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# Parental smoking during pregnancy: findings from the Growing Up in New Zealand cohort

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## ABSTRACT

**AIMS:** To investigate patterns of exposure to tobacco smoke in pregnancy among a representative sample of New Zealand women.

**METHODS:** Analyses of smoking-related data from the first wave of the Growing Up in New Zealand cohort study, ie from the first data-collection point during the antenatal period in 2009–10.

**RESULTS:** Twenty percent of mothers reporting smoking before pregnancy and 9.9% of mothers continued during pregnancy. These figures were higher in younger women ( $p < .0001$ ), women with lower educational achievement ( $p < .001$ ) and Māori women ( $p < .001$ ). Similarly, being Māori ( $p < .0001$ ) and having a lower education achievement ( $p < .0029$ ) were associated with smoking during an unplanned compared to a planned pregnancy. Multiparous mothers were more likely to be smokers than primiparous mothers (11%: 95% Confidence Interval [CI] 10.0–12.1 vs 8.3%: 95% CI 7.2–9.4). Second-hand smoke exposure was more common for younger women (Odds Ratio [OR] 3.2: 95% CI 1.6–6.4), Māori women (OR 1.9: 95% CI 1.4–2.5), and women with unplanned pregnancies (OR 3.4 95% CI 12.0–14.8).

**CONCLUSIONS:** There are differences in a range of contextual and behavioural factors related to smoking before and during pregnancy. Low educational achievement, being young, Māori and multiparous were all associated with smoking during pregnancy. A better understanding of why these differences exist is needed in order to find appropriate interventions to support women in becoming smoke-free.

Tobacco smoke exposure in pregnancy (maternal smoking and second-hand smoke [SHS] exposure) is one of the single most important preventable risks for maternal, fetal and infant health.<sup>1–3</sup> In this paper we present new data on tobacco smoke exposure in pregnancy for New Zealand women.

### Maternal smoking during pregnancy

Smoking prevalence in the general population in developed countries has declined more rapidly in recent years compared to developing countries.<sup>4</sup> However, globally 22% of the world's adult population are estimated to be current smokers (36% men, 8% women).<sup>5</sup> A similar picture is evident in New Zealand, with the prevalence of current smoking declining from 25% in 1996/97 to 18% 2012/13.<sup>6</sup> However, the rates

of decline in smoking prevalence has been slower for Māori and Pacific Peoples during this period.<sup>6</sup> Furthermore, there has been little change in smoking rates over time among pregnant women in New Zealand (19.5% in 2008 versus 18.4% in 2010<sup>7</sup>), particularly if they are Māori, aged 20 years and under, living in the most deprived areas and/or multiparous.<sup>7,8</sup>

Smoking during pregnancy is associated with a range of health risks for the baby and pregnancy, including adverse fetal development,<sup>9–11</sup> birth complications,<sup>12,13</sup> antepartum haemorrhage<sup>14</sup> and pre-term delivery.<sup>15</sup> Smoking during pregnancy also has deleterious effects on children in the early neonatal and preschool periods, with respiratory morbidity being more common.<sup>16,17</sup> Harms have also been reported to continue through the child's

life course into adulthood. For example, maternal smoking during pregnancy is associated with adolescent-onset of mental illness<sup>18</sup> and an increased risk in adulthood of obesity,<sup>19</sup> metabolic disorders<sup>19</sup> and cardiovascular disease.<sup>3</sup>

### Exposure to SHS

Exposure of non-smokers to SHS is also associated with harms.<sup>20</sup> The 2008–2010 Global Adult Tobacco Survey found that almost one half (n=470 million) of reproductive-aged women (15–49 years) from 14 low- and middle-income countries were exposed to SHS in their homes.<sup>21</sup> At a global level it is estimated that of all deaths attributable to SHS, 28% occur in children and 47% in women.<sup>22</sup> When non-smoking pregnant women are exposed to SHS there is evidence of harmful effects on fetal development and on the health of the child, such as asthma, low birth weight and neural tube defects.<sup>17,23–24</sup> An increased risk of cardiovascular disease among adult offspring exposed to SHS during pregnancy and infancy has also been reported.<sup>25</sup> Higher exposure to SHS, both in the home and at work, is seen for those who are socio-economically disadvantaged.<sup>26</sup> In US and Australia studies, women with lower educational achievement and from marginalised ethnicities are more exposed to SHS when pregnant than their counterparts.<sup>27,28</sup>

In New Zealand, non-smokers with the highest exposure to SHS are pre- and school aged children, Māori and those of low socioeconomic status.<sup>6,29–30</sup> Data on SHS exposure among pregnant New Zealand women are limited. Given the high rates of daily smoking among males aged 25–54 years,<sup>31</sup> and the high rates of smoking in the home,<sup>29,32,33</sup> it is highly likely that many non-smoking pregnant women are exposed to SHS. Exposure is likely to be disproportionately greater for Māori women, due to the higher proportion of Māori that smoke

and similarly for those experiencing high levels of deprivation. In a small study of pregnant Māori women who smoked (n=60), all lived with smokers and smoking was the norm among their Whānau, friends and co-workers.<sup>34</sup> Participants remarked that their environment made being smoke-free a difficult position to adopt.<sup>34</sup> Exposure to SHS in the home has almost halved between 2006/07 and 2012/2013 for New Zealand adults (7.5% to 3.7%) and for children aged 0–14 years (9.6% to 5%). The decrease experienced by Māori (adults 16% to 9.4%; children 18.9% to 9.2%) was substantial but not enough.<sup>35</sup> The Māori and Māori children are disproportionately affected in terms of disability adjusted life years (DALYs) due to SHS exposure.<sup>35</sup>

The Growing Up in NZ (GUiNZ) cohort study offers a unique opportunity to examine smoking behaviour and exposure to SHS over time. This paper focuses on the data reported at the first data-collection point (antenatal) which ended in June 2010. Our aim is to present the patterns of pregnancy and exposure to tobacco smoke in this cohort, to better understand the profile of smokers and the at-risk groups.

## Methods

The methodology of GUiNZ is reported elsewhere<sup>36</sup> but in brief, GUiNZ is a longitudinal study that has recruited and collected information from pregnant mothers and their partners from before children are born. All participants had an expected delivery date between 25<sup>th</sup> April 2009 and 25<sup>th</sup> March 2010. In total, 6,822 pregnant women enrolled and completed a computer-assisted face-to-face antenatal interview. The cohort is comparable to the most recent New Zealand national birth statistics with regard to maternal age, ethnicity, parity and socioeconomic indicators.<sup>37</sup>

**Figure 1:** GUiNZ smoking questions for the mother.

Own smoking.	Exposure to SHS.
1. Did you smoke regularly—that is, every day—before you were aware you were pregnant? [Yes; no; don't know]	1. Does anyone currently regularly smoke in the same room as you? [Yes; no; don't know]
2. How many cigarettes did you smoke per day, on average, before this pregnancy?	2. How often? [Rarely (less than once a week); occasionally (a few times a week); often (almost or every day of the week); don't know]
3. Are you currently smoking? [Yes; no; don't know]	
4. How many cigarettes do you smoke per day, on average?	

## Measurements

### Smoking

The smoking questions specifically for the mother were used (Figure 1).

### Ethnicity

Ethnicity was self-prioritised and coded into six Level 1 categories in line with Statistics New Zealand's coding criteria.<sup>38</sup> For the purpose of presenting smoking data, we combined the categories of MELAA and Other due to small numbers.

### Social-economic position

Socio-economic deprivation was measured using the 2006 New Zealand Deprivation Index (NZDep2006) and area-level (neighbourhood) index constructed from nine Census 2006 variables (means-tested benefits; household income; home ownership; single-parent family; employment; qualifications; household overcrowding; access to a telephone and access to a car).<sup>39,40</sup> We aggregated summary deprivation scores as quintiles, with '1' representing the least deprived neighbourhoods and '5' the most deprived neighbourhoods. Highest educational

qualification was coded as: no qualifications; secondary school completion; diploma/trade certification; bachelors' degree; or higher degree.

### Statistical analyses

All statistical analyses used SAS version 9.3 (SAS Institute, Cary, Indiana,). We used descriptive statistics to examine associations between mothers' smoking with demographics, pregnancy period (before or during), planned/unplanned pregnancy and parity. Where multiple regression modelling was used, variables were entered only if they were significant covariates in univariate analyses. Outcomes with less than 10 people in each cell are not presented.

## Results

In total, 1,946 mothers reporting smoking either before or during pregnancy—20.4% (n=1,387) smoked before pregnancy and 9.9% (n=559) reported that they smoked during pregnancy. In univariate analyses, being younger, Māori or Pacific, more deprived and less educated were all associated with smoking before and during pregnancy (Table 1).

**Table 1:** Mothers smoking pre- and during pregnancy by demographic characteristics.

Demographic characteristics		MOTHERS SMOKING							
		Before pregnancy <sup>1</sup>				During pregnancy <sup>2</sup>			
		n (N=6,807)	% (95% CI)	Odds ratio (95% CI)	p-value	n (N=5,664)	% (95% CI)	Odds ratio (95% CI)	p-value
Total		1,387	20.4 (19.4–21.3)	-	-	559	9.9 (9.1–10.6)	-	-
Age group	19 or less	190	57.9 (52.6–63.3)	4.4 (2.8–6.9)	<0.0001	85	31.1 (25.6–36.6)	1.7 (0.9–2.9)	<0.0001
	20–29	758	28.5 (26.8–30.2)	2.4 (1.6–3.5)		299	13.6 (12.2–15.1)	1.4 (0.9–2.3)	
	30–39	405	11.5 (10.4–12.5)	1.2 (0.8–1.7)		162	5.4 (4.6–6.2)	0.9 (0.5–1.4)	
	40 or older	34	12.1 (8.3–15.9)	1		13	6.4 (3.0–9.7)	1	
Ethnicity	Māori	444	46.8 (43.7–50.0)	2.2 (1.8–2.6)	<0.0001	236	31.6 (28.3–34.9)	3.1 (2.5–3.9)	<0.0001
	Pacific	316	31.7 (28.8–34.6)	1.1 (0.9–1.3)		98	13.5 (11.0–16.0)	1.0 (0.7–1.3)	
	Asian	35	3.5 (2.4–4.6)	0.2 (0.1–0.3)		-	-	-	
	MELAA & Other	18	11.5 (6.5–16.4)	0.6 (0.3–1.0)		-	-	-	
	New Zealand European	572	15.5 (14.3–16.7)	1		220	6.8 (5.9–7.7)	1	
NZDep2006	1 (least deprived)	106	9.7 (7.9–11.4)	1	<0.0001	31	3.3 (2.2–4.5)	1	<0.0001
	2	175	14.2 (12.2–16.1)	1.4 (1.1–1.9)		66	6.1 (4.7–7.5)	1.8 (1.1–2.7)	
	3	182	15.6 (13.5–17.7)	1.4 (1.0–1.8)		64	6.3 (4.8–7.8)	1.6 (1.0–2.5)	
	4	284	20.0 (17.9–22.0)	1.4 (1.1–1.9)		112	9.6 (7.9–11.2)	1.9 (1.3–3.0)	
	5 (most deprived)	640	34.0 (31.8–36.1)	2.0 (1.6–2.6)		286	19.5 (17.5–21.6)	2.9 (1.9–4.4)	
Highest education	No sec school qualification	284	58.0 (53.6–62.3)	1	<0.0001	143	40.6 (35.5–45.8)	1	<0.0001
	Sec school / NCEA 1–4	423	26.0 (23.9–28.2)	0.4 (0.3–0.5)		158	11.9 (10.2–13.7)	0.3 (0.2–0.4)	
	Diploma / Trade cert / NCEA 5–6	532	25.6 (23.7–27.5)	0.4 (0.4–0.6)		222	12.9 (11.3–14.5)	0.4 (0.3–0.5)	
	Bachelor's degree	101	6.6 (5.3–7.8)	0.1 (0.1–0.2)		21	1.6 (0.9–2.3)	0.1 (0.0–0.1)	
	Higher degree	41	3.9 (2.7–5.0)	0.1 (0.1–0.1)		13	1.4 (0.6–2.1)	0.1 (0.0–0.1)	

1. Relates to question: “Did you smoke regularly—that is every day—before you were aware you were pregnant?”
2. Relates to question: “Are you currently smoking?” NB: These results relate to mothers who were interviewed during pregnancy—mothers who were interviewed post-partum were excluded from these analyses.

Of the women who reported they were currently smoking (n=533), 40.1% (n=222) reported that they smoked ≤4 cigarettes per day (CPD), 31.1% (n=172) smoked between 5–9 CPD and 28.8% smoked ≥10 CPD. Given the small numbers in each subgroup, we used regression analyses to investigate

differences between smoking <10 and ≥10 CPD (Table 2). The findings show that when all factors were controlled for, older women (aged 30–39 years; OR=0.7, 95% CI 0.2–2.6; p=0.0004) and being Māori (OR=1.2, 95% CI: 0.8–1.9, p<0.0001)) were associated with smoking ≥10 CPD.

**Table 2:** Average number of cigarettes smoked per day by demographic characteristics.<sup>1</sup>

Demographic characteristics		NUMBER OF CIGARETTES PER DAY					
		9 or less <sup>2</sup>		10 or more		Odds ratio (95% CI)	p-value <sup>3</sup>
		n (N=553)	% (95% CI)	n (N=553)	% (95% CI)		
Total		394	71.2 (67.5–75.0)	159	28.8 (25.0–32.5)	-	-
Age group	19 or less	70	84.3 (76.5–92.2)	13	15.7 (7.8–23.5)	0.2 (0.0–0.7)	0.0004
	20–29	216	73.0 (67.9–78.0)	80	27.0 (22.0–32.1)	0.4 (0.1–1.5)	
	30–39	101	62.7 (55.2–70.2)	60	37.3 (29.8–44.8)	0.7 (0.2–2.6)	
	40 or older	-	-	-	-	1	
Ethnicity	Māori	151	64.8 (58.7–71.0)	82	35.2 (29.0–41.3)	1.2 (0.8–1.9)	<.0001
	Pacific	82	84.5 (77.3–91.8)	15	15.5 (8.2–22.7)	0.3 (0.2–0.7)	
	Asian	-	-	0	-	-	
	MELAA & Other	-	-	0	-	-	
	New Zealand European	156	71.6 (65.6–77.6)	62	28.4 (22.4–34.4)	1	
NZDep2006	1 (least deprived)	24	77.4 (62.7–92.2)	-	-	1	0.37
	2	49	75.4 (64.9–85.9)	16	24.6 (14.1–35.1)	1.0 (0.4–2.9)	
	3	45	72.6 (61.4–83.7)	17	27.4 (16.3–38.6)	1.4 (0.5–3.9)	
	4	79	70.5 (62.1–79.0)	33	29.5 (21.0–37.9)	1.6 (0.6–4.2)	
	5 (most deprived)	197	69.6 (64.2–75.0)	86	30.4 (25.0–35.8)	1.9 (0.7–4.9)	

**Table 2:** Average number of cigarettes smoked per day by demographic characteristics.<sup>1</sup> (Continued.)

Highest education	No sec school qualification	86	61.0 (52.9–69.1)	55	39.0 (30.9–47.1)	1	0.0002
	Sec school / NCEA 1–4	133	84.2 (78.5–89.9)	25	15.8 (10.1–21.5)	0.3 (0.2–0.5)	
	Diploma / Trade cert / NCEA 5–6	149	68.0 (61.8–74.2)	70	32.0 (25.8–38.2)	0.6 (0.3–0.9)	
	Bachelor’s degree	13	65.0 (44.0–86.0)	-	-	-	
	Higher degree	11	84.6 (64.9–100.0)	-	-	-	

These results relate to:

1. The question: ‘How many cigarettes do you smoke per day, on average?’; mothers who indicated that they were currently smoking; and, mothers who were interviewed during pregnancy—others who were interviewed post-partum were excluded from these analyses.
2. As this question was only asked of mothers who indicated that they currently smoke, ‘nine or less’ includes those who responded ‘zero’.
3. Outcome being modelled is ‘10 or more’.

Tables 3 and 4 present the unadjusted findings for the number of cigarettes smoked by planned or unplanned pregnancy and by parity. Among women with unplanned pregnancies unplanned smoking ≥10 CPD was more common (31.2%) than

among women with planned pregnancies (20.7%) (Table 3) Table 4 shows that multiparous women were more likely to smoke ≥10 CPD (32.1%) than their primipara counterparts (22.6%, n=195).

**Table 3:** Number of cigarettes per day by planned/unplanned pregnancy.<sup>1</sup>

Maternal self-reported average daily cigarette consumption	Planned pregnancy		Unplanned pregnancy	
	n (N=135)	% (95% CI)	n (N=414)	% (95% CI)
9 or less	107	79.3 (72.4–86.1)	285	68.8 (64.4–73.3)
10 or more	28	20.7 (13.9–27.6)	129	31.2 (26.7–35.6)

These results relate to:

1. The question: ‘How many cigarettes do you smoke per day, on average?’;
2. Mothers who indicated that they were currently smoking; and,
3. Mothers who were interviewed during pregnancy—mothers who were interviewed post-partum were excluded from these analyses.

**Table 4:** Number of cigarettes per day by parity.<sup>1</sup>

Maternal self-reported average daily cigarette consumption	First pregnancy		Subsequent pregnancies	
	n (N=195)	% (95% CI)	n (N=358)	% (95% CI)
9 or less	151	77.4 (71.6–83.3)	243	67.9 (63.0–72.7)
10 or more	44	22.6 (16.7–28.4)	115	32.1 (27.3–37.0)

These results relate to:

1. The question: ‘How many cigarettes do you smoke per day, on average?’;
2. Mothers who indicated that they were currently smoking; and,
3. Mothers who were interviewed during pregnancy - mothers who were interviewed post-partum were excluded from these analyses.

**Planned versus unplanned pregnancy on continued smoking**

Smoking before pregnancy was greater when that pregnancy was unplanned, particularly for younger women ( $p < .0001$ ), those with lower education achievement ( $p < .001$ ) and Māori women ( $p < .001$ ).

After adjusting for all covariates in the regression analysis, being Māori ( $p < .0001$ ) and having lower education achievement ( $p < .0029$ ) were found to be significantly associated with continuing to smoke during an unplanned pregnancy compared to planned, while age was less important ( $p < .015$ ) (Table 5).

**Table 5:** Mothers smoking during pregnancy by planned/unplanned pregnancy.

Demographic characteristics		DURING pregnancy <sup>1</sup>				Odds ratio (95% CI)	p-value <sup>2</sup>
		Planned		Unplanned			
		n (N=3,488)	% (95% CI)	n (N=2,156)	% (95% CI)		
Total		135	3.9 (3.2–4.5)	420	19.5 (17.8–21.2)	-	-
Age group	19 or less	8	9.4 (3.2–15.6)	77	90.6 (84.4–96.8)	2.6 (0.7–10.8)	0.01
	20–29	73	24.7 (19.8–29.6)	223	75.3 (70.4–80.2)	0.7 (0.2–2.4)	
	30–39	50	31.1 (23.9–38.2)	111	68.9 (61.8–76.1)	0.7 (0.2–2.4)	
	40 or older	4	30.8 (5.7–55.9)	9	69.2 (44.1–94.3)	1	
Ethnicity	Māori	30	12.8 (8.5–17.0)	205	87.2 (83.0–91.5)	3.4 (2.1–5.4)	<.0001
	Pacific	26	26.8 (18.0–35.6)	71	73.2 (64.4–82.0)	1.3 (0.8–2.2)	
	Asian	0	-	-	-	-	
	MELAA & Other	-	-	0	-	-	
	New Zealand European	77	35.3 (29.0–41.7)	141	64.7 (58.3–71.0)	1	
NZDep2006	1 (least deprived)	10	32.3 (15.8–48.7)	21	67.7 (51.3–84.2)	1	0.16
	2	19	30.2 (18.8–41.5)	44	69.8 (58.5–81.2)	0.8 (0.3–2.0)	
	3	25	39.1 (27.1–51.0)	39	60.9 (49.0–72.9)	0.5 (0.2–1.3)	
	4	29	25.9 (17.8–34.0)	83	74.1 (66.0–82.2)	0.7 (0.3–1.8)	
	5 (most deprived)	52	18.2 (13.8–22.7)	233	81.8 (77.3–86.2)	1.1 (0.5–2.5)	
Highest education	No sec school qualification	23	16.2 (10.1–22.3)	119	83.8 (77.7–89.9)	1	0.002
	Sec school / NCEA 1–4	44	28.0 (21.0–35.1)	113	72.0 (64.9–79.0)	0.4 (0.3–0.8)	
	Diploma / Trade cert / NCEA 5–6	51	23.1 (17.5–28.6)	170	76.9 (71.4–82.5)	0.7 (0.4–1.2)	
	Bachelor’s degree	10	50.0 (28.1–71.9)	10	50.0 (28.1–71.9)	0.2 (0.1–0.6)	
	Higher degree	-	-	7	-	-	

1. Relates to question: “Are you currently smoking?” NB: These results relate to mothers who were interviewed during pregnancy—mothers who were interviewed post-partum were excluded from these analyses.
2. Outcome being modelled is ‘Unplanned pregnancy’.



**Parity and Smoking**

While the survey did not capture if mothers smoked during earlier pregnancies, Table 6 reports unadjusted smoking responses by parity status. There was little difference in smoking between the parity groups (first-born: 20.5%, 95% CI 19.0–22.0 vs subsequent: 20.3%, 95% CI 19.0–21.5) or during pregnancy (first-born: 8.3%,

95% CI 7.2-9.4 vs subsequent: 11%, 95% CI 10.0–12.1).

However, after controlling for age, ethnicity, deprivation and educational achievement; continuing to smoke during pregnancy was more common in multiparous women who were Māori and Pacific (Table 6).

**Table 6:** Mothers smoking during pregnancy by parity.

Demographic characteristics		DURING pregnancy <sup>1</sup>				Odds ratio (95% CI)	p-value <sup>2</sup>
		First-born		Subsequent			
		n (N=2,396)	% (95% CI)	n (N=3,268)	% (95% CI)		
Total		198	8.3 (7.2–9.4)	361	11.0 (10.0–12.1)	-	-
Age group	19 or less	67	78.8 (70.1–87.5)	18	21.2 (12.5–29.9)	0.0 (0.0–0.1)	<.0001
	20–29	100	33.4 (28.1–38.8)	199	66.6 (61.2–71.9)	0.2 (0.0–0.6)	
	30–39	30	18.5 (12.5–24.5)	132	81.5 (75.5–87.5)	0.6 (0.1–2.3)	
	40 or older	-	-	12	92.3 (77.8–100.0)	1	
Ethnicity	Māori	77	32.6 (26.6–38.6)	159	67.4 (61.4–73.4)	1.9 (1.2–2.9)	<.0001
	Pacific	27	27.6 (18.7–36.4)	71	72.4 (63.6–81.3)	2.2 (1.3–3.9)	
	Asian	0	-	-	-	-	
	MELAA & Other	-	-	-	-	-	
	New Zealand European	92	41.8 (35.3–48.3)	128	58.2 (51.7–64.7)	1	
NZDep2006	1 (least deprived)	-	-	24	77.4 (62.7–92.1)	1	0.16
	2	25	37.9 (26.2–49.6)	41	62.1 (50.4–73.8)	0.5 (0.2–1.4)	
	3	24	37.5 (25.6–49.4)	40	62.5 (50.6–74.4)	0.9 (0.3–2.7)	
	4	46	41.1 (32.0–50.2)	66	58.9 (49.8–68.0)	0.4 (0.1–1.1)	
	5 (most deprived)	96	33.6 (28.1–39.0)	190	66.4 (61.0–71.9)	0.6 (0.2–1.5)	

**Table 6:** Mothers smoking during pregnancy by parity. (Continued.)

Highest education	No sec school qualification	39	27.3 (20.0–34.6)	104	72.7 (65.4–80.0)	1	<.0001
	Sec school / NCEA 1–4	65	41.1 (33.5–48.8)	93	58.9 (51.2–66.5)	0.4 (0.2–0.6)	
	Diploma / Trade cert / NCEA 5–6	81	36.5 (30.2–42.8)	141	63.5 (57.2–69.8)	0.3 (0.2–0.5)	
	Bachelor’s degree	-	-	16	76.2 (58.0–94.4)	0.3 (0.1–0.9)	
	Higher degree	-	-	-	-	-	

1. Relates to question: “Are you currently smoking?” NB: These results relate to mothers who were interviewed during pregnancy—mothers who were interviewed post-partum were excluded from these analyses.
2. Outcome being modelled is ‘subsequent pregnancy’.

**Exposure to SHS**

Seven percent of the 5,664 women reported being exposed to SHS from someone smoking in the same room. For planned pregnancies, someone else smoking in the same room as the mother was substantively less (3%, 95% CI 2.4–3.6) than for unplanned pregnancies (13.4%, 95% CI 12.0–14.8). However, when parity was examined irrespective of planned or unplanned, no difference was apparent,

(primipara mothers: 8.1%, CI 7.0–9.1 versus multiparous mothers: 6.2%, 95% CI 5.3–7.0).

Adjusting for age, ethnicity, deprivation and educational status, being ≤ 19 years of age (OR 3.2, 95% CI 1.6–6.4; p<.0001), being Māori (OR 1.9: 95% CI: 1.4–2.5; p<.0001), living in an area of high deprivation (OR 3.5 CI: 2.0–5.7; p<.0001) and having a low educational achievement (p<.0001) were significantly associated with mothers reporting having someone smoking in the same room as them (Table 7).

**Table 7:** Exposure to SHS by demographic characteristics.

Demographic characteristics		EXPOSURE TO SECOND-HAND SMOKE DURING PREGNANCY					p-value <sup>2</sup>
		Yes		No		Odds ratio (95% CI)	
		n	% (95% CI)	n	% (95% CI)		
Total		394	7.0 (6.3–7.6)	5,270	93.0 (92.4–93.7)	-	-
Age group	19 or less	77	28.2 (22.9–33.5)	196	71.8 (66.5–77.1)	3.2 (1.6–6.4)	<.0001
	20–29	228	10.4 (9.1–11.7)	1,967	89.6 (88.3–90.9)	1.6 (0.9–3.0)	
	30–39	79	2.6 (2.1–3.2)	2,913	97.4 (96.8–97.9)	0.6 (0.3–1.2)	
	40 or older	10	4.9 (1.9–7.9)	194	95.1 (92.1–98.1)	1	
Ethnicity	Māori	135	18.1 (15.3–20.8)	612	81.9 (79.2–84.7)	1.9 (1.4–2.5)	<.0001
	Pacific	84	11.6 (9.2–13.9)	642	88.4 (86.1–90.8)	1.1 (0.8–1.5)	
	Asian	27	3.4 (2.1–4.6)	775	96.6 (95.4–97.9)	0.7 (0.5–1.1)	
	MELAA & Other	-	-	134	96.4 (93.3–99.5)	0.6 (0.3–1.6)	
	New Zealand European	142	4.4 (3.7–5.1)	3,100	95.6 (94.9–96.3)	1	

**Table 7:** Exposure to SHS by demographic characteristics. (Continued.)

NZDep2006	1 (least deprived)	18	1.9 (1.0–2.8)	918	98.1 (97.2–99.0)	1	<0.0001
	2	38	3.5 (2.4–4.6)	1,042	96.5 (95.4–97.6)	1.6 (0.9–2.9)	
	3	49	4.9 (3.5–6.2)	960	95.1 (93.8–96.5)	1.8 (1.0–3.2)	
	4	78	6.7 (5.2–8.1)	1,094	93.3 (91.9–94.8)	2.0 (1.1–3.4)	
	5 (most deprived)	211	14.4 (12.6–16.2)	1,254	85.6 (83.8–87.4)	3.4 (2.0–5.7)	
Highest education	No sec school qualification	94	26.7 (22.1–31.3)	258	73.3 (68.7–77.9)	1	<0.0001
	Sec school / NCEA 1–4	113	8.5 (7.0–10.0)	1,213	91.5 (90.0–93.0)	0.4 (0.3–0.6)	
	Diploma / Trade cert / NCEA 5–6	144	8.4 (7.1–9.7)	1,573	91.6 (90.3–92.9)	0.5 (0.3–0.7)	
	Bachelor's degree	31	2.4 (1.5–3.2)	1,277	97.6 (96.8–98.5)	0.2 (0.1–0.3)	
	Higher degree	-	-	941	99.1 (98.4–99.7)	0.1 (0.0–0.2)	

These results relate to:

1. The question: 'Does anyone currently regularly smoke in the same room as you?'; Mothers who were interviewed during pregnancy—mothers who were interviewed post-partum were excluded from these analyses.
2. Outcome being modelled is 'Does anyone currently regularly smoke in the same room as you?—Yes'.

## Discussion

Being younger (<20 years), being less well educated and living in an area of high deprivation continue to be strongly related to smoking before and during pregnancy. These factors are similar to those reported internationally<sup>41,42,43</sup> and nationally.<sup>7,8</sup> The finding that multiparous women were more likely to continue to smoke during pregnancy and smoke more CPD than primipara women has also been previously reported.<sup>44</sup> While first time pregnancy appears to be a motivator for smoking cessation, it does not seem to hold true for multiparous women. This finding has also been reported before for New Zealand,<sup>7</sup> and may be related to both smoking behaviour (eg being more cigarette dependent) and contextual factors (eg less social support, financial pressures and low self-confidence).<sup>45</sup> Understanding these factors is important, as this group is highly likely to be contributing to the wider family's (including older children) exposure to SHS, as well as their unborn child.

A planned pregnancy was positively associated with not smoking during pregnancy or if still smoking, a lower consumption of cigarettes (<9 CPD). This finding may

signal that women (and families) may have planned a wider “healthy” strategy which included smoking cessation when planning to start or add to their family. It is not known if these women (and families) also have greater and/or earlier interactions with health professionals and as such are exposed to early cessation advice, support and treatment. Until relatively recently, cutting down rather than quitting smoking was the dominant message to pregnant smokers by health professionals.<sup>46,47</sup>

While there is a high awareness of the harms of smoking on themselves and their unborn child, the lived context of the pregnant women plays a large part in smoking cessation. It is not possible to determine who actively cut down their CPD in this study but research suggests that adoption of a cutting down approach versus quitting is more common in women with low educational achievement and living in areas of greater deprivation.<sup>46,48,49</sup> It is critical that a consistent message and a subsequent supportive environment is provided if changes to these rates are to happen. It will also be important to explore the smoking data in subsequent GUINZ waves, as international research suggests

women often resume smoking in the days or weeks following the birth of their child.<sup>7,50</sup>

### Second Hand Smoke

Wider social contexts (friends, family, work) are important factors in supporting or impeding behavioural change activities.<sup>51</sup> While only 7% of our cohort reported another person smoking in the same room, this finding was correlated with being younger, living in the most deprived area, lower educational achievement and Māori. Once again, understanding these contexts in more detail is important for intervention strategies to be successful. Exploration of the GUiNZ partner responses and the other contextual details captured in GUiNZ data (including stressors) is needed. It is clear that New Zealand's current smoke-free strategies are not proving to be as effective for multiparous women and it is unclear why this is so. More in-depth qualitative research is needed to explore their motivations and situational contexts. Such research will help identify where additional interventions could be focused so as to reduce the burden of SHS on other children living at home.<sup>52</sup>

### Equity

The impact of high rates of smoking is evident for Māori mortality and health-related outcomes across the life course from the new-born through to adulthood.<sup>35,53</sup> Māori reportedly receive antenatal care later in pregnancy.<sup>7</sup> In repeated smoking surveys, Māori youth report having their first cigarette significantly earlier than their non-Māori counterparts, and smoking prevalence in young Māori females (15–24 years) was significantly higher than for non-Māori.<sup>54</sup> This finding may partly account for the low smoking cessation rate for Māori during pregnancy.<sup>34</sup> However it does not explain the contextual drivers that influenced earlier initiation or higher consumption. Arguably, it will not be until a deeper understanding of this issue is obtained, that effective interventions can emerge.

It is clear that efforts to support young Māori and Pacific women at their first pregnancy to quit are pivotal, as both groups were positively associated with smoking during subsequent pregnancies. The ability to act on information given about smoking in pregnancy has been reported as low by Māori women.<sup>47,55</sup> This finding should emphasise that the effectiveness of the

current suite of interventions is suboptimal for pregnant Māori women regardless of parity, and new strategies are needed to reduce significant life course harms.

### Interventions

There is a burgeoning literature on the effectiveness of cessation activities for the general smoking population. However, there is less research on smoking cessation interventions for pregnant women (prima and multiparous) and indigenous populations. Indigenous research by Glover et al<sup>56,57</sup> and Walker et al<sup>33</sup> have set some of the ground work for identifying successful directions for smoking cessation interventions, such as coaching models and using incentives as motivators for change. It is clear that more work is urgently needed to evaluate these and other data in more detail, as it remains unclear why some of these strategies work and others do not.

A Cochrane review specifically examining smoking cessation interventions for indigenous populations concluded that more rigorous trials are required to bridge the gap between tobacco-related health disparities in Indigenous and non-Indigenous populations.<sup>58</sup> Another Cochrane Review<sup>59</sup> reported that using a mix of interventions was most effective in helping pregnant women that smoke to quit, and highlighted the positive findings around the use of incentives. Use of incentives is a strategy rarely used in New Zealand, but is showing promise particularly for younger Māori mothers (ie <30 years)<sup>60</sup> and with one context of a team competition.<sup>60</sup> However, the cost-effectiveness of such strategies is unclear.

Engaging with mothers and families early in their antenatal care in another strategy that shows promise in the New Zealand context, in reducing smoking rates.<sup>50</sup> While New Zealand has a significant array of smoking cessation intervention programmes based on and contributing to the evidence base, there are few that have a specific focus on pregnant women.<sup>61</sup> Evaluations of these programmes appear to be scarce in the published and grey literature, or are small in scale and duration<sup>62</sup> and as such are often not widely adopted. While not specific to mothers, a study of the awareness and perceived effectiveness of smoking cessation services for those living in high deprivation areas in New Zealand, reported these to

be low.<sup>63</sup> This finding is important as our findings show that being Māori and living in high deprivation areas were associated with smoking during pregnancy.

## Conclusion

Reducing maternal tobacco smoke exposure has the potential to have a positive

health effect that far exceeds the immediate health of both mother and infant. There is a paucity of local evidence on the effectiveness of smoking cessation interventions for Maori women. Without effective interventions to reduce tobacco smoke exposure in pregnancy, intergenerational health equalities will become more entrenched.

### Competing interests:

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## Publication rates and characteristics of undergraduate medical theses in New Zealand

Ibrahim Saleh Al-Busaidi, Yassar Alamri

In New Zealand, the fate and publication rates of theses produced by medical students is unknown. Adding to the existing literature on New Zealand medical student research and publishing, this study sheds light on their contribution to international scientific literature. During the period from January 1995 to December 2014, almost one-third of BMedSc(Hons) theses resulted in a publication in a peer-reviewed journal. Although higher than reported figures from previous studies, publication rates of BMedSc(Hons) theses remain lower than expected. To improve our understanding of medical student publishing in New Zealand, formal examination of the factors hindering medical students from publishing their theses is imperative.

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## How effective is our current Orthopaedic Prioritisation Tool for scoring patients for arthroplasty surgery?

Neal Singleton, Lewis Agius, Sudhindra Rao

The aim of this study was to compare those patients being accepted onto the waiting list for total hip or knee replacement in Hawke's Bay with those being declined surgery using the Oxford score which is a validated questionnaire for assessing patient function. Patients are currently prioritised for surgery using a non-validated tool which scores patients according to their symptoms and likely benefit from surgery. We found that there was no difference between those patients being accepted for surgery and those being declined surgery. In other words, patients were equally disabled. Patients being seen in Hawke's Bay Hospital for consideration of arthroplasty surgery are severely disabled and yet nearly half are declined surgery. This paper has highlighted the issue of unmet need for arthroplasty surgery which is becoming an increasing issue with New Zealand's ageing population.

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## Parental smoking during pregnancy: findings from the Growing Up in New Zealand cohort

Gayl Humphrey, Fiona Rossen, Natalie Walker, Chris Bullen

We used the Growing Up in New Zealand cohort study, which follows a group of people over a number of years, to explore smoking behaviour in cycle one of the study which was when all the women in the study were pregnant. This paper looked at factors that may contribute to women who continued to smoke during pregnancy and also the exposure to second-hand smoke. We used analyses to show the importance of these factors in reducing or stopping smoking as well as what factors influenced continued smoking. The term confidence intervals is used to show how 'confident' we are that our finding is within the two numbers ie CI 12.0–14.8) and hence how confident that we feel our finding is correct.

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## Low FODMAP diet efficacy in IBS patients—what is the evidence and what else do we need to know?

Tim Kortlever, Clarice Hebblethwaite, Julie Leeper, Leigh O'Brien, Chris Mulder, Richard B Gearry

Irritable Bowel Syndrome (IBS) is a common gastrointestinal disorder characterised by intermittent abdominal pain with altered bowel habit. Low FODMAP diet has been shown to reduce gastrointestinal symptoms in people with IBS. Low FODMAP diet should be taught by an experienced dietitian.

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