Pregnancy-related low back and pelvic girdle pain:

Listening to Australian women

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I would like to make the following acknowledgements and thanks.

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My rock and my closest friend: Thankyou for graciously putting your own hopes and dreams 'on hold' for the last five years.

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To the women in my care

Whether as a physiotherapist or a midwife, I have had the privilege of sharing an amazing part of your lives, helping you through struggles with back or pelvic girdle pain, to better enjoy your pregnancy and birth and fulfill your role as mothers, partners and friends. We have shared tears of frustration, pain and joy. Thankyou for listening, sharing your stories and for your encouragement.

This thesis is for you.

Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Candidate

Presentations

The preliminary results of this research have been reported as oral presentations at the following conferences and seminars during the course of this thesis:

July 2010: '*Breathing New Life into Maternity Care*'

3rd Biennial Conference, Australian College of Midwives with the Royal Australian and New Zealand College of Obstetricians and Gynaecologists and the Australian College of Rural and Remote Medicine, Alice Springs, NT, Australia

August 2010: Westmead Hospital Week, Sydney West Area Health Service, NSW, Australia

- Nursing and Midwifery Symposium
- Physiotherapy Symposium

The final results of this research will be shared as a poster presentation at the following meeting:

- *Melbourne International Forum XI: Primary Care Research on Low Back Pain,* 15th-18th March, 2011, Australia.

Preface

I have been working as a physiotherapist in women's health since the birth of my youngest child, who is now 17 years old. My journey in this area of health began with childbirth education, teaching women about the changes in their bodies during pregnancy and birth, the benefits of exercise, and strategies for coping with common 'discomforts' such as back pain. In 1997 I started conducting water exercise classes and physiotherapy consultations for pregnant women in response to the needs and queries of those who wanted to help in this area, and in 2000 I commenced working as a physiotherapist in continence and women's health at Westmead Hospital.

During this time I became increasingly frustrated with the apparent attitudes of some maternity carers to the women I was helping. Often I would pass these women in the corridors of the hospital, or they would come 'hobbling' into the postnatal physiotherapy class, explaining that they had had been told by their midwife or doctor: "Back pain is normal in pregnancy" or "There is nothing much you can do for your pain" and "Don't worry; it will go away after you have had the baby". Yet, on a daily practical level, physiotherapy made a significant positive impact on their lives.

Throughout my early years at Westmead Hospital, I often thought about doing postgraduate studies, possibly a Masters by research, but nothing ever really gelled. Then in May 2005, I was sitting reading the Sunday paper when I came across an article outlining an interview with Professor Caroline Homer, about a new course called the Bachelor of Midwifery. It was then that I instantly knew what I was to do. It didn't make any 'head' sense, but in my heart I knew it was right. I needed to be 'with woman' (Leap, 2006) not just before and after birth, but in every way, through the whole process. To possess not just an abstract physiological and biomechanical knowledge of pregnancy and birth, but to experience the complexities of childbirth first hand, and gain a better understanding of the health care system in which I was working.
The Bachelor of Midwifery Honours thesis has given me the opportunity of

exploring the lives of women in Western Sydney. I have been able to tap into the experiences of a few of the many women who pass through the doors of the Women's Health Clinic at Westmead Hospital each day. I have been able to investigate whether the literature that I had been reading on pregnancy-related lumbo-pelvic pain stood 'true' for my clinical setting. As a midwife, a physiotherapist and researcher, I have been able to 'listen' to and 'measure' the women's experience of low back and/or pelvic girdle pain. The thesis you are about to read is the end result of this journey: it is their story, and it is also my story.

The 'world view' that I hold of women, birth and maternity care has been shaped over the years by the medical system in which I trained and worked, and in which I experienced the birth of my own children. The Bachelor of Midwifery program has stretched, challenged and changed the thoughts and opinions that I have held about 'women' and 'birth' in many ways; however my core philosophy of serving my 'sister' and finding ways to help improve her health, and therefore her pregnancy and birth experience has never swayed. Through my experiences I have gained a profound respect for the midwives and doctors in our health care system, and for their dedication to the care of women, regardless of philosophy.

I am thankful for the academic process, as I have gained a better understanding of research and a greater appreciation of those who have ventured down this path. I can now read journal articles with a more critical eye, and an appreciation of the 'blood, sweat and tears' that would have gone into the finished product. I no longer just read the abstract, introduction and the conclusion, but find myself in the methods and discussion, questioning, agreeing and at times arguing with the authors.

My hope is that my journey into midwifery and this research thesis will have some impact on the lives of Australian childbearing women and on those who care for them. It has certainly impacted my life! Someone once said to me that an acorn starts as a small seed, but it will eventually grow into the most amazing tree. I look forward to standing in the shade of that tree, marveling at its beauty and size, and seeing all the new acorns that it will produce.

"…be quick to listen, slow to speak…"

James 1:19(NIV)

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Abstract

Background

Pregnancy-related low back and/or pelvic girdle pain (PLPP) is experienced by women in the lumbar and/or sacro-iliac area and/or symphysis pubis during pregnancy or immediately after birth. At least 45% of pregnant women experience PLPP which can be associated with some form of disability, leading to social and economic consequences for the woman and for health provider organisations. PLPP is often accepted as a 'normal' discomfort of pregnancy; however women may use analgesics and experience a reduced ability to maintain an active lifestyle. PLPP has been reported to negatively influence psychological health and some women develop a chronic pain condition.

Aim

The aim of this study was to investigate the prevalence of PLPP, and the associated pain and disability experienced by a sample of Australian women.

Method

A cross-sectional survey was employed with 105 pregnant women as they attended a public hospital antenatal clinic. Women reporting PLPP completed a second survey including a pain diagram, Visual Analogue Scale and the Oswestry Disability Index (Version 2.1a). A physical assessment differentiated low back, pelvic girdle or combined low back and pelvic girdle pain. Open ended questions explored the experiences of the women. The sample was analysed descriptively. The Pearson's Chi-Square was used to test the difference between groups for non-parametric data. A thematic analysis explored the open ended questions.

Results

The prevalence of self reported PLPP during the pregnancy was 71%, and on the day of survey was 34%. There was an association between the reporting of PLPP and multiparity ($p=0.05$), a previous history of lumbo-pelvic pain ($p=0.005$), and the regular use of stairs ($p= 0.04$). The average pain score was

6.5 (SD 2) out of 10 for ‘usual pain, and 3.8 (SD 3) on the day of the survey. A majority of women (67%) scored a ‘mild disability’ and had reported their pain to their maternity carer (71%) but only 25% had treatment. Almost a quarter (23%) of the women had taken sick leave because of PLPP. Most women (70%) agreed that PLPP was to be expected during pregnancy. Key themes related to PLPP as expressed by the women, were pain and its affect on lifestyle, psychological health and the woman’s ability to cope.

Conclusion

PLPP is highly prevalent and expected during pregnancy. Only a small proportion of women receive treatment, despite consequences for some in terms of pain, disability, lifestyle and psychological health. Dissemination of these findings to maternity carers may assist with recognition of the condition as a potentially significant health issue during pregnancy.

Acronyms

PLPP	Pregnancy related low back and/or pelvic girdle pain
LPP	Lumbo-pelvic pain
LBP	Low back pain
PGP	Pelvic girdle pain
SWAHS	Sydney West Area Health Service
WHO	World Health Organization
ABS	Australian Bureau of Statistics
PPPP	Posterior pelvic pain provocation test
VAS	Visual Analogue Scale
ODI	Oswestry Disability Index

Chapter 1: Introduction

The introductory chapter for this thesis outlines the background of pregnancy-related low back and pelvic girdle pain within the context of the woman's birth experience. An outline of the rationale for the research undertaken in this thesis, with study objectives and methods will be provided.

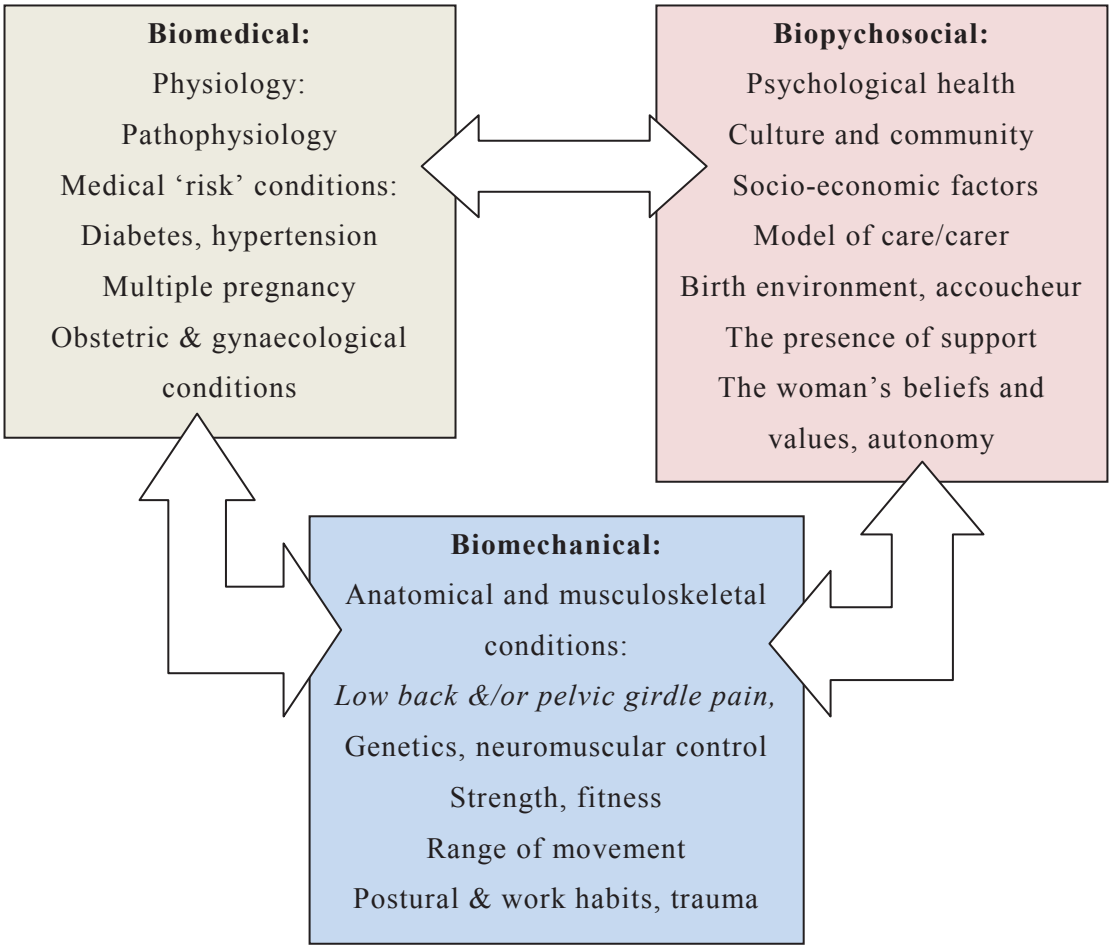
Context

Becoming a mother is one of the most important and challenging events in the life of a woman. The meaning of birth for each woman is complex "…taking it's form within a web of cultural and social influences, within a life history"(McCourt & Percival, 2000, p. 245). The health of the woman is paramount in determining the life outcomes of the woman and her child, and the influences on her health during pregnancy and birth are multifactorial. My own clinical experience working with women during pregnancy and birth, combined with consideration of the current knowledge in this area, have led me to believe that a combination of biopsychosocial, biomedical and biomechanical factors interconnect, determining a woman's birth experience and health outcomes, as shown in Figure 1. A woman experiences remarkable change as a new human life is conceived and grows, occupying space within her womb. Her anatomy and physiology adapt to sustain, nurture and then finally birth the baby. The pelvis is a pivotal part of the mother's body in this process. It is the skeletal basin housing her womb, and the canal through which the baby passes for a normal birth.

Anatomically, the pelvis is a bony ring with four articulations: two sacro-iliac, the symphysis pubis and the sacrococcygeal. The pelvic joints are supported by some of the strongest ligaments in the body, and optimal performance of the sacro-iliac and pubic symphysis joints and surrounding ligamentous, musculo-tendinous and neurological structures is essential for normal mobility and function. During pregnancy hormonal changes play a role in 'softening'

connective tissue, allowing expansion and mobility of the pelvic joints to accommodate the growing baby and to prepare for birth. The pelvic girdle becomes a dynamic and adaptable part of the skeleton as each structure undergoes stretching, stress and strain secondary to the physiological and biomechanical challenges of childbearing.

Figure 1: The potential influences on a woman's health outcomes during pregnancy and birth.



Theoretical background

Stability of the pelvic joints is essential for the optimal transfer of loads between the lumbar spine and lower limbs, and for the successful achievement of daily functional tasks such as walking, standing up from a chair, rolling in bed and climbing stairs (Vleeming, de Vries, Mens, & van Wingerden, 2002). If ligamentous laxity is not compensated for by adequate neuromuscular control of

the pelvic joints, a person may experience musculoskeletal pain and dysfunction (Lee, 1996; Lee, Lee, & McLaughlin, 2008; Vleeming, Albert, Ostgaard, Sturesson, & Stuge, 2008). Pregnancy-related low back pain and pelvic girdle pain (PLPP), is pain of musculoskeletal origin that is experienced in the lumbar and/or sacro-iliac area during pregnancy or in the immediate postpartum period. Pain may occur in conjunction with, or separately in the symphysis pubis (Vleeming, et al., 2008).

Low back pain (LBP) during pregnancy is often described as a 'common' or 'minor' discomfort (Grigg, 2006; Yerby, 2005) or an 'unpleasant symptom' (Enkin, et al., 2000). A commonly held belief is that the development of pain is associated with postural adaptations, such as an increased lumbar lordosis and the physiological changes of pregnancy (Bastiaanssen, de Bie, Bastiaenen, Essed, & van den Brandt, 2005). Some research however, demonstrates that the lumbar lordosis is not always increased in pregnancy (Bullock, Jull, & Bullock, 1987) and evidence of the role of the pregnancy hormone relaxin in PLPP is inconclusive (Bjorklund, Bergstrom, & Nordstrom, 2000; Damen, et al., 2001; Hansen, Jensen, Larsen, Wilken-Jensen, & Petersen, 1996; MacLennan & MacLennan, 1997; MacLennan, Nicholson, Green, & Bath, 1986).

Pain originating from the pelvic girdle during pregnancy is not commonly discussed as a condition discrete from lumbar pain, possibly because it is regarded as a normal side effect of pregnancy from which most women will recover. A review of the literature indicates that there is a limited understanding of PLPP amongst maternity carers and the question as to whether pelvic girdle pain (PGP) is 'normal' or 'pathological' is a topic of debate (Mogren, 2006; Olsson & Nilsson-Wikmar, 2004).

Women who experience PLPP may suffer considerable pain and disability, with both social and economic consequences for the woman and for health provider organisations (Mogren, 2006). Analgesic medications and mobility aids may be required and life threatening conditions such as venous thrombosis are possible complications of bed rest or immobility (Babarinsa, Adewole, Fatade, & Ajayi, 1999). PLPP may impact on the amount of sick leave a woman requires, influence her psychological health and become a chronic health issue (Mogren,

2006; Olsson & Nilsson-Wikmar, 2004). Vermani, Mittal, and Weeks (2009) suggest there is an increasing number of women who are requesting an early induction of labour or an elective caesarean in order to achieve relief from their pain. There is no evidence however, to support these interventions and the risk or benefit to the mother and her child requires further investigation.

The proportion of pregnant women who experience PLPP has been investigated in a number of studies with most research about the condition coming from Scandinavian populations. Prevalence is a measure of the relative frequency of reports or diagnoses of PLPP. 'Period prevalence' refers to number during the pregnancy and 'point prevalence' to number at the time of measurement (Wu, et al., 2004). A review of period prevalence studies indicates that at least 45% of pregnant women experience PLPP and 25% of all postpartum women (Wu, et al., 2004). The point prevalence of *pelvic girdle pain* during pregnancy is thought to be 20% (Vleeming, et al., 2008). The prevalence of low back pain during pregnancy in an Australian population has been previously reported (Smith, Russell, & Hodges, 2008; Stapleton, MacLennan, & Kristiansson, 2002), however the prevalence of low back *and/or pelvic girdle pain*, and the associated degree of pain and disability suffered by Australian women is currently unknown. A better understanding of PLPP may assist in improving both short and long term health outcomes for women.

Research objectives

The primary objective of this research was to determine the number of pregnant women with low back pain and/or pelvic girdle pain (PLPP) in a sample attending an Australian public hospital antenatal clinic. The secondary objective of the research was to assess the level of pain and disability experienced by the women who reported low back pain (LBP) and/or pelvic girdle pain (PGP). The foreseen benefit of a descriptive analysis and reporting of study results was to increase maternity health care workers' understanding of pregnancy-related LBP and PGP in an Australian context.

Thesis outline

The body of this thesis begins with a literature review which is a report on published research and writings related to PLPP. A summary of the different terminologies used for PLPP and current proposals of the aetiology, risk factors and prevalence of the condition are provided. The debates within the literature as to whether PLPP should be deemed as 'normal' or 'pathological' during pregnancy; and whether the condition should be considered as a single disorder, or differentiated into low back or pelvic girdle pain are addressed. The relationship of PLPP to psychosocial consequences and mental health issues such as depression are considered, with an overview of the current evidence for the management of the PLPP. The literature review provides a framework and guidance for the research undertaken in this thesis.

The third chapter of this thesis provides a detailed explanation of the selected population sample, chosen methods for achieving study objectives, and the conduct of the study including ethical considerations. A rationale for the selection of tools for the measurement of pain and disability, and a description of these tools is provided. The statistical tests used in the analysis of data collected are explained. The fourth chapter presents the research results by a descriptive analysis of the study sample. Variables within the population are explored to ascertain whether there is an association between the participant characteristics and the reporting of PLPP. A summary of study findings is provided at the conclusion of the chapter.

The final chapter discusses the study findings within the context of contemporary opinions and research findings, with reference to literature in the fields of nursing/midwifery, medicine and allied health. Interpretation of results is acknowledged to be influenced by my 'world view', which has been shaped and informed by the medicalised system of maternity care in which I work and my experiences of the public health care system within an Australian setting. A strategy that has developed for the dissemination of research findings within this setting is discussed. The chapter will close with a conclusion summarising the main issues raised in the discussion, study limitations and proposals for future research.

Within this thesis, pregnancy and birth are viewed as normal physiological processes that are influenced by the culture, values and beliefs of the woman, the resources that she has access to, and the society in which she lives.

Chapter 2: Literature Review

Pregnancy-related low back pain and pelvic girdle pain (PLPP) is pain of musculoskeletal origin that is experienced in the lumbar and/or sacro-iliac area during pregnancy or in the immediate postpartum period. Pain may occur in conjunction with, or separately in the symphysis pubis (Vleeming, et al., 2008). Although PLPP may be associated with considerable pain and disability, there remains a limited understanding of the condition, particularly PGP, amongst maternity carers (Fredriksen, Moland, & Sundby, 2008; Leadbetter, Mawer, & Lindow, 2004; Owens, Pearson, & Mason, 2002). A review of the literature was undertaken to assist in understanding the condition within a multi-disciplinary framework of terminology, definitions and classification methods. Research methods and findings were explored to guide and inform the research process undertaken in this thesis.

Terminology

Contributing to a limited understanding of PLPP amongst maternity carers has been a lack of standardised terminology, with a variety of descriptions and diagnostic criteria used in research studies. Posterior pelvic girdle pain (pain related to the sacro-iliac or lumbo-sacral areas) is often subsumed within 'low back pain' and when described as a separate disorder may be referred to as pelvic instability, pelvic joint syndrome, symptomatic pelvic girdle relaxation, pelvic insufficiency or peripartum pelvic pain. Pain in the anterior pelvis has been referred to as symphysis pubis dysfunction, diastasis symphysis pubis, symphysiolysis or pubic symphysis arthropathy. Further to these terminologies, pelvic girdle pain should be discriminated from 'pelvic pain' that is gynaecological or organic in origin. A review of the literature therefore reveals a plethora of multidisciplinary research and opinions that present a complex and confusing picture.

Over the last decade, several authors have attempted to bring clarification to the understanding of PLPP through systematic reviews (Leadbetter, et al., 2004;

Mens, Pool-Goudzwaard, & Stam, 2009; Vermani, et al., 2009; Wu, et al., 2004) and the development of guidelines for diagnosis and treatment (Vleeming, et al., 2008). European maternity and allied health professionals, with consumer support groups, have recognised the problem of diverse descriptions and have proposed that 'pregnancy-related pelvic girdle pain' is the most appropriate term for pain experienced in the pelvic girdle during pregnancy or in the immediate postnatal period ((Association of Chartered Physiotherapists in Women's Health, 2007; Vleeming, et al., 2008). It is hoped that consensus in terminology will lead to an improved knowledge about prevalence, aetiology and management.

Pregnancy related 'lumbo-pelvic' pain: normal or pathological?

Despite attempts at consensus in terminolgy there remains debate over whether the pregnancy-related low back and/or pelvic girdle pain (PLPP) should be regarded as 'normal' or 'pathological'. Bastiaanssen and colleagues (2005) explore the evolution of this medical debate with an overview of studies published between 1861 and 2004. The authors discuss the condition from the time it was first described by Hippocrates (c. 400 B.C.) as "disjunctio pelvica", a widening of the pelvis associated with childbirth, with the oldest documented description of the condition by Snelling in 1870:

> The affection appears to be consistent with the relaxation of the pelvic articulations, becoming apparent suddenly after parturition, or gradually during pregnancy; and permitting a degree of mobility of the pelvic bones which effectually hinders locomotion, and gives rise to the most peculiar, distressing and alarming sensations.
>
> (Snelling, 1870, cited in Bastiaanssen, et al., 2005, p.4)

Whilst they support a standardised definition, Bastiaanssen and colleagues (2005) suggest that this should be wide-ranging rather than specific, as PLPP is a complex syndrome with biological, psychological and social factors.

Aetiology (cause of PLPP)

The aetiology of PLPP is not fully understood, but is thought to be multifactorial with several proposed theories (Vleeming, et al., 2008). There is no distinct pathological cause that has been found to initiate the condition, and the role of pregnancy hormones such as relaxin is inconclusive, with studies both supporting and refuting its influence in the development of PLPP, and in particular PGP (Bjorklund, et al., 2000; Kristiansson, 1997; Wylie, 2005). The Association of Chartered Physiotherapists in Women's Health (2007) suggest that PGP experienced during pregnancy is most likely biomechanical in origin, arising from asymmetrical movement or positioning of the pelvic joints, and altered pelvic girdle biomechanics secondary to altered activity in spinal, abdominal, pelvic girdle and hip and/or pelvic floor muscles. Further research is required to determine the possible causative factors of PLPP (Vermani, et al., 2009; Vleeming, et al., 2008; Wu, et al., 2004).

Risk factors

Evidence of risk factors for development of PLPP and PGP is also largely inconclusive (Vleeming, et al., 2008). The main risk factors appear to be a previous history of low back or pelvic girdle pain, previous trauma to the pelvis and multiparity (Vleeming, et al., 2008). Other cited risk factors with conflicting evidence include: a physically and/or psychosocially demanding workload; a high body mass index (BMI) and general joint hypermobility (Albert, Godskesen, Korsholm, & Westergaard, 2006; Mogren & Pohjanen, 2005; Vleeming, et al., 2008; Wu, et al., 2004).

Prognosis

PLPP has been described as having severe short and long-term effects to the woman's health as her ability to maintain an active lifestyle during pregnancy is compromised. It has been proposed that 25% of all women with PLPP have 'serious' pain during pregnancy and 8% have 'severe' disability (Wu, et al., 2004), with at least 7% of women continuing to have pain up to 3 months after birth (Vleeming, et al., 2008). The most serious short term effect of PLPP that

may result from immobility and bed rest is the risk of venous thrombosis (Babarinsa, et al., 1999). PLPP may also effect sleep (Mogren, 2006), require the use of analgesics, mobility aids and sick leave (Olsson & Nilsson-Wikmar, 2004; Robinson, Eskild, Heiberg, & Eberhard-Gran, 2006). A reduction in hours of employment and therefore reduced income and work productivity has also been reported (Mogren, 2006). The woman may be unable to perform tasks related to house work and parenting, and the condition may negatively influence her psychological health (Gutke, Josefsson, & Oberg, 2007). According to the World Health Organization "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organisation, 1948). When considering the effects of PLPP within this context, it becomes apparent that women who report a more severe form of this condition are not experiencing a normal and healthy pregnancy (Olsson & Nilsson-Wikmar, 2004).

The view that PLPP is a pathological condition is supported by studies investigating the effects of PLPP on daily function and quality of life. For example, Mogren (2006) investigated the consequences of PLPP in a cross sectional population based survey. A questionnaire was given to 1,071 women within 24 hours of birth, with a response rate of 83%. The questionnaire formed part of a larger study of mental health issues in the reproductive period, based on a self-reported, retrospective recollection. Mogren (2006) reports increased sick leave, an impaired sexual life and a higher risk of reporting poor health in women with high pain scoring PLPP. This concurs with another Swedish study by Olsson and Nilsson-Wikmar (2004), who conducted a survey of 160 women in late pregnancy, with an 85% response rate, assessing pain, disability and health profile. These authors compared the reduction in quality of life to other musculoskeletal conditions, such as rheumatoid arthritis, osteoarthritis and osteoporosis. Robinson and colleagues (2006) had similar results from a postal questionnaire of 1,817 Norwegian women (73% returned). It was concluded that PLPP has a significant economic and social impact on women who experience the condition.

Pregnancy-related low back and pelvic girdle pain: the same condition?

There is debate in the literature as to whether PGP experienced during pregnancy should be considered as a separate condition to LBP (Gutke, Ostgaard, & Oberg, 2006; Wu, et al., 2004). Some authors suggest that the group be described as 'lumbo-pelvic' disorders and researched as such (Bastiaenen, Bastiaanssen, et al., 2006). On the other hand, there is a large body of literature that supports the theory that PGP is discrete from LBP, although the conditions may co-exist, and different management strategies are required (Albert, Godskesen, & Westergaard, 2001; Gutke, Ostgaard, & Oberg, 2008; Ronchetti, Vleeming, & van Wingerden, 2008). It is also proposed that classification of PLPP into subgroups will assist in identifying those women most at risk of long-term dysfunction (Ronchetti, et al., 2008; Rost, Jacqueline, Kaiser, Verhagen, & Koes, 2006). Gutke and colleagues (2006), in a study of the lifestyle effects of PPGP and PLBP, used clinical tests by a single examiner to differentiate and confirm the diagnosis of PGP and/or LBP in their study population. Their questionnaire included the use of the Oswestry Disability Index and the EuroQol to evaluate the women's function, health and quality of life. They identified that women with PGP only or combined PGP and LBP, scored significantly higher on pain intensity, had higher levels of disability and lower health status compared to women without PLPP or with LBP alone.

Symphysis pubis dysfunction

Aside from these debates, there are a number of reviews and studies that explore the condition of symphysis pubis dysfunction without consideration of the context of the wider definition of PLPP (Leadbetter, et al., 2004). There are also case reports (low level evidence) of traumatic diastasis of the symphysis pubis during birth (Demirkale, Tecimel, Bozkurt, & Bozkurt, 2008). These studies have value in assisting an understanding of the effects of pelvic girdle pain, however they need be considered within the broader perspective of research knowledge.

There is body of qualitative literature within the nursing and midwifery fields that explores the experiences women who have self reported or diagnosed symphysis pubis dysfunction (Crichton & Wellock, 2008; Fredriksen, et al., 2008; Owens, et al., 2002; Shepherd, 2005; Wellock & Crichton, 2007b). These studies support the evidence of the negative effects of PGP on the woman's lifestyle and psychosocial health. Thematic analysis of these studies has also identified a lack of recognition of the condition amongst health professionals.

Review of methods used in studies of PLPP

A review of the literature was undertaken to ascertain the methods used in the investigation of the prevalence of PLPP and its impact on the woman. A quantitative survey method was used by Mogren (2006), Olsson and Nilsson-Wikmar (2004) and Robinson and colleagues (2006), for the investigation of prevalence rates, where data collected were based on a retrospective self-reported PLPP. This method is subject to recall bias. Although study samples were large with good response rates, these researchers did not discuss exclusion criteria such as other musculoskeletal disorders which may cause pain and influence results. Other researchers such as Gutke and colleagues (2006) and Mousavi, Parnianpour and Vleeming (2007) in studies investigating the prevalence of PLPP, have used a prospective cross-sectional design with clinical diagnostic criteria, and excluded women with conditions such as 'systemic locomotor system disease', fractures, neoplasm or recent surgery to the spine, pelvis or femur. When investigating prevalence rates of PLPP it is important to consider other possible causes for the reporting of pain as potential confounding variables, as their presence in the study population will affect the reporting of the condition.

The assessment of pain, disability and quality of life during pregnancy requires the selection of the most appropriate measuring instruments. A review of the literature reveals that there are no validated measuring tools specifically for PLPP (Vleeming, et al., 2008). Evaluation of the effects of PLPP and analysis of results should take into account that pregnancy itself may contribute to a considerable reduction in functioning with everyday activities (Olsson &

Nilsson-Wikmar, 2004; Rost, Jacqueline, Kraiser, Verhagen, & Koes, 2004). Gutke et al (2006) address this issue when discussing the reasons for the use of the Oswestry Disability Index in their study. A pregnancy mobility index (van de Pol, de Leeuw, van Brummen, & et al., 2006) and a scoring system for symphysis pubis dysfunction (Leadbetter, Mawer, & Lindow, 2006) have been developed, but have not been widely used.

Whether or not the woman has sought assistance, or asked for referral for management of PLPP, has been used as a measure of prevalence and severity of the condition (Wu, et al., 2004). Wu and colleagues (2004) question the results of studies on self-reported pain, as minor or 'mild' symptoms may be included with analysis of more severe pain. If the condition is considered a 'normal' part of pregnancy, however, the woman may not have asked for help if she believes that she should 'put up' with her pain. The conclusions of studies where PLPP is identified only from women referred for management, may not be reflective of the full extent of the condition.

Prevalence

As the majority of studies investigating PLPP are derived from Scandinavian countries, there has been a question as to whether pregnancy-related PGP is a condition confined mostly to these populations; however it is possible that this may simply be because this is where studies have been conducted. Overall, reported prevalence rates vary considerably due to use of different terminology, definitions and diagnostic criteria. Wu et al (2004) in their review conducted an analysis of studies deemed reasonable quality and concluded that around 45% of all pregnant women and 25% of all postpartum women suffer from LBP and/or PGP. Vleeming et al (2008) in their evaluation of prospective studies where diagnosis was confirmed by pain history and a clinical examination, suggest a 20% point prevalence of pregnancy-related PGP. A small number of studies that investigate the prevalence of the condition in non-European cultures (Mazicioglu, et al., 2006; Mousavi, et al., 2007) support these measures of prevalence.

Research using population based cross-sectional surveys has attempted to quantify the prevalence of pregnancy-related LBP in Australia (Smith, et al., 2008; Stapleton, et al., 2002). The findings of Smith et al (2008) indicate that chronic back pain originated during pregnancy, and LBP may be linked to urinary incontinence. The study conducted by Stapleton and colleagues (2002) reported that 35.5% of women surveyed recalled having moderately severe PLBP, and these women were more likely to be younger, report ill health and be unemployed. Half of the women with symptoms were not treated for their pain and 68% continued to experience recurring LBP, which impacted negatively on self reported health. Because of the nature of the surveys, PGP was not separately identified and symphysis pubis dysfunction was not considered. The data were obtained by a self-reported retrospective recollection of PLPP in women aged between 15 and 93, and is subject to recall bias. This research highlights the degree of possible long-term morbidity and the lack of treatment associated with PLPP and the value of further investigation.

Pain and depression

The relationship between pregnancy-related LBP, PGP and mental health disorders such as depression has been explored in a few studies (S. Brown & Lumley, 2000; Gutke, et al., 2007). Depression may manifest in the struggles a woman experiences in caring for a child and family, infant feeding problems, social isolation, and relationship difficulties (Shepherd, 2000). Brown & Lumley (2000) found that back pain was associated with significantly increased odds of depression at six to seven months postnatal. Gutke et al (2007) reported that postpartum depressive symptoms were three times more prevalent in women with lumbo-pelvic pain than in those without, after accounting for possible confounding variables. These studies highlight the importance of investigating the effects of PLPP as a condition that may have negative psychological effects and social consequences.

Management of PLPP including PGP

Although there are many suggested treatments for ‘back ache’ in pregnancy, research evaluating the acceptability, safety and effectiveness of interventions

is limited. Enkin and colleagues (2000) discuss 'back ache' recommending that women should be reassured that it usually resolves spontaneously soon after birth, particularly for those who did not have back ache prior to pregnancy. Women are encouraged to follow 'common sense advice' about lifestyle including use of back support and avoidance of heavy lifting. Pennick and Young (2007) include 'pelvic pain' in a Cochrane systematic analysis of the literature on interventions for preventing and treating pelvic and back pain in pregnancy. Eight studies were in this analysis; however PGP was not clearly differentiated from LBP. In summary, participating in strengthening exercises, sitting pelvic tilt exercise and water 'gymnastics' (Kihlstrand, Stenman, & Nilsson, 1999), reduced reported pain intensity and the amount of related sick leave taken by women compared with usual antenatal care. A specially designed product called the Ozzlo pillow was found to be more effective than a regular one at relieving back pain although this is no longer commercially available (Thomas, Nicklin, Pollock, & Faulkner, 1989). Acupuncture (Elden, Ladfors, Olsen, Ostgaard, & Hagberg, 2005), stabilising exercises (Stuge, Laerum, Kirkesola, & Vollestad, 2004), stretches and physiotherapy (Nilsson-Wikmar, Holm, Oijerstedt, & Harms-Ringdahl, 2005), appear to relieve pain more than usual antenatal care alone as women receiving usual care required more analgesics, physical modalities and sacro-iliac belts. Pennick and Young (2007) emphasise that all but one of the studies had a moderate to high potential for bias and so results should be viewed cautiously.

Theermann Schumacher and van der Wurff, (2007), also conducted a review of the literature on the effectiveness of stabilising exercises in pregnancy and concluded that although the number of studies is limited, physiotherapy and in particular stabilising exercises seem to have a positive effect on lumbo-pelvic pain. This conclusion has been further supported by Morkved and colleagues (2007). In this study, 301 healthy nulliparous women were randomised (with concealed allocation), at 20 weeks gestation into a training group or a control group. The intervention group participated in daily pelvic floor muscle exercises and weekly group training over 12 weeks including aerobic exercises. The authors conducted an 'intention-to-treat' analysis with between-group

comparisons. This means that all participants who began in the groups were considered in the analysis, even if they dropped out. Morkved et al (2007) reported that at 36 weeks gestation the women in the training group were less likely to report lumbo-pelvic pain (p=0.03), and at three months after delivery there remained a difference in the training group (p=0.06). The authors reported no difference in sick leave but the women in the training group had higher scores on functional status. In another study, Granath, a Swedish midwife and colleagues (2006) randomised 390 healthy pregnant women into two groups in three centres to compare water aerobics to land based exercise. They concluded that water aerobics diminished pregnancy-related low back pain and sick leave due to pregnancy related back pain (p=0.03) when compared to land based exercise. PGP was not identified nor differentiated in this study. These findings however, are viewed with caution as there were several methodological flaws within this study. These included: lack of concealment of randomised allocation; the subjects and assessors were not blinded to the intervention and there was no 'intention-to-treat' analysis.

In a recent Australian study, Kalus, Kornman, and Quinlivan (2008), conducted a randomised trial comparing the use of tubigrip which is a generic elasticised support garment with a 'BellyBra' for the management of back or posterior pelvic pain in pregnancy. Both garments were found to be associated with a reduction in the severity of pain. Within this trial however, the therapists were not blinded to the intervention and there was no 'intention-to-treat' analysis. In a similar approach, Mens, Damen, Snijders, and Stam (2006), investigated the use of a pelvic belt in women with pregnancy-related PGP and found a significant reduction in the mobility of the sacroiliac joints. They proposed that the reduced joint movement may assist in the reduction of pain, however this proposal remains speculative.

There is emerging evidence and discussion around the importance of a 'biopsychosocial' approach to the management of PLPP (Bastiaenen, de Bie, et al., 2006; O'Sullivan & Beales, 2007a). The authors consider the importance of addressing psychosocial issues related to pain management, rather than simply focusing on physical interventions such as exercise and manual therapy. In

summary, it is suggested that whatever management is used, it is important the intervention is based on the mechanisms that underline the pain, not just the alleviation of signs and symptoms (O'Sullivan & Beales, 2007a).

Conclusion

This review of the literature has considered the use of terminology for PLPP, as well as the possible aetiology, risk factors and prognosis for women who experience the condition. According to prevalence studies, PLPP is experienced by almost half of all childbearing women. After pregnancy, the prevalence of PLPP declines rapidly, however some women continue to suffer pain and disability. The cause of PLPP is not fully understood and there remains debate in the literature as to whether the condition should be considered as 'normal' or pathological'. Most authors agree however, that PGP should be differentiated from the condition of LBP during pregnancy, as women who experience PGP have higher levels of pain, greater disability and a poorer quality of life when compared to women with LBP or those who do not suffer PLPP.

The main risk factors for the development of PLPP include a previous history of LBP, or previous trauma to the pelvis. There is emerging evidence of the benefit of exercise and a 'biopsychosocial' approach as interventions for PLPP. Recognition, diagnosis and management of this condition may assist in improving both short and long term health outcomes for women. This may also influence the psychosocial and economic consequences of PLPP.

Research is required into the prevalence of PLPP discriminating LBP and PGP, in Australian women, and the level of pain and the disability experienced by these women, as this is currently unknown. The main aim of the study described by this thesis was to investigate the proportion of women reporting PLPP in a sample attending a public hospital antenatal clinic. Secondly, an investigation was made of the levels of pain and disability experienced by the women who reported low back and/or pelvic girdle pain. The following chapters in this thesis will outline the methods undertaken to achieve the study objectives, the results of the research undertaken, and a discussion of these results within the context of the existing literature in this field of knowledge.

Chapter 3: Study sample & method

Objectives of the research

The primary objective of this research was to determine the number of pregnant women with low back pain (LBP) and/or pelvic girdle pain (PGP) in a sample attending an Australian public hospital antenatal clinic. The secondary objective of the research was to assess the level of pain and disability experienced by the women who reported LBP and/or PGP. The foreseen benefit of a descriptive analysis and reporting of study results was to increase maternity health care workers' understanding or pregnancy-related LBP and PGP in an Australian context, thereby informing practice to improve health outcomes for women. This chapter will outline the methodology employed to achieve the study objectives. The method and conduct of the study will be explained, including a description of measurement tools and the statistical tests used for the analysis of data.

Study Design Overview

Selection of methodology

The methodological design chosen to achieve study objectives was a quantitative, descriptive survey. Quantitative research endeavors to measure and compare the *quantity* or numbers of a *variable* within a population, and then develops theories about the relationships between variables, which may explain the measurements (Harris, 2004). Descriptive research attempts to describe the characteristics of the population studied and the levels of phenomena of that population (de Vaus, 2004). A cross sectional survey was chosen, as this design enabled a reasonably representative sample of the population. This method was also simple, quick and inexpensive to administer, with women required to only participate once, on the day of survey (Jolley, 2004).

The survey

The survey used in this study was designed by the researcher with the advice of academic supervisors and Dr Jenny King, a urogynaecologist at the study hospital. In the development of the survey, attention was given to general instructions and question instructions, as well as the appearance and length of the survey. The aim during development was to maximise responses through the acceptability of the survey to the participant (de Vaus, 2004). The survey was analysed for simplicity of wording, clarity of questions, and for a logical and 'easy to read' format. The formatting of previously used surveys was investigated to assist this process. The survey was pilot tested on 15 pregnant women prior to the commencement of data collection. After receiving feedback and making adjustments to numerous versions, the final version received the approval of the Sydney West Area Health Service (Westmead Campus) Human Research Ethics Committee (Appendix 1).

Study population

The study was conducted at Westmead Hospital, a major tertiary referral hospital located in Western Sydney NSW. The hospital is administered by Sydney West Area Health Service (SWAHS), services a population of 1.85 million people and is described as one of the largest health campuses in Australia. Demographics of the resident population indicate significant cultural and linguistic diversity, with a large proportion of new Australian settlers from skilled and family immigration, and from Humanitarian Programs aiding the resettlement of refugees (Australian Bureau of Statistics, 2007). According to the Australian Bureau of Statistics (2007) 39% of residents spoke a language other than English at home, with highest proportions in Auburn (66%), Holroyd (45%) and Parramatta (44%). The population also covers a large spectrum of socio-economic indexes with some residents amongst the most disadvantaged in NSW with low income, low educational attainment and high unemployment. During 2009, there were 4,587 pregnancies with 4,724 babies born at Westmead Hospital (Westmead Obstetrix, 2010).

Inclusion criteria

Criterion for inclusion in the study was determined according to study limitations, ethical considerations, and possible confounding variables of LBP and/or PGP. Women in their third trimester were selected so that a retrospective recollection of pain throughout the pregnancy could be obtained, as well as reported pain on the day of data collection. English speaking women were required to complete the survey as time constraints and lack of study funding did not allow for use of interpreters and translation of the questionnaire into other languages. Women under the age of 18 were excluded due to the age of consent. Women with intellectual or mental impairment were also excluded due to the nature of the survey and consent process requiring adequate skills in reading, writing, and interpretation of questions and a general understanding of the aims of the project. Women who reported conditions such as inflammatory or osteoarthritis, a recent fracture or surgery to the back, hip or pelvic area (in the previous 12 months) and/or any other serious pathology (eg. carcinoma) were excluded from the study sample due to the possible influence of these conditions on the reporting of pain. The example of other authors was followed when determining these exclusion criteria (Gutke, et al., 2006; Mousavi, et al., 2007).

Process of data collection

Data were collected in the Women's Health Clinic at Westmead Hospital between 17th and 23th March, 2010. The purpose-designed survey was administered to a cross sectional cohort of 105 primiparous or multiparous women in their third trimester of pregnancy (from 28 weeks gestation), with a singleton or multiple pregnancy. Sample size was not calculated for statistical power but selected as one that needed to be manageable due to the limited time available for completion of an Honours project and was a non-random convenience sample. It is recognised that this limits inferences drawn from the study as the sample may not be fully representative of the target population. Eligible women were invited to participate in the study and supplied with a study brochure and 'participant information sheet' with consent form, as required by SWAHS Human Research Ethics Committee. Consenting women

who met inclusion criteria were then recruited to the study. Copies of the 'Investigator Brochure' and 'Participant information sheet and consent form' are found in Appendix 2.

Conduct of the study

The study consisted of three phases. These phases are briefly summarised below and then described in more detail in the next section.

Initial Survey

The initial survey was self-administered to all consenting participants, the researcher on hand to answer any queries arising during the completion of the survey. Survey questions included demographics, exercise habits and lifestyle. Following the initial survey, women who reported no symptoms of low back and/or pelvic girdle pain during the current pregnancy did not participate further in the study.

Secondary Survey

Women who reported symptoms of low back or pelvic girdle pain through the initial survey were asked to complete a second survey with a pain diagram, a Visual Analogue Scale to assess pain intensity, and the Oswestry Disability Index (version 2.1a). An open ended question was used at the end of the survey to explore any further concerns expressed by the women.

Physical assessment

The third phase of the study was a physical assessment to confirm diagnosis and differentiate LBP and PGP. The assessment was carried out by a single examiner (the researcher) a physiotherapist with extensive experience in the assessment of musculoskeletal disorders associated with pregnancy.

Description of survey and selection of measurement tools

Initial survey

Demographics, exercise habits and lifestyle

Questions about demographics, exercise habits and lifestyle were asked to provide descriptive data of the study population and to enable comparisons to be made with previous studies of prevalence. Variables in the population studied included age, number of previous pregnancies and the estimated date of birth of current pregnancy, country of birth, body mass index (pre-pregnancy) and employment status. Exercise was assessed according to frequency (number of times per week) and type (general, pregnancy specific, abdominal, pelvic floor). Lifestyle factors that were thought to be possible confounding variables of low back or pelvic girdle pain were also assessed; these included bending, lifting, the use of stairs and house work, and whether or not the woman had support at home to help with these activities.

Secondary survey

Selection of measurement tools

When selecting a measurement tool for use in research there are several considerations that should be addressed. Whilst it is recognised that no instrument is perfect (Bombardier, 2000), it is important that the tool is simple to administer and easily understood by the target population. The concepts of reliability, validity and sensitivity of the tool should also be evaluated. *Reliability* means that the test scores provided by an individual on two separate occasions are similar; *validity* is the extent to which the test measures what it is supposed to measure; and *sensitivity* indicates that the measurement scale covers the whole dimension of the construct (Ong & Seymour, 2004).

A method used for examining the validity of questionnaires is a Rasch analysis (Davidson, 2008). This method was developed by a Danish mathematician George Rasch, as a model to test the probability or extent to which a pattern of responses to questions correlate with an expected pattern. The analysis transforms measures from ordinal to interval scales; the interval scaling system

provides standardised distances between points in the scale and therefore allows a more precise interpretation of the levels measured so that the validity of the scale can be assessed (Page, Shawaryn, Cernich, & Linacre, 2002).

Evidence of reliability, validity and sensitivity were taken into consideration when selecting tools for the measurement of the key constructs in this study: pain and disability. The construct of 'quality of life' would have been interesting to explore however was not measured in this study due to the limitations of the study as an Honours project with time constraints.

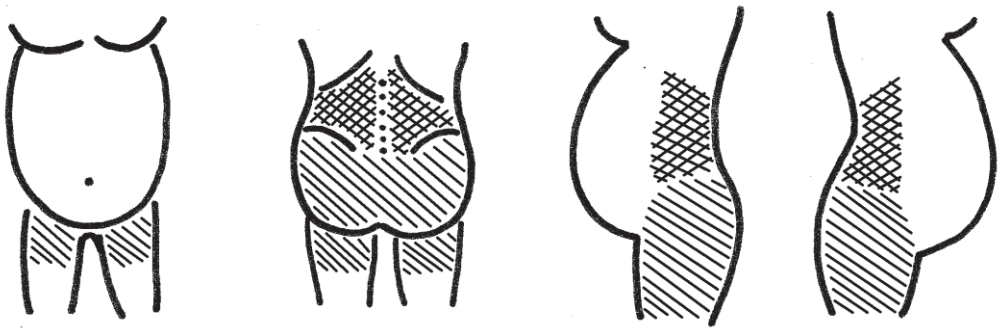
Measurement of pain

Pain is a critical element of this study. Pain is complex phenomena, with a multitude of descriptive terminology. According to the International Association of the Study of Pain, pain is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage and described in terms of such damage" (Merksey & Bogduk, 1994). Pain is a personal and subjective experience, therefore the very nature of this construct makes objective assessment impossible (Breivik, et al., 2008). Any attempt to measure and assess pain must rely on 'self-report': the person's ability to communicate and recall pain. A retrospective recollection of pain however, may not be accurate as the memory of pain may be affected by changing context (Breivik, et al., 2008).

Ong and Seymor (2004) describe three distinct dimensions of pain: *sensory-discriminative* covering pain intensity and location; *affective-motivational* which includes the emotional and aversive aspects of pain; and *cognitive-evaluative* which deals with the value a person places on the meaning and consequences of their pain including its impact on his/her quality of life. There is no single pain measurement tool that is able to cover all dimensions and a multitude of tools are described in the literature.

The pain diagram

Figure 2: The pain diagram for self report of LBP, PGP or both



Pain drawings are a major source of information regarding the surface (extent) and location (distribution) of pain that is perceived, and are a standard assessment tool used by clinicians to assist diagnosis (Margolis, Chibnall, & Tait, 1988; Ong & Seymour, 2004). Clients are asked to shade or mark areas within an outline of a human figure that correspond to the areas of their body where they experience pain. The test-retest reliability of the pain drawing has been investigated with chronic pain, and has been shown to be reliable over time (Margolis, et al., 1988). The tool has been used to differentiate low back and pelvic girdle pain in pregnancy (Ostgaard, Andersson, & Karlsson, 1991).

The pain diagram is used in this study as a self-report tool of LBP, PGP or combined LBP and PGP (Figure 2). Areas marked above the level of the 5th lumbar vertebra (L5) are classified as LBP; areas marked below the level of L5 and the iliac crests (anterior, posterior and/or lateral view) are classified as PGP and those marked both above and below are classified as combined LBP and PGP.

The Visual Analogue Scale

The Visual Analogue Scale (VAS) was used in the second survey. It is a simple ratio scale, and a well validated tool used to determine pain intensity (Boonstra, Schiphorst Preuper, Reneman, Posthumus, & Stewart, 2008; Price, McGrath, Rafii, & Buckingham, 1983). The instrument consists of a horizontal line, 100mm in length, anchored by word descriptors at each end of the scale: 'no pain' and 'pain as bad as it could possibly be' (Figure 3). The client is asked to

select the point on the scale that best represents his/her perceived level of pain. The 10 point scale has been described as providing an adequate level of discrimination for pain sufferers (Jensen, Turner, & Romano, 1994), being sensitive to small differences in perceived pain intensity (Ong & Seymour, 2004; Rosier, Iadarola, & Coghill, 2002). The VAS has been previously used in studies of PLBP and PPGP (Gutke, et al., 2006; Mousavi, et al., 2007; Olsson & Nilsson-Wikmar, 2004).

In this study pain intensity was measured by a VAS with numerical rating scale for 'usual pain' during the pregnancy, and current pain (pain experienced on the day of the study). The use of verbal descriptors for pain was not employed, however the segmentation of verbal descriptors within the scale assisted in categorisation of pain level for data analysis and reporting or result (Figure 3).

Figure 3: Commonly used one-dimensional pain intensity scales

- ***Figure removed due to copyright***

The 11-point numerical rating scale (NRS), the VAS from no pain (=0) to worst pain imaginable [=10 (or 100)] and the four-point categorical verbal rating scale (VRS) (Breivik, et al., 2008).

Measurement of Function

The ability of the pregnant woman to function physically: to effectively perform mobility and ambulatory tasks in everyday activities, as affected by her pain; was seen as key construct to measure in this study. The World Health Organization (WHO), (2001) recommends an International Classification of Functioning Disability and Health (ICF), which takes into consideration a person's functioning not only classified according to bodily function and

structure, but one which occurs within an individual's context or societal environment. This stance by the WHO shifts the emphasis from the *cause* of the disability to the *impact*, and sees disability not just as a medical or biological dysfunction (World Health Organization, 2001).

'Disability' has been defined as the ability of an individual to meet social or occupational demands due to either physical or psychological disadvantage (Ong & Seymour, 2004). This concept is distinct from 'impairment' which is described as the loss of function due to a physiological or anatomical abnormality (Ong & Seymour, 2004). As with pain, disability is a complex phenomenon and there is no ideal tool for its measurement. Pain and disability are also distinct concepts and therefore do not necessarily correlate with each other.

There are various tools described in the literature used to measure disability. As already discussed, the tool selected should be one that has proven validity, reliability and sensitivity.

The Oswestry Disability Index (version 2.1a)

The Oswestry Disability Index (ODI), (Version 2.1a) is a commonly used condition-specific tool in the management of spinal disorders. It attempts to quantify the level of pain interference with physical activities by providing an estimate of disability expressed as a percentage score (Davidson, 2008). The index is a questionnaire with ten sections covering the assessment of: pain intensity; personal care; lifting; walking; sitting; standing; sleeping; sex life; social life and travelling. For each section there are six statements which are scored on a scale from 0 to 5, according to rank. The scores are totalled out of a possible score of 50, and then calculated as a percentage; a higher percentage score indicates a greater disability. The tool was first developed by John O'Brien in 1976, and published in 1980 (Fairbank, Couper, & Davies, 1980) and has been shown to be a valid and reliable measure. Some adaptations of the tool by various researchers have not been validated, which according to Fairbank (2007) leads to a higher mean score and an exaggeration of any

treatment effect. The original authors of the ODI emphasise the importance of using the tool without alteration (Fairbank, 2007).

Version 2 of the ODI was developed by the Medical Research Council group in the United Kingdom (Fairbank & Pynsent, 2000). A Rasch analysis of this version has supported its construct validity however pregnancy was excluded from the analysis (Davidson, 2008). An evaluation of the effects of PGP and analysis of results should take into account that pregnancy itself may contribute to a considerable reduction in the woman's ability to function with everyday activities (Olsson & Nilsson-Wikmar, 2004; Rost, et al., 2004). Olsson and Nilson-Wikmar (2004) employ a 'Disability Rating Index' to score physical ability during pregnancy in their study however do not verify its use as a valid and reliable measure during pregnancy. Gutke et al (2006) support the use of the ODI (vs 2) in their study of pregnancy-related disability because of the recommendation of the need for standardised clinical outcome measures in back pain sufferers by an international group of back pain researchers (Deyo, et al., 1998).

There are only a few tools reported in the literature for the measurement of function specifically during pregnancy, none of which have proven validity (Vleeming, et al., 2008). A pregnancy mobility index (van de Pol, et al., 2006) and a scoring system for symphysis pubis dysfunction (Leadbetter, et al., 2006) have been developed. On closer examination of these tools, it was decided by the researcher that the questions used did not reflect cultural differences in an Australian population, and the tool for assessment of symphysis pubis dysfunction did not address the conditions of posterior pelvic girdle and lumbar pain. The ODI (vs2.1a) was chosen because of its use in previous studies of PLBP and PPGP (Gutke, et al., 2006) and because it measures disability not just as mobility dysfunction but as a social and environmental construct. Consent was obtained from the authors for use of the ODI (refer to Appendix 3) and the questionnaire was retrieved from the website: http://www.orthosurg.org.uk/odi/. As part of the survey in this study, the instrument was not altered in any way and the scoring system was strictly adhered to.

Further questions about pain

The secondary survey provided an opportunity to explore further issues related to PGP and LBP by asking questions related to the onset of the pain (period of gestation), whether the woman had reported pain to their antenatal carer, and whether or not treatment had been received and was beneficial. Women were also asked whether LBP and /or PGP were conditions that were to be expected because of pregnancy. An open-ended question was asked at the conclusion of the survey to capture any further views or concerns that the women might wish to express. The content of the complete survey is in Appendix 1.

The physical assessment

Background to diagnostic tests used for PGP

A large body of literature supports the theory that pregnancy-related PGP is discrete from LBP, although the conditions may co-exist, and different management strategies are therefore required for each condition (Albert, et al., 2001; Gutke, et al., 2008; Ronchetti, et al., 2008). Albert, Godskesen, and Westergaard (2002) propose that classification of pelvic girdle pain should involve both reports from the woman and a physical assessment. Also, differentiation of pregnancy-related LBP and PGP into subgroups assists in identifying those women most at risk of long-term dysfunction (Ronchetti, et al., 2008; Rost, et al., 2006). It was therefore decided for this study that physical assessment would be included to provide further information regarding the woman's condition. This was undertaken in phase three of the study.

A recent European publication on guidelines for the management of pelvic girdle pain, recommends the use of more than one clinical test to diagnose and differentiate LBP and PGP (Vleeming, et al., 2008). The following tests were used in this study to confirm diagnosis of either:-

- Pelvic girdle pain (lumbo-sacral, sacro-iliac and/or pubic symphysis)
- Lumbar pain, or
- Combined lumbar and pelvic girdle pain

The tests were selected because of reported high specificity; indicating that if they are negative, it is likely that the woman does not suffer from pain in the pelvic girdle. The sensitivity of the tests however is lower; therefore more than one test was administered. If two or more tests of PGP were found to be positive, the diagnosis was made of PGP.

Description of tests used

Posterior pelvic pain provocation test (Ostgaard, 1996)

Patient:	Supine with the hips and knees flexed.
Therapist:	Standing at the patient's side.
Palpate:	Flex the ipsilateral hip and knee to 90°. Gently stabilise the contralateral anterior superior iliac spine with one hand.
Test:	Apply a posterior force gently through the axis of the femur to the ilium thus posteriorly shearing the sacro-iliac joint and note the reproduction of any symptoms.

The posterior pelvic pain provocation test is a highly reliable test to differentiate between low back pain and posterior pelvic pain in pregnancy, considered positive if pain is reproduced in sacro-iliac joint or symphysis.

Palpation of the long dorsal sacroiliac ligament (Vleeming, et al., 2002)

Patient:	Standing or side-lie (slight hip/knee flexion)
Therapist:	Standing at the patient's side. Gently palpate the long dorsal ligament directly caudal to the posterior superior iliac spine.
Test:	If pain persists for more than 5 seconds after removal of the therapist's hand, it is recorded as pain. If pain disappears within 5 seconds it is recorded as tenderness.

Palpation of the symphysis (Vleeming, et al., 2008)

Patient:	Supine
Therapist:	Gently palpate the entire anterior surface of the pubic symphysis.
Test:	If pain persists for more than 5 seconds after removal of the therapist's hand, it is recorded as pain. If pain disappears within 5 seconds it is recorded as tenderness.

Modified Trendelenburg (Vleeming, et al., 2008)

Patient:	Stands on one leg and flexes the hip and knee to 90°
Therapist:	Provide support and modify as necessary.

Test: If pain is elicited in the symphysis the test is considered positive.

The active straight leg raise (Mens, Vleeming, Snijders, Koes, & Stam, 2001)

Patient: Supine lying, legs extended.

Therapist: Monitor the anterior superior iliac spines bilaterally.

Test: Instruct the patient to raise their leg with an extended knee (20cm above couch). Note the ease with which they are able to do so, the provocation of any symptoms as well as any compensatory motions of the trunk during the test. When the active (neuromuscular) system is dysfunctional, the pelvic girdle will tend to rotate towards the leg which is being raised.

Passive straight leg raise (Rebain, Baxter, & McDonough, 2003)

This test was used if lumbar disc pathology was suspected. It is reported that disc pathology only occurs in about one in 10,000 pregnancies (Abou-Shameh, Dosani, Gopal, & McLaren, 2006).

Patient: Supine lying, legs extended.

Therapist: Monitor the anterior superior iliac spines bilaterally.

Test: Assist the patient to raise their leg with an extended knee until limitation of movement is reached. Note the provocation of any neural symptoms.

Analysis

Assistance with the preliminary analysis of data was provided by Westmead Hospital's statistician. Further analysis was made by reference to Pallant (2009).

The study questions for analysis were:

1. What is the number of women who report LBP and/or PGP in the sample?
2. What is the level of pain and disability of women who report LBP and/or PGP?

The researcher was interested in the investigation of whether there was a relationship between reporting of LBP and/or PGP (as the independent variables), the study population characteristics, and the measures of pain and disability (the dependant variables).

Reporting of results

The number of pregnant women (prevalence in the sample) with LBP and/or PGP is reported in following ways:

- Self report from initial survey, overall prevalence of 'lumbo-pelvic' pain (LPP):
    - On the day of completion of survey: 'point prevalence'
    - Over the period of the current pregnancy: 'period prevalence'.
- Self report of area of pain: differentiation of LBP, PGP or combined LBP/PGP from the pain diagram.
- Diagnostic confirmation and differentiation of LBP, PGP or combined LBP/PGP from the physical assessment.

For the purpose of reporting data the following terms are used:

- *'Low back pain and/or pelvic girdle pain'* (LBP and/or PGP): as a single category in the initial survey sample (n=96) will be referred to as lumbo-pelvic pain (**LPP**).
- *'Low back pain only'*: as a single category in the LPP sample for self report of area of pain from the pain diagram (n=63), or for diagnostic confirmation from the physical assessment (n= 57) will be referred to as low back pain only (**LBP**).
- *'Pelvic girdle pain only'*: as a single category in the LPP sample will be referred to as pelvic girdle pain only (**PGP**).
- *'Combined LBP and PGP'*: as a single category in the LPP sample will be referred to as both LBP and PGP (**both LBP and PGP**).

Statistical significance

When determining the statistical significance of results, a significance level of 95%, confidence interval= 5% (Type 1 error) was used. Results of two tailed tests are reported where appropriate because they are more conservative than one tailed. Yates Continuity of Correction was used when required in

determining the p value. If the p value was $\leq$ 0.05 the null hypothesis was rejected.

Agreement between definitions and diagnosis

It was seen as an important consideration within the study to address the difficulty of definition and 'diagnoses' of the condition of pregnancy related LBP and/or PGP, so that what was reported could be compared to previous studies. In the published literature, some studies have used self report and/or the pain diagram from a survey in categorising the condition (Mogren, 2006; Olsson & Nilsson-Wikmar, 2004; Robinson, et al., 2006; Skaggs, et al., 2007; Van de Pol, Van Brummen, Bruinse, Heintz, & Van der Vaart, 2007) , and others have used clinical diagnostic tests in the form of a physical assessment (Albert, et al., 2006; Gutke, et al., 2006; Mousavi, et al., 2007). A statistical method available to assess the consistency or degree of agreement between two different diagnostic methods is the non parametric Kappa Measure of Agreement. Two categorical variables are required with an equal number of categories for this statistical test. In this study the two different methods used to report LBP and/or PGP were: 'Self report from the pain diagram' and 'Diagnosis from the physical assessment'. Each variable is categorised as either 'LBP only', 'PGP only' or 'both LBP and PGP'. The Kappa Measure of Agreement was used to assess the degree of agreement between the two methods used to define the condition. When reviewing the results of this analysis it should be taken into consideration that differentiation of the condition from the pain diagram was representative of self reported pain during the period of the pregnancy, whereas the differentiation of PLPP from the physical assessment was determined on the day of the survey. This is likely to influence the level of agreement between methods.

Statistical software

Data were analysed using PASW statistics 18 (formerly known as SPSS). The choice of statistical tests and type of analysis used was supported by Pallant (2009). The rationale for choice of tests will be described in each section. In summary, the sample was analysed descriptively, with calculation of means and standard deviations for parametric data. The Pearson's Chi-Square (x^2) or

Fisher's Exact Test, and the Kappa Measure of Agreement were used to test the difference between groups for categorical, non-parametric data. For a one way analysis of variance, the Kruskal-Wallis Test was used to test the differences between groups for non-parametric data. A descriptive thematic analysis with reference to key words was used to explore open ended questions.

Ethics Approval

The study received the approval of the SWAHS (Westmead Campus) Human Research Ethics Committee. In order to meet the requirements of the committee, Staff Specialist and Director of the Pelvic Floor Unit at Westmead Hospital, Dr Jenny King agreed to oversee the study site as the 'Chief Investigator'. The following criterion was addressed for consideration of ethics approval. Copies of the letters of ethics approval and study site approval can be found in Appendix 4.

Privacy and confidentiality

The privacy and confidentiality of all study participants was protected and administrative obligations relating to monitoring and archiving data were adhered to. All participants gave informed consent prior to enrolment in the study. Consent forms were stored separately from data in a locked cabinet in the office of Dr King at Westmead hospital. Data collected did not identify the participant: each woman was identified throughout the study by an allocated number. The number of questionnaires, participant recruitments/refusals, and any practical issues arising from data collection, were recorded daily on a standardised, purpose designed summary sheet. The summary sheet was reviewed during the data collection phase of the study by the Nursing Unit Manager of the Women's Health Clinic in order to monitor the progress of the study.

Coercion

Participants were informed that researcher was an employee of SWAHS. Prior professional relationships between the researcher and participants was unlikely to pre exist, therefore minimising any impairment of voluntary participation (for example feelings of coercion). Participants were assured that their

participation was completely voluntary and that they could withdraw from the study at any stage.

Workplace issues

The time and place of data collection was negotiated with the workplace so as to cause minimal inconvenience to participants, their family members or staff. Prior arrangements were made for any concerns raised during data collection to be discussed with Dr King or the Nursing Unit Manager of the Women's Health Clinic. There were, however, no reported concerns during the data collection phase of the study.

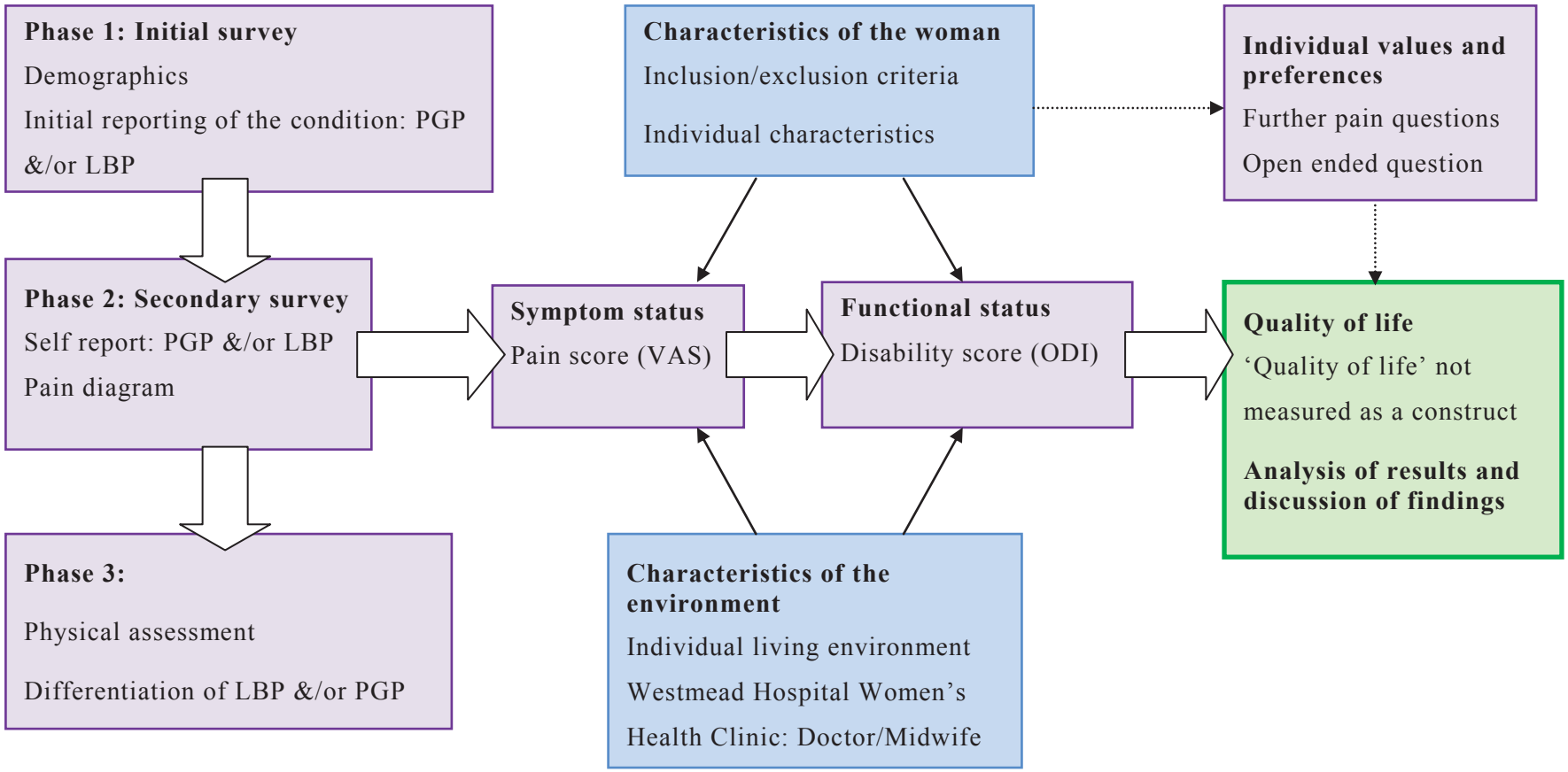
Risk and monitoring

Risk to the woman and her unborn child during the study, including the physical assessment, was considered minimal. Monitoring of un-anticipated developments or presentations to the Birth Unit was conducted by Dr King. A summary sheet with details of the woman's name, medical record number and gestation of pregnancy was kept by an independent clerical assistant whose role was to notify Dr King of any unscheduled presentations to the Birth Unit for a two week period following the study participation. There were no un-anticipated developments or reports of harm following participation in the study.

Summary

An overview of the design and method use in this research, including study sample, method and measurement tools selected, is summarised in the following diagram, adapted from Bombardier (2000). The next chapter will present the results of the research study undertaken for this thesis.

Figure 4: Conduct of the study



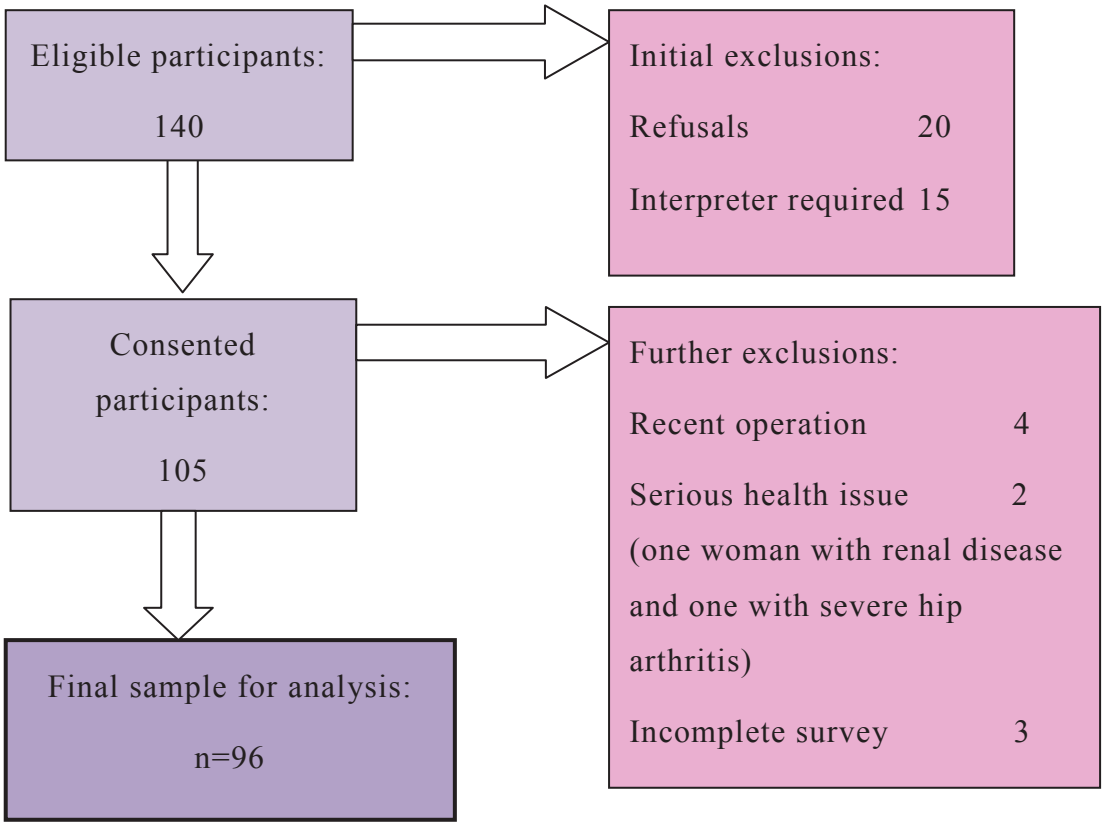
Chapter 4: Results

This chapter presents the results of the research as related to the study objectives. Statistical tests chosen for use in the analysis of data collected will be explained were necessary to assist the interpretation of results. Additional unexpected outcomes of importance that contribute to the body of knowledge in this topic will also be outlined.

Data collection and sample size

One hundred and forty women were approached as they presented for their antenatal appointment, after they had registered their attendance with the receptionist in the Women's Health Clinic at Westmead hospital. I approached the women as the researcher. Twenty women refused to participate; the main reason cited was concern over the time involved in the survey and physical assessment. Fifteen women were unable to participate due to inadequate English and the need for an interpreter. There were 105 participants who consented to participation in the study and completed the initial survey. Following evaluation of responses from the initial survey, a further nine women were excluded from the analysis, leaving a final study sample of 96 women. A flow chart of the method of selection of study participants for inclusion in my study and the final sample used in the analyses is shown in Figure 5.

Figure 5: Flow chart of participants



Description of study sample

The initial survey provided descriptive characteristics of the participants. Categorical variables (clinic, age, parity, ethnicity and employment) were investigated using descriptive statistical analysis and frequencies. Continuous variables (number of weeks of pregnancy and body mass index) were analysed for mean, standard deviation, minimum and maximum values, as well as skewness or kurtosis of the distribution. The results of the analyses are summarised below. Data is provided in detail in Appendix 5.

Women's Health Clinic

Of the 96 women in the final analysis, 46 (48%) were attending a midwives' clinic and 49 (51 %) a medical (doctors') clinic (1 missing data). Medical clinics were for women with 'high risk' pregnancies; for the monitoring of maternal and fetal welfare associated with medical conditions such as

hypertension and diabetes. Analysis of variables within the sample demonstrated no significant differences between the clinic groups in terms of age, parity, country of birth, number of weeks of pregnancy and pre-pregnancy body mass index (BMI) or reporting of PLPP during the pregnancy or on the day of the survey (Table 1).

Table 1: Antenatal clinic and participant characteristics

Participant Characteristic n=95*	**Midwives Clinic n=46 (% of total sample)**	**Doctors Clinic n=49 (% of total sample)**
Age: < 35	41 (51)	40 (49)
≥ 35	5 (36)	9 (64)
Parity: Primiparous	26 (51)	25 (49)
Multiparous	20 (45)	24 (55)
BMI: < 25**	30 (55)	25 (45)
≥ 25	15 (39)	24 (61)
Country of Birth:		
Australia	18 (50)	18 (50)
Asia (including India)	19 (53)	17 (47)
Other	9 (40)	14 (60)
PLPP during the pregnancy (n=67)	33 (49)	34 (51)
PLPP on the day of survey (n=32)	16 (50)	16 (50)

*1 missing participant in this table as clinic not identified

** Unable to calculate BMI for one woman due to missing height/weight

Age

The distribution of age of the participants followed a normal curve, with the largest group between 25 - 29 years (36 women; 37%; Appendix 5). For cross-tabulation analyses, age groups were re-coded into two categories: ' < 35 years' and ' ≥ 35 years'. Support for this decision is found in obstetric literature which describes maternal risk as increasing after the woman reaches the age of 35 (National Collaborating Centre for Women's and Children's Health, 2008).

Parity

Fifty one women (54% of the 96 in the analysis) were experiencing their first pregnancy (primiparous) and 44 (46%) had one or more previous births (multiparous): 29 (30%) one previous birth, 7 (7%) two, 5 (5%) three, 2 (2%) four and one woman had six previous births. In the analysis women were re-coded as either 'primiparous' or 'multiparous'. One woman had a twin pregnancy.

Ethnicity

Ethnicity was determined by reported country of birth. It is recognised that this is not necessarily an accurate indication of the cultural background or ethnic origin of the respondent and this will influence the interpretation of results. Assessment of ethnicity is complex and becoming increasingly challenging in a society of multicultural diversity and possible mixed racial partnered relationships and families. This measure of ethnicity was chosen because of its simplicity and use in previous studies (Dahlen & Homer, 2008).

Twenty seven different countries of birth were identified from the initial survey and these were grouped into three categories for data analysis: 37 (38.5 %) women stated that they were born in Australia; 36 (37 %) from Asia (including 18 (20%) from India/Sri Lanka); 23 (24 %) women were grouped as 'other', the largest sub-group of 6 (6%) was Middle Eastern (Lebanon, Afghanistan, Iraq, Iran) (refer to Table 1). Other countries reported in the survey included America, Canada, Europe (Poland, Bosnia, Germany and Italy), the United Kingdom (England, Ireland), Africa (Sudan, Sierra Leone) and the Pacific

Islands (New Zealand, Fiji). These data revealed a broad and reasonably representative sample of the population of western Sydney (SWAHS), comparable to 2006 census data from the Australian Bureau of Statistics (Australian Bureau of Statistics, 2007).

Period of gestation of current pregnancy (in weeks)

The inclusion criterion for the study sample was selected as the third trimester of pregnancy (≥ 28 weeks). A term pregnancy is described as 37 to 42 weeks gestation. The period of pregnancy of the study sample ranged from 28 to 41 weeks, n=96). The mean gestation was 34.8 weeks; the median and mode were equal at 35 weeks (SD 3.5). The distribution was skewed at -0.42 (Appendix 5).

Body Mass Index

Body Mass Index (BMI) was calculated from pre-pregnancy weight and height. Almost half of the women (40; 42%) were found to have a 'healthy BMI' or normal weight range of 20 to 24.9. Fifteen women (16%) were below normal weight (≤ 19.9), 20 women (21%) were classified as overweight (25 to 29.9) and 20 (21%) obese (≥ 30). Two of these latter women had a pre-pregnancy BMI over 40. BMI was analysed as a categorical variable: ' < 25': normal or underweight; or ' ≥ 25': overweight or obese.

Employment

Twenty two (23%) of women surveyed were employed full time, 14 (15%) part time and 5 (5%) casual. Fifty three (55%) of women were not currently employed and two (2%) were on maternity leave. Categories of employment were re-coded for analysis as either 'employed' 41 (43%) or 'not currently employed'.

Exercise habits and lifestyle

A summary of exercise habits and lifestyle characteristics of the women surveyed is found in Table 2. Regular exercise was classified as walking, swimming or a gym class. Of the 60 women (64%) who reported regular exercise almost one third (n=28, 30%) indicated that they exercised three or more times each week. The questions regarding pelvic floor and abdominal muscle exercise were asked as a statement: "I do an exercise program for

pregnancy including pelvic floor/abdominal exercises". Five women (5%) indicated that they did pelvic floor exercises three or more times a week, and only one woman did regular abdominal exercises three or more times a week. Exercise responses (regular, pelvic floor and abdominal) were re-coded into dichotomous variables for data analysis: ' ≥ once per week', or 'no regular exercise'. Sixty two women (68%) indicated that they had support at home to help with child minding and/or housework.

Table 2: Exercise and lifestyle characteristics of the participants

Exercise and lifestyle	**Yes: n (%) n=93***
Regular exercise (≥ once per week)**	60 (64)
Regular pelvic floor exercise (≥ once per week)**	23 (24)
Regular abdominal exercise (≥ once per week)**	15 (16)
Regular use of stairs	63 (68)
Regular bending	55 (59)
Regular lifting	39 (42)

*3 missing data; **Participants could give more than one response.

The prevalence of pregnancy-related low back and/or pelvic girdle pain

Period and point prevalence of LPP, LBP and/or PGP

The overall prevalence of self-reported lumbo-pelvic pain during the current pregnancy was 68 (71%); with 33 (34%) women reporting pain on the day of completion of the survey (Figure 6). Of the women who reported lumbo-pelvic pain, when pain was differentiated as LBP, PGP or both LBP and PGP from the pain diagram (n=63): 11 (17%) women reported LBP only, 21 (33%) reported PGP only and 31 (50%) reported both LBP and PGP. Twenty seven women (42%) of the LPP group reported pain in the area of the pubic symphysis on the pain diagram. According to the result of the physical assessment (n=57) conducted in the third phase of the study, 8 (15%) women were found to have LBP only, 30 (52%) PGP only and 19 (33%) had both LBP and PGP (Figure 7).

Figure 6: Prevalence of self reported lumbo-pelvic pain (LPP) in the sample

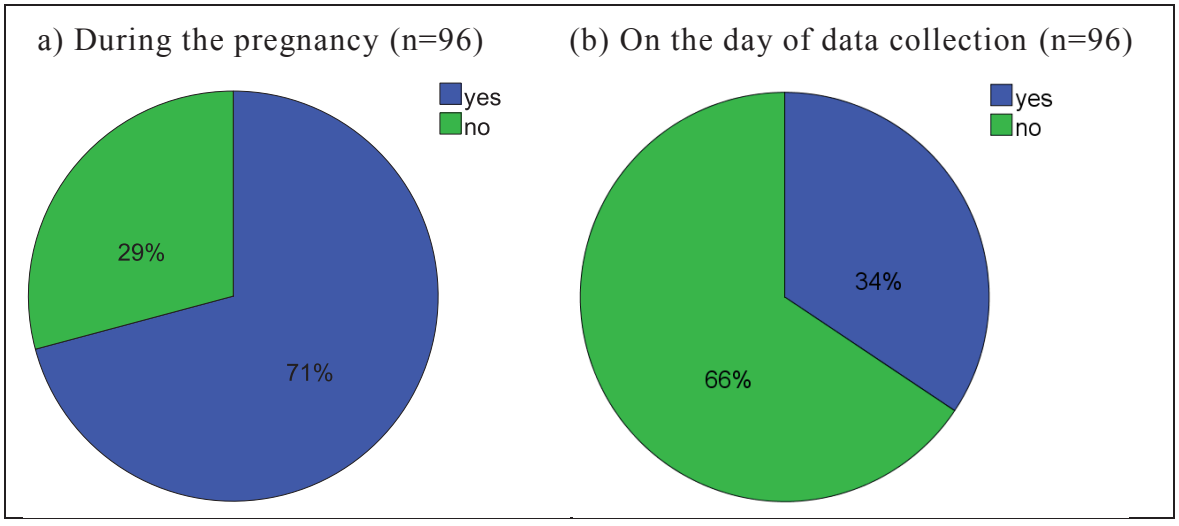
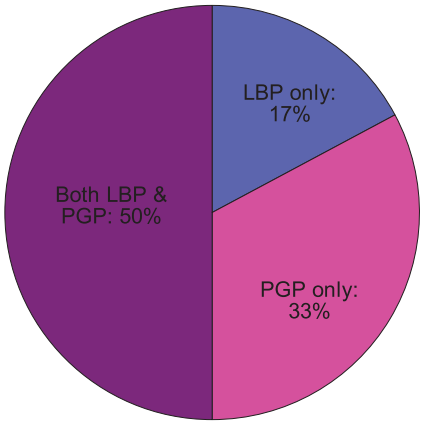
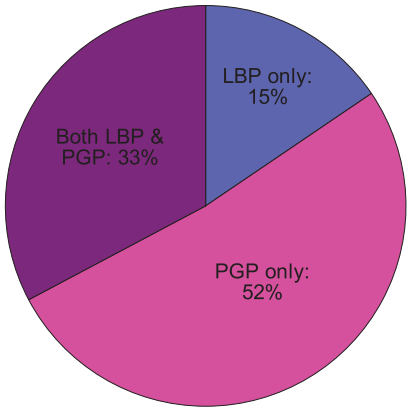


Figure 7: Prevalence of LBP, PGP or both LBP and PGP

(a) Self report of area of pain: differentiation of LBP, PGP or combined LBP/PGP from the pain diagram (n=63, 5 data missing: did not complete secondary survey).



(b) Diagnostic confirmation and differentiation of LBP, PGP or combined LBP/PGP from the physical assessment (n=57, 6 women did not stay for the physical assessment).



Agreement between the methods of reporting LBP and/or PGP

The result of the Kappa Measure of Agreement was 0.5 ($p<0.0005$) indicating that there was moderate agreement between the methods used (Peat, 2001 in Pallant, 2009). Discussion of differences in statistical outcomes for methods of reporting will be referred to in the discussion chapter.

Period of onset of pain during the pregnancy

Half of the women (n=32, 51%) in the LPP sample reported that the onset of their pain (LBP and/or PGP) had occurred between 16 and 28 weeks of pregnancy. Ten women (17%) reported that the onset of their pain had been before 16 weeks of pregnancy, and 20 (32%) after 28 weeks. There was no statistical significance found in the onset of pain when pain was categorised as LBP only, PGP only or both LBP and PGP, either by the pain diagram or by the physical assessment. The response to the question was a retrospective recollection by the woman and is therefore susceptible to response bias. A graphical representation of the period of onset of PLPP, for the subgroups of LBP, PGP and both LBP and PGP, as classified by the pain diagram and the physical assessment can be found in Figures 8 and 9.

Figure 8 : Onset of LBP and/or PGP: self report from pain diagram

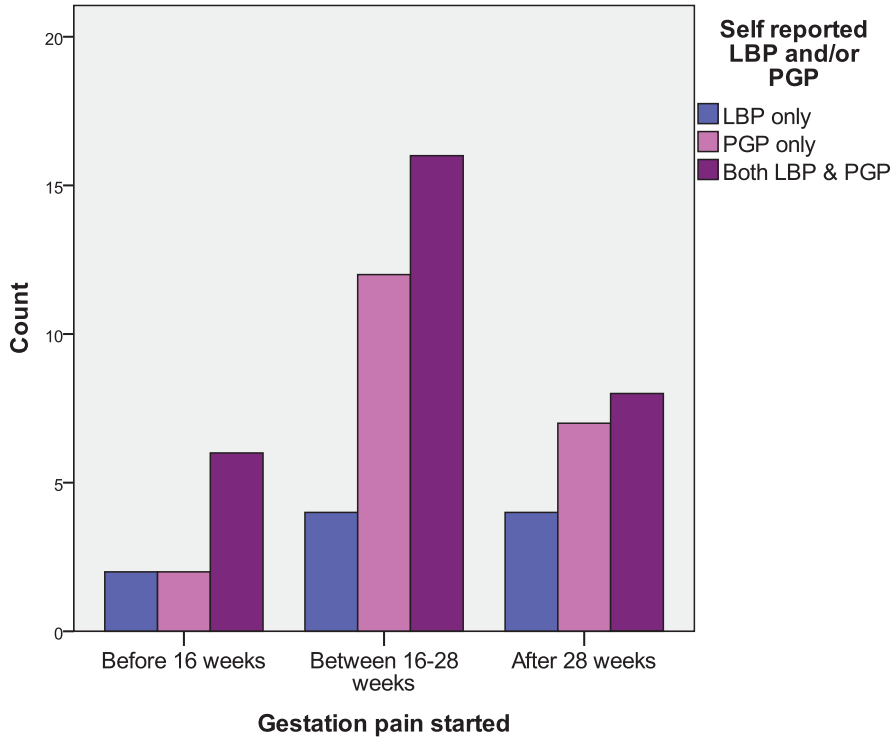
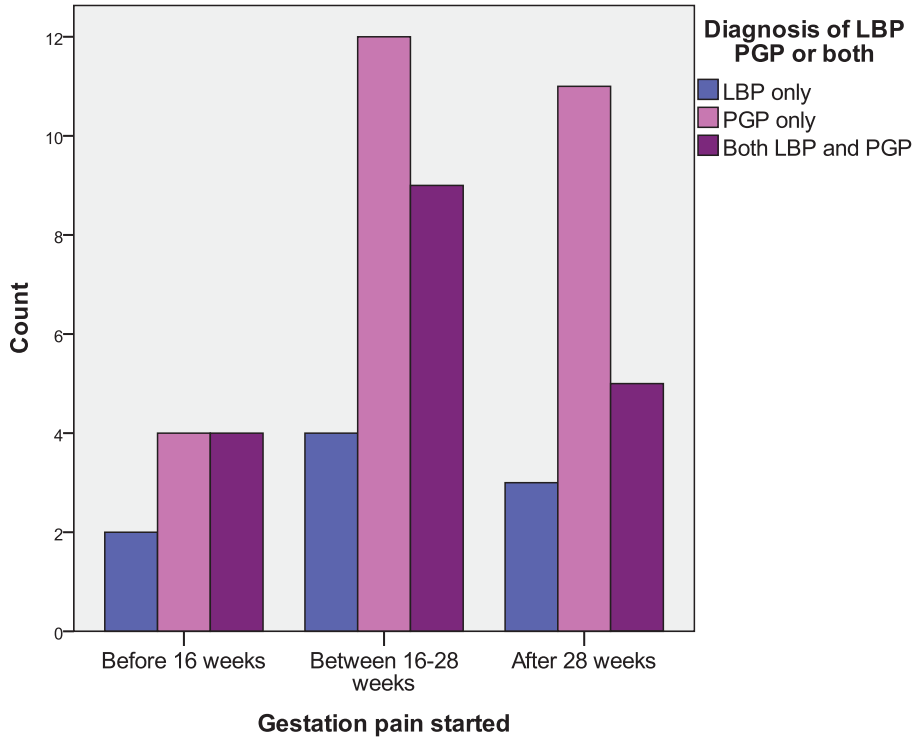


Figure 9: Onset of LBP and/or PGP: diagnosis from physical assessment



The relationship between pregnancy-related low back and/or pelvic girdle pain and participant characteristics

Testing the null hypothesis

In order to investigate whether there was an association between the reporting of LPP and study sample characteristics as categorical data, the following *null hypotheses* were tested:

There is no association of the reporting of LPP, LBP and/or PGP with:

Demographic variables
- Age: < or ≥ 35
- Parity: primiparous/multiparous
- Ethnicity: Australian/ Asian/ other
- Period of gestation
- Body Mass Index: < or ≥ 25
- Work status: Employed/not employed

Previous history of lumbo-pelvic pain
- LPP in the past unrelated to pregnancy
- LPP in the year before pregnancy
- LPP in a past pregnancy.

Exercise and lifestyle variables
- Regular exercise (general, pelvic floor, abdominal)
- Regular use of stairs
- Regular lifting
- Regular bending
- Regular housework
- Support in the home

Physical assessment variables (determined by palpation on the day of survey):
- Abdominal muscle diastasis
- Fetal lie

Statistical tests for the null hypothesis

The *Pearson Chi Square* test for independence was used to explore the relationship between categorical variables. *Yates' Correction for Continuity* was used to report statistical significance when cross tabulation involved a two by two table. A correlation coefficient, the *phi coefficient* was used to determine the strength of the association between the variables. The value of the phi coefficient ranges from 0 to 1, with higher values indicating a stronger association: 0.10 for small effect, 0.30 for medium effect and 0.50 for large effect (Pallant, 2009). A summary of population characteristics and the relationship between reporting of LPP can be found in Table 3. Further details

of the descriptive analysis of data with cross tabulation results of the Pearson Chi Square can be found in Appendix 6.

Table 3: The relationship between LPP and study sample demographics.

Study Population	n=96 (%)	LPP	n (%)	p value
		Yes	No	
Age: 18-34	82 (85)	56 (68)	26 (32)	0.2
35+	14 (15)	12 (86)	2 (14)	
Parity:				
Primiparous	52 (54)	2 (62)	20 (38)	**0.05***
Multiparous	44 (46)	38 (82)	8 (18)	
Country of birth:				
Australia	37 (39)	28 (76)	9 (24)	0.2
Asia (including India)	36 (37)	27 (75)	9 (25)	
Other	23 (24)	13 (57)	10 (43)	
BMI: < 25	55 (58)	37 (67)	18 (33)	0.3
≥ 25	40 (42)	30 (75)	10 (25)	
Antenatal Clinic:				
Midwife	46 (48)	33 (72)	13 (28)	1.0
Doctor	49 (51)	34 (69)	15 (31)	
Missing data	1 (1)			
Work status:				
Current employment	41 (43)	28 (68)	13 (32)	0.4
No employment	55 (57)	40 (73)	15 (27)	

* x^2 (1df, n=96) = 3.8, p=0.05, phi =0.34, (p value before Yates Continuity Correction = 0.03); df = degree of freedom

Results

The null hypothesis was rejected for 'parity'. The Pearson Chi Square test (with Yates Continuity Correction) indicated a significant association between

the reporting of LPP and parity, x^2 (1df, n=96) = 3.8, p=0.05, phi =-0.2. Multiparous women were more likely to report LPP than primiparous women. This was also found with cross tabulation of parity when LPP was differentiated to self report of LBP, PGP or both LBP and PGP, x^2 (2df, n=63) = 7.2, p=0.03, phi=0.34. The cross tabulation was not significant however for differentiation of LPP by diagnosis. This can be viewed in Table 3.

The null hypothesis was rejected for 'LPP in the past unrelated to pregnancy'. If the woman reported a past history of LPP unrelated to pregnancy she was more likely to report LPP on the day of data collection, x^2 (1df, n=96) =9.1, p=0.005, phi= 0.3. LPP in a previous pregnancy or in the year before pregnancy showed no association with reported LPP in the current pregnancy. This can be viewed in Table 4.

Table 4: The relationship between LPP and previous history of LPP.

Initial survey question (Q): Previous history of LPP (n=96)	n (%)	LPP during pregnancy within the Q: n (%)	p value	LPP today within the Q: n (%)	p value
Q: LPP in past unrelated to pregnancy?					
Yes	28 (29)	20 (71)	0.6	16 (57)	**0.005***
No	68 (71)	48 (71)		17 (25)	
Q: LPP in the year before pregnancy?					
Yes	10 (10)	7 (70)	1.0	4 (40)	0.5
No	86 (90)	61 (71)		29 (34)	
Q: LPP in a past pregnancy?					
Yes	19 (20)	17 (90)	0.9	10 (52)	0.1
No	77 (80)	51 (66)		23 (30)	

*x^2 (1df, n=96) =9.1, p=0.005, phi= 0.3

The null hypothesis was also rejected for the 'regular use of stairs'. Women were more likely to report LBP (n=8) or PGP (n=18) if they used stairs regularly, x^2 (2df, n=62) = 6.2, p= 0.04, phi= 0.3. No significance was found however for cross tabulation of the regular use of stairs with diagnosis from the physical assessment. Refer to Table 5 for a summary of these results.

Table 5: The relationship between exercise, lifestyle and self report of LPP

Initial survey: Exercise & lifestyle	n=61** (%)	LBP	PGP	Both LBP & PGP (%)	p value
Regular exercise					
≥ once per week	36 (59)	7 (70)	12 (57)	17 (57)	0.7
No regular exercise	25 (41)	3 (30)	9 (43)	13 (43)	
Regular bending					
Yes	39 (64)	7 (70)	14 (67)	18 (60)	0.8
No	22 (36)	3 (30)	7 (33)	12 (40)	
Regular lifting					
Yes	28 (45)	3 (30)	13 (62)	12 (40)	0.1
No	34 (55)	7 (70)	8 (38)	19 (62)	
Regular stairs					
Yes	43 (69)	8 (80)	18 (86)	17 (55)	**0.04***
No	19 (31)	2 (20)	3 (14)	14 (45)	

*x^2 (2df, n=62) = 6.2, p= 0.04, phi= 0.3; ** only 61 women who reported pain are included.

Further analyses of the null hypothesis

An association was also found between regular bending and self report of LPP on the day of the survey (x^2(2df, n=93) = 9.9, p=0.002, phi = 0.002). There was no association found between the reporting of PLPP and exercise (regular, abdominal or pelvic floor), regular lifting, or the presence of support in the home. There was no association found between PLPP (differentiated as LBP, PGP or both), by self report or physical assessment, and rectus abdominal muscle diastasis or fetal lie as determined by palpation (Appendix 6).

Pregnancy-related low back and/or pelvic girdle pain, level of pain and disability

Analysis

The Visual Analogue Scale (VAS) and the Oswestry Disability Index (Vs2a) were analysed descriptively as continuous dependant variables for mean, median (Md), mode, standard deviation (SD), range of scores and skewness. For one way analysis of variance, the Kruskal-Wallis test for K independent samples was used as a non parametric test for answering the questions:

- Is there a difference in sub-grouped Visual Analogue Scale scores or Oswestry Disability Index scores across the three groups: 'LBP' only, 'PGP' only or 'both LBP and PGP', by self report from the pain diagram?
- Is there a difference in sub-grouped Visual Analogue Scale scores or Oswestry Disability Index scores across the three groups: 'LBP' only, 'PGP' only or 'both LBP and PGP', by diagnosis from physical assessment?

Pain

Pain associated with LPP was reported by women in the study on the VAS as previously described in the Methods Chapter: for *usual pain* (usual pain intensity over the pregnancy) and for *pain today* (pain intensity on the day of data collection). The mean pain score (scaled from 0 to 10) for LPP (n=65) reported by women for usual pain was 6.5 (median 7, mode 8, SD 2.2, range 9, skew=-0.4), and on the day of data collection was 3.8 (median 3, mode 5, SD 2.7, range 10, skew=0.3). The VAS scores were sub-grouped into four categories for analysis: no pain (<1), mild pain (1 to 3.9), moderate pain (4 to 6.9) and severe pain (7 -10). The guidance for sub-grouping was taken from the numerical rating scale with verbal descriptors, as described in the Methods Chapter. Figure 10 and 11 show the median and range of pain scores for self report of pain from the pain diagram and the physical assessment. The Kruskal-Wallis test for K independent samples revealed statistically significant differences in *pain intensity levels* across the three groups: 'LBP', 'PGP', and 'both LBP and PGP', for self report from the pain diagram for usual pain (LBP,

n=11, PGP, n=21, both LBP and PGP, n=32), x^2 (2, n=64)=12.6, p=0.002) and for pain today (LBP, n=11, PGP, n=21, both LBP and PGP, n=32), x^2 (2, n=64)=8.2, p=0.017). Figures 12 and 13 show these results.

Figure 10 *:* Box plot of VAS for usual pain across the 3 categories: LBP, PGP and both LBP and PGP by self report from pain diagram

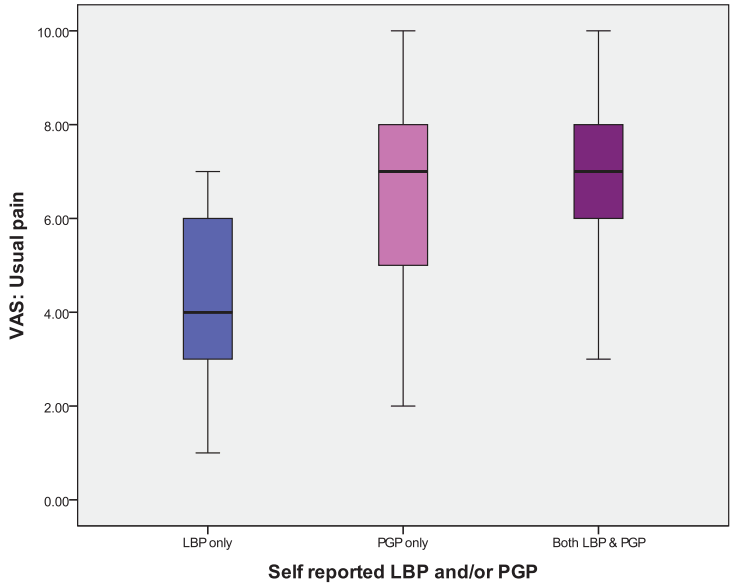


Figure 11*:* Box plot of VAS for pain on the day of data collection across the 3 categories: LBP, PGP and both LBP and PGP by self report from pain diagram.

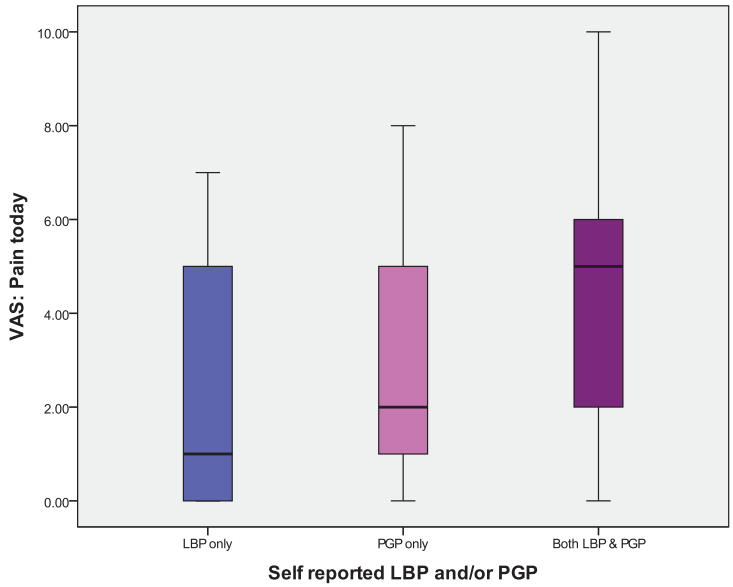


Figure 12*:* Distribution of scores of VAS for usual pain across the 3 categories: LBP, PGP and both LBP and PGP by self report from pain diagram.

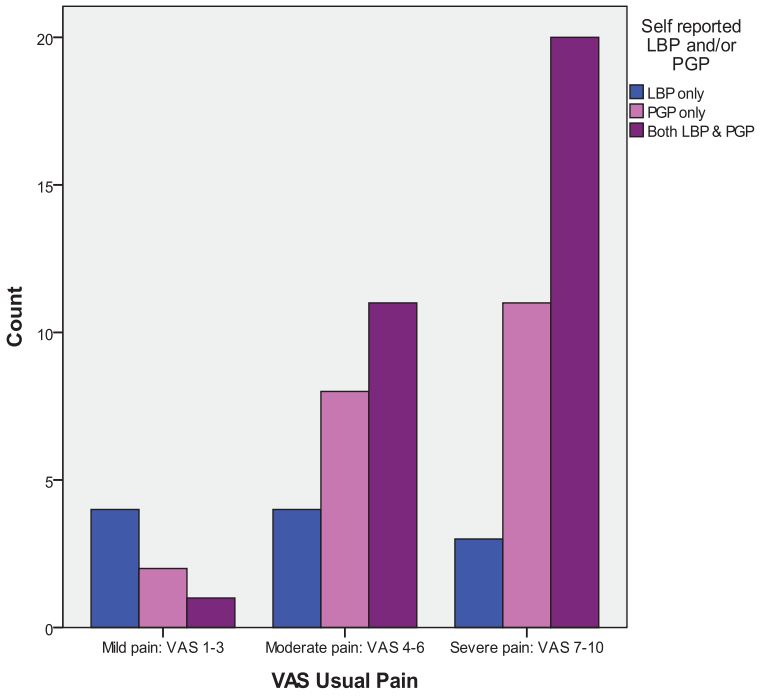
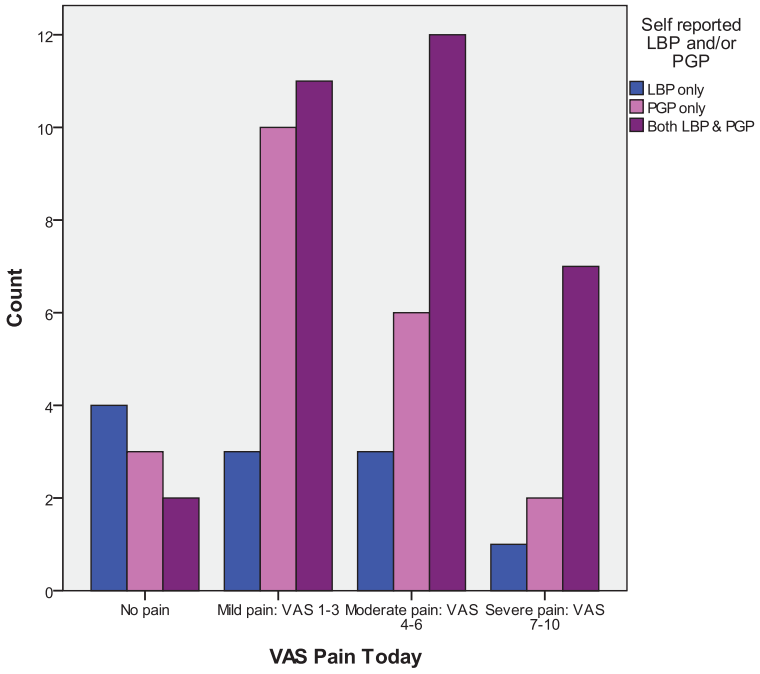


Figure 13*:* Distribution of scores of VAS for pain on the day of data collection across the 3 categories: LBP, PGP and both LBP and PGP by self report from pain diagram.



Disability

In the secondary survey, the disability of the woman as affected by her pain was measured by the Oswestry Disability Index (vs 2a) (ODI) calculated as a percentage score of the 10 categories that were assessed: pain intensity; personal care; lifting; walking; sitting; standing; sleeping; sex life; social life and travelling. As presented in the Methods Chapter, there are six statements for each section which are scored on a scale from 0 to 5, according to rank. The score is calculated out of a total possible score of 50, and then converted to a percentage; a higher percentage score indicates a greater disability. The mean ODI score reported by women with LPP was 29% (Md=26, mode=16, SD=16.7, range=74, skew=0.7, kurtosis=0.3).

The distributions of scores for the women surveyed in this study are presented in Figures 14 and 15. The ODI scores were sub-grouped into three categories for analysis: 'minimal disability': score $\leq$ 10%; 'mild disability': score 11 to 39%; and 'moderate disability': score $\geq$ 40%. The guidance for sub-grouping of the scale was taken from a previous study of pregnancy related LBP and PGP (Gutke, et al., 2006). A majority of women (n=37, 67%) were classified as having a mild disability. Seven women (13%) were classified as having 'minimal disability', 11 women (20%) were classified as having a moderate disability. Four of these women scored 60% or higher, the highest disability score was 74%. The mean scores with standard deviations of each of the subgroups: 'LBP', 'PGP', and 'both LBP and PGP', for 'self report from the pain diagram', and for 'diagnosis from the physical assessment' are presented in Tables 6 and 7.

Table 6: VAS and ODI scores for self report from the pain diagram.

Self report: position of pain from pain diagram	n=63(%)	ODI % (n=62) Mean (SD)	VAS: Mean (SD) Usual pain	Pain today
LBP only	11(17)	18 (10.8)	4.3 (2)	2.5 (2.6)
PGP only	21(33)	26 (15.6)	6.5 (2.2)	3.0 (2.4)
Both LBP/PGP	31(50)	33.5 (17.4)	7.1 (1.7)	4.7 (2.7)

Table 7: VAS and ODI scores for diagnosis from the physical assessment.

Diagnosis of pain from physical assessment	n=57* (%)	ODI % (n=57) Mean (SD)	Usual pain VAS: Mean (SD)	Pain today VAS: Mean (SD)
LBP only	9 (15)	24 (10.4)	5.9 (2.1)	4 (2.9)
PGP only	29 (52)	26 (17.3)	6.2 (2.2)	3.6 (2.8)
Both LBP/PGP	19 (33)	32.4 (17)	6.8 (2.3)	3.6(2.8)

*n=57, 6 participants did not stay for physical assessment.

The Kruskal-Wallis test revealed a statistically significant difference in the ODI scores across the distribution, x^2 (2, n=64) =7.1, p=0.03) for self reported 'LBP', 'PGP', and 'both LBP and PGP'. Women with 'both LBP and PGP' scored a higher median score (Md=29), therefore higher disability level than women with PGP (Md=26) or LBP (Md=18). The test was not significant for diagnosis by physical assessment of these groups. The mean and range of scores of the Oswestry Disability Index for the subgroups LBP, PGP and both LBP and both LBP and PGP, from the pain diagram and the physical assessment are shown in figures 14 and 15, then in figures 16 and 17.

Figure 14: Box plot of ODI % across the 3 categories: LBP, PGP and both LBP and PGP by self report from pain diagram.

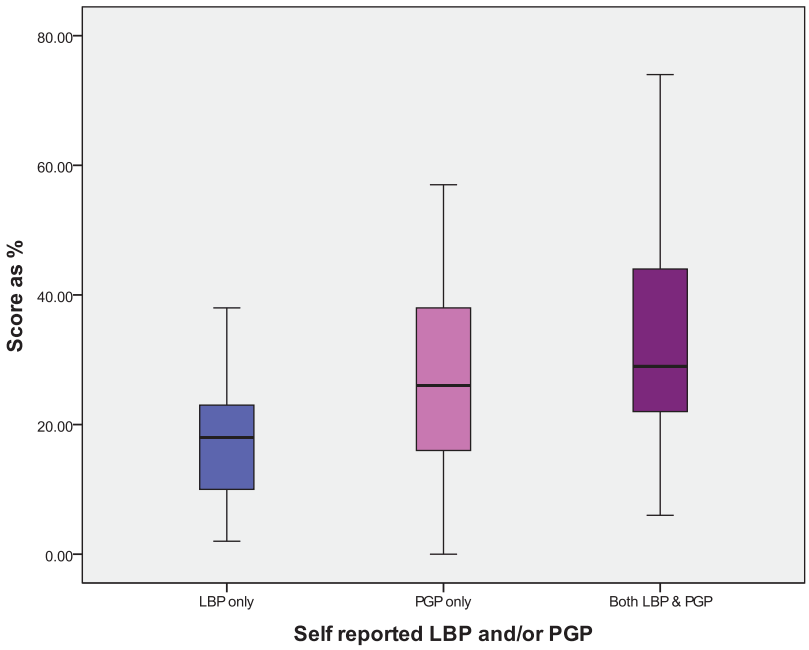


Figure 15: Box plot of ODI % across the 3 categories: LBP, PGP and both LBP and PGP by diagnosis from the physical assessment.

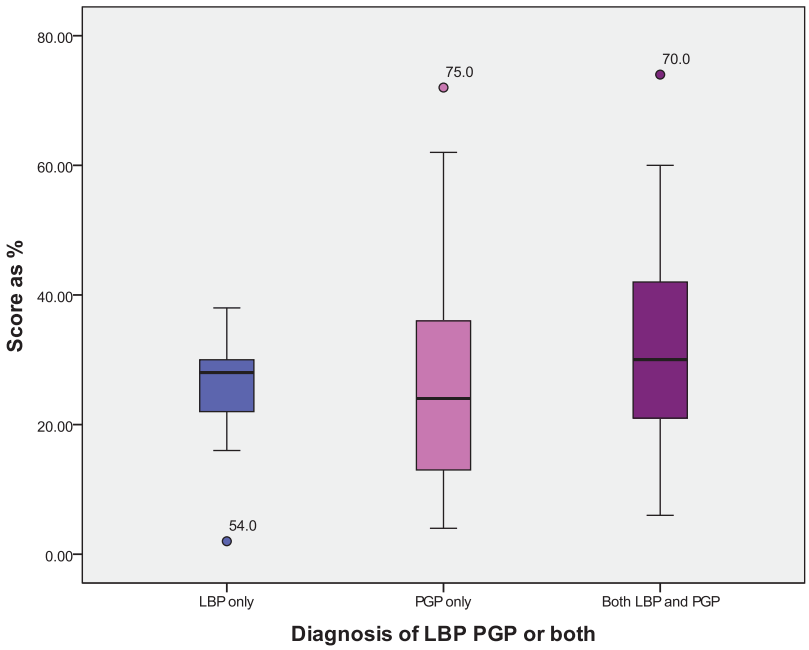


Figure 16: Distribution of ODI scores as % across the 3 categories: LBP, PGP and both LBP and PGP by self report from pain diagram.

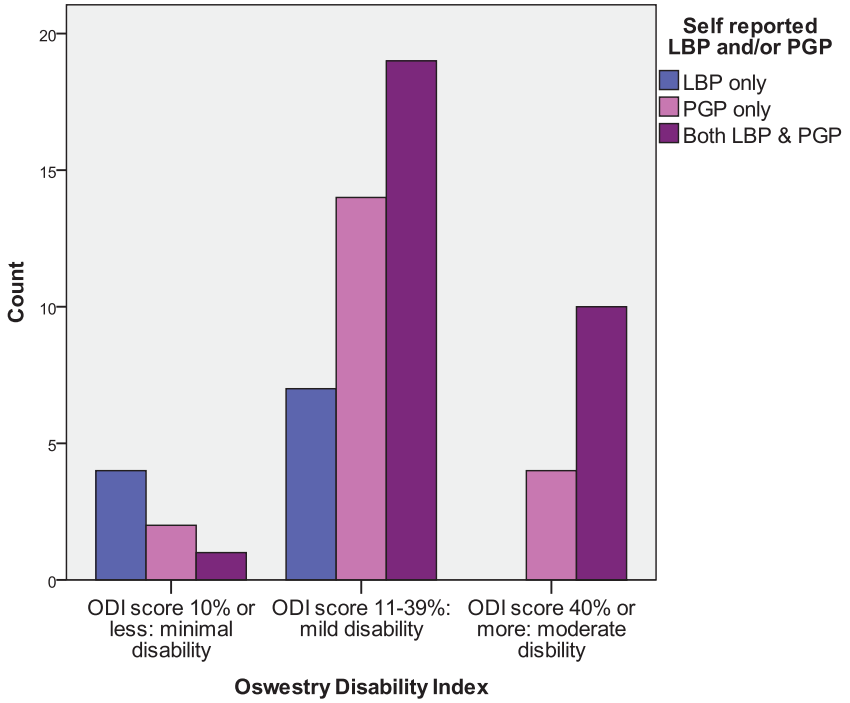
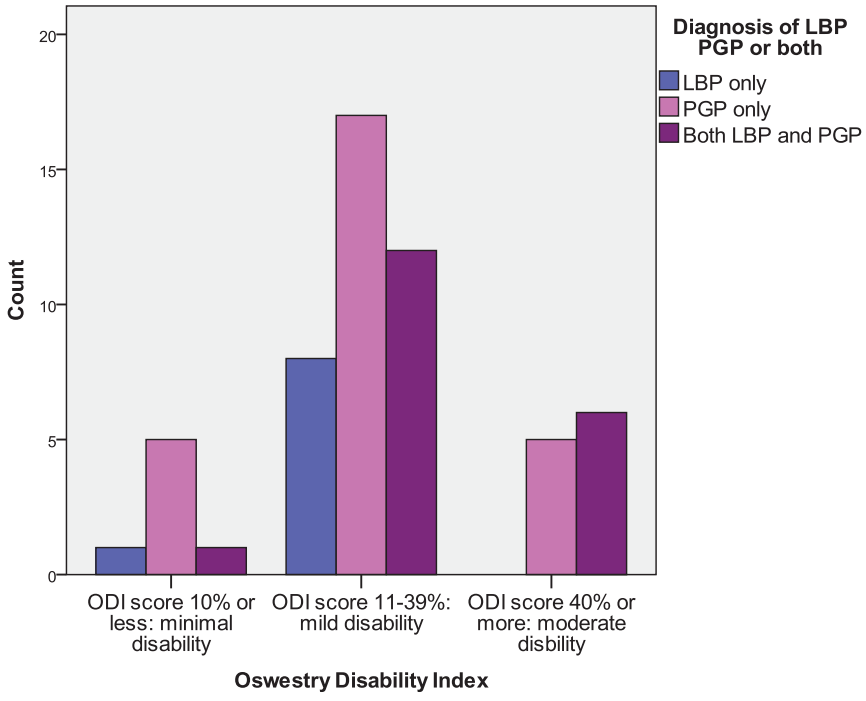


Figure 17: Distribution of ODI scores as % across the 3 categories: LBP, PGP and both LBP and PGP by diagnosis from the physical assessment.



Further questions about pain

Responses to further questions about pain

Even though 45 (71%) of the women in the LPP sample had reported their pain to their antenatal carer, only 16 women (25%) had received any form of treatment. Twelve 12 women (75% of those treated) reported benefit from the treatment (refer to Table 8). Ten women had received physiotherapy and five took paracetamol, including one who reported also taking oxycodone and paracetamol with codeine. Fourteen women (23%) indicated that they had taken sick leave from their employment due to the pain. When asked why they had not received treatment, the responses included:

- "I was told during the last pregnancy that there was nothing that there could be done to help"
- "I asked the doctor but they said it is normal in pregnancy"
- "No one cared or suggested any treatment."

Other women stated:

- "I don't think it's necessary"
- "I didn't think I needed treatment"
- "The pain [is] manageable and I have not seen the doctor since 29 weeks of pregnancy".

A majority of women (70%) indicated that they agreed with the statement that "LPP was to be expected because of the pregnancy"; 3% disagreed and 27% were undecided.

Table 8: Responses to further questions from the secondary survey.

Questions about the effect of pain (n=63)	Yes: n (%)
Has told midwife or doctor about pain	45 (71)
Has received treatment for pain	16 (25)
Treatment helped	12 (19)
Time of work or sick leave because of pain	14 (23)
LBP/PGP to be expected because of pregnancy	42 (70)

Responses to the open ended question

Eighteen women (29%) took the opportunity to provide additional comments to the final question of the secondary survey:

- Is there anything else you would like to say about your experience of pain?

Responses were collated as a group then categorised according to the identification of themes and key words as written by the women. There were four themes that emerged from this process:

- **Pain:** the physical symptoms of LPP as described by the women.
- **The impact of LPP on lifestyle:** the restriction of the woman's everyday physical function compared to what they felt was normal.
- **The impact of LPP on psychological health:** the woman's psychological response to the condition.
- **What helped LPP:** explanation or advice on how to cope with the condition.

Examples of the women's comments include the following:

- "[Pain] It has severely restricted my activities during pregnancy, exhausted me doing menial tasks and hindered my joy of being pregnant. It has felt debilitating and de-motivating for things like the exercise"

- "Sometimes it [pain] makes me very worried and I think that it shouldn't be happening or it's pretty unusual. So I go to the GP but when they listen to me they said it's just normal"

- "Pain – it puts a toll on life, makes it hard to be happy all the time, makes your family upset because you are suffering and doesn't allow you to do the normal things with your family like taking care of kids, going shopping with girlfriends etc"

- "It has gotten worse with each pregnancy"

- "I try to manage my lifestyle and movements so that I don't aggravate my back or cause added problems"

- "More info[rmation] should be given out to mothers early in pregnancy so they can prevent the pain from occurring. They should also be given more info[rmation] about physio[therapy] and other options available to help prevent"

- "I don't experience back pain all the time or every day but only sometimes more or less once a week, especially when I get tired maybe at work doing stairs or lifting objects"

A diagrammatic representation of this analysis is provided by Figures 14 to 17. Key words used by the women in my study who experienced PLPP were chosen to highlight the representation of the themes: 'pain' and its impact on 'psychological health', 'lifestyle' and 'help/coping'.

Figure 18: The relationship between pregnancy-related LPP and the four themes.

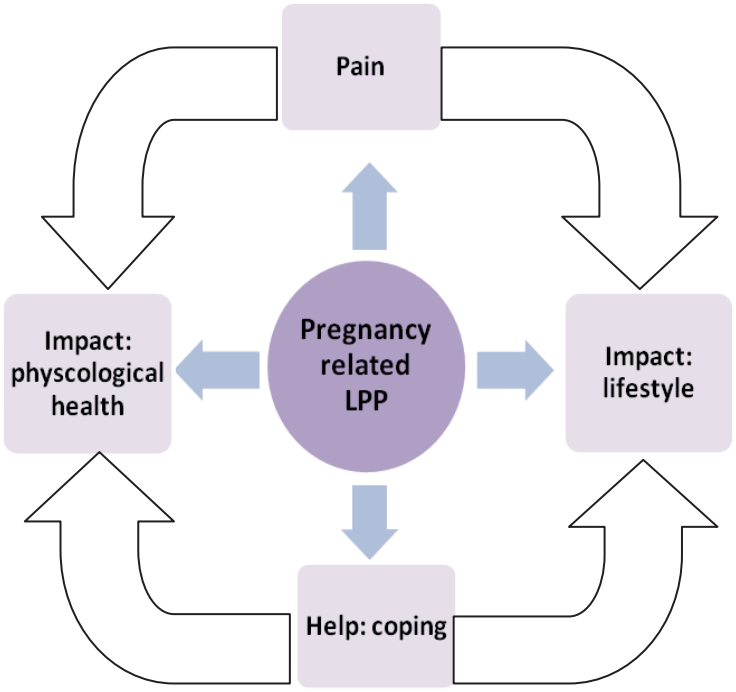


Figure 19: Key words from the women related to the type or severity of pain.

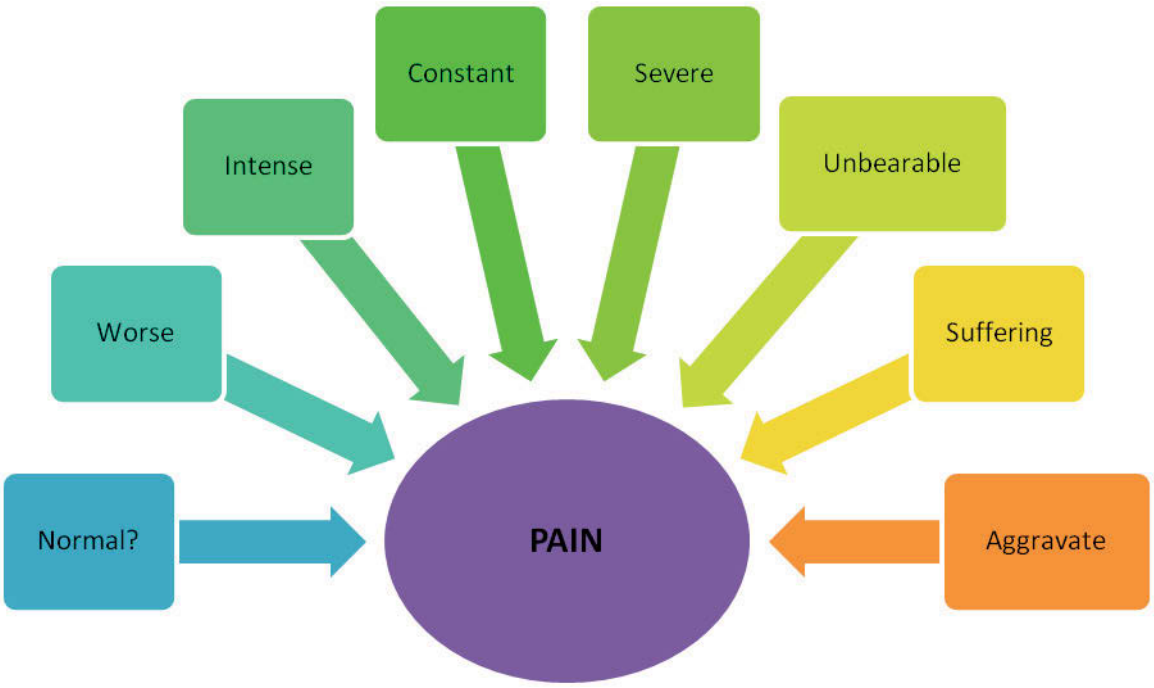


Figure 20: Key words from the women related to the impact of PLPP on lifestyle.

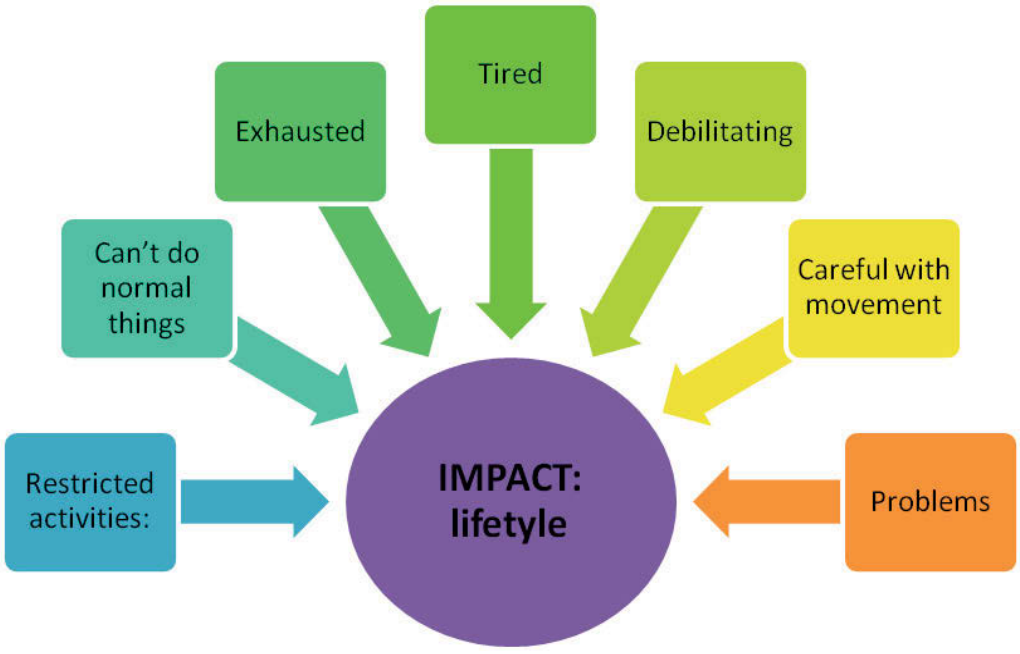


Figure 21: Key words from the women related to the impact of PLPP on their psychological health.

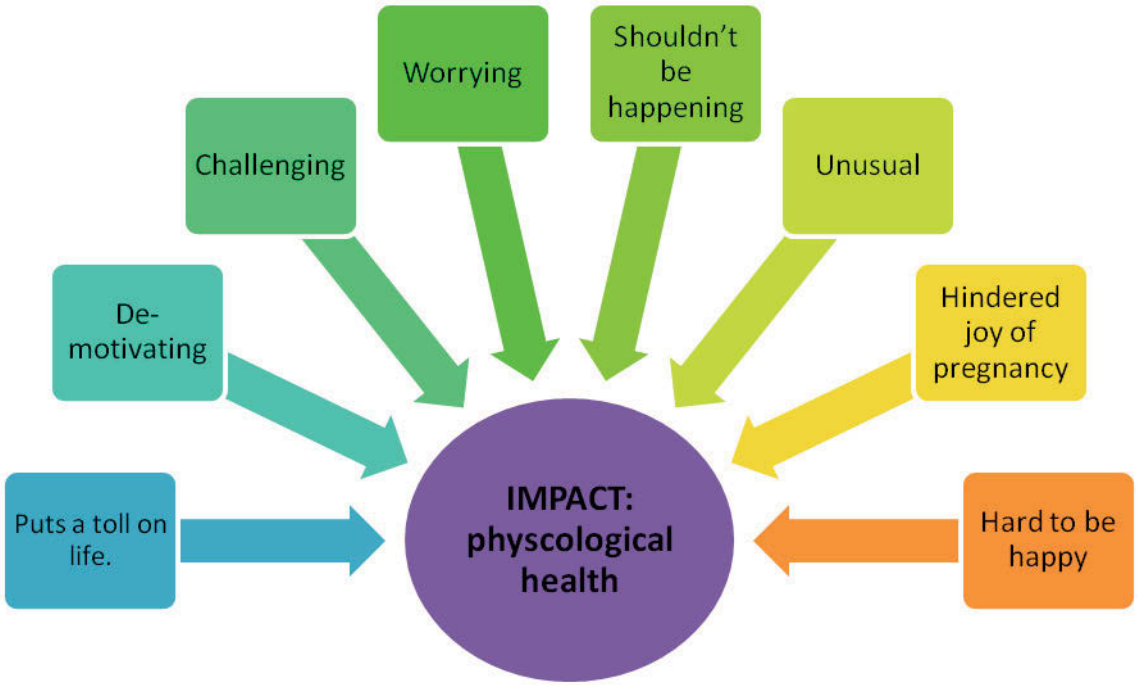
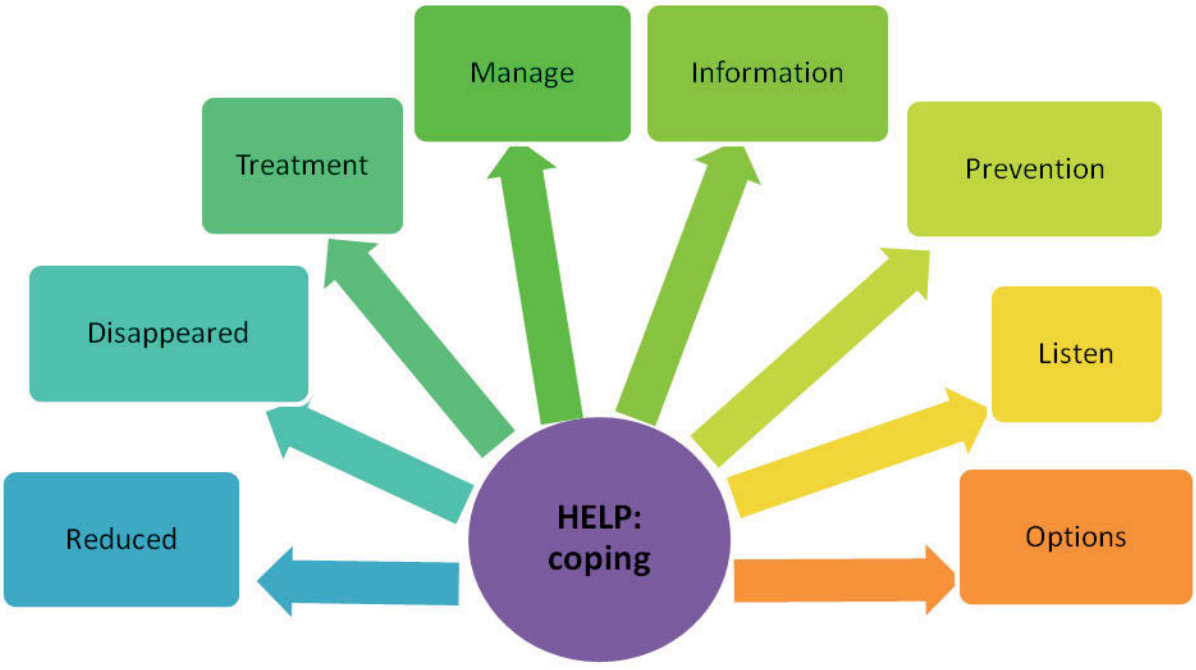


Figure 22: Key words from the women related to how they sought help and coped.



Challenges in data collection

The process of data collection presented a few challenges that are discussed to give context to study results.

Incomplete surveys

There were three surveys that were excluded from the analysis due to significant amounts of missing data. After the first day of data collection, the researcher realised that some of the secondary survey, in particular the pain diagram had not been completed. As a result of this discovery, the surveys were checked for completion on return to the researcher, prior to the physical assessment.

Physical assessment

There were six women who, despite having completed the secondary survey, were lost to the researcher for the physical assessment. Within the busy environment of the Women's Health Clinic it is possible that they either forgot to stay after their antenatal appointment or had decided that they preferred not to wait if the researcher was involved with the physical assessment of another woman. The women were encouraged to stay for the opportunity to have their "abdominal muscles assessed for separation" and they were also given an information booklet titled "Exercise before and after birth". This booklet had been compiled by a working group of physiotherapists from the SWAHS, and was approved for distribution to women by the SWAHS Human Research Ethics Committee.

Summary of results

The results of this study indicate that there was a high prevalence in this sample of low back and/or pelvic girdle pain during pregnancy (71%), and one third of the women (34%) reported pain on the day of the survey. An association was found between the reporting of lumbo-pelvic pain and parity ($p=0.05$), a previous history of lumbo-pelvic pain unrelated to pregnancy ($p=0.005$) and the regular use of stairs ($p=0.04$). When pain was sub-grouped into LBP, PGP or combined LBP and PGP by either a pain diagram, or by a physical assessment,

LBP alone was found to be the smallest component of the condition (17% or less). A moderate level of agreement was found between the two methods used to sub-group lumbo-pelvic pain (Kappa 0.5).

In this study, women with low back and/or pelvic girdle pain during pregnancy had on average a 'usual pain' intensity score of 6.5 out of a possible 10 (10 being the worst pain imaginable). Women with low back and/or pelvic girdle pain on the day of the survey, scored on average 3.8/10. The average disability score reported by women with low back and/or pelvic girdle pain was 29% indicating a mild disability (11-40%). A majority of women (67% of women) scored a mild disability. When lumbo-pelvic pain was sub-grouped according to the pain diagram, women with PGP or combined LBP and PGP had higher levels of pain intensity and higher levels of disability. This result was seen as a trend when lumbo-pelvic pain was sub-grouped by physical assessment, but was not found to be statistically significant.

A majority of women (71%) had reported their pain to their maternity care-giver but only 25% had received any form of treatment. Of these, five women were taking medication for their pain, mainly paracetamol. Almost a quarter of the women in the LPP group had taken sick leave from their employment because of pain. Four themes emerged from the open ended responses from the women regarding their experience of pain: pain described as a physical symptom; the impact of pain on their lifestyle; the impact of pain on their psychological health; and what they found helped the pain including coping strategies. These results are discussed in the next chapter.

Chapter 5: Discussion and Conclusion

Introduction

The discussion chapter will present the results of the research undertaken for this thesis within the context of existing observations and theories related to pregnancy-related low back and/or pelvic girdle pain. The discussion will reference similarities and differences in outcomes that have been previously reported in the literature. The chapter will explore the implications of the high reported prevalence rate of low back and/or pelvic girdle during pregnancy and the relationships between the reporting of low back and/or pelvic girdle pain, pain intensity and disability. These issues will then be placed within the context of the psychosocial consequences for women. A strategy for the management of PLPP and dissemination of research knowledge to maternity health care providers is also put forward.

The results of this thesis support the association of lumbo-pelvic pain with parity, a previous history of lumbo-pelvic pain unrelated to pregnancy and the regular use of stairs. Women with pelvic girdle pain or combined low back and pelvic girdle pain scored higher levels of pain intensity and higher levels of disability than those women with low back pain alone. A majority of women had reported their pain to their maternity carer but only a quarter of the women had received any form of treatment. When given the opportunity, women described their pain experience, and key words used pointed to the impact of PLPP on their lifestyle, psychological health and ability to cope.

The prevalence of 'lumbo-pelvic' pain during pregnancy

'Back pain' is considered to be a common complaint during pregnancy (National Collaborating Centre for Women's and Children's Health, 2008). The results of this study support a high prevalence of 'lumbo-pelvic pain' (LPP) for pregnant women, both during the pregnancy (71% period prevalence) and on the day that the survey was completed (34% point prevalence). The period prevalence found in this population is comparable to other studies that use similar definitions and a cross sectional survey

design. For example, Mogren and Pohjanen (2005), in a survey of 891 women in Sweden within 24 hours of birth reported the prevalence of LPP during pregnancy as 72%; Ando and Ohashi (2009) in a survey of 213 Japanese women who were more than 36 weeks' gestation also found a period prevalence of 72%. The women in my study were from culturally and linguistically diverse backgrounds living in Western Sydney. Table 9 presents a comparison of prevalence rates for pregnancy-related lumbo-pelvic pain, from different international researchers. The table provides a summary of the study method, sample size and measurement tools used for PLPP.

The study reported in this thesis is the first known Australian study to report both the period and point prevalence of 'pelvic girdle pain' as well as 'low back pain' during pregnancy from a prospective cross sectional cohort. Smith, Russell and Hodges (2008), analysed data from the 'Australian Longitudinal Study on Women's Health' (W. Brown, Bryson, Byles, Dobson, & Schofield, 1998) looking at the relationship between back pain, parity and continence. Their results showed that 24% of the 'younger' pregnant women surveyed (18-25 years) had back pain 'rarely in the previous 12 months,' 36% 'sometimes' and 19% 'often'. The combined figure of reported 'back pain' for younger pregnant women totaled 80%, which was compared to 67% for non-pregnant women. These figures would have included back pain prior to the pregnancy, and pain in the 'upper back' area would also have been reported as the 'low back' is not specified. Smith and colleagues (2008) acknowledge that the nature of the survey did not allow for discrimination of the prevalence of 'pelvic girdle pain' although it was commented upon that this would have been interesting to investigate.

In another Australian study, Stapleton, MacLennan, and Kristiansson (2002) reported on data from 'The South Australian Health Omnibus' survey of 1998. Of the women surveyed who had a pregnancy of more than 20 weeks duration, 35.5% indicated that 'low back pain' had affected them during one or more pregnancies and of these, 61.8% reported that the low back pain was a least 'moderately severe'. The results were from a retrospective recollection of low back pain of the women surveyed who were aged between 15 and 93 years, and is therefore subject to recall bias. As with the study by Smith and colleagues (2008), the condition of 'pelvic girdle pain' was not able to be investigated.

Table 9: Comparison of prevalence rates of PLPP; *PPPP: Posterior pelvic pain provocation test

Authors (year)	Country	Type of study	Method and measurements used for description or diagnosis of LPP	Period prevalence LPP	Point prevalence LPP
Pierce (This study)	Australia	Cross sectional survey: n=96 LBP and/or PGP	Pain diagram & physical assessment Usual pain, pain today and disability Third trimester Excluded mild complaints	70.8% 52%	34.8% 27%
Mogren & Pohjanen (2005)	Sweden	Cross sectional survey: n=891. LBP and PGP	Pain diagram, "recurrent or continuous pain for > one week" retrospective for the pregnancy Within 24 hours of birth	71.7%	
Ando & Ohashi (2009)	Japan	Cross sectional survey, n=263. LBP and PGP	Survey: self reported 'lumbo-pelvic' pain intensity, disability; differentiation by physical assessment: 1 test: PPPP*	72%	38% (+ve PPPP)*
Mohseni-Bandpei, et al., (2009)	Iran	Prospective, randomised Cross sectional survey, n=1062. 'LBP' only	Survey: self reported LBP only from pain diagram; pain intensity, disability All pregnant women	59.4%	
Mousavi, Parnianpour, & Vleeming (2007)	Iran	Cross sectional survey, n=325	Survey and one physical test: PPPP* for differentiation of LBP, PGP or both 12-36 weeks	49.5%	
Gutke, Ostgaard, & Oberg (2006)	Sweden	Cross sectional survey n=313	Survey and physical assessment: sub-grouped into LBP, PGP or both 12-18 weeks	62%	
Wu, et al. (2004)	Various	Review	Review of 28 studies: PGP, LBP or both Exclude mild complaints	45% 25%	

Direct comparisons of prevalence rates in the literature are problematical due to diverse terminologies and definitions of LPP, and the variety of methodologies used. The study in this thesis was investigating the prevalence rates in 'self reported pain', and included women with either low back pain (LBP), pelvic girdle pain (PGP) or combined low back and pelvic girdle pain. Some studies report on the prevalence of 'back pain' or 'low back pain' only (Mohseni-Bandpei, et al., 2009; Skaggs, et al., 2007) or 'pelvic pain' or 'pelvic girdle pain' only (Albert, et al., 2001; Van de Pol, et al., 2007). The study in this thesis also included the reporting of mild symptoms. When women with mild symptoms (Visual Analogues Scale score $\leq$ one and Oswestry Disability score ≤ 10) were removed from the sample, the period prevalence was recalculated as 52% with a point prevalence was 27%. Wu and colleagues (2004) in their systematic review of PLPP conducted an analysis of 28 studies of prevalence rates. They concluded that the overall prevalence of LPP during pregnancy is likely to be around 45%, with 20% classified as 'mild complaints'. Gutke, Ostgaard and Oberg (2006) classified 15% of the woman in their study as experiencing 'no consequences' because of their symptoms, according to a VAS less than or equal to 10mm, and ODI less than or equal to 10% (Gutke, 2006).

The value of direct comparisons of prevalence rates for LPP during pregnancy for my study is in the recognition of LPP as a condition with potential consequences; a condition that affects the woman's pregnancy and postnatal experience, and possibly her long term health. The clarification of prevalence becomes an important issue when determining whether low back pain and/or pelvic girdle pain should be considered a 'normal' discomfort of pregnancy, and whether intervention should be initiated. The results of my study support the view that for *some* women, LPP pain can be viewed as a 'discomfort': 19% of women reported a pain intensity score of less than or equal to one out of a possible 10 or a disability score of less than or equal to 10% (almost one third of the LPP period prevalence group). When responding to questions regarding their pain and why they had not received treatment, a few women indicated "I don't think it's necessary"; or "I didn't think I needed treatment"; and "The

pain [is] manageable…" Other comments however, focused on the negative impact of LPP on women's lifestyle, for example: "[Pain] It has severely restricted my activities during pregnancy, exhausted me doing menial tasks and hindered my joy of being pregnant. It has felt debilitating and de-motivating for things like the exercise". The comments of the women indicate that there are a wide range of experiences of LPP during pregnancy. It is feasible to conclude that at least two out of every three women in my study who reported symptoms of LPP during pregnancy encountered lifestyle consequences due to pain and disability.

The prevalence of 'low back', 'pelvic girdle' or 'combined pain' during pregnancy

The wide range of described experiences, and the broad levels of pain and disability reported by women who have LPP during pregnancy, reinforces the value of identifying those women with a more severe form of the condition, as well as those who are at risk of co-morbidities and long term health problems. The importance of investigating 'pelvic girdle pain' as distinct from 'back pain', and value of differentiation of the conditions of 'low back pain' and 'pelvic girdle pain' is well substantiated in the literature (Gutke, et al., 2006; Ostgaard, 1996; Vleeming, et al., 2008; Wu, et al., 2004). In my study, the LPP sample was sub-grouped by a pain diagram and a physical assessment, so that the reliability of each method could be compared, and the prevalence rates of the different sub-groups analysed and reported to give further meaning to the data.

Other studies have used different criteria when sub-grouping LPP during pregnancy. Robinson and colleagues from Norway (Robinson, et al., 2007; Robinson, et al., 2006; Robinson, Mengshoel, Bjelland, & Vøllestad, 2010; Robinson, Mengshoel, Veierød, & Vøllestad, 2010; Robinson, Veierød, Mengshoel, & Vollestad, 2010), have distinguished between PGP and LBP based on where the pain is located on a pain diagram, and reported on a subgroup of women with combined pubic symphysis and bilateral posterior pelvic pain. This has also been referred to as 'pelvic girdle syndrome'. They

proposed that women in this sub-group are more afflicted than those with other pain combinations. The example of Gutke and colleagues (2006) was followed in my study for the sub-grouping LPP into the conditions 'LBP only', 'PGP only' and ''both LBP and PGP'. When LPP was differentiated from the pain diagram, 17% were classified as 'LBP only', 33% 'PGP only" and 50% as 'both LBP and PGP'. According to the result of the physical assessment 15% were classified as 'LBP only', '52% PGP only' and 33% as 'both LBP and PGP'. A comparison of these figures can be made with three studies that used similar methods, and a summary can be found in Table 10.

The reported prevalence rates of 'LBP only' within the LPP group for the study in this thesis were 17% and 15%; These reported rates are similar to the 17% described by Gutke's study (2006); however Robinson and colleagues (2010) found that only 6% of women in their LPP sample had LBP only. The common feature, of all of these studies however, is the prevalence figure of the 'LBP only' sub-group being consistently lower than figures for PGP or combined pain syndromes. The findings of my study provide support to early research in this area by Ostgaard and colleagues in Sweden. Their work found that the prevalence figure of lumbar pain was constant throughout pregnancy at around 10% (Ostgaard, 1996; Ostgaard, et al., 1991).

The implications of the lower prevalence rate of LBP during pregnancy when compared with PGP or combined pain, becomes apparent when a review is made of the results of pain and disability levels for each of the sub-groups. These results support the theory that LBP is less intense and less disabling during pregnancy when compared to PGP or combined pain groups, (Gutke, et al., 2006; Ostgaard, 1996). Correspondingly, the prevalence rate of 'PGP only' from the physical assessment in the LPP sample was higher than the 'LBP only' group and similar to other reported figures: 52% of the LPP group (as classified from the physical assessment) for my study, compared with Gutke and colleagues (2006): 54%; Mousavi and colleagues (2007): 57%; and Robinson and colleagues (2010) who found 65%.

Table 10: Prevalence rates for LBP, PGP or combined LBP and PGP during pregnancy

Authors (Year)	Country	Type of study	Definition of diagnosis	Prevalence LBP % (within LPP group)	Prevalence PGP % (within LPP group)	Prevalence combined pain % (within LPP group)
Pierce (This study)	Australia	Cross sectional survey: n=96 LBP and/or PGP	LBP, PGP or both Pain diagram: Physical assessment: > 28/40	11 (17) 9 (15)	22 (33) 33 (52)	33 (50) 22 (33)
Gutke, Ostgaard & Oberg, (2006)	Sweden	Survey Cohort, n=313	LBP, PGP or both Survey & physical assessment 12-18/40	11 (17)	33 (54)	18 (29)
Mousavi, Parnianpour & Vleeming (2007)	Iran	Cross sectional survey, n=325	Survey and PPPP LBP, PGP or both 12-36 weeks	13 (27)	28 (57)	8 (17)
Skaggs, et al. (2007)	America	Cross sectional survey, n=599	Self reported musculoskeletal pain: 2nd trimester LBP, pubic(pelvic) pain	85 (57)	38 (25)	–
Albert, Godskesen, & Westergaard (2001)	Denmark	PGP: point prevalence n=1460	Physical assessment: 15 tests for PGP, pain history 33/40		20.1	–
Vleeming, Albert, Ostgaard, Sturesson, & Stuge (2008)	Europe	Guidelines for PGP	Review of 4 prospective studies with strict guidelines: pain history and physical assessment	-	20	–

The prevalence of the 'PGP only' group, as differentiated by the pain diagram in my study was 33%, and there was only moderate agreement between methods of reporting PLPP subgroups in this study (Kappa co-efficient of 0.5). The reason for differences in the reported prevalence rates of the sub-groups and therefore statistical outcomes from comparative analyses could be because the pain diagram was representative of self reported pain for the period of the pregnancy as well as that experienced on the day of the survey. The physical assessment for the reporting and differentiation of PLPP was determined from the objective examination on the day of the survey. This is likely to influence the level of agreement between methods.

The difference in results could also be due to the challenge in classifying pain from a pain diagram: there is a possibility for error when markings were made on the diagram by the woman. The example of Ostgaard (1991) was followed when the decision was made to sub-group from the pain diagram. Ostgaard (2001) used the pain diagram in combination with the woman's subjective history and a physical assessment. For the pain diagram, LBP had markings above the sacrum in the lumbar spine, whereas 'posterior pelvic pain' (PGP) had markings in the gluteal area. Robinson and colleagues (2010) also used self report of LPP from the pain diagram in the reporting of their results. In their study however, the completed pain diagram was reviewed by a therapist, and the woman asked to point out her pain location so that if necessary the pain drawing could be corrected. This was thought to add validation to the classification method. This added procedure was not used in my study.

There are further considerations that should be taken into account when reviewing the results of the sub-grouping of the LPP cohort. When conducting the physical assessment in my study 'negative' PGP tests were used to classify LBP by exclusion (Ostgaard, 1996; Vleeming, et al., 2008). Women with 'both LBP and PGP' were classified according to two or more positive pelvic girdle pain tests, and the presence of restricted movements in the lumbar spine and tenderness of the area to palpation. The inclusion of further objective clinical tests during the physical assessment would have assisted in confirmation of the presence of pain in the lumbar area for those women with combined pain

(Gutke, Kjellby-Wendt, & Öberg, 2010; Gutke, et al., 2006). Gutke and colleagues (2010) found good inter-rater reliability of two therapists (Kappa coefficient of 0.79) when using specific diagnostic criteria for differentiation of sub-groups including an assessment method called the McKenzie Protocol (McKenzie & May, 2003). The McKenzie Protocol involves a subjective history, followed by repeated end-of-range movement of the lumbar spine into flexion and extension and lateral flexion if required, with observation of the effects of movements on baseline symptoms (Gutke, et al., 2006).

The disparity in methods for different studies indicates that all studies of LPP during pregnancy should be interpreted with caution, whether using the pain diagram and/or a physical assessment as a method for reporting of the condition. Indeed some studies have only used one clinical test in their reporting (Ando & Ohashi, 2009; Mousavi, et al., 2007). The strength of my study is that there was a single examiner for the physical assessment, and results are similar to other studies that use similar methodology. Weaknesses of the study include the small sample size, limited physical tests used for subgroup classification and only a moderate level of agreement between reporting methods.

The following section will discuss the debate in the literature regarding the consideration of whether low back and/or pelvic girdle pain should be considered ‘normal’ or ‘pathological’ during pregnancy.

Low back and/or pelvic girdle pain during pregnancy: ‘Normal’ or ‘pathological’?

Low back and/or pelvic girdle pain in pregnancy is often described as a ‘normal’ discomfort. Pain located in the anterior pelvic girdle (pubic symphysis dysfunction) often presents as a severe and debilitating condition. Not all of the literature reviewed discusses pubic symphysis dysfunction within the wider definition of pelvic girdle pain. In order to ascertain what is ‘normal’, a definition of what is ‘pathological’ is required.

Back pain: a common discomfort

The reported prevalence rates of low back and/or pelvic girdle pain during pregnancy can be interpreted in a variety of ways by health professionals and researchers within and across disciplines. The high prevalence indicates that low back and/or pelvic girdle pain are very common conditions for women during pregnancy; however, does 'common' mean 'normal'? Furthermore, does 'common' minimise the importance of the impact and consequences for women who experience a more severe form of the condition?

The Antenatal Care Guidleines from the National Collaborating Centre for Women's and Children's Health in the United Kingdom (2008) refer to the condition of 'backache' during pregnancy and state that the definition of the condition is subjective due to the nature of pain. It is proposed that the pain is attributable to "… altered posture due to increasing weight of the womb and increased laxity of supporting muscles as a result of the hormone relaxin" (National Collaborating Centre for Women's and Children's Health, 2008, p. 167). This commonly held assumption, that 'back strain' arises from biomechanical stress as a result of the hormone relaxin and "…the weight of the uterus and altered posture (compensatory lordosis)…" (Shepherd, Rowan, & Powell, 2005, p. 274) , is not well supported by the literature. There are no scientific findings to confirm the belief of an increased lumbar lordosis during pregnancy in response to an anterior shift in the woman's centre of gravity (Ostgaard, 1996) and some studies even refute it (Bullock, et al., 1987; Orvieto, Achiron, Ben-Rafael, Gelernter, & Achiron, 1994). Softening of ligamentous structures, particularly around the pelvis during pregnancy is accomplished by the interaction of the hormones oestrogen, progesterone and relaxin. The increased mobility of pelvic joints however, has not been shown to directly correlate with LPP and theories of the effects of relaxin are inconclusive (Albert, Godskesen, Westergaard, Chard, & Gunn, 1997; Hansen, et al., 1996; MacLennan, et al., 1986; Mens, et al., 2009).

Symphysis pubis dysfunction

'Symphysis pubic dysfunction' is a condition given more specific attention in maternity literature due to the severity of its clinical presentation (Shepherd, et al., 2005). The condition however, remains poorly understood by health professionals (Owens, et al., 2002; Shepherd, 2005), and often not linked to the wider definition of 'pelvic girdle pain'. This may stem from a lack of knowledge of broader research in this topic across disciplines, and a limited understanding of the biomechanical role of the role of the pelvic ring as a pivotal point in the human skeleton. Ostgaard (1996; 1991; Ostgaard, Vleeming, Mooney, & Stoeckart, 2007) contends that the pubis is never affected alone, and that pain in this area of the body is manifested in the posterior pelvis (in the area of the sacroiliac joints) as well. Ostgaard's foundational work has been supported by a proliferation of research over the past two decades. Ostgaard (1996) further stated that back pain during pregnancy is not one single diagnosis, but may include pain from the lumbar spine area, the posterior pelvis and the symphysis pubis. As previously discussed in the Literature Review, recent consensus in terminology has redefined 'pubic symphysis dysfunction' as 'pregnancy-related pelvic girdle pain'(Association of Chartered Physiotherapists in Women's Health, 2007; Vleeming, et al., 2008).

Pain: so what is 'normal'?

In order to ascertain what is 'normal' for pregnancy it is important to define what is not normal or 'pathological'. Pathology can be defined as a deviation from normal physiology because of injury, infection or disease (Heuther, 2004). The aetiology and pathophysiology of low back and pelvic girdle pain during pregnancy continues to be an area of uncertainty with various proposed theories of causality, as definitive pathological changes have not been identified (Vermani, et al., 2009). Various researchers have explored theories that link the role of the hormones oestrogen and progesterone to pain modulation (Aloisi, Bonifazi, Aloisi, & Bonifazi, 2006) as well as to the inflammatory process (Schmidt, et al., 2006). Pro-inflammatory cytokines in adipose tissue and the physiological effects of a hyper-oestrogenic state have been suggested to play a

role in the development of back pain in women (Bailey, 2009). Vermani and colleagues (2009) recommend that the most plausible hypothesis behind the development of LBP and/or PGP is a combination of hormonal and biomechanical factors, however further research is required.

Pain is the human body's messenger of the potential or actual threat of injury or disease, and is perceived by a person as a manifestation of the interaction of three body systems: sensory/discriminative, motivational/affective and cognitive/evaluative (Heuther, 2004; Ong & Seymour, 2004). Pain is ultimately a personal and private experience, and is therefore subjective in nature (Cui, Matsushima, Aso, Masuda, & Makita, 2009). Authors suggest that the quality and duration of pain varies according to a person's individual sensitivity, and this can complicate a clinician's attempt to diagnose a condition (Nielsen, Staud, & Price, 2009). The varying influences of culture, gender, lifestyle and social conditions each contribute to individual differences in the perception, expression and tolerance of pain (Miller & Newton, 2006). Left untreated, the development of chronic or 'pathological' pain can have negative physical and psychological consequences (Cui, et al., 2009; Vermelis, Wassen, Fiddelers, Nijhuis, & Marcus, 2010). The lack of adequate management of pain during pregnancy and the risk of the development of pregnancy-related PGP as a chronic pain condition will be further explored in the following section.

Management of pain

The acceptance that low back and/or pelvic girdle pain are a' normal' conditions of pregnancy, assists in explaining a lack of suggested coping measures, and low rates of referral to services that can help and support women. Women's responses to open ended questions in the survey reflect the attitudes of some of their maternity carers, for example: "I asked the doctor but they said it is normal in pregnancy"; "No one cared or suggested any treatment"; and "I was told during the last pregnancy that there was nothing that there could be done to help." In my study, 25% of women in the LPP group reported receiving some form of treatment for their pain, including the taking of pain relieving medications, primarily paracetamol. Skaggs and colleages (2007), in their study of the prevalence of back pain and treatment satisfaction in an 'under-served'

American population, found that of the women surveyed, 85% had not been offered treatment and 75% used pain medications. Van de Pol and colleagues from the Netherlands (2007) stated that seven out of 20 women with 'pelvic instability' did not receive treatment. In the previously discussed Australian population survey (Stapleton, et al., 2002), 48.9% of women reported not having treatment for their back pain during pregnancy.

The belief amongst health professionals that low back and/or pelvic girdle pain are 'normal' conditions of pregnancy, and the minimisation of symptoms with subsequent lack of treatment has been investigated in a few studies. 'Negative labeling' of women who complain of pain and 'dismissive staff' were themes that emerged from a study by Wellock and Crichton (2007a) who explored the relationship between health professionals and women who had experienced pubic symphysis dysfunction during their pregnancy. A Swedish study investigating obstetrician's attitudes to pregnant women taking sick leave indicated that 67% of those surveyed thought that a woman's personal problems may lead to or cause back pain (Larsson, Sydsjo, Alexanderson, & Sydsjo, 2006). It is possible that attitudes and beliefs are perpetuated by obstetric and midwifery texts, which do not adequately define the condition, often describing the condition in a list of 'minor discomforts' (Enkin, et al., 2000; Yerby, 2005). Several authors agree that back and/or pelvic girdle pain during pregnancy should *not* be considered as 'normal' (Ando & Ohashi, 2009; Mogren, 2006; Skaggs, et al., 2007). The results of my study lend support to the acknowledgement and timely referral of women who report pain and disability.

The following section of this thesis will discuss how listening to the woman's report of her level of pain and disability, can assist maternity carers to make informed clinical care decisions regarding the need for intervention.

Low back and/or pelvic girdle pain during pregnancy: Levels of pain and disability

One of the main aims of this thesis was the investigation of the levels of pain and disability experienced by Australian women who have PLPP. The discussion now focuses on the levels of pain intensity and disability in the

different subgroups of lumbo-pelvic pain, and the possible development of chronic pain. The results of this thesis will be interpreted and compared to studies that employ similar research method.

Pain intensity

The Visual Analogue Scale was used in this study in an attempt to quantify the woman's pain experience. The mean pain score (scaled from 0 to 10) for LPP reported by women for 'usual pain' over the pregnancy was 6.5 (SD 2.2, range 9), and on the day of data collection was 3.8 (SD 2.7, range 10). The Visual Analogue Scale is the most commonly used measure for pain intensity in studies of LPP, and the pain intensity scores for this study are comparable to several other studies: Mohseni-Bandpei and colleagues (2009) report a mean pain score of 5.1 (SD 2.1); Mousavi and colleagues (2007): 5.6 (SD 2.0); Mogren & Pohjanen (2005): 5.4 (SD 3.8); and Olsson and Nilsson-Wikmar (2004): 5.9 (range 1.1-9.7). Whilst it is acknowledged that pain is a phenomenon interpreted and responded to differently, by different women, the question that needs to be asked is: should pain at this level of intensity be considered as 'normal' or as a 'discomfort'? The ranges of scores reported indicate that for some women the pain was minimal and could be considered a 'discomfort', but for others, the pain was perceived as considerable.

Adding further support to the theory that PGP is different to LBP, women with 'PGP only' and 'both PGP and LBP' in this study, had higher median pain scores of 7 out of 10 for 'usual pain' when compared to the median 'LBP only' score of 4 (when sub-grouped by the pain diagram). This intensity of pain is classified by verbal descriptors of the scale as 'severe pain'. When reporting pain intensity or the day of the survey, women with 'both LBP and PGP' had a median pain score of 5: for 'pain today'; 2: for 'PGP' and 1: for 'LBP'. This trend of scores mirrored Gutke's results (2006) who found a median pain score for 'pain today' as 3.6 for 'both LBP and PGP'; 2.6: for 'PGP'; and 2.3: for 'LBP'.

Interestingly and perhaps not surprisingly, a majority of women surveyed in my study indicated that pain was an expected part of pregnancy. This may also help explain the low rates of treatment. Whether this was a reflection of the attitudes

of their carers to the women or the women themselves deserves further exploration.

Pain and disability

The Oswestry Disability Index (version 2.1a) (ODI) was used in this study to report a woman's disability as affected by her experience of LPP. The Oswestry Disability Index is calculated as a percentage score for 10 categories of activities related to daily life: pain intensity; personal care; lifting; walking; sitting; standing; sleeping; sex life; social life and travelling. The mean ODI score calculated for women with LPP was 29% (SD 16.7). Mohseni-Bandpei (2009) reported a very similar mean ODI score for women with LPP of 34 (SD 15.8). As reported in the Results Chapter, a majority of women (67%) were classified as having a 'mild' disability (11-40%). Four women had a disability score of 60% or higher, the highest disability score being 74%.

Gutke and colleagues (2006) do not report a mean ODI score over the LPP group but provided different scores for each of the subgroups. In Gutke's study, the mean values of the ODI were: 'LBP only': 20% (8-37); 'PGP only' 28% (11-52) and for 'both LBP and PGP': 43% (28-62). These scores correlated with pain intensity scores, and were comparable to those found in this study: women with 'both LBP and PGP' scored 29%, therefore had higher disability level than women with PGP (26%) or LBP (18%). As previously described in the Methods Chapter, these scores were calculated from self report of pain from the pain diagram. Comparisons of median scores were not significant for diagnosis by physical assessment of these groups, although a similar trend of scores was apparent.

The increased level of disability experienced by women, who have low back and or pelvic girdle pain, implies that simple mobility and ambulatory tasks involved in everyday life become restricted and sometimes impossible to perform. This has consequences for the woman's lifestyle, as her ability to perform physical tasks such as lifting, sitting, standing and walking is limited. These ODI scores also include her rating on personal care, sleep, sexual and social life, and her ability to travel. It is likely that for women who scored a moderate or higher level of disability (11 women (20%) in my study scored

ODI greater than 40%), these limitations would have had a profound effect on her lifestyle and on her partner and/or family.

Ando and Ohashi (2009) did not use the ODI for rating disability; however their results using the Roland-Morris Disability Questionnaire and the Quebec Back Pain Disability Assessment, also reflect the results of my study. They found that the disability scores of the PGP group (sub-grouped by a positive posterior pelvic pain provocation (PPPP) test) were significantly higher than the group with a negative posterior pelvic pain provocation test, and pain intensity scores correlated with disability scores. Van de Pol and colleagues (2007) also found similar results using the Pregnancy Mobility Index that was developed by the same authors in a previous study (van de Pol, et al., 2006). They concluded that women with PGP are less mobile than those without PGP. The 'Pregnancy Mobility Index' was not selected for use in this study as some of the mobility questions were not considered culturally appropriate for the population studied. For example, one of the questions asked "Do you experience complaints /limitations in your pelvic girdle and/or back… travelling by bicycle" (van de Pol, et al., 2006, p. 791). The study was conducted in the Netherlands where a large proportion of the residents use bicycles for transport (Totaro, 2010); this is not the case for the population of Western Sydney.

There are several considerations that need to be addressed when interpreting the results of my study. Firstly, as previously discussed in the Methods Chapter, it is important to take into account the possibility that the pregnancy itself could have contributed to the disability score, despite the questions in the ODI measurement scale being specifically linked to pain. The disability of pregnant women who *did not* report LPP during the current pregnancy was not addressed in this study. The period of gestation of the woman may also have affected her disability score: those women of later gestation possibly having a greater disability. The example of other authors was used when the decision was made to use the ODI. Gutke (2006) argued that the ODI is better for a population with a higher level of disability, and the activities in an alternative scale such as the Disability Rating Index, were viewed as unsuitable for pregnant women, as the responses to questions would most likely to be due to the pregnancy itself. The

Disability Rating Index measures disability according to activity limitation independent of pain.

These comments are interesting to consider when reviewing the results of a study by Robinson and colleagues (2010). The authors of this study supported their use of the Disability Rating Index by stating that they wanted to measure the disability of pregnant women who *did not* have LPP. The results of their study indicate that *all* pregnant women have *some* degree of disability; however women with PGP (as defined by pain in three pelvic joints) had higher levels of disability. Their results failed to find an association between disability levels in the LBP group when compared to the group of women with no reported LPP.

This issue of choice of a disability scale as an outcome measure for pregnancy remains a challenge. It is important that a measure of disability for pregnancy be developed and validated, taking into consideration different periods of gestation. Nevertheless, whichever scale was used in current studies, similar conclusions are reached by the authors: those pregnant women with LBP only have less disability than those women with PGP or combined pain conditions.

Chronic pain and disability

Women who experience high levels of pain and disability are at risk of developing a chronic pain condition. According to research by Ostgaard, Zetherstrom, Roos-Hansson, and Svanberg (1994), high pain intensity scores for women suffering from PLPP indicate a poorer prognosis. A poor prognosis means that their recovery from their condition was less likely, with the woman experiencing ongoing pain and disability after birth. This prediction has been supported by research over the past two decades. Albert (2001) investigating prognostic factors for PGP agreed with Ostgaard's earlier work as they found that women with a high pain intensity (scoring $\geq$ 6 on the Visual Analogue Scale) were more likely to have pain at 6 months post partum. This study conducted a postnatal follow-up of women, who had been assessed and classifeid into subgroups of LPP at 33 weeks gestation. Interestingly, of the 6.6% who were diagnosed with pubic symphysis joint pain, none had symphysis pain at 6 months following birth. Gutke, Ostgaard and Oberg (2008) found that women with combined LBP and PGP, recovered to a lesser degree than those

with PGP or LBP alone. Rost and colleagues (2006) found that 10% of women with 'pelvic pain' during pregnancy still had moderate to severe pain and disability at 18 months postpartum. It appears that while most women recover from pregnancy-related LPP, some do not, and experience chronic pain.

Chronic pain is defined as pain without a biological cause that has persisted beyond the normal duration of tissue healing (usually 2 to 6 months) (Walsh & Radcliffe, 2002). Where 'acute' pain is adaptive, chronic pain is described as a maladaptive condition (Cui, et al., 2009). Maintenance of a chronic pain state is said to occur by central nervous system sensitisation (Woolf, 2004). There is a plethora of research investigating the psychosocial aspects of chronic back pain, including the stress response and coping strategies (Grotle, Vøllestad, Veierød, & Brox, 2004; Truchon, Côté, Fillion, Arsenault, & Dionne, 2008). A person's experience of chronic pain may include elevated levels of anxiety, 'pain catasrophising' and 'fear-avoidance' beliefs. Pain catasrophising is the tendency to exaggerate the threat of pain and negatively judge one's ability to deal with pain (Hirsh, George, Riley Iii, & Robinson, 2007). Fear avoidance beliefs are thought to interfere with a person's realistic appraisal of pain provoking activities and influence attitudes towards active rehabilitation (Walsh & Radcliffe, 2002).The implications of chronic pain for women who experience low back and/or pelvic pain during pregnancy will be discussed in the following section.

Psychosocial aspects of pain and disability

Pain is a complex phenomenon which needs to be interpreted within a psychosocial framework. The impact of pain and disability on a person may include the development of mental health disorders such as depression, and have socio-economic consequences. The identification of women at risk of developing chronic pelvic girdle pain dysfunction is vital, as these disorders can become complex, with the development of centrally mediated pain. This experience of 'abnormal' pain may start as 'normal' during pregnancy. Paradoxically, there is literature surrounding pain and birth, which focuses on the relief of labour pain as an 'abnormal' and a potentially negative experience.

The experience of pain in childbirth, however, is different for each woman, and may depend on the resources and support that she receives. These topics will be further explored in this next section of the discussion.

Depression

The experience of chronic pain is strongly linked to mental health disorders such as depression (Clarke, 2009) . Depression has also been found to increase the consumption of health care resources (Chisholm, et al., 2003) and is thought to have negative impact on mothering and infant bonding (Rowan, 2009; Wilkinson & Mulcahy, 2010). The relationship between LPP during pregnancy and depression has been supported by Gutke, Josefsson and Oberg (2007) . In Gutke's study (2007), postpartum depressive symptoms, as measured by a score of greater or equal to 13 on the Edinburgh Depression Scale, were found to be three times more prevalent in women who had experienced LPP during pregnancy. Child birth is a complex emotional time in a woman's life and the woman's emotional state is an important health concern as it may impact the uterine environment and subsequent fetal and child development (Wilkins, Baker, Bick, & Thomas, 2009).

One of the themes indentified in the open-ended question of my study was the psychological impact of LPP. Key words and expressions that the women used included: "worrying"; "de-motivating", "hard to be happy"; and "hindered joy". Conversely, some women used words that implied effective help and coping: "manage"; "information"; and "options". It is evident that the impact of lumbo-pelvic pain on a woman's lifestyle and psychological health is a balance between perceived pain level, resultant disability and the capacity to elicit help and employ coping strategies.

Although mental health issues in relation to low back and/or pelvic girdle during pregnancy were not specifically investigated in this study, the results of the present study lend support to the belief that some women are at risk of depression and the development of a chronic pain condition. It is proposed that the identification of these women early in their pregnancy would be beneficial (Ando & Ohashi, 2009; Ostgaard, 1996; Robinson, Mengshoel, Veierød, et al., 2010), but remains a challenge. Ostgaard in his foundational work in this area

predicted that recognition of LPP early in pregnancy and appropriate referral would reduce the number of women with pregnancy-related LBP and/or PGP, and impact future pregnancies. Robinson and colleagues (Robinson, Mengshoel, Veierød, et al., 2010; Robinson, Veierød, et al., 2010) reported that the number of positive pain provocation tests, together with a history of pre-pregnancy back pain was significantly correlated with pain and disability at 30 weeks gestation and with the woman's disability measured 12 weeks after birth. Fear avoidance beliefs were also investigated using a modified version of the Fear Avoidance Beliefs Questionnaire that is described by Linton and colleagues (2000). Women were asked if they believed there was a relationship between their pain and certain activities, as measured on a scale from 0 (total disagreement) to 6 (total agreement). Fear avoidance beliefs in Robinson's study (2006) were not found to be associated with pain and disability.

Ando and Ohashi (2009) have suggested training midwives in the application of the posterior pelvic pain provocation test to pregnant women, which they demonstrated to be 'safe' and 'acceptable' in women greater than 36 weeks gestation. The midwife who conducted this study was trained by an orthopedic specialist in the administration of the test. If the test was found to be positive, women could then be appropriately advised regarding their condition and prognosis, and interventions initiated. The posterior pelvic pain provocation test, as described in the Methods Chapter, was used in the physical assessment in my study. Any risks to the pregnant woman and her unborn child were considered to be extremely low, being no greater than when undergoing a regular antenatal assessment. This potential risk issue was highlighted in the ethical considerations in Chapter 3.

Chronic pelvic girdle pain disorders

The complexity of chronic PGP disorders is reflected in recent publications, and drives the need for recognition and effective management during pregnancy (Albert, et al., 2006; Gutke, et al., 2008). The challenge of assisting women who suffer long term problems has been narrated in distressing case studies, including stories of surgical intervention and dramatic alterations in the lifestyles of women. O'Sullivan and Beales (2007b) discuss two case studies

where both women report that the onset of PGP had occurred during pregnancy. The management process described was a "mechanism based approach within a biopsychosocial framework"(O'Sullivan & Beales, 2007a). The classification of PGP disorders and a multidisciplinary approach were advocated where the woman had developed centrally mediated pain. The validity of these types of classifications and intervention strategies requires further research.

A similar 'psychosocial' approach has been examined in a randomised controlled trial conducted by Bastiaenen and colleagues (2006). The authors investigated an intervention for pregnancy-related PGP, where the emphasis of treatment was on relieving the woman's worries about her condition, building a positive therapist/patient relationship with education and the promotion of an active lifestyle including goal setting rather than avoidance of activities. The authors found a significantly greater improvement of outcomes as measured by activity limitations in the 'intervention' group when compared to the 'usual treatment' group. This suggests that management of PLPP should include the consideration of psychosocial factors such as listening to the woman's concerns, providing educational resources, having positive attitudes towards prognosis and supportive relationships with carers.

Socio-economic consequences of pain and disability

Several authors have advised that women who report LPP during pregnancy have an increased risk of reporting poor health (Mogren, 2006; Skaggs, et al., 2007). Mogren (2006) in a survey of 891 women in Sweden, found that of the 68% of women who reported taking sick leave during pregnancy, in almost half, the cause of the sick leave was LPP and the average length of sick leave was 12 weeks. Van de Pol and colleagues from the Netherlands (2007) report that 8.1% of women with 'pelvic instability' in their sample had taken sick leave of more than a week. In the present study 23% of participants in the LPP group reported that they had taken sick leave because of LPP (67% of the LPP sample reported being not currently employed). The length of leave as well as loss of productivity and monetary costs to employers were not investigated, but would have been interesting to explore.

Pain, pregnancy and birth

As the literature concerning 'pain and pregnancy' most often centres on childbirth and the experience of pain during labour, it was thought that the inclusion of this theme was appropriate for the discussion of the results of this study, although a full discussion is beyond the scope of this thesis. It can be viewed as a paradox that much attention is given by authors to the discussion about pain, and the relief of labour pain, a 'normal' pain experience, whilst the relief of pregnancy-related back and pelvic girdle pain an 'abnormal' pain, appears largely ignored.

Childbirth is a unique event for each woman. The woman experiences 'acute' pain during labour as the result of a complex interaction of multiple physiological and psychosocial processes (Lowe, 2002). Whilst some authors interpret the pain of labour as a potentially negative experience, requiring elimination through pharmacological management (Vermelis, et al., 2010), others view the pain of labour as a positive sign of 'good' progress, with the end result or 'goal' being the successful birth of the child (Lowe, 2002). Leap and Anderson (2004) state that given the right environment and circumstances, a woman will be able to cope well with the pain of a normal labour, and to "…offer women in normal labour pain relief is to deny them their transformation and triumph…" (Leap & Anderson, 2004, p. 37). If a woman is able to perceive her pain as a non-life threatening pain experience, then her choice to persevere in spite of her pain can be better understood by those around her, as the experiences of immense joy and a sense of accomplishment can be co-existent to the experience of pain (Lowe, 2002).

Whatever viewpoint is taken, when considering an acute pain experience, pain should be interpreted with consideration of the concepts of helplessness and suffering, which can occur when individuals have insufficient resources and are unable to cope (Lowe, 2002). The evidence of the presence of continuous support during labour, assisting the woman's ability to cope is reflected in a shorter labour, an increased likelihood of a spontaneous vaginal birth, less pharmacological management and improved birth satisfaction (Hodnett, Gates, Hofmeyr, & Sakala, 2009). Leap and colleagues (2010) discuss how a

supportive relationship of trust with their midwife enabled women to cope with the pain of labour, reducing the need for pharmacological management. It is likely that this evidence can be translated to the woman's experience of LBP and/or PGP. When a woman has sufficient resources, this influences factors associated with her pain experience such as fear, anxiety and poor coping strategies. Resources in the form of adequate and correct information and appropriate support can promote self-efficacy and limit the subsequent development of co-morbidities and chronic pain conditions. This view is supported by the intervention trial implemented by Bastiaenen and colleagues (2006), as previously discussed, where women's worries and the therapist/patient relationship were the main target of an intervention for PLPP.

A practical model of this process, demonstrating the potential experiences of women with low back and pelvic girdle pain was reflected in the thematic analysis of the open-ended question of my study. When women were provided with the opportunity to share their experiences, four themes were identified from their responses. These included: pain; the impact of pain on the woman's lifestyle; the impact of pain on her psychological health; and 'what helped'/coping. These themes were found to be mirrored in a previous qualitative study conducted by Shepherd, (2005), who used phenomenology to describe women's experiences of pubic symphysis dysfunction. For Shepherd's study, data were collected from a purposeful sample of nine women using semi-structured interviews. The four themes described by Shepherd include: pain; emotions; lifestyle adaptation; and health professionals/support and information. Shepherd proposed that midwives need to routinely enquire if women have support for pubic symphysis dysfunction, and that prompt recognition and management would reduce morbidity. Collaborative care by health professionals and the routine use of the Edinburgh Postnatal Depression Scale were also suggested as ways to improve care (Shepherd, 2005).

Support

The need for support for women and recognition of the condition is evidenced by the world-wide existence of various internet sites and support groups. In Australia a support group titled the 'Pelvic Instability Association' was founded

in Melbourne, Victoria by a midwife who had personally experienced frustration surrounding the management of her PGP condition (http://www.pelvicinstability.org.au). Research exploring popular perspectives on PGP though women's discourses on the internet was conducted by Fredriksen, Moland and Sundby (2008). The themes of fear, endurance and lack of acknowledgement were analysed with an identification of a 'gap' in discourse between Norwegian health care system policy makers who considered PGP as a 'common complaint' and the women's experiences that reflected PGP as a real condition that required attention.

Identifiable risk factors for PLPP will assist maternity carers in the recognition of women who require support, or would benefit from early intervention strategies. The following section discusses the results of the analyses of the relationship between characteristics of the women in my study, and the reporting of PLPP. These results provide further support to previous research on risk factors for PLPP.

Further findings: Risk factors for low back and/or pelvic girdle pain during pregnancy

The results of this thesis strengthen previous findings for the identifiable risk factors for the reporting of PLPP of multiparity, and a reported previous history of LPP. The regular use of stairs was also identified as a lifestyle activity associated with the reporting of PLPP.

Parity

The results of this study support previous research that indicates that having more than one pregnancy increases the risk of experiencing LPP during pregnancy (Albert, et al., 2006; Bjelland, Eskild, Johansen, & Eberhard-Gran, 2010; Larsen, et al., 1999; Mogren & Pohjanen, 2005; Ostgaard, et al., 1991). Reasons for the association remain speculative although authors have proposed that multiparous women may have increased joint mobility when compared to nulliparous women (Robinson, Mengshoel, Veierød, et al., 2010). As previously discussed, the evidence of a positive association between pelvic joint mobility and pelvic girdle pain is limited. Multiparous women may also have increased

mechanical strain on the pelvic and back structures due to an increased work load; however this also remains reasonably speculative. Multiparous women can be encouraged by their maternity carers to seek support for PLPP if it occurs, as according to these study results, they are more at risk of developing the condition.

Previous history of back pain

The results of this study also support previous research that demonstrates a relationship between a previous history of low back and/or pelvic girdle pain and back pain and/or pelvic girdle pain during the current pregnancy (Albert, et al., 2006; Larsen, et al., 1999; Larsson, et al., 2006; Mohseni-Bandpei, et al., 2009; Olsson & Nilsson-Wikmar, 2004; Ostgaard, et al., 1991). When interviewing women during pregnancy, it would be beneficial for maternity carers to ask women about a previous history of low back and/or pelvic girdle pain. This information will assist in identifying women at risk of developing PLPP through the pregnancy. Appropriate resources can then be provided, and if necessary referral to support services can be made.

The regular use of stairs

No other study was found investigating the association of the regular use of stairs with the presence of back and/or pelvic girdle pain during the current pregnancy. Other lifestyle aggravating, or pain provocative activities that have been cited by various authors, include standing, walking and cycling (Hansen, et al., 1999; Mens, Vleeming, Stoeckart, Stam, & Snijders, 1996; Ronchetti, et al., 2008). The commonality of these activities lays in the unilateral asymmetrical loading through the pelvis during the activity, and the need for "form' and 'force' closure and adequate neuromuscular control of the pelvic joints during lower limb loading and weight transfer (Lee, 1996). This activity was common for the participants in this study: 68% reported a regular use of stairs. The population of Western Sydney has a high proportion of women living in multi-storey dwellings, as well as taking public transport, where the negotiation of stairs is most likley regularly required. This activity could be paralleled to the regular riding of bicycles by women in the Netherlands.

Anecdotally, the management and re-training of this activity where possible, has reduced the woman's experience of pain.

Other variables

My study found an association between regular bending and the reporting of PLPP on the day of the survey. There was no association found between low back and/or pelvic girdle pain during the current pregnancy and pre-pregnancy body mass index, status of employment, age or ethnicity, or amount or type of exercise, although previous studies have reported a relationship (Albert, et al., 2006; Mogren & Pohjanen, 2005; Wu, et al., 2004). This may be due to the small sample size. Further proposed risk factors for the development of pregnancy-related low back and pelvic girdle pain that have been investigated with positive findings include smoking (Biering, et al., 2010) , diabetes (Eberhard-Gran & Eskild, 2008), and lactose intolerance (Granath, 2007), although evidence is rated as 'weak' (Vleeming, et al., 2008; Wu, et al., 2004).

Knowledge translation for low back and/or pelvic girdle pain during pregnancy

Research findings need to be translated into information that is meaningful to maternity carers, so that improved recognition and management of PLPP can occur.

Lack of recognition of low back and/or pelvic girdle pain during pregnancy

One of the aims of this study has been to increase the awareness of LBP and/or PGP among maternity carers. The foreseen benefit of a descriptive analysis and reporting of study results was improve the understanding or pregnancy-related LBP and PGP in an Australian context, thereby informing practice to improve health outcomes for women.

Where a lack of appropriate professional acknowledgement of the condition of LBP and/or PGP during pregnancy has occurred, an explanation of this dilemma is proposed to be associated with a lack of communication between professional disciplines. Whilst there has been an explosion in research over the last two decades in relation to low back and pelvic girdle pain in the allied health field,

there has not been an adequate communication of this knowledge to maternity carers in the Australian health care setting. A discussion of the difficulty of cross professional communication and the transformation of 'evidence' into practice is reflected upon in the Canadian nursing literature, and can be referred to as a process called 'knowledge transfer' or 'knowledge translation'.

Strategies for inter-professional communication

Baumbusch and colleagues (2008) discuss the challenge of translating evidence into practice, and argue that the approach has been principally driven by the development of 'evidence based practice' (Sackett, Rosenberg, & Gray, 1996), and that this process is essentially dependent upon a unidirectional, linear passive flow of information. The authors suggest that a broader more inter-active model, that more effectively addresses the challenge of translating research findings into information that is meaningful. Crucial to this model is a 'shared' process of information 'trading' between producers and users of knowledge. A diagrammatic model of this process is shown in Figure 23.

Figure 23 A collaborative model of knowledge translation between research and practice in clinical settings.(Baumbusch, et al., 2008, pp. 132,figure 1)

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The concepts around knowledge transfer and knowledge translation are evolving in the literature and clarification of these concepts is necessary, as different sectors have been using inter-changeable terminology in their discussions (Thompson, Estabrooks, & Degner, 2006). Thompson and colleagues (2006) conducted a literature review of the concepts used by different sectors such as medicine, education and management in knowledge transfer, and suggested that *interpersonal communication* plays a key role in knowledge diffusion, by addressing the research 'gap'. They outlined five key strategies that are necessary for successful knowledge transfer in different environments. Basically, the process requires people who are: opinion leaders; facilitators; champions; or linking agents. *Opinion leaders* have credibility within their professions and are able to persuade others by word-of-mouth, or face-to-face encounters. *Facilitators* are goal orientated people who gather participants in an atmosphere of mutual respect, assisting these groups towards change. *Champions* advocate new ideas and exhibit passion and enthusiasm with visionary qualities, taking risks and relentlessly promoting their ideas. *Linking agents* act as a go-between for what may be considered as two incompatible 'worlds', bridging the gap, achieving interaction and transmitting information from one group to another (Thompson, et al., 2006).

One of the goals of this research has been to improve the woman's access to timely, relevant research knowledge by facilitating knowledge transfer and therefore practice change, rather than relying on the passive dissemination of knowledge. My role as the researcher has evolved during this process, and can be described as a both a champion and linking agent at various stages of the journey. It is hoped that through this journey 'knowledge' can become 'wisdom' and all involved in this process may benefit: myself as the researcher, the health care worker and the women in our care.

Study limitations

The sample

The main limitation of this study was the small sample size, which was not calculated for statistical power, but was selected as one that needed to be

manageable due to the limited time available for completion of an Honours project. This restricted the statistical tests available for use on this study population and conclusions of tests are therefore conservative. Another drawback was the need to exclude a large proportion of women from participating in the survey due to lack of competency in English. Future research should provide the use of interpreters and translated questionnaires to gain a more representative sample of this multi-cultural and linguistically diverse population. In the study, ethnicity was not able to be analysed well, due to the definition used as country of birth. It would be worthwhile to explore the use of a more comprehensive definition of ethnic origin with a larger sample. A more accurate definition of ethnicity may ascertain whether there is an association between ethnicity and LPP during pregnancy.

The instruments

A review of the chosen instruments reveals challenges in the method of this study. As already discussed, the Oswestry Disability Index is not a scale for pregnancy, and this therefore limits the interpretation of the scale and the results of the study. Future research should pay attention to the accuracy of the pain diagram when used as a tool for the reporting of LPP. The use of more clinical tests in the physical assessment will assist in improving diagnostic accuracy.

The survey

The interpretation of the woman's experiences is limited, as there was not a high response rate for the open ended question. Conducting face-to-face interviews would have provided more information than a written response. A mixed methods research method, using a sequential design (Creswell & Plano Clark, 2007) would be a suitable approach for further investigation of the women's experiences. With a mixed methods approach the qualitative data can serve to provide further meaning and validity to the quantitative data.

Conclusion

The main aim of this thesis was to investigate the prevalence of pregnancy-related low back and/or pelvic girdle pain (PLPP), and the associated levels of pain and disability experienced by Australian women, in a public hospital setting. The results of this investigation demonstrate that a high proportion (71%) of pregnant women attending the Women's Health Clinic at Westmead Hospital experienced 'lumbo-pelvic pain' (LPP) during their pregnancy, with 34% reporting pain on the day of the survey. This is the first known Australian study to report both the period and point prevalence of 'pelvic girdle pain' as well as 'low back pain' during pregnancy from a prospective cross sectional cohort. The number of women in this study with self reported PGP during the pregnancy according to a pain diagram was one third (33%) of the PLPP group, and according to the physical assessment on the day of the survey, was one half (52%) of this group. These results are similar to research conducted in other countries using similar methodology, however the sample size for my study was small and not calculated for statistical power, therefore further investigation with a larger sample size is needed to provide more support to these findings. Comparisons of prevalence rates are problematical due to diverse terminologies and definitions of PLPP, and some studies have used different criteria when sub-grouping LPP during pregnancy. These disparities indicate that all studies of LPP during pregnancy should be interpreted with caution, with attention paid to definitions, sample size and classification method used for reporting of the condition.

It is my recommendation that low back and/or pelvic girdle pain should not be accepted as a 'normal' part of pregnancy. The ranges of pain and disability scores reported in my study, and the women's responses to the open ended questions indicate that for some the condition was 'minor' and could be considered a 'discomfort', but for others, the levels of pain and disability were considerable. My study reinforces the conclusions of other research in this field, which affirms that women with pelvic girdle pain (PGP) or combined low

back pain (LBP) and PGP experience higher levels of pain and disability when compared to women with LBP only. Women with PGP or combined LBP and PGP can experience considerable lifestyle consequences and are at risk of developing a chronic pain condition.

The number of women taking sick-leave, and the responses to the open ended questions in my study indicate that for some women the experience of PLPP has psychosocial and socio-economic consequences. It is recommended that the effective management of PLPP would include factors such as listening to the woman's concerns, providing educational resources and developing supportive relationships with their carers. It can be viewed as a paradox that a lot of attention is given to the relief of labour pain, usually a 'normal' pain experience, whilst the relief of pregnancy-related low back and pelvic girdle pain as 'abnormal' pain, appears largely ignored. It is proposed that as with management of the pain of labour, when a woman has sufficient resources and support, this can influence elements associated with her pain experience such as fear, anxiety and poor coping strategies. Appropriate and timely help and support of women with PLPP may limit the subsequent development of co-morbidities and chronic pain conditions. This proposal however is speculative and requires further investigation.

The results of this thesis strengthen previous findings for the identifiable risk factors for the reporting of PLPP of multiparity, and a previous history of LPP. The regular use of stairs and regular bending were also identified as a lifestyle activities associated with the reporting of LBP and/or PGP. Other associated risk factors for PLPP may not have been identified due to the small sample size. Knowledge of risk factors for PLPP will assist maternity carers in the early recognition of women who require support, or would benefit from intervention strategies. Physical assessments such as the posterior pelvic pain provocation test may be one method assisting maternity carers to differentiate LBP from PGP, in order to more objectively assist women in their care. The acceptability, practicality and effectiveness of this proposal require further investigation.

It is proposed that future research in this area could investigate the benefits of early identification and management of PLPP. A longitudinal study of women,

including early pregnancy assessment, pregnancy monitoring, postnatal and longer term follow-up, would provide information regarding the benefit of early identification, intervention and support. Further investigation of different strategies employed in the inter-professional translation of knowledge regarding PLPP would assist in understanding the effectiveness of these processes.

In conclusion, this thesis supports the value of differentiating the conditions of pelvic girdle and low back pain; the importance of assisting women with pain and disability to access resources for support and management of their condition; the necessity of distinguishing those women who are at risk of a chronic pain condition; and the need for maternity carers to listen to Australian women so that they may experience optimal long term health outcomes.

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Appendices

1. The survey
2. The ‘Investigator Brochure’, ‘Participant information sheet’ and consent form.
3. Consent for use of the Oswestry Disability Index.
4. Letters of Ethics Approval, and Site Approval.
5. Further data: Participant’s characteristics.
6. Further data: Results of the cross tabulation for testing of the null hypotheses: PLPP is not associated with sample characteristics.

Survey: Back and Pelvic Girdle Pain in Pregnancy

Survey No:
Clinic: M / D
Date of completion:
___/___/2010

Your responses are confidential.

Please mark response like this **X**

Mark only one box unless instructed.

About you:

1. My age group in years is

❒<20 ❒20-24 ❒25-29 ❒30-34 ❒35-39 ❒40 +

2. Before this pregnancy the number of babies (more than 20 weeks pregnancy) that I have given birth to is

❒ None ❒ One ❒ Two ❒ Three ❒ Four ❒ Five ❒ Six +

3. My country of birth is _____

4. My baby is due to be born on _____/_____/2010, (I am currently _____weeks pregnant).

5. My weight just before this pregnancy was _____kg

6. My height is _____cm.

7. My job is…
   - ❒ Full-time
   - ❒ Part-time
   - ❒ Casual
   - ❒ I do not currently have a job

Questions about your exercise habits and lifestyle:

Please mark response like this [X]

Mark only one box unless instructed

1. I exercise regularly (eg walking, swimming, gym class)

❒ Once a week ❒ twice a week ❒ x3 or more a week ❒ I do not do regular exercise

2. I do an exercise programme for pregnancy including pelvic floor exercises

❒ Once a week ❒ twice a week ❒ x3 or more a week ❒ I do not do regular pelvic floor exercises

3. I do an exercise programme for pregnancy including abdominal exercises

❒ Once a week ❒ twice a week ❒ x3 or more a week ❒ I do not do regular abdominal exercises

4. I regularly use stairs ❒ Yes ❒ No

5. My job/lifestyle involve activities that require regular bending ❒ Yes ❒ No

6. My job/lifestyle involve activities that require regular lifting ❒ Yes ❒ No

7. I have support at home to help with child minding/ housework ❒ Yes ❒ No

8. In the past, I have had an injury to my

(You may mark more than one box)

❒ back ❒ pelvic area ❒ hip ❒ knee ❒ ankle/foot ❒ none of these

9. I have recently had an operation to the abdomen, spine, legs or pelvis.

❒ Yes ❒ No

10. I have recently been diagnosed with a serious health problem

❒ Yes ❒ No

Questions about back and/or pelvic girdle pain:

I have experienced pain in the low back, pelvic, groin, pubic bone or hip area:

(You may mark more than one box)

- ❒ In the past, unrelated to pregnancy (that is, before ever being pregnant)
- ❒ In the year before this pregnancy
- ❒ During a past pregnancy (before this pregnancy)
- ❒ During this pregnancy
- ❒ Recently (today or in the past week)
- ❒ I have never experienced any low back, pelvic, groin, pubic bone or hip area

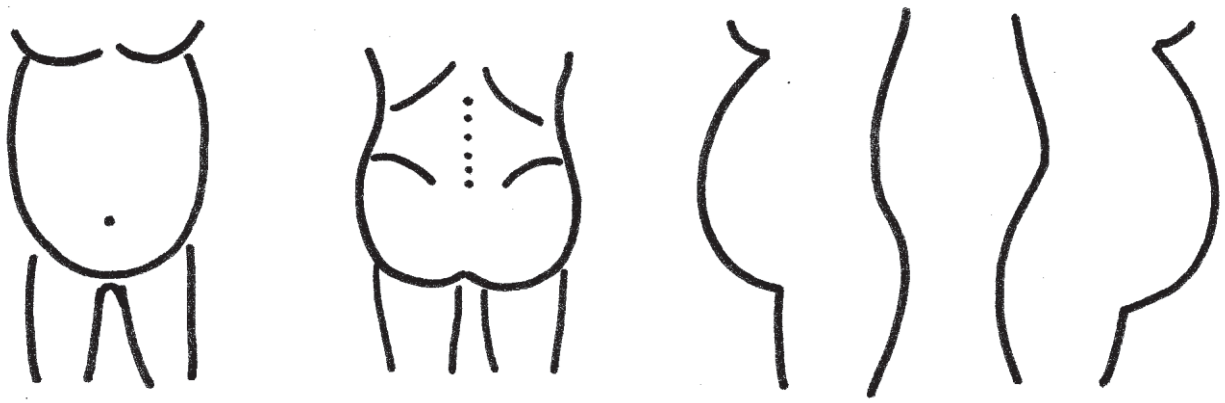
If you have not experienced back or pelvic girdle pain during this pregnancy, then you do not need to answer any further questions.

Thankyou for your assistance in completing this survey. ☺

If you have experienced back or pelvic girdle pain during this pregnancy, the researcher would like to do a brief physical assessment to confirm the source of your pain. This can take place today before or after your antenatal visit. The researcher will speak to your midwife/doctor so that you don't miss your appointment. Please continue the survey by answering the following questions about your pain. This should only take between 5 and 10 minutes. The researcher is available to assist you with answering any queries you may have.

Questions about your back and/or pelvic girdle pain:

If you have experienced pain during this pregnancy, please indicate on the following diagram where your pain is located



Front back left side right side

Please put a mark on the following scale of 0 to 10 to show how bad your usual pain has been during this pregnancy:

0 1 2 3 4 5 6 7 8 9 10

|____|____|____|____|____|____|____|____|____|____|____|

No pain Pain as bad as it could possibly be

Please put a mark on the following scale of 0 to 10 to show how bad your pain has been today:

0 1 2 3 4 5 6 7 8 9 10

|____|____|____|____|____|____|____|____|____|____|____|

No pain Pain as bad as it could possibly be

Questions about your pain:

These questions help us with information about how your pain affects your ability to manage in everyday life. Please answer every section.

Mark one box only in each section that most closely describes you today. **X**

1. Pain intensity

- ❒ I have no pain
- ❒ The pain is very mild at the moment
- ❒ The pain is moderate at the moment
- ❒ The pain is fairly severe at the moment
- ❒ The pain is very severe at the moment
- ❒ The pain is the worst imaginable at the moment

2. Personal care (washing, dressing, etc)

- ❒ I can look after myself normally without causing extra pain
- ❒ I can look after myself normally but it is very painful
- ❒ It is painful to look after myself and I am slow and careful
- ❒ I need some help but manage most of my personal care
- ❒ I need help every day in most aspects of self care
- ❒ I do not get dressed, wash with difficulty and usually stay in bed

3. Lifting

- ❒ I can lift heavy weights without extra pain
- ❒ I can lift heavy weights but it gives extra pain
- ❒ Pain stops me from lifting heavy things off the floor but I can manage if they are conveniently positioned, eg on a table
- ❒ Pain prevents me from lifting heavy things but I can manage light to medium weights if they are conveniently positioned
- ❒ I can lift only very light weights
- ❒ I cannot lift or carry anything at all

4. Walking

- ❒ Pain does not prevent me walking any distance
- ❒ Pain prevents me walking more than 1 km
- ❒ Pain prevents me walking more than 500m
- ❒ Pain prevents me walking more than 100m (one block)
- ❒ I can only walk using crutches or a stick
- ❒ I rest or I am in bed most of the time and need assistance to toilet

5. Sitting

- ❒ I can sit in any chair as ling as I like
- ❒ I can only sit in my favourite chair as long as I like
- ❒ Pain prevents me sitting more than1 hour
- ❒ Pain prevents me sitting more than ½ hour
- ❒ Pain prevents me sitting more than 10 minutes
- ❒ Pain prevents me sitting at all

6. Standing

- ❒ I can stand as long as I want without extra pain
- ❒ I can stand as long as I want but it gives extra pain
- ❒ Pain prevents me standing for more than 1 hour
- ❒ Pain prevents me standing for more than ½ hour
- ❒ Pain prevents me standing for more than 10 minutes
- ❒ Pain prevents me from standing at all

7. Sleeping

- ❒ My sleep is never disturbed by pain
- ❒ My sleep is occasionally disturbed by pain
- ❒ Because of my pain I have less than 6 hours sleep
- ❒ Because of my pain I have less than 4 hours sleep
- ❒ Because of my pain I have less than 2 hours sleep
- ❒ Pain prevents me from sleeping at all

8. Sex life

- ❒ My sex life is normal and causes no extra pain
- ❒ My sex life is normal but causes some extra pain
- ❒ My sex life is nearly normal but is very painful
- ❒ My sex life is severely restricted by pain
- ❒ My sex life is nearly absent because of pain
- ❒ Pain prevents any sex life at all

9. Social life / activities

- ❒ My social life is normal and gives me no extra pain
- ❒ My social life is normal but increases the degree of pain
- ❒ Pain has no significant effect on my social life but limits my activities that require energy
- ❒ Pain has restricted my social life and I do not go out as often
- ❒ Pain has restricted my social life to my home
- ❒ I have no social life because of my pain

10. Travel

- ❒ I can travel anywhere without extra pain
- ❒ I can travel anywhere but it gives me extra pain
- ❒ Pain is bad but I can manage journeys over two hours
- ❒ Pain restricts me to journeys of less than I one hour
- ❒ Pain restricts me to short necessary journeys less than 30 minutes
- ❒ Pain prevents me travelling except to the doctor or hospital

Further questions about your pain:

Please complete the sentence or mark response like this [X]

Mark only one box unless instructed

11. The pain started

❒ Before 16 weeks of pregnancy

❒ Between 16 – 28 weeks

❒ After 28 weeks

12. I have told my midwife/doctor about my pain ❒ Yes ❒ No

13. I have received treatment for my pain ❒ Yes ❒ No

If you have received treatment, please indicate the type of treatment (eg physiotherapy, tablets)

_____

14. The treatment helped ❒ Yes ❒ No ❒ I have not received treatment

15. I did not receive treatment for my pain because of

(You may mark more than one box)

❒ Lack of time

❒ Expensive

❒ Childminding difficulties

❒ Transport difficulties

❒ I did not think treatment would help

❒ Not applicable to me

Other_____

16. I have taken time off work/sick leave or reduced hours because of the pain

❒ Yes ❒ No ❒ Not applicable to me

17. My pain is usually worse when I

_____

_____

18. My pain is usually better when I

_____

_____

19. Do you agree with the following statement?

"Low back and/or pelvic pain is to be expected because I am pregnant"

❒ Yes ❒ No ❒ Not sure

20. Is there anything else that you would like to say about your experience of pain?

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Thankyou for your time and assistance in completing this survey. ☺

Survey No:
Clinic: M / D
Date of completion:
___/___/2010

Survey: Back and Pelvic Girdle Pain in Pregnancy

[To be completed by the investigator only]

Consent for physical assessment: Yes / No

1.	PPPP		Left + / -	Right + / -
2.	Palpation of LDSIL for tenderness		Left + / - °	Right + / - °
3.	ASLR		Left + / -	Right + / -
4.	Passive SLR	Yes / No	Left + / -	Right + / -
5.	Modified Trendelenburg		Left + / -	Right + / -
6.	Palpation of symphysis		Left + / -	Right + / -
7.	Palpation of symphysis		Right anterior /Left anterior	
8.	Ilial rotation/ slip		Left ant/ post	Right ant/ post
9.	Foetal position	LOA LOL LOP	ROA ROL ROP	Breech Other
10.	Rectus Diastasis			

Confirmation of diagnosis:

- PGP Yes / No
- LBP Yes / No
- Combined PGP and LBP Yes / No
- Other (comments)

_____

_____

_____

- Information booklet offered/ accepted Yes / No / has already received
- Referral recommended Yes / No / has already received

Being in this study will help health care workers better recognise and manage pregnancy –related low back and pelvic girdle pain . A better understanding of this type of pain may help improve women's health in the future.

More information about back care and exercise in pregnancy can be found in the booklet: 'Exercises before & after birth'. Please ask you midwife or Doctor for a copy.

A **Pregnancy Exercise Class** is held once a month, here at the hospital. You may book into this class by calling:

9845 6005

A **Pregnancy Water Exercise Class** is held every Tuesday at 9.30am in the Hydrotherapy Pool, here at the hospital. A referral & medical clearance from a Doctor is required. To book in please call:

9845 6500

Like to know more about the study?

Please contact the

Associate Investigator, Heather Pierce on:

0409 308 815

Investigator Brochure Version 1:

October 2009

Investigator Brochure Version 1:
October 2009

Low back & pelvic pain in pregnancy

Information about A study to understand more about low back and pelvic girdle pain experienced by women during pregnancy

Investigators:

Dr Jenny King &

Registered Midwife & Physiotherapist

Heather Pierce

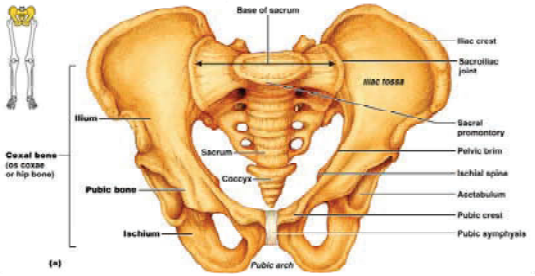
SWAHS: Westmead Hospital, department of Women's & children's health

LOW BACK & PELVIC GIRDLE PAIN IN PREGNANCY

During pregnancy women often experience pain in the joints, muscles and ligaments around the pelvis and lower spine.

The pelvis is an important part of the woman's body during pregnancy and childbirth. Pregnancy hormones help to soften ligaments to allow room for the growing baby, and to help the pelvic joints open slightly during a vaginal birth.

Firm and well supported pelvic joints are important for being able to do activities such as walking, standing up from a chair, rolling over in bed and climbing stairs. If the effect of soft ligaments is not compensated for by good muscle control, pain and disability can occur.



What is the study for?

The purpose of this study is to understand more about low back and pelvic girdle pain experienced by women during pregnancy, by finding out:

- How many pregnant women in a sample of 100 attending the Women's Health Clinic at Westmead Hospital experience low back and/or pelvic girdle pain?
- How does this pain affect their everyday activities?

Who will be asked to enter the study?

Women who attend either a Midwife's or Doctor's Clinic, are aged between 18 – 45, can read/write English and are in the last 3 months of their pregnancy. Participation in this study is voluntary and will not affect the woman's care or their relationship with staff. Women can withdraw at any time without giving a reason.

How will the study be done?

There is a short survey to fill in.

Women will be asked to show on a body chart where their pain is, and mark on a scale how severe the pain is: '0' being no pain and '10' being their worst pain. They will also be asked some questions about how the pain affects their daily activities such as sleeping, walking, dressing, looking after their home, other children and their ability to work. Women will also have the chance to tell us anything else that they would like about their experience of pain.

If women have pain, they will be asked to undergo a brief physical assessment to work out the type of pain and where the pain is.

The assessment will be done by a physiotherapist and midwife, Heather Pierce. It involves simple movements of legs in standing and when briefly lying on the back (the same position is used during ante-natal check-ups). Heather will also press gently over the lower back, pelvis and abdomen. The uterus and baby will also be gently examined.

PARTICIPANT INFORMATION SHEET AND CONSENT FORM

Study Title:
A Pilot Study of Pregnancy-related Low Back and Pelvic Girdle Pain

Chief Investigator: Dr Jenny King
Associate Investigator: Heather Pierce

Department of Women's and Children's Health, Westmead Hospital

Invitation

You are invited to participate in a research study about low back and pelvic girdle pain during pregnancy.

The study is being done by Dr Jenny King, a Specialist Urogynaecologist and Heather Pierce, a Registered Midwife and Physiotherapist.

Before you decide whether to participate in this study, it is important for you to understand why the research is being done and what it will involve. Please read the following information carefully and discuss it with others if you wish.

What is the purpose of the study?

The purpose of this study is to understand more about low back and pelvic girdle pain during pregnancy, by looking at:

- How many pregnant women in a sample attending the Women's Health Clinic experience low back and/or pelvic girdle pain and
- How much this pain affects their everyday activities.

Who will be invited to enter the study?

You are eligible to participate in this study because you are in the last 3 months of your pregnancy.

Do you have a choice?

Participation in this study is voluntary. It is completely up to you whether or not you participate. If you decide not to participate, it will not affect the care you receive now or in the future or your relationship with the staff. If you wish to withdraw from the study, you can do so at any time without giving a reason.

What will happen on the study?

If you choose to be in this study, you will be asked to sign the Participant Consent Form. Your participation in the study will then occur today.

If you agree to participate, you will be asked questions about yourself, your lifestyle and exercise habits and if you are having any pain in the low back, pelvis, hips, groin or pubic area at the moment.

There is a short survey to fill in. On this, you will be asked to show on a body chart where the pain is, and mark on a scale how severe the pain is: '0' being no pain and '10' being the worst pain that you have ever experienced. You will also be asked some questions

PARTICIPANT INFORMATION SHEET AND CONSENT FORM

Study Title:
A Pilot Study of Pregnancy-related Low Back and Pelvic Girdle Pain

about how the pain affects your daily life such as sleeping, walking, dressing, looking after your home and your ability to work. You will have the chance to tell us anything else about your experience of pain at the end of the survey.

If you do experience pain, you will also be asked to undergo a brief physical assessment to work out the nature and location of the back pain. The associate investigator, Heather Pierce, will conduct the examination. The assessment involves simple movements of your legs in standing and when lying on your back (the same position is used when you are examined by your doctor or midwife during antenatal check-ups). She will also press gently over your lower back, pelvis and abdomen. Your uterus and baby will also be examined.

The survey will take between 5 and 10 minutes. If an assessment is required, this will take a further 5 to 10 minutes.

Are there any risks?
The risks associated with this study are minimal.

Time is required to fill out the survey and possibly have the physical assessment if you have pain. We will try and use the time while you are waiting for your appointment, so that you don't have any extra inconvenience. You might need to stay after your antenatal appointment for the physical assessment.

There are no known risks or complications of the physical assessments to yourself or your baby. You will however, most likely experience some of your usual discomfort during the assessment as this is the only way to work out what sort of pain it is. There are no medical interventions or physiotherapy treatments involved in this study.

Are there any benefits?
Being in this study will help the recognition and management of pregnancy –related low back and pelvic girdle pain. Having a better understanding of this pain may help improve women's health in the future.
The benefit of undergoing a physical assessment is that a diagnosis can be made (if this has not already occurred) and if you choose, education and referral pathways can be initiated for pain management.

Confidentiality / Privacy
Information that is collected about you in this study will be non identifiable. This means that once you have completed the study, your responses will be not be connected to you personally in any way and no-one will be able to identify your information. An allocated number will identify the survey and results of the physical assessment. Only the researchers named above will have access to the results of this study. All the information will be held securely here at Westmead Hospital.

PARTICIPANT INFORMATION SHEET AND CONSENT FORM

Study Title:
A Pilot Study of Pregnancy-related Low Back and Pelvic Girdle Pain

Financial Disclosure
The study has no financial interests or sponsor.

Will taking part in this study cost me anything, and will I be paid?
Participation in this study is not paid, nor will it cost you anything.

What will happen at the conclusion of the study?
If you report low back and/or pelvic girdle pain and it is apparent that you may benefit from further assessment (that you have not already received), you may ask your midwife or doctor for referral to the physiotherapist at this hospital. You may also choose to have treatment from a healthcare professional outside of the hospital. You will be given an information booklet about the condition that includes specific exercises and self-help measures. There is also a 'Pregnancy Exercise Class' that is held here at the hospital once a month. This class is run by a physiotherapist. It includes a practical session and up-to-date information on pregnancy exercise and caring for your back.

What happens with the results?
If you give us your permission by signing the consent document, we may discuss and/or share the results of this study in publications, presentations at conferences or other professional forums. In any publication, information will be provided in such a way that you cannot be identified. Results of the study can be provided to you, if you wish.

Complaints
This study has been approved by the Sydney West Area Health Service Human Ethics Committee. If you have any concerns about the conduct of the study, or your rights as a study participant, you may contact:
Westmead Hospital Patient Representative, Ms Jillian Gwynne Lewis,
Telephone No 9845 7014 or email jillian.lewis@swahs.health.nsw.gov.au

Contact details
When you have read this information, the associate investigator Heather Pierce will be happy to discuss it with you and answer any queries you may have. If you would like to know more at any stage, please do not hesitate to contact her during working hours on 9845 6500 or after hours on mobile: 0409 308 815.

Thank you for taking the time to consider this study.
If you wish to take part in it, please sign the attached consent form.
This information sheet is for you to keep.

PARTICIPANT INFORMATION SHEET AND CONSENT FORM

Study Title:
A Pilot Study of Pregnancy-related Low Back and Pelvic Girdle Pain

CONSENT TO PARTICIPATE IN RESEARCH

Name of Researcher: Dr Jenny King

1. I understand that the researcher will conduct this study in a manner conforming to ethical and scientific principles set out by the National Health and Medical Research Council of Australia and the Good Clinical Research Practice Guidelines of the Therapeutic Goods Administration.

2. I acknowledge that I have read, or have had read to me the Participant Information Sheet relating to this study. I acknowledge that I understand the Participant Information Sheet. I acknowledge that the general purposes, methods, demands and possible risks and inconveniences which may occur to me during the study have been explained to me by Heather Pierce (associate researcher) and I, being over the age of 16 acknowledge that I understand the general purposes, methods, demands and possible risks and inconveniences which may occur during the study.

3. I acknowledge that I have been given time to consider the information and to seek other advice.

4. I acknowledge that refusal to take part in this study will not affect the usual treatment of my condition.

5. I acknowledge that I am volunteering to take part in this study and I may withdraw at any time.

6. I acknowledge that this research has been approved by the Sydney West Area Health Service Human Research Ethics Committee.

7. I acknowledge that I have received a copy of this form and the Participant Information Sheet, which I have signed.

8. I acknowledge that any regulatory authorities may have access to my medical records to monitor the research in which I am agreeing to participate. However, I understand my identity will not be disclosed to anyone else or in publications or presentations.

Before signing, please read 'IMPORTANT NOTE' following.
IMPORTANT NOTE:
This consent should only be signed as follows:
1. Where a participant is over the age of 16 years, then by the participant personally.

Name of participant _____ Date of Birth _____

Address of participant _____

Signature of participant _____ Date: _____

Signature of researcher _____ Date: _____

Signature of witness _____ Date: _____

From:	Jeremy Fairbank
To:	Heather Pierce
Subject:	Re: Use of the ODI during pregnancy
Date:	Wednesday, 26 August 2009 6:47:37 AM

Dear heather
You are welcome to use ODI for your study, but not to modify it. Unfortunately modifications have caused a lot of trouble and are not validated. I am currently setting up a licencing system for ODI. Please look at the website for latest version v2.1a
http://www.orthosurg.org.uk/odi/
Jeremy
On 24 Aug 2009, at 11:49, Heather Pierce wrote:

> Dear Jeremy,
> I am an Honours student and I am conducting a research study on pregnant women with low back and pelvic girdle pain. I would like your permision to incorporate a modified version of the Oswestry Disability Index in my questionnaire. Have you knowledge of any versions of the questionnaire specifically designed for the pregnant population?
> Regards,
> Heather Pierce

SYDNEY WEST
AREA HEALTH SERVICE | NSW HEALTH

HUMAN RESEARCH ETHICS COMMITTEE (Westmead Campus)
Research Office, Room 2020 Clinical Sciences
Westmead Hospital, Hawkesbury Road, Westmead NSW 2145

Telephone: 02 9845 8183
Facsimile: 02 9845 8352
Email: ResearchOffice@swahs.health.nsw.gov.au

Our Ref: ***HREC2009/11/4.10(3060) AU RED HREC/09/WMEAD/271***

29 January 2010

Dr Jennifer King
Department of Women's and Children's Health
Westmead Hospital

Dear Dr King

Project title: 'A Pilot Study of Pregnancy-related Low Back and Pelvic Girdle Pain'

Receipt is acknowledged of Ms Heather Pierce's letter dated 10 December 2009 addressing the matters raised in the HREC's letter dated 30 November 2009 following single ethical review of the above project at its meeting held on 24 November 2009.

This HREC has been accredited by the NSW Department of Health as a lead HREC to provide the single ethical and scientific review of proposals to conduct research within the NSW public health system. This lead HREC is constituted and operates in accordance with the National Health and Medical Research Council's *National Statement on Ethical Conduct in Human Research* and the *CPMP/ICH Note for Guidance on Good Clinical Practice.*

I am pleased to advise that the HREC has now granted ethical approval of this single site research project to be conducted at:

- Westmead Hospital - Chief Investigator Dr Jenny King

The following documentation has been reviewed and approved by the HREC:

- Research Protocol dated 7 October 2009
- Revised Participant Information and Consent Form Version 5 dated 10 December 2009
- Survey Version 10 dated October 2009
- Data Summary Sheet Version 1 dated October 2009
- Investigator Brochure Version 1 dated October 2009
- SWAHS booklet 'Exercises Before and After Birth'

Please note the following conditions of approval:

- The coordinating investigator will immediately report anything which might warrant review of ethical approval of the project in the specified format, including unforeseen events that might affect continued ethical acceptability of the project.
- Proposed amendments to the research protocol or conduct of the research which may affect the ethical acceptability of the project, are provided to the HREC to review in the specific format. A copy of all proposed changes is also provided to the relevant research governance officer.
- The HREC must be notified, giving reasons, if the project is discontinued at a site before the expected date of completion.
- The coordinating investigator must provide an annual report to the HREC and a final report at completion of the study, in the specified format. HREC approval is valid for 12 months from the date of final approval and continuation of the HREC approval beyond the initial 12 month approval period is contingent upon submission of an annual report each year. A copy of the Annual / Final Research Report Form is attached and can be obtained electronically from the Research Office on request.
- It should be noted that compliance with the ethical guidelines is entirely the responsibility of the researcher.

You are reminded that this letter constitutes *ethical approval only.* You must not commence this research project until separate authorisation from the Chief Executive or delegate has been obtained. A copy of this letter together with copies of all other approved documents listed above must be forwarded to the SWAHS Research Governance Officer.

A summary of the HREC Standard Operating Procedures is attached for your reference. Should you have any queries about the HREC's Terms of Reference, Standard Operating Procedures or membership, please contact the HREC Executive Officer through the Research Office on 9845 8183 or emailing researchoffice@swahs.health.nsw.gov.au.

In all future correspondence concerning this study, please quote approval number ***HREC2009/11/4.10(3060) AU RED HREC/09/WMEAD/271.*** The HREC wishes you every success in your research.

Yours sincerely

Ms Tina Goodenough
HREC Executive Officer
SWAHS Human Research Ethics Committee (Westmead Campus)

cc Ms Heather Pierce, Dept of Women's and Children's Health

SYDNEY WEST
AREA HEALTH SERVICE | NSW HEALTH

SWAHS Research Governance Officer
Room 2020, Clinical Sciences Corridor
Westmead Hospital
Hawkesbury Road
Westmead NSW
2145

Telephone: (02) 9845 9634
Facsimile: (02) 9845 9636
Email: margaret.piper@swahs.health.nsw.gov.au

25 February 2010

Dr Jennifer King
Department of Women's and Children's Health
Westmead Hospital

Dear Dr King

HREC reference number: HREC/09/WMEAD/271
SSA reference number: SSA/10/WMEAD/44
Project title: A Pilot Study of Pregnancy-related Low Back and Pelvic Girdle Pain
Protocol number: Dated 7 October 2009

Thank you for submitting an application for authorisation of this project. I am pleased to inform you that authorisation has been granted for this study to take place at the following site:

- Westmead Hospital

The following conditions apply to this research project. These are additional to those conditions imposed by the Human Research Ethics Committee that granted ethical approval:

1. Proposed amendments to the research protocol or conduct of the research which may affect the ethical acceptability of the project, and which are submitted to the lead HREC for review, are copied to the research governance officer;
2. Proposed amendments to the research protocol or conduct of the research which may affect the ongoing site acceptability of the project, are to be submitted to the research governance officer.

Yours faithfully

Maggie Piper
SWAHS Research Governance Officer

c.c Heather Pierce, 29 Cook Street, Baulkham Hills NSW 2153

Appendix 5: Particpant characterisitics

Maternal age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 20	1	1.0	1.0	1.0
	20-24	23	24.0	24.0	25.0
	25-29	36	37.5	37.5	62.5
	30-34	22	22.9	22.9	85.4
	35-39	12	12.5	12.5	97.9
	40+	2	2.1	2.1	100.0
	Total	96	100.0	100.0	

Parity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	52	54.2	54.2	54.2
	1	29	30.2	30.2	84.4
	2	7	7.3	7.3	91.7
	3	5	5.2	5.2	96.9
	4	2	2.1	2.1	99.0
	6+	1	1.0	1.0	100.0
	Total	96	100.0	100.0	

Ethnicity (place of birth)

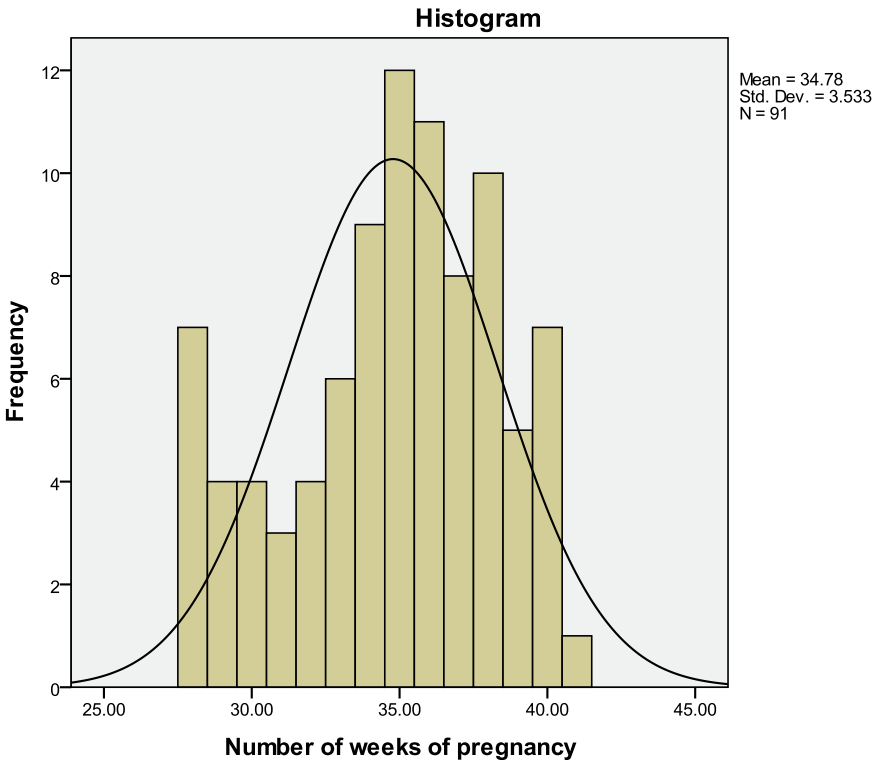
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Australia	37	38.5	38.5	38.5
	Asia	17	17.7	17.7	56.3
	Middle East	6	6.3	6.3	62.5
	India/ Sri Lanka	19	19.8	19.8	82.3
	Europe	4	4.2	4.2	86.5
	America/Canada	4	4.2	4.2	90.6
	Africa	5	5.2	5.2	95.8
	U.K	3	3.1	3.1	99.0
	Fiji	1	1.0	1.0	100.0
	Total	96	100.0	100.0	

Body Mass Index

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<19.9	15	15.6	15.8	15.8
	20-24.9	40	41.7	42.1	57.9
	25-29.9	20	20.8	21.1	78.9
	30-34.9	12	12.5	12.6	91.6
	35-39.9	6	6.3	6.3	97.9
	>40	2	2.1	2.1	100.0
	Total	95	99.0	100.0	
Missing	Missing	1	1.0		
Total		96	100.0		

Gestation of Pregnancy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	28-29	11	11.5	11.5	11.5
	30-31	7	7.3	7.3	18.8
	32-33	10	10.4	10.4	29.2
	34-35	21	21.9	21.9	51.0
	36-37	19	19.8	19.8	70.8
	38-39	19	19.8	19.8	90.6
	40+	9	9.4	9.4	100.0
	Total	96	100.0	100.0	



Employment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Full time	22	22.9	22.9	22.9
	Part time	14	14.6	14.6	37.5
	Casual	5	5.2	5.2	42.7
	No current employment	53	55.2	55.2	97.9
	Maternity leave	2	2.1	2.1	100.0
	Total	96	100.0	100.0	

Pelvic floor exercise

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once a week	14	14.6	14.9	14.9
	twice a week	4	4.2	4.3	19.1
	3 times or more a week	5	5.2	5.3	24.5
	No regular PF exercise	71	74.0	75.5	100.0
	Total	94	97.9	100.0	
Missing	Incomplete	2	2.1		
Total		96	100.0		

Abdominal exercise

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once a week	11	11.5	11.7	11.7
	twice a week	3	3.1	3.2	14.9
	3 times or more a week	1	1.0	1.1	16.0
	No regular abdominal exercise	79	82.3	84.0	100.0
	Total	94	97.9	100.0	
Missing	Incomplete	2	2.1		
Total		96	100.0		

Posterior Pelvic Pain Provocation Test

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	negative test	20	20.8	34.5	34.5
	L +ve	14	14.6	24.1	58.6
	R +ve	8	8.3	13.8	72.4
	L & R +ve	16	16.7	27.6	100.0
	Total	58	60.4	100.0	

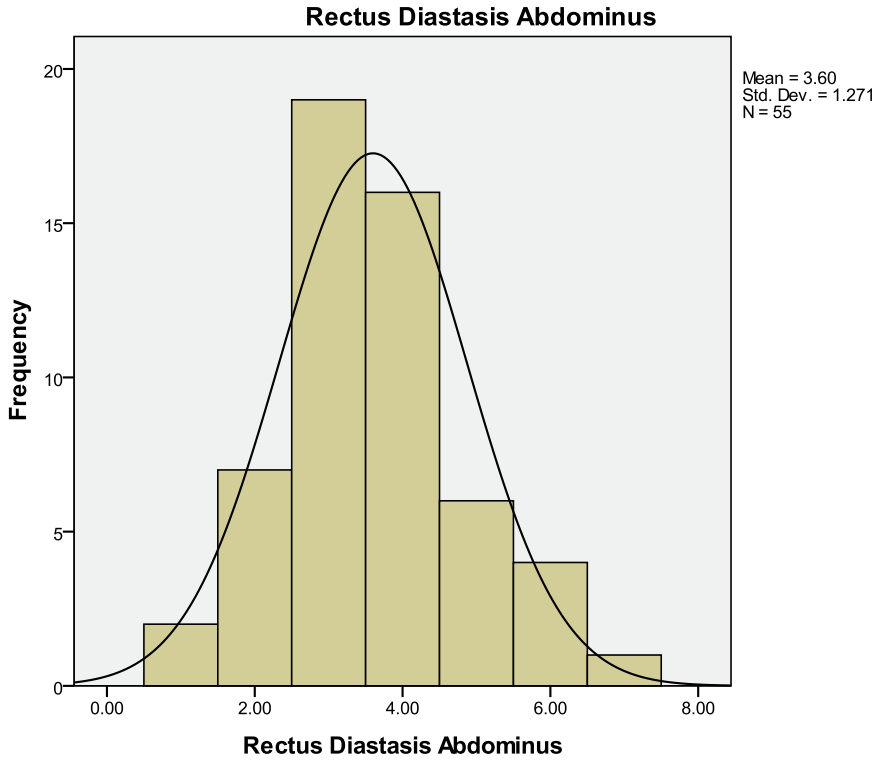
Fetal Position

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	LOA*	13	13.5	22.4	22.4
	LOL	11	11.5	19.0	41.4
	LOP	5	5.2	8.6	50.0
	ROA	10	10.4	17.2	67.2
	ROL	13	13.5	22.4	89.7
	ROP	1	1.0	1.7	91.4
	Breech	4	4.2	6.9	98.3
	Twins	1	1.0	1.7	100.0
	Total	58	60.4	100.0	

*L(R) OA= left (right) occipito-anterior; L (R) OL= left (right) occipito-lateral; L (R) OP= left (right) occipito-posterior;

Rectus Diastasis Abdominus

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 cm	2	2.1	3.6	3.6
	2cm	7	7.3	12.7	16.4
	3cm	19	19.8	34.5	50.9
	4cm	16	16.7	29.1	80.0
	5cm	6	6.3	10.9	90.9
	6cm	4	4.2	7.3	98.2
	7cm	1	1.0	1.8	100.0
	Total	55	57.3	100.0	



Appendix 6: Results of the cross tabulation for testing of the null hypotheses: PLPP is not associated with sample characteristics.

Participant response to survey Q (n=96)	PLPP during pregnancy yes (%)	PLPP during pregnancy no (%)	p value	PLPP on day of survey yes (%)	PLPP on day of survey no (%)	p value
Regular exercise*						
Yes	18 (30)	42 (70)	0.2	39 (65)	21 (35)	0.2
No	14 (42)	19 (58)		26 (70)	7 (21)	
PF exercise*						
Yes	16 (70)	7 (30)	1.0	7 (30)	16 (70)	0.6
No	50 (70)	21 (3))		26 (37)	45 (63)	
Abdominal exercise*						1.0
Yes	9 (60)	6 (40)	0.4	5 (33)	10 (67)	
No	57 (72)	22 (28)		28 (35)	51 (65)	
Regular bending						
Yes	42 (76)	13 (24)	0.1	26 (47)	29 (53)	**0.002****
No	23 (60)	15 (40)		6 (16)	32 (84)	
Regular lifting						
Yes	31 (80)	8 (20)	0.1	16 (41)	23 (59)	0.4
No	35 (64)	20 (36)		17 (31)	38 (69)	
Regular stairs						
Yes	44 (70)	19 (30)	0.8	21 (33)	42 (67)	0.6
No	22 (73)	8 (27)		12 (40)	18 (60)	
Support at home						
Yes	45 (73)	17 (27)	0.6	23 (37)	39 (63)	0.6
No	19 (65)	10 (35)		9 (31)	20 (69)	

*≥once per week; ** x^2 (2df, n=93) = 9.9, p= 0.002, phi= 0.002

Physical assessment	n=57 (%)	LBP (%)	PGP (%)	Both LBP & PGP (%)	p value
Rectus diastasis					
≤ 2 fingers separation	7 (14)	2 (29)	1 (14)	4 (57)	0.6*
≥ 3 fingers separation	45 (86)	8 (18)	15 (33)	33 (49)	
Fetal lie					
LOA/L	24 (42)	3 (12)	13 (54)	8 (33)	0.4*
ROA/L	23 (40)	4 (17)	11 (48)	8 (35)	
ROP/LOP	6 (11)	0	3 (50)	3 (50)	
Breech	4 (7)	2 (50)	2 (50)	0	

*Study numbers too small to determine significance for test