# The therapeutic positional preferences of pregnant women

Jane F Ashby *BPhty, MPhty*
*Professional Practice Fellow, Barrington Physiotherapy Clinic, School of Physiotherapy, University of Otago, New Zealand*
Gillian M Johnson *PhD, MSC, FNZCP*
*Associate Professor, Centre for Health, Physical Activity and Rehabilitation, University of Otago, New Zealand*

## ABSTRACT

The study sought to identify the therapeutic positional preferences held by pregnant women at different stages of their pregnancy. This was a longitudinal, observational study on 13 healthy pregnant women. Participants were assessed at 20-22 weeks gestation in a face-to-face session where anthropometric data was gathered. Participants were then placed in each of three treatment positions (side lying, quarter turn from prone and forward leaning sitting) typical of those used in physiotherapy management. The positions were presented to the participants in random order and they were asked to rank their least to most preferred positions. Participants verbally repeated the task of ranking their positional preferences by telephone interview at 26, 32 and 38 weeks of their pregnancy. Photographs of the three treatment options had been issued to the participants to serve as a prompt prior to the commencement of the interview sessions. The results showed that the positional preferences are distinct and varied throughout pregnancy, and that side lying was the most preferred therapeutic position of the three options. Sitting was the second choice for most women and was increasingly favoured as pregnancy progressed. Pregnant women experiencing pain consistently preferred side lying over other positional options.

*Ashby JF, Johnson GM (2015) The therapeutic positional preferences of pregnant women. New Zealand Journal of Physiotherapy 43(3): 86-92. doi 10.15619/NZJP/43.3.03*

Key words: positions, pregnancy, patient perspective, preference

## INTRODUCTION

Pregnancy related low back or pelvic pain has been recognised as a medical entity since mentioned in the 4th century BC by Hippocrates. The topic has also been researched widely in the last century (Kanakaris et al 2011) and there is now recognition that the conditions of pregnancy-related pelvic girdle pain (PGP) and pregnancy-related low back pain (PLBP) are distinct clinical entities under the generic framework of pregnancy related lumbo-pelvic pain (PRLPP) (Wu et al 2004). Approximately 25% of women seek help for PRLPP during pregnancy, with 5% of women continuing to seek treatment at the postpartum phase (Wu et al 2004).

Research regarding PRLPP has predominantly focussed on the epidemiology (Ostgaard et al 1991, Robinson et al 2010, Wu et al 2004) and assessment (Gutke et al 2010, Mens et al 2001) and there is still a need for further evidence as to its optimal management (Pennick and Liddle 2013, Vermani et al 2010, Vleeming et al 2008). Further evidence on management of PRLPP is needed to ensure that the problems do not become chronic leading to reduced productivity and reduced activity levels, and potentially increasing costs to health systems.

Ligamentous laxity, weight gain and hyperlordosis are common physical changes associated with pregnancy (Borg-Stein et al 2005) and physiotherapists must adapt their usual practice accordingly. For example, when positioning women in pregnancy prior to undertaking manual therapy the physical changes of increased abdominal girth must be acknowledged and steps taken to eliminate risk and optimise patient comfort. However, information regarding patient-level choices of comfort and positions applicable to physiotherapy over the three trimesters of pregnancy is lacking. Knowledge about patient preferences in body position during pregnancy will assist physiotherapists to deliver more comfortable and safer therapy options, and thereby potentially improve patient outcomes.

Many studies investigating body position in pregnancy have been conducted with the intention of informing the medical profession for anaesthetic or surgical interventions at full term of pregnancy and around the time of delivery. Collectively, there is evidence that side lying (preferably left side lying) is the optimal position in the later stages of pregnancy from a physiological and haemodynamic perspective. (Almeida et al 2009, Armstrong et al 2011, Bamber and Dresner 2003, Ellington et al 1991, Kienzl et al 2014, Tamas et al 2007). The supine position causes occlusion of the inferior vena cava and aorta from the gravid uterus (Ellington et al 1991, Kienzl et al 2014), and in the side lying position, maternal cardiac output, renal excretion and hormonal changes (Almeida et al 2009, Bamber and Dresner 2003) are all improved. Sitting is known to be less beneficial than side lying for maternal cardiac index measurements (Armstrong et al 2011). Foetal responses are also improved when the mother is in left side lying compared with the supine lying position (Tamas et al 2007).

Physiotherapists may see pregnant patients at any stage of pregnancy, often well before full term, and so there is a need to investigate their therapeutic positional choices at various stages of pregnancy. A good understanding of the risks and benefits of various positions in pregnancy appropriate for treatment is imperative to ensure that physiotherapists are able to inform the patient and discuss the available options, then come to a mutually agreeable decision. The patient-led decision making process is considered to be vital in other facets of obstetric care (Dugas et al 2012). Although this is extended into the

physiotherapy field, there is little information on views and opinions regarding pregnant women's preferences of possible treatment position options. Therefore, the aim of this study was to identify the therapeutic positional preferences of pregnant women at four different stages of pregnancy. These stages were selected to represent a longitudinal capture of possible changes throughout pregnancy rather than any distinct physical or physiological stages of pregnancy.

## METHODS

### Participants

Thirteen pregnant women were recruited by advertising in local midwifery clinics, physiotherapy practices and hospital departments, and by direct referrals from two maternity clinics in suburban Christchurch. Women were included in the study if they had reached 20 weeks gestation of a normal pregnancy (as determined by their charge midwife). Exclusion criteria were women with a high risk pregnancy, a verified diagnosis of spinal problems or serious musculoskeletal disease and/or a history of spinal fracture, neoplasm or spinal or pelvic surgery. This study was approved by the Upper South B Regional Ethics Committee (Authorisation reference URB/11/EXP/042). Participants were provided with both verbal and written information on the study, as well as providing written consent prior to entering the study.

### Procedure

#### *Initial Assessment*

An assessment was scheduled at a convenient time for each of the participants no later than 22 weeks gestation. Baseline information of age (years), weight (kg) and height (cm) along with details regarding the current pregnancy, and previous pregnancies and births was gathered. The history of current and previous back pain was documented and their favoured sleep position was established. Participants also completed a body chart indicating location of their current back pain (if any). The Oswestry Low Back Pain Disability Questionnaire (Fairbank et al 1980) was used to evaluate any physical disability attributable to back pain. The Pelvic Girdle Questionnaire (PGQ) (Stuge et al 2011), which is a condition-specific measure of disability due to PGP, was also completed in order to differentiate symptoms unrelated to this condition. Participants were assessed with the Active Straight Leg Raise (ASLR) Test (Mens et al 2001). The ASLR Test was chosen over other provocation tests on the basis of its ability to differentiate individuals with PGP from healthy subjects (Mens et al 2001) along with the demonstration of it having sound clinimetric properties in pregnant women (Mens et al 2001, Roussel et al 2007). However, it is worthy of note that the ASLR Test does not exclusively test for PGP, and can be predictive of low back pain conditions, such as possible lumbar instability (Rabin et al 2013).

Operational definitions were determined for each of the three positions offered as treatment options for the purpose of this study: sitting leaning forwards (Figures 1A & B); side lying (Figure 1C); quarter turn from prone (Figure1D). The participants were then placed in these three therapeutic positions in randomised order. The random order was determined using an online tool (www.random.org). The positions were each sustained for three minutes duration and on completion of the trial, participants ranked the positions in order of their least to most preferred position. Photo cue cards of the positions were used to assist participants with the ranking. The participants were also invited to justify their ranking choice of positional preference. It was not stipulated at any stage whether the side lying and quarter turn from prone positions should be left or right sided as this was decided by individual preference. Documentation of the side selected was not undertaken.

#### *Follow-up phase*

Follow up telephone interviews were made at 26, 32 and 38 weeks gestation. Information was gathered through questioning on the participant's current preferred sleeping position and any new additional onset of pain. The interview questions were not formally standardised, however specific information was gathered and recorded on a data collection sheet so as to minimise misinterpretation of the information being gathered.

The participants were asked to trial the positions at home (there was no randomisation, nor standardised time spent in each position at this stage) and to again rank them in order of preference, stating their reasons for their preferences. In order to make this easy for the participants to carry out independently the same photo cue cards were used, which had been given to each of the participants at their preliminary data collection session to serve as a prompt for the telephone interview.

## RESULTS

### Participants

Thirteen participants volunteered for the study, mean age 30, standard deviation (SD) 3.1 years (range 26-38 years) with a mean height of 164 cm (SD 6.2 cm) and mean weight 63.5 kg (SD 6.5 kg). Parity ranged from 1 to 5 children with a mean parity of 2 (SD 1.3) and mode of 1. All participants stated their ethnicity to be New Zealand European.

The opinions of all 13 participants regarding their positional preference were gathered on four separate occasions excepting on the last session (38 weeks of pregnancy) where four of these participants were lost to the study as they had delivered their (healthy) babies slightly prematurely. There were no reported adverse problems associated with any of the participants' involvement with the study.

Eight participants stated they were pain free, three reported PGP and two reported lumbar pain at the 20 week recruitment stage. Four of the seven women of the multigravida status group had experienced PRLPP previously. Eight participants registered a score on the Oswestry questionnaire and PGQ ranging from 0-13/50 and 0-65/100 respectively. The individual Oswestry and PGQ scores are shown in Table 1.

The ASLR Test (Mens et al 2001) was self-rated as negative for all participants with the exception of one individual who reported a slight difficulty in raising the legs with the test. The examiner noted three participants who had reported PGP at 20 weeks had a slight difficulty (scoring 1/5) with the ASLR test with minor trunk rotation. In one of these cases, the participant's PGP had resolved by the 26 week stage, with the other two participants continuing to have PGP throughout their pregnancy.

**Table 1: Baseline (20 weeks gestation) individual and group mean and standard deviation (SD) scores for both the Oswestry low back pain and pelvic girdle questionnaires (n=13)**

| Participant number | Owestry Low Back Pain Questionnaire Score out of 50 | Pelvic Girdle Questionnaire Score out of 100 |
|---|---|---|
| 1 | 0 | 0 |
| 2 | 8 | 19 |
| 3 | 13 | 65 |
| 4 | 0 | 4 |
| 5 | 3 | 1 |
| 6 | 0 | 0 |
| 7 | 2 | 8 |
| 8 | 0 | 0 |
| 9 | 0 | 9 |
| 10 | 0 | 30 |
| 11 | 0 | 0 |
| 12 | 0 | 0 |
| 13 | 2 | 7 |
| Mean (SD) score | 2.15 (3.98) | 11.00 (18.54) |

### Therapeutic positional preferences

At 20 weeks as a group, the participants' most preferred position was side lying (69%, n= 9) with only one participant ranking this position to be their least preferred option (Figure 2). The least preferred position for all other participants was that of quarter turn from prone (54%, n= 7) though one participant determined this to be her most preferred position (Figure 3).

At the second recording phase (26 weeks) the participants became more polarised in their ranking with the quarter turn from prone increasing in both the least and most preferred selections (Figure 3). Side lying remained the most favoured position at 26 weeks (Figure 2).

At 32 weeks of pregnancy side lying was ranked as the first choice by 54% (n=7) of participants (Figure 2). Conversely, sitting increased in popularity as equally likely to be chosen as first or second choice with five participants respectively (Figure 4). Quarter turn from prone remained unpopular being the least preferred position choice for the majority of participants (Figure 3).

None of the participants in the final stage of data collection (38 weeks) chose quarter turn from prone as their preferred therapeutic position (Figure 3). Here, side lying was the most preferred position at 67% (n=6) for first choice (Figure 2). Sitting was found to be the most favoured position for three participants, and also the least favoured position for another four participants (Figure 4).

Overall, 12 of the 13 participants had changed their preferences at some stage of their pregnancy. The one participant who did not change her preference throughout was not assessed at the 38 week stage due to an early delivery.

### Reasons for position choice rankings

Side lying was deemed to be the most comfortable and relaxing position for those participants who ranked this to be their preferred position. However at the 32 week stage there were negative comments of increasing back and pelvis pain, discomfort due to the position of the foetus, and shortness of breath when adopting the side lying option, therefore making the sitting position, initially not deemed to be as relaxing, a more preferred option. By 38 weeks side lying was the outright preferred position again due to

**Figure 1A: Sitting leaning forwards: Participant sits with knees apart and upper body supported with arms on a raised table or plinth, keeping the back straight.**

**Figure 1B: Sitting astride a chair: Participant sits astride a chair in a leaning forward position while supporting the upper body on the back of the chair, and keeping the back straight.**

**Figure 1C: Side lying: Participant in side lying with bilateral hip and knees flexion separated by a pillow placed between the knees.**

**Figure 1D: Quarter turn from prone: Participant lies as far into prone as possible with the upper knee and hip flexed and the lower leg straight. The lower arm should be behind the trunk in this position.**

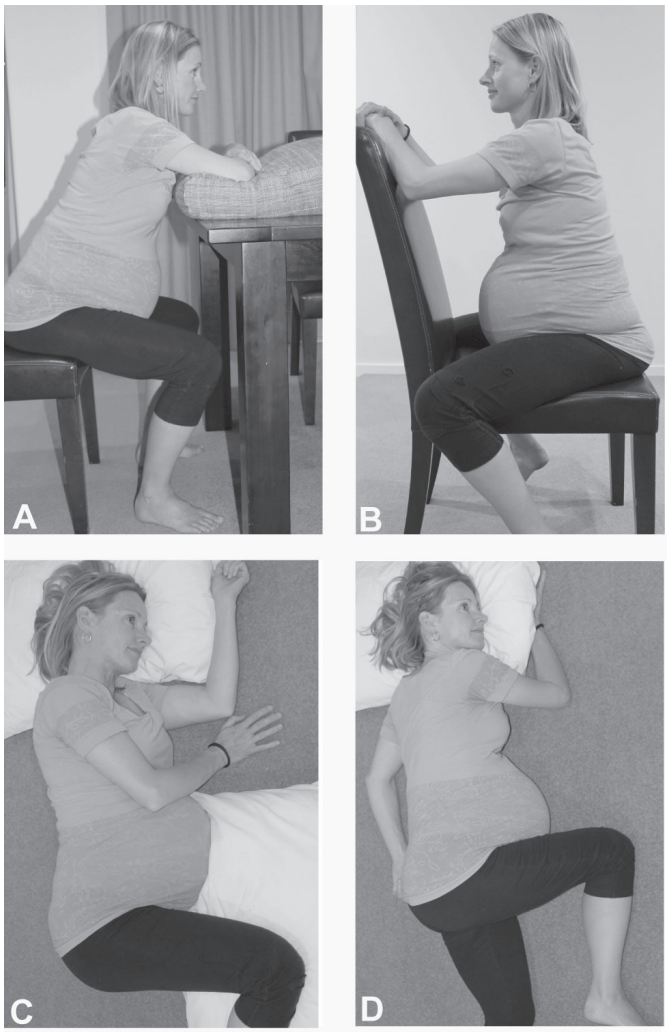


**Figure 2: Side lying rankings as the "preferred therapeutic position" at four different stages of pregnancy.**

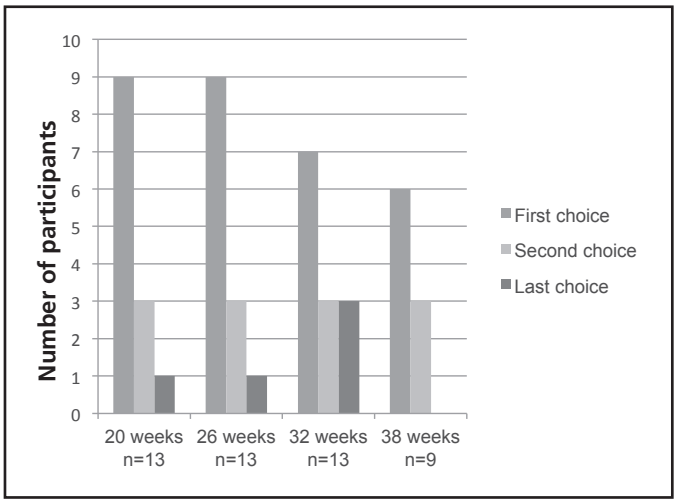



**Figure 3: Quarter turn from prone rankings as the "preferred therapeutic position" at four different stages of pregnancy.**

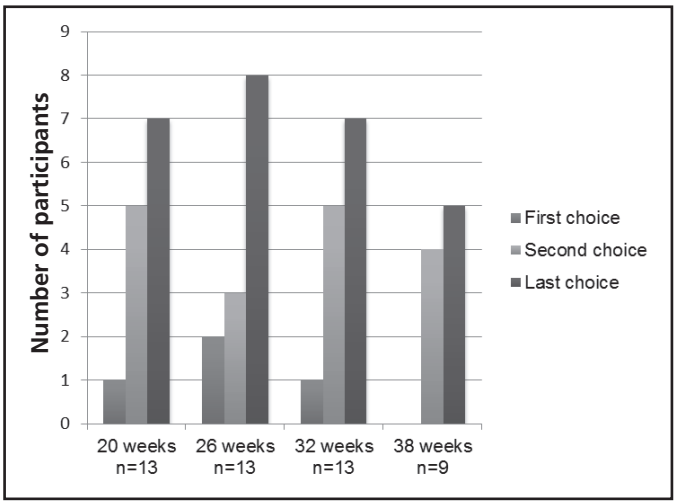
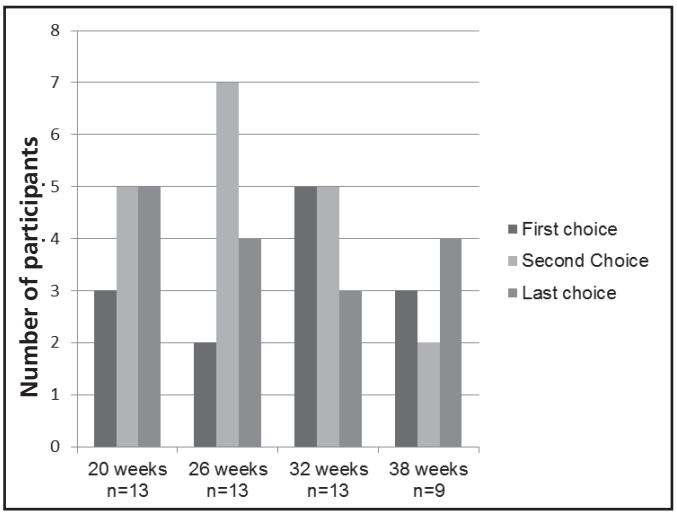



**Figure 4: Sitting rankings as the "preferred therapeutic position" at four different stages of pregnancy.**




feelings of increased comfort in this position, and sitting became less desirable due to the low position of the foetus.

Although quarter turn from prone ranked the least preferred position in all stages of pregnancy the participants who preferred it at the 20 week stage of pregnancy found it to be supportive and similar to their sleeping position. It was suggested that altering the underneath arm position would increase the comfort of this position.

### The presence of pain

The participants' pain status results show an increase in the prevalence of PRLPP throughout pregnancy (Table 2). For ease of collation those participants reporting a combination of lumbar and PGP were assigned to the PGP group. At 26 weeks two participants had experienced flu-like symptoms and found it difficult to specify the nature of their pain.

Five of the participants stated they had pain at the 20 week recruitment stage, three of these had PGP. One of the participants with PGP preferred side lying until 38 weeks when sitting became more comfortable. Another participant with PGP preferred the sitting position throughout pregnancy until 38 weeks when the baby's position caused discomfort in sitting and therefore side lying was preferred. The third participant with PGP preferred side lying throughout her pregnancy to 32 weeks, however the 38 week data were not collected due to early delivery of the baby. Overall, side lying was the preferred position for those women with lumbo-pelvic or thoracic pain as shown in Figure 5.

## DISCUSSION

This study aimed to identify the therapeutic positions preferred by pregnant women at different stages of their healthy pregnancies, to address the existing lack of information regarding maternal comfort applicable to physiotherapy treatment positions. The results showed that side lying was the overall preferred position throughout pregnancy in this group of pregnant women, including those experiencing pain. The sitting position was the second most preferred position and also tended to be more popular in the early part of the third trimester of pregnancy during the time of their pregnancy when the women may have been experiencing more discomfort or pregnancy-related pain. The option of quarter turn from prone was the least preferred position at all stages of pregnancy. A variation of the quarter turn from prone position is suggested as an acceptable alternative, whereby the lower arm is placed forward from the body if rotation of the thoracic spine is considered to be acceptable to the woman receiving treatment and, if it is appropriate for the therapeutic intervention.

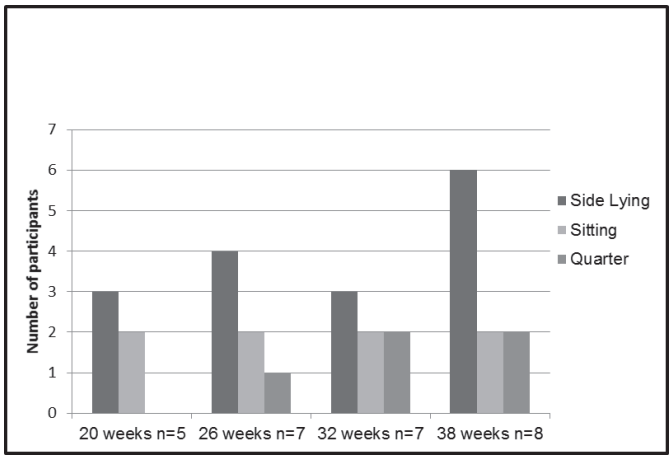
The results in this study indicate that side lying is the preferred therapeutic position choice and these results correlate well to the physiological changes taking place over the duration of pregnancy. In the side lying position, the gravid uterus is able to release compression of the inferior vena cava and aorta, which advantageously improves cardiac output and consequently, renal perfusion (Almeida et al 2009, Bamber and Dresner 2003). Consequently, there is a consensus that side lying is recommended for physiological reasons as the position of

**Table 2: Prevalence and classification of participants experiencing pain at four stages of pregnancy**

| | 20 weeks (n=13) | 26 weeks (n=13) | 32 weeks (n=13) | 38 weeks (n=9) |
|---|---|---|---|---|
| Number of participants reporting pain | 5 | 7 | 7 | 8 |
| Lumbar pain | 2 | 2 | 2 | 1 |
| Positional preference for lumbar pain | Side (1) | Side (1) | Side (1) | Side (1) |
| | Sitting (1) | Sitting (1) | Quarter turn (1) | |
| Pelvic girdle pain | 3 | 4 | 4 | 3 |
| Positional preference for pelvic girdle pain | Side (2) | Side (3) | Side (2) | Side (3) |
| | Sitting (1) | Sitting (1) | Sitting (2) | Sitting (2) |
| "Other pain" | 0 | 1 | 1 (rib) | 2 (rib) |
| *Positional preference for "other pain"* | | *Quarter turn from prone (1)* | *Quarter turn from prone (1)* | *Side (2)* |

Notes: Positional preference noted as the (number of participants selecting each position) as their first choice for each type of pain

**Figure 5: Position preferences for participants with pain at four different stages of pregnancy.**




choice for surgical and medical procedures at the latter stages of pregnancy (Almeida et al 2009, Armstrong et al 2011, Bamber and Dresner 2003, Ellington et al 1991, Kerr et al 1964).

Lying flat positions can create a feeling of shortness of breath in women in pregnancy due to the growing foetus. Similarly, reflux or dyspepsia can become a problem when lying flat. Heartburn symptoms may be due to hormonal changes in the body causing oesophageal sphincter relaxation or physical pressure on the stomach allowing acid reflux into the oesophagus (Keller et al 2008). An inclined position could help relieve this discomfort and women suffering from these symptoms may prefer to adopt the sitting position.

As pregnancy progresses into the latter part of the third trimester and the foetus descends in preparation for birth, some of the symptoms of reflux and shortness of breath may be reduced. Aches and pains may alter for the mother with this change in foetal position by changing forces and pressure through the pelvis and therefore it is reasonable to expect that the preferred therapeutic positions will alter accordingly. A change in foetal position may account for the tendency to select the side lying position towards the end of pregnancy and why the sitting position is less comfortable for some women.

Lying in the prone position for therapeutic intervention is not usually possible for women in later stages of pregnancy even though it is known that compression of the maternal large blood vessels by the gravid uterus is eliminated when adopting the prone lying position (Nakai et al 1998). Prone positioning is not used often because beds that allow for this position in pregnancy are not readily available in most physiotherapy settings. The closest position to prone lying that was examined in this current study was the quarter turn from prone, which was found to be the least preferred position at all the stages of pregnancy, often due to awkwardness of the arm position.

As part of the feedback in this study, some of the participants stated that their lumbo-pelvic pain was more noticeable in the quarter turn from prone position. In the quarter turn from prone position the pelvis is subjected to some torsion with one leg flexed and the other leg extended which may create physical challenges for some pregnant women. Although quarter turn from prone was rarely ranked as the favourite treatment position it was often the second choice. The gravitational effect of the uterus on the abdominal blood vessels is reduced in the quarter turn from prone position, as it is with side lying, and a greater level of abdominal support gave some participants a degree of comfort.

The small sample size is a notable limitation of the current study. A larger sample size would have provided more representative data and analysis of those pregnant women who experience PRLPP and their associated positional preferences. The lack of an independent examiner to carry out the testing and interviewing is a further limitation that needs to be acknowledged. Although the telephone interviewing was carried out in order to gather specific information the interview process was not strictly standardised. One of the strengths of the study is the longitudinal nature of the study design

which allowed the preferences of the women to be monitored throughout their pregnancies. Consequently, relevant information was obtained for physiotherapists who often treat women well before the end of pregnancy.

Future research should now focus on positional preferences for those women seeking treatment for PRLPP. In such research the classification of participants into subgroups of lumbar pain, PGP or alternatively, a combination of these two conditions, as documented by Gutke et al (2010) will assist the analysis of treatment position preference for various clinical presentations.

## CONCLUSION

Pregnant women demonstrate definite positional preferences throughout their pregnancy. Side lying was found to be the preferred therapeutic position applicable to physiotherapy in a small group of women experiencing a normal pregnancy. The position preferences of the women match well with the known physiological changes experienced in different stages of pregnancy thereby highlighting the need for physiotherapists to take the stage of pregnancy and the woman's individual preference into account when considering an intervention.

## KEY POINTS

- The following recommendations are made relating to positioning choices for pregnant women when seeking physiotherapy. Positional preferences are distinct and varied throughout pregnancy. Information regarding the pregnant woman's preferred sleeping and sitting positions is a useful guide to positional preference for treatment.
- Most women prefer to lie in the side lying position for treatment in the early stages of pregnancy.
- The sitting position is an alternative option for consideration in the third trimester of pregnancy.
- The supine position should be avoided later in pregnancy due to the compromise of the cardio-vascular and haemodynamic system.
- Adapting the side lying treatment position with pillows and leg position should allow comfort and relaxation for specific techniques or interventions if required.

## PERMISSIONS

This study was approved by the Upper South B Regional Ethics Committee (Authorisation reference URB/11/EXP/042) along with feedback from the Ngāi Tahu Research Consultation Committee, University of Otago. Written permission for the purposes of publication was obtained from the individual in the figures. Participants were provided with both verbal and written information on the study as well as providing written consent prior to entering the study.

## DISCLOSURES

No conflicts of interest have been identified for this research.

## ACKNOWLEGEMENTS

The study participants who offered their commitment to this study at a time when living in post-earthquake Christchurch was a challenge in itself. The Midwives on Barrington, Halswell Village Midwives and the Physiotherapy Department of the Christchurch Women's Hospital who offered their time and expertise to this study are also thanked.

## FUNDING SOURCE

Canterbury Physiotherapy Charitable Trust, Physiotherapy New Zealand

## ADDRESS FOR CORRESPONDENCE

Jane Ashby. Postal Address: Barrington Physiotherapy Clinic, PO Box 33102, Christchurch, New Zealand; Phone: 03 3322627; Fax: 03 3379003 Email: jane.ashby@otago.ac.nz

## REFERENCES

Almeida FA, Pavan MV, Rodrigues CIS (2009) The haemodynamic, renal excretory and hormonal changes induced by resting in the left lateral position in normal pregnant women during late gestation. *BJOG: An International Journal of Obstetrics and Gynaecology* 116: 1749-1754. doi:10.1111/j.1471-0528.2009.02353.x

Armstrong S, Fernando R, Columb M, Jones T (2011) Cardiac index in term pregnant women in the sitting, lateral, and supine positions: An observational, crossover study. *Anesthesia and Analgesia* 113: 318-322. doi:10.1213/ANE.0b013e31821f125c

Bamber JH, Dresner M (2003) Aortocaval compression in pregnancy: The effect of changing the degree and direction of lateral tilt on maternal cardiac output. *Anesthesia and Analgesia* 97: 256-258.

Dugas M, Shorten A, Dube E, Wassef M, Bujold E, Chaillet N (2012) Decision aid tools to support women's decision making in pregnancy and birth: a systematic review and meta-analysis. *Social Science and Medicine* 74: 1968-1978. doi: 10.1016/j.socscimed.2012.01.041

Ellington C, Katz VL, Watson WJ, Spielman FJ (1991) The effect of lateral tilt on maternal and fetal hemodynamic variables. *Obstetrics and Gynecology* 77: 201-203.

Fairbank JC, Couper J, Davies JB, O'Brien JP (1980) The Oswestry low back pain disability questionnaire. *Physiotherapy* 66: 271-273.

Gutke A, Kjellby-Wendt G, Oberg B (2010) The inter-rater reliability of a standardised classification system for pregnancy-related lumbopelvic pain. *Manual Therapy* 15: 13-18. doi:10.1016/j.math.2009.05.005

Kanakaris NK, Roberts CS, Giannoudis PV (2011) Pregnancy-related pelvic girdle pain: An update. *BMC Medicine* 9. doi:10.1186/1741-7015-9-15

Keller J, Frederking D, Layer P (2008) The spectrum and treatment of gastrointestinal disorders during pregnancy. *Nature Clinical Practice Gastroenterology and Hepatology* 5: 430-443. doi:10.1038/ncpgasthep1197

Kerr MG, Scott DB, Samuel E (1964) Studies of the inferior vena cava in late pregnancy. *British Medical Journal* 1: 532-533.

Kienzl D, Berger-Kulemann V, Kasprian G, Brugger PC, Weber M, Bettelheim D, Pusch F, Prayer D (2014) Risk of inferior vena cava compression syndrome during fetal MRI in the supine position - a retrospective analysis. *Journal of Perinatal Medicine* 42: 301-306. doi:1 0.1515/jpm-2013-0182

Mens JM, Vleeming A, Snijders CJ, Koes BW, Stam HJ (2001) Reliability and validity of the active straight leg raise test in posterior pelvic pain since pregnancy. *Spine* 26: 1167-1171.

Nakai Y, Mine M, Nishio J, Maeda T, Imanaka M, Ogita S (1998) Effects of maternal prone position on the umbilical arterial flow. *Acta Obstetricia et Gynecologica Scandinavica* 77: 967-969.

Ostgaard HC, Andersson GB, Karlsson K (1991) Prevalence of back pain in pregnancy. *Spine* 16: 549-552.

Pennick V, Liddle SD (2013) Interventions for preventing and treating pelvic and back pain in pregnancy. *Cochrane Database of Systematic Reviews: The Cochrane Collaboration*. doi:10.1002/14651858.CD001139.pub3

Rabin A, Shashua A, Pizem K, Dar G (2013) The interrater reliability of physical examination tests that may predict the outcome or suggest the need for lumbar stabilization exercises. *Journal of Orthopaedic and Sports Physical Therapy* 43: 83-90. doi:10.2519/jospt.2013.4310

Robinson HS, Veierod MB, Mengshoel AM, Vollestad NK (2010) Pelvic girdle pain - Associations between risk factors in early pregnancy and disability or pain intensity in late pregnancy: A prospective cohort study. *BMC Musculoskeletal Disorders* 11. doi:10.1186/1471-2474-11-91

Roussel N, Nijs J, Truijen S, Smeuninx L, Stassijns G (2007) Low Back Pain: Clinimetric Properties of the Trendelenburg Test, Active Straight Leg Raise Test, and Breathing Pattern During Active Straight Leg Raising. *Journal of Manipulative and Physiological Therapeutics* 30: 270-278. doi:10.1016/j.jmpt.2007.03.001

Stuge B, Garratt A, Jenssen H, Grotle M (2011) The pelvic girdle questionnaire: A condition-specific instrument for assessing activity limitations and symptoms in people with pelvic girdle pain. *Physical Therapy* 91: 1096-1108. doi:10.2522/ptj.20100357

Tamas P, Szilagyi A, Jeges S, Vizer M, Csermely T, Ifi Z, Balint A, Szabo I (2007) Effects of maternal central hemodynamics on fetal heart rate patterns. *Acta Obstetricia et Gynecologica Scandinavica* 86: 711-714. doi:10.1080/00016340701252217

Vermani E, Mittal R, Weeks A (2010) Pelvic girdle pain and low back pain in pregnancy: a review. *Pain Practice* 10: 60-71. doi:10.1007/s00586-008-0602-4

Vleeming A, Albert HB, Ostgaard HC, Sturesson B, Stuge B (2008) European guidelines for the diagnosis and treatment of pelvic girdle pain. *European Spine Journal* 17: 794-819. doi:10.1007/s00586-008-0602-4

Wu WH, Meijer OG, Uegaki K, Mens JMA, Van Dieen JH, Wuisman PIJM, Ostgaard HC (2004) Pregnancy-related pelvic girdle pain (PPP), I: Terminology, clinical presentation, and prevalence. *European Spine Journal* 13: 575-589. doi:10.1007/s00586-003-0615-y