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Carbon Monoxide Screening in Pregnancy: An Evaluation Study of a Plymouth Pilot Intervention.

The study was commissioned by
Plymouth NHS Stop Smoking Services
and Smoke Free South West

Plymouth 
Teaching Primary Care Trust

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Executive Summary

This report provides an analysis and evaluation of a National Institute for Health and Care Excellence (NICE) recommended pilot intervention which was designed to identify pregnant women exposed to carbon monoxide due to cigarette smoke and refers them to local stop smoking services (LSSS). The pilot intervention was carried out by community midwives working in two areas of Plymouth. The city has areas of social and health inequalities and the study drew on populations from a socially deprived neighbourhood and a socially affluent area. The pilot was instigated following new NICE guidance recommending that all women attending initial ante natal booking appointments with their community midwives be offered a Carbon Monoxide (CO) breath analyser screening to determine their smoking status and or exposure to other forms of CO. This evaluation study identifies the benefits and barriers associated with the implementation of the CO screening pilot. In particular, our aims were to explore any detrimental impact on the relationship between women and their community midwives, identify the impact on midwives in terms of time and resources, reveal the responses and acceptability or otherwise of the screening as perceived and experienced by the women being asked to participate during the booking appointment and finally to evaluate the success of the intervention overall in relation to the numbers of referrals made to Plymouth's LSSS. A further aim was to explore any differences in the two socio demographic areas.

We adopted a mixed methods approach involving four focus group interviews with 23 midwives, a survey posted to the 258 women who attended initial antenatal booking appointments in the study areas, an online version of the survey to ascertain the views and experiences of pregnant women and new mothers nationally and an interrogation of an internet forum discussion board for mothers. A two page questionnaire consisting of 12 questions was designed and posted to women who attended the booking appointment with the midwife during the three month pilot period and the same survey was made available online. Questions were designed to elicit women's views about the information given by the midwife in relation to the screening, whether they had agreed to participate in the CO screening process, their experiences and views about offering CO screening to pregnant women and their smoking status and those of other household members. Of the 258 questionnaires

posted to women who had attended the clinic during the pilot intervention 40 completed responses were returned representing a 15.5% response rate. Only 4 responses were received from the online survey posting but an additional 484 comments posted on the Mumsnet website discussion board were analysed.

Our findings show that in general there was a high degree of acceptability for the intervention. Midwives and their clients were generally in support of the screening being offered to all pregnant women. However, this support was dependent on a number of contextual factors. Women wanted to be properly informed about the screening and midwives wanted to be kept informed about the effects of the intervention on women's smoking cessation. Initial and ongoing training of midwives in utilising the protocol and in instructing women to correct use the monitor was also very important. Trust was revealed to be a very important aspect of the relationship between women and their midwives. Some women felt that the CO screening was being used just to check whether or not they were smokers and some midwives also worried about the possible negative effects the CO screening may have on their relationships with women.

Acknowledgements

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1. Introduction

Smoking during pregnancy in the UK is relatively common and presents serious long-term health risks for both women and their babies. The harmful effect of cigarette smoking on maternal, fetal and infant health is of great concern for public health and maternity services. A recent report by the Royal College of Physicians states that approximately 5,000 miscarriages, 300 perinatal deaths, 2,200 premature births and 19,000 babies with low birth weight occur annually as a result of tobacco exposure in utero (Royal College of Physicians 2010). It is estimated that $\frac{1}{3}$ of all deaths of infants in the UK under the age of 1 year are caused by smoking. International research shows that more than $\frac{1}{4}$ of the risk of Sudden Infant Death Syndrome is attributable to smoking during pregnancy and exposure to second hand smoke, particularly in the home (Rogers 2009). This risk is 3 times more in infants whose mothers smoke both during and after pregnancy (McDonnell-Naughton et al. 2012). Short term adverse health outcomes include an increased incidence of birth defects and the long term health consequences to infants born with a low birth weight babies are a greater risk of coronary heart disease, type 2 diabetes, and obesity in adulthood (Lumley et al. 2009).

To evaluate the effectiveness and impact of a Carbon Monoxide (CO) Screening in pregnancy in Plymouth a pilot intervention was carried out by community midwives in two areas of the city following the implementation of NICE guidance recommending that all women attending initial antenatal booking appointments with their community midwives be offered a CO breath screening to determine their smoking status and/or exposure to other forms of CO. Once above normal levels of CO were detected women were referred to the Local Stop Smoking Services (LSSS) team. The evaluation study reported here sought to identify the benefits and barriers associated with the implementation of the CO screening pilot.

2. Background and Context

2.1 The Prevalence of Smoking during Pregnancy

Recent statistics reveal that 26% of mothers in England smoked during the 12 months immediately before or during their pregnancy (Health and Social Care Information Centre for 2012). Although just over half reported giving up during pregnancy, the percentage of mothers smoking at the time of giving birth was 13.4% (Health and Social Care Information Centre for 2012). The robustness of these statistics has been questioned due to the under-reporting of smoking behaviour by women and incomplete or incorrect completion of data collection forms by midwives and other healthcare professionals. Consequently the prevalence of smoking during pregnancy is greater than reported (Javors et al. 2011; Martinez et al. 2004). The percentage of women in Plymouth who smoke during pregnancy is higher than the England average at 18.6% (English Public Health Observatories 2012).

2.2 Social Determinants of Smoking

As with other social determinants of health, smoking during pregnancy is strongly associated with poverty, poor social support, low levels of education, depression and psychological illness (Health and Social Care Information Centre 2012). The Marmot Review (2011) into health inequalities in England states that reducing health inequalities is a matter of fairness and social justice. Social inequalities in health arise due to inequalities in society, in the conditions in which people are born, grow, live, work and age (Marmot et al. 2011). Rates of smoking in England vary by region, social group and age, with pregnant women from unskilled occupation groups five times more likely to smoke than professionals, and teenagers six times more likely to smoke than older mothers (Tobacco Advisory Group of the Royal College of Physicians 2000). In Plymouth the number of women smoking during pregnancy is in excess of the national average and this is particularly the case in the socially deprived areas of the city where the number of smokers in general are about double the Plymouth average (English Public Health Observatories 2012).

2.3 Smoking Cessation Interventions

Getting women to stop smoking during pregnancy is now of paramount importance for Public Health initiatives in England. This is reflected in governmental targets that aim to reduce smoking during pregnancy to $\leq 11\%$ by the end of 2015 (Department of Health 2011). One of the main aims for Public Health policies in Plymouth is to reduce health inequalities. Targeting the number of women who smoke in pregnancy is a central part of this strategy (National Health Service Plymouth 2011). However, historically strategies and interventions designed to reduce the number of women smoking during pregnancy have had limited success. A Cochrane Review of Smoking Cessation in Pregnancy (Lumley et al. 2009) found that interventions offered to promote smoking cessation in pregnancy are generally given individually and include cognitive behaviour therapy and motivational interviewing, offering incentives; and nicotine by-products. The review concluded that interventions were effective in helping women to stop smoking during pregnancy by approximately 6%. This finding is supported by an international systematic review of smoking cessation in pregnancy intervention trials which included data on over 25,000 women. The review reports that while there was some success in reducing women's smoking in late pregnancy, they too found only a 6% reduction in women who had stopped smoking throughout their pregnancy (Schneider et al. 2010). Smoking cessation interventions have been delivered by a number of different healthcare professionals and agencies including LSSS. These are National Health Service referral clinics that operate to provide advice and support to those wishing to stop smoking. While prior to the implementation of NICE guidance on CO screening midwives referred pregnant women who smoke to Plymouth's LSSS, the introduction of the CO screening intervention was designed to increase the number of referrals and thereby help further reduce the number of women smoking during pregnancy.

2.4 NICE Guidance: Carbon Monoxide Screening in Pregnancy

In 2010 national guidelines (NICE 2010) were introduced to assist midwives and other healthcare professionals implement a new smoking cessation intervention during pregnancy by inviting women to be screened using a CO breath/smoke analyser monitor. The CO screening is an opt-out intervention and was designed to

be offered to all pregnant women irrespective of smoking status. It was seen not only to be useful in identifying those unlikely to report their positive smoking status but to have an additional benefit by highlighting exposure to passive cigarette smoke and the prevention of accidental CO poisoning from other sources, such as gas, coal, wood or paraffin cooking and heating appliances. However, concerns were raised by the Royal College of Midwives (RCM) that CO screening could make women feel guilty and could undermine the relationship of trust between women and their midwives (RCM 2010). In debating the issue the RCM concluded that CO screening should not be compulsory, and women should not be coerced, however, they recognised that midwives have an important opportunity to educate women about the harms of smoking. They stated that midwives 'have a duty of care to provide women with full and honest information about the purpose of CO screening, the implications and possible actions based on the result' (RCM 2010).

NICE guidance includes resources to make it easier for midwives to discuss the benefits of CO screening, the dangers of smoking during pregnancy and the benefits of quitting. This guidance recommends that smoking status is collected and recorded in maternity held records, through discussion and CO screening, during the woman's first maternity antenatal booking appointment (usually at 6-8 weeks gestation). If women report that they smoke and/or if the smoke analyser displays a positive CO reading, women are to be advised and referred to LSSS. A regional survey (Beenstock et al. 2012) designed to identify the factors that enable and hinder midwives in implementing the NICE guidance found few implementation difficulties and high levels of motivation among the respondents but there was some uncertainty reported about the consequences of the intervention as well as resourcing and contextual environmental concerns.

Women have always sought and been given advice about pregnancy, although the sources of information have varied over time and in different places (Hanson 2004). It is well established that midwives have had a role in public health; there is now a pivotal and explicit need for midwives to give advice related to smoking in pregnancy. Midwives establish a relationship with the women and her family early in

pregnancy and this is an ongoing relationship throughout her pregnancy and post birth (Deery et al forthcoming). A plethora of research over the last 40 years or so highlights that midwife/woman relationship works better when trust is established (Oakley 1980, Bailey et al 2004, Letherby et al 2012) throughout the process. Risk and risky behaviour (within pregnancy and more generally) has and is defined variably (Lupton 1993, Samples and Heyman forthcoming) healthcare professionals (including midwives) are increasingly orientated to risk assessment and management through numerous strategies and guidelines.

This report describes a pilot intervention aimed at monitoring and reducing risk associated with smoking in pregnancy that took place in two areas in Plymouth one socially deprived area and one affluent area and reflects on the implications for trusting relationships between women and midwives.

3. The Study

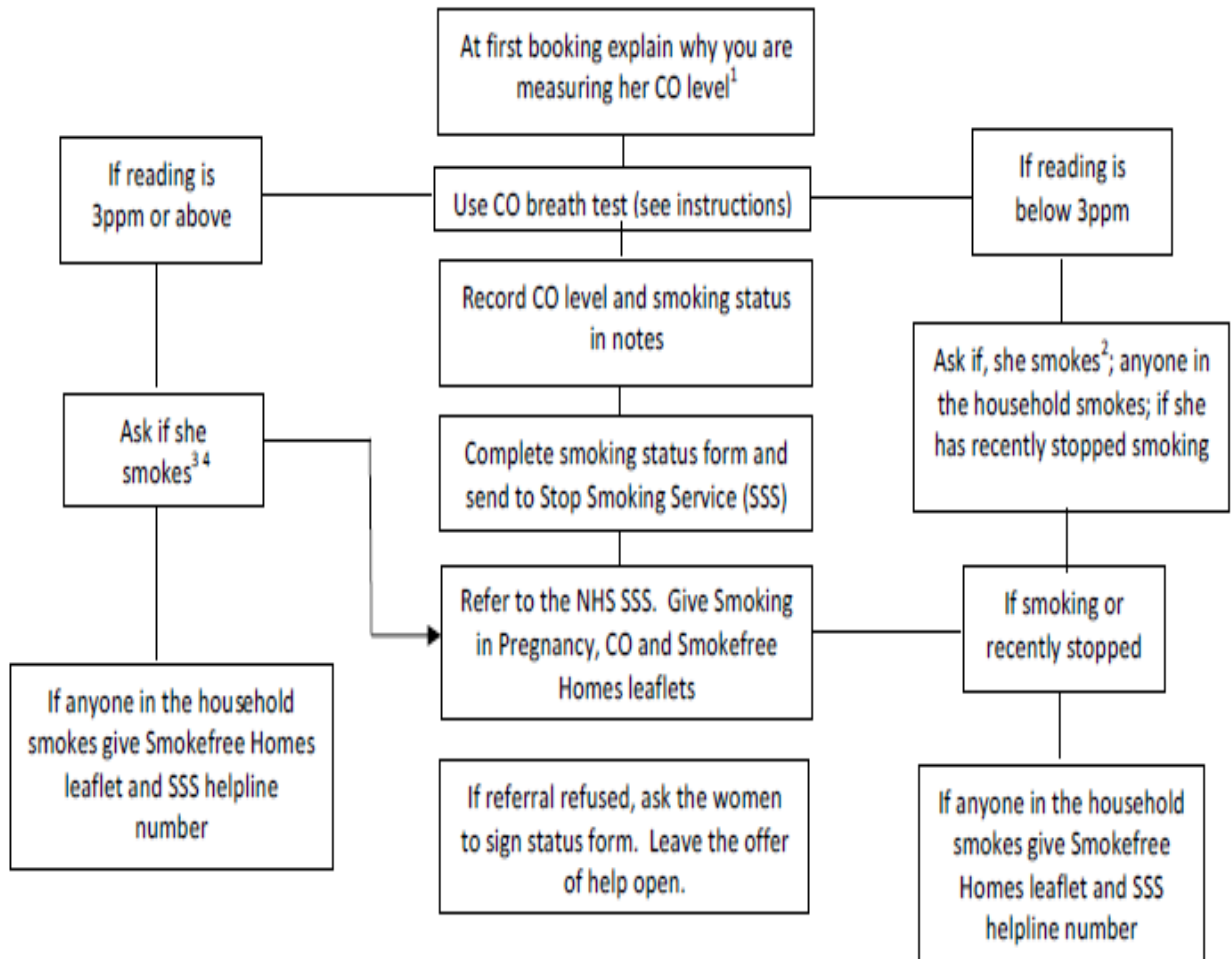
3.1 Carbon Monoxide Screening Pilot in Plymouth

Given the involvement of midwifery services, the time and cost involved in implementation of CO screening in pregnancy. The concern expressed by midwives at national level about the potential for the screening to be viewed suspiciously by clients and for trust between the pregnant woman and her midwife to be eroded, it was decided to evaluate the pilot intervention before rolling the service out fully across Plymouth. Between October 1st 2012 and January 31st 2013 this intervention was trialled in two areas of Plymouth (A and B). These areas were chosen due to their demographic socio economic variances and differences in terms of health inequalities. More than 10 times as many people live in poor housing, over twice as many individuals smoke, and low birth weight is almost four times higher in area B as A (plymouth.gov 2013). Midwives were given prior training by the LSSS team on how to provide information on the screening, instruct women on how to breathe into the CO analysers and how to interpret readings in accordance with the protocol guidance.

Once the pilot began midwives executed the protocol (Figure 1), asking women questions about their smoking status, and inviting them to participate in the CO screening during their initial clinic booking appointment. Results of the screening were then faxed to the LSSS within one working day and the LSSS team subsequently contacted the women who had positive readings, inviting them to be supported by the LSSS to stop smoking.

We were invited as academic researchers to evaluate this intervention. Given the pivotal role of midwives in the successful implementation of this intervention we decided to focus our evaluation on exploring midwives' experiences and views on implementation as well as the views and experiences of women attending antenatal booking appointments. In addition, we wanted to collect information about the smoking status of the women before, during and after their initial booking appointment and the views of pregnant women nationally. This report presents the findings of the evaluation of the Plymouth pilot and in addition draws on data provided by the LSSS providers regarding the numbers of women referred as a result of the intervention.

Figure 1 Smoking in Pregnancy Protocol



Note

- 1 Raised carbon monoxide levels are dangerous to you and your baby. We monitor CO levels in all pregnant women.
- 2 Low levels of CO ie less than 3ppm may apply to light/infrequent smokers.
- 3 Higher levels of CO might apply if there has been exposure to environmental sources eg faulty gas appliance.
- 4 If the women says she does not smoke consider the use of other products eg shisha and cannabis. Also advise about CO poisoning and give the Health and Safety Executive's gas safety advice line on 0800 300 363.

3.2 Aims

The main aim of the project on which this report is based was to evaluate the effectiveness and impact of a Carbon Monoxide (CO) Screening in pregnancy in Plymouth. Further subsidiary aims were:

- To assess the impact on referrals to the local Stop Smoking Service and on midwifery resources in undertaking the screening.
- To determine whether CO screening of all pregnant women at booking has any adverse effect on their attendance at future appointments.
- To elicit women's views about CO screening in pregnancy.
- To examine the impact of screening on the midwifery team and resources.
- To ascertain changes to referral rates to Plymouth's Local Stop Smoking Service.

3.3 Methods

We adopted a mixed methods approach which included:

- focus group interviews with 23 midwives
- a survey posted to the pregnant 258 women who attended study areas
- an online version of the survey to ascertain the views and experiences of pregnant women and new mothers nationally
- an interrogation of internet forum discussion boards
- secondary analysis of smoking cessation statistics and non/attendance at antenatal appointments post-booking.

3.3.1 Focus Group Interviews

Two focus group interviews from area A, and two focus group interviews from area B, were carried out with 23 midwives taking part. The focus group interviews with community midwives were deployed to explore any barriers to implementation by midwives and any noteworthy experiences such as unexpected positive or negative outcomes. Focus groups interviews are generally utilised to generate group discussions organised to explore a specific set of issues (Merton, 1956[2008]; Morgan, 1996; Kitzinger, 1994). The idea is not to generate consensus but to facilitate a group dynamic so that discussion can develop spontaneously (Kvale 2006).

The focus group interviews were conducted by ES and transcribed verbatim. Initial thematic analysis of this data was carried out by OC and corroborated by the other members of the research team (Appendix One Interview Schedule).

3.3.2 Surveys

A two page questionnaire consisting of 12 questions was designed. Questions were designed to elicit women's views about the information given by the midwife in relation to the screening, whether they had agreed to participate in the CO screening process, their experiences and views about offering CO screening to pregnant women and their smoking status and those of other household members. There was a box for comments so that respondents could expand on any areas and report any issues not directly contained within the set questions. Stamped addressed envelopes were included and University letter heads and contact details were used as these are well-known strategies to increase response rates (Edwards et al 2002).

The survey was first piloted on a small group of pregnant women and small changes were made. Following the piloting of the questionnaire (Appendix Three) it was posted along with a covering letter (Appendix Two) to the 258 women who attended antenatal booking appointments in the study areas during the pilot period. Of the 258

questionnaires posted to women who had attended the clinic 40 completed responses were returned representing a 15.5% response rate. While this is a relatively low rate of response, given that many of the women would either be heavily pregnant or new mothers a smaller response rate was to be expected.

The questionnaire was also uploaded onto the internet using survey monkey and the link was advertised through Mums.net, an online internet forum run by parents for parents. Four were completed. The questionnaire data was entered onto an SPSS statistical package and analysed.

3.3.3. Interrogation of Internet Fora

We also searched Mumsnet for related postings on the topic. Mumsnet is the UK's second largest website by parents for parents. Its members have been referred to as 'a bunch of Guardian reading laptop harpies' (Young 2011) and therefore not representative. Its founder, Justine Roberts said that Mumsnet is aimed at 'women who want to set up their own business, change to a more family friendly career or go back to work after maternity leave' (Roberts 2014).

On interrogation a total of 484 postings related to this area were noted and analysed using thematic analysis.

3.3.4 Secondary Analysis of Statistical Data

Routinely collected data on attendance at the first booking and second antenatal appointments with a midwife at the antenatal clinic was obtained from the antenatal data analysis clerk. It is usual practice that CO screening is undertaken at the first booking appointment.

3.4 Ethics

To avoid any concerns among midwives that the evaluation involved checking on individual staff behaviour and attitudes, and to maintain interviewee privacy, data was anonymised and participants' names were replaced with pseudonyms. To

further protect identities we do not identify the areas of Plymouth where the midwives are based and refer to them as areas A and B. In order to protect the identity of the questionnaire respondents we did not ask for their names and they were invited to include the first four digits of their post code only so that we could identify whether responses were from areas A or B. In analysing the survey data we used the post codes to enable a comparison of the two areas.

4. Data and Discussion

The data gathered provides an insight into the views and experiences of pregnant women and midwives regarding CO screening at the first antenatal booking appointment. It also highlights if the views/experiences expressed by the pregnant women may have had an impact on their attendance at future antenatal appointments or their referral to the LSSS.

4.1 Screening Overview

The CO screening project took place between 1st October 2012 until the 31st January 2013; during this three month period 258 women were seen for a first booking in clinics. Of these 258 women, 68 were smokers, 177 non- smokers and 13 women who declined the CO screening. This is shown in Figure 2 below:

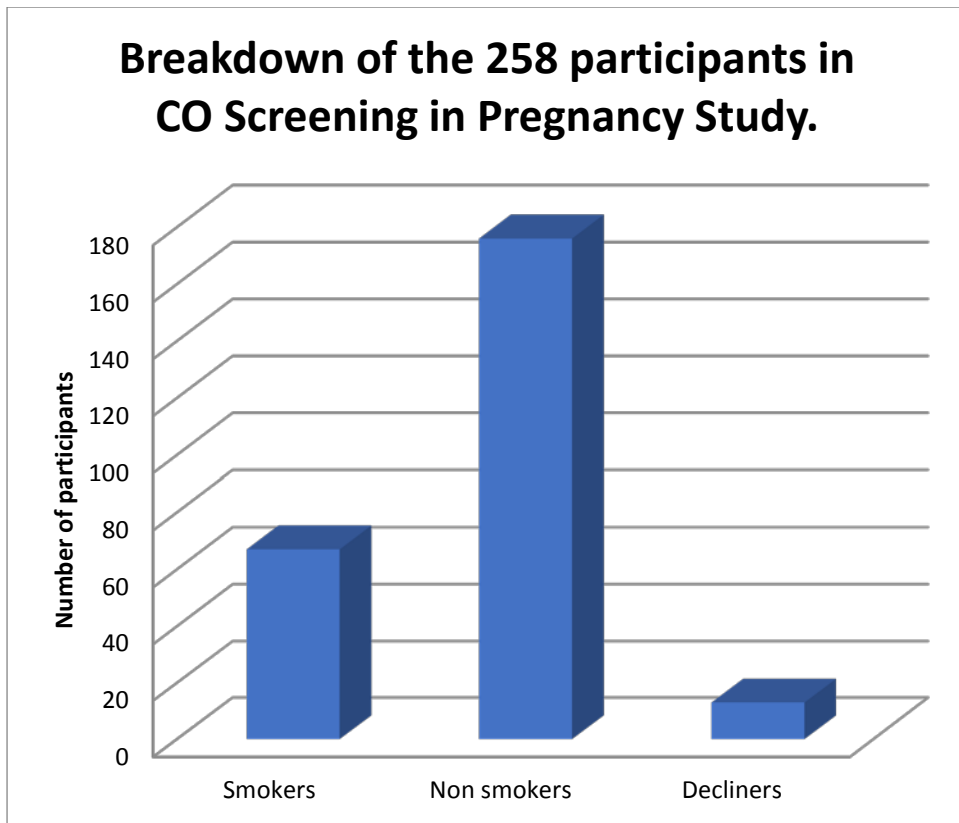


Figure 2

Of the 68 participants who smoked, 21 declined a LSSS appointment and 47 were subsequently reviewed at LSSS. Of the 47 women refereed: 7 quit smoking, 13 did not stop smoking 21 were lost to follow up 5 miscarried and 1 was seen by the Practice Nurse in her GP surgery as show in Figure 3.

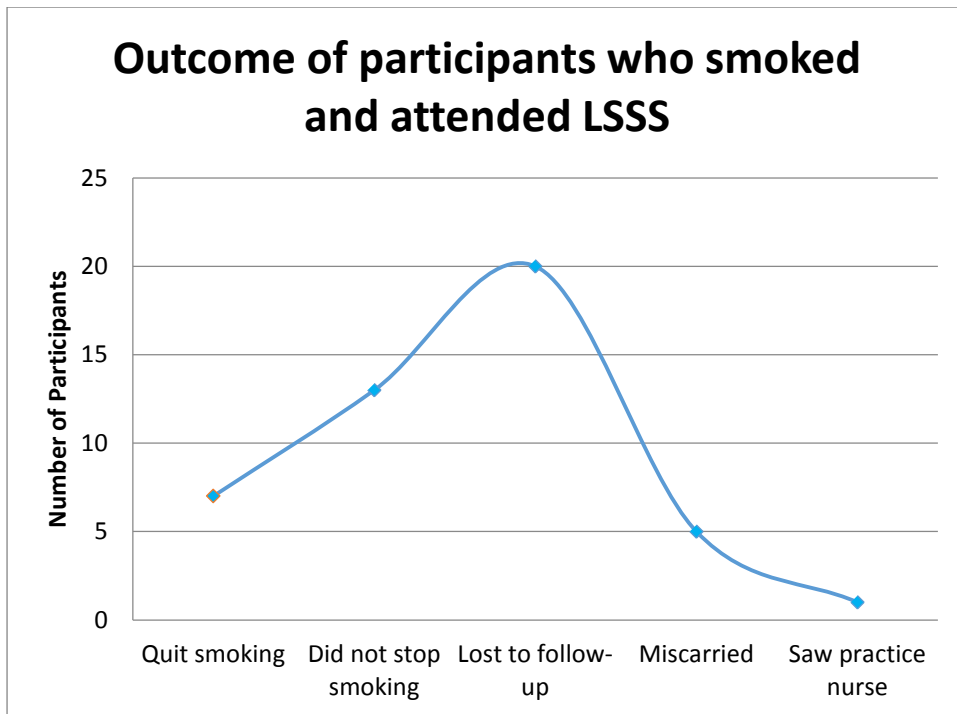


Figure 3

Figures reported from the LSSS for the pilot phase reveal an 83% increase in referrals to the team during the first month, a 50% increase in the following three months. The figures suggest that the pilot was successful in increasing the number of women referred to the LSSS team in Plymouth. The attendance at follow-up antenatal clinics was only available for 2 months of the 4 month pilot due to administration processes of recoding this information changing and administrative staff shortages. This is shown in Figure 4. However, we cannot discriminate between women who did not attend the second appointment due to the effects of CO screening and women who did not attend due to other reasons (e.g. pregnancy loss, moved away, inappropriate appointment time).

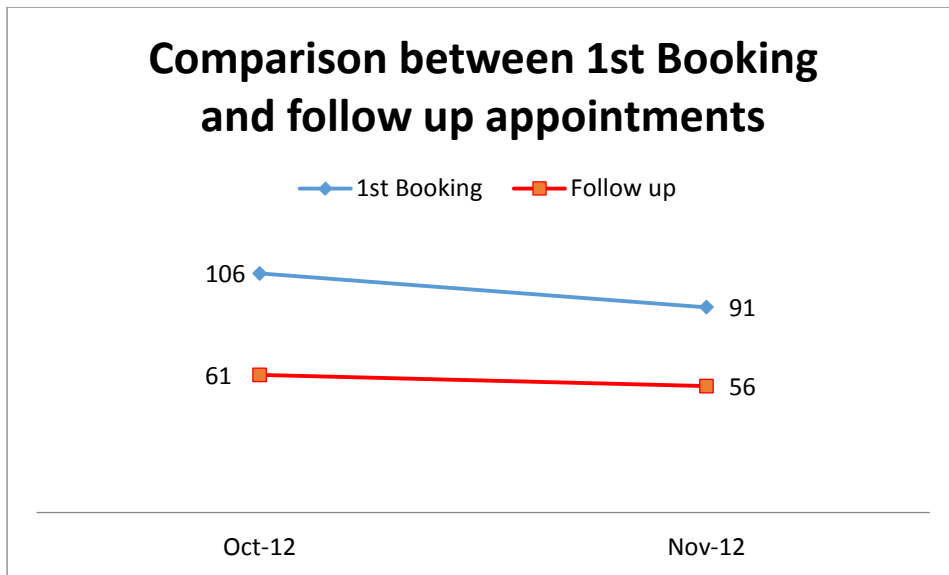


Figure 4

4.2.1 Catalyst for Change

The analysis of the questionnaire showed that 87% of pregnant women respondents were offered CO screening at the first booking appointment. Of the five respondents not offered the CO screening three were from the affluent area of Plymouth, one respondent did not provide post code information and the fifth was from a more socially mixed demographic area (Figure 5).

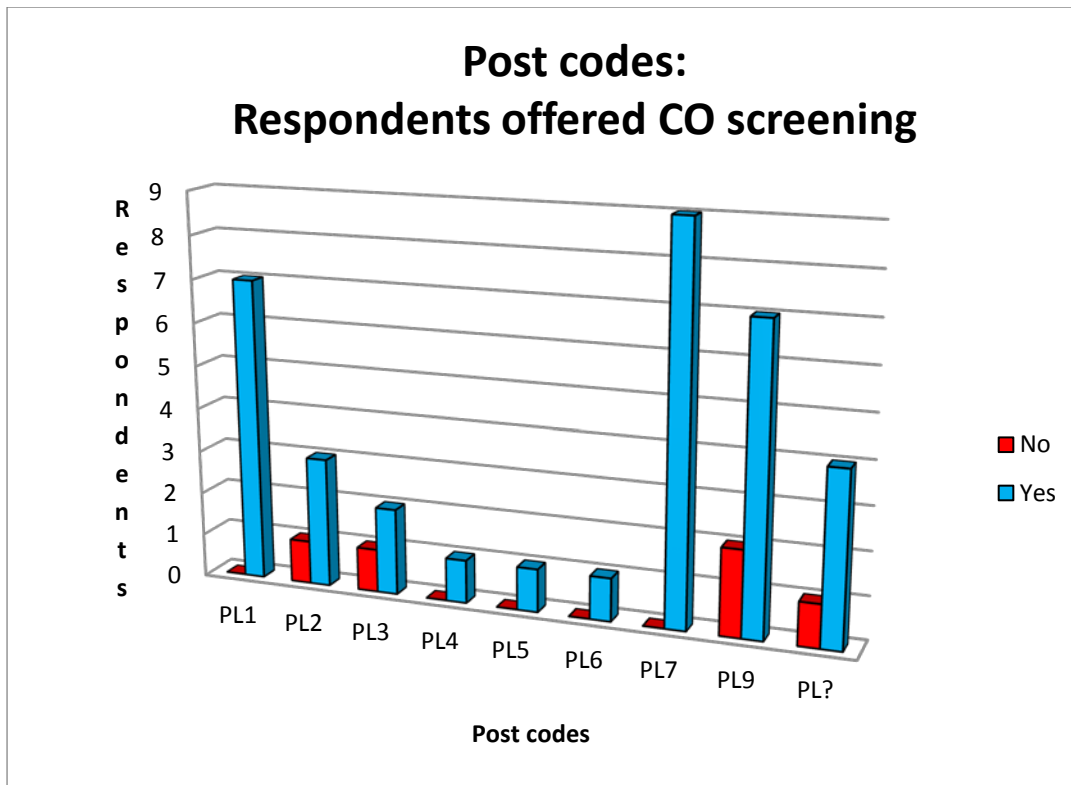


Figure 5

The majority of our survey respondents reported being given information that the screening was designed to detect CO levels due to smoking cigarettes; however fewer women were informed that a positive reading could indicate other sources of CO such as passive smoking and faulty boilers (Figure 6).

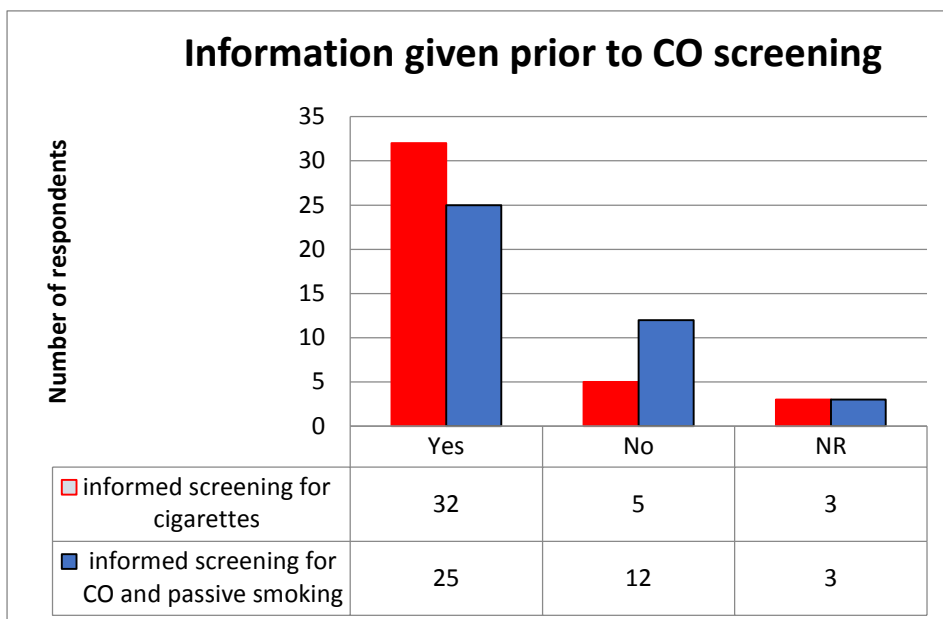


Figure 6

Only two of our questionnaire respondents informed us that they refused the screening (one from area A and one from Area B). Of those who participated none reported being unhappy with the experience and the majority (27) were very happy or happy with their experience. An overwhelming majority of women felt that CO screening should be offered to pregnant women but less felt that the screening should be offered to others in the household (Figure 7).

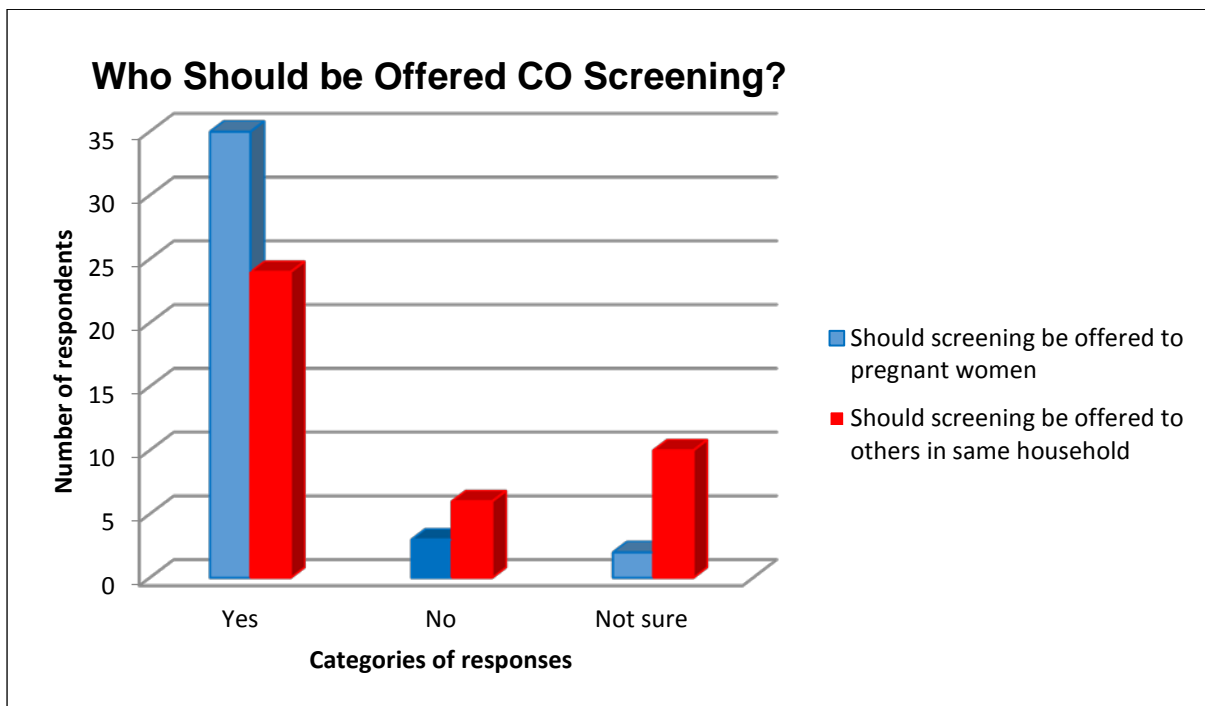


Figure 7

In focus group interviews some midwives responded very positively about the CO screening with most reporting that the majority of pregnant women they had asked seemed 'fairly happy' or resigned to undergo screening. 'They just seem to accept it....' (Mary, FG1). Several midwives said something similar to Sue (FG4) who articulated:

...quite a lot of women had taken up the offer and actually we've managed to refer a lot more than we would have without it.

Sarah spoke enthusiastically about the intervention having the potential to be a 'catalyst for change'. Although for her the potential was less due to the technology being deployed and more because women would reflect on the fact that somebody (the midwife) is showing a willingness to be involved in a supportive way:

...it's almost like a catalyst then for change ...it still might be that they think oh a bit later on, you know, stop or change because someone's bothered to engage with them (Sarah, FG4).

Thus the research supports other research that highlights the importance of the mother/midwife relationship (see above).

Only one interviewee reported that one of her clients refused to participate:

ES: Has anybody declined and said that they don't want to do it?

Sue (FG4): Yes, one of my ladies and she said that she's not having any help, she smoked about 20 a day, she don't want them round there and she's not doing it. She's also not having her GTT she says so ... you can't help everyone.

As Samples and Heyman (forthcoming) point out epidemiological evidence may mean less to women who have smoked in previous pregnancies and have a healthy child and thus it is important for midwives to find ways to inform women of potential risks whilst maintaining a positive trusting relationship. As Samples and Heyman (forthcoming) add:

Socioeconomic factors have an important role to play in pregnancy related outcomes. Perinatal (stillbirths and early neonatal deaths) mortality rates for 2010 in England and Wales were 7.4 per 1000 live and stillbirths

(ONS, 2013). Statistics categorised by social and biological factors highlight particular groups of women who are more likely to experience a perinatal death. (A statistic above 7.4 per 1000 births indicates an increased risk relative to the general population.) These women include younger mothers (under 20 years: 8.3), older mothers (40 years and over: 10.2), women born in western Africa (14.5), or central Asia (16.7) (ONS, 2013).

However, whilst this epidemiological information is valuable for ensuring effective care analysis of the woman/midwife relationship needs to be considered in the development of any intervention as the next section shows.

Eight nine percent of survey respondents thought that CO screening was a good idea and should be routinely offered to all pregnant women (Figure 7 above). As one of our survey respondents commented:

I believe these tests are extremely important for the health of your baby.

We received comments from another respondent about how the screening could be further rolled out:

This should be offered to everybody in the household. This also should be offered again after the birth of the baby. Maybe carbon monoxide testers should be offered to place around the home?

In response to the NICE guidelines, proposing that midwives will 'test' women at antenatal appointments and those with high CO readings will be given advice on how to quit smoking. Of the 484 messages posted on Mumsnet the almost unanimous branded the plans 'utter meddlesome nonsense' and 'intrusive nannying'. This is

supported by media coverage of the issue (McDermott 2013). Furthermore, speaking on Radio Four's Today Programme in May (2013) Louise Silverton, Director of Midwifery at the Royal College of Midwives, said:

It is a bit draconian. They are asking us to test each pregnant woman for carbon monoxide on their very first visit. It is not allowing women to say no or midwives to use their judgment. And it puts pressure on the first visit when a lot of women are already dealing with a lot of information and stress.

Reading through the postings on Mumsnet, the general consensus seems to be that women felt tricked, untrustworthy and insulted:

Jazz Sun 12-May-13 15:23:18

Really terrible idea. Women are not just baby incubators once they're pregnant.

The following postings show further examples of the negative responses to the proposals:

tribpot Sun 12-May-13 11:32:46

So the idea is to 'catch out' pregnant women who are smoking but lying about it (yet somehow agree to the test that will reveal they are lying) and then, presented with the evidence that they are lying, ask them nicely if they'd fancy going to the smoking cessation clinic? How or why would that work?

Featherbag Sun 12-May-13 12:32:14

I'd love to see NICE's rationale for this recommendation. As a HCP and a pregnant woman (non-smoker) I can't see any benefit to the health of either the mother or the baby in this, or how it could possibly improve therapeutic relationship-building between woman and midwife. CO2 tests are already used as part of the smoking cessation service, and in that context they are extremely useful, but I think the current system of providing information and allowing women to make their own decisions using that information is how it should be.

andadietcoke Sun 12-May-13 16:57:05

I too had this at booking in. I don't think I was told it was a test for smoking - just for carbon monoxide, so I was happy to have it in case something was leaking at home (which is what I assumed they were checking for). I've never smoked but I think I would feel somewhat belittled if I'd told the mw I'd stopped smoking only to be subsequently 'tested'. I guess it depends on whether they are just testing for smoke, or screening for pollution or carbon monoxide as well.

JanePlanet Sun 12-May-13 19:58:45

When I went for my booking in appointment a couple of months ago I was asked if I smoke, I said no. I was later asked to blow into something without being told what it was. I asked if it was a carbon monoxide test to check if I was lying. Seemed quite underhand to me. Wasn't sure how to feel about it afterwards.

Out of the 484 postings the only positive attitude was from this member. However, even she doubted whether the midwife was being truthful:

Jojobump1986 Sun 12-May-13 17:56:48

I did a breath test at my booking appt. Never smoked in my life but it didn't seem like a big deal to blow into a tube for a couple of seconds. The midwife said they'd picked up some dodgy boilers by doing the test - no idea if that was true though

4.2.2 Tensions between the general and the particular

Most of the midwives interviewed could see how the intervention might benefit women smokers in general but did not think it was as appropriate an intervention for particular groups of women, particular localities or particular individuals:

I've had a slight issue is with the ladies who don't have English as a first language ... I have had a real problem with that because the booking process is long enough anyway and then when they don't smoke and you then you're having to try and explain how to use this thing when they don't speak English, you're trying to do it by a language... on a few occasions, I have just not done it. (Sue, FG4)

Sue is a midwife in the socially deprived area of the City and it was revealed during the interview that 15% of her normal caseload were women whose first language was not English and that some of them did not speak any English. Other midwives also raised the issue of the inappropriateness of this intervention for their particular local population of women:

I feel there are other priorities. I'd rather talk to them more about diet, which would be much more relevant for the women in this area ... in all the time I've been doing it, I've had one smoker (Maggie, FG1)

... over here, there are not a lot who smoke. It's very unusual, I only have about a handful a year that smoke in pregnancy, so therefore we're spending our time talking about that when we could direct it on something else and I [am], completely with the smoking [cessation intervention], with the ones who smoke and they absolutely do it and absolutely get them referred and I don't have a problem spending time talking to them about it, but it's the ones that are clearly non-smokers that we have to do it to. (Mary, FG1).

It was clear that a number of midwives while cooperating well with the pilot project remained unconvinced about the benefits in 'their' area and saw it as hindering other work that needed to be carried out with their particular clients. One midwife who works in one of the more economically affluent areas in Plymouth where the population of parents who smoke is almost half the City's average (plymouth.gov2013) was concerned about how worthwhile the intervention was for her locality:

[I]t adds to the booking process, which is always a bit of a hindrance, cause the booking process is very, very lengthy now, erm, to be honest in [area B] we haven't got a great number of smokers and if they are, they're hardy smokers that aren't really gonna give up very easily. The patients have all been fine to cooperate with the testing, no problem, but none of them need referring and almost... well is it worthy of [Area B's] clients? (Christina, FG2).

Nevertheless in contrast the perception of some midwives we interviewed made the particularities of a given population more amenable to participating in screening:

. . . most of them are well educated or reasonably well educated women who attend at the right time for their appointment and want to do the best for their baby, erm and that are, generally will do something. Anything you

offer them, they will have and they often want more than the service would give them (Fran FG2).

For Fran, although the population in her area (Area A) were far less likely to smoke, the fact that they were well educated meant that they were trusting and compliant and therefore willing to participate.

Although some of the data suggests that the targeting of screening – within particular areas and with particular groups of people – other respondent accounts highlight problems with this. As Dodds (2009) notes risk has become part of the ‘social exclusion’ agenda but *at risk* is often interpreted as *participating in* high risk activities and behaviours which can lead to the stereotyping of particular groups and individuals (Bailey et al 2004, O’Malley 2008). Such stereotypes can impact on the woman/midwife relationship, as being labelled ‘a risk taker’ can lead to increased scrutiny, which in turn may lead to women not accessing the services they are entitled to, thus putting them at greater risk (Bailey et al 2004) for examples of pregnant teenagers and young women not accessing services for fear of prejudice and discrimination).

4.2.3 The Value or Not of CO Screening

Some of our respondents were clearly aware of the complexity of the issue and some midwives’ support for the intervention was dependent on whether it was making any difference in terms of referrals and the number of women who would stop smoking as a result:

But what I wasn’t sure looking at the information whether actually it had a made, because again for us, if we have a smoker and we refer them, you know, they were referred anyway, whether doing the carbon monoxide made anybody, are women, if you refer them at normally, they would have go ... so has the carbon monoxide monitor ... made them any more likely

to be referred because they would have all have agreed anyway and has it made any difference to the number of women who give up? ...But that would be my question, for our time and effort that we have to put into it, are the results significantly different as a result of using a CO2 monitor than they were by doing normal direct referral. ... Cause it was an opt out referral system and I never had a woman who opted out. If I found a smoker, they would always be referred. (Jan, FG3)

For Jan it was important to get feedback from the LSSS and to know the intervention is making a difference to justify her 'time and effort'. Others, such as Julie, although willing to comply with the CO screening, were unconvinced that about its benefits in her area:

ES: Would you be happy for it to continue?

Julie (FG1): Yeah, I don't... I would be happy to participate if its helping the department, but I'm not seeming like I'm gaining anything from it, cause nearly all mine are non-smokers and as I said before the ones that are smoking, they're very hardened smokers for many, many years and they've smoked through several pregnancies.

There was a general consensus in the focus groups that feedback was important and a suggestion that without it they may tend lose interest and possibly 'slack' off:

Feedback would be really good though, because I think that kind of encourages us, because I am a bit slack sometimes (Pam, FG2).

So it would be nice to get some feedback from the stop smoking service about, you know, whether they've successfully contacted the woman and

if not, then it's something that we could maybe go on prompt because, you know as Julie says, we're very aware of all the reasons not to smoke in pregnancy all (Sarah, FG4).

All of this is further evidence of proper evaluation of such intervention, not least because of the potentially negative impact of such an intervention on the woman/midwife relationship. While many midwife respondents thought that the ability to alert women to other sources of CO was a good idea, it seems that false positive readings led to an increase in anxiety among some non-smokers until a boiler was tested or further screening was repeated showing a normal reading. As one questionnaire respondent said:

I had a test and it came back with a high reading good job my midwife knew me. I had my boiler tested as a result of this and it was fine. So guess it must have been a faulty meter reading as I have never smoked in my life!

In the questionnaires diverse opinions were expressed about the morality of smoking during pregnancy and one respondent saw the screening as a vehicle for making clear the harmful effects:

I believe some smokers convince themselves no harm is being done to them and their unborn child as a result of smoking as they can't see the effects. This may help both parents understand the possible effects smoking has.

And yet another respondent who had previously smoked although not during her current pregnancy stated that 'People shouldn't be pressurised/feel they have to by health care professionals'. The potential for the intervention to further erode trust was raised by some survey respondents:

I was told it would test if I'd breathed in pollution that would harm my baby because I cycle a lot. When it came out in the news it was to see if I had been smoking. I thought it was quite sneaky – doesn't help build trust.

I think further explanation of the study could have been provided. It felt as though I was being tested for whether I would tell the truth about whether I smoke or not.

All of this suggests that clear communication of the value of CO screening would be useful for midwives and for women and their families (McGowan et al 2008, Grover et al 2012).

4.2.4 Resources: Time and Space Pressure

Many of the midwives reported that time constraints made the additional task of administering the intervention difficult and burdensome, particularly when an initial booking appointment already involved extra time:

...sometimes ... what I feel were up against is the timing and I mean you stayed behind and did that lady who appeared out of nowhere ... I mean literally turns up from, was it Cambridge or somewhere like that (Sarah, FG4).

She took two hours... (Sue, FG4).

It was clear from the focus group discussions that the need for extra time was an exception rather than a routine but they reported how such an instance can create additional time pressures:

Two previous children [were] removed, 37 weeks, and you're sort stuck with a massive problem to deal with and I'm not saying that's your routine booking ... generally speaking you need an hour, but I still think you need another half an hour at the next hit to mop up all the other bits or if you didn't get time to do that because it also too long a time for ladies in one hit is actually not good for them ... they wane off of the whole thing and they don't listen then ... It is overload definitely (Sue, FG4).

Midwives also reported that when the booking appointment was longer than an hour that this created problems for their clients too:

It is also about the women I do, because you know ... some of them actually struggle to get an hour in a day to sit and have a booking done ... (Sarah, FG4).

You can see they've glazed over about half way through. I think that's probably why they just accept it, because they, well they've just, by half way through the booking, you can see, they've glazed over. Most of them just want this to finish it and get out. You know, sometimes they've got a toddler with them who's playing up and.... (Maggie, FG1).

It is well documented that the amount of health information needed to be given to women and the examinations to be undertaken within a designated time are already onerous (McCourt 2006) without the inclusion of CO screening. Other barriers to implementing the intervention relate to the midwives remembering and having the capacity to carry the equipment. This was reported as a particular problem when midwives worked in non-dedicated rooms:

...because I only have that room that afternoon, I have to, I can't leave the equipment there, I have to bring it in and out every time, sometimes I forget to take it in and I have to go back to the car for it (Linda, FG1).

...well, yesterday I didn't do the three that I booked yesterday.... it was in the boot of my car, by the time I'd carried in two bags, this, and my sonicaid and my packed lunch I was, I didn't have another hand to carry things in (Maggie, FG1).

4.2.5 Trust Relationship between Pregnant Women and her Midwife

As already suggested midwives were concerned that 'checking up' on women's smoking habits creates tension and distrust between the midwife and her client and undermines trust:

I think also its the fact that you can sort of say well you know it's not just about, erm, smoking, but it could be about faulty boilers and erm, do you know what I mean, then I just feel like we're offering them another little check and it feels... (Lesley, FG2).

Yeah, yeah, I know that they're all taking up the referral and I know that [midwife] been round to quite a number of them, but then they slack off and they don't answer the door and things like that (Sue, FG4).

But not all agreed and some thought it depended on how they approached the issue:

It's how you ask people (Maggie, FG1).

... it depends how you're asking them. They might be thinking "oh god, are they trying to catch me out or something", but in fact if you just do a bit more explaining and they actually seem, you know they seem quite happy with it and you know you sort of say to them, we're expecting that if you don't smoke, we're not expecting it to show a reading, then you know (Pam, FG2).

Although midwives are knowledgeable about the harms caused by smoking during pregnancy some were sympathetic to the reasons why some women continued to smoke despite the harms:

I had a twin lady the other day and she was obviously smoking, stinking of fags and I thought "oh god, you've got twins and you're like smoking" and it just all seems so like wrong you know and she wasn't going to get it at all and when I saw her yesterday, she had delivered quite safely these two fairly nice size babies, but I just thought "aww, what a shame" you know coz she's, she just is one of those hardened smokers ... she didn't even have an epidural ... she just dropped them out to be fair. (Sue, FG4).

While Sue expresses some regret that the mother smoked she was also respectful about the mother's toughness and acknowledges the 'ease' with which she gave birth to two 'fairly nice sized babies'.

The erosion of trust was another issue of concern for those posting online comments on the internet cite Mumsnet:

Happyday Thu 16-May-13 09:56:14

It would certainly affect my relationship with someone who tried to insist on it after I had told them I don't smoke and never have; I am **not** a liar and would be pissed off at being treated like one

While we had very poor uptake of our online survey accessed via Mumsnet (4 responses) these respondents were much less enthusiastic about the screening. For example:

coffeeinbed Sun 12-May-13 12:32:14

I was unhappy about this test because the reasons for it were not explained. I am a non-smoker living in a non-smoking household and had already given the midwives this history. To be asked to provide a sample without explanation made me feel as if they did not trust me to tell the truth about my smoking history and thereby damaged the working relationship. I recognise that this is not a problem with the test itself but rather the manner in which it is administered.

JanePlanet Sun 12-May-13 19:58:45

What is the driver behind this? Is it about identifying women with leaky boilers or is it about catching people out who smoke?! If it's the former, seems fine. If the latter, not sure ... there's a risk it could be seen as paternalistic and patronising.

The comments posted on the topic of CO screening in pregnancy were much more critical of the intervention seeing it a waste of time and money and unlikely to reduce the number of women smokers:

Coppertop Sun 12-May-13 10:49:59

I would refuse the test. Everyone already knows how to access smoking cessation should they wish it. Utter meddlesome nonsense.

Boffin Mum Mon 13-May-13 10:36:21

If I did smoke I'd have to be a bit thick to have missed all the warnings so I'd either have given up myself/accessed the help or decided for whatever reason to continue. A test won't change that.

Of the 40 postal survey responses received only two women reported that they had smoked during their pregnancy and these women reported that they are currently smoking. However, 26 respondents did not answer the question about their current smoking status.

4.2.6 Uncertainty about Readings

Some midwives reported that that the results from the CO monitor could generate unnecessary anxiety:

They get anxious if it does come up the gold, you know, "oh, well I don't smoke, my partner doesn't smoke. I've not been in a smoky atmosphere" and in some ways it's creating anxiety which is unnecessary (Maggie, FG1).

This problem was further exasperated as some initial monitors were later found to be faulty:

Maggie (FG1): I think I've had one green one out of all of it; it's been orange every time.

ES: Yeah and you think that was the machines, did they change the machines?

Maggie (FG1): No ...was really embarrassing, she said "well I've got carbon monoxide, I don't smoke", so she did it twice, I did it on her twice and I said well, I've got to send it off anyway, and the next lady came in, non-smoker, it was positive, I did it, it was positive, so obviously I had something wrong with the machine at that time.

ES: Have you had any false positives?

Maggie (FG1): ... I did get a 3 in someone that said she didn't smoke and to me there's got to be carbon monoxide going on, but her husband smokes, so I guess she's picking it up off his clothes and stuff, so yeah, it was a bit of a shock cause she said she's a non-smoker, so that was my only shock I must admit and it did make me think. She said he always smoked outside, I said, yeah, but it always lingers on your clothing and your breath for some time, so maybe....

and:

I had one the other way round, where he was a smoker and hadn't a cigarette since the day before, but it came up as negative (Julie, FG1).

But I did have a patch where I referred quite a few people because their carbon monoxide levels were high and they'd never smoked (Maggie, FG1)

Well, mine, mine virtually all mine go, not to the green, to the yellow one. So I, well, I discussed it with Sandra [the LSSS trainer] and she said it's just the background carbon monoxide if they've driven in, in a car, it's going to come up as there is some anyway (Julie, FG1).

NICE Information relating to equipment reading acknowledges 'that it is unclear as to what constitutes the best cut-off point for determining smoking status and that CO quickly disappears from expired breath (the level can fall by 50% in less than 4 hours). Furthermore, environmental factors such as traffic emissions or leaky gas appliances may cause a high CO reading – as may lactose intolerance.

Another potential barrier to successful implementation was the difficulty some women had in correctly breathing into the monitor:

You would think it was quite easy to explain how to do it, but you would be amazed how many people don't actually do it properly. (Sarah, FG4).

I find that as well it is quite [all talking again] you want them to like, to almost...If you get them to inhale too early and they can't hold their breath in that long (Sue, FG4).

This generated a great deal of conversation in the focus group about the techniques and whether the difficulty was due to the midwives' lack of proficiency:

I don't necessarily know that its instructor error, I just think it's people's perception and we give them so much information when we book them. They feel a bit bombarded (Sarah, FG4).

4.2.7 Screening Male Partners

Another positive and seemingly unanticipated outcome of the intervention was the response of the male partners who were asked to participate:

Carol (FG2): I've also been testing random dads, anybody that looks like they've got a chesty cough, I've used it on them, erm so erm, and we've picked up some surprisingly high results on dads who've smoked and literally put a cigarette out just before entering the building, erm and one of them was severely shocked, he got the highest score on the piece of kit so that put him in to a bit of a shock ...

ES: Have you seen him since? Has he given up?

Carole (FG2): Yes and he sent me a nice box of chocolates for Christmas, so he wasn't distressed ... He hasn't given up, but he allowed me to send the referral back into [the referral nurse], because they'd refused before. So both of them are on the referral system again...

While it was clear from the focus group discussions that not all accompanying male partners were asked to participate, having the screening equipment on hand encouraged some of the midwives to take the opportunity to invite male partners; especially those who they suspected were smokers:

Concerning that one family that was so shocked, when she (the pregnant woman) went to the toilet and I looked at him, I thought he's a bit blue round the face, "do you mind if I test this kit on you..." (Lisa, FG3)

One woman reported that the results of the screening prompted her husband to stop smoking:

Although I did not smoke, my CO levels were high enough to say I was – my partner has now quit smoking completely as it proved smoking at the back door was bad enough!

However, overall, there was less enthusiasm for offering the screening to male partners or other members of the household and there is a suggestion that acceptance and support of the screening in general depend on understanding of the potential benefits to women other than in detecting cigarette smoke:

Now that I understand (courtesy of the information contained in this questionnaire) I am now of the opinion that routine CO test should be a valued part of ante-natal care. However, at the time of my pregnancy it was not made clear what environmental effects were being tested, nor were my results given to me. If this is to become a regular part of ante-natal care then the midwives need the appropriate training to deliver this successfully.

Although there was less support reported among the women respondents for screening partners and other household members there were instances reported by midwives and women where such screening aided understanding of the potential harm of passive smoking and had prompted at least one male partner to stop smoking. An Australian study (Wakefield et al 1998) involving focus group discussions with male smokers whose pregnant partners also smoked, found that the men were largely unaware that their own smoking could pose a specific risk to the foetus and believed their smoking habits were unimportant in relation to their partners' smoking cessations. For these men, barriers to quitting during their partners' pregnancy were; lack of understanding that passive smoking can affect the

foetus, lack of motivation to quit early in pregnancy due to the baby not being "real"; and concern about stress-induced marital discord associated with cigarette withdrawal. A more recent UK reveals that most of the pregnant women who were interviewed had partners who smoked, which for many acted as a disincentive to stop smoking (Haslam and Draper 2001). It is clear then that partners' attitudes and smoking behaviour can be positively changed as a result of this intervention. This is not routinely offered to accompanying partners but may be something to consider in the future.

5: Some Implications

Instead of acknowledging the need for increased support for those living on low incomes the US welfare system has increasingly become entwined with moral aspirations to manufacture 'better' clients and citizens (Soss, 2005). The . . . focus on individually based, therapeutic approaches. . . suggests that British welfare policy may be leaning in the same direction (Dodds 2009: 508).

Our findings show that in general there was a high degree of acceptability for the intervention. Midwives and their clients were generally in support of the screening being offered to all pregnant women. However, this support was dependent on a number of contextual factors. Women wanted screening to 'be offered in an open and honest way that allows the patient to make an informed decision about participating' (online survey respondent). It was clear too that women very much welcomed the additional benefit that CO screening offers in identifying other sources of to which they may be exposed.

Midwives also wanted to be kept informed about the effects of the intervention on women's smoking cessation and it was clear this was important to keep them motivated as the booking appointment is a busy time for both the midwife and her

client. Initial training of midwives in utilising the protocol and in instructing women to correct use the monitor was also very important as is ongoing support for the implementation of the intervention.

Trust was revealed to be a very important aspect of the relationship between women and their midwives. Some women felt that it was unclear whether the screening was designed to check CO levels for the sake of their future baby's health or whether the prime motivation for to detect people who smoked. These women felt the latter to be deceitful and damaging to their relationship with their midwife. While trust is often a tacit and taken for granted aspect of health care professional and client relationship a breakdown in trust can be very damaging and difficult to restore.

Information is clearly important to all concerned. Whereas women want clear and honest information regarding the purpose and implications of CO screening midwives want communication the LSSS about the value and success (or not) of the screening. Therefore data on women's feelings, experience and behaviour are all important to the future development of the intervention.

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Appendix One

Interview Schedule

Tell me how it has gone?

How have you found it?

Have you had any women decline?

Why do you think women decline?

Appendix Two

Invitation Letter

Re Carbon Monoxide Screening in Pregnancy Survey

Dear

We would like to invite to you answer a few questions by completing the short attached questionnaire. We are part of a team of social science and healthcare researchers at Plymouth University specialising in the experiences of maternity and reproductive care and we would really like to hear about your experiences and views on a new carbon monoxide screening that you may have been offered when you attended your antenatal booking appointment with your midwife.

We would really appreciate it if you are able answer the short questionnaire attached which should only take a few minutes of your time to complete. Please answer the questions whether or not you were offered the screening as we are keen to get the views of women attending antenatal clinics. We would like to reassure you that we are not collecting any personal identifying information and ask only that you provide the first 4 digits of your post code to help us evaluate the service in your area of Plymouth.

If you have any questions relating to the project please do not hesitate to call or email one of the names listed below. Many thanks in advance and please return the survey form once complete in the stamped addressed envelope provided.

Yours sincerely,



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Appendix Three

Carbon Monoxide Screening in Pregnancy Survey

Please tick all that apply

Q. 1 *During your antenatal care with your community midwife were you offered to breathe into a machine that screen your carbon monoxide levels?*

Yes No Not sure

(If 'no' or 'not sure', please go **Q. 7**)

Q. 2 *Were you informed that these machines measure the carbon monoxide levels in your lungs and detect your exposure to cigarette smoke including the inhalation of the cigarette smoke of others (passive smoking)?*

Yes No No, I was not aware at the time but I discovered this later

Q. 3 *Were you informed that these machines measure your carbon monoxide levels and detect environmental factors such as a faulty domestic boiler?*

Yes No No, I was not aware at the time but I discovered this later

Q. 4 *Did you agree to have your breath monitored by the machine?*

Yes No (If No, please go to **Q. 8**)

Q. 5 *Were you advised about the meaning of your breathing screening result?*

Yes No

Q. 6 *Overall, how happy did you feel taking part in the breathing screening?*

Very happy Happy Neither happy nor unhappy Unhappy

Q. 7 *During your antenatal care was your partner or any member of your household offered to breathe into a machine that screened their carbon monoxide levels?*

Yes No

Q. 8 *Does anyone in your household currently smoke cigarettes, or not?*

Yes, someone does No, no one does Not sure

Q. 9 *Do you think that a carbon monoxide breathing screening should be routinely offered to pregnant women?*

Yes

No

Not sure

Q. 10 *Do you think such breathing screening should be offered to partners or those living in the same household as the pregnant woman?*

Yes

No

Not sure

Q. 11 *Have you smoked cigarettes at any time during this pregnancy?*

Yes

No

(If No, please go to Q. 3)

Q. 12 *Are you still smoking cigarettes?*

Yes

No

Please can you provide the first 4 letters of your post code in the box below:

We would welcome your comments in the box below about your views on the offering of such screening as part of your routine antenatal care and any further related comments.