

Smoking prevalence trends: An analysis of smoking at pregnancy registration and at discharge from a midwife Lead Maternity Carer, 2008 to 2010

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ABSTRACT

Background: Smoking during pregnancy has a detrimental effect on both maternal and neonatal health. The government has agreed a long term goal for New Zealand (NZ) to become a smoke-free nation by 2025, with smoking cessation during pregnancy a government priority. Contemporary information, reviewing the prevalence and demographics of women who smoke during pregnancy, is important so that change can be monitored and cessation support appropriately targeted. **Aim:** To examine the prevalence of smoking for 81,821 pregnant women who registered with a midwife Lead Maternity Carer (LMC) between the years 2008 to 2010. **Methods:** A retrospective observational design using aggregated clinical data from the New Zealand College of Midwives clinical outcomes research database (COMCORD) for the years 2008 to 2010. Women's self-reported smoking or smoke-free status was recorded at registration with, and at discharge from, a midwife LMC. **Findings:** A trend of reduced smoking prevalence at registration was found for this

cohort (reduced from 19.5% in 2008 to 18.4% in 2010). Women who identified as Māori had the highest rates of smoking (42.9%) followed by Pasifika (15%) and NZ European ethnicity (13.4%). Women in the 16 to 19 years age group had the highest rate of smoking (39.4%) followed by the under 16 years age group (35.7%). Increasing parity was also associated with an increased likelihood of smoking at registration. By discharge from midwifery care there were reduced rates of smoking across all groups.

Conclusion: Overall smoking during pregnancy prevalence rates are trending down with reduced rates of smoking across all groups by discharge from a midwife. Cessation messages and support need to be targeted to young women (under 25 years), multiparous women and women of Māori ethnicity.

KEY WORDS

Smoking, pregnancy registration & discharge, midwife

INTRODUCTION

Smoking during pregnancy affects both maternal and neonatal health and remains the most significant preventable cause of fetal and infant death and disease (ASH, 2009). When a woman smokes during pregnancy she is at increased risk for pregnancy complications and neonatal/infant mortality and morbidity. Smoking cessation prior to or during pregnancy can dramatically improve health outcomes for the woman, her infant and family (McCowan et al., 2009). Support for smoking cessation during pregnancy has the potential to impact not just maternal health but also neonatal and family health. If sustained it may also have a wider impact on the health and smoking prevalence within New Zealand society.

In 2011 the government agreed a long term goal of making New Zealand essentially a smoke-free nation by 2025 with a short term goal to halve tobacco consumption by 2015 (Dowswell et al., 2011). Smoking cessation during pregnancy has been set as a health target with all health professionals required to **A** (ask about smoking status), **B** (provide brief advice) and **C** (refer to cessation services) every person accessing health services. The rationale underlying this strategy is that the more frequently a person is asked whether or not they smoke and, if they do, then informed (again) of the harmful effects of smoking by a health professional, the more likely they are to stop smoking. There are a variety of other strategies, such as pictorial health warnings on cigarette packets and smoke-free community environments, which altogether are expected to have an effect on smoking prevalence. Recording the number of women who smoke during pregnancy on a regular basis is important and can provide a benchmark against which changes can be monitored and evaluated.

In 2009 the New Zealand College of Midwives (NZCOM) published research reporting the rates of smoking during pregnancy for a cohort of New Zealand women for the years 2004 to 2007 (New Zealand College of Midwives, 2009). Smoking status was documented by the Lead Maternity Carer (LMC) midwife at pregnancy registration and again at postnatal discharge. The prevalence of smoking at pregnancy registration was 19.2% in 2007 dropping to 15% at discharge from midwifery care during the postpartum period. Women under the age of 25 years and women who identified as Māori had the highest rate of smoking at pregnancy registration and the highest rates of reduction by the postpartum period.

The primary aim of this study was to describe and analyse the prevalence of smoking during pregnancy among a cohort of pregnant women for the years 2008 to 2010. The data are from information provided by midwives who work as Lead Maternity Carers and are members of the Midwifery and Maternity Provider Organisation (MMPO). The secondary aim was to identify and describe trends, by utilising the same methodology and research database as the previous study of smoking during pregnancy (NZCOM, 2009).

METHOD

This retrospective cohort study used longitudinal, prospectively collected data to describe and analyse information about smoking and smoke-free behaviour of women at pregnancy registration and then at postnatal discharge, who were registered with an MMPO member midwife LMC across the years 2008 to 2010. Sub group analysis determined the association between age group, ethnicity, parity and reported smoking/smoke-free status. Descriptive statistical data techniques using SPSS 17 were used to analyse the data. Ethical approval was obtained from the New Zealand Health and Disability Ethics Committee using the expedited ethics process URA/11/EXP/041.

DATA SOURCE

The Midwifery and Maternity Provider Organisation is a national practice management system which all members of the College of Midwives, who practise as LMCs, are eligible to join, with numbers increasing annually. Information from the clinical maternity health record for each woman is summarised by the LMC midwife and sent to the MMPO. This information is then entered into the IT system by dedicated data entry staff. Midwives themselves can also directly enter information via a remote link if they wish. The summary data are provided to Sector Services (Ministry of Health) to support midwifery claims for services. They are also used to provide individual midwives with personalised outcome reports which inform their biennial Midwifery Standards Review, a component of which is reflection on outcomes related to practice.

The summary data are aggregated and anonymised to provide the College of Midwives Clinical Outcomes Research Database (COMCORD). The database has several inbuilt features designed to enhance the reliability of the data. An annual national midwifery outcome report is published yearly using the database. Data are used by researchers and the midwifery profession to investigate specific issues within maternity care in New Zealand.

Smoking behaviour is a mandatory field in the clinical notes with data collection being required when the midwife registers as the woman's LMC and at postnatal discharge. Women are asked if they smoke, and results are documented as either 'does not smoke' or the number of cigarettes smoked daily. This question is repeated at postnatal discharge from midwifery care which occurs between 4 and 6 weeks following the birth.

SAMPLE

For the years 2008 to 2010 information was available for a total of 81,821 women within the NZCOM research database. This included data from:

- 01 Jan 2008 to 31 Dec 2008 – 25,149 women
- 01 Jan 2009 to 31 Dec 2009 – 26,767 women
- 01 Jan 2010 to 31 Dec 2010 – 29,905 women

All women who had registration, birth and postnatal discharge data were

included in the study. The study cohort provided data on between 38% and 46.5% of the whole maternity population between 2008 and 2010.

FINDINGS

The demographic information for the total cohort is presented in Table 1 along with smoking status.

Table 1: Cohort demographics of ethnicity, age and parity by smoking status 2008 to 2010 years combined

Demographics at time of registration	Smoking status by ethnic group			
	Not smoking		Reported smoking	
	n	%	n	%
<i>Ethnicity</i>				
NZ European	45797	86.6	7070	13.4
Māori	9869	57.1	7426	42.9
Pacific Island	3690	85.0	653	15.0
Asian	4489	99.0	46	1.0
Other	2502	95.9	106	4.1
Not stated	147	85.0	26	15.0
Total	66494	81.3	15327	18.7
<i>Age</i>				
	n	%	n	%
< 16	240	64.3	133	35.7
16-19	4494	60.6	2916	39.4
20-24	11378	69.9	4890	30.1
25-29	17826	83.3	3571	16.7
30-34	19770	89.4	2355	10.6
35-39	10902	90.1	1196	9.9
40+	1884	87.6	266	12.4
Total	66494	81.3	15327	18.7
<i>Parity</i>				
	n	%	n	%
Nulliparous	28321	83.7	5518	16.3
Multiparous	38173	79.6	9809	20.4
Total	66494	81.3	15327	18.7

A comparison between the 2010 COMCORD cohort and the Ministry of Health report on Maternity for 2010 was made (Ministry of Health, 2012). This was to determine whether the cohort was representative of the maternity population and could therefore be generalised to the whole of the maternity population (Table 2).

Table 2: Comparison of cohort to National Minimum dataset for 2010

	2010	
	MOH 2010 National Minimum dataset	Study cohort
Age		
<19	7.1	9.2
20-24	18.6	20.3
25-29	24.9	26.4
30-34	27.6	26.9
35 +	21.7	17.2
Ethnicity		
Māori	25.4	21.1
Pasifika	11.7	6.2
NZ European	50.1	62.6
Asian	10.8	6.3

The study cohort had a median age of 28 years in 2010 compared to a median of 29 years for the national dataset (Ministry of Health, 2012). The ethnicity data demonstrated that Māori, Pasifika and Asian ethnicities were under represented in the study cohort when compared to the 2010 national MOH dataset, thus reducing the generalizability of the results to these groups.

Over the three years 2008 to 2010 the percentage of women who were smoke free increased from 80.5% in 2008 to 81.6% in 2010 (Table 3).

Table 3: Smoking status at registration and at discharge for the years 2008 to 2010

Antenatal registration smoking status	2008		2009		2010	
	n	%	n	%	n	%
Not smoking	20248	80.5	21837	81.6	24409	81.6
Reported Smoking	4901	19.5	4930	18.4	5496	18.4
Not stated	0	0.0	0	0.0	0	0.0
Total	25149	100	26767	100	29905	100
Postnatal discharge smoking status	2008		2009		2010	
	N	%	N	%	N	%
Not smoking	20523	81.6	21734	81.2	24891	83.2
Reported Smoking	3818	15.2	3635	13.6	4118	13.8
Not stated	808	3.2	1398	5.2	896	3.0
Total	25149	100	26767	100	29905	100

Of the 15,327 women who reported smoking at registration, 11,571 reported that they were smoking at postnatal discharge - a reduction of 24.5% (n=3756) across the total cohort between registration and discharge. Smoking status was missing for less than 4% of the cohort at completion of midwifery care following the birth. Reasons for this data loss were varied but the lack of data was considered to have a minimal influence on overall results because the proportion of data loss was similar for both smoking and non-smoking groups.

The proportions of women who reported smoking at registration and at postnatal discharge for each year were examined using McNemar's test to determine the significance of any difference between the correlated proportions (Table 4).

Table 4: Mean reduction in proportion of smokers between antenatal and postnatal visit ('not stated' was excluded from analysis)

Year	% Smoking		% Difference (95% CI)	McNemar χ^2	P	Odds Ratio (95% CI)
	Antenatal registration	Postnatal discharge				
2008	19.3	15.7	3.6	338.8	<0.0001	2.2 (2.1, 2.4)
2009	18.4	14.3	4.1	445.6	<0.0001	2.5 (2.3, 2.8)
2010	18.3	14.2	4.1	529.8	<0.0001	2.3 (2.0, 2.4)
All years	18.6	14.7	3.9	3100.5	<0.0001	2.5 (2.3, 2.6)

There was a reduction in smoking at the postnatal discharge across all the years (2008 to 2010). For the three years combined there was a 3.9% reduction in smoking between the antenatal registration and postnatal

discharge. For each individual year the percentage reduction in the number of women who reported smoking antenatally and not postnatally varied between 3.6% (OR 2.2 CI 95% 2.1 – 2.4) in 2008 to 4.1% (OR 2.3 CI 95% 2.0, 2.4) in 2010. This reduction in smoking status was statistically significant ($P < 0.0001$) and the odds ratios indicate an increase in the odds of women not smoking at discharge.

Trends in smoking during pregnancy from 2004 to 2010

When the results from this 2008-2010 study are pooled with those of the previous research study (2004 to 2007) the trends for smoking during pregnancy can be determined over a seven year period (New Zealand College of Midwives, 2009). The data from the seven year period indicate a trend reduction in the percentage of women reporting smoking at pregnancy registration from 22.9% in 2004 to 18.4% in 2010, a reduction of 4.5% over the seven years (Figure 1). A comparison has been made to the Ministry of Health *Tobacco Use in New Zealand* survey (2010) and *Tobacco Trends 2008* (2009) which provide a general overview of the smoking prevalence for the population overall (age 15 – 64) in New Zealand. This comparison is useful in that it demonstrates the slow but steady decrease in smoking within the general population that has occurred over time and a similar steady reduction in the percentage of women smoking at pregnancy registration in the MMPO cohort from 2004 to 2010.

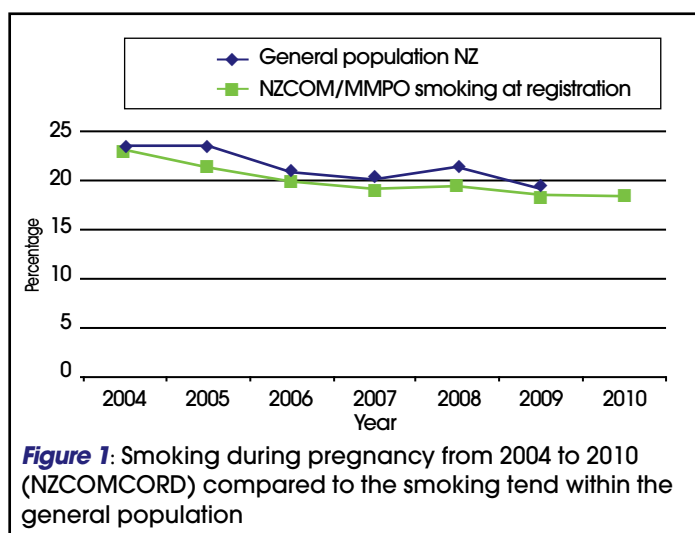


Figure 1: Smoking during pregnancy from 2004 to 2010 (NZCOMCORD) compared to the smoking trend within the general population

Ethnicity and smoking

At registration, women self-identified their ethnicity from up to 16 different ethnicity options, with the woman able to choose up to three ethnic groups, each of which was recorded by the midwife. These groups were then prioritised as per the Health and Disability Sector ethnicity data protocols (Ministry of Health, 2004). The ethnicity and smoking status for each year were examined to determine whether ethnicity was a significant factor in smoking or non-smoking behaviour (Table 5).

Women who identified as Māori had the highest rates of smoking with 42.9% of the total Māori cohort self-reporting smoking at registration. Women who identified as Pasifika had the second highest rate of smoking at 15% followed by NZ European women at 13.4%. Those women who identified as Asian ethnicity had the lowest rate of smoking (1%). There was a statistically significant association between smoking and ethnicity ($\chi^2=8998$, $df=5$, $p < 0.0001$) in that significantly more women, who identified as Māori, reported smoking. This was consistent across each individual year and all years combined and true for both antenatal and postnatal smoking.

Table 5: Ethnicity and smoking at registration and discharge 2008 to 2010

Year	2008				2009				2010			
	Pregnancy registration		Postnatal discharge		Pregnancy registration		Postnatal discharge		Pregnancy registration		Postnatal discharge	
Ethnicity	n	%	n	%	n	%	n	%	n	%	n	%
NZ European	2312	13.9	1835	11.4	2309	13.2	1718	10.3	2449	13.1	1830	10.0
Māori	2325	43.6	1801	35.4	2403	42.4	1777	33.5	2698	42.8	2068	34.2
Pacific	204	17.1	129	11.1	171	13.1	106	8.7	278	15.1	170	9.6
Asian	16	1.3	16	1.4	8	0.6	7	0.5	22	1.2	14	0.8
Other	32	4.2	26	3.6	37	4.7	24	3.2	37	3.5	26	2.5
Not Stated	12	19.7	11	19	2	4.8	3	7.9	12	17.1	10	14.7

From registration to discharge there was a reduction in smoking prevalence across all groups. The greatest reduction occurred for women who identified as Māori with a reduction of between 8.2% and 8.9% for each of the three years (from 43.6% down to 35.4% in 2008) and women who identified as Pasifika (between 4.6% and 6%) (Table 5).

Smoking and age

To establish whether age was an important determinant of smoking, the age and smoking status for each of the years were examined. Age was categorised as: less than 16 years, 16-19 years, 20-24 years, 25-29 years, 30-34 years, 35-39 years and more than 40 years.

Those most likely to report smoking at pregnancy registration were women who were 25 years of age or younger (Table 6). The highest prevalence of smoking was amongst the 16-19 years group with a prevalence of 39.4% across the three years (Table 1). An independent t-test indicated that pregnant women who smoked were on average 3.6 years younger than non-smokers ($p < 0.0001$). The mean age for a woman who smoked was 25.3 years compared to 28.8 years for a woman who didn't smoke.

Pregnant women under 16 years of age comprised the highest proportion of smoking at pregnancy registration (35.7%) overall, but over the three years there was a greater reduction (8.8%) of smoking within this group, from 39.1% in 2008 to 30.3% in 2010 (Table 6).

Less than 4 percent (3102/81821) of the cohort had smoking status missing at postnatal discharge, but this was not statistically significant. Smoking status at discharge demonstrated reductions in smoking across all age groups, with the age group showing the largest decrease in smoking between antenatal registration to postnatal discharge being women between 16 and 19 years of age (10.1%). This was followed by the under 16 age group (reduction of 8.4%) and women between 20 and 24 years of age group (7.1%).

Table 6: Age and smoking at registration and discharge 2008 to 2010

Year	2008				2009				2010			
	Pregnancy registration		Postnatal discharge		Pregnancy registration		Postnatal discharge		Pregnancy registration		Postnatal discharge	
Age group	n	%	n	%	n	%	n	%	n	%	n	%
<16	45	39.1	38	33.0	48	38.1	35	27.8	40	30.3	29	22.0
16-19	961	40.4	718	30.2	925	38.5	674	28.1	1030	39.1	778	29.6
20-24	1453	29.6	1155	23.5	1623	30.7	1222	23.0	1814	29.9	1360	22.4
25-29	1199	18.4	942	14.5	1112	15.9	832	11.9	1260	16.0	935	11.9
30-34	777	11.3	594	8.6	738	10.2	505	7.0	840	10.4	621	7.7
35-39	392	10.5	309	8.3	403	9.9	302	7.4	401	9.3	302	7.0
40+	74	12.3	62	10.3	81	11.9	65	9.5	111	12.8	93	10.7

Smoking and parity at registration and discharge

The correlation between parity and smoking behaviour was explored with smoking and parity examined as a discrete cohort. During registration with a midwife the woman's obstetric history is taken, which includes the number of previous births, if any (Table 7). The results indicate that as parity increased the likelihood of smoking at registration also increased. It would appear that there is a link between smoking and parity. This association was statistically significant for both antenatal smoking ($\chi^2_{trend}=1422$, $df=1$, $p < 0.0001$) and postnatal smoking ($\chi^2_{trend}=1287$, $df=1$, $p < 0.0001$) such that the greater the parity the greater the likelihood of smoking.

Table 7: Parity and smoking 2008-2010 combined

Parity	Smoking at registration		Smoking at discharge	
	n	%	n	%
0	5518	16.3	3978	12.2
1	4300	16.0	3325	12.8
2	2594	20.7	2001	16.6
3	1431	29.9	1106	24.0
4	729	37.6	570	30.6
5+	755	42.4	591	34.9

Across all groups there were fewer women smoking at postnatal discharge. The group with the greatest reduction were women who were para 4 plus (7% fall in smoking by discharge) although there was a reduction in smoking (of approximately 4%) across all parities.

Predicting likelihood of smoking during pregnancy

Demographic variables thought to be predictive of antenatal smoking were entered into a logistic regression. The odds of a woman smoking at registration were 2.6 times (95% CI: 2.5 to 2.7) higher for a woman who identified as Māori when compared to a New Zealand European woman. The odds of smoking increased with parity. Whereas a woman with a parity of one was 1.4 (95% CI: 1.3 to 1.5) times more likely to smoke than a primiparous woman, a woman who had four children was 5.8 (95% CI: 5.2 to 6.5) times more likely to smoke than a nulliparous woman. Similarly for each additional year of age at registration the odds of smoking antenatally decreased by 0.888. (OR 0.884 to 0.891).

DISCUSSION

The purpose of this research was to provide information about smoking during pregnancy for a cohort of pregnant women in the New Zealand context of maternity care. Smoking cessation during pregnancy is a key health target. Having recent and reliable information about the prevalence of smoking during pregnancy for a sizeable proportion of NZ pregnant women and the key groups within that sample of women who smoke, can provide a benchmark on which to measure how close New Zealand as a whole is to the 2025 smoke-free goal.

Ethnicity, age and parity all appear to have an influence and are predictive of smoking at pregnancy registration. Findings also indicate a change to smoke-free status which has occurred at some point between pregnancy registration and postnatal discharge for some in these groups. All of the women in this study had a midwife providing lead maternity care during pregnancy and into the postpartum period. Midwives are educated to provide information, support and referral to cessation services when a woman reports smoking during pregnancy.

Trends

This study found that between 2004 and 2010 smoking prevalence during pregnancy was trending down and comparison with national data reveals a similar trend (Ministry of Health, 2010: *Tobacco Trends*, 2009). However, the prevalence reported for 2010 in the MMPO cohort is higher than that reported in the 2010 maternity report (data gathered on all pregnancies in 2010) (Ministry of Health, 2010b, 2012). Reasons for this difference are not known.

Specific groups with higher smoking prevalence

Globally there are particular groups which continue to have a higher incidence of smoking than others. In New Zealand society smoking prevalence is related to age and ethnicity, with the greatest incidence of smoking found amongst people of Māori and Pasifika ethnicity and people under the age of 25 (Butler, Williams, Paterson, & Tukuitonga, 2004; McLeod, Pullon, & Cookson, 2002; Ministry of Health, 2010). The prevalence of smoking at pregnancy registration appears to be reflective of the general smoking prevalence for these groups within New Zealand society, with higher rates of smoking during pregnancy registration found amongst women who identified as Māori. Additionally a strong correlation was found between smoking and age, with smoking rates decreasing as age increased. This finding follows international trends, with a Scottish study reporting the highest smoking rates during pregnancy were in the under twenties (47%) followed by the 20-24 year age group (40%) (Bonellie, 2001). For the New Zealand women in this cohort who reported smoking at registration there continued to be the potential to change with fewer women smoking at postnatal discharge than at registration. The groups with the highest prevalence of smoking (under 25 years of age and who identified as Māori or Pasifika) also had the greatest reduction in smoking at completion of midwifery care.

A positive finding is the trend data which identified an on-going reduction in smoking prevalence during pregnancy for the under 16 years age group (from 49.4% in 2004 to 42.9% in 2010). This reduction is in line with the most recent Year 10 survey (ASH, 2011), which demonstrated the biggest decline in daily youth smoking since 2003/2004.

Parity

Women's parity would appear to have an influence on smoking behaviour with a linear correlation found between increasing parity and smoking during pregnancy. Age and ethnicity are likely to have influenced this result with women of Māori ethnicity tending to give birth at a younger

age, (median age of 25 years) when compared to Pasifika women (28 years) and New Zealand European women (31 years) (Ministry of Health, 2012). Additionally, the fertility rate for Māori women under the age of 25 years is higher than the rates of other ethnic groups (Statistics New Zealand, 2012).

An association with higher parity was identified as one of the factors linked to an increased risk of smoking in pregnancy (Butler, Williams, Paterson, & Tukuitonga, 2004). McLeod, Pullon, and Cookson (2002) found that women, who smoked throughout a previous pregnancy and had given birth to a healthy infant, were more likely to continue smoking and more likely to be smoking three years later. First time mothers have been identified as being more likely to spontaneously stop smoking in pregnancy (McLeod et al., 2002; Soloman & Quinn, 2004). Many women who are smoking at the start of pregnancy will attempt to modify their behaviour by spontaneously stopping or decreasing the number of cigarettes smoked (Ebert & Fahy, 2007). The reasons pregnant women give as to why they stop smoking are the desire to have a healthy pregnancy and reduce the risks of harm to the baby (McLeod et al., 2002). Additionally, social stigma and nausea or illness in early pregnancy may influence women to stop smoking (Soloman & Quinn 2004). Therefore the decision to stop smoking may not be due to a personal desire to cease smoking altogether and there is often a return to previous levels of tobacco use within the first few months following the birth (Coleman & Joyce, 2003).

International studies have found that women often resume smoking within days or weeks following the birth (Gaffney, Asher, Beckwith, & Friesen, 2008; Letoureau et al., 2007). Reasons given for a return to smoking include stress, sleep deprivation, postnatal depression, the influence of a partner who smokes, as well as a wish to return to pre-pregnancy weight. (Letoureau et al., 2007; Levine & Marcus, 2004; Levitt, Shaw, Wong, & Kaczorowski, 2007). Women report limiting potential harm to their child by smoking outside or in another room (Kohorn, Nguyen, Schulman-Green & Colson, (2012). These findings imply that smoking cessation in pregnancy may be more of a suspension of smoking rather than a permanent behaviour change. This also suggests that women need support to transition from pregnant former smoker to a permanent non-smoker.

In our findings we demonstrate that a reduction in smoking prevalence has occurred by postnatal discharge from the midwife with discharge occurring between 4 and 6 weeks postnatally. Whether smoking cessation then continued cannot be measured by this study but this question would benefit from further investigation. Research is needed to record and analyse the smoking status of women for the first year following birth to establish the incidence of smoking relapse for women of childbearing age. This is especially important as our findings indicate that the greater the parity the greater the likelihood of smoking. Thus women may be stopping for the duration of pregnancy and initially after the birth but are smoking again for the next pregnancy. Returning to smoking following the birth not only exposes infants and children to the harmful effects of second-hand smoke, especially the risk of Sudden Unexplained Death of an Infant (SUDI) (Fleming & Blair, 2007), but also increases future reproductive health risks for the woman (ASH, 2009; Herrmann, King, & Weitzman, 2008; Shenassa & Brown, 2004).

STRENGTHS AND WEAKNESS OF THE STUDY

This study has provided detailed and specific contemporary information on a large cohort of New Zealand women from LMC registration through to discharge. The data source is consistent and reliable and can provide a benchmark for measuring the impact of any future strategies designed to support smoking cessation during pregnancy.

The MMPO practice management system has several inbuilt features which reduce the risk of data entry error, adding to the integrity, validity and reliability of the data. In addition there is also the unique ability to link data from the antenatal period to the postnatal period which further enhances the usefulness of the findings.

There are several issues that added to the data limitations of this study. Firstly, accurate data collection was reliant on the women's self-reported responses concerning smoking status, which may be subject to self-denial or recall bias. Secondly, it is possible that some women had more than one birth in the three year period so there may be some duplication. Thirdly the cohort was under-represented for Māori, Pasifika and Asian ethnicity. Smoking status

was categorised according to either the number of cigarettes smoked or not smoking at both point of registration, and discharge. If a woman ceased to smoke between registration and discharge, the date at which she ceased was not recorded. No distinction was made between the women who smoke a relatively low number of cigarettes a day and those who smoke a high number.

IMPLICATIONS FOR POLICY AND PRACTICE

The prevalence of smoking appears to have reduced over the seven years discussed in this research but the reduction is slow and more needs to be done if New Zealand is to reach the target of becoming smoke-free by 2025. Our findings support other New Zealand smoking data which demonstrate higher prevalence of smoking among women who identified as Māori when compared to women who identified as Pasifika, European and Asian ethnic groups along with women belonging to the lower age groups. (Butler et al., 2004; McLeod et al., 2002; Ministry of Health, 2010a; New Zealand College of Midwives, 2009). Smoking cessation support and service provision should meet the needs of these groups and be culturally sensitive and age appropriate.

Women need to be encouraged to become smoke-free for themselves as well as for the baby so that smoking cessation during pregnancy is a permanent change and not 'just for the pregnancy'. Rather an emphasis should be placed on being smoke-free for the first year of the baby's life, as a means of reducing the risk of SUDI and other infant morbidities. Midwives are the main providers of care for women during pregnancy and childbirth so it is important that education and support to discuss smoke-free pregnancy are continued, not only for midwives but also for all other health professionals involved in the care of women of childbearing age.

RECOMMENDATIONS FOR FUTURE RESEARCH

The value of this study has been in its success in uncovering the trends related to smoking during pregnancy over seven years. The findings have provided a benchmark for future studies. It is important that the level of smoking during pregnancy continues to be measured and carefully analysed so that changing trends can be identified.

The link between parity and smoking requires further exploration, particularly as there are higher numbers of multiparous women within the Māori and Pasifika ethnicities who have the highest rates of smoking; it also needs to be considered when developing future smoking cessation programmes.

More research is required to understand how to motivate smoking cessation for the woman's health and not just for the baby's. This may be a crucial element in reducing the level of smoking within society. If women stop smoking for the duration of their pregnancy and the first year of their infant's life, the risk of smoking prior to and during any subsequent pregnancy will be reduced. Additionally, more research is required to assess and analyse smoking behaviour following birth to explore when the women recommence smoking and why.

CONCLUSION

This study has provided data on the smoking behaviour of 81,821 women during the antenatal and postpartum periods of their pregnancies, in New Zealand from 2008 to 2010. The results demonstrate a small reduction in the percentage of women smoking during pregnancy over this three year period. Between pregnancy registration and discharge from postnatal midwifery care there is a further reduction in the percentage of women smoking. This study has examined ethnicity and age and found that these factors continue to affect the likelihood of smoking behaviour during pregnancy and the postnatal period. Parity was examined and a strong relationship between increasing parity and smoking prevalence was found. The data provide robust, reliable and valid evidence and when combined with the previous report revealed smoking trends and outcomes for a period of seven years. This ongoing assessment of smoking behaviour within a very specific subset of the population, provides an important link to the effectiveness of the strategies, policies and interventions aimed at reducing smoking in pregnancy and to the goal of New Zealand becoming a smokefree nation by 2025.

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