



Original research

An investigation into the exercise behaviours of regionally based Australian pregnant women

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ABSTRACT

Objectives: Regular exercise during pregnancy is a recommended prenatal care strategy with short and long-term health benefits to mother and child. Unfortunately, most pregnant women are insufficiently active to obtain health benefits and there is evidence that activity levels decrease overall during pregnancy. Physical activity among regionally based women is lower than that of urban-based women within Australia. However, little is currently known about exercise behaviours of regionally based Australian pregnant women. To successfully promote exercise among regionally based pregnant women, a greater understanding of exercise behaviours must first be explored. This study investigated exercise behaviours in a sample of regionally based Australian pregnant women.

Design: Regionally based Australian pregnant women ($n = 142$) completed a modified version of the Godin Leisure-Time Exercise Questionnaire examining exercise behaviours before and during pregnancy.

Methods: Women self-reported their exercise behaviours, including exercise frequency, intensity, time and type, before and during pregnancy.

Results: Chi-square analysis revealed significantly less ($\chi^2 = 31.66, p < 0.05$) women participated in exercise during pregnancy (61%) compared to before pregnancy (87%). During pregnancy, respondents exercised at a significantly lower frequency ($\chi^2 = 111.63, p < 0.05$), intensity ($\chi^2 = 67.41, p < 0.05$), shorter time/duration ($\chi^2 = 114.33, p < 0.05$), and significantly less ($\chi^2 = 8.55, p < 0.05$) women (8%) are meeting 'exercise during pregnancy' guidelines compared to women before pregnancy (49%) meeting physical activity guidelines.

Conclusions: Exercise during pregnancy decreases to levels significantly lower than what is currently recommended. Public health initiatives that promote exercise among Australian pregnant women should aim to increase frequency, intensity, time and type of exercise to be undertaken during pregnancy.

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1. Introduction

Historically, pregnancy was believed to be a time for rest. However, an increasing body of epidemiological and experimental evidence has recently challenged this view.^{1–3} It is now widely acknowledged that appropriate exercise undertaken during pregnancy promotes many benefits for both the mother and her unborn child.^{2–4} Current evidence suggests that these benefits begin to occur with an accumulation of at least 150 min of aerobic exercise per week at a moderate intensity.^{5,6} For the pregnant mother these benefits include a lower risk for gestational diabetes and other pregnancy-related complications such as caesarean section and preeclampsia, improved cardiovascular function, enhanced

muscular strength and lean muscle mass, a greater sense of well-being, and improved sleep.^{2–4} Benefits to the unborn child include decreased resting foetal heart rate, improvement in the viability of the placenta, increased amniotic fluid levels, healthier birth weights, and increased gestational ages.^{2,4} Despite this evidence and the subsequent release of 'exercise during pregnancy' guidelines by governing health bodies across the western world,⁷ international and national data suggests that the majority of pregnant women (60–70%) are insufficiently active to obtain health benefits.^{8,9}

To date, little is known about the specific exercise behaviours (exercise frequency, intensity time and type [FITT]) of Australian pregnant women. Previous research has separately examined these exercise behaviours and observed that Australian women are less active during pregnancy than before pregnancy,^{10–12} and that exercise intensity and exercise duration also decrease over the course of the pregnancy.¹¹ However, no research to date has

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concurrently examined all four of the FITT exercise behaviours during pregnancy in the same cohort of Australian women. Furthermore, research focusing on healthy women residing outside of urban areas is currently lacking. Health status and geographical location are important factors as they are known to influence physical activity behaviour, both directly and indirectly by influencing other determinants (including beliefs, attitudes and knowledge).¹⁴

Research examining exercise behaviours in relation to each of the FITT principles and improving our understanding of why changes in exercise behaviours occur throughout pregnancy is needed to develop targeted interventions which are known to be more effective than generic “one-size-fits-all” interventions in pregnant women.¹⁵ The purpose of the current study was to examine the frequency, intensity, time and type of exercise behaviours undertaken by regionally based pregnant women before and during pregnancy.

2. Methods

A convenience sample of pregnant women currently accessing prenatal care were invited to participate in the study via recruitment materials (posters and flyers) displayed in 11 geographically dispersed medical practices within the Rockhampton region of Central Queensland, Australia. An information sheet outlining the purpose of the study was attached to each of the surveys for potential participants to read. No incentive for completion was offered. Participants were not identifiable and informed consent was assumed on the completion and return of the hardcopy survey to the reception desk at the medical practice. Data was collected between March–September, 2014. The Central Queensland University Human Research Ethics Committee gave approval to conduct the study (H14/02-031).

The 53-item survey instrument was developed after an extensive review of the both previous research literature and previously developed questionnaires examining pregnant women’s physical activity patterns, perceptions and beliefs about exercise during pregnancy.^{16,17} The survey was then pilot tested ($n=12$) among medical practitioners, academic researchers and postgraduate students who provided feedback that contributed to the final version of the instrument. As part of a larger study, the survey consisted of three sections that in turn examined participants’ demographic characteristics, beliefs regarding exercise during pregnancy, and exercise behaviours both before and during pregnancy. However, only participants’ demographic characteristics and exercise behaviours have been reported in the current paper.

Demographic characteristics assessed included age, combined household income, marital status, level of education, employment status, whether or not participants had other children, gestational age of the baby, and whether or not respondents were accessing private or public health care for their prenatal care. The Godin Leisure-Time Exercise Questionnaire (GLTEQ),¹⁸ for which content validity and test-retest reliability have been previously established, was then used to examine participants self-report of exercise frequency, intensity and time before and during pregnancy. The GLTEQ tool was adapted for the purpose of this study to also examine the types (aerobic exercise, flexibility training, strength training or other) of exercise respondents participated in. Time to complete the survey was approximately 10 min.

Descriptive statistics were calculated for all demographic and exercise behaviour data. Chi-square analysis examined differences in the proportion of responses in each of the FITT categories. Statistical significance was accepted at an alpha level of $P<0.05$. Data analysis was performed using Statistical Package for the Social Sciences Version 20 (IBM Corp, NY).

Table 1
Demographic characteristics of 142 pregnant women respondents.

Variable	N (%)
Australian citizen	134 (95)
English as primary language	139 (97.9)
Age (years)	
18–24	23 (16.2)
25–34	98 (69)
35+	21 (14.8)
Annual combined household income	
Less than \$50,000 per year	9 (6.3)
\$50,001–\$100,000 per year	49 (34.5)
\$100,001–\$150,000 per year	41 (28.9)
More than \$150,000 per year	34 (23.9)
Unsure/Would rather not say	9 (6.3)
Highest level of education	
Secondary/high school	35 (24.6)
Technical or further educational institution (inc TAFE)	35 (24.6)
University or other higher education institution	71 (50)
No Schooling	1 (0.7)
Current employment status	
Full-time	70 (49.3)
Part-time/casual	36 (25.4)
Unemployed	1 (0.7)
Student	4 (2.8)
Home duties	26 (18.3)
Self-employed	5 (3.5)
Marital status	
Married/de facto/in a relationship	139 (97.9)
Single/divorced/separated/widowed	3 (2.1)
How many children do you currently have	
None	57 (40)
1 child	53 (37.3)
2 children	21 (14.8)
3 or more children	11 (7.7)
First pregnancy	
Yes	55 (38.7)
No	87 (61.3)
Gestation	
First trimester	34 (23.9)
Second trimester	39 (27.4)
Third trimester	69 (48.7)
Pre-natal care system	
Private care system	35 (24.6)
Public care system	107 (75.4)

3. Results

The demographic characteristics of the 142 respondents are shown in Table 1. Participants were primarily Australian citizens (95%), spoke English as their first language (98%), aged 25–35 years (69%), married (93%) and in some form of employment (74%). Just under half of the respondents were in their third trimester of pregnancy (49%) and with their first child (40%). Over two-thirds of the participants (75%) were accessing public prenatal health care at the time of this study.

Table 2 shows a significant reduction in exercise participation during pregnancy compared to before pregnancy ($\chi^2=31.66$, $p<0.05$). Of those that continued to exercise, there was a significant reduction in the number of pregnant women meeting exercise guidelines ($\chi^2=8.55$, $p<0.05$). Exercise frequency ($\chi^2=111.63$, $p<0.05$), intensity ($\chi^2=67.41$, $p<0.05$), and time/duration ($\chi^2=114.33$, $p<0.05$) also significantly decreased from before pregnancy to during pregnancy. Just under a third (27%) of respondents ceased exercise all together once becoming pregnant. Moreover, 64% of respondents reported participating in exercise at least 3–4 times per week before pregnancy. However, exercise frequency decreased significantly among those women who continued to exercise during pregnancy, with 58% of participants reporting exercising only 1–2 times per week.

Eighty-seven active women (70%) in the study participated in exercise at either a ‘moderate’, ‘hard’ or ‘very hard’ intensity before

Table 2
Exercise behaviours of the 142 pregnant women respondents.

Questions	Exercise behaviours BEFORE pregnancy N (%)	Exercise behaviours DURING pregnancy N (%)
Do you participate in exercise?		
Yes	124 (87.3)	86 (60.6) [*]
No	18 (12.7)	56 (39.4)
Currently meeting Exercise guidelines	61 (49)	11 (8) [*]
Of those that do exercise:	N = 124	N = 86
On average, how many times per week did you exercise?		
1–2 times per week	45 (36.3)	50 (58.1)
3–4 times per week	56 (45.2)	30 (34.9)
5–7 times per week	21 (16.9)	5 (5.8)
more than 7 times per week	2 (1.61)	1 (1.2)
On average, at what intensity did you exercise?		
Very Light (1–20% of maximal effort)	8 (6.5)	20 (23.3) [*]
Light (21–49% of maximal effort)	29 (23.4)	44 (51.2) [*]
Moderate (50–70% of maximal effort)	37 (29.8)	18 (20.9)
Hard (71–85% of maximal effort)	37 (29.8)	4 (4.6) [*]
Very hard (86–100% of maximal effort)	13 (10.5)	0
On average, how long did your exercise sessions go for?		
Less than 10 min per session	1 (0.8)	1 (1.2)
10–20 min per session	10 (8.1)	18 (20.9) [*]
21–30 min per session	23 (18.5)	34 (39.5) [*]
31–40 min per session	23 (18.5)	13 (15.1) [*]
41–50 min per session	25 (20.2)	8 (9.3) [*]
51–60 min per session	34 (27.4)	11 (12.8) [*]
more than 60 min per session	8 (6.5)	1 (1.2) [*]
On average, what are the main types of exercise you did?		
Aerobic exercise	95 (77.9)	46 (50.5)
Strength-training	49 (40.2)	9 (9.9)
Flexibility training	32 (26.2)	11 (12.1)
Other (walking, gardening, house work)	20 (16.4)	25 (27.5)

^{*} $p < 0.05$; participants could select more than one activity.

pregnancy. However, during pregnancy, the exercise intensity significantly reduced. Among those 61% of total respondents still active, 74% participants reporting exercise intensities of 'light' or 'very light'.

The most frequently self-reported exercise session time/duration before pregnancy was 21–60 min with 18% of respondents reporting both 21–30 min and 31–40 min, 20% reporting 41–50 min and 27% reporting 51–60 min of exercise per exercise session. In contrast, during pregnancy, the exercise session duration decreased significantly with the most commonly reported exercise session duration among respondents lasting less than 30 min (62%).

Before pregnancy, flexibility training was found to be the least popular type of exercise. Specifically, 26% of respondents reporting participating in flexibility training compared to 40% who undertook strength training and 78% who reported participating in aerobic training. In contrast, during pregnancy flexibility training was the second most frequently reported type of exercise with 11 (12%) respondents reporting participating in flexibility training. During pregnancy, strength training was the least frequently reported with only 9 (10%) respondents indicating they participated in strength training during pregnancy. Aerobic exercise was also reported less frequently during pregnancy (50%) compared to before pregnancy (78%).

Furthermore, while no statistical analysis was undertaken due to the small number of respondents sufficiently active during pregnant (8%), exercise participation decreased during pregnancy as gestational age increased from the second (25%) to the third trimester (23%).

4. Discussion

The present study provides new insight into the FITT exercise behaviours of 142 regionally based Australian women before and during pregnancy. The present findings strongly suggest that the

majority of respondents are insufficiently active during their pregnancy to obtain health benefits.^{5,6} Moreover, the results suggest that a significant percentage of regionally based active women cease to exercise once becoming pregnant and exercise continues to decline as gestational age increases from the second to the third trimester. Furthermore, for women who continued to exercise during pregnancy, exercise frequency, intensity and time are significantly reduced.

The majority of study respondents (87%) were participating in some type of exercise before becoming pregnant. However, in agreement with national trends showing that just under 50% of Australian women meet physical activity guidelines,⁸ only 49% of the study respondents were active enough to be meeting physical activity guidelines before pregnancy.⁶ This finding suggests that pre-pregnancy physical activity levels among regional women in Australia are typical of those observed in urban women. This is unexpected, given that previous research has shown that activity levels of regionally based people tend to be lower than that of their urban counterparts.^{10,20,21} The present results suggest that a significant proportion of women in regional Australia are insufficiently active to obtain health benefits prior to becoming pregnant but that the levels of physical activity are similar to those observed in urban dwelling Australian women.^{10,21} Previous research suggests that women who are active before pregnancy are more likely to remain active during and after pregnancy.²² As such, physical activity interventions undertaken before pregnancy among these populations are highly recommended.

In the current study, 69% of respondents continued to exercise during pregnancy. However these respondents were not sufficiently active enough to be meeting exercise during pregnancy guidelines. The remaining 31% of respondents completely ceased exercise once becoming pregnant with only 8% of respondents remaining sufficiently active enough to meet the exercise during pregnancy guidelines. Additionally, no women who were

previously inactive before pregnancy reported commencing exercise during pregnancy. Previous studies examining exercise behaviours of pregnant women residing in urban-dwelling areas in Australia suggest a greater number of women are sufficiently active and meeting exercise during pregnancy guidelines (20–35%).^{10,11,21} These figures contrast with the findings of the present study which found only 8% of regionally based pregnant women were sufficiently active to be meeting exercise during pregnancy guidelines.

Three possible reasons may explain the between-study variability in the number of women considered sufficiently active and meeting exercise during pregnancy guidelines. Firstly, the findings of the present study suggest that regionally based women are less active during their pregnancy than their urban counterparts. Secondly, Wilkinson et al. used the self-report Active Australia Survey (AAS) instrument which measures not only participation in exercise, but also time and frequency of participation in leisure-time activities. Additionally, Wilkinson et al. examined pregnant women predominately in their second trimester (74%).²¹ Third, Smedley et al. only asked participants to report if they had participated in physical activity 'never', 'sometimes', or 'always'.¹⁰ Participants in the current investigation were predominately in their third trimester and only considered sufficiently active if they were exercising on at least 3–4 days per week and accumulating at least 150 min of moderate–high intensity aerobic exercise in accordance with exercise during pregnancy guidelines. As such, the comparisons between women predominately in their second trimester against women in their third trimester and the inclusion of leisure-time activities and/or categorical responses are inappropriate and may have resulted in an over-representation of actual women meeting exercise during pregnancy guidelines.

However, given that almost half (49%) of the respondents from the present study were in their third trimester, and that a decline in both exercise participation and those respondents meeting exercise during pregnancy guidelines was observed with an increase in gestational age from the second to the third trimester, the current suggest that regionally based Australian pregnant women behave similarly to their urban counterparts during pregnancy.¹¹ Specifically, of the 80 women in the present study who continued to participate in some form of exercise during pregnancy, 20 were in their first trimester, 31 in their second and 29 in their third. Of the 11 pregnant women who reported being sufficiently active in accordance with exercise during pregnancy guidelines, 2 were in their first trimester, 5 in their second and 4 in their third trimester. These results reflect previous research that suggests women are more active in their second than their first trimester due to a variety of physiological changes and adaptations that occur predominately during the first trimester of pregnancy.²³

Although the present study suggests that regionally based pregnant women in Australia display similar exercise behaviours to that of their urban counterparts, further contributing factors due to geographic location might also be considered when attempting to understand why regionally based women significantly reduce their exercise behaviours once they become pregnant. For example, previous research suggests that doctor and specialist visits are less frequent among regionally based women compared to their urban counterparts.²⁴ As a result, medical practitioners have fewer opportunities to undertake physical activity counselling with their regionally based patients. This is of concern considering medical practitioner advice is considered a powerful motivator to increase physical activity levels due to perceived practitioners' credibility and authority.²⁵ This is especially important among pregnant women who consider pregnancy as an opportune time to implement healthy lifestyle changes.²⁶ Furthermore, physical activity counselling has been found to be both effective and feasible within the general population and pregnant women.²⁷ Access to transport

and facilities such as outdoor gyms, pregnancy-specific exercise classes and walking paths have also been shown to be reduced among women living in regional areas of Australia.

Based on previous general population research, we expected women living in regional areas would be less physically active than urban women.²⁴ The present results suggest this may not be the case, with the significant reduction in exercise frequency, intensity and duration in pregnant women observed regardless of geographical location. Therefore, paying extra attention to regionally based geographical locations in the development and implementation of interventions and health initiatives may not be needed.

The above finding of a significant decrease in level of physical activity from before to during pregnancy strongly suggests the need for tailoring physical activity interventions and health initiatives in pregnant women, regardless of geographical location. Importantly, these interventions should aim to increase women's exercise behaviours before and during pregnancy in accordance with the appropriate activity guidelines. Furthermore, increased attention may be needed for women in their second and third trimesters in an attempt to keep them sufficiently physically active throughout their entire pregnancy. Moreover, there are many well documented barriers (e.g. parity, trimester of pregnancy, mothers that already have children) that women face when becoming pregnant which may impact on their ability to become or remain sufficiently physically active during pregnancy. These barriers should also be taken into consideration when developing interventions and recommendations to pregnant women about exercise.^{28,29} Currently inactive women who become pregnant should be encouraged to commence an exercise routine during pregnancy and work progressively towards an accumulation of 150 min of moderate-intensity aerobic exercise per week.⁵ Currently active women who become pregnant should also be encouraged to continue their exercise routine during pregnancy and work towards an accumulation of 300 min of moderate–high intensity aerobic exercise per week.⁶ Inactive or active, pregnant women should also be encouraged to exercise on most, if not all days of the week, as well as participate in 2 sessions of strength-training per week.^{5,6}

There are a number of strengths and limitations of the present study that should be considered when interpreting the findings. First, the sample was a convenience sample of pregnant women from Rockhampton, Queensland. Thus the findings may not be generalizable to pregnant women living in other areas of Australia, such as major urban areas or very remote areas. Second, the sample size was too small to perform secondary analysis to investigate factors and possible barriers associated with pregnant women and their exercise behaviours. Such analyses are recommended in future studies to provide greater insight into when health initiatives may be most needed. Third, self-report measures were used with no objective measure of physical activity due to cost and impracticality.³⁰ Finally, participants were asked to recall physical activity before pregnancy retrospectively (potentially from 6 months prior) before becoming pregnant. Future longitudinal investigations that access physical activity both before and during pregnancy within a population-based sample are recommended. Of note, compared to other Australian-based studies, this study has concurrently examined the exercise behaviours of pregnant women in regards to the specific FITT exercise principles. While previous studies have established an 'overall reduction' in activity among pregnant women, the current study provides much needed information on changes to the frequency, intensity, time and type of exercise undertaken by pregnant women before and during pregnancy. Since these factors determine the benefit to be gained from undertaking an exercise program, understanding exercise behaviours in relation to each of the FITT principles is essential for guiding future policy and practice.

5. Conclusion

Exercising in accordance with exercise during pregnancy guidelines is important for the health of both the mother and unborn child. The present study provides detailed and important insights into the FITT exercise behaviours of regionally based Australian women suggesting that women significantly reduce their exercise frequency, intensity, time and type of exercise once they become pregnant. Importantly, these decreases result in a minority of pregnant women exercising sufficiently enough to obtain the associated health benefits for both themselves and the unborn child. Additionally, the present data show that exercise behaviours of regionally based women are similar to that of their urban-dwelling counterparts before and during pregnancy. This consistent finding among pregnant women in Australia strongly suggests the need to increase exercise participation and adherence among Australian women in accordance with appropriate activity guidelines both before and during pregnancy.

Practical implications

- Public health initiatives need to be developed to help increase exercise participation among women in accordance with peak industry body guidelines both before and during pregnancy.
- Public health initiatives need to address in detail the key exercise prescription principles of exercise frequency, intensity, time/duration and type.
- Interventions should encourage healthy pregnant women to accumulate at least 150 min of moderate–high intensity aerobic exercise, as well as participating in two sessions of strength training per week. Previously sedentary women should also be encouraged to participate in regular exercise during pregnancy to obtain associated health benefits for both themselves and their unborn child.
- Regionally based pregnant women in Australia display similar exercise behaviours to urban counterpart, thus tailoring interventions based on geographical location may not be necessary. However, other barriers to exercise prescription need to be further investigated as previous research suggests these are likely to impact on exercise levels in pregnant women.

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References

1. Kader M, Naim-Shuchana S. Physical activity and exercise during pregnancy. *Eur J Physiother* 2014; 16(1):2–9.
2. Mudd L, Owe K, Mottola M et al. Health benefits of physical activity during pregnancy: an international perspective. *Med Sci Sports Exerc* 2013; 45: 268–277.
3. Symons Downs D, Chasan-Taber L, Evenson K et al. Physical activity and pregnancy. *Res Q Exercise Sport* 2012; 83(4):485–502.
4. Nascimento S, Surita F, Cecatti J. Physical exercise during pregnancy: a systematic review. *Curr Opin Obstet Gynecol* 2012; 24:387–394.
5. Hayman M. Women in sport fact sheet series: pregnancy and exercise. SMA 2014.
6. Brown W, Bauman A, Bull F et al. *Development of evidence-based physical activity recommendations for adults (18–64 years)*, Australian Government Department of Health, 2012.
7. Evenson K, Barakat R, Brown W et al. Guidelines for physical activity during pregnancy: comparisons from around the world. *Am J Lifestyle Med* 2013; 8(2):102–121.
8. Mishra G, Loxton D, Anderson A et al. *Health and wellbeing of women aged 18 to 23 in 2013 and 1996: findings from the Australian Longitudinal Study on Women's Health*, Australian Government Department of Health, 2014.
9. Gjestland K, Bo K, Owe KM et al. Do pregnant women follow exercise guidelines? Prevalence data among 3482 women, and prediction of low-back pain, pelvic girdle pain and depression. *Br J Sports Med* 2013; 47(8):515–520.
10. Smedley J, Jancey J, Dhaliwal S et al. Women's reported health behaviours before and during pregnancy: a retrospective study. *Health Educ J* 2014; 73(1):28–40.
11. Sui Z, Moran L, Dodd J. Physical activity levels during pregnancy and gestational weight gain among women who are overweight or obese. *Health Promot J Aust* 2013; 24:206–213.
12. Dodd J, Turnbull D, McPhee A et al. Limiting weight gain in overweight and obese women during pregnancy to improve health outcomes: the LIMIT randomised controlled trial. *BMC Pregnancy Childbirth* 2011; 11(79):1–5.
13. Short C, Vandelanotte C, Rebar A et al. A comparison of correlates associated with adult physical activity behavior in major cities and regional settings. *Health Psychol* 2014; 33(11):1319–1329.
14. Currie S, Sinclair M, Murphy MH et al. Reducing the decline in physical activity during pregnancy: a systematic review of behaviour change interventions. *PLOS ONE* 2013; 8(6):e66385.
15. Stengel M, Kraschnewski J, Hwang S et al. 'What my doctor didn't tell me': examining health care provider advice to overweight and obese pregnant women on gestational weight gain and physical activity. *WHI* 2012; 22(6):e535–e540.
16. Entin P, Munhall K. Recommendations regarding exercise during pregnancy made by private/small group practice obstetricians in the USA. *J Sports Sci Med* 2006; 5(3):449–458.
17. Godin G, Shepard R. Godin Leisure-Time Exercise Questionnaire. *Med Sci Sports Exerc* 1997; 29:36–38.
18. Sui Z, Turnbull D, Dodd J. Enablers of and barriers to making healthy change during pregnancy in overweight and obese women. *Australas Med J* 2013; 6(11).
19. Wilkinson S, Miller Y, Watson B. Prevalence of health behaviours in pregnancy at service entry in a Queensland health service district. *Aust N Z J Public Health* 2009; 33(3):228–233.
20. Pereira M, Rifas-Shiman S, LKleinman K et al. Predictors of change in physical activity during and after pregnancy: Project viva. *Am J Prev Med* 2007; 32(4):312–319.
21. Ferraro Z, Gaudet L, Adamo K. The potential impact of physical activity during pregnancy on maternal and neonatal outcomes. *Obstet Gynecol Survey* 2012; 67(2):99–110.
22. Mishra G, Loxton D, Anderson A et al. *Health and wellbeing of women aged 18 to 23 in 2013 and 1996: findings from the Australian Longitudinal Study on Women's Health*, Australian Government Department of Health, 2013.
23. Andersen R, Blair S, Cheskin L et al. Encouraging patients to become more physically active: the physician's role. *Ann Intern Med* 1997; 127(5):395–400.
24. Phelan S, Phipps M, Abrams B et al. Practitioner advice and gestational weight gain. *J Womens Health* 2011; 20(4):585–591.
25. Aittasalo MJ, Raitanen TK et al. Is intensive counseling in maternity care feasible and effective in promoting physical activity among women at risk for gestational diabetes? Secondary analysis of a cluster randomised NELLI study in Finland. *Int J Behav Nutr Phys Act* 2012; 9(104).
26. De Costa D, Ireland K. Perceived benefits and barriers to leisure-time physical activity among pregnant women. *Women Health* 2013; 53(2):185–202.
27. Santos PC, Abreu S, Moreira C et al. Impact of compliance with different guidelines on physical activity during pregnancy and perceived barriers to leisure physical activity. *J Sports Sci* 2014; 32:1398–1408.
28. Evenson K, Wen F. Prevalence and correlates of objectively measured physical activity and sedentary behavior among US pregnant women. *Prev Med* 2011; 53:39–43.