Pregnancy-related Pelvic Girdle Pain and Pregnancy Massage: Findings from a Subgroup Analysis of an Observational Study

Sarah Fogarty, PhD,[1*] Catherine McInerney, Dip Remedial Massage,[2] Phillipa Hay, PHD[1]

[1]School of Medicine, Western Sydney University, Sydney NSW, Australia, [2]Pregnancy Massage Australia, Wandiligong VIC, Australia

Background: Pregnancy-related pelvic girdle pain (PPGP) significantly impacts women's lives both physically and psychologically. Given the severity and impact of PPGP on pregnancy, the authors anticipated that pregnant women with PPGP might respond differently to massage than pregnant women without PPGP.

Purpose: The aim of the study was to further analyze a published 2017 study to assess the response of pregnancy massage in participants with and without PPGP.

Setting: Two massage clinics, one in Sydney and one in Melbourne, recruited participants from December 2016 to December 2017.

Participants: Nineteen women with PPGP and 78 without PPGP.

Research Design: PPGP and non-PPGP women receiving at least one massage, with outcome measures assessed immediately prior to and after massage, and again one week postmassage.

Main Outcome Measures: Visual analog scales for pain, stress, range of movement, sleep, and self-reported side effects of massage.

Results: Both groups changed significantly and similarly over time for measures of pain, stress, range of motion, and sleep (all $p < .05$). Post hoc analysis found significant reduction in all outcome measures immediately following massage, but returned to baseline at one week postmassage for all measures except pain, which remained reduced for the PPGP group (49.79±25.68 to 34.75±34.75, $p = .03$, effect size 0.593), and stress remained reduced in the non-PPGP group (33.36±21.54 to 24.90±19.18, $p = .002$, effect size 0.373). The PPGP group entered the study with higher baseline levels of pain ($p = .01$) and a greater restriction in range of motion ($p = .006$) than the non-PPGP group. There was no difference in the number of side effects experienced between the two groups ($p = .130$).

Conclusions: Although PPGP clients report greater pain and restriction in range of motion at baseline than non-PPGP clients, the response to pregnancy massage was similar. Results support a role of pregnancy massage in the management of PPGP. More research on massage for PPGP is needed to confirm a lasting effect of pain reduction from massage.

KEY WORDS: pelvic girdle pain; massage; pregnancy

INTRODUCTION

Pregnancy-related pelvic girdle pain (PPGP) is pain in the pelvic area that may develop during pregnancy. PPGP is defined as "pain between the posterior iliac crest and the gluteal fold, particularly in the vicinity of the sacroiliac joint (SIJ), which may radiate to the thighs and hips".[1-4] Pain can be experienced in conjunction with—or separately to—pain in the pubic symphysis.[1,4-6] The prevalence of PPGP is not clear, with incidences ranging from 20% to 65% worldwide;[4,6-11] however, an Australian study reported a prevalence rate of 55%.[12]

PPGP significantly impacts women's lives, with literature demonstrating it limits daily activities, decreases quality of life, alters sleep patterns, impairs mobility, decreases independence, and decreases women's ability to care for their other children.[1,4,13,14] Further, women with PPGP are more likely to have depression, report social isolation, and take more sick leave from work than women without PPGP.[12,14,15] In some cases, women with PPGP are so severely impacted that they are housebound, and have reported taking more than the

recommended doses of analgesia in attempts to reduce pain.[14]

Risk factors for the development of PPGP include previous low back or pelvic pain before pregnancy and/or during pregnancy,[1,6] pain in multiple pelvic locations or sites which also increases pain severity,[6,16] multiparity,[1] increased body mass,[1] history of trauma to the back or pelvis, and emotional distress.[1,6] The exact etiology of PPGP is not known, but it is believed to be multifactorial and related to "hormonal, biomechanical, traumatic, metabolic, genetic, and degenerative factors" (p.439).[1] Research has postulated that pelvic stability (generated by muscles, fascia, and ligaments), impaired load transfer (thought to involve the sacrospinous ligament and superficial sacroiliac joint structures such as the long dorsal sacroiliac ligament), and/or altered pelvic mechanisms and/or motor control (excessive and insufficient motor activation of the lumbopelvic and surrounding musculature such as transverse abdominals and pelvic floor muscles) are involved in the pathogenesis of PPGP.[16]

Research has found that health-care professionals might view PPGP as an accepted and expected symptom of pregnancy and thus fail to recommend management.[8,12] When management is recommended, there is no consensus about how to best manage PPGP; however, it is generally managed conservatively with a multidisciplinary approach that addresses pain, psychological impacts, and activity modification.[1,7] Physiotherapy, general practitioner consultations, and analgesia are common approaches to manage PPGP,[7,17] but these approaches do not suit all women. Some women do not want to take medication and some women do not respond to common approaches of pain reduction and or management.[8,14,17-19]

In Australia, remedial massage is defined as a complementary therapy which aims to systematically assess and treat muscles, tendons, ligaments, and connective tissue of the body that are damaged, knotted, tense or immobile, and assist in rehabilitation, pain, and injury management.[20] Massage is a popular, non-pharmacological treatment option to reduce or manage PPGP; however, there is limited information on the effectiveness of massage as a treatment for PPGP.[8,9,21] A 2016 systematic review and meta-analysis investigated pregnancy-related back and pelvic pain and found positive effects for osteopathy and massage on pain intensity;[22] however, the only available studies on massage investigated its effect on pregnancy-related low back pain, not PPGP.[23] Given the paucity of research on the efficacy of massage for pregnant women with PGP, it is not known how women with PPGP may respond to massage. The aim for the present study was a subgroup analysis of massage in participants with and without PPGP from our published study.[24]

METHODS

This paper reports a subgroup analysis of pregnant women with PPGP compared to all other pregnant participants from the former prospective observational study.

Diagnosis of PPGP is based on clinical assessment, including pain location and several clinical tests. However, in Australia massage therapists are not able to diagnose any condition. Therefore the criteria for PPGP for the study was based on pain location, and included individuals who presented complaining of pain in the pelvic region such as gluteal, pubic, and/or sacroiliac pain. This information was collected via the client intake form. No formal diagnosis of PPGP by a health-care professional (e.g., physiotherapist, osteopath or General Practitioner) was required for participation in the study.

Ethics

All participants provided informed consent prior to their inclusion in the study. Ethics approval was obtained from Human Research Ethics Committee of Western Sydney University. The ethics approval number is H11819.

Participants, Intervention and Outcome Measures

Participants

The study participants included 97 women, greater than 18 years of age, who received a pregnancy massage at two massage clinics in Australia in 2017. Participants were a convenience sample of pregnant women who choose to use massage therapy during their pregnancy. Informed consent was obtained for all participants.

Intervention

The treatment was undertaken at two clinics in Australia (one in Victoria and

one in New South Wales). As the women were paying clients of the two clinics, they received the style and type of massage that they wanted and treatments were individualized to the client including style of massage, areas treated, and the type of massage techniques used. Treatment could involve the whole body or just the areas that the client requested ('the problem' areas). Both clinics predominately use Swedish massage techniques utilizing the following massage strokes: gliding (both longitudinal and transverse), kneading, cross-frictional work (transverse frictions), static holds (digital ischemic pressure), and muscle stretching. Both clinics generally treat in the side-lying position, but this was dependent on the presentation of the client on the day. Both clinics offered the choice of 60-minute, 75-minute, and 90-minute pregnancy massage consultations.

Outcome Measures

The study used a client information and treatment form that collected information about participants past history, previous pregnancies, current pregnancy, health, the reason for the visit, and treatment data. Data were also collected on the effect of massage on commonly reported symptoms such as pain, stress, restriction of range of movement, and sleep. This was collected pre- and postmassage and one week postmassage via visual Analog Scales (VAS).[25-27] The scales ranged from 0 to 100. Data on the side effects of massage were collected one week postmassage via a self-reported online questionnaire and included information on massage side effects such as postmassage soreness.

Analysis

Data analysis was performed on participants' only or first visit for all aspects of the study other than treatment side effects. Demographic data for the two groups were presented including age, trimester at time of massage, gravida (number of times been pregnant), parity (number of pregnancies reaching viable gestational age), previous loss, and experience of pregnancy massage. A chi-squared test was used to compare demographic data between groups (PPGP group and non-PPGP group). The sub-group analysis involved the following two outcomes: a) the effect of massage on commonly reported symptoms of pain, stress, restriction of range of movement, and sleep; and b) massage side effects. For the PPGP and the non-PPGP group, the pre- and postmassage outcomes (e.g., stress, pain, sleep, and restriction of range of movement) were reported as mean scores with standard deviations.

Two-way ANOVA repeated measures looking at between-group effects as well as within-subject effects (group and time and interaction of group and time) were undertaken on the repeated outcomes (pain, stress, restriction of range of motion, and sleep) for the two groups (PPGP group and the non-PPGP group). Secondary analysis included analysis of individual group results with a post hoc test using the Bonferroni correction ($\alpha_{original} = 0.05$, $\alpha_{corrected} = 0.017$) to determine statistical differences between time points of the individual group results.

Effect sizes were calculated between pre- and postmassage scores, premassage and one week postmassage scores, and postmassage to one week postmassage scores within-group only. Effect sizes were interpreted as ≤ 0.2 trivial, 0.5 medium, ≥ 0.8 large.[28]

The data from the one-week follow-up regarding side effects were analyzed as incidences (e.g., postmassage soreness), and reported as a count and a percentage and a chi-squared test was undertaken to compare differences in side effects between the two groups (PPGP group and the non-PPGP group). Information collected on participants who had multiple treatments was presented descriptively as regards to patterns regarding postmassage side effects and number of treatments.

RESULTS

There were 19 individuals (19.6%) in the PPGP group and 78 (80.4%) individuals without PPGP.

Demographics

There were no statistical differences between the PPGP and non-PPGP groups for age, ($p = .425$) trimester in at time of massage $\chi^2(1, 97) = 1.523$, $p = .217$, gravida (number of times been pregnant) $\chi^2(1, 97) = 1.896$, $p = .168$, parity (number of pregnancies reaching viable gestational age) $\chi^2(1, 97) = 0$, $p = .996$, and experience of pregnancy

massage $\chi^2(1, 97) = 0.2571$, $p = .61$ (see Table 1). Women in both groups presented, on average, as 34 years-of-age, in their third trimester, having a singleton, and having been pregnant previously.

Six individuals in the PPGP group had multiple treatments (31.6%) and 23 individuals in the non-PPGP had multiple treatments (29.5%). The majority of the non-PPGP groups' treatments were 75-min sessions (n = 41) (52.6%), with 27 60-min treatments (34.6%) and three 90-min treatments (3.8%). The majority of the PPGP groups' treatments were either 75-min long (n = 10) (55.6%) or 60-min long (n = 8) (44.4%), with one participant receiving a 90-min session (5.6%). The majority of treatments for both groups (n=76 [97.4%] non-PPGP and n = 19 [100%] PPGP) involved a full body massage (back, gluteals, neck, arms, hands, leg, and feet), with a focus on the areas that the participant sought massage treatment for, while two of the non-PPGP treatments (2.6%) involved receiving a massage on only the problem areas.

Outcome Measures

The between-subjects effects shows there was a significant difference between the groups for pain $F(1, 77) = 7.055$, $p = .01$ and for restriction in range of motion $F(1, 77) = 7.973$, $p = .006$. There was no significant difference between the groups for stress or sleep.

The within-subject test indicates that there is a significant time effect for pain ($F(2, 154) = 26.677$, $p < .001$), stress ($F(1.9, 154) = 48.6743$, $p < .001$), restriction in range of motion ($F(2, 154) = 24.935$, $p < .001$), and sleep ($F(2, 77) = 21.070$, $p < .001$), indicating a decrease in pain, a reduction in stress, less restriction in range of motion, and better sleep across the study time frame.

The interaction of time and group is not significant for pain, stress, restriction in range of motion, nor sleep, indicating that that the groups are changing the same way over time.

Post hoc analysis found a significant reduction in all outcome measures immediately

TABLE 1. Participant Demographic and Other Features in Each Group at Baseline

	PPGP (n =19)	*Non PPGP (n = 78)*	*Statistics*
	Mean (SD)		*t test, p*
Age	34.8 (3.5)	34.0 (4.2)	$p = .425$
	n (%)		*Chi-squared (χ^2(df,n) p)*
Trimester in at time of massage • First trimester and second trimester combined • Third trimester	4 (21.1%) (1 in 1st & 3 in 2nd) 15 (78.9%)	28 (35.9%) (4 in 1st & 24 in 2nd) 50 (64.1%)	$\chi^2(1, 97) = 1.523$, $p = .217$
Having a singleton Having twins	18 (94.7%) 1 (5.2%)	78 (100%) 0 (0%)	n.a
Gravida (number of times been pregnant) First time been pregnant Been pregnant more than once	 5 (26.3%) 14 (73.7%)	 34 (43.6%) 44 (56.4%)	 $\chi^2(1, 97) = 1.896$, $p = .168$
Parity (number of pregnancies reaching viable gestational age) Not reached viable gestational age Reached viable gestational age	 9 (47.4%) 10 (52.6%)	 37 (47.4%) 41 (52.6%)	 $\chi^2(1, 97) = 0$, $p = .996$
Previous loss (type of loss unknown) Yes No	 7 (36.8%) 12 (63.2%)	 21 (26.9%) 57(73.1%)	 $\chi^2(1, 97) = 0.7321$, $p = .39$
Experience of pregnancy massage Previous experience No previous experience	 9 (47.4%) 10 (52.6.6%)	 42 (53.8%) 36 (46.2%)	 $\chi^2(1, 97) = 0.2571$, $p = .61$

following massage with all measures returning to baseline at one week post-massage except for pain, which remained reduced for the PPGP group (49.79±25.68 to 34.75±34.75, $p = .03$, effect size 0.593), and stress, which remained reduced in the non-PPGP group (33.36±21.54 to 24.90±19.18, $p = .002$, effect size 0.373) (see Table 2).

Massage Side Effects

The Rate of Participants Experiencing Side Effects Postmassage

In the PPGP group, eight individuals (42.1%) experienced one or more side effects, with the most common being postmassage soreness (n = 6), posttreatment soreness (n = 4), and an increase in pain (n = 2). In the non-PPGP group, 24 individuals (28.2%) experienced one or more side effects, with the most common being postmassage soreness (n = 15) and tiredness or fatigue (n = 5). Other side effects experienced by either group were headaches, dizziness, exacerbation of symptoms, Braxton Hick's worse day after massage, bruising, heightened anxiety, and unsettled digestion. See Table 3 for the side effects.

A chi-squared test indicated that self-rated side effects were not significantly different between massage groups for women with PPGP and without PPGP, $\chi^2 = 2.296$ (1, 95), $p = .130$. For individuals who received multiple massage treatments, there appeared to be no pattern regarding postmassage side effects; individuals in both groups experienced varied side effects at different time points.

DISCUSSION

The study found no differences in response to pregnancy massage for PPGP and non-PPGP participants. Both groups had significant positive changes over time, and the findings show that both groups

TABLE 2. Pain, Stress, Range of Movement and Sleep for Those with PPGP (N = 19) and Non-PPGP (N = 78)

	Before the Massage	*After Massage*	*One Week Postmassage*	*Pre- to Postmassage*	*Premassage to One Week Postmassage*	*Postmassage to One Week Postmassage*
	Mean (SD)[a] Effect size and p values (within group time point analysis)					
Pain						
PPGP group (n =19)	49.79 (25.68)	20.42 (20.64)	34.75 (25.5)	1.261 $p < .001$[b]	0.593 $p = .03$[b]	- 0.681 $p = .014$[b]
Other participants (n =78)	31.33 (25.04)	11.47 (15.33)	26.68 (27.52)	0.969 $p < .001$[b]	0.192 $p = .72$	- 0.703 $p < .001$[b]
Stress						
PPGP group (n =19)	28.63 (25.87)	9.05 (10.34)	24.89 (19.62)	0.994 $p = .001$[b]	0.035 $p = .99$	- 1.143 $p = .001$[b]
Other participants (n =78)	33.83 (21.48)	9.57 (11.68)	24.90 (19.18)	1.385 $p < .001$[b]	0.373 $p = .002$[b]	- 0.97 $p < .001$[b]
Range of Movement						
PPGP group (n =19)	44 (28.41)	22.95 (17.26)	39.53 (24.92)	0.896 $p = .004$[b]	0.049 $p = .99$	- 0.916 $p = .009$[b]
Other participants (n =78)	28.9 (23.86)	13.76 (14.57)	24.12 (21.38)	0.813 $p < .001$[b]	0.29 $p = .30$	- 0.598 $p < .001$[b]
Sleep						
PPGP group (n =19)	70 (21.57)	NA	53 (21.54)	NA	0.752 $p = .03$[b]	NA
Other participants (n =78)	60.72 (24.41)	NA	44 (27.64)	NA	0.657 $p < .001$[b]	NA

[a]Higher scores equal greater pain, stress or restriction of movement or sleep more restless than usual.
[b]Statistically significant difference within group time point analysis
N/A = not applicable
PPGP = pregnancy–related pelvic girdle pain

TABLE 3. Side Effects Experienced by Both Groups

	Adverse Events		
	Chi-square (χ^2(df,n) p)	*PPGP Group*	*Non-PPGP Group*
No side effect	9 (57.9%)	56 (71.8%)	$\chi^2 = 2.296$ (1, 95), $p = .130$
Adverse effects	8 (42.1%)	22 (28.2%)	
Side Effects			
Post massage soreness	6	15	
Post treatment muscle soreness	4	3	
Tiredness or fatigue	1	5	
Headache	1	4	
Increased pain	2	3	
Exacerbation of symptoms	1	1	
Dizziness	1	1	
Other: Braxton Hicks worse day after massage, bruising, heightened anxiety, unsettle digestion	0	4	

PPGP= Pregnancy-related Pelvic Girdle Pain

are changing the same way over time. The findings did show that the two groups differed significantly in presentation, with the PPGP group having higher levels of pain and a greater restriction in range of motion than the non-PPGP group. The higher levels of dysfunction (pain and restriction of range of motion) reflect, on average, the levels of pain seen in women with PPGP.[4]

The significantly lower rating of pain one week postmassage treatment for those with PPGP is promising, as research shows that PPGP pain is a major factor in a reduction in activities of daily living and a source of distress and emotional impact, and could lead to isolation.[4,14] Massage may be a potential treatment option for women with PPGP to manage pain. Further research is needed to investigate the role of massage in the management of PPGP pain and the impacts of any pain reduction on emotional health and the physical burden of PPGP pain.

There were no significant within-group differences from the premassage outcome measures to one week postmassage outcomes, except for the PPGP pain outcome and the non-PPGP stress outcome (see Table 2). Both of these outcomes were significantly decreased/reduced one week postmassage treatment, on average, compared to premassage levels. This is supported by the medium effect sizes seen for this time period (premassage to one week postmassage; see Table 2). A possible hypothesis for these findings is that PPGP pain and non-PPGP stress have a greater response period to massage than other outcome measures. Potential explanations for this could include that PPGP pain has a mechanical component and affects the myofascial structures around the sacroiliac joint[14] which are impacted positively by the massage treatment. A potential explanation for the non-PPGP group findings on stress may result from multifactorial aspects such as environment (not being exposed to stress-provoking stimuli) and/or endocrine (less production of stress hormones [e.g., cortisol] and greater production of relaxing hormones serotonin), and/or increased vagal activity which increases cerebral blood flow across several brain regions involved in depression and stress regulation.[29,30] Other factors may be influencing the sustained benefits of pain (PPGP group) and stress (non-PPGP group), and individual research with larger study numbers is needed to replicate these findings.

Whilst there was a greater incidence of postmassage side effects in the PPGP group, this was not significantly different to the non-PPGP group. There is little-to-no research-related evidence on the side effects of massage during pregnancy and, thus, there is no research with which we can use to compare our study findings and make any conclusions. Women with PPGP report the impact of PPGP psychologically,[4,13,14] and it is possible that the physiological and psychological aspects of living with PPGP may potentially make women more vulnerable to coping with any side effects experienced. However, more research is needed to determine if women with PPGP have a reduced coping mechanism when experiencing a side effect of massage and what the pathophysiology of this may be.

The study findings reflect PPGP in general only, and the study did not collect data on the potential mechanisms of the participants' pain such as the specific involvement of the SIJ, gluteal musculature,

symphsis pubis or lower back (both musculature and spine). In general, this study found promising results for massage to reduce pain in PPGP; however, the involvement of specific areas of the body such as SIJ, gluteal musculature, symphsis pubis or lower back may potentially alter the management, treatment, and response of the client and, thus, no clinical recommendations for practice are presented. This highlights the need for further research to understand client responses based on subcharacteristics.

Limitations

The study involves small numbers and is a subgroup analysis from a prior study; further research is needed to confirm these findings. The original study did not have a control group and this limits the findings, especially with regards to the benefits of massage. The comparison of PPGP and non-PPGP women in this substudy does not constitute a control group especially in regard to benefits of massage. The comparison of PPGP and non-PPGP women in this substudy investigates average responses to treatment only. The study sample may have been influenced by bias due to the selective sample and the small sample size. The study, however, had very good recruitment and follow-up rate, and the participants represent a clinical sample of women who do seek massage during pregnancy.

CONCLUSION

No differences were found in responses to pregnancy massage for PPGP and non-PPGP participants. Both groups had significant positive changes over time and both groups are changing the same way over time. There was a significant difference in presentation between the two groups, with the PPGP group having higher levels of pain and a greater restriction in range of motion than the non-PPGP group. The individual significantly lower rating of pain postmassage and one week postmassage treatment for those with PPGP shows promise, and this is particularly important given that the pain aspect of PPGP affects the physical and psychological health of pregnant women. More research is needed to determine the role of massage in PPGP management.

ACKNOWLEDGMENTS

The authors would like to thank all the pregnant women that participated in this study.

CONFLICT OF INTEREST NOTIFICATION

Catherine McInerney is the owner of Pregnancy Massage Australia; she was not involved in the analysis of the data. Phillipa Hay receives sessional fees and lecture fees from the Australian Medical Council, Therapeutic Guidelines publication, and New South Wales Institute of Psychiatry, and receives support from Shire Pharmaceuticals for speaking engagements.

REFERENCES

1. Walters C, West S, Nippita TA. Pelvic girdle pain in pregnancy. *Aust J Gen Pract*. 2018;47(7):439–443.
2. Gutke A, Hansson ER, Zetherström G, Ostgaard HC. Posterior pelvic pain provocation test is negative in patients with lumbar herniated discs. *Eur Spine J*. 2009;18(7):1008–1012.
3. Miles D, Bishop M. Use of manual therapy for posterior pelvic girdle pain. *PM&R*. 2019;11:S93–S97.
4. Clarkson CE, Adams N. A qualitative exploration of the views and experiences of women with Pregnancy related Pelvic Girdle Pain. *Physiotherapy*. 2018;104(3):338–346.
5. Vermani E, Mittal R, Weeks A. Pelvic girdle pain and low back pain in pregnancy: a review. *Pain Pract*. 2010;10(1):60–71.
6. Wuytack F, Daly D, Curtis E, Begley C. Prognostic factors for pregnancy-related pelvic girdle pain, a systematic review. *Midwifery*. 2018;66:70–78.
7. Gutke A, Betten C, Degerskar K, Pousette S, Olsen MF. Treatments for pregnancy-related lumbopelvic pain: a systematic review of physiotherapy modalities. *Acta obstetricia et gynecologica Scandinavica*. 2015;94(11):1156–1167.
8. Hughes CM, Liddle SD, Sinclair M, McCullough JEM. The use of complementary and alternative medicine (CAM) for pregnancy related low back and/or pelvic girdle pain: an online survey. *Complement Ther Clin Pract*. 2018;31:379–383.
9. Sibbritt D, Ladanyi S, Adams J. Healthcare practitioner utilisation for back pain, neck pain and/or

pelvic pain during pregnancy: an analysis of 1835 pregnant women in Australia. *Int J Clin Pract*. 2016;70(10):825–831.
10. Dunn G, Egger MJ, Shaw JM, Yang J, Bardsley T, Powers E, et al. Trajectories of lower back, upper back, and pelvic girdle pain during pregnancy and early postpartum in primiparous women. *Womens Health*. 2019;15:1745506519842757-.
11. Fakari RF, Simbar M, Naz SM. The relationship between fear-avoidance beliefs and pain in pregnant women with pelvic girdle pain: a cross-sectional study. *Int J Community Based Nurs Midwifery*. 2018;6(4):305–313.
12. Pierce H, Homer CS, Dahlen HG, King J. Pregnancy-related lumbopelvic pain: listening to Australian women. *Nurs Res Pract*. 2012:387482.
13. Ceprnja D, Chipchase L, Liamputtong P, Gupta A. How do Australian women cope with pelvic girdle pain during pregnancy? A qualitative study protocol. *BMJ Open*. 2018;8(7):e022332.
14. Mackenzie J, Murray E, Lusher J. Women's experiences of pregnancy related pelvic girdle pain: A systematic review. *Midwifery*. 2018;56:102–111.
15. Stafne SN, Vøllestad NK, Mørkved S, Salvesen KÅ, Stendal Robinson H. Impact of job adjustment, pain location and exercise on sick leave due to lumbopelvic pain in pregnancy: a longitudinal study. *Scand J Primary Health Care*. 2019;37(2):218–226.
16. Hilde G, Gutke A, Slade S, Stuge B. Physical therapy interventions for pelvic girdle pain (PGP) after pregnancy. *Cochrane Database System Rev*. 2016;11:CD012441.
17. Davenport MH, Marchand AA, Mottola MF, Poitras VJ, Gray CE, Jaramillo Garcia A, et al. Exercise for the prevention and treatment of low back, pelvic girdle and lumbopelvic pain during pregnancy: a systematic review and meta-analysis. *Br J Sports Med*. 2019;53(2):90–98.
18. Frawley J, Adams J, Sibbritt D, Steel A, Broom A, Gallois C. Prevalence and determinants of complementary and alternative medicine use during pregnancy: Results from a nationally representative sample of Australian pregnant women. *Aust NZ J Obstetr Gynaecol*. 2013;53(4):347–352.
19. Beales D, Hope JB, Hoff TS, Sandvik H, Wergeland O, Fary R. Current practice in management of pelvic girdle pain amongst physiotherapists in Norway and Australia. *Manual Therapy*. 2015;20(1):109–116.
20. healthdirect. Remedial Massage. Australian Government, Department of Health; 2017 [cited 2019 23 January]. Available from: https://www.healthdirect.gov.au/remedial-massage
21. Steel A, Adams J, Sibbritt D, Broom A, Gallois C, Frawley J. Utilisation of complementary and alternative medicine (CAM) practitioners within maternity care provision: results from a nationally representative cohort study of 1,835 pregnant women. *BMC Pregnancy Childbirth*. 2012;12(1):146.
22. Hall H, Cramer H, Sundberg T, Ward L, Adams J, Moore C, et al. The effectiveness of complementary manual therapies for pregnancy-related back and pelvic pain: A systematic review with meta-analysis. *Medicine*. 2016;95(38):e4723.
23. Field T, Diego MA, Hernandez-Reif M, Schanberg S, Kuhn C. Massage therapy effects on depressed pregnant women. *J Psychosom Obstet Gynecol*. 2004;25(2):115–122.
24. Fogarty S, McInerney C, Stuart C, Hay P. The side effects and mother or child related physical harm from massage during pregnancy and the postpartum period: An observational study. *Complement Ther Med*. 2019;42:89–94.
25. Lesage FX, Berjot S, Deschamps F. Clinical stress assessment using a visual analogue scale. *Occupational Med*. 2012;62(8):600–605.
26. Zisapel N, Nir T. Determination of the minimal clinically significant difference on a patient visual analog sleep quality scale. *J Sleep Res*. 2003;12(4):291–298.
27. Ruiz FK, Bohl DD, Webb ML, Russo GS, Grauer JN. Oswestry Disability Index is a better indicator of lumbar motion than the Visual Analogue Scale. *The Spine J*. 2014;14(9):1860–1865.
28. Cohen J. Statistical Power Analysis for the Behavioral Sciences. Hillsdale, NJ: L. Erlbaum Assoc.; 1988.
29. Diego MA, Field T. Moderate pressure massage elicits a parasympathetic nervous system response. *Int J Neurosci*. 2009;119(5):630–638.
30. Field T. Touch for socioemotional and physical well-being: a review. *Dev Rev*. 2010;30(4):367–383.

Corresponding author: Sarah Fogarty, PhD, School of Medicine, Western Sydney University, PO Box 8218 Ferntree Gully, Victoria, Australia 3156
E-mail: s.fogarty@westernsydney.edu.au