Prevalence of health behaviours in pregnancy at service entry in a Queensland health service district.

Shelley A. Wilkinson[1], Yvette D. Miller[2] & Bernadette Watson[3]

Corresponding author & reprint requests:

[1]B.Sc(Hons)(Psyc).GradDipNut&Diet. PhD Student, School of Psychology, The University of Queensland, St Lucia, Brisbane, Queensland, Australia, 4072.

Telephone: + 61 7 3346 7282
Facsimile: +61 7 3365 4466
Email: s.wilkinson@uq.edu.au

[2] Ph.D. Senior Research Fellow, School of Psychology, The University of Queensland, St Lucia, Brisbane, Queensland, Australia, 4072.

Telephone: + 61 7 3346 7619
Facsimile: +61 7 3365 4466
Email: ymiller@psy.uq.edu.au

[3] Ph.D. ARC Postdoctoral Research Fellow, School of Psychology, The University of Queensland, St Lucia, Brisbane, Queensland, Australia, 4072.

Telephone: + 61 7 3365 6398
Facsimile: +61 7 3365 4466
Email: bernadette@uq.edu.au

Prevalence of health behaviours in pregnancy at service entry in a Queensland health service district.

Objective: Limited prevalence data for unhealthy pregnancy health behaviours make it difficult to prioritize primary prevention efforts for maternal and infant health. This study's objective was to establish the prevalence of cigarette smoking, sufficient fruit and vegetable intake and sufficient physical activity among women accessing antenatal clinics in a Queensland (Australia) health service district.

Method: Cross-sectional self-reported smoking status, daily fruit and vegetable intake, weekly physical activity and a range of socio-demographic variables were obtained from women recruited at their initial antenatal clinic visit, over a three-month recruitment phase during 2007.

Results: Analyses were based on 262 pregnant women. The study sample was broadly representative of women giving birth in the district and state, with higher representation of women with low levels of education and high income. More than one quarter of women were smoking. Few women met the guidelines for sufficient fruit (9.2%), vegetables (2.7%), or physical activity (32.8%) during pregnancy.

Conclusions: There were low levels of adherence to health behaviour recommendations for pregnancy in this sample.

Implications: There is now a clear need to develop and evaluate effective pregnancy behaviour interventions to improve primary prevention in maternal and infant health. Brief minimal contact interventions that can be delivered through primary care to create a greater primary prevention focus for maternal and infant health would be worth exploring.

MESH Keywords (3-10): antenatal, health behaviours, maternal health, nutrition, physical activity, pregnancy, preventive, primary prevention, smoking

Introduction

Health behaviours during pregnancy are associated with pregnancy-related and long-term health outcomes for both the mother and infant. Cigarette smoking[1], poor nutrition[2], insufficient levels of physical activity[3], and inappropriate weight gain[4] during pregnancy have been associated with a number of poor maternal and infant outcomes. These outcomes include an increased risk of: pregnancy complications[5], caesarean sections[4], low birth weight[1], pre-term birth[4,6], inappropriate weight gain during pregnancy[7], and chronic disease in adult life[2,8]. Adherence to health behaviour recommendations during pregnancy has been shown to decrease the risk of gestational diabetes mellitus[9], attenuate pregnancy symptoms[10], and improve mental health[11,12]. Poor pregnancy health behaviours and associated maternal and infant health outcomes have been linked with increased costs of health care delivery through longer hospital admissions and intensive care admissions[4,13,14] and greater childhood health care costs[15]. Understanding the prevalence of these behaviours is important for health promotion and service planning.

Abstinence from cigarette smoking is recommended during the entire gestational period and there are demonstrated benefits of cessation at any stage of pregnancy[16]. Abstinence from cigarette smoking during pregnancy decreases the risk of low birth weight and preterm birth[16]. Between 10% and 25% of women give up smoking when they are planning a family or become pregnant[17], but available data indicate that between 12% to 40 % of women smoke during pregnancy[18].

The recommended diet for pregnancy follows the national dietary guidelines. The recommended fruit intake increases from 2 to 4 serves during pregnancy[19]. In addition, 5 serves of vegetables per day are recommended during pregnancy[19]. Minimal population consumption data are available for fruit and vegetable intake during pregnancy. Moreover, national intake data indicate a low prevalence of recommended consumption of fruit and

vegetables in non-pregnant women[20]. Therefore, with increased requirements in pregnancy, it is likely that the proportion of women meeting these guidelines is even lower than in the general population.

Moderate exercise for at least half an hour on most, if not all days is recommended during pregnancy[21], mirroring physical activity guidelines for the general population[22]. These guidelines also recommend previously inactive women become active during their pregnancy[23]. No Australian data exist for activity levels during pregnancy, however we know that approximately 50% of non-pregnant women meet physical activity guidelines[23] and that pregnancy represents a life stage in which women decrease their physical activity levels[24,25]. Thus, it is likely that the prevalence of pregnant women meeting physical activity recommendations is lower than that of the non-pregnant population.

To date, we have limited data on the prevalence of pregnant women's consumption of fruit and vegetables and levels of physical activity. Importantly, no previous studies have collected data on all of the health behaviours identified above with regard to their impact upon maternal and infant health outcomes in pregnant populations. The lack of data on the current prevalence of pregnancy health behaviours make it difficult to establish the need for and to prioritise further primary prevention efforts, or to set targets for healthy pregnancy behaviours at the population level. This study addresses these gaps and aims to establish the prevalence of cigarette smoking, sufficient fruit and vegetable intake, and sufficient physical activity among women accessing antenatal clinics in a South-East Queensland health service district (HSD), Australia.

Materials and Methods

Study design and participants

In this study we report data from a cross-sectional study establishing the prevalence of health behaviours during pregnancy among women utilising the antenatal services in one

Queensland HSD. Women were recruited for the study from antenatal clinics across one HSD over a three-month recruitment phase, from April to June 2007. Women were invited by midwives to participate at their first visit to the clinic. Eligibility criteria included ability to provide informed consent and to speak and read English. Ethical approval was granted by the relevant university and HSD ethics committees. We collected self-reported data (outlined in measures) using computer assisted telephone interviewing (CATI).

Based on previous research, we estimated a prevalence of 20% for smoking in a pregnant sample, which would require a sample of 243 to estimate within 5% with 95% confidence[30]. Although there are no pregnancy-specific estimates for the other behaviours examined, based on estimates in comparable samples of the general population we estimated a true prevalence of 55% (± 5%) for adequate fruit intake (requiring a sample size of 374), 20% for adequate vegetable intake (requiring a sample size of 261) and 55% for physical activity (requiring a sample size of 377) [30].

Measures

Valid and reliable self-report measures of health behaviours were used. **Smoking status** was assessed using a self-report measure designed to increase disclosure[31,32] of current and preconception smoking status. Pre-pregnancy smoking was defined as smoking in the three months prior to pregnancy. Current smoking behaviour was defined as either currently smoking OR having quit but having a cigarette within the last 30 days[31,32]. ***Current smoking quantity*** was assessed by asking the number of packs of cigarettes smoked in the last week and number of cigarettes per pack[32]. The number of cigarettes smoked in the past week was then calculated by multiplying reported packs smoked by cigarettes per pack[32]. Self- reported daily **fruit and vegetable** intake was collected using a modified version of the National Nutrition Survey Short Questions. These items have demonstrated validity[33], and the two-item measure has been validated against objective measures of intake and biochemical markers[34,35].

Self-reported **physical activity** was assessed using the Active Australia Survey (AAS)[22]. The AAS assesses the frequency and duration of participation in walking, moderate, and vigorous physical activity in the past week. **Current weight and height** were self-reported Body height was recorded in metres and weight was recorded in kilograms or in stones and pounds, which was later converted to metric units. Body Mass Index was calculated as weight (kg)/height (m)^2. Overweight was classified as BMI 25 to 29.9 kg/m^2 and obese was classified as greater than 30 kg/m^2.

Continuous outcome variables relating to **fruit** and **vegetables** were assessed as serves consumed per day. Two variables were for this purpose: "**serves of fruit**" and "**serves of vegetables**". These variables were both normally distributed (using the Kolmogorow-Smirnov test)[36],thus were reported as means and standard deviations. Medians and interquartile ranges were also reported. **Physical activity** data were summed to determine total minutes of weekly physical activity, as per the AAS manual[22]. This captured time spent in activities of walking, vigorous exercise, and vigorous yardwork/gardening. It did not record household chores, occupational or incidental activity[22]. In calculation of minutes of physical activity, minutes of vigorous activity was not weighted by two as suggested in the AAS manual[22], as we were interested in absolute minutes active, rather than the association between physical activity dose and health benefits that may be dependent on total energy expenditure. This allowed the creation of the parametric variable **"minutes of physical activity"**. This was capped at 840 minutes, according to the AAS manual[22]. This variable was positively skewed and was reported as median minutes of physical activity and the corresponding IQR.

Categorical outcome variables were also created (i.e. meeting/not meeting guidelines according to current public health guidelines for pregnancy). These included: smoking status, sufficient fruit, sufficient vegetables, and sufficient physical activity. **Smoking status** was defined as 'non-smoker' and 'current smoker'. Consistent with the dietary guidelines,

sufficient fruit and sufficient vegetable intakes were defined as women who consumed ≥ 4 serves of fruit and ≥ 5 serves of vegetables each day[19]. A nonparametric **physical activity** variable with two categories was created. Participants were categorised as engaging in sufficient physical activity using a cut-off of 150 minutes of activity (walking, gardening, moderate or vigorous activity) that occurred in five or more sessions[22].

Demographic data were compared with Australian Census data[37-39], National Perinatal data[40], and Queensland Health perinatal and antenatal services benchmarking data[41-43] to assess the representativeness of the sample

Results

Midwives recruited 304 of the 773 (39.3%) pregnant women who attended the antenatal clinic during the recruitment period. Of these, 86.2% completed the CATI survey. The 13.8% of women who did not complete the CATI survey were unable to be contacted, due to disconnected telephones or not answering our calls. The demographic characteristics of the sample are compared with the HSD and state profile characteristics in Table 1. Our study sample had representation of age groups that was between state and HSD distributions, and representation of Aboriginal and/or Torres Strait Islander women that closely reflected the HSD profile. Our sample was also less educated, more likely to be in de facto relationships and less likely to be separated/divorced, and had higher household incomes compared with the state and HSD profile. Our sample size provided sufficient power to detect a true prevalence of 55% for sufficient vegetable intake and 20% for smoking status.

Approximate placement for Table 1

Health behaviours

The proportion of women who met guidelines for health behaviours that influence maternal and infant health outcomes during pregnancy are illustrated in Figure 1. Few women met the guidelines for sufficient fruit (9.2%) or sufficient vegetable (2.7%) intake. On

average, women consumed half of the recommended serves of fruit (Mean 2.2, SD 1.1; Median 2.0, IQR1.0-2.0) and little more than one third of the recommended serves of vegetables (Mean 2.0, SD 0.6; Median 2.0, IQR 1.0-3.0) per day. Approximately one third (32.8%) of the population was undertaking sufficient physical activity (see Figure 1). Women undertook a median of 112.5 minutes of physical activity per week (IQR 43.8 - 240.0). A large proportion of women smoked prior to pregnancy (37.8%) and over one quarter continued to smoke during pregnancy. Approximately 10% of women quit smoking when they became pregnant. On average, women smoked 15.9 cigarettes a day (SD 1.2, n = 103) before becoming pregnant and smoked 13.4 cigarettes a day (SD 2.6, n = 26) once becoming pregnant. Twenty one percent of women were overweight and 20.0% were obese before becoming pregnant.

Approximate placement for Figure 1

Discussion

This study aimed to establish the prevalence of health behaviours known to influence maternal and infant pregnancy outcomes among women accessing antenatal clinics in a South-East Queensland HSD. To our knowledge, no other paper has reported the prevalence of these health behaviours simultaneously or compared behaviours with population guidelines. Poor adherence to recommended guidelines for smoking cessation, fruit and vegetable intake, and physical activity behaviours was observed.

The prevalence of cigarette smoking in this study is above the state estimate [40], but is similar to that documented in other studies[18,27]. Proportions of women consuming sufficient serves of fruit and vegetables were significantly lower than those in the last reported population intake data[44]. A smaller proportion of women were sufficiently physically active compared with the national average for non-pregnant women[23].

Given the strong evidence for the role of health behaviours during pregnancy on maternal and infant health, low levels of adherence to public health recommendations for these behaviours are of concern. Continued smoking remains a public health concern requiring effective smoking cessation interventions for pregnant women. The intake of sufficient fruit and vegetables has been proposed as the most important public health message for the decrease of chronic disease[45]. Thus, the low prevalence of women meeting the dietary guidelines warrants further attention. There also exists an urgent need to identify and address the barriers to women undertaking sufficient physical activity during pregnancy.

Over 40% of women in this study were overweight or obese at the beginning of pregnancy. Overweight and obesity in pregnancy is associated with an increased risk of maternal and infant health complications[4]. Evidence also suggests that awareness of weight gain guidelines may influence pregnancy weight gain. Cogswell et al., (1999) demonstrated that women advised to gain less or more than the Institute of Medicine weight gain guidelines were 3.6 times more likely to report actual gains below or above recommendations, compared with women advised to gain within the guidelines[46]. Women not advised about weight gain were more likely to gain weight outside the recommended weight gain range[46]. Thus it is vitally important that all pregnant women have knowledge of pregnancy weight gain guidelines.

Our recruitment rate was similar to other epidemiological studies that attempt to estimate population prevalence of health behaviours[25,47], and as expected given our method of recruitment[48] via antenatal clinic staff, rather than dedicated research staff. However, we may have had more than acceptable error in our estimation of prevalence of sufficient fruit intake and sufficient physical activity with our current sample size. We did not collect pregnancy history information or demographic details about women who were approached but did not consent to participate. This procedure would have provided a richer picture of our study

participants. However, the demographics of our study sample demonstrate fair representativeness of young women and women with lower levels of education, despite documented difficulties in the engagement of these groups in research more generally[49] and their less regular use of antenatal services [50, 51]. We still had a lower representativeness of women from lower income households, but given what we know about the associations between socioeconomic status and healthy behaviours[27, 29, 52, 53], such sampling bias would only have resulted in an underestimate of the actual size of the problem. Nevertheless, this does limit the generalisability of the results beyond the sample population and points to a continued need for future studies to focus on recruiting marginalised groups.

A strength of the study is the use of CATI to circumvent literacy issues that may be apparent in written self-report studies[48]. Additionally, the collection of data regarding a suite of health behaviours at the start of pregnancy is the first reported study of this kind. The use of self-report measures also introduces potential biases. Objective measures of all behaviours may have strengthened findings. The tools selected were valid, reliable and suitable for telephone delivery[55,56].

Future recommendations

These results suggest three important avenues for investigation and effective practice changes that can be implemented. Firstly, as data have not previously been collected regarding these health behaviours during pregnancy, tracking of behaviour change throughout pregnancy is recommended. Secondly, research investigating patterns of occurrence of multiple risk factors for unhealthy behaviours, particularly stratification according to socio-demographic and other health behaviours would provide more information for planning interventions. Finally, there is a need to support women with greater barriers to meeting health recommendations. Structuring health services to allow systematic delivery of support and services to women in this environment would be one avenue to reach women at a time in

which the majority of them are in contact with the health service[57]. Positioning pregnancy care in accessible community locations to enable greater service utilisation and accessibility is recommended[58].

Conclusion

This paper documented the prevalence of health behaviours in a pregnant population within a Queensland HSD. We found low levels of adherence to recommendations known to influence pregnancy maternal and infant health outcomes, including high rates of cigarette smoking, and low rates of sufficient fruit, vegetables, and physical activity. These findings highlight that there is now a clear need to develop and evaluate effective interventions to address these problems. Brief minimal contact behavioural interventions that can be delivered through primary care to create a greater primary prevention focus for maternal and infant health as a practical step to address these health issues would be worth exploring.

Acknowledgments

This research was funded by Queensland Health to meet the requirements of a larger project ("The Development of a Food, Nutrition, and Physical Activity Project for Pregnancy and Early Life") which was conceived and developed by a group of interdisciplinary researchers at The University of Queensland. Funding was also received from the Redcliffe Hospital Foundation. We would like to thank Meredith Shallcross and staff of the Redcliffe-Caboolture Health Service that participated in the recruitment for this study project. . We are grateful to the 'Caboolture mums & little ones' and the 'Redcliffe Health Behaviours in Pregnancy' data collection interviewers and to the women who participated in the survey for their valuable contribution.

References

1. Secker- Walker R, Vacek PM. Relationships between cigarette smoking during pregnancy, gestational age, maternal weight gain, and infant birth weight. *Addict Behav*, 2003; 28, 55-66.

2. Darnton-Hill I, Nishida C, James W. A life course approach to diet, nutrition and the prevention of chronic diseases. *Pub Health Nut*, 2004; *7*(1A), 101-121.

3. Pivarnik JM, Chambliss HO, Clapp JF, Dugan SA, et al. Impact of physical activity during pregnancy and postpartum on chronic disease risk. Round table consensus statement. *Med Sci Sports Exerc*. 2006;38(5):989-1006.

4. Callaway LK, Prins JB, Chang AM, McIntyre HD. The prevalence and impact of overweight and obesity in an Australian obstetric population. *MJA*. 2006;184(2):56-9.

5. Castles A, Adams EK, Melvin CL, Kelsch C, Boulton ML. Effects of smoking during pregnancy: five Meta-analyses. *Am J Prev Med*. 1999;16(3):208- 15.

6. Campbell E, Walsh RA, Sanson- Fisher RW, Burrows S, Stojanovski E. A group randomised trial of two methods for disseminating a smoking cessation programme to public antenatal clinics: effects on patient outcomes. *Tob Control*, 2006; 15, 97-102.

7. Furuno JP, Gallicchio L, Sexton M. Cigarette smoking and low maternal weight gain in medicaid-eligible pregnant women. *J Women's Health*. 2004;13(7):770- 7.

8. Mamun AA, Lawlor D, Alati R, O'Callaghan MO, Williams GM, Najman JM. Does maternal smoking during pregnancy have a direct effect on future offspring obesity? Evidence from a prospective birth cohort study. *Am J Epidemiol*. 2006;164(4):317-25.

9.. Dempsey JC, Sorensen TK, Williams MA, Lee I-M, Miller RS, Dashow EE, et al. Prospective study of gestational diabetes mellitus risk in relation to maternal recreational physical activity before and during pregnancy. *Am J Epidemiol*. 2004;159:663-70.

10. Sternfeld B, Queensbury CP, Eskenazi B, Newman LA. Exercise during pregnancy and pregnancy outcome. *Med Sci Sports Exerc*. 1995;27(5):634- 40.

11. Morris SN, Johnson NR. Exercise during pregnancy. A critical appraisal of the literature. *J Reprod Med.* 2005;50:181- 8.

12. Goodwin A, Asterbury J, McMeeken J. Body image and psychological well-being in pregnancy: A comparison of exercisers and non-exercisers. *ANZJOG*. 2000;40:442- 7.

13. Burns L, Mattick RP, Cooke M. The use of record linkage to examine illicit drug use in pregnancy. *Addiction*. 2006;101:873-82.

14. Burns L, Mattick RP, Cooke M. Use of record linkage to examine alcohol use in pregnancy. *Alcohol Clin Exp Res*. 2006;30(4):642-8.
15. Petrou S, Hockley C, Mehta Z, Goldacre M. The association between smoking during pregnancy and hospital inpatient costs in childhood. *Soc Sci Med*. 2005;60:1071-85.
16. Lumley J, Oliver SS, Chamberlain C, Oakley L. Interventions for promoting smoking cessation during pregnancy. *The Cochrane Database of Systematic Reviews*. 2004;Issue 4.:1-70.
17. Australian Institute of Health and Welfare. *2004 National drug strategy household survey*. Canberra: AIHW; 2005.
18. McDermott L, Russell A, Dobson A. *Cigarette smoking among women in Australia*. Canberra: Commonwealth Department of Health and Ageing; 2002.
19. National Health and Medical Research Council. *Food for health. Dietary guidelines for Australian adults. A guide to healthy eating*. Canberra: NHMRC; 2003.
20. Australian Food and Nutrition Monitoring Unit. *Key food and nutrition data for Australia 1990-1999.* Canberra: Commonwealth Department of Health and Aged Care; 2001.
21. American College of Gynecology. Exercise during pregnancy and the postpartum period. ACOG committee opinion No. 267. *Obstet Gynecol*. 2002;99:171-3.
22. Australian Institute of Health and Welfare. *The Active Australia Survey: A guide and manual for implementation, analysis and reporting*. Canberra: AIHW; 2003.
23. Bauman A, Ford I, Armstrong T. *Trends in population levels of reported physical activity in Australia, 1997, 1999, and 2000*. Canberra: Australian Sports Commission; 2001.
24. Brown WJ, Trost SG. Life transitions and changing physical activity patterns in young women. *Am J Prev Med*. 2003;25(2):140-3.
25. Borodulin KM, Evenson KR, Wen F, Herring AH, Benson AM. Physical activity patterns during pregnancy. *Med Sci Sports Exerc.*2008; 40(11): 1901-1908.
26. Hodnett ED, Fredericks S. Support during pregnancy for women at increased risk of low birthweight babies. *The Cochrane Database of Systematic Reviews*. 2003;Issue 3:1- 36.
27. Walsh RA, Redman S, Brinsmead MW, Fryer JL. Predictors of smoking in pregnancy and attitudes and knowledge of risks of pregnant smokers. *Drug Alcohol Review*. 1997;16:41-67.
28. Pereira MA, Rifas-Shiman SL, Kleinman KP, Rich-Edwards JW, et al. Predictors of change in physical activity during and after pregnancy. *Am J Prev Med*. 2007;32(4):312-9.
29. Queensland Health. *Infant and child nutrition in Queensland 2003*.Brisbane: Queensland Health; 2005.

30. Raosoft. Sample size calculation. 2004. [Accessed 8 December 2008]. Available from: http://www.raosoft.com/samplesize.html
31. Mullen P, Carbonari JP, Tabak E, Glenday M. Improving disclosure of smoking by pregnant women. *Am J Obstet Gynecol*. 1991;165:409-13.
32. Melvin CL, Tucker P, Smoke-Free Families Common Evaluation Measures for Pregnancy and Smoking Cessation Projects Working Group. Measurement and definition for smoking cessation intervention research: the Smoke-Free Families experience. *Tob Control*. 2000;9(Suppl3):iii87-iii90.
33. Australian Food and Nutrition Monitoring Unit. *Evaluation of short dietary questions from the 1995 National Nutrition Survey*. Canberra: Commonwealth Department of Health and Aged Care; 2001.
34. Coyne T, Ibiebele TI, MacNaughton S, Rutishauser I, et al. Evaluation of brief dietary questions to estimate vegetable and fruit consumption-using serum carotenoids and red-cell folate. *Public Health Nutrition*. 2004;8(3):298- 308.
35. Cappuccio F, Rink E, Perkins- Porras L, MacKay C, et al. Estimation of fruit and vegetable intake using a two- item dietary questionnaire: a potential tool for primary health care workers. *Nutrition Metabolism and Cardiovascular Disease.* 2003;13:12-9.
36. Pallant J. *SPSS Survival Manual* (3rd Ed). Sydney: Allen & Unwin; 2007.
37. Australian Bureau of Statistics. *2006 Census Community Profile Series - Redcliffe City SSD*. 2007 [cited 2007 29 November]; Available from: http://www.censusdata.abs.gov.au/ABSNavigation/prenav/ViewData?&action=404&documentproductno=30545&documenttype=Details&tabname=Details&areacode=30545&issue=2006&producttype=Community%20Profiles&&producttype=Community%20Profiles&javascript=true&textversion=false&navmapdisplayed=true&breadcrumb=PLD&&collection=Census&period=2006&producttype=Community%20Profiles&#Expanded%20Community%20Profile
38. Australian Bureau of Statistics. *2006 Census Community Profile Series - National Regional Profile: Queensland.* 2007 [cited 2007 29 November]; Available from: http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/32000-2004?OpenDocument&tabname=Details&prodno=3&issue=2000-2004&num=&view=&
39. Australian Bureau of Statistics. *2006 Census Community Profile Series - Caboolture Shire SSD*. 2007 [cited 2007 29 November]; Available from: http://www.censusdata.abs.gov.au/ABSNavigation/prenav/ViewData?&action=404&documentproductno=30520&documenttype=Details&tabname=Details&areacode=30520&issue=2006&producttype=Community%20Profiles&&producttype=Community%20Profiles&javascript

=true&textversion=false&navmapdisplayed=true&breadcrumb=PLD&&collection=Census&period=2006&producttype=Community%20Profiles&#Expanded%20Community%20Profile

40. Australian Institute of Health and Welfare. *Australia's mothers and babies 2005*. Sydney: AIHW National Perinatal Statistics Unit; 2007.

41. Redcliffe-Caboolture Health Service District Clinical Benchmarking. *Maternity Services Survey*. RCHSD*:* Queensland Health; 2008.

42. Queensland Health. *Perinatal Data Collection: Quarterly Report (Redcliffe Hospital).* Brisbane: Queensland Health; 2007.

43. Queensland Health. *Perinatal Data Collection: Quarterly Report (Caboolture Hospital).* Brisbane: Queensland Health; 2007.

44. Australian Bureau of Statistics. *National Nutrition Survey. Foods Eaten. Australia. 1995*. Canberra: Commonwealth Department of Health and Aged Care; 1997.

45. Queensland Public Health Forum. *Eat Well Queensland 2002- 2012: Smart Eating for Healthier State*. Brisbane: Queensland Public Health Forum; 2002.

46. Cogswell ME, Scanlon KS, Fein SB, Schieve LA. Medically advised, mother's personal target, and actual weight gain during pregnancy. *Obstet Gynecol*. 1999;94:616-22.

47. Brown WJ, Bryson L, Byles JE, Dobson AJ, Lee C, Mishra G, Schofield M. Women's health Australia: Recruitment for a National Longitudinal Cohort Study. *Women Health*. 1998; 28(1):23-40.

48. Lee RE, McGinnis KA, Sallis JF, Castro CM, Chen AH. Active vs. passive methods of recruiting ethnic minority women to a health promotion program. *Ann Behav Med*. 1997, 19(4):378-384.

49. Pletsch PK, Howe C, Tenney M. Recruitment of minority subjects for intervention research. *J Nursing Scholarship*. 1995. 27(3), 211-215.

50. Blondel B, Marshall B. Poor antenatal care in 20 French districts: risk factors and pregnancy outcome. *J Epidemiol and Community Health*. 1998;52: 501-506.

51. Raatikainen K, Heiskanen P, Heinonen, S. Under-attending free antenatal care is associated with adverse pregnancy outcomes. *BMC Public Health*. 2007;7: 268-275.

52. Casagrande, S. S., Wang, Y., Anderson, C., & Gary, T. L. (2007). Have Americans increased their fruit and vegetable intake? The trends between 1988 and 2002. *AmJPrev Med*, 32(4), 257-263.

53. Evenson, K. R., Savitz, D. A., & Huston, S. L. (2004). Leisure- time physical activity among pregnant women in the US. *Paed Peri Epidem*, 18, 400- 407.

54. Corey CR, Freeman HE. Use of telephone interviewing in health care research. *Health Serv Res*. 1990;25(1):129-44.
55. Brown WJ, Bauman A, Chey T, Trost SG, et al.. Comparison of surveys used to measure physical activity. *Aust N Z J Public Health*. 2004;28(2):128-34.
56. Rutishauser I, Webb K, Abraham B, Allsopp R. *Evaluation of short dietary questions from the 1995 National Nutrition Survey*. Canberra: Commonwealth Department of Health and Aged care; 2001.
57. Chan A, Scott J, Nguyen A-M, Green P. *Pregnancy outcome in South Australia 2002*. Adelaide: Department of Human Services; 2003.
58. Hirst C. *Re-Birthing. Report of the review of maternity services in Queensland*. 2005 [cited 26 September 2006]; Available from: http://www.health.qld.gov.au/maternity/rebirthing.asp

Table 1 Demographic characteristics of the study sample compared with the local Health Service District (HSD) and state populations of women giving birth.

Characteristic	Mean (SD, range) or percentage **Study Sample (n=262)**	Percentage **HSD**	Percentage **Queensland**
Age (years)	27.2 (5.8; 16-46)	-	29.1c
≤ 20 years	9.9%	12.0%[d]	5.6%[c]
21-25 years	24.4%	28.0%[d]	17.5%[c]
26-30years	29.8%	28.5%[d]	27.7%[c]
31-35 years	24.8%	21.8%[d]	31.3%[c]
≥36 years	10.7%	9.7%[d]	17.9%[c]
Missing	0.4%	-	-
Pre-pregnancy BMI (kg/m²)	25.3 (5.8;15.4-50.4)	-	-
Underweight (<18.5)	8.0%	-	-
Healthy weight range (18.5-24.9)	45.4%	-	-
Overweight (25-29.9)	21.0%	-	-
Obese (≥ 30)	20.2%	-	-
Missing	5.3%	-	-
Education: Did not finish high school	60.4%	57.1%[b]	48.5%
Household income (gross, per week)			
Less than $600[a]	12.6%	35.2%[b]	28.8%[b]
$600-799[a]	11.5%	7.1%[b]	6.5%[b]
$800-999	9.9%	7.4%[b]	7.1%[b]
$1000-1999	11.5%	11.7%[b]	11.6%[b]
More than $1200	42.7%	27.9%[b]	34.6%[b]
Refused to answer	10.3%	-	-
Missing	1.5%	-	-
Marital status			
Married	48.5%	49.9%[b]	49.0%[b]
de facto	34.7%	9.5%[b]	10.2%[b]
Separated/Divorced	5.3%	21.9%[b]	18.2%[b]
Never Married	9.9%	36.2%[b]	30.0%[b]
Missing	1.5%	-	-
Private Health Insurance			
Hospital	8.8%	-	-
Missing	1.5%	-	-
Ancillary services	13.7%	-	-
Missing	1.5%	-	-
Employment			
Full time work	24.4%	21.5%[b]	26.6%
Part time/ Casual work	25.6%	22.6%[b]	23.3%
Studying	0.8%	n/avail	n/avail
Full time home duties	42.4%	n/avail	n/avail
Unemployed	5.3%	3.4%[b]	2.9%
Missing	1.5%	-	-
Country of birth			
Australia	81.7%	76.9%[b]	83.3%[c]
Pacific Islands	4.0%	4.7%[b]	4.4%[c]
Asia	4.0%	1.7%[b]	4.3%[c]

Europe	8.0%	8.0%[b]	2.5%[c]
Other	1.1%	1.0%[b]	5.9%[c]
Missing	1.5%	-	-
English (main language) spoken at home	93.5%	91.0%[b]	86.6%
Missing	1.5%	-	-
ATSI status			
Aboriginal and/or Torres Strait Islander	4.7%	4.0%[d]	5.6%[c]
Neither	93.9%	96.0%[d]	94.3%[c]
Missing	1.4%	-	-
Stage of gestation – weeks	19.4 (5.6; 10-38)	-	-
First trimester	19.1%	-	-
Second trimester	73.7%	-	-
Third trimester	7.3%	-	-

[a]<$650; $650-799 for HSD and state columns; [b]ABS data (2007 census); [c]AIHW data (2005 mothers and babies); [d]HSD Clinical Benchmarking Department 2007; NB some missing/refused to answer data in the study sample results in some %s not equalling 100. Ns are provided to indicate missing data.

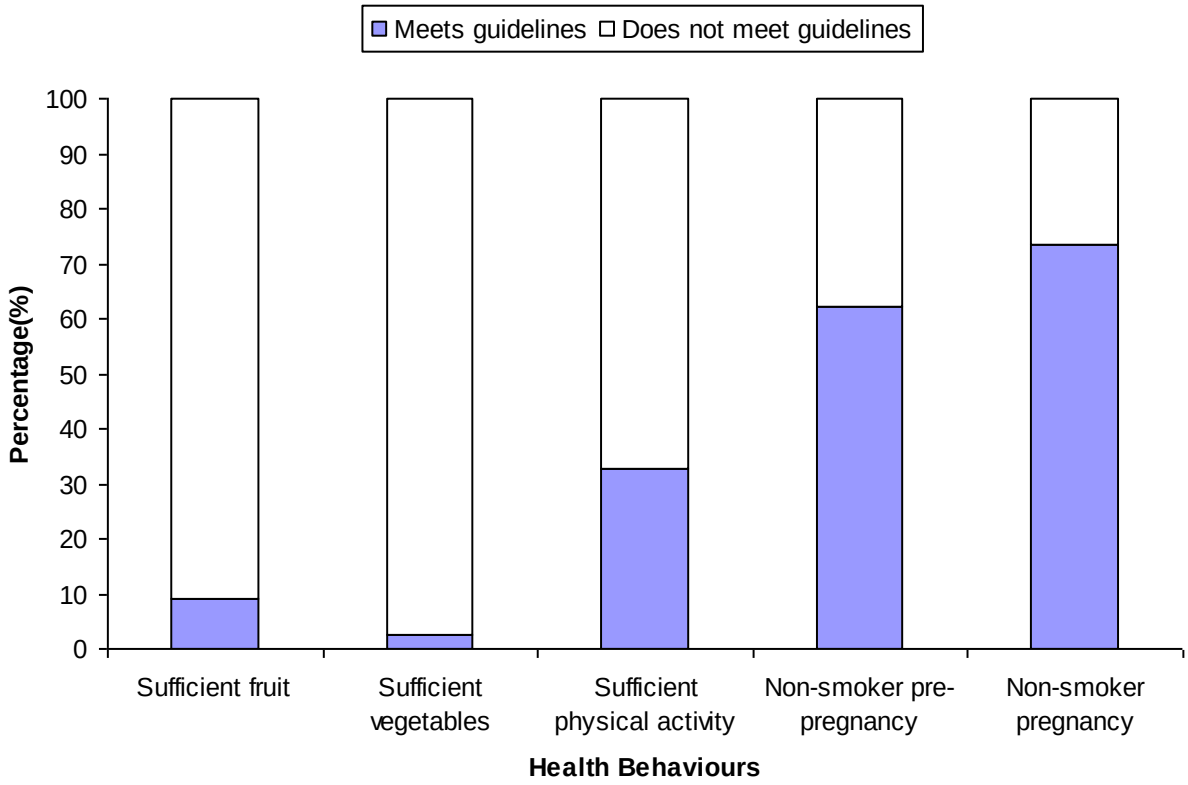

Figure 1 Proportion of women meeting health behaviour guidelines for pregnancy