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Barriers and facilitators to smoking cessation in pregnant women in the United Kingdom: A systematic review

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Abstract: -

Introduction: Smoking during pregnancy poses severe public health risks, including preterm birth, low birth weight, and congenital anomalies. Despite ongoing public health efforts, the prevalence of smoking among pregnant women in the United Kingdom (UK) remains concerning.

Methods: A mixed-methods systematic review was conducted, focusing on studies published between 2014 and 2024. The search strategy was designed to retrieve relevant studies from PubMed, CINAHL, Cochrane, and Medline databases, using a combination of keywords, Medical Subject Headings (MeSH), and Boolean operators (e.g., AND, OR). Eligibility criteria required studies to specifically examine factors influencing smoking cessation in pregnant women, including psychosocial, behavioural, and healthcare-related aspects. Only studies in English and conducted in the UK were included to ensure geographic relevance.

Results: The review identified significant barriers to smoking cessation, including psychological dependence, financial strain, and a lack of social support. Conversely, facilitators included the motivation to protect infant health, supportive healthcare providers, and the use of digital interventions like MiQuit, which provided continuous motivational support.

Conclusion: The findings highlight the need for multi-faceted, tailored interventions that address both psychological and socioeconomic challenges. Integrating mental health support, offering non-judgmental, personalized approaches, and embedding cessation programs into routine prenatal care are essential for improving smoking cessation outcomes among pregnant women.

Keywords: Smoking cessation, pregnant women, UK, digital interventions, psychological dependence, socioeconomic barriers, qualitative research, quantitative research, MiQuit, healthcare interventions, public health, smoking in pregnancy.

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Introduction

Smoking cessation during pregnancy is crucial due to the significant health risks it poses to both the mother and the foetus (1). Smoking while pregnant is associated with a heightened risk of several adverse outcomes, including preterm birth, low birth weight, and congenital anomalies (2)(3). It is a major risk factor for complications such as intrauterine growth restriction (IUGR), congenital heart defects, and sudden infant death syndrome (SIDS), contributing to long-term developmental issues in children, including cognitive delays and respiratory disorders (4). Globally, the prevalence of smoking during pregnancy is estimated to be 1.7% (5) which contributes to approximately 10% of all perinatal deaths and is a leading preventable cause of pregnancy complications such as preterm birth, low birth weight, and increased perinatal mortality (6)(7)(8). Despite global efforts to reduce smoking rates, the prevalence of smoking during pregnancy remains high in certain regions. For instance, Europe has the highest prevalence at 8.1%, followed by the Americas at 5.9% (9)(10). In the United Kingdom (UK), smoking remains prevalent among pregnant women despite numerous public health initiatives, with an estimated 9.5% of women continuing to smoke throughout

pregnancy (11). This figure contrasts starkly with countries such as Nigeria, where the prevalence of smoking in pregnant women is as low as 0.4% (10), Sweden and Japan, which report smoking rates of approximately 6% and 7.5%, respectively, among this demographic (12)(13). In the United States, smoking during pregnancy has decreased but still affects 5.4% of pregnant women (14), highlighting the widespread persistence of this public health issue. This global burden reflects disparities in tobacco control policies, socio-economic factors, and access to smoking cessation resources. In contrast, regions such as Sub-Saharan Africa report lower smoking rates, partly due to cultural norms and lower tobacco use among women in general (15). However, these figures may underestimate the burden due to underreporting and limited data collection in many LMICs.

In the UK, free smoking cessation services, including nicotine replacement therapy (NRT) and behavioural support, are available to pregnant women through the National Health Service (NHS), yet challenges remain. Despite these resources, many women continue to face psychological barriers, such as nicotine dependence and stress, which are heightened during pregnancy (16). inconsistent support from healthcare providers and a lack of tailored cessation programs, further hinder efforts to reduce smoking rates in this population (17).

This review adopts a critical perspective on the various factors influencing smoking behaviour among women in this demographic, blending quantitative data on prevalence and impact with the qualitative insights into the lived experiences of pregnant women.

Aims

This mixed methods review aims to synthesise the existing literature on barriers and facilitators to smoking cessation among pregnant women in the UK.

Objectives

To identify key barriers that hinder smoking cessation among pregnant women in the UK.

To examine the facilitators that support smoking cessation during pregnancy.

To provide evidence-based recommendations for healthcare providers and policymakers to improve smoking cessation support and outcomes for pregnant women.

Methods

The mixed-methods design was selected to capture both numerical patterns from quantitative studies and rich contextual insights from qualitative research, facilitating a comprehensive understanding of the complex factors influencing smoking behaviour during pregnancy (18)(19). The study was guided by the following hypothesis: Null Hypothesis (H_0): There is no statistically significant difference in smoking cessation rates between pregnant women receiving tailored interventions (such as text message support and financial incentives) and those receiving usual care. Alternative Hypothesis (H_1): Pregnant women receiving tailored interventions (such as text message support and financial incentives) will have significantly higher smoking cessation rates compared to those receiving usual care.

Database Selection and Search Strategy

The databases selected for this systematic review were PubMed, CINAHL, Cochrane, and Medline. These databases were chosen due to their extensive coverage of medical, public health, and behavioural science literature, ensuring access to a broad spectrum of peer-reviewed studies relevant to maternal health, smoking cessation, and healthcare interventions (20). The search strategy employed Boolean operators (e.g., AND, OR, NOT) and a combination of keywords and Medical Subject Headings (MeSH) terms to maximize retrieval of relevant articles. Keywords such as "UK," "pregnant women," "quit smoking," "smoking," "cigarette smoking," "interventions," "knowledge," "attitudes," "perceptions," and "qualitative" were used to explore the psychosocial, behavioural, and healthcare-related dimensions of smoking cessation (21)(22)(23)(24)(25). Synonyms and antonyms of these keywords, along with various permutations and combinations, were applied to ensure comprehensive search results (26)(25). For qualitative studies, keywords such as "barriers," "facilitators," and "challenges" captured the psychosocial context, while quantitative studies included terms like "randomised controlled trial," "smoking cessation interventions," and "pregnancy," focusing on outcome measures and intervention efficacy (21)(22)(23)(24). These strategies allowed the review to gather both qualitative insights and quantitative findings, while ensuring that studies with robust methodological designs were selected.

Inclusion and Exclusion Criteria

The review's inclusion criteria were deliberately precise, focusing exclusively on studies involving pregnant women in the UK that examined barriers and facilitators to smoking cessation. Articles that did not meet these criteria were excluded from the analysis. Only studies published in English between 2014 and 2024 were included to capture the most recent advancements in smoking cessation interventions and public health policy (20). Eligible studies specifically investigated factors influencing the ability of pregnant women to quit smoking, covering psychosocial, behavioural, and healthcare-related aspects (27) (28). Both qualitative and quantitative studies were considered to ensure a well-rounded understanding of the topic (29). Conversely, studies that focused on populations with significant comorbidities, such as HIV, diabetes, or hypertension, were excluded to avoid confounding variables that could skew the results and ensure the review remained focused on the general pregnant population (21) (30).

Moreover, studies conducted outside the UK were excluded to maintain the geographic relevance of the findings, aligning them with the unique healthcare and social systems in the UK (31). These stringent criteria were critical for preserving the internal validity of the review while minimizing heterogeneity. Additionally, a detailed search string was developed and maintained by the group to ensure consistency in retrieving relevant articles across databases.

Study Selection Process

The study selection process adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, ensuring transparency and methodological rigour throughout (32) (33) (34). Initially, two independent reviewers

screened the titles and abstracts of all retrieved studies. This step was critical in narrowing down the search results to studies that directly addressed the research question (35). After the initial screening, full-text reviews were conducted to assess the studies' alignment with the inclusion criteria (33). Any discrepancies between the two reviewers were resolved through discussion, and in cases where consensus could not be reached, a third reviewer was consulted (36). This process helped maintain objectivity and reduced the potential for selection bias (20).

Quality Appraisal

The quality of the included studies was assessed using the Critical Appraisal Skills Programme (CASP) tools for both qualitative studies and RCTs (37)(38). The CASP tool evaluates key methodological elements, including the clarity of research questions, the appropriateness of study design, and the validity of the findings (39). For RCTs (see Table 1), specific attention was given to randomisation procedures, blinding, and follow-up practices, as these elements directly impact the internal validity of the results (40) (39). In contrast, qualitative studies (see Table 2) were appraised based on the transparency of data analysis, ethical considerations, and the depth of the insights provided (36) (37) (38). This comprehensive quality appraisal ensured that only studies of sufficient methodological rigour was included, thereby enhancing the reliability of the review's findings.

CASP RCT Checklist Item	Coleman *et al* (2022)	Emery *et al* (2024)	Naughton *et al* (2017)	Ussher *et al* (2024)
Did the study address a clearly focused research question?	3	3	3	3
Was the assignment of participants to interventions randomized?	3	3	3	3
Were all participants who entered the study accounted for at its conclusion?	3	2	3	3
Were the participants 'blind' to the intervention they were given?	2	1	1	2
Were the study groups similar at the start of the randomized controlled trial?	3	3	3	3
Apart from the experimental intervention, did each study group receive the same level of care?	3	3	3	3
Were the effects of intervention reported comprehensively?	3	3	3	3
Was the precision of the estimate of the intervention or treatment effect reported?	3	3	3	3
Do the benefits of the experimental intervention outweigh the harms and costs?	3	3	3	3
Can the results be applied to your local population/in your context?	3	3	3	3
Would the experimental intervention provide greater value to the people in your care than existing interventions?	3	3	3	3
Studies were graded (Yes = 3, Partial = 2, No = 1) with overall score of 33 (Highest quality for included studies = 33 (11×3), lowest = 11 (101×1), range = 33 - 11. Categories: High = 33 - 27, medium = 26 - 19, and Low = 18-11.	32	30	31	32

Table 1: Quality assessment of RCT studies.

CASP Qualitative Checklist Item	Kaur et al. (2023)	Fergie et al. (2019)	Ford et al. (2021)	McDaid et al. (2021)	Stacey et al. (2022)	Griffiths et al. (2021)	Broadfield et al. (2023)	McCormack et al. (2022)	Lauren-White et al. (2024)	Bowker et al. (2020)	Thompson et al. (2019)	Jones et al., 2019	Philips et al. (2019)	McKell et al. (2022)
Was there a clear statement of the aims of the research?	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Is a qualitative methodology appropriate?	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Was the research design appropriate to address the aims of the research?	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Was the recruitment strategy appropriate to the aims of the research?	3	3	3	3	3	2	3	3	3	2	3	3	2	2
Was the data collected in a way that addressed the research issue?	3	3	3	3	3	3	3	3	3	2	3	3	3	3
Has the relationship between researcher and participants been adequately considered?	2	3	2	2	3	3	3	3	2	2	2	2	1	2
Have ethical issues been taken into consideration?	3	3	3	3	3	3	3	3	3	3	2	3	2	2
Was the data analysis sufficiently rigorous?	2	3	2	2	3	2	3	3	2	2	3	2	2	2
Is there a clear statement of findings?	3	3	3	3	3	3	3	3	3	3	3	3	3	3
How valuable is the research?	3	3	3	3	3	3	3	3	3	3	3	3	3	2
Studies are graded (Yes = 3, Partial = 2, No = 1); Highest quality for included studies = 30 (10×3), lowest = 10 (10 ×1), range = 30 - 10. Categories: High = 30 - 24, medium = 23 - 17, and Low = 16-10.	28 (High)	30 (High)	28 (High)	28 (High)	30 (High)	29 (High)	30 (High)	30 (High)	28 (High)	26 (High)	28 (High)	28 (High)	25 (High)	25 (High)

Table 2: Quality assessment of Qualitative studies.

Data Extraction and Synthesis

Data extraction was carried out using a pre-designed extraction form, ensuring uniformity across all included studies (41). For each study, essential information, such as study characteristics (author, year, and location), sample size, participant demographics, study design, intervention type, and outcomes, was systematically recorded (20), see Appendix 1). In qualitative studies, concepts related to barriers and facilitators of smoking cessation were extracted, while quantitative studies focused on data regarding intervention effectiveness, cessation rates, and statistical associations with sociodemographic factors (21). This structured method enabled a comprehensive analysis of the evidence while minimizing the risk of data extraction errors (35).

For qualitative data, thematic synthesis was applied. This approach enabled the reviewers to identify recurring concepts across the studies, such as psychological dependence, lack of social support, and the role of healthcare providers (42)(43). Thematic synthesis also facilitated the integration of insights across different studies, providing a deeper understanding of the lived experiences of pregnant women trying to quit smoking (44); Bowker *et al.*., 2020).

For quantitative studies, a meta-analysis was conducted where appropriate. Using the RevMan software, effect sizes for smoking cessation interventions were pooled, allowing for an assessment of the overall impact of various interventions (41) (35) (23)).

Finally, the results derived from both thematic synthesis and meta-analysis were merged using thematic analysis. Together, these approaches facilitated the integration of diverse data sources, providing a comprehensive view of the multifaceted challenges and supports that pregnant women encounter in their efforts to quit smoking (41) (35) (44).

Results

From an initial search of 3,217 records, 18 studies conducted in the UK were selected for inclusion in the review, guided by the PRISMA framework (see Figure 1). These studies were grouped into five major themes: psychological dependence, socioeconomic status, safety of interventions, motivation, and support systems, which reveal the complexity of smoking cessation during pregnancy (see Appendix 1 for general study characteristics).

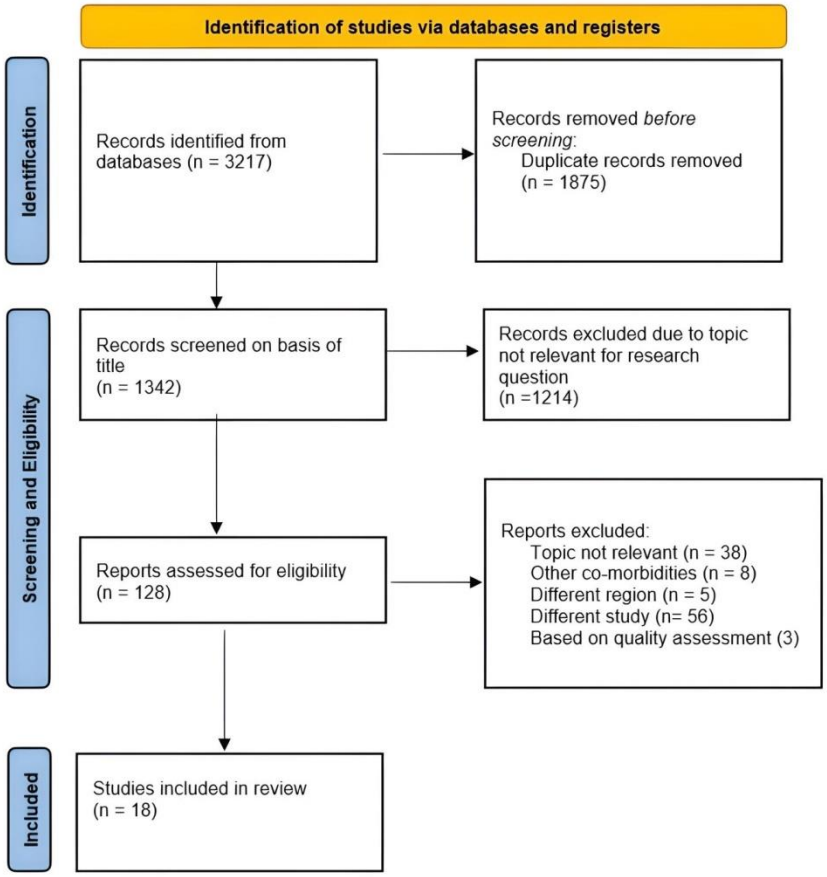


Figure 1. Prisma Flowchart (34)

Quantitative Analysis of Smoking Cessation Factors

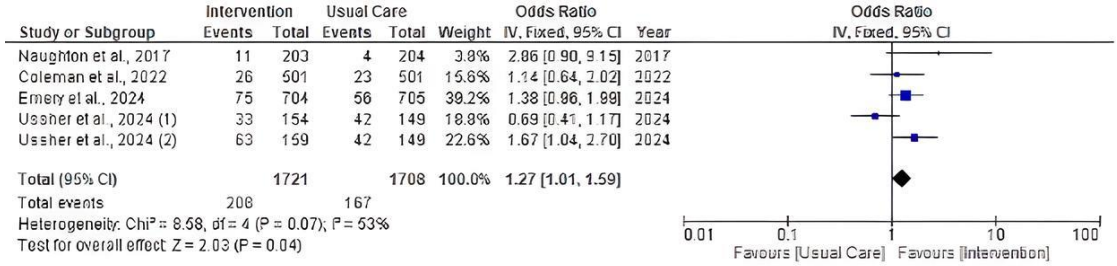
Quantitative studies provide essential insights into the effectiveness of smoking cessation interventions for pregnant women. The four included studies (45) (46) (47) (48) examined tailored interventions such as text message support and financial incentives, using randomized controlled trials (RCTs) and a multi-trial pooled analysis.

Text Message Support Interventions: Several studies investigated the efficacy of text message interventions for smoking cessation, specifically the MiQuit program. Naughton *et al.* (2017) conducted a pilot RCT to test the feasibility of a low-cost, tailored, self-help smoking cessation text message intervention. The results

showed an odds ratio (OR) of 2.86 (95% CI: 0.90, 9.15), indicating potential effectiveness but limited precision due to the small sample size (N = 407). Similarly, Coleman *et al.* (2022) evaluated MiQuit3, a more advanced version of the text message support intervention. This study involved 1,002 pregnant women and reported an OR of 1.14 (95% CI: 0.64, 2.02), reflecting a smaller effect size compared to Naughton *et al.*'s (2017) pilot but still indicating a positive trend toward increased cessation rates. Emery *et al.* (2024) conducted a multi-trial pooled analysis of text message interventions, focusing on the moderators and mechanisms of action that affect cessation outcomes. The pooled analysis of 1,409 participants showed an OR of 1.38 (95% CI: 0.96, 1.99), suggesting moderate effectiveness, though the confidence interval approached the margin of statistical significance. The larger sample size in this analysis strengthened the overall findings, though it also highlighted the variability in responses to the intervention and inclusion of effect moderators such socio-economic status (SES) and timing of intervention, enhanced the generalizability of findings.

Financial Incentives: Ussher *et al.* (2024) examined the impact of financial incentives on smoking cessation during pregnancy and the maintenance of cessation postpartum. Two separate interventions were tested: a 3-month financial incentive program and a 12-month program. The 3-month incentive program demonstrated an OR of 0.69 (95% CI: 0.41, 1.17), indicating not statistically significant effect. However, the 12-month incentive program showed more promising results, with an OR of 1.67 (95% CI: 1.04, 2.70), suggesting that long-term financial incentives may significantly increase cessation rates.

Overall Quantitative Findings: The combined analysis across all five studies, encompassing a total of 3,429 participants, yielded an OR of 1.27 (95% CI: 1.01, 1.59), with a Z-value of 2.03 (p = 0.04), indicating a statistically significant effect of the interventions on smoking cessation rates among pregnant women. However,, moderate heterogeneity was observed (I^2 = 53%, p = 0.07), indicating variability in intervention efficacy across studies. The observed variability in intervention efficacy is importance in understanding how specific interventions work in different contexts. For instance, while financial incentives had a strong effect in Ussher *et al.* (2024), other studies like Naughton *et al.* (2017) had limited success with tailored text message interventions. Therefore, a one-size-fits-all approach to smoking cessation may not be appropriate.



Footnote:

(1) at 3 months incentives

(2) at 12-month incentives

Figure 2: Forest plot showing Effect Sizes and Statistical Analyses of Smoking Cessation Interventions During Pregnancy: Meta-Analysis and Subgroup Findings.

Study or subgroup	Aim/Focus of the Study	Design	Study Population	Intervention Evaluated	Effect sizes	SE	Sample Size		Weight	Odds Ratio	Year
							Intervention (n =2291)	Usual care (n = 22278)		IV, Random, 95%	
Naughton et al. (2017)	To test the feasibility and effectiveness of a low-cost, tailored, self-help smoking cessation text message intervention (MiQuit) for pregnant smokers.	Pilot RCT	Pregnant smokers	Low-cost, tailored self-help smoking cessation text message intervention for pregnant smokers (MiQuit).	2.7	0.589	203	204	10.50%	14.88 [4.69, 47.20]	2017
Coleman et al. (2022)	To evaluate the effectiveness of tailored text message self-help support (MiQuit3) for smoking cessation in pregnant women.	RCT	Pregnant women who want information on stopping smoking	Tailored text message self-help smoking cessation support (MiQuit3).	1.15	0.292	501	501	20.00%	3.16 [1.78, 5.60]	2022
Hajek et al. (2022)	To compare the effectiveness of electronic cigarettes versus nicotine patches for smoking cessation in pregnant women.	RCT	Pregnant women	Comparison of electronic cigarettes versus nicotine patches for smoking cessation in pregnancy.	1.55	0.249	569	571	21.70%	4.71 [2.89, 7.68]	2022
Emery et al. (2024)	To analyse the effectiveness of text message support (MiQuit) for smoking cessation during pregnancy, focusing on effect moderators and mechanisms of action through a multi-trial pooled analysis.	Multi-trial pooled analysis	Pregnant women	Text message support (MiQuit) with analysis of effect moderators and mechanisms of action.	1.73	0.233	705	704	22.40%	5.64 [3.57, 8.91]	2024
Ussher et al. (2024) (1)	To examine the effect of financial incentives on smoking cessation during pregnancy and maintenance of cessation 12 months postpartum.	RCT	Postpartum women	3-months financial incentives for smoking cessation during pregnancy and postpartum vs usual care.	0.69	0.268	154	149	20.90%	1.99 [1.18, 3.37]	2024
Ussher et al (2024) (2)		RCT	Postpartum women	12-months financial incentives for smoking cessation during pregnancy and postpartum vs usual care.	1.67	1.04	159	149	4.50%	5.31 [0.69, 40.79]	2024

Table 3: Effect Sizes and Statistical Analyses of Smoking Cessation Interventions During Pregnancy: Meta-Analysis and Subgroup Findings

Qualitative Insights into Smoking Cessation

Personal experiences and psychological barriers: *(*50) (51) found that pregnant women often used smoking as a coping mechanism for stress and anxiety, with guilt over continued smoking exacerbating emotional distress. Similarly, Ford *et al.* (2021) revealed that while the fear of harm to the unborn child was a motivator, psychological dependence often outweighed this motivation.

Social Influences and Support Systems: *(*53) (54) (55) emphasized that women with supportive social environments were more likely to quit successfully. However, Jones *et al.* (2019) and Fergie *et al.* (2019) noted that conflicting advice from family members and cultural beliefs in minority communities hindered cessation efforts.

Structural and Socioeconomic Barriers: Economic constraints and limited access to healthcare resources were also significant barriers identified in the studies. Lauren-White *et al.* (2024) and McKell *et al.* (2022) highlighted that woman from socio-economically disadvantaged backgrounds faced greater difficulty accessing cessation programs, particularly digital tools. Similarly, McCormack *et al.* (2022) demonstrated that while women found incentives motivating, they expressed concerns about fairness and sustainability. McDaid *et al.* (2021) observed that many women were worried about nicotine replacement therapy (NRT) safety, which led to poor adherence. Stacey *et al.* (2022) and Kaur *et al.* (2023) further critiqued the healthcare system's inability to integrate smoking cessation into routine prenatal care due to structural limitations and the lack of healthcare professional training.

Thematic Analysis: Merged Findings

Psychological Barriers and Emotional Triggers: Quantitative evidence (45) (46) (48) underscores the critical role of psychological dependence in hindering smoking cessation, while qualitative data (50) (54). Addressing these psychological barriers is crucial for effective cessation interventions, especially for pregnant women who face emotional challenges. Digital interventions like MiQuit, a text message-based self-help program, have shown promise in reducing psychological dependence by providing continuous motivational support (45). Based on the findings from the quantitative analysis, which demonstrated statistically significant improvements in cessation rates among women receiving tailored interventions like MiQuit and financial incentives, the null hypothesis (H_0) is rejected. The results support the alternative hypothesis (H_1), indicating that tailored interventions are more effective in promoting smoking cessation among pregnant women. These results are further supported by qualitative insights, which highlight the motivational role of personalized support and the economic benefits of financial incentives (45) (46) (48).

Socioeconomic Challenges and Access to Healthcare: Both the meta-analysis (49) and qualitative synthesis (28) highlight the adverse effects of socioeconomic challenges, such as financial strain and limited healthcare access, which hinder cessation efforts. These barriers not only impede quitting but also reduce the likelihood of women accessing cessation services. Tailored interventions should consider economic barriers, offering financial incentives and making cessation resources more accessible to low-income women (49).

Support Systems and Motivation: Quantitative data (Naughton *et al.*., 2017; Ussher *et al.*., 2024) demonstrate the significant role of healthcare provider support and continuous intervention strategies, such as text messaging, in increasing smoking cessation rates. Qualitative findings (50) complement these results, illustrating how social and emotional support from family members and healthcare providers motivate women to quit, especially when linked to the health of the infant. Digital interventions like MiQuit act as facilitators by reinforcing motivation through personalized messages, although their success is enhanced when combined with strong support networks (48). Strengthening these support systems is critical for the success of cessation interventions, both digital and traditional.

Discussion

The quantitative analysis of smoking cessation interventions identifies key socio-demographic, psychological, and healthcare-related factors that significantly impact cessation outcomes for pregnant women. Notably, digital interventions, such as the MiQuit text messaging program, have emerged as vital facilitators in this effort. These interventions provide pregnant women with personalized, continuous support that helps mitigate psychological dependence, offering a scalable, low-cost solution for healthcare systems (45). However, the success of digital interventions often depends on user engagement and accessibility, particularly in socio-economically disadvantaged groups, which underscores the importance of tailoring interventions to meet the diverse needs of this population (48). By integrating digital tools with traditional support systems, healthcare providers can better address the multifaceted challenges pregnant women face in quitting smoking, ultimately improving health outcomes for both mothers and infants.

Social influences play a critical role in smoking cessation efforts. Supportive social environments, including encouragement from partners, family, and healthcare providers, can significantly facilitate cessation, as noted by Thomson *et al.* (2019). However, cultural stigma surrounding smoking during pregnancy and conflicting advice from family members often hinder cessation efforts (54). In many cases, women may receive conflicting information or pressure from family members to continue smoking, particularly in communities where smoking is normalised.

Socio-demographic factors such as age, educational attainment, and SES are consistently shown to play a role in cessation success (62) (63) (64). For instance, one notable moderator influencing smoking cessation success is SES. Emery *et al.* (2024) conducted a multi-trial pooled analysis of text message interventions and found that SES influenced cessation outcomes, with women from lower-income backgrounds showing reduced cessation rates, even when receiving interventions. Moreover, the timing of intervention also plays a critical role, as women who receive early prenatal cessation support is more likely to quit successfully than those who receive late-term interventions. These findings suggest that integrating smoking cessation into early prenatal care could be crucial for maximising cessation rates (65) (66).

Furthermore, the financial incentive approach had the highest cessation rates among the reviewed studies, indicating the

importance of material rewards in motivating pregnant women to quit smoking. Ussher *et al.* (2024) explored the role of financial incentives where the intervention's effectiveness highlights the importance of addressing economic constraints, especially for low-income women who might otherwise be less motivated to quit. These findings align with findings of other studies that affirm the significant influence of healthcare-related factors on cessation outcomes (67).

Psychological factors also present substantial barriers to cessation. Nicotine dependence, emotional stressors, and motivation to quit are pivotal psychological elements (68). Griffiths *et al.* (2021) and Philips *et al.* (2021) found that pregnant women frequently struggle with emotional triggers such as stress, anxiety, and relationship issues, which exacerbate nicotine dependence. Naughton *et al.* (2017) and Coleman *et al.* (2022) investigated the impact of psychological support through tailored text message interventions like MiQuit, which offer personalised self-help for smoking cessation. These studies reported significant findings with moderate effects suggesting that tailored text messages can positively influence psychological factors like motivation and self-efficacy in cessation efforts. Several studies have shown that tailored text messages can positively influence psychological factors. For instance, Altendorf *et al.* (2020) demonstrate that message frame-tailoring significantly enhances self-determined motivation. Similarly, Haug *et al.* (2013) reveal that tailored text messages lead to increased quit attempts.

Moreover, Kong *et al.* (2014) highlight the efficacy of text messaging interventions in improving self-efficacy and motivation. These emotional barriers can be more challenging to overcome than physical addiction alone. Hence, effective cessation support must address these psychological and emotional dimensions, offering non-judgemental and personalised interventions.

Evidence-Based Recommendations

To address these challenges, comprehensive, multi-faceted interventions are necessary. Low-cost, scalable interventions like tailored text message support (MiQuit) should be implemented more broadly, particularly in underserved communities (45) (46) (48). Financial incentives also show promise as an effective tool, especially when combined with other forms of support, such as counselling and follow-up (49).

Conclusion

The success of smoking cessation interventions during pregnancy depends on a range of sociodemographic, psychological, and healthcare-related factors. While tailored interventions like MiQuit and financial incentives have demonstrated efficacy, their success is moderated by factors such as SES and timing. Moreover, the moderate heterogeneity observed in the meta-analysis highlights the challenges of generalising findings across diverse populations. Qualitative insights further emphasise the need to address psychological dependence and emotional triggers, while social and structural barriers must also be considered.

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Appendices

Appendix 1

Table 4: Summary of Qualitative and Quantitative Studies on Smoking Cessation Interventions for Pregnant Women

Author	**Country**	**Aim**	**Study Design (sample size, sampling)**	Data collection (methods **used [**focus groups, interviews**], duration, and** recording)	Participant characteristics (Age, Sex, Smoking profile**, pregnant)**	**Intervention/Exposure**	**Themes**	**Results (with focus** on Barriers and facilitators to smoking cessation in **pregnant woman)**	**Limitations**
1. Bowker *et al.* (2020)	UK	To explore the experiences of pregnant women using e-cigarettes, with a focus on their perceptions of the risks and benefits compared to smoking, and how these perceptions impact their usage behaviours.	Qualitative study; sample size: 21 participants; sampling: purposive sampling (recruited from antenatal clinics in a UK city).	Data collection methods: semi-structured interviews; duration: 45-60 minutes per interview; recording: audio-recorded and transcribed verbatim.	Age: Range 20-40 years (mean around 30 years); Sex: All female; Smoking profile: Current smokers or ex-smokers; Pregnant: All participants were pregnant (in their second or third trimester).	E-cigarette use during pregnancy	Risk perception, Benefits of e-cigarettes, Attitudes toward smoking vs. vaping, Influence of health advice.	Participants viewed e-cigarettes as a less harmful alternative to smoking, though many expressed concerns about the long-term effects and the lack of comprehensive research on e-cigarette safety during pregnancy. Some reported using e-cigarettes to reduce or quit smoking.	Limited generalizability due to small, non-random sample size; findings are specific to one city and may not represent broader populations; potential for interviewer bias due to the subjective nature of qualitative data collection.
2. Broadfield *et al.* (2023)	UK	Examine the effectiveness of e-cigarettes for smoking cessation in pregnant women.	Mixed methods, nationwide study, 150 participants.	Surveys and interviews, duration not specified, recorded.	Pregnant women, various ages, smokers.	E-cigarette use for smoking cessation during pregnancy.	Safety concerns, effectiveness, societal perceptions.	Mixed results; some women successfully quit with e-cigarettes, but concerns remained about safety.	Nationwide sample but self-reported data.

Author	**Country**	**Aim**	**Study Design (sample size, sampling)**	Data collection (methods **used [**focus groups, interviews**], duration, and** recording)	Participant characteristics (Age, Sex, Smoking profile**, pregnant)**	**Intervention/Exposure**	**Themes**	**Results (with focus** on Barriers and facilitators to smoking cessation in **pregnant woman)**	**Limitations**
3. Coleman *et al.* (2022)	UK	To evaluate the effectiveness of tailored text message self-help support (MiQuit3) for smoking cessation in pregnant women.	Randomized controlled trial (RCT), Sample size: 1,282, Sampling: Random	Methods: Questionnaires, Surveys, Duration: 12 weeks, Recording: Electronic data capture	Median age: 28 years; Female; Current smokers; Daily smokers who wanted to quit during pregnancy Pregnant	Tailored text message self-help support (MiQuit3)	Smoking cessation, Digital interventions, Pregnancy	MiQuit3 intervention increased cessation rates compared to control	Limited to self-reported data, potential selection bias
4. Emery *et al.* (2024)	UK	To analyse the effectiveness of text message support (MiQuit) for smoking cessation during pregnancy, focusing on effect moderators and mechanisms of action.	Multi-trial pooled analysis, Sample size: 2,600+, Sampling: Combined from multiple trials	Methods: Questionnaires, Surveys, Duration: Varies by trial, Recording: Electronic data capture	Median age: 29 years; Female; Current smokers; Interested in receiving text support for smoking cessation; Pregnant	Text message support (MiQuit)	Smoking cessation, Digital interventions, Pregnancy	MiQuit support improved cessation, with specific moderators influencing outcomes	Heterogeneity across trials, limited generalizability
5. Fergie *et al.* (2019)	UK	To explore pregnant smokers' experiences and opinions of techniques aimed at addressing barriers and facilitators to smoking cessation	Qualitative study (n=20, purposive sampling)	Semi-structured interviews, 30-60 minutes, audio-recorded	Age: 18-40 years, Sex: Female, Smoking profile: Daily smokers, Pregnant: Yes	Smoking cessation techniques (e.g., counseling, nicotine replacement therapy)	Barriers to cessation, Facilitators to cessation, Effectiveness of techniques	Identified key barriers (e.g., stress, lack of support) and facilitators (e.g., personalized support) to smoking cessation among pregnant smokers	Small sample size, self-reported data, lack of generalizability to all pregnant smokers

Author	**Country**	**Aim**	**Study Design (sample size, sampling)**	Data collection (methods **used [**focus groups, interviews**], duration, and** recording)	Participant characteristics (Age, Sex, Smoking profile**, pregnant)**	**Intervention/Exposure**	**Themes**	**Results (with focus** on Barriers and facilitators to smoking cessation in **pregnant woman)**	**Limitations**
6. Ford *et al.* (2021)	UK	Explore factors influencing adherence to e-cigarette trials for smoking cessation in pregnant women.	Qualitative study, convenience sampling, 30 participants.	Focus groups and interviews, 1 hour, audio-recorded.	Pregnant women, mean age 29, smokers.	E-cigarettes for smoking cessation.	Concerns about safety, social stigma, need for support.	Many women expressed concerns about using e-cigarettes despite their desire to quit.	Self-selection bias, small sample.
7. Griffiths *et al.* (2021)	UK	Explore engagement with stop smoking services by pregnant women.	Qualitative, purposive sampling, 18 participants.	Interviews, 1 hour, audio-recorded.	Pregnant women, aged 20-40, smokers or recent quitters.	Engagement with stop smoking services during pregnancy.	Supportive environments, accessibility, information clarity.	Engagement with stop smoking services was seen as variable, depending on healthcare provider interactions.	Limited generalizability, potential for social desirability bias.
8. Jones *et al.* (2019)	UK	To evaluate the implementation of a smoking cessation intervention in pregnancy	Qualitative study, interviews with 98 participants (63 maternity staff, 35 smoking cessation staff)	Three methods: non-participant observation (11 sessions), diary keeping, interviews (conducted in various locations including workplace, community locations, video teleconferencing, and email)	Participants were mainly maternity staff and smoking cessation services staff. Specific characteristics such as age and smoking profile were not detailed.	Implementation of the babyClear© intervention package for smoking cessation in pregnancy	1) Initial t preparedness of organizations; 2) Staff training; 3) Managing partnership working; 4) Resources; 5) Review and planning for sustainability	Barriers: Organizational preparedness, resource availability, restructuring in smoking cessation services. Facilitators: Staff training, structured approaches to engaging with pregnant women about smoking, supportive partnerships.	The study was conducted during a period of widespread restructuring in smoking cessation services, which may have influenced the findings. Additionally, the focus was on staff perspectives rather than direct outcomes related to smoking cessation in

Author	**Country**	**Aim**	**Study Design (sample size, sampling)**	Data collection (methods **used [**focus groups, interviews**], duration, and** recording)	Participant characteristics (Age, Sex, Smoking profile**, pregnant)**	**Intervention/Exposure**	**Themes**	**Results (with focus** on Barriers and facilitators to smoking cessation in **pregnant woman)**	**Limitations**
									pregnant women.
9. Kaur *et al.* (2023)	UK	To assess the awareness of women regarding the risks with smoking during pregnancy, their smoking behaviour, willingness to quit, and influencing factors	Prospective questionnaire-based survey	Questionnaire (well-structured, pre-tested, and validated)	Age: Mean age 27.4 years (SD ± 5.7), Sex: Female, Smoking profile: Pregnant smokers, Pregnant: Yes, Educational attainment: Low (64%), Employment: 53% unemployed, Household smoking: 68%, Mental health: 35% had mental health problems	Smoking during pregnancy	Awareness, willingness to quit, influence of previous quit attempts, mental health issues	Awareness: 77% aware that smoking is harmful, Willingness to quit: 51.5%, Influencing factors: Awareness of harm (aOR: 46.459, $p < 0.001$), Past quit attempts (aOR: 0.048, $p = 0.001$), Mental health concerns absence (aOR: 6.097, $p = 0.038$)	Convenience sampling may lead to selection bias, self-reported data might introduce response bias, limited generalizability due to the specific population studied (Barnsley District) .
10. Lauren-White *et al.* (2024)	UK	Evaluate the implementation of two pilot interventions using e-cigarettes for smoking cessation in pregnant women.	Routinely collected data on pilot enrolment, retention, and effectiveness with a nested qualitative study (sample size not	Semi-structured interviews with professionals involved in pilot design, setup, and/or delivery; transcribed using Microsoft Teams or manually for phone interviews.	Pregnant women (age, sex, and smoking profile not specified); professionals involved in pilot design, setup, and/or delivery.	Provision of free e-cigarettes and NRT to pregnant women through specialist stop smoking in pregnancy services.	Barriers to pilot implementation included inconsistency in the perceptions of e-cigarettes among relevant services and resource availability.	Ethical concerns among healthcare professionals regarding advising and providing e-cigarettes; hesitancy due to mixed evidence around safety and efficacy; resource	Limited sample size details; reliance on self-reported data in some instances; variability in perceptions and resources across different services; ethical concerns

Author	**Country**	**Aim**	**Study Design (sample size, sampling)**	Data collection (methods **used [**focus groups, interviews**], duration, and** recording)	Participant characteristics (Age, Sex, Smoking profile**, pregnant)**	**Intervention/Exposure**	**Themes**	**Results (with focus** on Barriers and facilitators to smoking cessation in **pregnant woman)**	**Limitations**
			specified).				Facilitators included extensive engagement with key stakeholders and understanding the needs and resources of the target population.	availability and consistency in service delivery; need for ongoing training for healthcare professionals before wide implementation.	among healthcare professionals that need addressing for future rollout.
11. McCormack *et al.* (2022)	UK	Explore pregnant women's experiences of stopping smoking with incentive schemes.	Qualitative, convenience sampling, 25 participants.	Interviews, duration 60 minutes, audio-recorded.	Pregnant women, smokers, various ages.	Smoking cessation with incentives.	Motivation, accountability, external rewards.	Women found incentives motivating but expressed concerns about fairness and sustainability.	Small, non-representative sample.
12. McDaid *et al.* (2021)	UK	Understand pregnant women's beliefs regarding adherence to Nicotine Replacement Therapy (NRT).	Qualitative study, purposive sampling, 22 participants.	In-depth interviews, 60-90 minutes, audio-recorded.	Pregnant women, aged 20-35, current or recent smokers.	Nicotine Replacement Therapy (NRT) during pregnancy.	Safety concerns, effectiveness, perceived need for NRT.	Many women were concerned about NRT safety, leading to poor adherence.	Recall bias, potential lack of diversity in sample.
13. McKell *et al.* (2022)	UK	To explore the experiences and perceptions of patients undergoing tobacco cessation treatments	Mixed-methods approach; Sample size: 45 patients; Sampling: Convenience sampling	Methods: Semi-structured interviews; Duration: 30-60 minutes per interview; Recording: Audio recordings with transcription	Age: 25-60 years; Sex: Male and Female; Smoking profile: Current smokers, recent quitters; Pregnant: Not specified	Tobacco cessation treatments	1. Challenges in adherence to cessation programs. Psychological and emotional impacts of quitting. Support systems and their efficacy	Patients experienced difficulties with adherence due to psychological and social factors. Emotional support was found to be crucial in the cessation process.	Small sample size; Convenience sampling may not represent all patient demographics; Limited generalizability of findings; Potential interviewer bias

Author	**Country**	**Aim**	**Study Design (sample size, sampling)**	Data collection (methods **used [**focus groups, interviews**], duration, and** recording)	Participant characteristics (Age, Sex, Smoking profile**, pregnant)**	**Intervention/Exposure**	**Themes**	**Results (with focus** on Barriers and facilitators to smoking cessation in **pregnant woman)**	**Limitations**
14. Naughton *et al.* (2017)	UK	To test the feasibility and effectiveness of a low-cost, tailored, self-help smoking cessation text message intervention (MiQuit) for pregnant smokers.	Multi-center pilot RCT, Sample size: 407, Sampling: Random	Methods: Questionnaires, Surveys, Duration: 12 weeks, Recording: Electronic data capture	Age: Mean age ~28 years, Sex: Female, Smoking profile: Pregnant smokers seeking cessation, Pregnant: Yes	Low-cost, tailored, self-help smoking cessation text message intervention (MiQuit)	Smoking cessation, Digital interventions, Pregnancy	MiQuit intervention was feasible and effective in promoting cessation	Small sample size, reliance on self-reporting
15. Philips *et al.* (2021)	UK	To explore the impact of smoking on cardiovascular health	Qualitative study (n=30, purposive sampling)	Semi-structured interviews, 60 minutes each, audio-recorded	Adults aged 25-65, both sexes, smokers, non-pregnant	Smoking (cigarettes)	Health risks, behavioral insights	Participants reported increased awareness of cardiovascular risks associated with smoking; variations in risk perception between different demographic groups	Limited generalizability due to small sample size; potential for recall bias in self-reported data
16. Stacey *et al.* (2022)	UK	Investigate women's experiences and attitudes to smoking cessation during pregnancy.	Qualitative study, purposive sampling, 15 participants.	In-depth interviews, 1-2 hours, audio-recorded.	Pregnant women, aged 19-35, smokers and recent quitters.	Smoking cessation support during pregnancy.	Emotional support, judgmental attitudes from healthcare providers, desire for better support.	Women emphasized the need for non-judgmental, emotional support during cessation efforts.	Small sample, regional focus.

Author	**Country**	**Aim**	**Study Design (sample size, sampling)**	Data collection (methods **used [**focus groups, interviews**], duration, and** recording)	Participant characteristics (Age, Sex, Smoking profile**, pregnant)**	**Intervention/Exposure**	**Themes**	**Results (with focus** on Barriers and facilitators to smoking cessation in **pregnant woman)**	**Limitations**
17. Thomson *et al.* (2019)	UK	To explore the barriers and facilitators to Nicotine Replacement Therapy (NRT) use among pregnant women.	Sample Size: Not specified; Sampling: purposive sampling targeting pregnant women and practitioners	Methods: Focus groups and expert groups; Duration: Not specified; Recording: Audio-recorded and transcribed verbatim	Age: Not specified; Sex: Female; Smoking Profile: Pregnant women who smoke or have quit smoking using NRT; Pregnant: Yes	NRT use during pregnancy	1. Barriers to NRT use. Facilitators to NRT use	- Barriers included lack of knowledge, misconceptions about safety, and concerns about addiction. Facilitators included healthcare provider support and positive beliefs about NRT efficacy.	- Limited detail on the relationship between researchers and participants Limited comprehensive account of ethical considerations Small sample size may limit generalizability
18. Ussher *et al.* (2024)	UK	To examine the effect of financial incentives on smoking cessation during pregnancy and maintenance of cessation 12 months postpartum.	Randomized controlled trial (RCT), Sample size: 362, Sampling: Random	Methods: Questionnaires, Surveys, Duration: 12 months postpartum, Recording: Electronic data capture	Mean age: 27.5 years; Female; Current smokers; Evaluating financial incentives for smoking cessation; Pregnant	Financial incentives for smoking cessation	Smoking cessation, Financial incentives, Postpartum	Financial incentives significantly improved cessation rates during pregnancy and postpartum	Generalizability to non-incentivized settings may be limited

Systematic Review Details			
Title of systematic review or review of literature (please give full title): Barriers and facilitators to smoking cessation in pregnant women in the United Kingdom: A mixed methods systematic review.			
Question	Yes	No	If Yes please provide further detail
Does the project involve human participants, either directly (e.g. through use of interviews, questionnaires)		No	
Or indirectly (e.g. through provision of, or access to, a person's data).		No	

Please complete the following if you have answered **No** to the previous two questions:

Question	Yes	No	If Yes please provide further detail
Does the title identify the work as a systematic review or review of the literature, or both?	Yes		The title of the work has identified that it will be a mixed-method systematic review with quantitative and qualitative research systematically selected, and analysed and the results will be put up to answer research questions.
Is the question posed original and well defined?	Yes		The systematic review question is well defined, and is original.
Will the work affect the confidentiality originally promised to study participants?		No	
Will you be contacting the original researchers for more information?		No	

Declarations	Please Tick ☐	☐
We confirm that we have reviewed the project protocol and checked http://www.hra.nhs.uk/documents/2016/06/defining-research.pdf to define the project category.		☐
We conclude that research and does not require ethical or scientific merit review.		☐

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There is no funding for this research.	