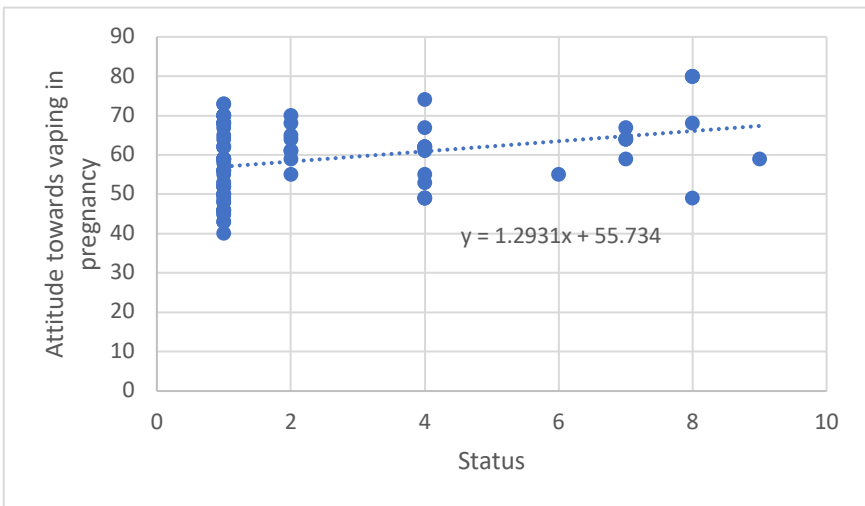


Figure 12: Bivariate analysis comparing attitude and care

Smoking status had significant moderating effects on attitude (14.55, $p = >0.001$). That is a positive smoking status increased the attitude score by 14.55 standard deviation. The positive effect of attitude towards recommendation of electronic cigarettes as a smoking cessation strategy can be further represented in figure 13. The positive slope of the graph highlights the positive relationship between attitude and smoking status.

Figure 13: Bivariate analysis comparing attitude and status



Age (-0.74, $p = 0.828$), experience (-1.57, $p = 0.586$), and training (-1.05, $p = 0.581$) had no statistically significant moderating effects on attitude.

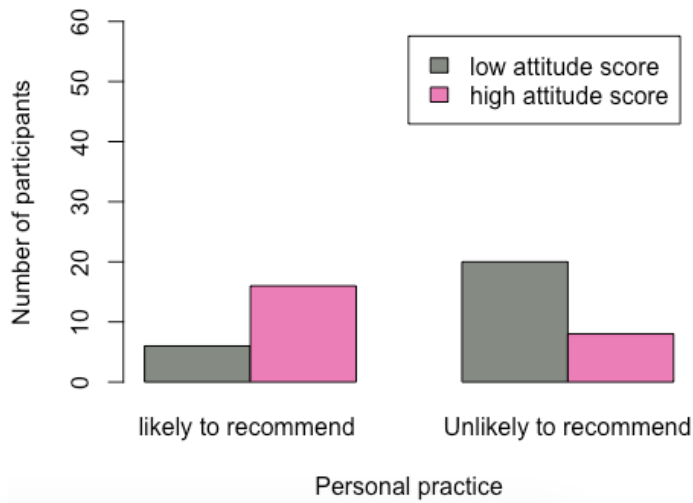
The variables were converted into dichotomous variables to allow for odds ratios to be calculated. 'Knowledge' was divided into 'high knowledge' and 'low knowledge'. The highest knowledge score a participant received was eighty and the median was forty six, therefore the 'high knowledge' was between forty six and eighty, and 'low knowledge' was between zero and forty five. 'Attitude' was divided into 'high attitude score' and 'low attitude score', whereby 'high attitude' corresponds to a positive attitude and 'low attitude' corresponds to a negative attitude. The highest attitude score a participant received was one hundred and the median was sixty one, therefore the 'high attitude' was between sixty one and one hundred, and the 'low attitude' was between zero and sixty. 'Age' was divided into 'below 50' and 'above 50'. 'Experience' was divided into 'less than 16 years' experience' and 'more than 16 years' experience'. 'Status' was divided into 'currently smoking or vaping' and 'not currently smoking or vaping'. 'You' was divided into 'likely to recommend' and 'unlikely to recommend'. 'Training' and 'care' were already dichotomous variables.

Box plots and bar plots

Variable	Odds ratio
Knowledge	0.79
Experience	1.19
Age	0.57
Smoking status	0.07*
Training	0.18*
Care	2.70*

Table 6: Table to show variables and their respective odds ratios. Significant results are bold and marked with an asterisk

Figure 14: Bar plot to show association between attitude and likelihood of recommendation



Participants with a low attitude score, a more negative attitude towards e-cigarettes, were more unlikely to recommend them as a smoking cessation during pregnancy. In contrast, those with a high attitude score, a more positive attitude towards e-cigarettes, were more likely to recommend them as a smoking cessation strategy during pregnancy. The odds ratio could not be calculated as one of the participants scored zero on the attitude section.

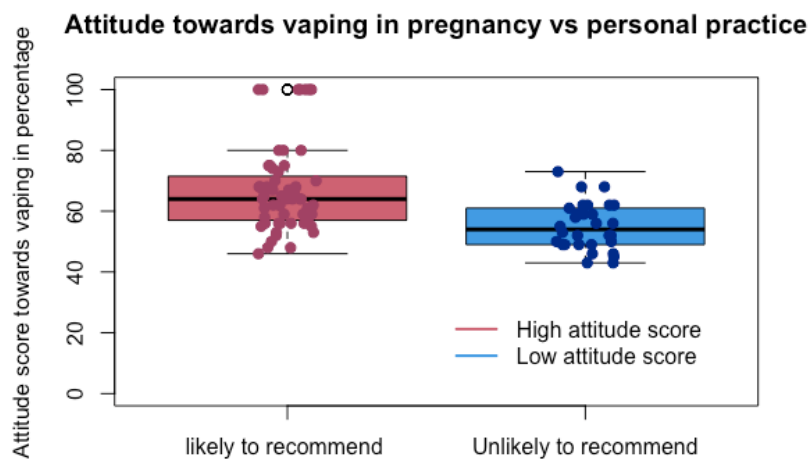
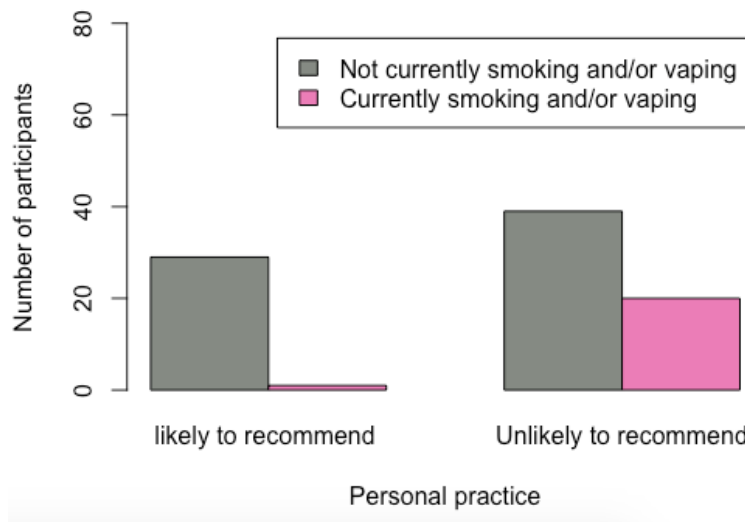


Figure 15: Box plot to show association between attitude and likelihood of recommendation

Figure 15 shows a box plot representing the distribution of data between a participants' attitude and their likelihood of recommendation, participants with a

higher attitude score, that is a more positive attitude towards vaping in pregnancy, were more likely to recommend electronic cigarettes as a smoking cessation strategy in pregnancy.

Figure 16: Bar plot to show association between smoking status and likelihood of recommendation



Participants who were not currently smoking or vaping were more unlikely to recommend electronic cigarettes as a smoking cessation strategy in pregnancy. Odds of recommending e-cigarettes were more than ten times lower in midwives who do not currently smoke or vape, compared to those who currently smoke or vape (OR 0.07), and this was statistically significant (95%CI = 0.01 - 0.56).

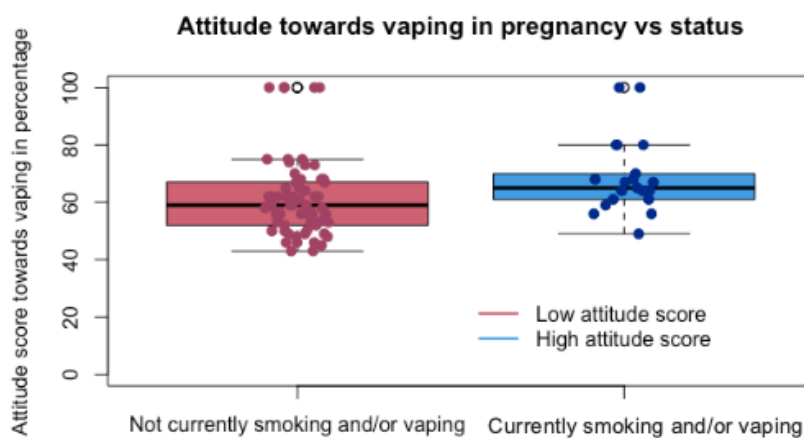
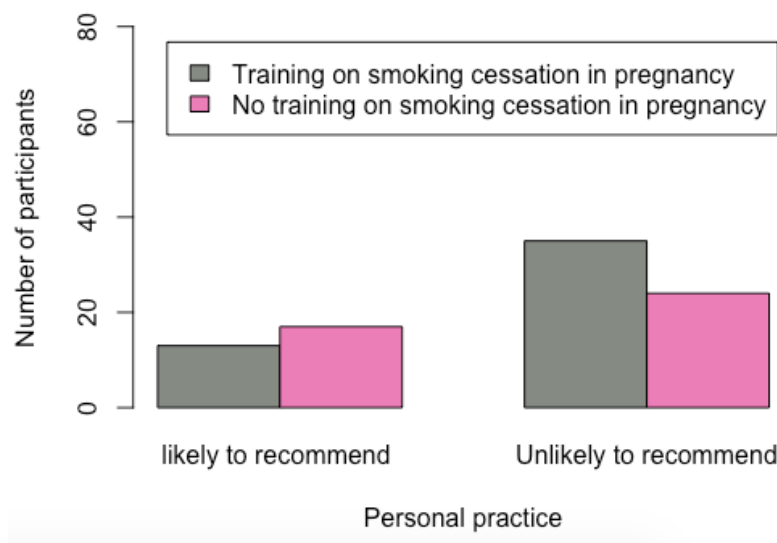


Figure 17: Box plot to show association between smoking status and likelihood of recommendation

This figure shows a box plot representing a participants' smoking status and their attitude towards vaping in pregnancy. It shows that those who currently smoked and/or vaped had a more positive attitude towards recommending electronic cigarettes as a smoking cessation strategy during pregnancy. In contrast, participants who do not currently smoke or vape had a lower attitude score, that is a more negative attitude towards vaping in pregnancy.

Figure 18: Bar plot to show association between training and likelihood of recommendation



Participants who had not received training regarding smoking cessation in pregnant women in the last two years were more unlikely to recommend e-cigarettes as a smoking cessation strategy. Odds of recommending e-cigarettes was lower in midwives who had not received training on smoking cessation in pregnancy, compared to in midwives who had received training on smoking cessation in pregnancy (OR = 0.18, 95%CI = 0.07 – 0.49).

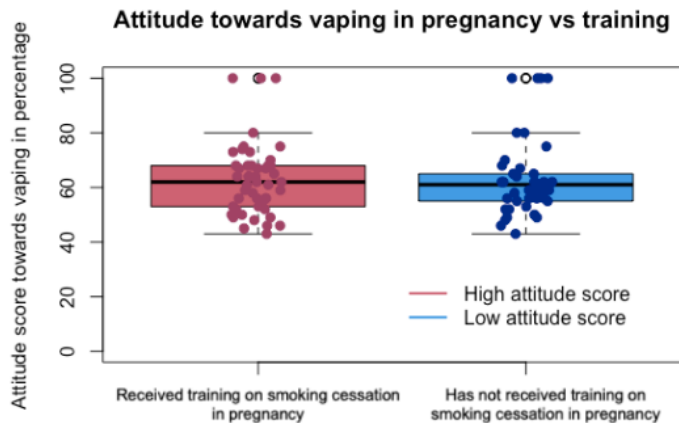
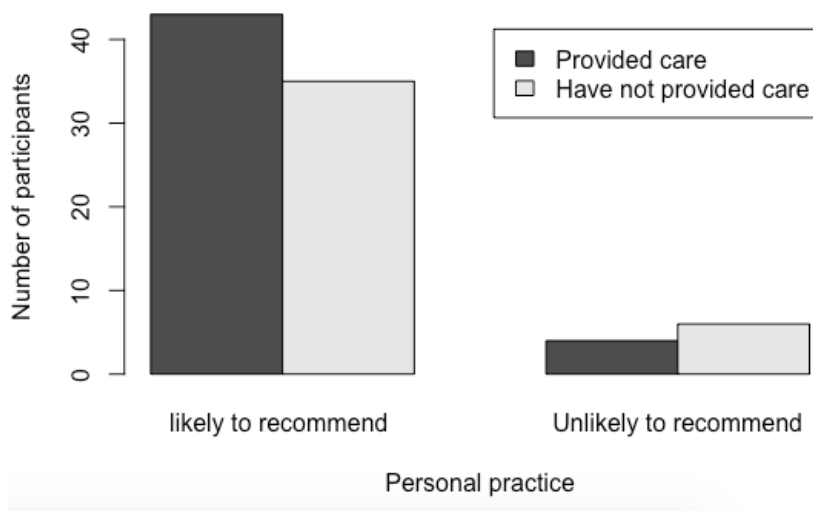


Figure 19: Box plot to show association between training and likelihood of recommendation

Figure 19 shows a box plot representing a participants' training and attitude towards vaping in pregnancy; a participant who had received training on smoking cessation in pregnancy had a higher attitude score, that is a more positive attitude towards vaping in pregnancy.

Figure 20: Bar plot to show association between care and likelihood of recommendation



Participants who had cared for a pregnant woman who had successfully quit smoking due to using an electronic cigarette were more likely to recommend e-cigarettes as a smoking cessation strategy in pregnancy. Odds of recommending e-cigarettes in midwives who had provided successful provision of care were almost

three times higher in comparison to midwives who had not provided care to a pregnant woman who had successfully quit smoking due to using an e-cigarette (OR = 2.70), and this was statistically significant (95%CI = 1.09 – 6.71).

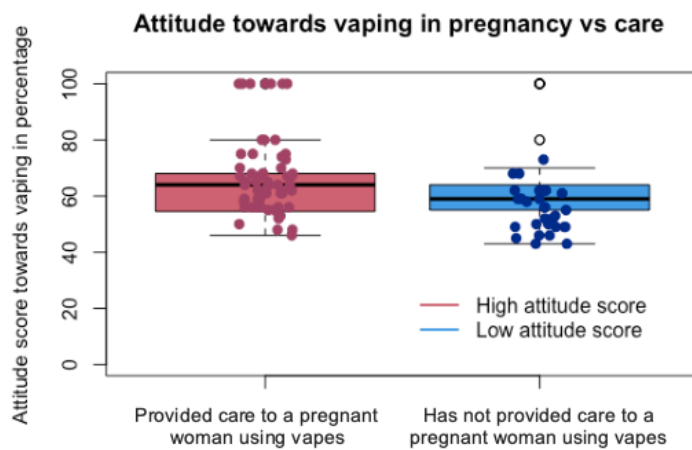


Figure 21: Box plot to show association between care and likelihood of recommendation

Figure 21 shows a box plot representing whether a participant has provided care for a pregnant woman who used electronic cigarettes. It shows that participants who had not provided care for a pregnant woman had a lower attitude score towards vaping, that is a more negative attitude. Participants who had provided care to a pregnant woman who had successfully quit smoking due to the use of vapes had a higher attitude score, that is a more positive attitude towards vaping in pregnancy.

There was no significant association between personal practice and knowledge, (OR = 0.79, 95%CI = 0.32 – 2.19), personal practice and age (OR = 0.57, 95%CI = 0.23 – 1.43), or personal practice and experience (OR = 1.19, 95%CI = 0.33 – 2.12).

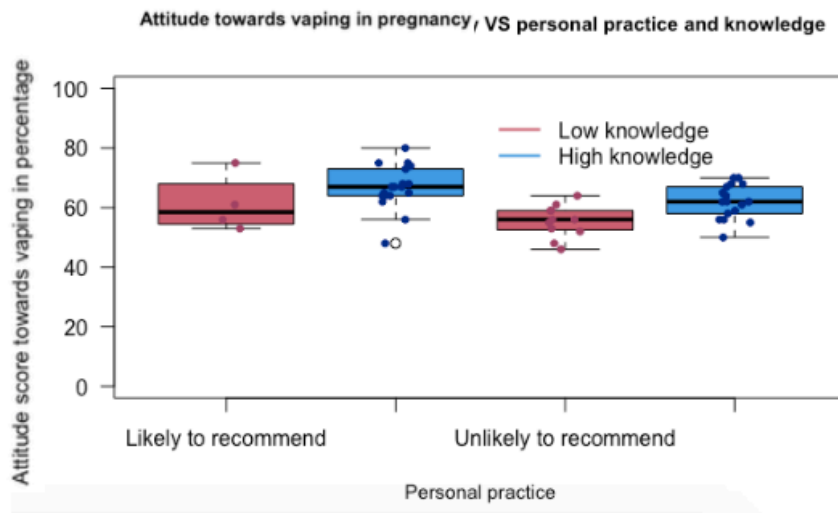


Figure 22: Box plot representing KAP model

Figure 22 shows a box plot representing the KAP model. The box plot furthest right shows that those who had a higher knowledge score but a lower attitude score were more unlikely to recommend electronic cigarettes during pregnancy as a smoking cessation strategy.

Linear regression models

Table 6 shows the four models that were created as well as their respective covariates, interactions and predictors. Standard deviation and 95% confidence intervals are also included in the table. Any data marked with an asterisk has been highlighted as significant. Likelihood and knowledge were consistently significant throughout all four models. Care was significant in models three and four.

Table 7: Linear Regression models estimates of attitude towards recommendation

Variables	Model 1 (Base Model)				Model 2				Model 3				Model 4			
	fit=lm(attitude ~ you + knowledge, data = amy)				fit=lm(attitude ~ knowledge * experience + you, data = amy)				fit=lm(attitude ~ knowledge * care + you, data = amy)				fit=lm(attitude ~ you * knowledge * experience * status * age * training * care, data = amy)			
	β	SE ²	95% CI	p	β	SE ²	95% CI	p	β	SE ²	95% CI	p	β	SE ²	95% CI	p
Covariates:																
Knowledge	-0.22***	0.068	-0.36 -- 0.09	0.0012	-0.21***	0.089	-0.38 -- 0.037	0.0183	-0.099***	0.104	-0.36 -- 0.11	0.343	-0.10***	0.104	-0.31 -- 0.10	0.317
Likelihood	-10.92***	2.60	-16.1 -- 5.77	>0.0001	-10.96***	2.62	-16.18 -- 5.74	>0.0001	-9.45***	2.77	-14.95 -- 3.95	0.000978	-7.99**	2.96	-13.9 -- 2.10	0.0085
Experience	-	-		-	0.79	6.81		0.907	-	-		-	-	-		-
Care	-	-	-	-	-	-	-	-	-0.25*	0.14	-0.53 -- 0.035	0.085	-0.27*	0.14	-0.56 -- 0.012	0.061
Status	-	-	-	-	-	-	-	-	-	-		-	4.20	3.14		0.184
AIC		684.23				688.09				684.92				685.01		
															-2.04 -- 10.44	

β is the regression coefficient i.e. the slope of the graph. SE² is standard error.

Multivariate analysis

Simple linear regressions analysis was applied to examine the relationship between an outcome measure, which in this case is attitude, and one or more independent variables (Press and Wilson, 1978).

Variable	Interpretation
Knowledge	Knowledge of different aspects of e-cigarettes, vaping, safety information and practice
Attitude	Attitude towards e-cigarette use during pregnancy as a smoking cessation strategy
Likelihood	Likelihood of recommendation of electronic cigarettes as a smoking cessation strategy during pregnancy
Status	Current smoking status
Care	Whether a participant has provided care for a pregnant woman who has successfully quit smoking due to the use of electronic cigarettes
Experience	How long a participant has been working since their graduation

Table 8: Table to show interpretation of variables

The base model was developed by including the covariates i.e. knowledge and likelihood into the model. It was hypothesised that more knowledge of electronic cigarettes and less of a likelihood of recommendation of electronic cigarettes will make the individual have a lower attitude score towards electronic cigarette used during pregnancy as a smoking cessation strategy.

Knowledge and likelihood had significant moderating effects on attitude in the base model. Knowledge negatively affected the attitude towards vaping in pregnancy, and was statistically significant (-0.24, $p = 0.0012$). That is knowledge reduced the attitude towards vaping in pregnancy by 0.24 standard deviation. Likelihood negatively affected the attitude towards electronic cigarette use in pregnancy as a smoking cessation strategy, and was statistically significant, (-10.92, $p = >0.0001$). The R Squared number for the base model was 0.27, which meant in this model 27% of variance in the attitude could be explained by the independent variables of knowledge and likelihood of recommendation.

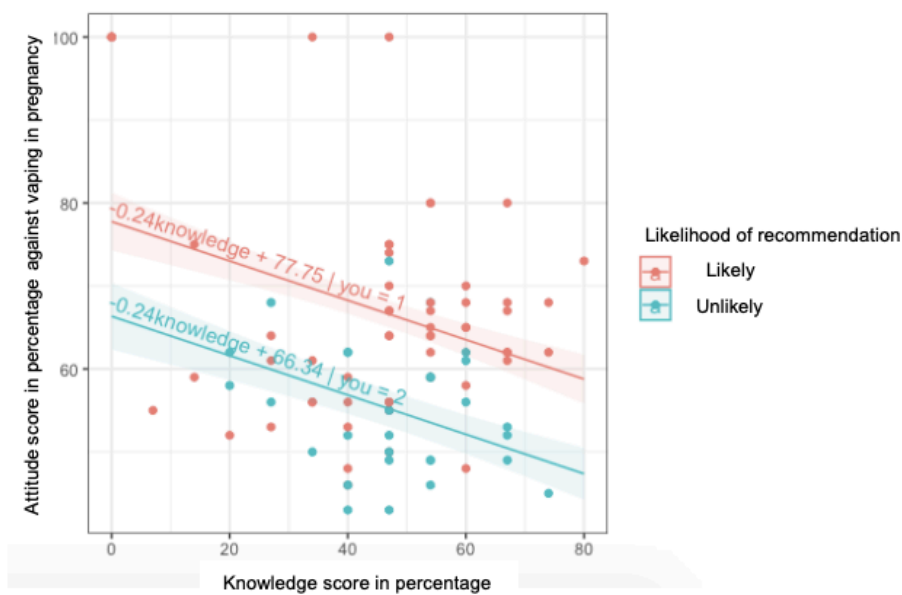


Figure 23: Graph to show the association between attitude, knowledge and likelihood of recommendation (Base model)

The base model represents the KAP model previously discussed. The KAP model stated that by increasing an individual's knowledge there would be a change in attitude, which would be reflected in their overall practice (World Health Organisation, 2008).

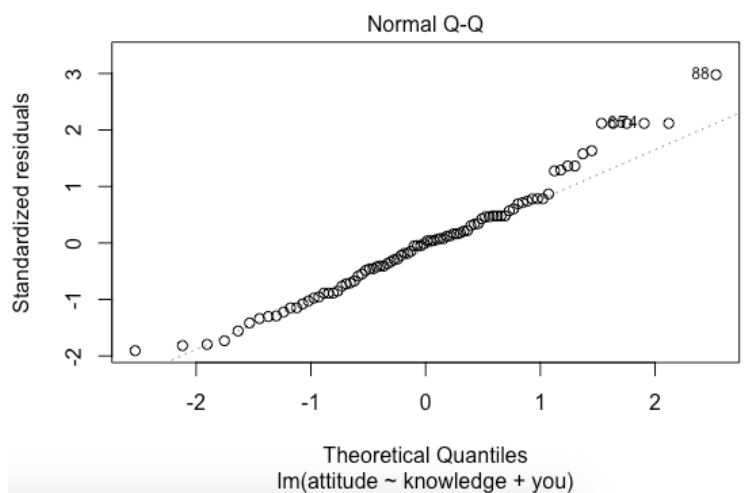


Figure 24: QQ plot for base model

A quantile-quantile (QQ) plot visualises the goodness of fit and distribution of data (Kratz and Resnick, 1996). The findings from the base model are further represented in the QQ plot in figure 24. The QQ plot shows normal distribution as most of the data points fall on the straight line. Therefore, both the standardised residuals and the theoretical distribution have comparable quantiles.

Knowledge and likelihood had significant moderating effects on the attitude in model 2. Model 2 showed that knowledge negatively affected the attitude towards recommending electronic cigarettes as a smoking cessation strategy in pregnancy, and this was statistically significant (-0.21 , $p = 0.0183$). That is knowledge reduced the attitude towards vaping in pregnancy by 0.21 standard deviation. Likelihood negatively affected the attitude towards electronic cigarette use during pregnancy as a cessation strategy and it was statistically significant (-10.96 , $p = >0.0001$). That is likelihood reduced the attitude towards vaping in pregnancy by 10.96 standard deviation.

Experience positively affected the attitude towards electronic cigarette use during pregnancy and a cessation strategy, but was statistically non-significant (0.79 , $p = 0.907$). The R squared number for model 2 was 0.30, which meant in this model 30% of variance in the attitude could be explained by the independent variables, knowledge and likelihood of recommendation.

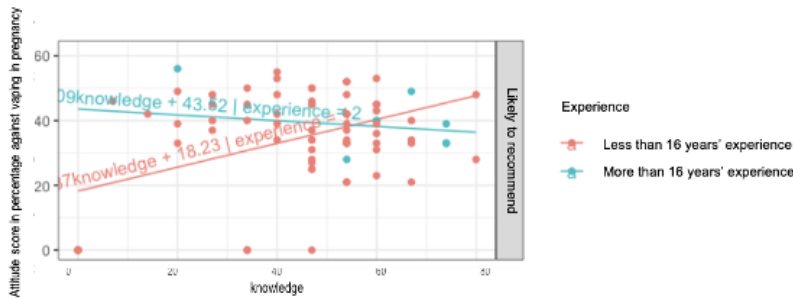


Figure 25: Graph to show association between attitude, knowledge, experience and likelihood of recommendation (Model 2)

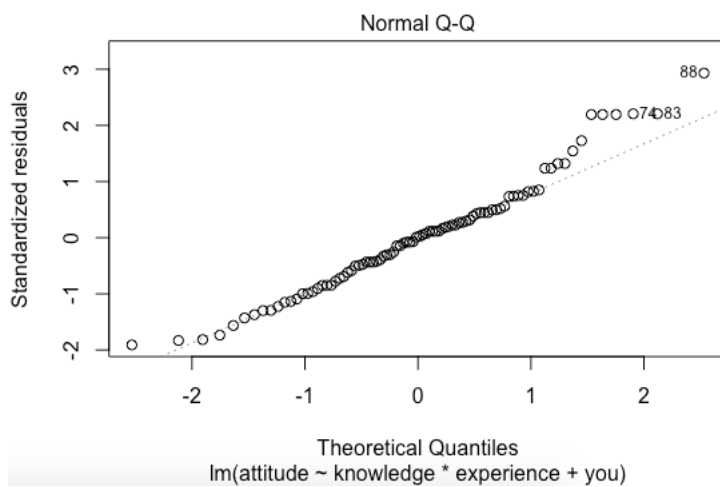


Figure 26: QQ plot for model two

The findings from model two are further represented in the QQ plot in figure 26. The QQ plot shows normal distribution as most of the data points fall on the straight line. Therefore, both the standardised residuals and the theoretical distribution have comparable quantiles.

Knowledge, likelihood and care had significant moderating effects on attitude in model 3. Model 3 showed that knowledge negatively affected the attitude towards vaping in pregnancy, and was statistically significant (-0.099, $p = 0.343$). That is knowledge reduced the attitude towards vaping in pregnancy by 0.099 standard deviation.

Likelihood negatively affected attitude towards vaping in pregnancy and was statistically significant (-9.45, $p = 0.000978$). That is likelihood reduced the attitude towards vaping in pregnancy by 9.45 standard deviation.

Similarly, care negatively affected the attitude towards vaping in pregnancy, and was also statistically significant (-0.25, $p = 0.085$). That is care reduced the attitude towards vaping in pregnancy by 0.25 standard deviation. The R squared number for model 3 was 0.30, which meant in this model 30% of the variance in the attitude could be explained by the independent variables of knowledge, likelihood of recommendation and care.

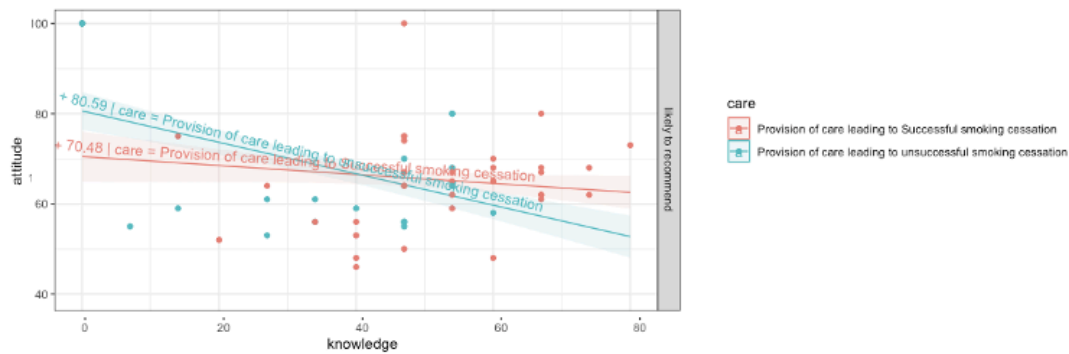


Figure 27: Graph to show association between attitude, knowledge, care and likelihood of recommendation (Model 3)

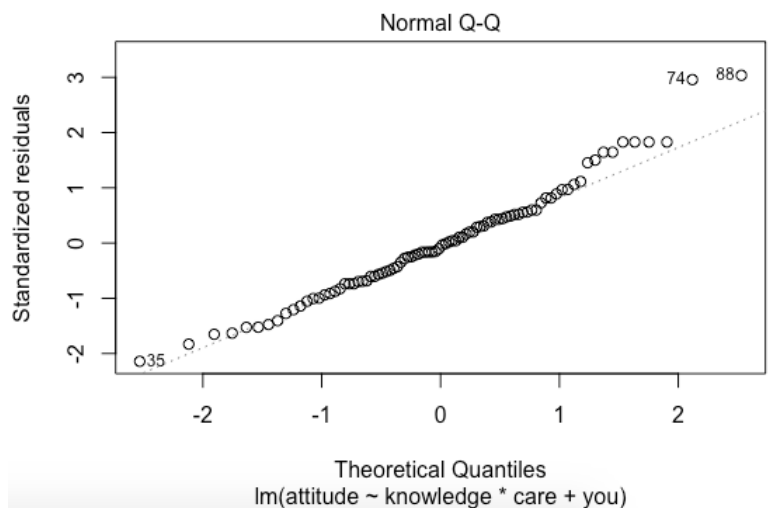


Figure 28: QQ plot for model three

The findings from model three are further represented in the QQ plot in figure 28. The QQ plot shows normal distribution as most of the data points fall on the straight line. Therefore, both the standardised residuals and the theoretical distribution have comparable quantiles.

Knowledge, likelihood and care had significant moderating effects on attitude in model 4. Model 4 showed that knowledge negatively affected the attitude towards recommendation of electronic cigarettes as a smoking cessation strategy during pregnancy, and this was statistically significant (-0.10, $p = 0.317$). That is knowledge reduced the attitude towards vaping in pregnancy by 0.10 standard deviation. Likelihood negatively affected attitude towards electronic cigarette recommendation during pregnancy and was statistically significant (-7.99, $p = 0.0085$). That is likelihood reduced the attitude towards vaping in pregnancy by 7.99 standard deviation. Similarly, care negatively affected the attitude towards electronic cigarette recommendation during pregnancy, and was also statistically significant (-0.27, $p = 0.061$). That is care reduced the attitude towards vaping in pregnancy by 0.27 standard deviation. Status positively affected attitude towards electronic cigarette recommendation during pregnancy, but was statistically non-significant (4.20, $p = 0.184$). The R squared number for model 4 was 0.32, which meant that in this model 32% of variance in the attitude could be explained by the independent variables of knowledge, likelihood of recommendation and care.

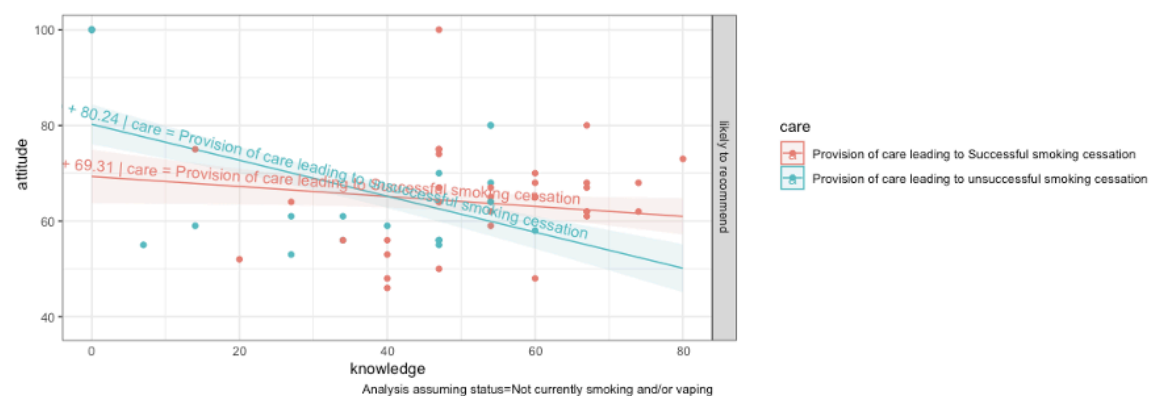


Figure 29: Graph to show association between attitude, knowledge, care, status and likelihood of recommendation (Model 4)

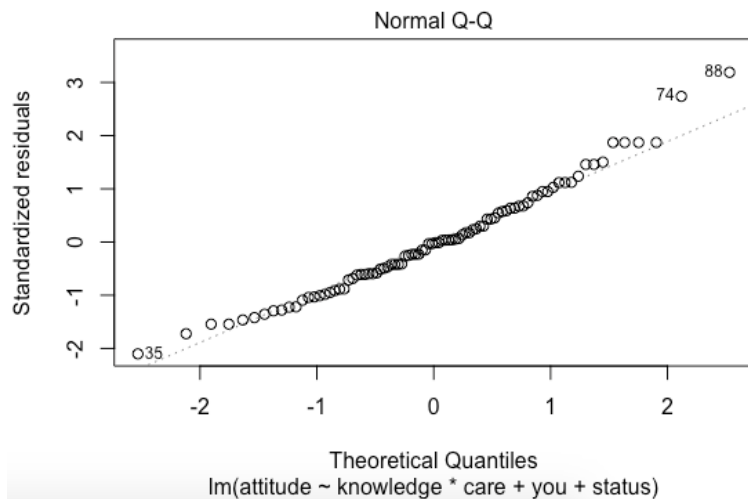


Figure 30: QQ plot for model four

The findings from model four are further represented in the QQ plot in figure 30. The QQ plot shows normal distribution as most of the data points fall on the straight line. Therefore, both the standardised residuals and the theoretical distribution have comparable quantiles.

Model selection

The Akaike Information Criterion (AIC) provides the means for model selection (Ingdal et al., 2019). AIC can estimate the goodness of fit of the four models presented, and estimates their predictability (Bianchi et al., 2020). The lower the AIC, the better the quality of the model (Lombardía et al., 2017). Evident in table 4, the AIC increased on average with the addition of interactions and predictors, therefore model one, the base model, is the best quality model as it has the lowest AIC, with a value of 684.23.

Qualitative analysis

Conventional qualitative content analysis was used to analyse three open-ended questions at the end of the survey. Conventional content analysis allows the researcher to design and develop categories based on the responses from participants (Hsieh and Shannon, 2005). Conventional content analysis is an inductive approach to analysis, which is important because it allowed for categories to develop based on the responses rather than pre-determining the categories.

The content analysis process used is provided in Appendix 8. Codes were used to identify similarities and differences throughout the responses. The main themes were then drawn out by revision of the codes.

An Excel spreadsheet was utilised in order to highlight the relevant themes.

A copy of the spreadsheet can be found in appendix 9.

The process was to add the response in the first column and extract the important information from the response. This important information was then given a code, a shorter explanation of what information the participant was conveying. Finally, similar codes were grouped together and given a final theme/category.

The process allowed themes/categories to be identified, extracted and refined.

Response	Information	Category	Theme
I have been advised by a smoking cessation midwife that vaping is safer to the baby but we don't know the long term health effects to the woman. CO monitoring is within normal ranges when vaping only.	Vaping is safer to the baby but we don't know long term health effects to the woman	Not enough evidence	Uncertainty influencing practice
At my last study session regarding	Insufficient evidence	Not enough evidence	

<p>smoking we were told not to recommend vaping and to discourage women from doing it due to insufficient evidence regarding safety in pregnancy.</p>	<p>regarding safety in pregnancy</p>	<p>Uncertainty influencing practice</p>
--	--------------------------------------	---

<p>I've had no education or training and feel unconfident on the issue. (I'm a hospital midwife)</p>	<p>No education or training</p>	<p>Not enough or No Training / Info / Resources</p>	<p>Not enough or No Training / Info / Resources</p>
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Table 9: Table to show content analysis process

Table 9 shows the content analysis process, wherein information was extracted from the original response, refined, and given a code and a theme. Responses with similar information could then be grouped by these themes.

The first qualitative question asked participants to comment on the resources given to midwives regarding electronic cigarette use as a smoking cessation strategy in pregnancy.

Q45 Please include any additional comments on the resources given to midwives regarding electronic cigarette use as a smoking cessation strategy in pregnancy.



Figure 31 - Question regarding resources given to midwives

The four categories identified from the responses are listed in the table below.

Categories

Not enough or no training/information/resources provided

Varying sources of support/information/resources are provided

Uncertainty influencing practice

Local policy influences practice but varies.

Table 10: Categories for first qualitative question

Not enough or no training/information/resources provided

This category centres around midwives reporting that they have been provided with insufficient information to support their practice, be that in the form of training, information, or resources. Some midwives reported receiving no information, training or resources (Participant 13: “Haven't been given any resources”; Participant 4: “Never been given any info or training on e-cigarettes”; Participant 20 “I've had no education or training and feel unconfident on the issue.”) Whereas other respondents stated that they had not received enough training, information or resources to be able to confidently advise pregnant women on using electronic cigarettes during pregnancy. For example, participant 37 stated “I feel like I did not have enough know how to answer some of the statements, this is due to lack of information being provided/available”, highlighting the lack of information, whereas participant 17 stated “provided with one A5 poster with minimal information, [but] no training”, showing some resources have been provided but not training. This highlights a clear perception by midwives that there is a lack of training, information and resources available to support them in their role in providing information to women regarding

the use of e-cigarettes for smoking cessation and may help to explain further why only 27.8% of the midwives surveyed were likely or very likely to recommend e-cigarettes. This also highlights the potential need for policymakers and organisations to provide clear, informative guidance and training, and ensure that this is communicated and delivered effectively at a local level to midwives to support them in translating recommendations into practice. This was emphasised by participant 45 who stated, “I need more guidance”.

Varying sources of support/information/resources are provided

It was apparent that whilst some participants felt that support, information and resources were provided, the quality and quantity of support and resources available to midwives, as well as the information being given regarding e-cigarette use in pregnancy was highly variable. Participant 17 stated they had been “provided with one A5 poster with minimal information, no training”, whilst others reported having information given to them by a smoking cessation midwife (participant 1: “I have been advised by a smoking cessation midwife that vaping is safer to the baby but we don't know the long term health effects to the woman”) or via study session regarding smoking. Others reported resources varying from the provision of leaflets and information to be shared with women (participant 54: “We've been given leaflets to hand out”), through to gaining knowledge during conference attendance, which is not usual for a vast majority of midwives (participant 57: “it was mentioned at a conference and we were given information leaflets).

It was also clear that the information provided via these sources was variable and inconsistent. Participant 9 stated “We have been provided with information that vaping is safer than smoking”. In contrast, participant 6 said, “At my last study session regarding smoking we were told not to recommend vaping and to discourage women from doing it”. Participant 2 reported that they had been “advised by a smoking cessation midwife that vaping is safer to the baby but we don't know the long term health effects to the woman”, whereas participant 22 stated that they had been given no resources, rather “we've just been told the benefits outweigh the potential risks”.

Responses from some respondents suggested some knowledge and communication around the lower levels of chemicals and lack of CO in vaping but the consistency and accuracy of the message being communicated to women overall was unclear.

Responses to the question “Please include any additional comments relating to the resources given to midwives regarding electronic cigarette use as a smoking cessation strategy in pregnancy” which relate to chemical presence (incl. Carbon Monoxide (CO)) in cigarettes/e-cigarettes.

“CO monitoring is within normal ranges when vaping only”

“We recommend e-cigarettes as we are told although they do contain nicotine they contain less chemicals than a cigarette and these are the chemicals that reduce the growth of the baby”

“We focus on the lack of carbon monoxide and therefore the reduced risk of IUGR”

“The train of thought is electronic cigarettes contain no carbon monoxide therefore are safer for women than cigarettes”

Table 11: Table to show responses to question relating to resources

This suggests that there is a lack of consistency when providing midwives with information to support pregnant women; this may also translate into inconsistency in local practice, with some participants stating that they have been providing information regarding electronic cigarettes to pregnant women, whereas others have been told to signpost pregnant women to smoking cessation services. Meanwhile, some midwives do not feel they have been given enough resources to advise pregnant women, showing both inconsistency between different areas of practice and in some cases, evidence of practice which is contradictory to national guidance.

Local policy influences practice but varies

The practice of referring women to smoking cessation services for advice regarding e-cigarette use was highlighted by more than one participant. Participant 42 stated “In practice we had been informed to signpost to a help to quit service and not necessarily enough advice for us to advise [sic]”, this practice was supported by participant 7, who stated “In my Trust the emphasis is on referrals to the smoking cessation service”; and participant 48, “We would always refer any women to smoking cessation as they are the experts”. Perhaps suggesting that the focus in some areas is that pregnant women should seek advice from stop smoking services rather than their midwife. This is an interesting finding as evidence suggests that the professionals working in these services feel they have insufficient evidence to advise women regarding vaping in pregnancy (Cooper et al., 2019). The study found that only 8.3% of stop smoking services were ‘likely’ or ‘very likely’ to advise the use of electronic cigarettes in pregnancy, whereas 56.9% of stop smoking services were ‘unlikely’ or ‘very unlikely’ to advise using them. In a similar study assessing smoking cessation services, it was found that 60% of stop smoking services reported they did not have a specific policy on the type of electronic cigarette advice they give to pregnant women using their services (Mann and Faflik, 2018). This suggests that there is also chance for inconsistent information within the smoking cessation services as there are no clear policies regarding what these services tell pregnant women.

In contrast another participant highlighted the practice of using nicotine replacement therapy as a first line treatment (participant 11: “As a trust we advise nicotine replacement however if they have tried this and have been unsuccessful, we recommend e-cigarettes”).

Whereas conversely, as previously mentioned, there was evidence that some NHS Trusts do not recommend e-cigarette use at all. (Participant 5: “At my last study session regarding smoking we were told not to recommend vaping and to discourage women from doing it due to insufficient evidence regarding safety in pregnancy”). These findings highlight variable practices in terms of both the recommendations being made to women regarding e-cigarette use in pregnancy, and potentially the professionals being relied upon to provide this advice. These findings suggest that

consistency and clarity of local processes may be beneficial to ensure that expectations are clear regarding where women can access advice, and that professionals have the appropriate knowledge to provide this.

Uncertainty influencing practice

Finally, the responses suggested that practice was influenced by uncertainty in relation to a number of factors. This category encompasses responses coded using three different codes

1. Conflict between media and professional advice
2. Not enough evidence
3. Lack of confidence to provide advice

Participant 49 stated that “it is acknowledged that vaping is a safer alternative to smoking but how safe we don't know. I don't know enough about vaping to make any recommendations”, suggesting that participants feel uncertain with the information they receive to advise pregnant women on electronic cigarette use in pregnancy.

In summary, it seems there are varying sources of support and information available, with some midwives being told to send pregnant women to smoking cessation services for support, whereas others are being told to provide information and advice themselves to pregnant women. This causes uncertainty within practice as it is unclear what the appropriate approach is. Similarly, the suggestion to point pregnant women to help to quit services seems to be unhelpful as these help to quit services have themselves stated they have no specific policy relating to electronic cigarette use in pregnancy, and over 56% have stated they would be unlikely to recommend them as a smoking cessation strategy.

The second qualitative question asked participants to comment on the safety of electronic cigarettes as a smoking cessation strategy in pregnancy.

Q46

Please include any additional comments regarding the safety of electronic cigarettes as a smoking cessation strategy in pregnant women.



Figure 32 - Question regarding the safety of electronic cigarettes

The five categories identified from the responses are listed in the table below.

Categories

Varying sources of support/information on safety are provided
Not enough or no training/information/ on safety provided
Has an alternative recommendation
Not enough research has been done regarding safety
CO monitoring

Table 12: Categories for second qualitative question

Varying sources of support/information on safety are provided

This category centres around midwives reporting that there is varying sources of support and information provided to them. Collectively, respondents mentioned a number of different ways in which they received safety information and/or support enabling them to discuss safety aspects of e-cigarettes with women. Participant 1 stated “I have been advised by a smoking cessation midwife that vaping is safer to the baby, but we don't know the long-term health effects to the woman”, and participant 22 stated “we have been told that the benefits outweigh the risks”, highlighting that midwives in differing settings receive variable support and information on which to base their practice, which may ultimately lead to inconsistencies in care.

Not enough or no training/information/ on safety provided

Respondents mentioned they felt they had not received enough training or information on safety. For example, participant 34: “I feel I do not know enough information to advise on safety and would not want to speculate without seeing the

studies” and participant 20: “I’ve had no education or training and feel unconfident on the issue”. This highlights inconsistency throughout trusts as some feel comfortable to advise pregnant women regarding the use of electronic cigarette use in pregnancy and have been told to do this by smoking cessation midwives, whereas some feel reluctant to do so.

Has an alternative recommendation

Respondents mentioned alternative recommendations to e-cigarettes. This included participant 25 stating “because safety is fairly unknown, not smoking at all is recommended or the use of other products to assist smoking cessation”, and participant 12: “I don’t think they are safe, patches would be better”. This reiterates the previous responses wherein there is a reluctance to advise the use of electronic cigarettes due to the uncertainty regarding safety. However, this is not consistent with professional guidance on what should be advised in practice, as the Royal College of Midwives state that if a pregnant woman who conventionally smokes chooses to switch to an electronic cigarette to aid quitting smoking during pregnancy, she should be supported in doing so (Royal College of Midwives, 2019).

Not enough research has been done regarding safety

Participant 38 said, “unaware of enough evidence of the safety of e-cigarettes to confidently advise pregnant women”, suggesting that participants would be more inclined to discuss the use of electronic cigarettes with pregnant women if there was more scientific evidence regarding their safety.

CO monitoring

Participant 1 said, “CO monitoring is within normal ranges when vaping only”, suggesting that they perceived electronic cigarettes to be safer for a pregnant woman due to their not containing carbon monoxide.

In summary, it seems that midwives felt they do not have enough information regarding safety to enable them to accurately advise women on electronic cigarette use during pregnancy. This appears to stem in part from a lack of resources given to midwives surrounding safety information and current research on electronic

cigarettes. There is a need for up-to-date resources for midwives to ensure they can confidently discuss safety with pregnant women.

The third qualitative question asked participants for any additional comments regarding electronic cigarette use in pregnancy as a smoking cessation strategy.

Please include any other additional comments on any other aspects of electronic cigarette use in pregnancy.

Q47




Figure 33 - Question asking for any additional comments regarding electronic cigarettes

The three categories identified from the responses are listed in the table below.

Categories

Would not recommend/it is unsafe

Not enough research or information to make recommendation/on fence

Would recommend as a smoking cessation strategy

Table 13: Categories for third qualitative question

Responses to this question appeared to fall into one of three categories reflecting midwives' attitudes and practice in relation to the recommendation of e-cigarettes during pregnancy; those who would recommend it as a smoking cessation strategy, conversely those who would not recommend it and/or felt it was unsafe; and finally those who were uncertain or felt that there was not enough information to inform their practice.

Would not recommend/it is unsafe

Despite guidance that advises midwives to promote e-cigarettes as a smoking cessation strategy in pregnant women (Royal College of Midwives, 2019), it was apparent that some midwives are not comfortable to do so and consider the practice

unsafe. Responses included statements such as “it is unsafe” by participant 15, “should not be recommended” by participant 9, and “on talking to staff many still feel uncomfortable suggesting vaping even though they are aware it is safer than smoking” by participant 6. As in the quantitative analysis, the responses within this category suggest that midwives (particularly those with negative attitude towards vaping) may not be adhering to guidance provided by Public Health England and the Royal College of Midwives, and that further investment into activities to influence such attitudes may be required to enable midwives to feel more comfortable with current recommended practice.

Not enough research/information to make recommendation

Some participants stated that they had been provided with no training, information or resources. For example, participant 1 stated, “I would like access to more evidence-based information”. Similarly, some participants stated that there has not been enough research regarding the use of electronic cigarettes during pregnancy, e.g. “if there was more evidence, I'd be more inclined to hold discussions with expectant mothers about vaping” by participant 25. This further highlights the importance of providing up to date research and information to midwives to aid them in confidently advising pregnant women on the use of electronic cigarettes as a smoking cessation strategy during pregnancy.

Would recommend as a smoking cessation strategy

Conversely, some participants stated that they would recommend electronic cigarettes as a smoking cessation strategy, e.g. participant 21 stated “would recommend instead of smoking”. Similarly, other participants responded that electronic cigarettes are a better alternative to smoking conventional cigarettes, participant 4 stated “I remind them it is their decision how to manage their smoking and while we don't have much research yet about vaping how can something with five or six ingredients compare to the carbon monoxide and 400 poisons cigarettes contain”, highlighting that they felt electronic cigarettes are a safer alternative than conventional cigarettes.

In summary, there are complex, multiple layers to the attitude's midwives hold regarding electronic cigarette use in pregnancy; the lack of resources and information available to midwives has caused inconsistencies in practice, meaning that some midwives are happy to recommend electronic cigarette use in pregnancy and some are not. This discrepancy between attitudes towards electronic cigarettes could be solved by accurate and up-to-date information and resources being provided to trusts, as well as a clear approach to holding discussions with a pregnant woman regarding electronic cigarette use during pregnancy as a smoking cessation strategy. Both the quantitative and qualitative analysis highlight that 'training' has an influence on practice, so it could be suggested that by providing more training to midwives could increase their knowledge, consequently changing their attitude and eventual practice. Therefore, providing training to increase a midwives' knowledge may result in more positive attitudes towards vaping, as those who had received training on smoking cessation during pregnancy were more likely to recommend vaping. This intricate nature of smoking cessation and pregnancy has been previously highlighted throughout many studies, and further research needs to be undertaken in order to determine whether these findings are replicable.

Discussion

The main aim of the study was to investigate the primary hypothesis, which was whether the attitude a midwife held towards electronic cigarette use during pregnancy influenced their recommendation of it as a smoking cessation strategy, and to determine if there was a link between the outcome measure and variables such as knowledge, likelihood, experience and status.

The KAP model, (Cleland, 1973), was found to be a suitable framework as it was reflected in the multivariate linear regression model of attitude against knowledge and likelihood of recommendation. It was found that when a participants' knowledge score increased, there was a decrease in the attitude to using an electronic cigarette during pregnancy. Also, the higher the knowledge and lower the attitude score, the less likely the participant was to recommend electronic cigarettes as a smoking cessation strategy in pregnancy. Therefore, it can be concluded that the higher the knowledge score was and the lower the attitude score was, the less likely the participant was to implement recommendation of electronic cigarettes in their personal practice, and knowledge and attitude were influencing practice.

This has potential implications for future research and practice, as the current guidelines promote the use of e-cigarettes as a smoking cessation strategy during pregnancy (Royal College of Midwives, 2019), however, the increase of knowledge appeared to cause a more negative attitude towards this. By providing appropriate and effective training for midwives to increase their knowledge, this may have a detrimental effect on practice as they may develop a more negative attitude towards vaping during pregnancy, hence there may be a reluctance to provide this type of support.

Smoking cessation

The findings do somewhat fit with the current literature available. For example, in a review discussing smoking cessation with midwives, it was highlighted that whilst it is important midwives hold these discussions with pregnant women, it is also important to involve other professionals such as smoking cessation services due to their expertise (Grogan, 2019). The use of this interprofessional approach was

demonstrated by a number of respondents, although the qualitative findings suggested that clarification of the roles, knowledge and practices expected of midwives and smoking cessation practitioners would be beneficial to ensure women receive clear, accurate and consistent advice. This is further recommended by NICE, who suggest that brief advice should be given to pregnant women, but there should be a referral to smoking cessation services for additional support (National Institute for Health and Care Excellence, 2018). Similarly, the qualitative findings also show this. For example, one participant mentioned that there is an emphasis on referrals to smoking cessation services, supporting the recommendations provided by NICE. This indicates that there may be a strong reliance on smoking cessation services to provide care to pregnant women looking to quit smoking, rather than it being provided by the midwife.

In addition to this, it was found that participants felt they had not received sufficient training to enable them to confidently advise pregnant women on smoking cessation and the use of e-cigarettes in pregnancy, which is also outlined in a study of midwives' attitudes to smoking cessation (Randall, 2009), wherein it was found that some midwives would not consider themselves qualified to discuss smoking cessation with a pregnant woman, which was further limited by the lack of resources available (Randall, 2009). Therefore, midwives were referring pregnant women to stop smoking services due to their perceived lack of knowledge on the subject of smoking cessation. This is significant as this finding suggests that midwives would be more likely to discuss smoking cessation options, such as vaping, with pregnant women if they had received more training. However, the findings from this thesis suggest that providing training may in fact result in a more negative attitude towards vaping during pregnancy, highlighted in the quantitative results, where an increase in training resulted in an increase in knowledge relating to e-cigarettes, which led to a more negative attitude towards the use of vapes during pregnancy.

Health effects

The health effects identified in the findings also somewhat fit with the literature aforementioned previously. For example, in a review of the safety of electronic cigarettes, it was found that the uncertainty of the health risks poses a challenge to clinicians as those wanting to quit will be looking to smoking cessation services and

midwives for support (Gotts et al., 2019). This supports the findings from the qualitative question regarding safety as some midwives stated that they felt they had received varying sources of information on safety with some expressing they do not know the long-term health effects, and others stated that not enough research had been done regarding safety of e-cigarettes. This causes a reluctance to advise and also highlights the demand for more current resources for midwives regarding safety, to enable them to discuss this with pregnant women more easily.

Similarly, in the US it was found that e-cigarettes contain harmful chemicals such as formaldehyde and ultrafine particles (Thanavala and Goniewicz, 2019). This also relates to the findings from the qualitative section as some midwives stated they are told that “e-cigarettes contain less chemicals than conventional cigarettes so are safer, as these chemicals reduce the growth of the baby”. Similarly, when asked about their safety, one participant stated that “evidence suggests e-cigarettes are 95% safer than conventional cigarettes as they do not contain carbon monoxide”. This shows that some participants are aware of the current literature regarding e-cigarettes as the latter participant quoted a figure from Public Health England (Public Health England, 2019), suggesting that they have been provided with up-to-date evidence to give to pregnant women.

Overall, it is clear from both the literature explored and the findings from the study that some midwives are uncertain on the health effects from using an e-cigarette in pregnancy, which leads to a reluctance in practice despite the suggested current practice being to recommend them as a smoking cessation strategy.

Opinions of smoking cessation in pregnancy

Previously discussed, in a mixed-methods study which explored the attitudes to electronic cigarettes from English stop smoking services, it was found that only 8.3% of stop smoking services were ‘likely’ or ‘very likely’ to advise the use of electronic cigarettes in pregnancy, and 56.9% of stop smoking services were ‘unlikely’ or ‘very unlikely’ to recommend them (Cooper et al., 2019). The main concern was that there was a lack of evidence regarding the safety of electronic cigarettes, especially during pregnancy. This finding is reflected in the qualitative question on safety, wherein most participants stated that the lack of safety surrounding electronic cigarettes is one of the reasons they feel reluctant in recommending them to pregnant women as

a smoking cessation strategy. Also, this finding is highlighted in the quantitative analysis, as participants who had a more negative attitude towards electronic cigarette use during pregnancy were more unlikely to recommend electronic cigarettes as a smoking cessation strategy in pregnancy. This mirrors the opinions of almost 57% of stop smoking services who were 'unlikely' or 'very unlikely' to recommend electronic cigarettes as a smoking cessation strategy in pregnancy (Cooper et al., 2019).

In addition to this, in a similar study with smoking cessation services, it was found that 60% of stop smoking services do not have a specific policy on the electronic cigarettes advice they give to pregnant women (Mann and Faflik, 2018). This is exemplified in the qualitative responses as midwives felt they were not given clear instruction or information on how to hold discussions regarding electronic cigarette use during pregnancy, and some referred pregnant women to smoking cessation services again. This further signifies the need for clearer information provided to allow such services to create a clearer policy. Moreover, the study highlighted that more than three quarters of the pregnant women surveyed were unsure of the potential harms in comparison to conventional smoking (Mann and Faflik, 2018), again suggesting that the information provided to midwives to aid pregnant women may not be useful as they are still unsure of this information.

However, these findings contrast some of the findings from quantitative analysis. For example, midwives who had previously provided care for a pregnant woman who had successfully quit smoking due to the use of an e-cigarette, were more likely to recommend e-cigarettes as a smoking cessation strategy in pregnancy, compared to a midwife who had not successfully provided this care. This differs from the higher percentage of smoking cessation services who stated they would be 'unlikely' or 'very unlikely' to recommend (Cooper et al., 2019). Therefore, it could be deduced that midwives who have experience with e-cigarettes are more likely to have a more positive attitude towards their use in pregnancy, so would be more likely to recommend them.

It could also be argued that a provision of training to improve midwives' knowledge would lead to more recommendation in line with current practice, as many midwives stated that they did not know enough about the topic of e-cigarettes to accurately and confidently advise. However, it is important to note that according to quantitative results, when a participant received training regarding smoking cessation in

pregnancy, whilst their knowledge score increased, their attitude towards vaping in pregnancy decreased, that is became more negative. Therefore, it could be argued that providing training to increase a midwives' knowledge on e-cigarettes could actually be detrimental to government recommendations being translated into practice, as providing training could create more negative attitudes towards vaping. It may therefore be important to explore what specific content or focus during training sessions would aid government recommendations by creating a more positive attitude towards electronic cigarette use during pregnancy.

Health concerns during pregnancy

The qualitative results found that participants who had previously provided care for someone who had successfully quit smoking using e-cigarettes were more likely to recommend the use of e-cigarettes during pregnancy in the future. These results can also be compared to a finding from a paper that assessed the confidence, attitudes and practices of midwives (Tzelepis et al., 2017). It was found that midwives who had previously delivered smoking cessation care to pregnant women were more confident in their provision of care (Tzelepis et al., 2017). In a similar study exploring the use and perceptions of smoking cessation in midwives' practice, it was found that midwives who had higher effective communications with patients about smoking cessation were more likely to have higher outcome expectations (Price et al., 2006). Both of these studies, as well as the project findings, could be linked to harm perception; being involved with successful care that resulted in a good outcome for the pregnant mother had influenced their attitude and practice of e-cigarettes. Similarly, in the 'safety' question of the qualitative section, one participant noted anecdotally that she had witnessed a fetus' growth markedly improve after the switch to vaping from conventional cigarette smoking. This further suggests that previous successful care has influenced attitudes and practice.

Despite the potentially negative result in provision of training previously mentioned, wherein training may increase a midwives' knowledge but it may also cause a more negative attitude towards vaping in pregnancy, it could be argued that policy makers can harness the impact of successful care to influence midwives' behaviours and perceptions of the risks. Perhaps training involving case studies and success stories should be considered to positively influence a midwives' attitude and practice of

electronic cigarette use in pregnancy. In a review of the beliefs and attitudes of healthcare professionals, this type of training seemed effective (Hunter et al., 2020). It was found that healthcare professionals, when questioned about their beliefs on the use of vaping as a smoking cessation tool, reported success stories such as pregnant women switching to vapes and then removing nicotine from their lifestyle completely. This suggests that positive experiences influence the attitude and practice of healthcare professionals such as midwives as they are more inclined to recommend electronic cigarettes as a smoking cessation strategy because of previous success. Therefore, this type of training that highlights case studies and success stories may be an effective way to positively influence a midwives' attitude and therefore their practice in recommending e-cigarettes during pregnancy. However, in contrast to this, in a study published by BMC Pregnancy and Childbirth, it was found that midwives sometimes kept negative experiences in mind which affected future similar situations (Daemers et al., 2017). Similarly, evident in appendix 7, it was found that participants were more likely to answer scientific questions correctly in comparison to questions relating to practice, so it could be advantageous to provide a more scientific type of training as the results suggest that participants can recall scientific information easier, potentially positively affecting their practice.

Organisational stances

In line with their code of conduct, the Nursing and Midwifery Council state that professionals should always practise in line with the best available evidence, and that any advice given must be evidence-based, hence why some may feel a reluctance to advise in absence of evidence (Nursing and Midwifery Council, 2020). Currently, the best available evidence suggests that vaping is safer and therefore should be recommended by healthcare professionals and stop smoking services (Public Health England, 2019) (Royal College of Midwives, 2019). This is reflected in the qualitative responses wherein some participants stated that they recommend e-cigarettes to pregnant women as they were told they are safer than conventional cigarettes. However, evident in appendix 7, when the participants were asked if they were aware of any NHS hospital encouraging pregnant women to quit smoking by using e-cigarettes, more participants stated they were not aware of any (39%) than

aware (25%), suggesting that they are not being recommended in practice. Mirroring this, in a study published by the Journal of Clinical Nursing, it was found that midwives felt that using the best available evidence is sometimes sub-optimal, and it found factors such as workplace culture and organisational characteristics key components in this (Leo et al., 2019). Some of the reasons for not using evidence-based practice were that it was 'difficult' and 'takes too much time'.

It is also suggested in the qualitative results that midwives feel there is not enough evidence present to confidently advise pregnant women on e-cigarettes, therefore are not practising in line with the best available evidence. Some participants felt that they have not been provided with enough resources to help them in advising pregnant women, so would rather not discuss this topic with them.

Similarly, Public Health England have stated that electronic cigarettes are 95% less harmful than conventional cigarettes (McNeill et al., 2019), and the Royal College of Physicians state that electronic cigarettes carry, at most, 5% of the risk of conventional tobacco (Royal College of Physicians, 2019). This again contrasts the responses to the safety question in the survey, wherein some midwives stated that electronic cigarettes were not a safe alternative, and they would not recommend them to pregnant women as a smoking cessation strategy. However, one participant directly quoted the PHE statistic, suggesting that they are up-to-date with current information and guidelines, although it is not clear whether this was through personal interest or due to resources provided through their trust.

It is important to note that those who had more experience as a midwife were more inclined to have a lower attitude score, however this was statistically insignificant in bivariate analysis. Some of the attitude questions in the survey were specifically included to gauge the participant's experience with pregnant women who wish to quit smoking, and those with more experience would have found these questions easier to answer as they may have had a previous similar scenario. These questions asked the participant whether they thought there were stigmas attached to smoking during pregnancy and whether electronic cigarettes should be recommended as a smoking cessation strategy during pregnancy. These questions may have influenced the final likelihood question for those with more experience, perhaps causing a biased

answer by those who have kept in mind previous similar scenarios from their long-standing midwifery role.

Similarly, some knowledge questions were included in the survey that related to midwifery codes of conduct released by PHE and RCM (Public Health England, 2019) (Royal College of Midwives, 2019). Midwives with more experience may be more likely to have read this information previously, so would be more likely to know the correct answer. One question was included specifically relating to the Royal College of Midwives advice, wherein if a pregnant woman has switched completely to vaping, she should be recorded as a non-smoker (Royal College of Midwives, 2019). However, more participants answered incorrectly (46%) than correctly (21%). This implies that participants who answered incorrectly were not aware of the position statement released by RCM, suggesting they have not read up-to-date information relating to smoking cessation during pregnancy.

In multivariate analysis, 'care' could have produced a significant association due to bias. For example, the care question asked participants whether they had ever provided care for a pregnant woman who had successfully used electronic cigarettes as a smoking cessation strategy. Therefore, those who had provided successful care were more likely to have a positive attitude towards vaping during pregnancy, as they had a previous positive experience with an expectant mother. A more positive attitude may lead the participant to be more likely to recommend electronic cigarettes as a smoking cessation strategy during pregnancy in future practice.

Limitations

There were several limitations throughout the project that could have affected the results. Firstly, due to COVID-19, the sample size was small as most of the NHS trusts that were approached, declined to participate in the project as they were focusing on COVID research. This meant that midwives had to be approached in another way, and it was decided to recruit midwives from Facebook groups. This, however, meant that we could not be certain that every participant was a qualified midwife in England. The risk of this was minimised as far as possible by the inclusion of eligibility criteria questions prior to the survey beginning, however, these questions could have been bypassed by answering the correct criteria responses, even if the participant did not match these criteria. This limitation would have been bypassed if midwives were only recruited from NHS trusts, as they would have only been able to

access the questionnaire if they were currently employed at one of the chosen trusts due to the survey link being sent to them by their respective R&D department. The target sample size was two hundred and sixty-four, however there were only one hundred and twenty-one responses. Therefore, it can be said that the data is not representative of qualified midwives in England, due to both the smaller than expected sample size, and the reliance on non-probability sampling. Also, a small sample size can increase the margin of error, so must be carefully interpreted due to extrapolation.

Another limitation found was that when the data was exported from Qualtrics, some of the questions were incomplete. So, a handful of midwives had left some questions blank. This reduced the number of responses, further increasing the margin of error.

Due to the COVID-19 pandemic, the desired number of participants was not reached. Similarly, recruitment through NHS trusts was not successful as some did not reply to original invitation email. This poses the question of whether they would have replied outside of the COVID environment.

On reflection, the sample size was not reasonable and poses a problem as the results are not generalisable.

Therefore, it could be suggested that this thesis could be viewed as a feasibility study with the view to scale up the study in order to increase the number of responses, hence improving generalisability and reducing the likelihood of false negative findings because the study is underpowered. This could be done by comparing the demographics of the study sample with demographic data of the midwifery workforce in England overall, to see whether a representative sample was recruited.

The average age of midwives in the survey could be comparable to data published by the Royal College of Midwives (Royal College of Midwives, 2018). In 2018, 44% of midwives were under forty years of age. 32% were aged fifty or over. In this research, it was found that 41% of midwives who took part in the survey were aged between thirty and forty-nine, evident from the demographic table in the results section. The highest percentage of registered midwives in England were between the ages of fifty and fifty-four, which contrasts the data in this research, as a higher percentage of midwives who took part in the survey were below fifty (69.7%).

Smoking status of midwives could not be found so this comparison could not be made, however it can be compared to the data for the general UK population. In 2019, in a report published by the Office for National Statistics, it was found that 15.8% of people aged 16 or over smoked cigarettes (Office for National Statistics, 2020). In this research, only 5% of participants currently smoke cigarettes. In the same report, it was found that 58% of people aged 16 or over in the UK do not smoke. More than half of the midwives who took part in the survey were neither a smoker nor a vaper, (53.3%). Whilst these numbers are similar, the statistic published by the ONS suggests that more people in the general UK population smoke conventional cigarettes than what is represented in this survey. It could therefore be argued that the generalisability of this survey is impacted as the data on smoking habits is not representative of that of the UK population.

Due to the average age of midwives being demographically representative to data published by the Royal College of Midwives (Royal College of Midwives, 2018), it could be argued that the non-probability sampling method used achieved a representative sample, and so can be used in a larger study to recruit a cohort from which findings could be generalised to the midwifery workforce in England.

Overall, these findings have brought to light a new area of research regarding the association of a midwives' knowledge and likelihood of recommending electronic cigarettes as a smoking cessation strategy in pregnancy to their attitude, specifically in relation to variables such as care and status. The study would need to be repeated in order to establish whether the findings are replicable in a larger, more generalisable sample.

Perhaps if there was more education and resources available surrounding the topic of electronic cigarette use during pregnancy, midwives would be more comfortable in discussing electronic cigarettes as a smoking cessation strategy with expecting mothers, but these suggestions are subject to these findings being replicated in a larger, more robust study.

There is a clear need for more research regarding the potential risks and benefits of electronic cigarette use during pregnancy, as well as more resources for midwives to

help them have informed discussions with respect to electronic cigarettes as a smoking cessation strategy.

Conclusion

Within the present literature, the health effects of electronic cigarette use during pregnancy have been explored, as well as whether they are an effective smoking strategy. Similarly, there have been various studies exploring the attitudes pregnant women hold over the use of electronic cigarettes as a smoking cessation strategy. However, it was important to identify the gap within the literature where that the knowledge and attitudes midwives' hold regarding electronic cigarette use during pregnancy was yet to be explored. Midwives were a particularly significant group as they have most likely had contemporary contact time with pregnant smokers. Also, there have been recent developments in midwifery practice in which the Royal College of Midwives now recommend electronic cigarettes as a smoking cessation strategy in pregnancy.

There was a significant association between care and personal practice; a midwife who had previously provided care to a pregnant woman who had successfully quit smoking due to the use of electronic cigarettes was more likely to recommend them as a smoking cessation strategy in their personal practice.

It was interesting to see the results of the survey and how knowledge and attitude relate to personal practice. It was found that the more knowledge a midwife had regarding the subject of electronic cigarettes, the lower their attitude score was, therefore the more negative their attitude was towards electronic cigarettes.

Similarly, a lower attitude score meant that midwives were less likely to recommend electronic cigarettes as a smoking cessation strategy in pregnancy. So, it can be deduced that those with more knowledge regarding electronic cigarettes and their use in pregnancy, also had a more negative attitude towards them and thus will be less likely to recommend them as a smoking cessation strategy.

This finding is representative of the KAP model, as it was found that an increase in knowledge caused a change in attitude, which was then reflected in practice by their reduced likelihood of recommendation.

There is a need for more readily available resources and research regarding the safety of electronic cigarettes in pregnancy, highlighted in the qualitative responses from midwives. This would allow midwives to increase their knowledge surrounding the subject, and would improve their conversation with pregnant women regarding

the use of electronic cigarettes as a smoking cessation strategy, therefore knowledge would be translated into personal practice.

Similarly, if midwives had more access to information on electronic cigarettes, perhaps this would change their attitude on the subject, consequently affecting their personal practice in the future.

It was also highlighted in the qualitative questions that common midwifery practice appears to include signposting of pregnant women to smoking cessation services, rather than discussing the use of electronic cigarettes by midwives themselves. However, to link back to the findings in the literature review, it was found that smoking cessation services are also reluctant to advise the use of electronic cigarettes during pregnancy. This is an important finding as it seems that there is no clear protocol when communicating with pregnant women regarding electronic cigarette use, which leaves both smoking cessation services and midwives referring pregnant women to each other for advice. Similarly, the disparity between how midwives communicate with pregnant women regarding electronic cigarettes, and how smoking cessation services communicate, causes an inconsistency in practice as well as an uncertainty by the pregnant woman, who may be told differing pieces of information from each service. It is important to note that the Royal College of Midwives position statement encourages midwives themselves to have conversations with pregnant women and provide advice about vaping in pregnancy, however, there seems to be a reluctance to do this stemming from a lack of knowledge, leading to a lack of confidence (Royal College of Midwives, 2019).

As a final conclusion, which is supported by the literature discussed throughout and the results of the project, it appears that there needs to be more evidence associated with the safety of electronic cigarettes during pregnancy, and that midwives have not been provided with enough information and resources to feel confident in translating current recommendations into practice. It is however recommended that further research should be conducted to confirm the findings of this research. A future aim is to improve on the knowledge midwives hold regarding electronic cigarettes, by providing clear, informative resources, and a clear approach in discussions with expectant mothers who are looking to use electronic cigarettes as a smoking cessation strategy during their pregnancy. The results of this study could serve as a point of reference for future clinical research as well as clinical practice by bringing to

light the knowledge and attitudes midwives have regarding electronic cigarette use in pregnancy, and thus may be able to suggest some changes to improve the current practices.

Recommendations for future work

Based on these conclusions, further, more robust research would be beneficial to corroborate or refute these findings. Nonetheless, this research has highlighted a number of issues regarding inconsistencies in practice, therefore, it would be of significant importance to understand the resources provided to midwives and how they can be improved to ensure consistency in practice. As midwives are in continuous direct contact with pregnant women who choose to smoke or vape, it would be important to create resources and research regarding safety and make them more accessible to midwives, as this could influence a change in personal practice. It would also be advantageous to create a clear resource that aids midwives on how to approach the subject of electronic cigarette use in pregnancy, as this would improve the amount of signposting to smoking cessation services. Many midwives felt they simply did not know enough about electronic cigarettes to confidently advise a woman on their use during pregnancy, therefore it seems it would be highly beneficial to increase midwives' knowledge on the subject. It would be imperative to create informative resources for midwives, in the form of study days, online courses or lectures to further improve their knowledge. Similarly, it could be advantageous to implement case studies or success stories into training in order to create a more positive attitude towards vaping during pregnancy, thus increasing the likelihood of recommendation.

The use of electronic cigarettes in pregnancy is becoming an increasingly important subject, as more research is being undertaken relating to the safety to both the mother and fetus. Therefore, it is vital that midwives are supplied with up to date information to improve their knowledge and allow for more informed discussions in practice.

Appendices

Appendix 1 – Top 10 relevant papers

- List top 10 most relevant papers that you have read; and provide us with the summary of the main points in no more than 50 words.
 1. Bowker, K., Orton, S., Cooper, S., Naughton, F., Whitemore, R., Lewis, S., Bauld, L., Sinclair, L., Coleman, T., Dickinson, A. and Ussher, M., 2018. Views on and experiences of electronic cigarettes: a qualitative study of women who are pregnant or have recently given birth. *BMC pregnancy and childbirth*, 18(1), p.233. Available from <https://link.springer.com/content/pdf/10.1186%2Fs12884-018-1856-4.pdf>
 - Vapes viewed positively by pregnant women. Seen as less harmful than smoking. Perceived social stigma means that some feel uncomfortable using vapes in public, especially during pregnancy. Concerns about safety and nicotine dependence. Midwives should provide pregnant women with up-to-date info and advice, and consider influence of social stigma.
 2. Cooper, S., Orton, S., Campbell, K.A., Ussher, M., Coleman-Haynes, N., Whitemore, R., Dickinson, A., McEwen, A., Lewis, S., Naughton, F. and Bowker, K., 2019. Attitudes to E-cigarettes and cessation support for pregnant women from English stop smoking services: A mixed methods study. *International journal of environmental research and public health*, 16(1), p.110. available from <https://www.mdpi.com/1660-4601/16/1/110>
 - 8.3% of SSS were likely/ very likely to advise the use of e-cigarettes in pregnancy. 56.9% unlikely/ very unlikely to advise using them. Interviewees were positive about the potential of e-cigarettes for cessation in pregnancy. Concerns about perceived lack of evidence for safety were expressed.
 3. Cooper, S., Orton, S., Leonardi-Bee, J., Brotherton, E., Vanderbloemen, L., Bowker, K., Naughton, F., Ussher, M., Pickett, K.E., Sutton, S. and Coleman, T., 2017. Smoking and quit attempts during pregnancy and postpartum: a longitudinal UK cohort. *BMJ open*, 7(11), p.e018746. Available from <https://bmjopen.bmj.com/content/bmjopen/7/11/e018746.full.pdf>
 - 850 pregnant women who were current smokers or had smoked self-reported their smoking behavior, quit attempts and quitting intentions. Intention to quit fell as the pregnancy progressed. Within three months of giving birth, one third of

women who achieved abstinence during early pregnancy had returned to smoking.

4. Li, G., Chan, Y.L., Nguyen, L.T., Mak, C., Zaky, A., Anwer, A.G., Shi, Y., Nguyen, T., Pollock, C.A., Oliver, B.G. and Saad, S., 2019. Impact of maternal e-cigarette vapor exposure on renal health in the offspring. *Annals of the New York Academy of Sciences*. Available from <https://nyaspubs.onlinelibrary.wiley.com/doi/full/10.1111/nyas.14174>
 - Maternal exposure to nicotine-containing and nicotine-free vapour differentially altered inflammatory markers, suggesting nicotine is not the only sole responsibility for the harmful effects on developing fetus. The impact of e-cigarettes on an offspring's health outcomes would not be fully elucidated by human epidemiological studies for at least 50 years.

5. Mann, R. and Faflik, F., 2018. Survey of smoking cessation services and pregnant women's views on use of electronic cigarettes in pregnancy. *Journal of Health Visiting*, 6(1), pp.32-39. Available from <https://www.magonlinelibrary.com/doi/abs/10.12968/johv.2018.6.1.32>
 - 69% reported they advise pregnant women that e-cigarette use during pregnancy is a personal choice. 28% of pregnant women considered using e-cigarettes, 76% were unsure of the potential harms compared to smoking, and 62% were unsure if women should even have the choice to use electronic cigarettes during pregnancy.

6. McNeill, A., Brose, L.S., Calder, R., Bauld, L. and Robson, D., 2019. Vaping in England: an evidence update February 2019. *A report commissioned by Public Health England. London: Public Health England*. Available from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/821179/Vaping_in_England_an_evidence_update_February_2019.pdf
 - Stand by statement that vaping is 95% less harmful than smoking. Report that English stop smoking services have small proportion of quit attempts using a vape. Combining e-cig use and SSS support should be a recommended option available to all current smokers. Midwives should receive education/training on using a vape in quit attempts.

7. Orzabal, M. and Ramadoss, J., 2019. Impact of electronic cigarette aerosols on pregnancy and early development. *Current Opinion in*

Toxicology. Available from

<https://www.sciencedirect.com/science/article/pii/S2468202018300986>

- Nicotine can permanently alter the intrauterine environment, could compromise the physiological development of major fetal organ systems. Report outlines potential harm that exposure to e-cig aerosols during early life may have on offspring development. Pregnant women should not be advised to use e-cigs or any tobacco product during pregnancy.

8. Schilling, L., Schneider, S., Karlheim, C., Maul, H., Tallarek, M. and Spallek, J., 2019. Perceived threats, benefits and barriers of e-cigarette use during pregnancy. A qualitative analysis of risk perception within existing threads in online discussion forums. *Midwifery*, p.102533.

Available from

<https://reader.elsevier.com/reader/sd/pii/S0266613819302256?token=7FC8B9E8F73B9DB3B7D594AB346B6B79C9AA386DCDF4D3EF103B532219BDA773180F8AD05FD0615E11BE08BCC7704E5A>

- Subthemes were severe nicotine related health risks, potential health risks of additional ingredients, relative risks and lack of knowledge and research studies. Perceived benefits were possibility and facilitation of smoking cessation, harm reduction and financial benefits. Perceived barriers were lack of satisfaction and social stigma.

9. Stroud, L.R., Papandonatos, G.D., Borba, K., Kehoe, T. and Scott-Sheldon, L.A., 2019. Flavored electronic cigarette use, preferences, and perceptions in pregnant mothers: A correspondence analysis approach. *Addictive behaviors*, 91, pp.21-29. Available from

<https://www.sciencedirect.com/science/article/pii/S030646031831253X>

- Pregnant women may be vulnerable to the appeal of flavourings due to alterations in taste and cravings. Lack of differences in harm perceptions across flavours may relate to public health and education campaigns regarding dangers of tobacco use during pregnancy. E-cigarettes were perceived as less harmful than conventional cigarettes.

10. Wigginton, B., Gartner, C. and Rowlands, I.J., 2017. Is it safe to vape? Analyzing online forums discussing e-cigarette use during pregnancy. *Women's Health Issues*, 27(1), pp.93-99. Available from

<https://reader.elsevier.com/reader/sd/pii/S1049386716301864?token=90F1BF9412E673ED4AB8B2586F596678290F437107CC2E0953DFAC3902AA1F48756CA51B6B81C2265ED9B602D72E33D2>

- Analysis of discussion forum threads discussing use in pregnancy. Three distinctive ways in the debates; quitting nicotine cold turkey is unsafe, vaping is lesser of 2 evils,

vaping is not worth the risk. Need to educate and support women about harm reduction options.

Appendix 2 - Questionnaire

Are you a practising midwife?

- Yes
- No

Do you currently work in England?

- Yes
- No

How did you hear about this research?

- Email from R&D at my trust
- A closed midwifery Facebook group
- Other

How old are you?

- Below 25
- 25-29
- 30-49
- 50-59
- 60 or above

How long have you been working as a midwife since your graduation?

- Less than 1 year
- 1-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 21-25 years
- 26-30 years
- More than 30 years

Do you have postgraduate qualification(s)?

- Yes
- No

In the last two years, have you had any training regarding smoking cessation in pregnant women?

- Yes
- No

Have you had managerial duties/posts in the past 5 years?

- Yes
- No

Are you currently assigned managerial duties/tasks?

- Yes
- No

Have you provided care for any pregnant women who have successfully quit smoking due to using electronic cigarettes?

- Yes
- No

What is your smoking status?

- Neither a smoker nor a vaper
- Ex-smoker and currently vaping
- Ex-vaper and currently smoking
- Ex-smoker only
- Ex-vaper only
- Ex-smoker and ex-vaper
- Smoking only
- Vaping only
- Smoking and vaping

Do electronic cigarette vapour contain carcinogens (products that can cause cancer)?

- Yes
- No
- Don't know

Is the vapour from electronic cigarettes safe for bystanders?

- Yes
- No
- Don't know

Can nicotine cross the placental barrier by vaping?

- Yes
- No
- Don't know

Is there evidence regarding the risks of electronic cigarettes to unborn babies?

- Yes
- No
- Don't know

Is there evidence regarding the effects of long-term use of electronic cigarettes to unborn babies?

- Yes
- No
- Don't know

Is nicotine's metabolism (through inhalation) faster in pregnancy?

- Yes
- No
- Don't know

Can electronic liquids contain different amounts of nicotine?

- Yes
- No

- Don't know

Do electronic cigarettes contain carbon monoxide?

- Yes
- No
- Don't know

If a pregnant woman has switched completely to vaping, should she be recorded as a non-smoker?

- Yes
- No
- Don't know

Are electronic cigarettes licensed for smoking cessation in pregnancy?

- Yes
- No
- Don't know

Can a mother use an electronic cigarette whilst breastfeeding?

- Yes
- No
- Don't know

Are electronic cigarettes the most popular method for quitting smoking?

- Yes
- No
- Don't know

Are you aware of any NHS hospital that is encouraging pregnant women to quit smoking by using electronic cigarettes?

- Yes
- No
- Don't know

Are the potential health effects of electronic cigarettes known?

- Yes
- No
- Don't know

Are electronic cigarettes recommended as the first-line treatment to assist smoking cessation?

- Yes
- No
- Don't know

To what extent do you agree with the following statements:

Electronic cigarettes should be suggested as a smoking cessation strategy for women during pregnancy.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Electronic cigarettes should be suggested as a smoking cessation strategy for women after giving birth (up to 12 months).

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Electronic cigarettes should be recommended as a first-line treatment to pregnant women as a smoking cessation strategy

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Midwives should advise pregnant women to use electronic cigarettes to stop smoking during pregnancy.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

I feel confident advising women of the potential risks to using electronic cigarettes in pregnancy.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Midwives should recommend electronic cigarettes over other nicotine replacement therapies such as nicotine patches as smoking cessation strategy in pregnant women.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Similar to other NRTs, electronic cigarettes should be available to pregnant women on prescription.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

There is a need for more evidence on the safety of electronic cigarettes in pregnancy for them to be recommended as smoking cessation strategy.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Midwives have been provided with enough resources to accurately advise pregnant women regarding electronic cigarettes as smoking cessation strategy

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

If a pregnant woman wants to switch from conventional cigarettes to an electronic cigarette, she should not be discouraged from doing so.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

If a pregnant woman wants to use a vape alongside conventional cigarettes, she should be supported in doing so.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

E-cigarettes are 95% less harmful than smoking.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Potential health effects of electronic cigarettes are known.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Stop smoking services should support pregnant women who want to quit smoking by recommending vaping.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

There is a stigma attached to using an electronic cigarette in public whilst pregnant.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

It is socially unacceptable for a pregnant woman to smoke in public.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

It is socially unacceptable for a pregnant woman to vape in public.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

How likely are you to recommend electronic cigarettes to a pregnant woman as a smoking cessation strategy?

- Very Likely
- Likely
- Neither likely nor unlikely
- Unlikely
- Very unlikely

Please include any additional comments on the resources given to midwives regarding electronic cigarette use as smoking cessation in pregnancy

Please include any additional comments regarding the safety of electronic cigarettes as smoking cessation strategy in pregnant women.

Please include any other additional comments on any other aspects of electronic cigarette use in pregnancy.

Appendix 3 – RStudio commands

Conversion to percentage:

```
amy$knowledge <- apply(knowledge, 1, sum)/15*100
```

```
amy$attitude <- apply(attitude, 1, sum)/68*100
```

Reliability testing:

```
library(mokken)
```

```
knowledge <- as.data.frame(knowledge, bycolumn=T)
```

```
check.reliability(knowledge)
```

```
attitude <- na.omit(attitude)
```

```
check.reliability(attitude)
```

Appendix 4 – Codes

Sociodemographic Question	Appointed Code
How old are you?	Age
How long have you been working since your graduation?	Experience
Do you have postgraduate qualification(s)?	Qualifications
In the last two years, have you had any training regarding smoking cessation in pregnant women?	Training
Have you had any managerial duties/posts in the past five years?	Five
Are you currently assigned managerial duties/tasks?	Current
Have you provided any care for any pregnant women who have successfully quit smoking due to using electronic cigarettes?	Care
What is your smoking status?	Status

Table 14: Table to show sociodemographic items included in survey

Knowledge Question	Appointed Code
Does electronic cigarette vapour contain carcinogens (products that can cause cancer?)	Carcinogen
Is the vapour from electronic cigarettes safe for bystanders?	Bystander
Can nicotine cross the placental barrier when vaping?	Cross
Is there evidence regarding the risks of electronic cigarettes to unborn babies?	Unborn

Is there evidence regarding the effects of long-term use of electronic cigarettes to unborn babies?	Long
Is nicotine's metabolism (through inhalation) faster in pregnancy?	Metabolism
Can electronic cigarettes contain different amounts of nicotine?	Nicotine
Do electronic cigarettes contain carbon monoxide?	Carbon
If a pregnant woman has switched to vaping, should she be recorded as a non-smoker?	Record
Are electronic cigarettes licensed for smoking cessation in pregnancy?	License
Can a mother use an electronic cigarette whilst breastfeeding?	Breast
Are electronic cigarettes the most popular method for quitting smoking?	Method
Are you aware of any NHS hospital that is encouraging pregnant women to quit smoking by using electronic cigarettes?	NHS
Are the potential health effects of electronic cigarettes known?	Known
Are electronic cigarettes recommended as the first-line treatment to assist smoking cessation in pregnant women?	First

Table 15: Table to show knowledge items included in survey

Attitude Question	Appointed Code
Electronic cigarettes should be suggested as a smoking cessation strategy for women during pregnancy	During
Electronic cigarettes should be suggested as a smoking cessation strategy for women after giving birth (up to 12 months)	After
Electronic cigarettes should be recommended as a first-line treatment for pregnant women as a smoking cessation strategy	Treatment
Midwives should advise pregnant women to use electronic cigarettes to stop smoking during pregnancy	Advise
I feel confident advising women on the potential risks to using electronic cigarettes in pregnancy	Confident
Midwives would recommend electronic cigarettes over other nicotine replacement therapies such as nicotine patches as a smoking cessation strategy in pregnant women	Patch
Similar to other NRTs, electronic cigarettes should be available to pregnant women on prescription	Prescribe
There is a need for more evidence on the safety of electronic cigarettes in pregnancy for them to be recommended as a smoking cessation strategy	Evidence
Midwives have been provided with enough resources to accurately advise pregnant women regarding electronic cigarettes as a smoking cessation strategy	Resource
If a pregnant woman wants to switch from conventional cigarettes to an electronic cigarette, she should not be discouraged from doing so	Switch
If a pregnant woman wants to use a vape alongside conventional cigarettes, she should be supported in doing so	Vape
E-cigarettes are 95% less harmful than smoking	Percent
Potential health effects of electronic cigarettes are known	Health
Stop smoking services should support pregnant women who want to quit smoking by recommending vaping	Stop

There is a stigma attached to using an electronic cigarette in public whilst pregnant	Stigma
It is socially unacceptable for a pregnant woman to smoke in public	Smoke
It is socially unacceptable for a pregnant woman to vape in public	Public
How likely are you to recommend electronic cigarettes to a pregnant woman as a smoking cessation strategy?	You

Table 16: Table to show attitude items included in survey

Appendix 5 – IRAS Approval

25 March 2020

Dear Miss Broadfield

**HRA and Health and Care
Research Wales (HCRW)
Approval Letter**

Study title: How do midwives' knowledge and attitudes of all aspects of electronic cigarettes influence the recommendation for their use as a smoking cessation strategy in pregnancy?

IRAS project ID: 274637

Protocol number: 20005

Sponsor: University of Lincoln

I am pleased to confirm that [HRA and Health and Care Research Wales \(HCRW\) Approval](#) has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications received. You should not expect to receive anything further relating to this application.

Please now work with participating NHS organisations to confirm capacity and capability, in line with the instructions provided in the "Information to support study set up" section towards the end of this letter.

Appendix 6 – LEAS approval



Application Details

Ethics Reference 2020-0977
Title of Project Midwives' recommendation of electronic cigarettes as a smoking cessation strategy in pregnancy
Lead Researcher Amy Broadfield
Academic Supervisor Helen Ayre, Josie Solomon, Keivan Ahmadi
Committee Human Ethics Committee (PR)
Date of Ethical Opinion 9 March 2020

FAVOURABLE OPINION

Thank you for your revised submission. The further information has been considered, on behalf of the committee and I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form and supporting documentation.

The favourable ethical opinion provided is conditional to the following requirements:

- Personal data should be destroyed when it is no longer necessary to contact participants.
- The following must be added to any recruitment materials (including posters, adverts, social media posts).
 - The project [insert study title] contributes to research conducted on behalf of the University of Lincoln and has received a favourable ethical opinion by a University Research Ethics Committee (Insert Ethics Reference - given at the top of this letter) in accordance with the Guidelines for research recruitment materials (available on the ethics portal page).
 - Please ensure that a version number and date is included on all recruitment materials (this should be the same as the version number and date listed on your favourable opinion letter).

Appendix 7 – Knowledge responses

Question	Number of correct responses	Number of incorrect responses
Does electronic cigarette vapour contain carcinogens (products that cause cancer?)	32	27
Is the vapour from electronic cigarettes safe for bystanders?	14	35
Can nicotine cross the placental barrier when vaping?	51	13
Is there evidence regarding the risks of electronic cigarettes to unborn babies?	14	42
Is there evidence regarding the effects of long-term use of electronic cigarettes to unborn babies?	56	10
Is nicotine's metabolism (through inhalation) faster in pregnancy?	34	15
Can electronic cigarettes contain different amounts of nicotine?	75	4
Do electronic cigarettes contain carbon monoxide?	47	14
If a pregnant woman has switched completely to vaping, should she be recorded as a non-smoker?	24	51
Are electronic cigarettes licensed for smoking in pregnancy?	44	10
Can a mother use an electronic cigarette whilst breastfeeding?	44	14
Are electronic cigarettes the most popular method for quitting smoking?	49	17
Are you aware of any NHS hospital that is encouraging pregnant women to quit smoking by using electronic cigarettes?	28	44
Are the potential health effects of electronic cigarettes known?	49	26
Are electronic cigarettes recommended as the first-line treatment to assist smoking cessation in pregnant women?	42	15

Appendix 8 – Conventional content analysis process

1. Responses are repeatedly read to enable understanding.
2. Each response is examined, highlighting key words and phrases that capture the main thoughts of the participants' response.
3. Responses were re-read and coded, using labels. This summarises the statements.
4. Each code is reviewed and sorted into a category.
5. Original responses are compared to the category. Categories are modified where necessary until all responses are linked to a suitable category.

Appendix 9 – Content Analysis Spreadsheet

Q45 - Please include any additional comments on the resources given to midwives regarding electronic cigarette use as smoking cessation in pregnancy

	Content	Code	Final code (if different from first)
1. I have been advised by a smoking cessation midwife that vaping is safer to the baby but we don't know the long term health effects to the woman. CO monitoring is within normal ranges when vaping only.	Advised by smoking cessation midwife	Varying sources of support / resources provided	
2. I have been advised by a smoking cessation midwife that vaping is safer to the baby but we don't know the long term health effects to the woman . CO monitoring is within normal ranges when vaping only.	Vaping is safer to the baby but we don't know long term health effects to the woman	Not enough evidence	Uncertainty influencing practice
3. I have been advised by a smoking cessation midwife that vaping is safer to the baby but we don't know the long term health effects to the woman. CO monitoring is within normal ranges when vaping only .	CO monitoring is within normal ranges when vaping only	Varying sources of support / resources provided	
4. Never been given any info or training on e cigarettes.	No training or info	Not enough or No Training / Info / Resources	
5. At my last study session regarding smoking we were told not to recommend vaping and to discourage women from doing it due to insufficient evidence regarding safety in pregnancy.	Study session regarding smoking	Varying sources of support / resources provided	
6. At my last study session regarding smoking we were told not to recommend vaping and to discourage women from doing it due to insufficient evidence regarding safety in pregnancy.	told not to recommend vaping and to discourage women from doing it	Local policy	
7. At my last study session regarding smoking we were told not to recommend vaping and to discourage women from doing it due to insufficient evidence regarding safety in pregnancy .	Insufficient evidence regarding safety in pregnancy	Not enough evidence	Uncertainty influencing practice
8. In my Trust the emphasis is on referrals to the smoking cessation service . We have been provided with information that vaping is safer than smoking.	emphasis is on referrals to the smoking cessation service	Local policy	
9. In my Trust the emphasis is on referrals to the smoking cessation service. We have been provided with information that vaping is safer than smoking .	provided with information that vaping is safer than smoking.	Varying sources of support / resources provided	

10. As a trust we advice nicotine replacement however if they have tried this and have been unsuccessful we recommend e-cigarettes as we are told although they do contain nicotine they contain less chemicals than a cigarette and these are the chemicals that reduce the growth of the baby.	Told vaping contains less chemicals, and chemicals reduce growth of the baby	Varying sources of support / resources provided
11. As a trust we advice nicotine replacement however if they have tried this and have been unsuccessful we recommend e-cigarettes as we are told although they do contain nicotine they contain less chemicals than a cigarette and these are the chemicals that reduce the growth of the baby.	As a trust (policy) NRT is advised, vaping only if NRT is unsuccessful	Local policy
12. Lacking evidence on the benefits and risks of using electronic cigarettes	Lack of evidence on benefits and risks	Not enough evidence Uncertainty influencing practice
13. Haven't been given any resources	No training or resources	Not enough or No Training / Info / Resources
14. None	No resources	Not enough or No Training / Info / Resources
15. we don't have enough resources	Not enough resources	Not enough or No Training / Info / Resources
16. Very little information given at a local level.	Very little information given	Varying sources of support / resources provided
17. Provided with one A5 poster with minimal information. No training.	No training	Not enough or No Training / Info / Resources
18. Provided with one A5 poster with minimal information	A5 poster, minimal info	Varying sources of support / resources provided
19. Local smoking cessation stopped, changed and still no training.	No training	Not enough or No Training / Info / Resources
20. I've had no education or training and feel unconfident on the issue. (I'm a hospital midwife)	No education or training	Not enough or No Training / Info / Resources

21. I've had no education or training and feel unconfident on the issue. (I'm a hospital midwife)	Feel unconfident on the issue	Lack of confidence	Uncertainty influencing practice
22. None. We just been told the benefits outweight the potential risks.	No resources	Not enough or No Training / Info / Resources	
23. None. We just been told the benefits outweight the potential risks.	Told benefits outweigh potential risk	Varying sources of support / resources provided	
24. not enough resources	Not enough resources	Not enough or No Training / Info / Resources	
25. Not enough resources	Not enough resources	Not enough or No Training / Info / Resources	
26. There are not currently enough resources	Not enough resources	Not enough or No Training / Info / Resources	
27. Not enough given	Not enough resources given	Not enough or No Training / Info / Resources	
28. Resources are not readily available	Not readily available	Not enough or No Training / Info / Resources	
29. Would not recommend	unclear response in relation to question. ? Would not recommend vaping? Or would not recommend resources		
30. Not enough resources	Not enough resources	Not enough or No Training / Info / Resources	
31. Barely any	Barely any	Not enough or No Training / Info / Resources	
32. Due to media coverage a few months back about vaping causing lung issues, this had caused pregnant women to become sceptical about using them, even though you try and explain that it was due to THC being used in Vapes.	Adverse media coverage causes skepticism despite midwife advice	Conflict between media and professional advice	Uncertainty influencing practice

33. We focus on the lack of carbon monoxide and therefore the reduced risk of IUGR	Lack of CO and reduced risk of IUGR	Varying sources of support / resources provided	
34. Limited but clear in message	Limited but clear in message	Varying sources of support / resources provided	
35. I have not been given any	Not been given any	Not enough or No Training / Info / Resources	
36. I feel like I did not have enough know how to answer some of the statements, this is due to lack of information being provided/available	did not have enough know how / lack of information	Not enough or No Training / Info / Resources	
37. I do not know enough about vaping to realistically comment.	I do not know enough	lack of confidence	Uncertainty influencing practice
38. I'm a casual smoker. I smoke only when I go out and this was not an option.	N/A		
39. I have not received enough information to be able to advise one way or another and ensuring it is evidence-based. In practice we had been informed to signpost to a help to quit service and not necessary enough advice for us to advise	not received enough information to advise	lack of confidence	Uncertainty influencing practice
40. I have not received enough information to be able to advise one way or another and ensuring it is evidence-based. In practice we had been informed to signpost to a help to quit service and not necessary enough advice for us to advise	Not enough information to ensure Evidence based advise	Not enough evidence	Uncertainty influencing practice
41. I have not received enough information to be able to advise one way or another and ensuring it is evidence-based. In practice we had been informed to signpost to a help to quit service and not necessary enough advice for us to advise	Been informed to signpost to help to quite service	Local Policy	
42. I have not received enough information to be able to advise one way or another and ensuring it is evidence-based. In practice we had been informed to signpost to a help to quit service and not necessary enough advice for us to advise	In practice been informed....not necessarily enough advice for [midwives] to advise	Local Policy	
43. Not enough resources are given to midwives	not enough resources given to midwives	Not enough or No Training / Info / Resources	
44. I need more guidance as I don't agree with my trust saying if pregnant woman vapes she is classed as non smoker	Need more guidance	Not enough or No Training / Info / Resources	

45. I need more guidance as I don't agree with my trust saying if pregnant woman vapes she is classed as non smoker	Don't agree with non-smoking status of vapers (referred to as Trust policy, but is RCM advice - lack of knowledge)	Not enough evidence / uncertain re EBP	Uncertainty influencing practice
46. The train of thought is electronic cigarettes contain no carbon monoxide therefore are safer for women that cigarettes. We would always refer any women to smoking cessation as they are the experts xxx	No CO is safer than cigarettes	Varying sources of support / resources provided	
47. The train of thought is electronic cigarettes contain no carbon monoxide therefore are safer for women that cigarettes. We would always refer any women to smoking cessation as they are the experts xxx	Refer to smoking cessation as experts	Local Policy	
48. It is acknowledged that vaping is a safer alternative to smoking but how safe we don't know. I don't know enough about vaping to make any recommendations.	Safer alternative, but how safe we don't know (evidence)	Not enough evidence / uncertain re EBP	Uncertainty influencing practice
49. It is acknowledged that vaping is a safer alternative to smoking but how safe we don't know. I don't know enough about vaping to make any recommendations.	Don't know enough to make recommendations	Not enough evidence / uncertain re EBP	Uncertainty influencing practice
50. there are not enough resources for us to make these decisions	not enough resources (decision making)		Uncertainty influencing practice
51. we have been given resources to advise pregnant women	Have been given resources to advise pregnant women	Varying sources of support / resources provided	
52. haven't been given much	Not given much	Varying sources of support / resources provided	
53. been given leaflets to hand out	Given leaflets	Varying sources of support / resources provided	
54. have been given leaflets and information to tell pregnant women	Given leaflets and info	Varying sources of support / resources provided	
55. not enough information to help them	Not enough info to help women	Not enough or No Training / Info / Resources	
56. It was mentioned at a conference and we were given information leaflets	mentioned at conference / info leaflets	Varying sources of support / resources provided	

57. we've only been given one resource on vapes, which i don't think is enough

only one resource given / not enough

Not enough or No Training / Info
/ Resources

Q46 - Please include any additional comments regarding the safety of electronic cigarettes as a smoking cessation strategy in pregnant women	Content	Code	Final code (if different from first)
1. I have been advised by a smoking cessation midwife that vaping is safer to the baby but we don't know the long term health effects to the woman. CO monitoring is within normal ranges when vaping only.	advised by smoking cessation midwife	Advised vaping is safer	Varying sources of support/information/resources are provided
2. I have been advised by a smoking cessation midwife that vaping is safer to the baby but we don't know the long term health effects to the woman. CO monitoring is within normal ranges when vaping only.	vaping is safer to the baby but we don't know long term health effects to the woman	Advised vaping is safer	Varying sources of support/information/resources are provided
3. I have been advised by a smoking cessation midwife that vaping is safer to the baby but we don't know the long term health effects to the woman. CO monitoring is within normal ranges when vaping only.	CO monitoring is within normal ranges when vaping only	CO monitoring	
4. I think there are risks to e cigarettes but less than normal cigarettes. I've read about popcorn lung. But as a crutch to move to being smoke free it could be a temp measure.	risk is less in normal cigarettes	Better than smoking	Varying sources of support/information/resources are provided
5. I think there are risks to e cigarettes but less than normal cigarettes. I've read about popcorn lung. But as a crutch to move to being smoke free it could be a temp measure.	e cigs are probs a temporary measure	Temporary measure	Varying sources of support/information/resources are provided
6. We have to advise women there is not lots of evidence of e-cigarettes in pregnancy but we discuss that they are safer and better than normal cigarettes.	advise there is not lots of evidence	Not enough research	
7. We have to advise women there is not lots of evidence of e-cigarettes in pregnancy but we discuss that they are safer and better than normal cigarettes.	Tell women they are safer than cigarettes	Better than smoking	Varying sources of support/information/resources are provided
8. Lack of evidence	Lack of evidence	Not enough research	
9. Don't know enough about it	Don't know enough	Not enough knowledge	
10. Unaware	Unaware of safety	Not enough knowledge	
11. i don't think they are safe, patches would be better	Don't think they're safe	Unsafe	

12. i don't think they are safe, patches would be better	Patches better than e cigs	Alternative recommendation	
13. I personally don't believe there is enough long term research however this is because vaping is relatively new. I feel you shouldn't promote someone you don't have the full knowledge of so although I appreciate the research short term is positive, it makes me nervous of what we might learn in the future.	Not enough long term research	Not enough research	
14. I personally don't believe there is enough long term research however this is because vaping is relatively new. I feel you shouldn't promote someone you don't have the full knowledge of so although I appreciate the research short term is positive, it makes me nervous of what we might learn in the future.	Don't have the full knowledge	Not enough knowledge	
15. I personally don't believe there is enough long term research however this is because vaping is relatively new. I feel you shouldn't promote someone you don't have the full knowledge of so although I appreciate the research short term is positive, it makes me nervous of what we might learn in the future.	Short term research is positive	Temporary measure	Varying sources of support/information/resources are provided
16. I personally don't believe there is enough long term research however this is because vaping is relatively new. I feel you shouldn't promote someone you don't have the full knowledge of so although I appreciate the research short term is positive, it makes me nervous of what we might learn in the future.	Long term research might not be	Not enough research	
17. not safe	Not safe	Unsafe	
18. Not safe	Not safe	Unsafe	
19. I do not believe they are safe	Not safe	Unsafe	
20. We need more information as we really don't know the true effects of smoking electronic cigarettes	Need more info	Not enough knowledge	
21. We need more information as we really don't know the true effects of smoking electronic cigarettes	Don't know the true effects	Not enough knowledge	
22. Not the safest	Not safe	Unsafe	
23. It is unsafe	Not safe	Unsafe	
24. Not safe	Not safe	Unsafe	
25. Because safety is fairly unknown, not smoking at all is recommended or the use of other products to assist smoking cessation	Unknown safety	Unsafe	

26. Because safety is fairly unknown, not smoking at all is recommended or the use of other products to assist smoking cessation	Recommends not smoking at all	Alternative recommendation	
27. Because safety is fairly unknown, not smoking at all is recommended or the use of other products to assist smoking cessation	Use other products	Alternative recommendation	
28. Evidence suggests that they are 95%safer than cigarettes as they don't contain carbon monoxide....I tell all pregnant ladies this. I do wish there was more research about this.	Safer than cigarettes	Better than smoking	Varying sources of support/information/resources are provided
29. Evidence suggests that they are 95%safer than cigarettes as they don't contain carbon monoxideI tell all pregnant ladies this. I do wish there was more research about this.	No CO	CO monitoring	
30. Evidence suggests that they are 95%safer than cigarettes as they don't contain carbon monoxide....I tell all pregnant ladies this . I do wish there was more research about this.	Tells women no CO	Advised vaping is safer	Varying sources of support/information/resources are provided
31. Evidence suggests that they are 95%safer than cigarettes as they don't contain carbon monoxide....I tell all pregnant ladies this. I do wish there was more research about this .	Need more research	Not enough research	
32. Safer than smoking cigarettes	Safer than cigarettes	Better than smoking	Varying sources of support/information/resources are provided
33. If there was evidence to support this recommendation midwives would feel more comfortable and confident in making the recommendations	Need more research	Not enough research	
34. I feel I do not know enough information to advise on safety and would not want to speculate without seeing the studies. Also the long term impacts of vaping still aren't known both in pregnant/general populations, therefore reluctant to give advice.	Need more info	Not enough knowledge	

35. I feel I do not know enough information to advise on safety and would not want to speculate without seeing the studies . Also the long term impacts of vaping still aren't known both in pregnant/general populations, therefore reluctant to give advice.	Need more research	Not enough research	
36. I feel I do not know enough information to advise on safety and would not want to speculate without seeing the studies. Also the long term impacts of vaping still aren't known both in pregnant/general populations, therefore reluctant to give advice.	Long term effects unknown.	Not enough research	
37. Unaware of enough evidence of the safety of e-cigarettes to confidentiality advise pregnant women	Not enough evidence on safety	Not enough research	
38. there isn't enough research to say that women should use them, i recommend quitting	Not enough research	Not enough research	
39. there isn't enough research to say that women should use them, i recommend quitting	Recommends quitting	Not enough research	
40. recent evidence says they're safe	Recent evidence says they're safe	Alternative recommendation	
41. safer than smoking	Safer than cigarettes	Better than smoking	Varying sources of support/information/resources are provided
42. safety is unknown	Unknown safety	Unsafe	
43. still needs to be studied more	Needs more info	Not enough research	
44. there's not enough research on e cigs to tell pregnant women they,Äre safe	Not enough research	Not enough research	
45. some research has been done and they,Äre said to be safer than smoking	some research has said they're safer than smoking	Better than smoking	Varying sources of support/information/resources are provided
46. it's hard to recommend to pregnant women when we're unsure of the safety , I'd rather not recommend	Unsure of safety	Unsafe	
47. it's hard to recommend to pregnant women when we're unsure of the safety, I'd rather not recommend	Rather not recommend	Alternative recommendation	

Q47 - Please include any additional comments on any other aspects of electronic cigarette use in pregnancy

	Content	Code	Final code (if different from first)
1. I would like access to more evidence based information	Access to more info	Need more information	on fence
2. However, when people ask me about them or I'm looking after a woman who smokes and is having complications, I remind them it is their decision how to manage their smoking and while we don't have much research yet about vaping how can something with five or six ingredients compare to the carbon monoxide and 400poisens cigarettes contain. Then I explain about what carbon monoxide does in the body. I support it without offically supporting it, sometimes with suggestive facial expressions.	Not enough research	Not enough research	on fence
3. However, when people ask me about them or I'm looking after a woman who smokes and is having complications, I remind them it is their decision how to manage their smoking and while we don't have much research yet about vaping how can something with five or six ingredients compare to the carbon monoxide and 400poisens cigarettes contain. Then I explain about what carbon monoxide does in the body. I support it without offically supporting it, sometimes with suggestive facial expressions.	Better than smoking cigs	Better than smoking	would recommend
4. However, when people ask me about them or I'm looking after a woman who smokes and is having complications, I remind them it is their decision how to manage their smoking and while we don't have much research yet about vaping how can something with five or six ingredients compare to the carbon monoxide and 400poisens cigarettes contain. Then I explain about what carbon monoxide does in the body. I support it without offically supporting it, sometimes with suggestive facial expressions.	Supports the use of e cigs	Would Recommend	would recommend
5. On talking to staff many still feel uncomfortable suggesting vaping even though they are aware it is safer than smoking	Uncomfortable suggesting	Should not be recommended	should not recommend
6. On talking to staff many still feel uncomfortable suggesting vaping even though they are aware it is safer than smoking	Safer than smoking	Better than smoking	would recommend

7. When a mother had been smoking cigarettes and the baby's growth dropped she then changed to e-cigarettes and the growth did improve for several weeks following the change.	Smoking stunts growth, e-cigs do not	Better than smoking	would recommend
8. not enough research for us to confidently advise	Not enough research	Not enough research	on fence
9. shouldn't be recommended	Shouldn't be recommended	Should not be recommended	should not recommend
10. Shouldn't be recommended	Shouldn't be recommended	Should not be recommended	should not recommend
11. I don't believe they are safe or should be recommended	Not safe	Unsafe	should not recommend
12. I don't believe they are safe or should be recommended	Shouldn't be recommended	Should not be recommended	should not recommend
13. Need more information	Need more info	Need more information	on fence
14. Electronic cigarettes should not be recommended while pregnant	Shouldn't be recommended	Should not be recommended	should not recommend
15. It is unsafe	Not safe	Unsafe	on fence
16. Should not be recommended	Shouldn't be recommended	Should not be recommended	should not recommend
17. At my trust we have a designated smoking cessation midwife whom we refer women to for the most up to date information regarding NRT/vapes etc	Designated smoking cessation midwife	Varying source of support	on fence
18. i recommend quitting rather than e cigs, sometimes suggest patches	Alternative recommendation	Alternative recommendation	should not recommend
19. if it stops them smoking it's ok	Good as smoking cessation	Good smoking cessation strategy	would recommend
20. would recommend	Would recommend	Would Recommend	would recommend
21. would recommend instead of smoking	Would recommend	Would Recommend	would recommend
22. if it helps a mother quit smoking then it is good	Good as smoking cessation	Good smoking cessation strategy	would recommend

23. i probably wouldn't recommend e cigs over patches	Alternative recommendation	Alternative recommendation	should not recommend
24. would prefer a pregnant women to use an e cig than smoke	Good as smoking cessation	Good smoking cessation strategy	would recommend
25. if there was more evidence I'd be more inclined the hold discussions with expectant mothers about vaping	Need more evidence	Not enough research	on fence

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