PELVIC/PERINEAL DYSFUNCTION & BIOPSYCHOSOCIAL MORBIDITY:

BIOLOGICAL PREDICTORS AND PSYCHOSOCIAL ASSOCIATIONS IN POSTCAESAREAN AND VAGINALLY DELIVERED PRIMIPARAE

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ABSTRACT – Background: The scope of postpartum pelvic dysfunction and perineal trauma is under-researched. Instrumental vaginal delivery or 3rd/4th degree tears were recognised risk factors for pelvic/perineal dysfunction; caesarean delivery was not implicated.

Aims:

- To analyse obstetrical/biological factors associated with pelvic dysfunction after caesarean or non-instrumental vaginal delivery
- To compare these associations between groups after determining frequencies
- To evaluate severity of pelvic/perineal dysfunction, including quantifying maternal perception of the psychosocial impact

Participants and Methods: 284 primiparae (184 caesarean, 100 vaginally delivered) had domiciliary, in-depth medical interviews using structured and open questioning.

Results: Caesarean (elective, emergency) vs. vaginally delivered were compared: Stress incontinence manifested in 60/184 (33%, 33%) vs. 54/100 (54%), anal incontinence in 94/184 (53%, 50%) vs. 44/100 (44%), dyspareunia in 50/184 (28%, 27%) vs. 46/100 (46%), haemorrhoids in 3/184 (2%) vs. 5/100 (5%) and double incontinence with dyspareunia in 33/284 (14%, 10% vs. 12%). Sixty sustained perineal trauma. Delivery mode and non-labour factors were predictors. Severity was evaluated by devising a psychosocial measure tailored to maternal functioning. New faecal incontinence necessitated continuous perineal protection in two pre-labour caesarean and one vaginally delivered mother. Severe dysphoria was associated with incontinence (p=0.038, OR 2.334, CI 1.049, 5.192), dyspareunia (p=0.005, OR 2.231, CI 1.272, 3.914) and post-caesarean wound problems (p=0.022, OR 3.620, CI 1.203, 10.896). Incontinence impaired leisure activities (p=0.036, OR 2.165, CI 1.051, 4.463) and employment (p=0.023, OR 1.912, CI 1.093, 3.345); caesarean mode affected social-networking (p=0.018, OR 2.438, CI 1.166, 5.099) and employment (p=0.031, OR 1.967, CI 1.064, 3.636).

Conclusions: Pelvic/perineal dysfunction was:

- Predicted by caesarean or non-instrumental vaginal delivery, with anal incontinence being more prevalent post-caesarean
- Comparable following elective or emergency caesarean
- Associated with severe and quantifiable biopsychosocial maternal morbidity

To

'THE PURSUIT OF KNOWLEDGE'

Initiated by

My Mum and Dad who
Made me believe that 'Knowledge is Virtue'
My Sisters and Brothers who
Cheered me in my quest for it
My Teachers who
Promoted my delight in it
Abhi, Ravi and Hubby who
Understood that I never could quit

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TABLE OF CONTENTS

LIST OF FIGURES AND CHART

*Courtesy Dudley Health Authority

Definitions applied to the subject areas discussed in this thesis:

Dysphoria – An emotional state[1] of anxiety, restlessness and depressive symptoms.

Elective caesarean section (El CS) – Caesarean carried out as a planned caesarean or immediately after the onset of labour (regular uterine contractions with no cervical dilation) in anyone due for a planned section (NIH)[2].

Emergency caesarean section (Em CS) – Caesarean carried out as an emergency, prior to or after the onset of labour.

Early labour – Stage of labour when cervical dilation[3] is <8cm.

Late labour – Stage of labour when cervical dilation[3] is ≥8cm.

Morbidity – The condition or state of being diseased, or being caused by disease; physical or mental illness[4].

New – Onset of symptoms at the time. In this thesis it refers to postpartum onset of stress incontinence or anal incontinence.

Psychosocial health – Health of, or involving, the influence of social factors on human interactive behaviour[5].

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GLOSSARY OF ABBREVIATIONS

AI	Anal incontinence
all part	all participants
Assoc	Association
B	beta value
BMI	Body Mass Index
Bwt	Birth weight
C.I.	confidence intervals
CS	Caesarean section
df	degrees of freedom
DI	Double incontinence
Dur 1st	Duration 1st stage
Dur 2nd	Duration 2nd stage
El CS	Elective caesarean
Emp	Employment
Em CS	Emergency caesarean
E lab	Early labour
EPDS	Edinburgh Postnatal Depression Scale
FI	Faecal incontinence
Fl I	Flatal incontinence
fp	Following page
GA	General Anaesthesia
GP	General practitioner
GSH	General sexual health

Hcirc	Head circumference
IOL	Induction of labour
IVD	Instrumental vaginal delivery
KHQ	King's Health Questionnaire
KW	Kruskal-Wallis test
LA	Leisure activities
L lab	Late labour
LUT	Lower urinary tract
MRI	Magnetic resonance imaging
MOD	Mode of delivery
MW	Midwife
n	number
NI	Not in model
NIH	National Institute of Health
NON	None
NS	Non-significant
n^x	Number
NVD	Non-instrumental vaginal delivery
OAB	Overactive bladder
OR	Odds ratio
over CS	overall caesarean
P	page
pp	pages
Per	Perineum
perin	perineal
PF	Pelvic floor

PFE	Pelvic floor exercises
PFD	Pelvic floor dysfunction
PFMT	Pelvic floor muscle training
PNTML	Pudendal nerve terminal motor latency
PP	Postpartum
RCT	Randomised Control Trial
S.E.	Standard error
Sex relat	Sexual relationship
SI	Stress incontinence
sig	significant
SN	Social networking
Std Dev	Standard Deviation
UI	Urinary incontinence
Un cx	Undilated cervix
Ur I	Urge incontinence
USS	Ultrasound scanning
VD	Vaginal delivery
WPr	Wound problems

LIST OF TABLES

Chapter and section **Page no**

CHAPTER I
INTRODUCTION

Pelvic floor dysfunction following childbirth is not uncommon, yet it remains under-diagnosed, under-recognised and under-researched, for we have not yet overcome the obstacles to under-reporting and, hence, the support services remain under-developed. Along with perineal trauma, it is responsible for both short and long-term morbidity, affecting the physical and psychosocial health of the mother. The direct and indirect costs of this morbidity, its impact on the mother's emotional wellbeing and the more general knock-on effect on the family and society cannot be quantified. Maternal health after childbirth has been called the 'Cinderella'[1] of maternity services as it appears to be marginalised by other postpartum events. During the last century, technological progress[2] and improved antenatal care have made a substantial contribution towards reducing the maternal/perinatal mortality rate[3-7]. However, from the start of the 21st century[4-7], psychiatric causes of maternal death took precedence over physical causes and remain significant; it is only by addressing this change in pattern and by reducing the morbidity from childbirth[4-7], that we will be able to further advance our delivery of woman-centred care[8,9].

This investigation into primiparous pelvic floor dysfunction and perineal trauma has been carried out using a biophysical model along with a psychosocial model as physical symptoms if perceived to be severe can interfere with normal psychosocial functioning and may cause significant morbidity. This approach had been advocated in the last century[10] but not promoted until the last decade when there has been a renewal of interest[11]. Yet it seems a logical way of researching the complexities of postpartum maternal health in a climate of dissatisfaction with the maternity services[8] despite a falling maternal mortality rate. The concept of science and the social sciences being widely separate disciplines had been in vogue in Obstetrics and Gynaecology for a considerable period. Hence, my initial extensive literature review (started in 1998) did not yield any publication on my combined subject and sparse[12,13] on postpartum health combining physical and psychological issues. The current trend in the level of significance of the different causes of maternal mortality and consequent morbidity along with consumer expectations has drawn more attention to the biopsychosocial aspect of disease manifestation; this was promoted in the discourses and publications of a recent World Congress[14] which aimed to create awareness about facilitating a paradigm shift towards more comprehensive patient care and further reinforced at another international meeting[15]. Accordingly, the biopsychosocial model of investigation introduced in this thesis has gained

greater significance in current approaches to research and management of those suffering from postpartum pelvic floor dysfunction and perineal trauma.

The introduction to this thesis starts with explanations about the terminologies used and the scope of the problem and intends to: advance further understanding of the disease by looking at the evolutionary history and relevant facets of medical history along with the embryological, anatomical and pathophysiological correlates; assess the need for this study by reviewing the research on obstetrical/biological predictors, and symptom frequencies (prevalence and incidence); evaluate relevant studies on the assessment of its severity including its impact on maternal psychosocial health; appraise the need for such a study by taking into account the views of Expert Bodies and finally by considering the implications for such an investigation in relation to the current trend in British childbearing. It ends in a conclusion summing up the unclear issues suggested from this literature review and supported by my clinical experience, which categorically advocates the need for this investigation of postpartum pelvic/perineal dysfunction and its severity.

1. Terminologies used and Scope of the problem

1.1 Terminologies used in this investigation are addressed below.

1.1 i) Pelvic floor dysfunction:

Pelvic floor dysfunction (hereafter referred to as pelvic dysfunction) can occur without a clinical manifestation as when there is pelvic floor descent evident on investigating pelvic floor function but there are no symptoms of pelvic dysfunction[16], such as incontinence. However, the term pelvic dysfunction, as used in this study, alludes to the commonly referred symptomatic manifestations of pelvic dysfunction resulting from its effect on the function of pelvic organs, namely, the bladder and urethra, the anorectum and the vagina. These symptoms include urinary incontinence, anal incontinence, prolapse, sexual problems and haemorrhoids, which can occur in isolation or in any combination[17]. The following terminologies have been used to explain the postpartum manifestations of pelvic dysfunction and perineal trauma which are being studied as per standard usage[18].

Incontinence, whether urinary or faecal, is the involuntary loss of urine or faeces that is a social or hygienic problem[18]. Urinary incontinence refers to stress incontinence, which is an involuntary urinary loss on coughing, laughing, exertion or changing posture[18]. Anal incontinence includes both faecal (solid or liquid stool) and flatal incontinence and the latter though not a hygienic problem can be an embarrassing social problem[19]. Faecal incontinence manifests when there is urgency (inability to defer defecation for more than five minutes), urge incontinence (involuntary defecation after feeling an urge to defecate) and passive

incontinence (involuntary defecation without feeling an urge to defecate). Prolapse is a descent of pelvic organs from their normal anatomical position. Sexual pelvic floor dysfunction refers to dyspareunia or vaginal laxity. Dyspareunia is an expression of pain[20] associated with penetrative vaginal intercourse. Pelvic dysfunction can directly cause sexual dysfunction by resulting in superficial and/or deep, dyspareunia and vaginal laxity[17] or indirectly by the effect of urinary or anal incontinence on sexual function. Both pelvic and perineal dysfunction can lead to reduced libido. Haemorrhoids[21] are tufts of engorged submucous blood vessels inside the anal canal, which as a result of pelvic dysfunction can descend below their normal anatomical position (above the anal valves) and prolapse out of the anus temporarily or permanently causing discomfort, bleeding and pain. The symptoms addressed in this study relate to those referred to in textbooks on pelvic dysfunction[17].

1.1 ii) Perineal trauma

Perineal trauma includes visible perineal tears namely, first, second, third and/or fourth degree or an episiotomy. These can occur separately or in any combination.

Perineal tears[22] can be classified as:

1st degree tear – Laceration extending through the vaginal mucosa and perineal skin only.

2nd degree tear – Laceration extending into the perineal body and not the anal sphincter.

3rd degree tear – Laceration extending into the anal sphincter without involvement of the anorectal mucosa.

4th degree tear – Laceration extending into the perineal muscle and involving the anorectal mucosa.

A more recent classification which is followed is the categorization of a 3rd degree tear as, 3a, where <50% of the fibres of the external anal sphincter are ruptured, 3b, where ≥ 50% of the fibres of the external anal sphincter are ruptured and 3c, where in addition the internal anal sphincter is ruptured[22]. However, this classification was not followed when the recruits to this study had delivered.

Perineal trauma can lead to perineal pain and sexual dysfunction, including dyspareunia. It can cause dyspareunia of its own accord (introital) or contribute to that resulting from pelvic dysfunction. Any such association is however, unclear, as is its association with psychosocial or overall sexual health.

Although pelvic floor and perineal function/dysfunction are closely related (vide pp 7-15), this study will target a large caesarean sample so the main thrust of the discussions will be on pelvic dysfunction, and perineal trauma will receive lesser representation as and when indicated.

1.2 Scope of the problem and the methodology used for the literature review

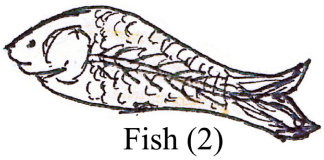
The scope of postpartum pelvic dysfunction includes its postpartum prevalence and incidence along with its severity, including the psychosocial impact. The existing literature in the English language on the subject was electronically searched using Medline (since 1966), Cochrane database, EMBASE, Psychlit and CINAHL. The key words used were caesarean (various spellings) on its own or combined with section or delivery and pelvic floor dysfunction, pelvic dysfunction, incontinence, stress incontinence, urinary incontinence, faecal incontinence, fecal incontinence, passive incontinence, anal incontinence, flatal incontinence, urge incontinence, urgency, double incontinence, dyspareunia, sexual dysfunction, sexuality, sexual behaviour, sex problems, emotion, depression, mood symptoms, psychology, social health, psychosocial health and then the term caesarean was replaced by vaginal delivery, vaginal birth or child birth or Lamaze birth or perineal trauma or episiotomy. Other key words used were postpartum or postnatal or puerperal and further searches using combinations e.g. postpartum stress incontinence or postpartum anal incontinence were carried out. Perineal trauma or postpartum perineal dysfunction and sexual dysfunction or dyspareunia were other terms used. The search histories were saved for future additions and further refined and developed by additions of new terminology such as perineal dysfunction. Hand searches of key journals were also carried out. The relevant publications were critically appraised and cross-referenced. The literature search did not reveal any relevant studies looking at the whole spectrum of postpartum pelvic dysfunction and psychosocial ill-health.

2. Understanding postpartum pelvic/perineal dysfunction from evolutionary and historical perspectives

A brief outline of the pertinent evolutionary history and historical facts would help to introduce the reader to the likely origins of postpartum pelvic/perineal dysfunction whilst analysing previous records related to the management of childbirth and psychosocial ill-health would improve our understanding of factors which increase the risk or modulate the maternal perception of these problems; this could aid in the development of measures to identify symptoms and analyse the prevalence and associated severity, including the psychosocial impact, of this dysfunction.

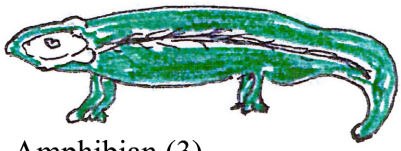
2.1 Evolutionary history: According to the theory of evolution[23] body structures progressed from single cells via invertebrates to vertebrate forms and this is illustrated in Fig. 1 [following page (fp) 4]. During this process, the abdominal muscles (rectus abdominis) of the fish evolved to form the pelvic floor of the tetrapod animals and then became angled in the upright *Homo sapiens* or humans. In humans, walking upright increased the pressure of the

Green algae (1)

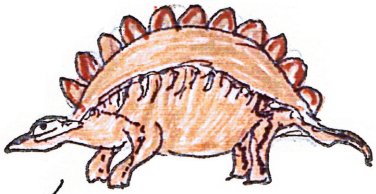


Fish (2)

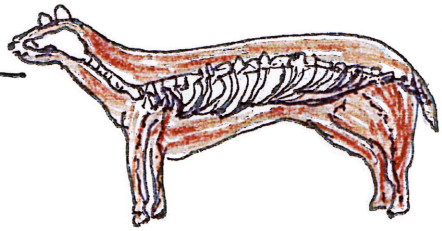
rectus abdominis in same line as caudal muscles



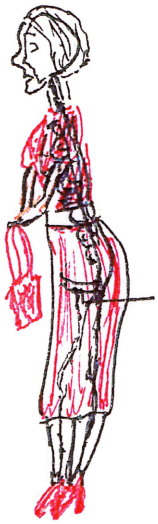
Amphibian (3)
rectus abdominis as in (2)



Dinosaur (4)
land-based quadruped
(strong 3-piece bony pelvis)



Mammal (quadruped) – (5)
pelvis and strong caudal muscles support abdominal contents guarding against changes in intra-abdominal pressure



pelvic floor

Human (6)
orthograde
(abdominal contents supported by thin pelvic floor)

Fig. i Evolution

abdominal organs on the pelvic floor, which attenuated it to a thinner sheet, thereby making it more vulnerable to pelvic dysfunction[17]. To counteract this weakness, the striated muscles of the pelvic floor have developed a continuous tone[24] so that they function continuously both during rest and in the active state. Nonetheless, in some individuals this functional change may be insufficient to counteract the pressure of biomechanical forces on the pelvic floor, such as from the additional weight of the uterine contents and that generated by uterine contractions associated with childbearing, which could consequently increase the risk of pelvic dysfunction. This may be one of the reasons why women suffer from pelvic dysfunction, with reports[25,26] indicating a greater prevalence than in men. Whilst we cannot change our evolutionary history, identifying and understanding the mechanism whereby aggravating obstetrical/biological factors act can help in devising strategies to diminish their effects.

2.2 Historical facets: "There may be precious grains of historical truth which cannot be cast away with the chaff" (JP Curran in '*The history never written*')[27]. This quote has a bearing on the relevance of the history of medicine to the clinician researcher as examining historical facts may enable one to determine whether to retain or re-introduce any practice that has been historically documented as being effective in managing disease and to discard those methods which are considered ineffective after due evaluation. Historical observations built on studies of ancient caves with rock-incised human figures of prehistoric females[28] have shown fetuses wedged in the pelvis or new-borns buried beside them, thereby confirming that these lives were foreshortened by obstetric mishaps when a caesarean or an instrumental delivery was not a management option. Pelvic floor disorders were not documented but it can be surmised that with a reduced longevity the deleterious effect of biomechanical pressures on the pelvic floor would have been limited, precluding manifestations of pelvic dysfunction. In the 9th Century B.C., it was the practitioners of Cretan/Mycenaean medicine[29] who first recorded that the rectum, bladder, buttocks and pelvic bones had a precise topographical relationship to each other. Among Greek physicians who were knowledgeable about women's diseases (obstetrics and gynaecology), the names of Hippocrates who practiced in the 5th century BC and Soranus who practised in the 2nd century AD[30], were well-known. Hippocrates, now considered as 'The father of Midwifery as well as Medicine', who wrote about his experience in managing women's diseases in the book, De Natura Muliebri; this influenced medical thinking. Soranus observed that the uterus was separate from the vagina, recognized the need to avoid tearing of pelvic soft parts at delivery, and wrote extensively of his clinical observations and management which again influenced medical learning in Europe. William Smellie, called 'the Master of British Midwifery'[31], who practised in the 17th century, wrote in his 'Treatise of Midwifery'[32] about the anatomy and pathophysiology of the pelvic floor, pelvic organs and

perineum, and their relationship to the process and management of childbirth; many of his observations are relevant to current obstetric practice.

In ancient India during the 1st Century AD[33], Caesarean delivery was performed with close attention to technique in order to save the lives of both mother and infant whereas in the 2nd century AD (Roman Medicine), Caesarean delivery was performed to save the life of the baby[30] after maternal death. In Britain 'caesarean section the mother being alive' was documented during the 17th century AD[32], as was the 'incision of the perineum during vaginal delivery in cases of extreme rigidity', besides the repair of perineal trauma by suturing. These techniques after undergoing further refinement and becoming safer (Poro – 1876, Saenger – 1882) remain in practice in modern obstetrics; however, their clinical indications have been extended and sometimes arouse controversy[34] as when caesarean delivery is advocated to prevent pelvic/perineal dysfunction or when it is requested by the woman in the absence of a medical indication. This has invited comments that pregnancy in the 20th century has been re-defined as a phenomenon akin to illness and medicalised[35].

With regards to delivery and postpartum psychosocial support, it is interesting to note that after childbirth, primitive man observed what would be similar to today's postpartum emotional/social support, by practising 'Couvade' – a custom[36] where the father stayed with the mother and newborn to prevent harm to them. Days or even weeks were spent in recuperating and the psychological benefit to the sick of trust in the healer's ways was recognized; this is applicable even today. Although Thomas Willis[37], an eminent physician, published the earliest English work on medical psychology in 1672 and William Smellie wrote about the psychological aspect of childbirth[32], this awareness did not remove the existing social stigma associated with mental illness. The mentally ill were often segregated with criminals and paupers until the English Quaker, William Tuke (1732-1822) attempted to improve their management by establishing the York Retreat for the humane care of the mentally ill. Both anxiety and depression were recognised and treated by the Hippocratic Corpus[30], which adopted the principle of studying the patient rather than the disease, believing that the patient's personality was important when evaluating illness and the chances of recovery. Later Sir Dugald Baird (1936) promoted social health to obtain better obstetric outcomes[38]. Individualisation of treatment to fit personalities and social circumstances is relevant to childbearing which is known to be associated with complex emotions and this approach gained more recognition towards the end of the 20th century[8,9]. Thus, certain aspects of patient management considered 'history' have been reintroduced and others, after undergoing modifications, are valid even now.

3. Embryological, anatomical and pathophysiological correlates – the unifying concept

All embryological or anatomical diagrams in this thesis are printed copies of my hand-drawn illustrations which are based on standard textbooks on these subjects[39-46] and are referred to in the following sections.

3.1 Embryology of the pelvic floor, pelvic organs and perineum in the human female

Pelvic floor symptoms manifest from a dysfunction of the pelvic floor and organs which retain the characteristics of the type of embryological tissue from which they originate and the manner in which these tissues are laid down to fashion pelvic floor structures. Embryological development by division of a structure or fusion of neighbouring structures results in anatomical proximity and a common innervation that increases the likelihood of dysfunction affecting more than one organ simultaneously. A brief overview follows.

After fertilisation[39-41] the zygote (Fig. ii-iv fp 7) divides to form the embryo which is trilaminar (ectoderm, mesoderm, endoderm), except at the cephalic procaudal and the caudal cloacal plate. The cloaca is partitioned into the urogenital sinus and the rectum (Fig. v fp 7). The urogenital sinus forms the bladder and the urethra. The rectum and the upper part of the anal canal are endodermal whereas the lower part of the anal canal, which develops from the proctodeum, is ectodermal. Fibres decussate between the urogenital sinus and the anal canal to form the urogenital sphincter; another surrounds the cloacal opening to form the external anal sphincter. The vagina is formed from an overgrowth of tissue at the junction of the urogenital sinus and the paramesonephric duct with a contribution from both. The urethra, anorectum, vagina, urogenital sphincter, external anal sphincter and pelvi-perineal floor have a common morphological origin and spinal segmental innervation. Hence, disease in one structure may affect another and explains why one must consider concomitant presenting pelvic floor complaints[25,26,47,48] when evaluating postpartum pelvic/perineal dysfunction.

Since the focus of this investigation is to study the manifestations resulting from derangement of the normal anatomy and physiology of the pelvic floor, pelvic organs and the perineum due to childbearing, these issues are discussed in the following section. This would facilitate the reader's understanding of childbearing related pelvic/perineal dysfunction and how variations in the normal parameters may modify individual susceptibility, the clinical response to structural damage and the results of pelvic floor investigations.

3.2 Anatomy of the pelvic floor, pelvic organs and the perineum

The following text pertinent to understanding the study are accompanied by illustrations derived from relevant textbooks[42-46].

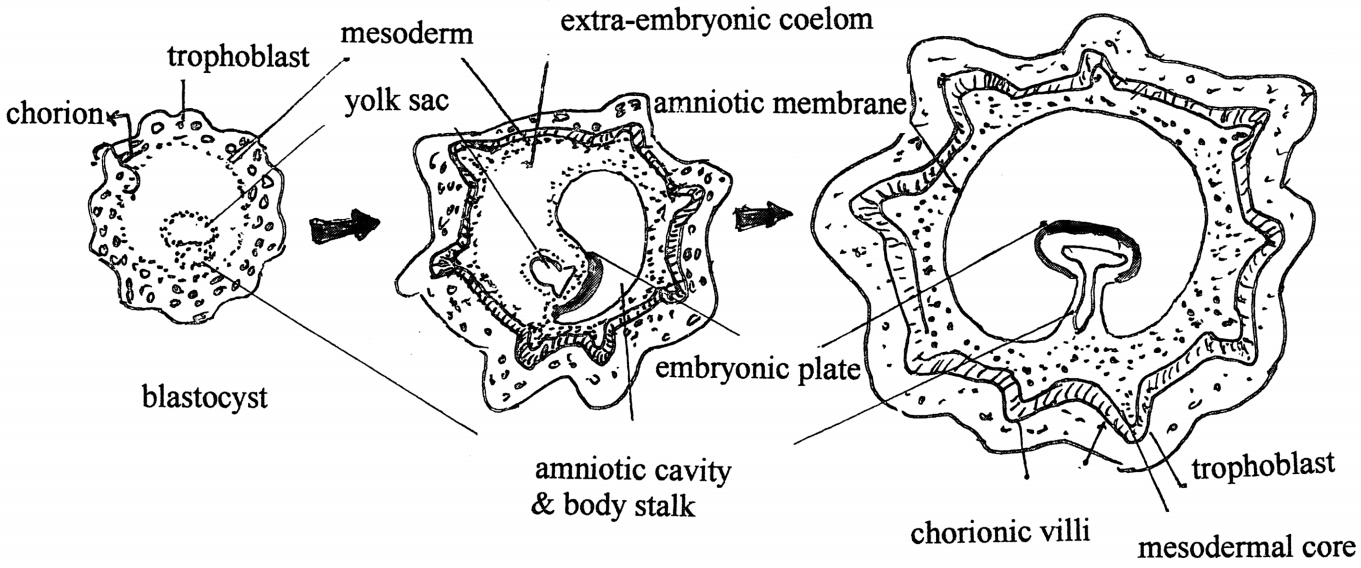


Fig. ii-iv Early embryogenesis

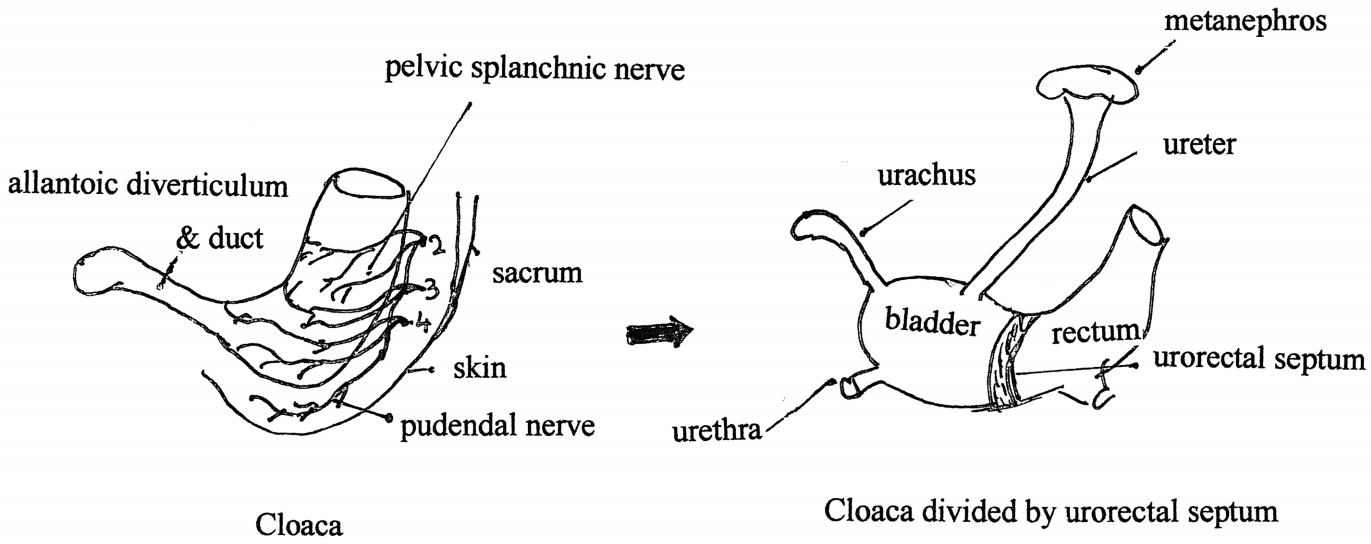


Fig. v Late embryogenesis

3.2 i) Pelvic floor

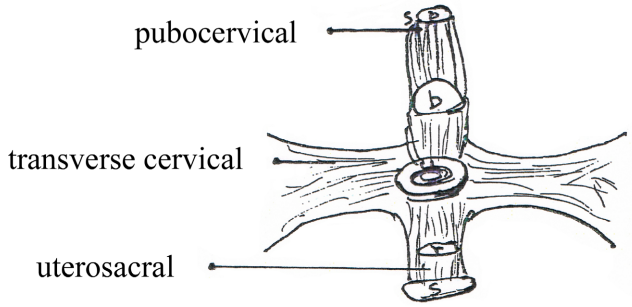
The pelvic floor[42-44] comprises the fascia, ligaments and muscles supporting the pelvic organs. It consists from inside outwards of the endopelvic fascia, the pelvic diaphragm, the urogenital diaphragm, the deep and superficial perineal pouches, the subcutaneous tissue and the skin of the perineum. The endopelvic fascia condenses to form ligaments (Fig. vi fp 8) which extend from the pelvic organs to the pelvic wall, supporting these. These fascia and ligaments have more visceral elements and finer collagen, which allows for expansion but not locomotion like other ligaments[49].

The pelvic diaphragm contains the levator ani muscle (Fig. vii fp 8) with fascial layers on its superior and inferior surfaces. Fibres of the pubovaginal muscle, part of the levator ani, merge with the intrinsic musculature of the vagina and the posterolateral aspect of the urethra so that its contraction causes urethral elevation[50]. The levator ani maintains a constant baseline tone, thereby, closing the lumen of the vagina and eliminating the hiatus, which would consequently reduce the risk of pelvic dysfunction.

The urogenital diaphragm is a triangular sheet of thin muscle with fascia on the superior and the inferior surfaces. It supports the lower third of the vagina, and controls the anterior half of the genital hiatus. Under the urogenital diaphragm lies the deep perineal pouch containing the transversus perinei profundus with its transverse fibres and sphincter urethrae encircling the middle urethra, along with a superior and inferior layer of fascia (Fig. viii fp 8). Below this is the superficial perineal pouch with the bulbospongiosus, ischiocavernosus and the superficial transversus perinei muscles under which lie the subcutaneous tissue and skin; these structures are incised when giving an episiotomy or are lacerated when there are 1st or 2nd degree perineal tears at delivery.

The triangular perineal body that lies between the vagina and the lower part of the anus[51] forms an integral part of the pelvic floor support to the pelvic organs. It contains the insertion of the levator ani and superficial perineal muscles and if damaged can lead to pelvic/perineal dysfunction.

Function of the pelvic floor in labour – The pelvic floor forms a part of the birth canal[52] and plays an important part in the mechanism of labour. The two levator ani muscles and their fascia form a musculo-fascial gutter during the second stage of labour and guide the salient portion of the presenting part forwards, towards the forward-looking opening of the vagina, thereby facilitating delivery over the perineum and influencing the duration of the second stage of labour. The vaginal wall, perineal skin, muscles of the superficial perineal pouch and the perineal body can be damaged along with the anal sphincters during a vaginal delivery,



sp – symphysis pubis
b – bladder
u – uterus
r – rectum
s – sacrum

Fig. vi. Pelvic ligamentous support (from above)

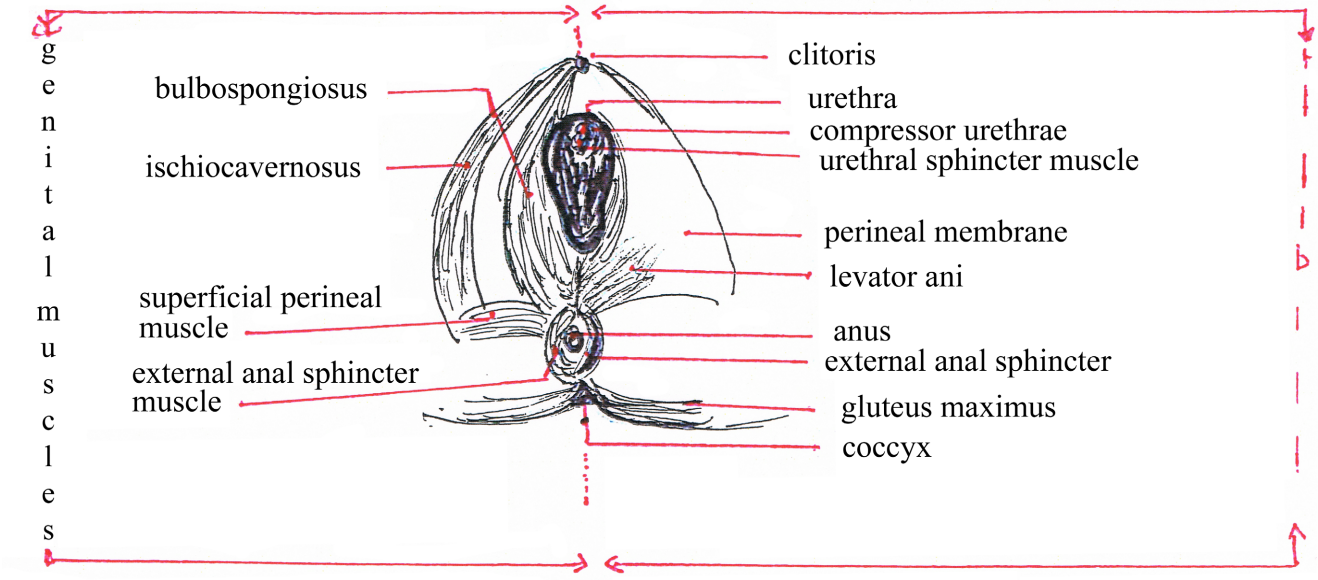
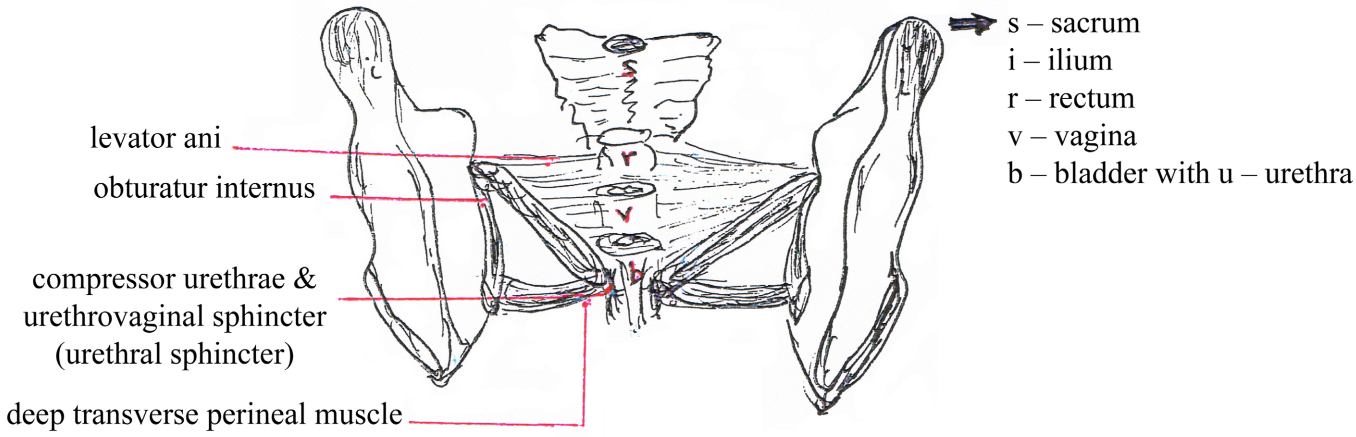


Fig. vii. Pelvic floor I

a = superficial layer
b = urogenital diaphragm



s – sacrum
i – ilium
r – rectum
v – vagina
b – bladder with u – urethra

Fig. viii. Pelvic floor II

Pelvic diaphragm –
levator ani & associated
parietal & visceral fascia

particularly instrumental or associated with 3rd/4th degree tears, resulting in incontinence if there are healing problems or the repair inadequate. This trauma can also result in dyspareunia and other forms of sexual dysfunction referred to as perineal dysfunction.

3.2 ii) The pelvic organs[42-46]

The vagina is a hollow fibromuscular tube extending from the vestibule to the uterine cervix. It has an H shaped lumen with the principal dimension being transverse. The lining is non-keratinised stratified squamous lying on loose connective tissue, the lamina propria. Outside this, there is a fibromuscular layer of smooth muscle, elastin and collagen, surrounded by adventitious tissue containing neurovascular elements along with elastin, collagen and adipose tissue. The cervix projects into it as a continuation of the uterus (Fig. ix fp 9). The vagina, bladder and rectum are supported by the ligamentous attachment of the vagina to the pelvic wall.

The lower urinary tract (bladder and urethra) depends on the pelvic floor for shape and position. The position of the bladder and urethra is important for urinary continence, with the upper part of the urethra and vesical neck being mobile and the lower part being fixed. The bladder is a hollow muscular organ. The anterior surface is extra-peritoneal while the superficial surface and upper 1-2cm of the posterior surface are peritoneal with a reflection onto the uterus which is incised when retracting the bladder during a caesarean delivery and during healing adhesions are formed; if dense adhesions are encountered during repeat caesarean delivery the risk of bladder damage with possible urinary problems is increased necessitating careful dissection. The epithelium is transitional and outside this is the loose lamina propria with muscle fibres being arranged as inner longitudinal, then circular and outer longitudinal. The trigone is a triangular area at the bladder base bounded at the corners by the ureters and at the apex by the urethra. The trigone has two layers of muscles; superficial continuous with the ureteric and urethral muscles (adrenergic nerve supply) and the deep continuous with the ureters only (cholinergic nerve supply). The pelvic urethra enters the trigone after passing through the parametrium over the lateral vaginal fornix and through the bladder wall.

The female urethra is 4cm long and 6mm in diameter. After passing through the retropubic space it perforates the urogenital membrane and ends at the external orifice, directly above the vaginal opening. In its upper third it can be separated from the vagina, but the rest is embedded in the adventitia of the anterior vaginal wall. The epithelium is transitional close to the bladder but non-keratinised stratified squamous in the rest and undergoes similar hormonal

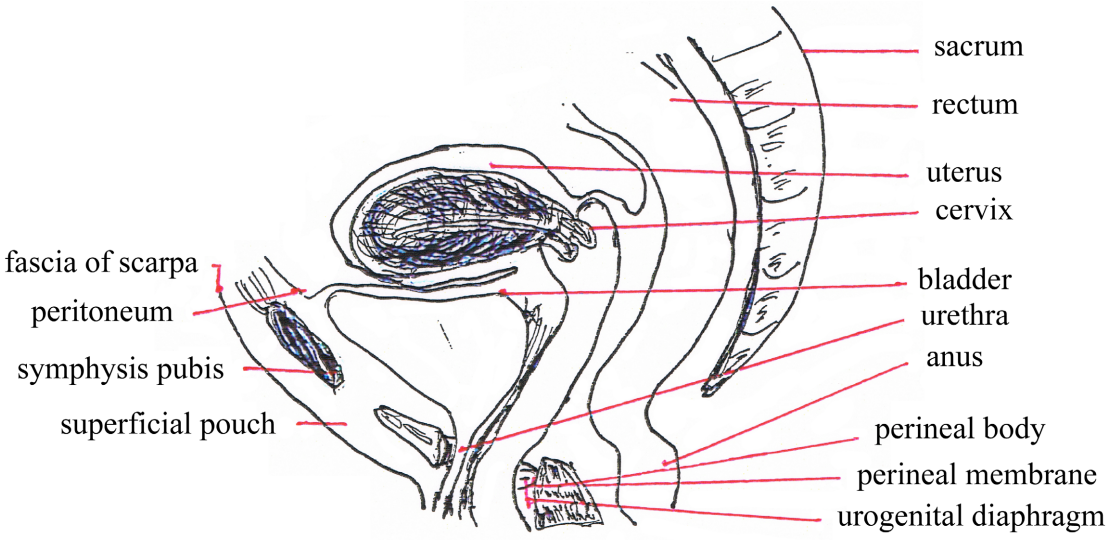


Fig. ix. Pelvic organs and the urogenital diaphragm (sagittal section)

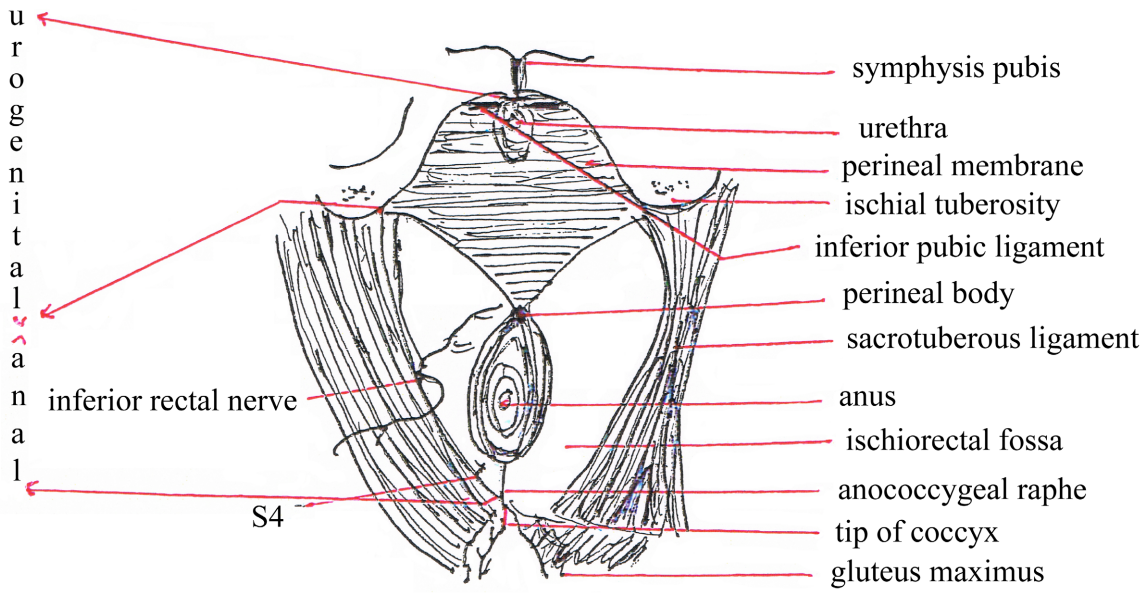


Fig. xi. Boundaries and subdivisions of the perineum

changes as the vestibule. There is a loose lamina propria outside this with abundant elastic fibres and several arteriovenous anastomoses that control flow into the large venules, assisting in watertight closure of the urethral canal[53]. This tissue also respond to hormones such as oestrogens. The urethral musculature is mainly longitudinal with outer circular fibres and is continuous with the detrusor muscle and the trigone but is separated from them embryologically and morphologically. The longitudinal fibres shorten and widen the urethral lumen during micturition whereas the circular muscle contributes to the urethral resistance at rest.

The rectum and anal canal are the terminal parts of the hindgut. The rectum starts at the end of the sigmoid colon and continues downwards and forwards, where it makes a right-angled bend and forms the anal canal. The anal canal is 3cm long and extends from the anorectal junction to the anus below. It remains closed except during defecation. The upper part of the anal canal possesses 5-10 permanent longitudinal folds of mucous membrane (Fig. x fp 10), the anal columns, whose lower ends are united by semilunar folds called the anal valves. Above the anal valves, there is columnar epithelium with an autonomic nerve supply, as it is derived from the cloaca (vide embryology, page 8). Below the anal valves it develops from the proctodeum, the epithelium is like the skin (other than 1cm below the valves where it is stratified squamous) and the nerve supply is from the spinal nerves. Just below the anorectal junction is the puborectal sling and the base of the urogenital diaphragm. The anal canal and rectum have an inner circular layer and an outer longitudinal layer of smooth muscle.

Antero-posterior and side to side flattening[54] – The anterior and posterior walls of the rectum are in contact with each other, whereas the lateral walls of the anal canal are in contact, when empty. The urethra and the external urethral orifice and the vagina and vaginal introitus are similarly orientated, and this orientation may play a role in the mechanical retention of contents.

Sphincters[42,44] – There is no specific localised smooth muscle sphincter in the urethra. Thus, the urethra and bladder are apparently one anatomical unit and function as such.

Striated urogenital sphincter – The urethral sphincter surrounding the outer layer of the urethra is formed by the muscle of the striated urogenital sphincter (20-80% of the total urethral length)[55]. In the upper two thirds, the fibres are circular whilst distally they circle the vaginal wall as the urethrovaginal sphincter and extend above the urogenital diaphragm, to form the compressor urethrae. In the distal urethra this compresses the urethra from above and proximally it compresses the lumen.

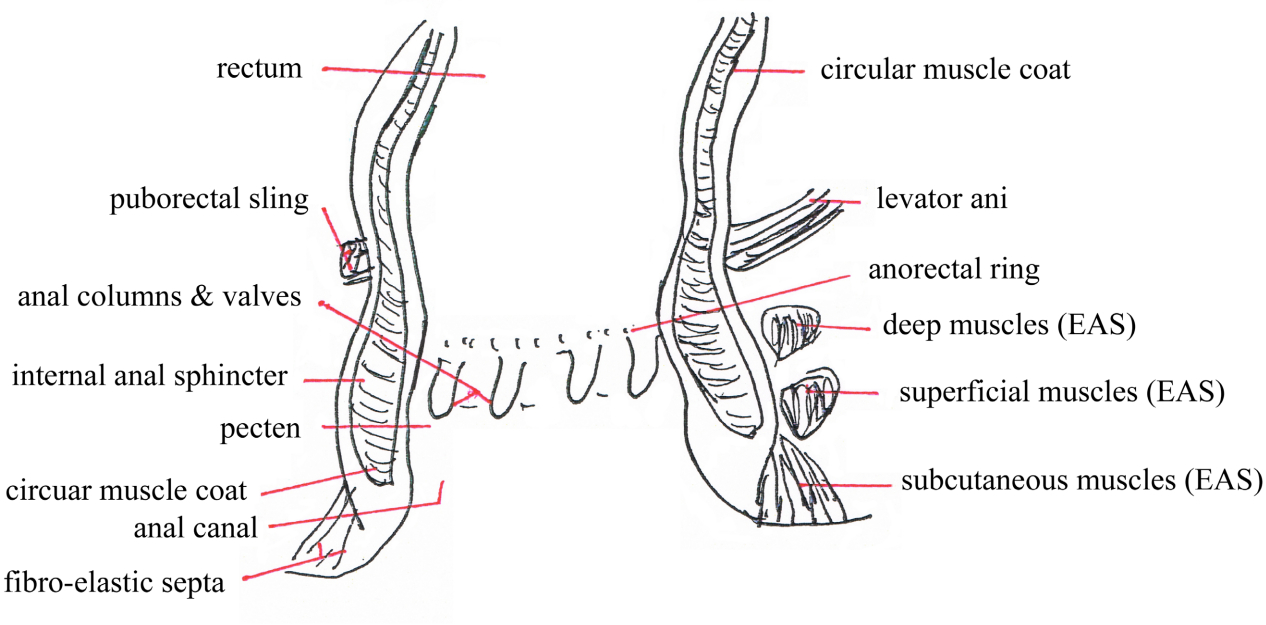


Fig. x. Rectum, anal canal and sphincters – saggital view
(EAS – External anal sphincter)

Anal sphincter – The anal sphincter mechanism (Fig. x fp 10) is composed of the external anal sphincter, internal anal sphincter and the puborectalis part of the levator ani muscle which forms the anorectal angle). The clinical management and categorisation of the degrees of perineal trauma rely on identifying the degree of damage to the various sections of the anal sphincter; hence, its anatomy is described. The external anal sphincter is comprised of a subcutaneous part that encircles the anal canal, an elliptical superficial part from the tip of the coccyx to the anococcygeal raphe and the deep part, which encircles it and blends above and on each side with the levator ani. The internal anal sphincter is a thickened inner circular layer continuous with that of the rectal wall and lying within the ring of the external anal sphincter. It is responsible for 85% of resting anal pressure. The outer longitudinal layer is connected anteriorly with the perineal body and posteriorly with the coccyx.

Neuroanatomical observations have shown[56,57] that both these striated muscle sphincters do not have muscle spindles but continence is maintained by the presence of type 1 (contract continuously) and type 2 fibres (contract during action): 50% of each type are present in the urethral sphincter but more of type 1 constitute the external anal sphincter.

3.2 iii) The perineum[58]

The anatomical perineum is diamond shaped and is illustrated in the diagram (Fig. xi fp 9).
The obstetric perineum is an area bounded anteriorly by the fourchette and posteriorly by the anus. The perineum contains the labium majus, labium minus, the vestibule – a cleft between the labium minus where the vagina, urethra, paraurethral and greater vestibular (Bartholin's) and lesser vestibular glands open.

Vascular supply – The bladder, urethra and vagina are supplied by the vesical arteries[54,59] and venous drainage is into the respective venous plexuses. The superior, middle and inferior rectal (haemorrhoidal) arteries and accompanying veins supply the rectum and anal canal[54]. The veins anastomose in the mucosa and submucosa, the superior rectal vein is valveless and belongs to the portal system whereas the others have valves and are a part of the caval system – haemorrhoids arise from these venous anastomoses.

Nerve supply –The skin of the entire perineum, urethra, vulva and anus, and the striated sphincter muscle of the urethra, vagina, anus and the pelvic floor are supplied by the pudendal nerve (S2, 3, 4) and directly from the sacral segments (S3,4)[60]. In some individuals, there is a further contribution from the posterior femoral nerve, genital branch of the genito-femoral nerve and the ilio-inguinal nerve. The pudendal nerve traverses the pudendal canal where it gives two major branches – the dorsal nerve of the clitoris and the inferior rectal nerve and

then exits as the perineal nerve. The external anal sphincter is supplied by the ipsilateral[61] pudendal nerve. Similarly, each half of the puborectalis part of the levator ani is supplied by direct branches of S3 and S4 that reach via the visceral surface. Thus if one side suffers neurological damage it is paralysed and incontinence may occur as there is no crossover. During instrumental vaginal delivery pudendal nerve block[62] with a local anaesthetic is carried out which may manifest as a transient postpartum incontinence.

Variable nerve supply of the external anal sphincter[60] – There is a ventral to dorsal distribution of different branches of the pudendal nerve as well as spinal segments S3 and S4. In 91% of patients, the ventral part of the external anal sphincter is supplied by the pudendal nerve or its perineal branch and the middle and dorsal part by the inferior rectal nerve. In 50% of individuals[58], the inferior rectal nerve arises directly from the sacral segment (S4) and not from the pudendal nerve and lies beside it in the canal. Being aware of the variability is of importance for interpreting the results of electromyographic evaluation of the external anal sphincter muscle, which is mainly used in investigating continence in a research setting; it can however, provide useful information for explaining variations in continence following anal sphincter rupture where there is disparity between the findings of imaging techniques and the presence or absence of incontinence.

Autonomic nerve supply[60] – The bladder, urethra, vagina and rectum are supplied by sympathetic efferents from T11, L2 forming the hypogastric nerve to the pelvic plexus and the parasympathetic innervation is from the pelvic splanchnic nerve (S2, S3, S4), which controls the muscle walls and sensation from these organs.

3.3 Pathophysiology

Continence[63-67] – The lower urinary tract contains the bladder as a storage organ for urine with timely expulsion from the urethra when the opportunity arises. The ability to retain urine within the bladder between voluntary acts of micturition is known as urinary continence. Similarly, the faeces are stored in the rectum with timely expulsion from the anus. The ability to retain faeces within the rectum between voluntary acts of defecation is known as bowel continence. Urinary continence is maintained by the position of the bladder neck and proximal urethra above the pelvic floor responding to intra-abdominal pressure, the urethral softness inside along with the turgidity outside, the involuntary sphincter mechanism at the upper end (the posterior urethro-vesical angle)[63] and the voluntary external sphincter. These mechanisms aim to keep the bladder pressure below the urethral pressure between voluntary acts of micturition. Anal continence is also maintained by the position of the anorectal junction,

sensitivity of the anal mucosa, the capacity of the rectum, the puborectalis and the contractions of the external and internal anal sphincters. These functions are controlled by local spinal reflexes, which are centrally facilitated or inhibited[64,65]. There seems to be an overlap in the mechanisms by which both sphincters maintain continence. The external sphincter compresses the rectal neck and anal canal mechanically and also prevents internal sphincter relaxation by 'voluntary inhibition action'. The internal anal sphincter plays a significant role in involuntary continence and also contributes to voluntary continence.

Loss of continence can occur by interruption of any of these mechanisms, which include the neuromuscular integrity of the pelvic floor. In addition, urinary incontinence can be caused by detrusor instability, mental conditions, diabetes, drugs and interference with the neurological supply to the bladder and urethra as after spinal cord injury. Similarly, anal incontinence can also be caused by abnormalities in rectal distensibilty, volume and consistency of stool, colonic movement, anorectal sensation, the sampling reflex[66], mental function and drugs. Flatal incontinence, urgency, urge incontinence and passive incontinence reflect partial or complete derangement of external and/or internal anal sphincter function. One concept of anal incontinence to fluid but not solid faeces is that only part of the external anal sphincter is destroyed with one functioning loop of muscle still remaining[67].

Haemorrhoids, by prolapsing, expose the columnar epithelium to a different environment in the anal canal, thereby interfering with the anal sampling of the rectal contents. Haemorrhoidal tissue also acts as a compressible lining, which allows the anus to close completely[21]. Although the aetiology of haemorrhoids is still not fully understood, it is known that derangement of the internal anal sphincter, straining or the biomechanical effect of pregnancy, may cause it to become symptomatic[68] and sometimes prolapse. To what extent haemorrhoids contribute to anal incontinence is unclear.

The effect of a first pregnancy on the pelvic floor/organs – The progressive stretch of the enlarging uterus on the adjacent tissues including the pelvic organs, pelvic floor and the perineum from about the 6th antenatal month during the woman's first pregnancy was observed[32] and serially illustrated by William Smellie (forerunner of today's obstetrician)[31]. These illustrations (Figs. xii a-b fp 13) are also a sad reminder of obstetric mishaps when intervention was sought too late. Modern imaging techniques have not replicated these serial illustrations, but a survey on pelvic dysfunction[69] at the turn of this century concurs with his observation that pelvic floor changes could start around 20 weeks of pregnancy.

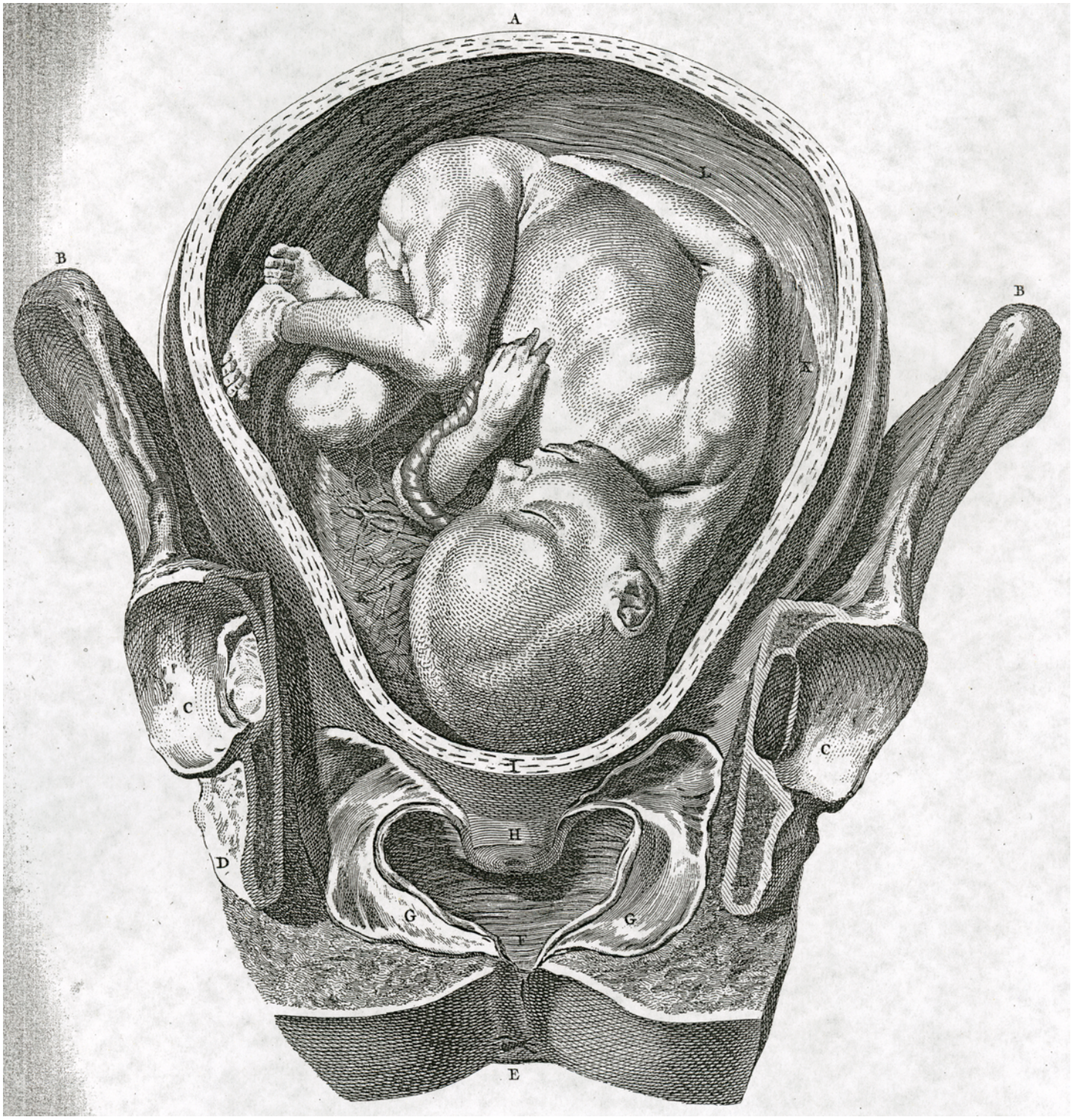


Fig. xiia (William Smellie, 1852)

THE EIGHTH TABLE

In the ſame View and Section of the parts as in Table VI. is repreſented the *Uterus* of the former Table, in order to ſhew its contents, and the internal parts as they appear in the ſixth or ſeventh Month of Pregnancy.

A The *Uterus* ſtretched up to the *Umbilical* Region.
B.B The ſuperior part of the *Oſſa Iliûm.*
C.C The *Acetabula.*
D.D The remaining poſterior parts of the *Oſſa Iſchiûm.*
E The *Anus.*
F The *Vagina.*
G The Bladder of *Urine.*
H The neck of the *Womb* ſhorter than in Table VI. and raiſed higher by the ſtretching of the *Uterus* above the Brim of the *Pelvis.*
I The Veſſels of the *Uterus* larger than in the unimpregnated ſtate.
K.K The *Placenta* adhering to the inferior and poſterior part of the *Uterus.*
L.L The *Membranes* that ſurround the *Fœtus*, the Head of which is here repreſented (as well as of thoſe in Table VI.) ſituated downwards at the inferior part of the *Uterus*, and which I am apt to believe is the uſual ſituation of the *Fœtus*, when at reſt, and ſurrounded with a great quantity of Waters, as the Head is heavier than any other part. With reſpect to the ſituation of the Body of the *Fœtus*, tho' the fore-parts are often turned towards the ſides and poſterior parts of the *Uterus*, they are here as well as in the foregoing Table repreſented at the anterior part or forwards, in order to ſhew them in a more diſtinct, and pictureſque manner.

Vide Vol. I. Lib. I. Chap. 3. Sect. 3, 4. Vol. II. Coll. 13. N°. 1.

From this Table may appear the difficulty of ſtretching the *Os Uteri* in flooding Caſes, even at this period, from the length and thickneſs of the neck of the *Womb*, eſpecially in a firſt Pregnancy: much the ſame method however is to be followed here as was directed in Table VI. 'till Labour comes on to dilate the *Os Uteri.* If the Flooding is then conſiderable, the *Membranes* ſhould be broken, that the *Uterus* may contract, and thereby leſſen the diſcharge. The Labour likewiſe if it is neceſſary, may be aſſiſted by dilating the *Os Uteri* in time of the pains, which alſo, if wanting, may be provoked by the ſame method when the Patient is in danger. If this danger is imminent and the Woman ſeems ready to expire, the *Uterus* as appears from this Table is at this time ſufficiently ſtretched to receive the Operator's hand to extract the *Fœtus*, if the *Os Internum* can be ſafely dilated.

Laſtly, It may be obſerved that Women are in greater danger at this period and afterwards than in the former Months.

Vide Vol. I. Lib. III. Chap. 4. Sect. 3. No. 1, 2, 3. Vol. III. Coll. 33. No. 2. See alſo in the *Edinburgh* Phyſical and Literary Obſervations, Art. XVII. The Diſſection of a Woman with Child, by Dr. *Donald Monro*, Phyſician at *London.*

Explanation of Fig. xiia (William Smellie, 1852)

Fig. xiib (William Smellie, 1852)

THE

NINTH TABLE.

In the ſame View and Section of the parts with the former, repreſents the *Uterus* in the eighth or ninth Month of Pregnancy.

A The *Uterus* as ſtretched to near its full extent, with the waters, and containing the *Fœtus* intangled in the *Funis*, the Head preſenting at the upper part of the *Pelvis*.
B.B The ſuperior part of the *Oſſa Iliûm*.
C.C The *Acetabula*.
D.D The remaining poſterior parts of the *Oſſa Iſchiûm*.
E The *Coccyx*.
F The inferior part of the *Rectum*.
G.G G The *Vagina* ſtretched on each ſide.
H The *Os Uteri*, the lips of which appear larger and ſofter than in the foregoing Table, the neck of the *Womb* being likewiſe ſtretched to it's full extent, or entirely obliterated.
I.I Part of the *Veſica Urinaria*.
K.K The *Placenta* at the ſuperior and poſterior part of the *Uterus*.
L.L The *Membranes*.
M The *Funis Umbilicalis*.

This and the foregoing Table ſhew in what manner the *Uterus* ſtretches, and how it's neck grows ſhorter, in the different periods of Pregnancy; as alſo the magnitude of the *Fœtus* in order more fully to explain Vol. I. Lib. 1. Chap. 3. Sect. 4, 5. alſo Lib. 3. Chap. 1. Sect. 1. 2. likewiſe Vol. II. Coll. 13 No. 1.

Notwithſtanding it has been handed down as an invariable Truth, from the earlieſt accounts of the Art, to the preſent times, that when the Head of the *Fœtus* preſented, the Face was turned to the poſterior part of the *Pelvis*, yet from Mr. *Ould*'s Obſervation as well as from ſome late Diſſections of the *gravid Uterus*, and what I myſelf have obſerved in Practice, I am led to believe that the Head preſents for the moſt part as is here delineated, with one Ear to the *Pubes*, and the other to the *Os Sacrum*: tho' ſometimes this may vary according to the form of the Head, as well as that of

Explanation of Fig. xiib (William Smellie, 1852)

Clinical implications of the mechanism of healing of pelvic floor injury (Kegel)[70] – Pelvic dysfunction is associated in varying degrees with clinical, electrophysiological and histological features of chronic partial denervation in the muscles of the pelvic floor, especially the puborectalis and levator ani muscles, the external anal and periurethral striated muscles, and childbirth is known to be implicated. Moreover, in the course of embryological development, contractile muscle tissue is formed earlier than the nerves that supply it, with subsequently, muscle cells becoming secondarily innervated. This ability of a nerve fibre to establish a connection with a muscle cell is carried over into adult life and muscle cells which have lost their innervations may become re-innervated under favourable circumstances[70], for example, following progressive resistance exercise. This has clinical implications in the conservative management of incontinence and sexual pelvic floor problems.

3.4 Sexual function/dysfunction

The sexual act is complex with interaction between the physiological, psychological and intellectual parts of the individual[71].

The sexual response[72,73]**:** The sexual response cycle consists of arousal, plateau, orgasm and resolution phases. In the 1970s, the concept of sexual desire was added to complete the picture of the sexual response cycle. Various parts of the vagina act synchronously in the sexual response and the proper anatomical relationship to other pelvic floor viscera and supports is required. Introital muscle activity involving the transversus perinei, bulbocavernosus, external anal sphincter, compressor urethrae and urethrovaginal sphincter muscles, is required for eliciting a normal sexual response. These work in a co-ordinated fashion with neurological control from the pudendal and the autonomic nerve supply as well as vascular effects. The vestibular, urethrovesical and external rectal vasculature are involved to a marked degree in the introital sexual response. Lubrication is caused by the dilation of the perivaginal veins.

During the excitation stage, the vaginal rugae get less distinct, while at the plateau stage the basal congestion gets more pronounced and the lumen of the outer third of the vagina becomes reduced. Labia minora become engorged and join the congested area to form an orgasmic platform. The platform release occurs rapidly after orgasm but takes up to thirty minutes if orgasm does not occur. Regular contractions occur in the outer third of the vagina. The apex of the vagina comprising the inner two-thirds, lengthens and distends during the excitement phase, with the uterus elevated out of the true pelvis. In the resolution phase, there is a zonal relaxation of the upper two thirds of the vagina and the cervix returns back to its normal anatomical position within 3-4 minutes.

There is sexual dysfunction when neurogenic, vascular or muscular elements are deranged resulting in dyspareunia or laxity and an unsatisfactory sexual response. ‘Dyspareunia’ from

Greek etymology means "bad or difficult meeting". Dyspareunia can also follow desire if there is failure of arousal, resulting in failure of lubrication.

The above is mainly a discussion of the physical aspect (pelvic floor/organs) of the sexual act. One's opinion of one's anatomy and one's experience of that anatomy affects one's fulfilment as a sexual person. Discussion of the psychological and intellectual aspects[71] of sexual health is not the primary aim of this thesis. However, failure of any aspect can lead to sexual dysfunction with fear of failure on subsequent occasions, and this can affect psychosocial health. A vicious cycle can then be perpetuated and can result in 'vaginismus'[71,73,74] where the woman has involuntary painful spasms of her perineal muscles at the introitus which prevents intercourse. Vaginismus has a large psychological element[71,73,74] and though a careful pelvic examination may help in differentiating it from dyspareunia there are inter-observer variations and distinguishing one from the other may sometimes be impossible. P Hilton[75] documented urinary leakage during intercourse. An underlying sexual conflict can present as urinary incontinence or vice-versa.

Postpartum dyspareunia manifests in some mothers resulting in sexual maladjustment, which, along with lowered self-esteem and negative body image, prevents a reciprocal exchange of positive sexual feelings[76-78]. To what extent postpartum dyspareunia contributes to impairment of overall sexual health is unclear as is its relation to other pelvic floor symptoms.

3.5 Hormonal influence on the pelvic organs and pelvic floor – Tissues derived from the Mullerian system and the urogenital sinus respond to oestrogens[79]. Oestrogen receptors[80,81] have been found in the urethra, external anal sphincter, vagina, trigone and rectus abdominis muscles and seem to conform to our evolutionary history and embryogenesis. These findings further help to explain the pathogenesis of pelvic floor disorders associated with hormonal changes while pregnant or when breast-feeding. This has implications for management. Oestrogens reportedly act by modifying the collagen of the urethral sphincter[82] and a beneficial effect of oestrogen supplements on urinary or faecal incontinence[83,84] was observed.

Summary – The pelvic organs are not only anatomically located close to each other, but are also inter-related embryologically and morphologically. The pelvic floor maintains the anatomical position of the bladder, rectum and vagina, as well as the optimal biomechanical orientation of the urethra and anorectal junction, which are required for continence. Hence, if there is a disorder of the pelvic floor, 'one or all' of the organ systems can be affected[85,86]. 'Our inability to solve some of the difficult problems of pelvic floor support lies in "our over emphasis on organ systems and a nosology of dysfunction that has been built up piecemeal by

three clinical specialities looking at fragmented sections of the problem through their own organ systems" (Wall & DeLancey)[87].

4. Review of literature on associated obstetrical/biological predictors, prevalence and incidence of pelvic dysfunction

In the continuing debate about the increased risk of pelvic dysfunction due to the vaginal mode of delivery[88], the role of caesarean birth in the prevention of pelvic dysfunction[89-91] remains controversial[92-98]. Chart 1 (fp 16) with a summary of relevant studies and the following discussion about associated obstetrical/biological factors which could increase the risk and prevalence of incontinence and sexual dysfunction, precede an appraisal of publications on the postpartum frequencies of these symptoms.

4.1 Obstetrical/biological factors associated with pelvic dysfunction: Although the comparative lack of representation of caesarean samples in background publications to this research on pelvic dysfunction seems to be better addressed in this millennium, gaps in the literature on the scope of pelvic/perineal dysfunction persist. Past studies had implicated vaginal birth[88,99-104] particularly, instrumental, in the genesis of pelvic floor problems[105-108] and the role of caesarean delivery was largely unexplored, as the latter mode was considered protective to the pelvic floor. One prospective study[109] in primiparae had reported stress incontinence following elective caesarean delivery but the interval from birth was unclear, with an upper range of up to six years. Similarly, it had been reported that dyspareunia was related to vaginal birth[104,110-117] specifically associated with perineal trauma, and there was no reporting on post-caesarean dyspareunia, other than an incidental finding during an investigation with a different primary aim[112]. The belief in the prophylactic role of elective caesarean[88,101] and the uncertainty of the role of emergency caesarean[118,120] with regards to anal incontinence were based on studies with small caesarean samples (n=7)[88] or (n=34)[119] and those of mixed parity[100-120] which did not investigate all the symptoms related to anal incontinence[101,120], such as flatal incontinence, urge incontinence and urgency. Post-caesarean haemorrhoids had not been investigated.

Variables such as age, baby birthweight, duration of labour and analgesia were reportedly associated with postpartum stress incontinence[12,121-124] but needed further definition to be used as predictors. Isolated reports suggested that the effect of pregnancy and menopause acting on an inherently weak pelvic floor[125] or the singular effect of pregnancy[126-128] could be of greater significance in the causation of stress incontinence than the mode of delivery.

Chart I. Studies on Pelvic/Perineal dysfunction

Abbreviations used: AI=anal incontinence, BMI=body mass index CS=caesarean section, DI=double incontinence, El CS=elective caesarean, Em CS=Emergency caesarean, FI=faecal incontinence, Fl I=flatal incontinence, IVD=instrumental vaginal delivery, LUT=lower urinary tract, MOD=mode of delivery, MW=midwife, NVD=normal vaginal delivery, OAB=overactive bladder, NIH=National Institute of Health, RCT=Randomised Control Trial, PF=pelvic floor, PFD=pelvic floor dysfunction, PP=postpartum, PNTML=perineal nerve terminal motor latency, UI=urinary incontinence, Ur I=urge incontinence, USS=ultrasound, SI=stress incontinence, VD=vaginal delivery * = publications update on similar issues following initial literature review

Author, Year & Country	No.	Objective	Design	PP interval	Sample size, description	Results	Conclusion
Pelvic dysfunction, SI, FI, dyspareunia, haemorrhoids, prolapse							
MacLennan et al[69], 2000, Australia	1	Prevalence of pelvic floor dysfunction & correlation with gender, age, parity & MOD	Home interview of youngest in house, retrospective	Unclear, probably long after as mean age-45 years.	Female 1546, Mixed parity, CS 43% VD 58%	SI-35%, FI-4%, Fl I-10%, dyspareunia 3.9%, haemorrhoids 8.8%	CS & NVD equally increase the risk of pelvic floor problems. Pregnancy after 20 weeks is also implicated.
Pelvic dysfunction, SI, FI, dyspareunia, haemorrhoids							
* Williams et al[136], 2007, Britain	2	Prevalence of enduring postnatal perineal morbidity & associations to mode & birth risk factors	Cross-sectional community survey using self administered postal questionnaire	One year	482/2100 (23.3%) response after reminder letter Sample sizes of caesarean, VD & IVD, and parity not reported	Poor perineal healing in 7 (4.4%) after NVD & 3 (5.5%) after IVD; SI, FI, haemorrhoids, dyspareunia & time to starting sexual intercourse reported amongst white & Asians	Enduring PP perineal morbidity is common, especially after a forceps delivery, associated risk factors are age, ethnicity, prolonged duration of labour & birth weight.
SI, FI & sexual dysfunction							
Meyer et al[159], 2000, Sweden	3	Assess the effects of forceps or spontaneous vaginal delivery on urethral sphincter & pelvic floor function	History, clinical examination, perineosonography & urodynamic studies	Within 2 yrs of birth. Seen during pregnancy then at 9 weeks & 12 months PP	151 white nulliparae, age 29 years, 25 forceps assisted 84 spontaneous vaginal delivery	Forceps vs spontaneous vaginal delivery: SI at 9 wks 32% vs 21% & at 10 months PP 20% vs 15%; FI at 9 weeks 8% vs 4% & at 10 months 4% vs 5%; decreased sexual response at 10 months as 12% vs 18%	Forceps delivery is not responsible for higher pelvic floor complaints or greater changes of bladder neck behaviour & urethral function compared to NVD, but a significantly greater decrease in intra-anal pressure & a weaker pelvic floor may occur.

Author, Year & Country	No.	Objective	Design	PP interval	Sample size, description	Results	Conclusion
SI, FI & prolapse							
*Handa et al[152], 2011, USA	4	To estimate differences in PFD by MOD	Longitudinal cohort study. Participants identified from medical records, telephone interview about eligibility then questionnaires on epidemiology of prolapse, incontinence, husband being bothered & gynaecological surgery	5-10 years postpartum	205 prelabour EL CS, 388 Em CS in labour, 418 NVD, 126 IVD	SI in: 14 (7%) El CS, 14 (6%) Em CS in 1st stage, 12 (9%) Em CS in 2nd stage, 47 (14%) NVD; AI in: 15 (8%) El CS, 19 (8%) Em CS 1st stage, 17 (12%) Em CS 2nd stage, 37 (11%) NVD; OAB in; 14 (7%) El CS, 14 (6%) Em CS 1st stage, 12 (9%) Em CS 2nd stage, 47 (14%) NVD	VD is associated with SI and prolapse, with instrumental delivery being most traumatic.
SI, FI							
Meyer et al[159], 1998, Switzerland	5	Effect of VD urethral sphincter, pelvic floor and anorectal function	Questioning, clinical examination, physiology tests, prospective	Monthly from pregnancy to 9 months PP	149 white nulliparae mean age 29 years, NVD, IVD, no CS	NVD- SI 21% & FI-5.5%, IVD-SI 34% & FI-4%, pregnancy SI 31% & FI none. SI persisted PP in 22%	Pregnancy increases bladder neck mobility & diminishes functioning urethral length, intra-vaginal & intra-anal pressures.
Chaliha et al[153], 1999, Britain	6	Effect of pregnancy & delivery on continence; whether physical markers of collagen weakness can predict PP UI, FI & FI I	Questionnaire interview antenatally + examination, same questionnaire PP as interview or by phone, Obstetric variables from records, prospective	After 34 weeks pregnancy & 3 months PP	549 nulliparae, 362 (69.6%) white, 82 (14.9%) black, 84 (15.3%) Asian, 1 (0.2%) Southeast Asian, All MOD	Prevalence of SI, FI I, faecal urgency (in that order) - pre-pregnancy were 3.1%, 0.5%, 1.1%; Pregnancy-35.7%, 6.0%, 8.7%; PP after NVD- 13.1%, 3.8%, 5.9%, IVD- 15.3%, 8.0%, 10.5%, CS- 8.4%, 4.6%, 3.1%	Physical markers cannot predict PP UI & FI. Faecal urgency is less frequent post-caesarean compared to after NVD & IVD.
Ryhammer et al[154], 1995, Sweden	7	Effect of repeated VD (1st, 2nd, 3rd) on risk of FI & UI	Postal questionnaire, retrospective	At least more than 12 months PP	242, mixed parity, mean age 28 years	Manifest UI-3% & FI I-1% after 1st, UI-1% FI I-1.5% after 2nd, UI-7% & FI I-8% after 3rd VD	Repeated vaginal deliveries increase the risk of minor AI & UI.

Author, Year & Country	No.	Objective	Design	PP interval	Sample size, description	Results	Conclusion
*McKinnie et al[163] 2005, USA	8	Determine the relative effects of pregnancy & MOD on the prevalence of UI & FI	Prospective observational multicentre questionnaire study of women presenting to six gynaecological clinics who enrolled over 18 months as part of the Pelvic Organ Support Study Project. Recruits were divided into: term pregnancy; no term pregnancy; only CS; only VD; with at least 1 VD	Variable	Number enrolled = 1004	UI was present in 237, FI in 128, BMI & age did not impact on results	Pregnancy increases the risk of UI & FI. CS does not decrease the risk of UI or FI compared to pregnancy with one vaginal delivery.
*Casey et al[107]. 2005, USA	9	Evaluate the association between obstetric antecedents for PFD	Questionnaire survey administered to women in labour to determine symptoms of UI & AI or prolapse pre- & during pregnancy. Same instrument given at follow-up visit for contraceptive advice	Assessed In labour then at 6/12 PP	Primiparae, 3887/10,643 (37%) women returned for interview	The risk of SI and UI were reduced after a caesarean, symptoms of UI doubled after a forceps delivery and symptoms of AI were increased in women who delivered a baby weighing > 4000 gm and doubled in those who were augmented with oxytocin and had an episiotomy, women with oxytocin augmentation who underwent a CS were likely to report anal Incontinence	Symptoms of PFD are increased after forceps assisted delivery, oxytocin augmentation, delivering a baby weighing > 4000 gm along with an episiotomy; CS reduces the risk of SI & UI but not of AI.
*Glazener et al[135], 2006, UK, New Zealand	10	Identify obstetric & other risk factors for UI during pregnancy or after childbirth	Self-report postal questionnaire of 8 questions with a closed format	3 months PP	3489 primiparae selected from a group (n=7879, 71.7% response) surveyed for a PF treatment study, 3405 (mean age 26.7), VD n=1606, vaginal/breech n=483, vacuum n=224, CS n=480	UI in 29%; 293 (18%) after VD, 104 (22%) after vaginal/breech, 48 (21%) after vacuum, 31 (7%) after caesarean birth. SI occurred in 48%. Older mothers were at increased risk of PP onset and the risk was reduced after CS, risk was not increased after forceps or vacuum delivery, an increase in BMI and heavier babies increased the risk of onset at pregnancy. FI was present in 9% and DI in 15%	The frequency of UI is less after caesarean birth & the risk of onset PP is increased with increasing age; the risk of onset during pregnancy is increased with increasing BMI & heavier babies.

Author, Year & Country	No.	Objective	Design	PP interval	Sample size, description	Results	Conclusion
*Altman et al[161], 2007, Switzerland	11	Compare the prevalence of incontinence disorders in relation to CS or VD	Observational single cohort study. Mailed self-administered questionnaire, prospective	10 year PP	Multiparous, median age 41.5 years (range 21-46) for CS and 39.9 years for VD (range 19-45), n=195 CS + 200 VD	CS vs VD: SI 54/195 vs 81/200, FI 57/195 vs 63/200. MOD did not show a significant association with incontinence but 3rd/4th degree perineal tears reached significance with FI I. Increase pad usage by VD for SI. Majority of those with SI & AI also had FI I	Incontinence is more common following VD than CS but CS is not associated with a major reduction in symptoms.
*Burgio et al[162], 2007, USA	12	Identify risk factors for FI & SI	Secondary analysis of data from the childbirth & pelvic symptoms study. Enrolled PP & questionnaire interview at 6/12 of those with 3rd/4th degree tear, & controls with intact perineum or 1st/2nd degree tear or EI CS.	6 months	921 enrolled & 789 participated with mean ages of 27.8 for sphincter tear group, 26.4 for the intact or 1st/2nd degree tear & 30.2 for the EI CS	Sphincter tear-n=335, Intact or 1st/2nd degree tear-n=319, EI CS-n=105. Risk of FI increased by: white race, older age, raised pre-delivery BMI, antenatal UI, anal sphincter tear but when duration of 2nd stage was added to the model, it displaced the tear in the sphincter tear cohort, for the intact or 1st/2nd degree tear any antenatal UI increased the risk but not for EI CS; Risk of UI increased by; raised pre-delivery BMI, antenatal UI, low education. EI CS is protective	Those with anal sphincter tear are more likely to have PP FI whilst UI during pregnancy increases the risk for both PP FI & UI.
* Lewicky-Gaupp et al[164], 2008, USA	13	To determine the prevalence of UI & AI during pregnancy & immediately postpartum in a convenience sample of African American teenagers in an urban setting	Self-report Wexner Continence grading scale & the Urogenital distress inventory was completed	Third trimester & at 6 weeks PP	n=74; 58/74 (78%) completed the study & 22% lost to follow-up; age range 14-17 years	In the 3rd trimester SI was present in 43%, FI in 12% & FI I in 41%; PP 9% complained of Ur I, 5% of SI, 4% of FI & 9% of FI I; PP FI I was more prevalent after IVD compared to that after VD or CS	UI & AI are present in African-American teenagers during pregnancy & PP with IVD increasing the risk. This should be addressed in this population.
SI							
Wilson et al[99], 1996, New Zealand	14	Relation between obstetric factors & UI	Postal questionnaire, retrospective	3 months after	1505, mixed parity of which 607 primiparous	Prevalence of UI in mixed parity group-34% & FI-5%, incidence of UI in primiparae	The risk of UI is increased if obese, nulliparous & after VD. CS is not completely protective. PFE reduce the risk.

Author, Year & Country	No.	Objective	Design	PP interval	Sample size, description	Results	Conclusion
Morkved & Bo[103],1999, Norway	15	Prevalence of UI during pregnancy, PP & examination of PF strength PP	Structured interview, pad test, if UI symptoms for urodynamic testing, VE for PF strength, prospective	2 months PP	144, mixed parity, mean age 28 years 122 NVD, 4 forceps, 5 vacuum,13 El CS	UI was manifest during: pregnancy 42%, PP 38% of which NVD 40%, forceps 25%, vacuum 20% & CS 23%	The prevalence of UI is nearly the same during pregnancy & PP. A strategy to prevent & treat during both phases is needed.
MacArthur et al[167], 1993, Britain	16	Prevalence of PP SI; Childbirth related predictors, effect of SI on the women's lives & their contact with medical professionals	Postal questionnaire, part of larger study of PP symptoms, retrospective	Unclear, 1-9 years PP	n=1107, predictors looked for in 1782 mothers, Mixed parity	SI in 1786 (15.2%) and 637 (5.4%) recurrent with multiparity. Predictors higher age, longer 2nd stage, greater birthweight. CS or Asian ethnicity were negative predictors	As results.
Dimpfl et al[128], 1992, FRG	17	Incidence of and any association between SI during pregnancy and postpartum, any associated factors	Interviewing about UI antenatally then PP questionnaire, prospective	Interview at last trimester, questionnaire at 6 weeks & 12 weeks postpartum	n=350 of which 60 had CS & 290 VD, mixed parity	155 (53.5%) mothers had SI during pregnancy, not after CS, 6% had SI after VD & a lower incidence of SI after epidural than after pudendal block	A significantly lower incidence of SI occurs after an epidural than after pudendal block.
Allen et al[100], 1990, Britain	18	Whether changes in PF muscles & nerve supply are caused by childbirth	Interview, physical examination & physiology tests, prospective	36 weeks of pregnancy 2-5 days PP, 2 months PP	96, primiparous	PP SI-8%	VD causes partial denervation of the pelvic floor.
Iosif & Ingemarsson[109], 1982, Sweden	19	Prevalence of SI following El CS	Postal questionnaire for El CS over a 6 year period, retrospective	Unclear, pregnancy & PP	204, mixed parity	PP SI- 7%	Pregnancy & predisposing hereditary factors are of great significance for the occurrence of SI.

Author, Year & Country	No.	Objective	Design	PP interval	Sample size, description	Results	Conclusion
Beck & Hsu[125], 1965, Canada	20	Importance of pregnancy, delivery & the menopause in causing SI	Questioning at gynaecology outpatient clinic, retrospective	Not known	1070 & later 74 added, mixed parity	SI Incidence during: pregnancy 65%, PP 14%, both pregnancy & PP 33%	Pregnancy & menopause acting on an inherently weak PF precipitate PF disorders, childbirth is less important.
Francis WJA[126], 1960, Britain	21	Prevalence of pregnancy-related SI	Attenders at antenatal clinic and after delivery questioned. Cysto-urethrography during pregnancy	Unclear	148 primiparae attending an antenatal clinic	Straightening of the urethrovesical angle during pregnancy with SI in 53%, pre-pregnancy SI in 42%, not during the puerperium	Pregnancy or pre-pregnancy factors, but not delivery. are implicated in the occurrence of SI.
Nemir & Middleton[137], 1954, USA	22	Prevalence of SI	Questioning at University health check-up with no documented anatomical/neurological problems	Not applicable	Nulliparous University physiotherapy students	52.4% of 1327 approached had SI	Inherent factors are considered as causative for SI.
*Groutz et al[169], 2004, Israel	23	Prevalence of SI following NVD, El CS & Em CS for obstructed labour	Questioning after delivery and interviewed postpartum, prospective	One year	363 primiparae (NVD, El CS, Em CS) Sample size – 145,118,100. Mean age in years 28, 31.7, 32.5	SI manifest in - NVD=15 (10.3%), El CS=4 (3.4%), Em CS=12 (12%). 50% reported moderate to severe symptoms but only 15-18% wanted further evaluation. Increasing age, BMI and SI during pregnancy increased the risk	Prevalence of SI is similar following NVD or Em CS for obstructed labour. El CS is associated with a lower prevalence of SI.
*MacArthur et al[172], 2005, Britain, New Zealand	24	Prevalence & persistence of long term postpartum urinary incontinence & associations with mode & subsequent delivery	Longitudinal cohort study, women delivered within a year were sent postal questionnaires & this was repeated again	3 months & 6 years PP after the first (index) birth	10,989 were sent a questionnaire & 7,879 replied. 7872 were sent questionnaire at six years & 4,214 (54%) replied. Age range <25->35 years & non-responders <25 years. El CS n=57, Em CS n=105	Prevalence of UI at both points was 24%, 9% with UI at 3 months did not have UI at 6 years, 21% with no UI at 3 months had UI at six years. 73% of the sample, including 71% primigravidae, had persisting UI. Persistent symptoms required a pad in 23%, 47% had an effect on hygiene, 16% on home life, 35% on social, 21% on work & 13% on sex life, & were more anxious & depressed	CS delivery reduces the risk of persistent & long term UI but not if followed by a VD.

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*Eason et al[130], 2004, Canada	25	Identify maternal and obstetric risk factors for UI during pregnancy; describe the prevalence severity of postpartum urinary incontinence; identify factors associated with postpartum incontinence	Information obtained as part of a RCT of perineal massage in pregnant women, self-completed demographic questionnaire at enrolment followed by questionnaire about perineal function pre-delivery which included questioning about episodes of SI, and a single mailed questionnaire postpartum about SI	34-35 weeks of pregnancy & 3/12 PP	N=1198 during pregnancy with 949 (79%) questionnaire return PP	Non-responders at 3/12 were younger (28.6 vs. 29.8), less educated (14.3 vs.15.8 years) & post-caesarean (17.7 vs.12.0%); primiparae with CS n=104 & VD n=392; amongst the post-caesarean SI was present in 16.3% pre-pregnancy & 55.8% during pregnancy and for the VD 16.1% & 58.9% respectively; PP 11.5% of post-caesarean & 31.2% of VD remained incontinent; of those continent during pregnancy 6.6% became incontinent post-caesarean & 20.6% after VD. Most (81.8%) were incontinent pre-delivery; 40.3% (119/295) had SI pre-pregnancy, 40.7% (120/295) developed SI in the 3rd trimester, & in 18.0% (53/295) between enrolment & PP; SI occurred daily in 0.88% after CS & 3.11% after VD; multiparity related to SI during pregnancy but age, BMI, hair colour & stretch marks did not; PP SI was related to SI pre-& during pregnancy, high pre-pregnancy BMI but not to age, weight gain, baby weight, MOD, epidural, duration 2nd stage, episiotomy, periurethral tears & perineal tears	Being pregnant increases the risk of PP SI irrespective of delivery mode; CS reduces the absolute risk of SI.
*Van Brummen et al[176], 2006, Netherlands	26	To assess the effect of 1st pregnancy on the severity of SI & OAB during pregnancy & at one year PP	Self-report using four questionnaires with the urogenital distress inventory assessing bothersome symptoms, prospective	At 36 weeks gestation & one year PP	Of 954 approached 430 refused, and of the remaining 50 got pregnant within a year & 130 only partly completed the questionnaire so 344 participated, mean age 30.4 years	57 (16.6%) underwent a CS, 223 (64.8% VD & 64 (18.6%) an IVD. Bothersome urinary symptoms were prevalent at 36 weeks of pregnancy (n=83, 24.2%) & declined to 9.6% (n=38) at one year PP. PP SI was associated with SI at 12 weeks of pregnancy & an increase in maternal age (32.5 vs 30.3 years). Ur UI was associated with a lower educational level & the risk increased after CS when compared to VD	Bothersome urinary symptoms are more prevalent at 36 weeks of pregnancy than at 1 year PP. OAB is more bothersome. CS protects against SI but Ur I is more common after CS. Physiotherapy can help.
* Ekström et al[140], 2008, Sweden	27	Compare LUT symptoms between VD and CS	Controlled observational cohort Self-report questionnaires given, prospective	Questionnaires pre-delivery (baseline), at 3/12 & 6/12 PP. Severity was based on frequency of leakage and pad usage	Of 545 with interest, 110 were excluded & 435 (VD=215, CS=220) included, 389 (VD=197, CS=192) completed the 2nd & 376 (VD=190, CS=186) the 3rd questionnaire	SI was present in CS vs VD as: 17 (8%) & 17 (8%) at baseline, 9 (4%) & 21 (10%) at 9/12 PP; OAB was present in: 5 (2%) & 4 (2%) at baseline, 4 (2%) & 6 (3%) at 3/12 PP, 8 (4%) & 10 (5%) at 9/12 PP; pad usage was similar for both modes at baseline, i.e. 1 (0.5%), increasing to 1 (1%) for the CS & 2 (3%) for the VD at 9/12 PP. IVD, degree of perineal tear & birthweight increased the risk only at univariate level	VD is associated with an increased risk of mild LUT symptoms 9 months after delivery when compared to El CS.

Author, Year & Country	No.	Objective	Design	PP interval	Sample size, description	Results	Conclusion
Boyles et al[177], 2009, USA	28	To estimate the effect of MOD on the incidence of UI in primiparae	A population based postal survey of all women delivered during a one year period	3-6/12	N=15,787 with a 39% response rate of whom 5841 were primiparae completed the survey	955 (17%) reported urinary leakage PP; those who had pre-pregnancy urinary leakage were excluded; 372 (8%) had prelabour CS, 616 (13.3%) CS in labour without pushing & 423 (9.1%) CS after pushing while 3060 (65%) and in 163 (3.5%) the MOD was not known; those having a VD (21.3%), particularly IVD or perineal laceration were more likely to report urinary leakage than after a CS (6%); the incidence of UI following El CS or Em CS was similar; PP UI was related to increase in BMI and constipation & after VD to increase in age, jogging during pregnancy & increase in birth weight	UI is common PP; although VD increases the risk of UI, labour and pushing without VD do not increase the risk.
*Wesnes et al[173], 2009, Norway	29	Prevalence of PP urinary incontinence & how continence during pregnancy & MOD influence it	Data from cohort study, part of the Norwegian Mother & child cohort study with information from postal questionnaires	15th week of pregnancy, 30th week of pregnancy, 6 months PP	Sample n=12,679. Primigravid with singletons continent before pregnancy, mean age 28 (range 15-45) years, mean BMI was 24.1 (range 14-54)	UI in: 3999/12,679 (31%) overall; CS (n=1815/12,679, 14%), El CS (n=355), Em CS (n=1348), acute on elective (n=45), unspecified (n=67); VD (n=10,864), forceps (n=309, 3%), vacuum (n=1647, 15%); SI was present in: (n=1728/12,679, 14%) at 6/12 PP and (n=2421) at 30 weeks. SI was severe if incontinent once or more per day and/or large amounts leaked & was present in 5% during pregnancy, 1% after CS & 3% after VD	The prevalence of SI is lower after caesarean than VD. Continence status during pregnancy does not influence the status PP.
*Hermann et al[174], 2009, Brazil	30	Estimate the incidence of SI three years after delivery and its correlation with MOD and parity	Cohort questionnaire study using structured telephone interview, prospective	3 years PP	n=120 at 3 years PP of the 340 enrolled for the study at 26 weeks of pregnancy. Mean age=29 ± 6.0 years	44.2% underwent a CS & 35% a VD, SI was present in 63 (52.5%);19% had SI following CS & 32% after VD, SI at 1st assessment was associated with SI after 3 years, MOD was not associated with SI at 1st assessment other than after 4 births; if asymptomatic at 1st assessment, VD increased the risk but not CS	Pregnancy & increasing parity predispose to SI three years PP. MOD does not significantly increase the risk of SI.
*Hantouszadeh et al[175], 2011, Iran	31	Incidence of SI after delivery and its relationship with different factors such as MOD and presence of SI	Questionnaire assessment of cohort attending three private hospitals, prospective	Assessment on 40th day, 3rd, 6th and 12th month PP	Nulliparae El CS on request n=350, NVD n=350 CS mean age=23.3 years, NVD mean age=23.9 years	Follow-up attendance for El CS 315/350 NVD 104/618 El CS with SI n=58 (18.4%) NVD with SI n=46 (15.1%) Pre-pregnancy SI affected symptoms of SI at one year	MOD does not have a significant effect on symptoms of SI at 6/12.

Author, Year & Country	No.	Objective	Design	PP interval	Sample size, description	Results	Conclusion
FI							
MacArthur et al[106], 2001, Britain & New Zealand	32	Prevalence of faecal incontinence after childbirth	Postal questionnaire, urgency not included	3 months PP, 3 obstetric units in England, Scotland & New Zealand	n=7879 with 147 primiparae	71.7% response rate, FI in 9.6%, FI I in 45.3%. Older, Indian ethnicity & increased body mass index associated	Forceps assisted delivery doubles the risk of AI, there is no association with ventouse, CS offers some protection.
Varma et al[179], 1999, Britain	33	Incidence of anal sphincter injury following childbirth	Questioning, anal USS, anorectal physiology tests, prospective	At 3 days of birth & at 6 weeks PP	Primiparae, 73 NVD no 3rd, 4th degree tears, 27 CS of which 22 El CS & 5 Em CS	Incidence of sphincter injury 9%, one case of faecal urgency, after CS no symptoms of AI reported	As results.
MacArthur et al[120], 1997, Britain	34	Prevalence of PP FI, obstetric risk factors, advice asked	Postal questionnaire, interview, FI I excluded	10 months PP	906, mixed parity	Incidence of PP FI-4% for all Em CS (n=6) of 906 deliveries, not after El CS	FI is an immediate consequence of delivery, medical help is rarely sought, Em CS is not protective, identification & treatment should be a priority.
Sultan et al[101], 1993, Britain	35	Incidence of mechanical, neurological trauma during childbirth using anal USS & physiology tests	Questioning, anal endosonography, manometry, perineometry & pudendal nerve terminal motor latency tests, prospective	Assessed at 36 weeks of pregnancy, at 6 weeks & 6 months PP	202 during pregnancy, 150 at 6 weeks PP, 32 at 6 months PP, 79 primiparae,127 VD	AI diagnosed in 13% primiparae and 23% in multiparae after VD. No symptoms after CS but 9 had prolonged PNTML (left) after Em CS	As results.
Jung et al[182], 2008, South Korea	36	Incidence & risk factors for PP anal incontinence	Retrospective examination of medical records followed by telephone interview to assess symptoms	6/12 PP	n=966/1123 (86%); CS 404 (41.8%), El CS 356, Em CS 48; VD 562 (58,2%), Mixed parity, mean age 31.6 years	Incidence of AI was 6.1% (faecal n=9, 0.9%); risk factors were multiparity, maternal weight gain > 15 kg, IVD, anal sphincter tear & Em CS	Koreans have a lower incidence of AI than Westerners (e.g. Guise et al), ethnicity may be a factor.

Author, Year & Country	No.	Objective	Design	PP interval	Sample size, description	Results	Conclusion
* Guise et al[183], 2009, USA	37	Identify factors associated with new-onset postpartum FI in primiparae	Population-based mail survey to determine the prevalence of FI according to the NIH definition which also included FI I	Questionnaire mailed at 3/12 and returned by 6/12 PP	40,300 questionnaire packs were sent & 15,787 (39%) responded of whom 6,152 were primiparous and 5,491 without pre-pregnancy FI completed the survey.	New onset FI was reported by 2,482 (45.2%) of whom 46.4% had FI I only. Women with FI had > 30 pre-pregnancy BMI, had a vaginal delivery, larger babies (>8 lb), pushed for > 2 hours in labour, stood for more than 75% of the day, were asthmatic, were constipated and practised yoga (FI I only), 28% delivered by CS, and were at lesser risk of FI but those who delivered by prelabour CS, CS without pushing or with pushing or the vaginally delivered had similar rates of new onset FI, vaginal delivery with laceration with or without instrumentation increased the risk of FI compared to CS	A BMI of >30, pushing for more than 2 hours & constipation increase the risk of FI irrespective of the mode of delivery.
Dyspareunia							
Goetsch et al[118],1999, USA	38	Incidence & course of dyspareunia, whether it was due to episiotomy or vaginal atrophy from low oestrogen	Questioning & clinical examination by author (n=40) & two colleagues (n=22)	Unclear - from 2-8 weeks up to a year PP	62 mothers, mixed parity and mode of delivery, median age 31 years	45% had entry dyspareunia with 6% at site of a repair; 39% had non-focal dyspareunia at 5.5 months & tenderness for 1 year; 29% caesarean & 41% lactating mothers were symptomatic	PP dyspareunia is quite common; causes significant difficulty in the mother; deserves more study.
Barrett et al[187], 2000, Britain	39	Whether women who underwent CS experience better sexual health PP than those who underwent VD	A cross-sectional study obtained data from medical records and postal survey of consecutive primiparae	6/12 PP	796 primiparae approached & 484 (61%) responded	Of the responders119 (25%) underwent CS (n=30 elective), 243 VD (50%) & 122 IVD (25%); 95 (80%) resumed sexual intercourse by 3/12 & 87% after 6/12 following a caesarean & 290 (80%) after 3/12 & 321 (89%) after 6/12 after VD; CS vs VD symptoms related to dyspareunia were 53% vs 76% at 3/12 but 39% vs 44% at 6/12; response related 61% vs 67% & 48% vs 49%; post-coital related 12% vs 18% & 8% vs 7% at 3/12 & 6/12. Symptoms were similar following elective or emergency CS	There is no basis for advocating CS to protect a woman's sexual function after childbirth.
Glazener et al[99], 1997, Britain	40	Postnatal sexual behaviour	Postal questionnaire, randomly selected sample, retrospective	8 weeks and 12-18 months PP	n=1116 at 8 weeks & n=427 at 12-18 months, mixed parity	53% resumed intercourse at 8 weeks, 49% at 12-18 months, 7-13% needed help but a fourth did not seek it	PP pain occurs in 30% following IVD, 7% after NVD & 2% after CS. PP sexual problems are common.

Author, Year & Country	No.	Objective	Design	PP interval	Sample size, description	Results	Conclusion
Larsson et al[104], 1991, Sweden	41	Indications for episiotomy, relation to anaesthesia, problems with episiotomy compared with spontaneous laceration	Clinical evaluation of perineum with the patients' perception of pain on a visual analogue scale, prospective	1,3, & 5 days PP & 8-12 weeks PP	1889, mixed parity	Higher infection rate & healing problems after episiotomy; dyspareunia occurred in 11% with lacerations and 16% with an episiotomy	Perineal pain increases after an episiotomy compared to laceration.
Grant et al[110], 1989, Britain	42	Comparing ultrasound, pulsed electromagnetic energy therapy with placebo	RCT, pain assessment by mother & clinical examination by MW, before & after treating pain, postal questionnaire, prospective	By 24 hours PP, treatment for 36 hours for 10 days, mother assessed by MW, then at 3 months PP	414,125 in each group, mixed parity, 60% IVD or breech delivery, 18% episiotomy extension, 4% with 3rd degree tear	Unclear whether there was dyspareunia both after treatment or in the untreated - 30% in each group without pain, urinary incontinence was present in 6%	No difference in outcomes between the groups with dyspareunia whether treated or untreated.
Grant et al[111], 1989, Britain	43	Perineal repair with glycerol - impregnated catgut vs chromic catgut, & dyspareunia	RCT postal questionnaire, prospective	3 year PP follow-up of previous study	516 total, 263 glycerol - impregnated, 253 untreated chromic catgut	Dyspareunia 19% in glycerol impregnated & 11% in those with untreated, chromic catgut, 1.7 times more painful in the former p= 0.02	Glycerol impregnated catgut causes persistent dyspareunia.
Bex & Hofmeyr[112], 1987, South Africa	44	Long term dyspareunia & perineal management	Postal questionnaire, retrospective	1-2 years PP	71 of 320 postal questionnaires returned	Dyspareunia in 16% following caesarean, 9% intact, 29% 2nd degree tear & 35% episiotomy, at 3 months	At 1 year PP dyspareunia is present in 17% following episiotomy but in none after a 2nd degree tear.
Sleep & Grant[113], 1987, Britain	45	Liberal vs restricted use of episiotomy prevents UI but may increase dyspareunia	RCT postal questionnaire, follow-up of earlier study 24, prospective	3 years PP	674 total, restrictive group 329, liberal group 345	Pain during intercourse was present in - restrictive group (16%) & liberal group (13%), UI in 34% & 36%, pad use in 9% & 8% respectively	There is no statistically significant difference between the two groups for sexual or urinary symptoms; liberal use of episiotomy does not increase long term dyspareunia.

Author, Year & Country	No.	Objective	Design	PP interval	Sample size, description	Results	Conclusion
Sleep et al[114], 1984, Britain	46	Liberal vs restricted use of episiotomy, resumption of intercourse & dyspareunia	RCT postal questionnaire, prospective	10 days, 3 months PP	Restrictive group (n=1000), liberal group (n=498), 502 mixed parity (n=502), mean age 26.6 years	90% in each group resumed intercourse; dyspareunia was present in – restricted (22%) & liberal (18%); UI was present in 16% & pad use in 6% at 3 months	There is no statistically significant difference between the two groups at 3 months regarding sexual or urinary symptoms.
Reading et al[115], 1982, Britain	47	Nature of post-episiotomy pain, recovery and patients' attitudes towards care received	Descriptive	24 hours described perineal pain & labour pain to researcher, 3 months PP postal questionnaire	101, primiparae mean age 24 years.	Episiotomy pain occurred in 22%, labour pain in 73% - using the visual analogue scale, more pain was experienced on sitting or defecation than when walking or during micturition, dyspareunia was present in 60% with reduced sexual functioning	As results, with some attributing the dyspareunia to episiotomy repair.
Coats et al[116], 1980, Britain	48	Consequences & benefits of medial and mediolateral episiotomy	Randomised trial, questioning & examination in hospital, follow-up clinic assessment	3 months PP	407 total,163 had midline & 244 medio-lateral episiotomies	Patient's estimate of pain was similar, 4.3% of the midline & 7.8% of the medio-lateral episiotomy group hadn't had intercourse	Anal sphincter injury is higher in the midline group but there is less scarring & intercourse is resumed earlier.
*Griffiths et al[186], 2006, Britain	49	To compare differences in manifest incontinence, dyspareunia, depression & sexual satisfaction after El CS or VD	Self-report postal questionnaire	18-24 months PP	111 of 208 (53.4% response) of whom 2 were excluded & 19 could not be contacted; n=19 El CS & n=36 NVD, n=54 IVD	When El CS vs. VD were compared – UI in 0% vs. 44 (49%) VD, FI I in 0% vs. 27 (30%); FI in 0% vs. 15 (17%); dyspareunia in 0% vs. 36 (40%); subjective depression not affecting life in 2 (10.6%) vs. 36 (40%); sexual satisfaction worse in 2 (10.5%) vs. 49 (54.4%)	Post-caesarean Incontinence & dyspareunia does not occur & subjective depression is low with sexual satisfaction worse in 10.5%; All symptoms are significantly increased after VD.
*Klein et al[189], 2009, Austria	50	Evaluate the influence of the MOD on PP sexuality	Self-report using Female Sexual Function Index (FSFI) questionnaire in Austrian & questions about subjective stress at childbirth	12-18 months PP but symptoms at 3/12, 6/12 PP and the year before delivery were asked about	Consecutive primiparae delivered within a 10 month period. Of 303 eligible, 254 were contacted, 155 (61%).responded, 16 refused & 40 excluded leaving n=99, mean age 33.3 CS & 29.6 VD	44 (44%) underwent a CS & 55 (56%) a VD; Patients' recall of dyspareunia at 3/12 were higher in those who underwent VD. The total score of the FSFI was similar between the two groups	No significant difference in sexual functioning is observed among women who undergo El CS & those who deliver by non-instrumental vaginal delivery & heavy tear (probably 3rd/4th degree) or an episiotomy.

Pregazzi et al[129] determined the association between postpartum perineal trauma and the development of postpartum pelvic dysfunction in 218 primiparae with singleton pregnancies who underwent vaginal deliveries. Participants were questioned about anal incontinence at two weeks postpartum by a gynaecologist blind to the perineal inspection and then assessed using clinical evaluation, digital scoring, vaginal manometry, stream interruption and uroflowmetry. Participants were divided into three groups which included mothers with an intact perineum (n=171), those with 1st/2nd degree tear (n=39) and 3rd/4th degree tear (n=8). Stress incontinence was present in 12.9% and anal incontinence in 1.8%. The sample sizes were unreported. They concluded that stress incontinence was unrelated to perineal damage.

Eason et al[130] investigated the possible causes of anal incontinence at 3 months postpartum by using self-reported postal questionnaires in a sample of 949/1198 women. Participants recruited antenatally were categorised as those who underwent vaginal delivery without (n=783) and with clinically recognised anal sphincter tear (n=51) or a caesarean (n=114). Flatal incontinence was reported by 26% and faecal incontinence by 3% mothers. Anal incontinence was predicted by forceps delivery and anal sphincter laceration but not by prolonged second stage or birth weight. In a mail survey to estimate the obstetric risk factors of faecal incontinence in a sample of 2,640 middle-aged women, Fritel et al[131] reported that faecal incontinence was not associated with parity or mode of delivery.

Nazir et al[132] prospectively investigated a possible correlation between anal incontinence, occult sphincter injuries, manometry values and delivery variables in vaginally delivered primiparae. After recruitment at 17 weeks gestation, participants (n=111) were investigated at 25 weeks using a bowel symptom questionnaire, vector volume manometry and transanal ultrasound. At five months postpartum, 19/76 (25%) vaginally delivered had flatal incontinence and 14/76 (19%) abnormal transanal ultrasound findings, though the vector volume manometry findings were normal. At one year, one third of the 19 symptomatic mothers had flatal incontinence associated with reduced vector volume manometry findings. Anal sphincter injuries were not related to vector volume manometry findings or symptoms. The baby's head circumference was significantly associated with transanal ultrasound abnormality. Two post-caesarean mothers (n=7) suffered flatal incontinence during pregnancy and four when postpartum but without any ultrasound abnormalities. The authors suggested a longer follow-up to detect any deterioration of continence.

Moving on from the initial literature review, other pertinent investigations include a report by Bollard et al[133], who in a 34-year follow-up used a questionnaire, endo-anal ultrasound and manometry to investigate the outcome of forceps assisted delivery, anal sphincter injury and continence. Although anal sphincter injury was associated with forceps assisted delivery,

faecal and urinary incontinence were not. No explanation for this lack of association was given. Frudinger et al[134], in their 10 year prospective study on clinically unrecognised anal sphincter tears and anal incontinence used a bowel questionnaire and anal endosonography antenatally and then at six months, five years and at ten years after vaginal delivery. Of the 156 recruits, only 107 participated until the study's conclusion. The continence of asymptomatic women with sonographically diagnosed tears did not deteriorate after ten years, signifying a non-progressive condition in this sample.

Casey et al[107] evaluated the association between specific obstetric antecedents for pelvic dysfunction using a standard survey questionnaire about incontinence and prolapse. Nulliparae were surveyed in the hospital pre-delivery and at 5 and 7 months postpartum when seeking contraceptive advice. During the study period 13,147 attended for delivery, 10,643 of whom were surveyed, and 3887 (37%) returned postpartum; 872 were post-caesarean and 250 (6%) had a forceps delivery. The mean age was 22±5 years and 3430 (88%) were Hispanics, 341 (9%) were blacks, 67 (2%) were whites and 49 (1%) were classified as 'other'. Pre-pregnancy 37 (1%) participants had stress incontinence, 26 (0.7%) had urge urinary and 26 (0.7%) anal incontinence. Postpartum 217 (72%) had urinary incontinence, 72 (24%) had any type of incontinence and 9 (3%) had double incontinence. Forceps assisted delivery, episiotomy and macrosomia (baby weight ≥ 4000grams) increased the risk of incontinence. The risk of urinary incontinence was reduced after a caesarean if not carried out under epidural analgesia. Caesarean delivery did not reduce the risk of anal incontinence and the risk increased after oxytocin augmentation. Caesarean under epidural analgesia increased the risk of urgency. Augmentation along with epidural analgesia increased the risk of urge incontinence. The type of caesarean delivery was not reported. Further research was suggested.

Glazener et al[135], in a three centre postal survey using a self-report, short questionnaire, investigated postpartum urinary incontinence. This sample (n=3489) was part of a study (n=7479) on the conservative management of incontinence and 3405 women with a mean age of 26.7 years responded. Urinary incontinence occurred in 293/1606 (18%) after normal vaginal delivery, 104/483 (22%) after vaginal/breech, 48/224 (21%) after a vacuum delivery, and 31/480 (7%) after a caesarean. The category vaginal/breech and caesarean type were unclear. Urinary incontinence required pad usage in 3%, affected home, work and social life in 50% and sex life in 17%; further details were unavailable. Postpartum urinary incontinence was associated with increasing age, reduced after a caesarean and did not increase after instrumental delivery when compared to non-instrumental delivery; raised body mass index (BMI), heavier babies or a normal vaginal delivery were associated with onset during pregnancy. Postpartum incontinence was not associated with that during pregnancy.

Williams et al[136], carried out a self-administered, postal survey a year after child-birth, to determine enduring morbidity, namely urinary, faecal and flatal incontinence, perineal pain, dyspareunia and sexual problems. The risk factors were age, ethnicity, prolonged duration of labour and birth weight. The response rate was 23.3% (482/2100). The sample size for each mode was not reported. A 45% ethnic representation with many not understanding English or literate in their native language would have hindered communication.

Nemir et al[137] reported stress incontinence in 52.4% (n=695) nulliparous University students whilst Eliasson et al[138] reported stress incontinence in 80% (n=18) elite trampolinists which was manifest only during training sessions. Buchsbaum et al[139] estimated the prevalence of urinary incontinence among nulliparous nuns (n=149) using questioning and the Incontinence Impact questionnaire. The participants' mean age was 68 years, the mean BMI 27; 97% were post-menopausal and 40% were on hormone replacement therapy. Stress incontinence was reported by 22 (30%), urge incontinence by 18 (24%), mixed incontinence by 26 (35%) and eight (11%) had incontinence not related to urge or stress. Pads were worn by 52%. Age was not a risk factor. The prevalence was similar to that in parous post-menopausal women suggesting the involvement of inherent biological and endocrinological aetiopathology in the incontinence.

Amid more recent studies, Ekström et al[140] investigated primiparous lower urinary tract symptoms using self-report questionnaires pre-delivery (at baseline), and at three and nine months postpartum. 545 agreed to participate but 60 who underwent an emergency caesarean and 50 with acquired complications were excluded. When caesarean (n=220) vs. vaginally delivered (n=215) were compared, stress incontinence was present in 17/220 (8%) vs. 17/215 (8%) at baseline, in 7/192 (3%) vs. 32/197 (15%) at 3/12 postpartum, and in 9/186 (4%) vs. 21/190 (10%) at 9/12 postpartum; overactive bladder in 5/220 (2%) vs. 4/215 (2%) at baseline, in 6/192 (3%) vs. 8/197 (4%) at 3/12 postpartum, in 9/186 (5%) vs. 12/190 (6%) at 9/12 postpartum. Pad usage was reported by 1 (0.5%) before delivery, by 1 (1%) post-caesarean and by 5 (3%) vaginally delivered at 9/12 postpartum. Stress incontinence pre-pregnancy and at 3 months postpartum, but not during pregnancy, were predictors for incontinence at 9/12. The low prevalence rate led to wide confidence intervals and the exclusion of 110 from follow-up caused loss of statistical power.

Amongst researchers specifically using imaging, Kearney et al[141] investigated obstetric factors associated with levator ani injury after vaginal birth using magnetic resonance imaging (MRI) in urinary incontinent (n=80) and continent (n=80) primiparae, and 80 nulliparous controls. Primiparae had undergone forceps (n=16) or ventouse delivery (n=12) and 63 had a midline episiotomy. Increasing age, forceps delivery, episiotomy and a longer second stage

increased the risk of levator ani defect. De novo stress incontinence was manifest in only 66% (20/29) with defects. This lack of association of symptoms with levator ani/sphincter defect was also noted by Sentovich et al[142] who reported that 20% of nulliparae with defects detected on endosonographic imaging were asymptomatic. Falkert et al[143] used three dimensional perineal ultrasound, at rest and during the Valsalva manouvre, to compare biometric measurements of the levator ani muscle according to maternal constitutional factors, delivery mode and size of the baby, in Caucasian primiparae (n=130) on the 2nd day postpartum. Levator hiatus had a positive correlation with baby weight and head circumference during Valsalva manouvre, *de novo* urinary incontinence, vaginal delivery (n=77, 59.2%) and operative vaginal delivery (n=14, 10.8%) but not with caesarean (n=39, 30%; elective n=11), the duration of the 2nd stage, episiotomy and maternal injuries (not specified), age and body mass index (BMI).

Previously, Pescher's et al[144] evaluated pelvic floor muscle strength using palpation, perineometry and perineal ultrasound during 36-42 weeks of pregnancy and 3-8 days, 6-10 weeks and 11 months postpartum in vaginally delivered primiparae (n=25), multiparae (n=20), and controls as caesarean mothers (n=10). Pelvic floor muscle strength was impaired soon after birth but recovered in most by 2 months. Discomfort and pain affected evaluation immediately postpartum. Heilburn et al[145] investigated correlation between levator ani muscle injury, incontinence and pelvic organ prolapse in primiparae at 6-12 months postpartum, using MRI. Levator ani muscle injuries were categorised as MRI –ve, no/mild vs. MRI +ve, major. Those with external anal sphincter tear (3rd/4th degree) were MRI +ve in 17/89 (19%) and those without external anal sphincter tear were MRI +ve in 3/88 (3.5%) whereas those delivered by elective caesarean were MRI –ve as 0/29. Sphincter tears were associated with major levator injuries and when compared with those with no/mild injury, faecal incontinence was manifest in 35.3% vs. 16.7%, pelvic organ prolapse in 35.3% vs. 15.5% whilst urinary incontinence was not associated; the different mechanisms of continence control for the bowel and bladder (vide pp 8-13) would have modulated the manifestations.

Differences in design, obstetric management and possible anomalous nerve supply (vide page 12, paragraph 2) have prevented consistent conclusions in the above studies and further definition of associations of these obstetrical/biological risk factors with pelvic/perineal dysfunction is called for.

4.2 i) Urinary, faecal and flatal incontinence, haemorrhoids and prolapse:

Only one general population study[69] with female (n=1546) and male (n=1464) respondents has reported the prevalence postpartum of all pelvic floor symptoms. In this study, MacLennan

et al[69] reported an incidence of female urinary incontinence of 35%, faecal incontinence of 3.5%, flatal incontinence of 10.9%, prolapse of 8.8%, dyspareunia of 3.9%, vaginal laxity of 5.2% and haemorrhoids of 30.2%. The post-delivery interval was unclear, but the average age of the participants was 44.5 years. Using the short form (SF36) generic questionnaire they reported that women with incontinence or prolapse had significantly lower scores than the healthy population mean in their summary physical and mental denomination scores whereas women with haemorrhoids had only a lower physical score. Collecting information from one family member on behalf of the rest of the family on these sensitive issues where sufferers are known to be reticent[146-150] may have introduced bias where those approached were too embarrassed to disclose symptoms to the designated family member.

Saurel-Cubizolles et al[151], investigated women from three units in France and five units in Italy. Women were interviewed thrice after childbirth and, in addition, a postal questionnaire was sent at twelve months to investigate any relationship between postpartum physical/emotional problems and social functioning such as, employment and relationship with the partner. Primiparae or secundiparae recruited from France (n=632) and Italy (n=723) reported symptoms at 5th and 12th months postpartum. Symptoms of physical discomfort, incontinence, sexual problems, depression, anxiety and tiredness were prevalent. Painful intercourse (31.9% France, 18.8% Italy), low libido (64.6% France, 47.7% Italy) tearfulness/depression (70.8% France, 49.7% Italy) were most common at twelve months. French mothers reported more symptoms than Italian mothers, did but the overall increase in symptoms showed a similar pattern. Physical/emotional and social health were not associated.

In a cohort study of pelvic dysfunction 5-10 years after delivery, Handa et al[152] reported on the cross-section at enrolment. Of the 2510 of 5215 who were contacted and were eligible, 1271 (51.8%) refused. Self-administered questionnaires on incontinence and prolapse were administered along with gynaecological examination by a physician or a research nurse. The index mode was the one considered most harmful amongst all of the participant's pregnancies. Vaginal, especially operative births, were significantly associated with stress incontinence, and prolapse in particular (OR 7.5, 95% CI 2.7-20.90), when compared to caesarean. Neither active labour nor complete cervical dilation increased the odds of pelvic dysfunction but the study had less than 80% power to detect a doubling of the odds and confidence intervals were wide.

4.2 ii) Urinary and faecal incontinence: Studies[86,152-158] reporting on the prevalence of urinary and faecal incontinence postpartum have been limited. Wilson et al[85] investigated urinary incontinence at 3 months postpartum using a postal questionnaire, and reported on the

prevalence of urinary incontinence in 34% mothers and faecal incontinence in 5%. All modes of delivery were included in their mixed parous sample (n=607). When analysed according to parity, 17/106 (16%) post-caesarean primiparae had urinary incontinence compared to 115/356 (32%) vaginally delivered. This difference in prevalence disappeared after the third caesarean delivery when urinary incontinence was reported in 7/18 (39%) caesarean and 113/300 (38%) vaginally delivered, with the authors implicating a neurogenic aetiology. Non-labour risk factors were not investigated.

Chaliha et al[153] observed stress incontinence, flatal incontinence and faecal urgency in 13%, 4% and 6% mothers after normal vaginal delivery, 15%, 8% and 11% following instrumental delivery and 8%, 5% and 3% following caesarean delivery. Ryhammer et al[154] used a retrospective postal questionnaire to investigate a mixed parous sample of 242 mothers who had delivered vaginally without a sphincter tear. They reported urinary incontinence in 8 (3.3%) and anal incontinence in 3 (1.2%) of primiparae with increasing prevalence associated with an increase in parity. After the third vaginal delivery, the prevalence of urinary incontinence had risen to 12%, and flatal incontinence to 8%. Although recall bias is less of a risk in primiprae[155-158], it may be higher after several deliveries. Caesarean deliveries were excluded. Meyer et al[159] reported on the effects of delivery on bladder and anorectal function in 144 nulliparae during pregnancy and at nine weeks postpartum. Questionnaires, clinical examination, perineal sonography, urethral pressure profilometry and recording of intra-vaginal and intra-anal pressures during pelvic floor contractions. Forty-six (31%) had stress incontinence during pregnancy which resolved postpartum in 88%. Postpartum urinary incontinence presented in 21% and faecal incontinence in 5.5%.

Thompson et al[158], in a population based cohort study, investigated postpartum health (n=1193) using four questionnaires distributed on the 4th day and at 8, 16 and 24 weeks postpartum. Mothers who underwent a caesarean delivery reported significantly more bowel problems (symptoms not specified) at 8 weeks and 24 weeks when compared to vaginally delivered whereas the latter reported significantly more symptoms of urinary incontinence until 8 weeks postpartum, after which frequencies were similar. Hannah et al[160] reported on incontinence as an incidental finding at the three-month follow up of the randomized term breech delivery trial (n=1596) where participants self-completed a questionnaire on the phone or at interview (71% response rate). This included participants from 26 countries with 798 randomly allocated to a planned vaginal birth and 798 to a planned caesarean delivery with the primary aim being to evaluate the optimal management of a term breech presentation. Urinary incontinence was reported in 4.5%, flatal incontinence in 10.7% and faecal incontinence in five following a planned caesarean, and similar symptoms in 7.3%, 9.7% and nine following

planned vaginal delivery. Whether the analysis controlled for confounding factors such as perineal trauma (n=336), forceps (n=456) or previous caesarean delivery (87.5% of planned caesarean, 50% of planned vaginally delivered) was unclear. Besides, 342 in the planned vaginal delivery group underwent a caesarean delivery and 73 of the planned caesarean ended up with a vaginal delivery. It confirms the complexity of randomising the delivery mode as the clinical picture can change rapidly.

Altman et al[161] compared the prevalence of incontinence according to the mode of delivery in multiparae (mean age 41.5 years), 10 years after the first delivery, using a self-administered questionnaire. Amongst those only delivered by caesarean (n=195) or vaginal delivery (n=200), the prevalence of stress incontinence and anal incontinence were common although mild-moderate symptoms were more frequent in the latter group. Severe symptoms of urinary incontinence, defined as leakage one or more times per week, were present in 10% of either group and flatal incontinence was experienced by many of these peri-menopausal sufferers suggesting that menopausal degenerative changes could worsen symptoms. Fecal urgency was more frequent in the vaginally delivered. Flatal incontinence and urgency were higher in those who sustained 3rd/4th degree tears. The caesarean cohort was not differentiated into types.

Burgio et al[162] aimed to identify risk factors for postpartum faecal incontinence and stress incontinence as a secondary analysis of data obtained from the Childbirth and Pelvic Symptoms Study. Participants, 789 of 921 enrolled after delivery, were white (67-76%), black (15-24%), Asians (3-5%) and 'others' (5-6%). Telephone interviews using questionnaires were given at six weeks and six months postpartum. Participants were those with vaginal delivery and 3rd/4th degree tears (1st group, n=335), controls with an intact perineum or 1st/2nd degree tears (2nd group, n=319) or those after an elective caesarean (3rd group, n=105) with mean ages of 27.8, 26.4 and 30.2 years, respectively. Women with pre-pregnancy faecal incontinence or those with antenatal symptoms were excluded. The risk of faecal incontinence was increased by being of white race, older age, raised pre-delivery BMI, antenatal urinary incontinence and an anal sphincter tear; when duration of 2nd stage was added to the analysis it gained significance by displacing the tear grade. Antenatal urinary incontinence increased the risk for the 2nd group but there were no variables selected for the 3rd group. The risk of urinary incontinence was increased by a raised pre-delivery BMI, antenatal urinary incontinence and low education, and reduced by an elective caesarean. The Fecal Incontinence Severity Index (FISI) was used but its suitability for this young sample was questioned.

4.2 iii) Urinary incontinence: Amongst community studies[165,166] of urinary incontinence during the last century, Thomas et al[165] reported from a survey (n=9323) of British women,

that the prevalence of stress incontinence varied from 0.2% to 11.6% and increased with parity. They observed 'unrecognised cases' and saw a scope for improving management and disclosure, as many were reticent. Another survey[166] (n=1993) reported that prevalence increased with age peaking at middle age.

Early publications on postpartum urinary incontinence[127,128,167-170] have reported a prevalence of 5.8%-40% [127,128]. Stanton et al in a prospective[127] observational study reported urinary incontinence in 34% mothers at 40 weeks of pregnancy and in 5.8% during the puerperium. The delivery mode was not specified. MacArthur et al[167] reported from a retrospective survey where 30,096 mothers were first mailed letters (39% return) to confirm their willingness to participate, then those willing were mailed a self-report questionnaire about postpartum health which was returned by 11,701. The study investigated the effect of intrapartum analgesia on postpartum health. The questionnaire was an A4 sheet with participant's details and the form of analgesic given printed on one side and 'yes/no' responses about the presence of symptoms, such as stress incontinence or tiredness, on the other side. Stress incontinence was reported by 1786/11701 (15.2%) of their mixed parous sample with a recurrence of stress incontinence in 637 (5.4%). The interval from delivery varied from 1-9 years. Stress incontinence was less frequent post-caesarean (9.3%) but the caesarean type was not reported. Maternal age was associated if symptom onset was > one week post-delivery, birth weight (caesarean group) and prolonged second stage (vaginally delivered) were associated, if symptom onset was earlier.

Allen et al[100] used interviewing, physical examination and physiological tests at 36 weeks antenatally, and at 2-5 days and three months postpartum, to assess pelvic muscle neurophysiology and symptoms of urinary incontinence following vaginal delivery. Stress incontinence was reported in 8% following partial denervation of the pelvic floor but details of vaginal delivery were not provided. Iosif et al[109], in a retrospective study using postal questionnaires, investigated mothers who had an elective caesarean (n=204) for a narrow pelvis and observed stress incontinence in 17%. The sample was of mixed parity and the interval from delivery unclear with a range from 1-6 years.

Mørkved et al[103] reported postpartum urinary incontinence in 40% following normal vaginal delivery, 25% following forceps, 20% following vacuum and 23% following caesarean delivery. Their mixed parous sample (n=144) included 13 caesarean mothers. In a prospective cohort (n=4242) survey, 5-7 years after delivery, Wilson et al[168] reported urinary incontinence in 44.6%; 53% returned the self-report questionnaire.

Groutz et al[169], investigated postpartum stress incontinence by interview one year after normal vaginal delivery (n=125), elective caesarean (n=118) and emergency caesarean for obstructed labour (n=100), with mean ages of 28, 31.7 and 32.5 years, respectively. Prevalence

of stress incontinence was similar after vaginal delivery (n=15; 10.3%) or emergency caesarean (n=12; 12%) while it was lower after elective caesarean (n=4; 4.3%). 50% reported moderate to severe symptoms but only 15-18% wanted further evaluation. Increasing age, raised BMI and stress incontinence during pregnancy increased the risk.

Rortveit et al[170] evaluated the risks of incontinence associated with vaginal delivery or caesarean in recruits ≥20 years of age. Of 34,755 women, 27,936 completed the questionnaire on urinary incontinence at home as part of health screening. The severity was assessed using a validated severity index. The prevalence of urinary incontinence was 20.7% and of stress incontinence 12.2%. The prevalence was increased with increasing age, BMI, years since last delivery and with parity only in the vaginally delivered. Of the 439 post-caesarean primiparae, 15.4% had an elective procedure and 12.1% an emergency. Urinary incontinence was most prevalent in the women who had a vaginal birth (oldest age group), followed by mothers delivered by a caesarean and lastly the nulliparae (youngest age group). The population attributable risk of urinary incontinence following vaginal delivery was 33%. It was 5.6% following a caesarean; if the proportion of caesarean deliveries was increased to 15%, the population attributable risk would be 30%. Thus, the attempt to reduce prevalence by prophylactic caesarean would have limited effect unless a large proportion had caesarean birth. Over 65 years of age, the association between urinary incontinence and mode of delivery or parity levelled off suggesting the effect of other factors. In a survey of primiparae, Schytt et al[171] reported urinary incontinence in 13% (140/1065) and 18% (194/1065) at two months and one year postpartum, respectively. Symptoms were not perceived as severe by 86%.

MacArthur et al[172] carried out a prospective, longitudinal, self-report questionnaire survey in a cohort who underwent a randomised controlled trial regarding the effect of pelvic floor exercises (PFE) on urinary incontinence. Of the 10,989 mailed questionnaires at three months postpartum (index birth) 7,879 replied, and 7872 of these were sent a second questionnaire at six years of the index birth and 4,214 (54%) replied. The age ranged between 25 to ≥35 years. The mean duration of the second assessment from the index birth was 5.97 years and for multiparae it was 10.9 years. Prevalence of urinary incontinence at both points was 24% (1010/4211); 9% (n=380) of those symptomatic at 3/12 were asymptomatic at six years whilst 21% (n=894) who were asymptomatic at 3/12 had urinary incontinence at six years. 73% (1010/1390) of the sample including 71% (400/566) of primigravidae had persisting urinary incontinence and 3.3% (63/1941) of the index group had urinary incontinence pre-pregnancy. Stress and urge incontinence were analysed jointly so proportions in the analysis are unclear. The risk of incontinence was increased by increasing parity, age and vaginal delivery but not by instrumental delivery or a caesarean but the caesarean type was not specified.

Wesnes et al[173] in a cohort sub-study of the data obtained from the Norwegian Mother and Child Cohort study, analysed information regarding urinary incontinence at six months postpartum and how continence during 30 weeks of pregnancy and the delivery mode influenced it. Their postal questionnaire was not validated but questions were similar to validated instruments. Primigravid with singletons (n=12,679) continent before pregnancy with a mean age of 28 years (range 15-45) and a mean BMI of 24.1 kg/m^2 (range 14-54) were selected. Questionnaires were administered at the 15th and 30th weeks of pregnancy and at six months postpartum. Of the 14% (n=1815/12,679) who underwent a caesarean, 355 were elective, 1348 were acute (emergency) caesarean, 45 were acute-on-elective and 67 were unspecified caesarean; 10,864 underwent a vaginal delivery with 3% forceps assisted and 15% vacuum delivery. Urinary incontinence was present in 3991/12,679 (31%). Stress incontinence was present in 21% at 30 weeks pregnancy, in 6% post-caesarean and in 15% following vaginal delivery at six months postpartum. Stress incontinence considered as severe if leakage occurred once or more per day and/or large amounts were leaked, occurred in 5% during pregnancy, in 1% post-caesarean and in 3% vaginally delivered. Continence during pregnancy could not predict stress incontinence at six months postpartum. The prevalence or severity of incontinence according to caesarean type was not reported.

Hermann et al[174] prospectively investigated a cohort by telephone interview three years after the first interview when 26 weeks pregnant. Of the initial recruits (n=340), 120 participated; they comprised of white (52.5%), black (10.9%) and mixed race (36.7%) participants. 44.2% delivered exclusively by vaginal and 35.0% by caesarean; 45 (37.5%) were primiparae with a mean age of 29 years. Overall 69 (43.5%) had stress incontinence. Stress incontinence three years after was associated with stress incontinence at the first assessment but not with the delivery mode. Asymptomatic pregnant women developed postpartum urinary incontinence after vaginal but not caesarean delivery. Postpartum, the incidence of stress incontinence dropped significantly, but not in women with ≥4 deliveries. PFE could have ameliorated the compromised life-style due to stress incontinence but sufferers accepted it as part of the normal aging process and did not seek help.

Hantouszadeh et al[175], investigated the incidence of postpartum stress incontinence in nulliparae attending three private hospitals. Assessments were on the 40th day, 3rd, 6th and 12th months following elective caesarean (n=350, mean age 23.3 years) and vaginal delivery (n=350, mean age 23.9 years). 315/350 caesarean and 303/350 vaginally delivered attended follow-up. Stress incontinence was present in 58 (18.4%) post-caesarean and 46 (15.1%) vaginally delivered. Pre-pregnancy stress incontinence affected stress incontinence at one year

postpartum. Delivery mode did not affect stress incontinence ≥ 6 months postpartum. Table 3 was confusing and contradictory statements were made regarding prophylactic caesarean.

4.2 iv) Anal incontinence: Studies on postpartum anal incontinence[101,120,106] reported a prevalence/incidence ranging from 4% to 55%. MacArthur et al[120] reported from a prospective study of a mixed parous sample (n=906) who were interviewed by different observers ten months postpartum, following a self-report postal questionnaire at six months postpartum. Faecal incontinence was not reported after elective caesarean and their findings regarding emergency caesarean were inconclusive. Flatal incontinence had been excluded. In a second study[106] using a postal questionnaire, they reported flatal incontinence in 45% and faecal incontinence in 9.6% mothers and concluded that caesarean delivery offered some protection but urgency was excluded.

Sultan et al[101] used symptomatology, neurophysiological testing and endosonography to prospectively evaluate primiparous faecal incontinence. Mothers who had instrumental delivery and sustained 3rd/4th degree tears were recruited and faecal incontinence was reported in 10/79 (13%). Occult sphincter defects occurred in 28/79 (35%) vaginally delivered but not after a caesarean (n=23). The clinical significance of these occult sphincter defects was uncertain. Pudendal nerve terminal motor latency (PNTML) and perineal descent were observed in 9 mothers after emergency caesarean delivery but not after elective caesarean (n=7). Post-caesarean faecal incontinence was not reported. Fornell et al[102] used per-rectal examination at 3 days, 3 weeks and 1 month postpartum along with a questionnaire and anal manometry at 6 months postpartum; they reported faecal incontinence in 51 (55%) after vaginal delivery with an anal sphincter tear and in 31 (45%) without an anal sphincter tear. Caesarean deliveries were excluded.

Abramowitz et al[178] investigated the incidence of postpartum anal incontinence prospectively. A questionnaire (urgency excluded), perineal examination, proctoscopy and anal endosonography were used, with one assessment during the last trimester and another at 6-8 months postpartum. Their reported incidence of faecal incontinence of 12% was higher than most reports, but they included instrumental deliveries and 3rd/4th degree tears. Although they also included lesser degrees of perineal trauma, the perineal tears were not classified separately as 1st/2nd degree and related to symptomatology. Their caesarean cohort did not have anal incontinence but the sample was small (n=31) and of mixed parity. Postpartum sphincter damage accounted for only 45% of those with anal incontinence, signifying that sphincter damage was not the sole cause of anal incontinence.

Fynes et al[119] used anorectal testing to investigate the relationship between the timing of caesarean delivery and anal sphincter injury in primiparae. They reported a reduction in the increment of squeeze pressure and a prolonged PNTML after caesarean in late labour (≥8cm), but not in early labour (<8cm). Their small caesarean sample (elective 8, emergency 26) did not manifest anal incontinence so the clinical significance of these findings could not be ascertained. Varma et al[179] assessed primiparae prospectively at three days and six weeks postpartum and found one case of faecal urgency in 73 and an incidence of sphincter injury of 8·7%, following non-instrumental vaginal delivery without 3rd/4th degree tears. Their small caesarean sample (22 elective and 5 emergency) were asymptomatic but they did not investigate beyond six weeks postpartum. Using telephone interviews at 9-12 months postpartum, Crawford et al[180], reported an association of anal incontinence with lesser degrees of perineal trauma in their sample of 70.

Faridi et al[181] used a bowel function questionnaire, anal manometry, PNTML and anal endosonography to assess anal sphincteric function in a mixed parous group. Post-caesarean (n=10) and vaginally delivered (n=42) were assessed. Those with occult anal sphincter defects were seen at three months postpartum. Two mothers with 3rd/4th degree tear had anal incontinence. Eight reported occult sphincter defects but no correlation was shown between symptoms and sphincter defects. Mothers did not report symptoms or have abnormal anorectal physiological tests following elective caesarean. The single forceps delivery and the five mothers with median episiotomy would increase the risk of anal incontinence but their place in the analysis was not reported.

4.2 v) Dyspareunia: The paucity of reports on postpartum sexual problems[104,110-116] gave a prevalence of dyspareunia of 2-35% following vaginal birth. Studies on post-caesarean dyspareunia were even more scarce[94,99]. Of these, Bex and Hofmeyr[112] investigated long term dyspareunia and perineal management using postal questionnaires and reported post-caesarean dyspareunia in 16% mothers, 17 % following vaginal delivery (including instrumental) and 7% non-instrumental. Their response rate was 22%. Glazener et al[117] in a longitudinal retrospective survey reported on postpartum sexual behaviour at 1 week, 7-27 weeks and 12-18 months postpartum in a mixed parous sample. The prevalence of perineal pain was 30% following assisted vaginal delivery, 7% (23/310) following vaginal delivery and 2% (1/65) post-caesarean. The postpartum interval was not reported nor the caesarean type specified.

There have been conflicting reports[104,110-116] about the postpartum perineal morbidity from episiotomies when compared to lacerations (vide Chart 1, fp 16). Of these Larsson et al[104] in a prospective study evaluated mothers from delivery until 12 weeks postpartum and reported dyspareunia in 11% with lacerations and in 16% following an episiotomy. Sleep et al[113,114]

noted no statistically significant difference in the outcomes (including dyspareunia) for restricted versus liberal use of episiotomies. Episiotomies have been advocated for their apparently beneficial effect on the pelvic floor but most studies[115,116] have failed to confirm this with scant evidence[184] suggesting that episiotomies have a unilateral protective effect. Grant et al[110], investigated women who had perineal trauma and/or oedema after delivery using questionnaires at 10 days and 3 months postpartum. The outcome was resumption of sexual intercourse and pain free intercourse. There was no difference between the two groups with 15% reporting perineal pain, 16% urinary incontinence and 4% faecal incontinence.

Martha Goetsch[118] reported the incidence of dyspareunia as 42% in the vaginally delivered and 29% in post-caesarean mothers but the sample (n=62) was of mixed parity, was selected from private clinics and examined postpartum by one of three physicians. She reported reticence in the disclosure of sexual symptoms.

Amongst later studies[185-187] on post-caesarean sexual dysfunction, Barrett et al reported[185] on a cross-sectional postal survey of sexual functioning in 484/796 primiparae who underwent unassisted vaginal delivery (n=243), assisted delivery (n=122), pre-labour caesarean (n=46) and emergency caesarean (n=73). Most resumed sexual intercourse in the puerperium with no difference in sexual functioning at six months. The authors concluded that caesarean section should not be advocated for protecting sexual function. In Griffiths et al's[186] postal survey conducted two years after delivery, participants who underwent vaginal delivery (unassisted (n=36), assisted (n=54) experienced an increase in dyspareunia and less sexual satisfaction than after an elective caesarean (n=19). In contrast Barrett et al[187] sampled mothers from an inner city area, using a self-reporting measure and observed a prevalence of dyspareunia in 8 (21%) following elective caesarean, 17 (28%) following emergency caesarean and 59 (30%) after vaginal delivery at six months postpartum. Their[148] response rate was 61%.

Patel et al[188] analysed the sexual function of women attending an academic Urogynaecology practice who complained of anal incontinence (n=112) and bothersome bowel symptoms (mean age 56 years) and of controls (n=115) without anal incontinence (mean age 50 years) matched for stage of prolapse. Patients completed the Pelvic Floor Distress Inventory and the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12). Women with anal incontinence were older and more likely to report forceps assisted delivery. Symptoms of anal incontinence were not associated with worse sexual function using the PISQ-12, particularly in younger women, although flatal incontinence, which can affect the quality of life, was not analysed separately. Sexual function did not get worse with incontinence or prolapse. The authors suggested that more in-depth questioning to explore sexual function was required as the PISQ-12 was limited in its scope.

Summary of the pertinent publications discussed – Studies appraised in the above review along with summarized pertinent reports in Chart1 [fp 16], which include my initial review and an update until mid-October 2011, have limitations in sample characteristics and/or methodology and varied time-intervals from delivery or between assessments leading to inconsistent conclusions. Most studies have aimed to investigate single pelvic floor symptoms such as urinary incontinence. Many studies reporting on postpartum prevalence prior to the onset of this research and several following its inception did not take into account prepartum prevalence and non-labour factors. Hence, publications may not reflect the effect of intrapartum factors accurately with implications for future research, including the development of preventative and relevant conservative management[190-192] strategies. Research has confirmed that randomisation of modes is impracticable[152] and controversial[193]. Moreover a declining enthusiasm by consumers to enter large surveys has been reported[194].

***Conclusions from reviews on the topic*:** My review on incontinence in 2003[90], concluding that there was not enough evidence to advocate caesarean delivery to prevent incontinence has been followed by a few reviews on this subject area. Of these [195-200], Press et al[195] in their systematic review concluded that caesarean birth reduced the risk of short term urinary incontinence but severe symptoms were not reduced by delivery mode whilst the earlier review by I Nygaard[196] mentioned that although caesarean was protective in nulliparae it did not prevent all from urinary incontinence and that any protective effect did not persist with subsequent births and increasing age; further research on elective caesarean samples to elucidate its role in preventing urinary incontinence was suggested. Nelson et al[197] carried out a Cochrane Systematic Review and concluded that there was not yet enough evidence to advocate prophylactic caesarean for preserving anal continence and Dudding et al[198] in their systematic review concluded that faecal incontinence was associated with obstetric anal sphincter damage and proactive obstetric management to reduce injury was needed along with recognition and appropriate follow up; both reviews advocated further research. Dumoilin C and Hay-Smith J[199] in their Cochrane review of interventions for urinary incontinence using pelvic floor muscle training (PFMT) versus no treatment or inactive control treatment have recommended that PFMT should be used as 1st line conservative management for urinary incontinence with best results having been obtained for stress incontinence. Abdool et al[200] in their review concluded that postpartum sexual dysfunction was under-explored despite social, physical and emotional implications. Thus issues considered unclear in my initial review have not been addressed comprehensively.

The above discussions suggest further research to determine how pelvic floor dysfunction and relevant morbidity can be understood better, including the place of caesarean delivery, and the suffering from disability identified and reduced.

Bladder/bowel continence is a voluntarily acquired socially appropriate behaviour learnt through a process of conditioning during childhood, so its loss would negatively affect psychosocial health. Sexual dysfunction would similarly have a personal and psychosocial impact. Notwithstanding these, the severity of postpartum pelvic dysfunction and perineal trauma including its impact on psychosocial health has received scant attention in the literature discussed above. The following section discusses the issues relevant to the severity of pelvic dysfunction including the psychosocial aspect.

5. The severity of physical manifestations

Studies on the severity of pelvic dysfunction including the patient's perception of severity are largely unaddressed as discussed below.

5.1 Objective measures and psychosocial impact

Studies[146, 165,166] have related severity to the need for perineal protection worn by incontinent mothers. However, this method of evaluation of severity would not be applicable in the assessment of severity for other pelvic floor symptoms or where the mother perceives that her incontinence is not severe despite her need for perineal protection. Under these circumstances, especially, health carers need to consider the mother's perception of the impact of the physical manifestations on her psychosocial functioning to enable provision of tailored support and maintain patient compliance with treatment such as PFE[201].

Recent reports indicate that patients with urinary incontinence have been dismissive about objective evaluations used so far such as, assessment of pad usage[202,203]. These studies[202,203] have sampled the general population rather than maternal samples but could be of greater relevance to child-bearing related symptoms where there is a physiological adjustment that increases the risk of incontinence during pregnancy or there is an impact of the delivery on the continence mechanisms, thereby limiting such objective evaluations. Even mild stress incontinence can be a nuisance to some sufferers but one can live with it, for it is neither life threatening nor noticeable to the public eye. Herbison et al[202] gathered research ideas from community dwelling women with urinary incontinence who served in citizens' juries (n=14 for stress incontinence, n=14 for urge incontinence), with an aim to find out which research outcomes would help sufferers. These juries stressed that quality of life was the most important outcome requiring research. They stressed that current research outcomes such as the pad test and bladder diaries, frequency and amount of leakage were subsidiary outcomes as

what was “a little bit” to one person was “a lot” to another. Participants felt that help-seeking should be facilitated and reach the “silent suffering majority”. Additionally, they suggested emotional distress, the quality of life of partners and sexual life should be other outcome measures. Ternent et al[203] sought evidence of what was important to women with stress incontinence that ought to be addressed in future research as publications did not focus on the social and personal impact of incontinence which sufferers consider as more important. Prospective questionnaires were sent to 188 women suffering from stress urinary incontinence and 105 (55.9%) responded with 73 questionnaires being completed correctly. These community dwelling participants with a mean age of 57 years felt that current methods for measuring outcomes have addressed what the doctor feels about the patient’s severity of her symptoms rather than evaluating what the patient perceives about the severity of her disease. They requested that relevant research should be prioritised. A patient generated index (PGI) was developed which was found to capture the concerns of the sufferer but this did not map well to the EuroQuol-5D (EQ – 5D with 5 dimensions)[1] nor correlate with the nine domains of the condition specific Kings Health Questionnaire (KHQ)[1] that had been introduced to assess the impact of urinary incontinence on the quality of life of sufferers. Some respondents had difficulty in completing the PGI.

Sinclair and Ramsay[204] in their recent review mention the limitation of research so far into the severity of urinary incontinence. The literature on bladder problems and their treatment have focused on objective assessments notably urodynamic parameters for the assessment of the amount of bother that a sufferer experiences. Nevertheless, what the sufferer feels about her symptoms is more important and how it impacts upon her life and the lives of those around her is of greater concern to her.

When approached from the sufferer’s point of view her perception of the severity of pelvic dysfunction would not only relate to the physical burden but also to the direct interference with her psychological and social[205-207], including sexual, health. Severity defined in this manner has a wider connotation and seems suitable for assessing the severity of both stress urinary and faecal incontinence, flatal incontinence and dyspareunia with an added advantage for the latter two symptoms which do not present as an objectively measurable physical manifestation but as a social impediment[17,117], any associated impairment of psychosocial health would tend to reflect the severity more closely. This approach to defining severity would also have considerable implications for women after confinement when there is a transition period of complex emotional and psychosocial changes[208,209], particularly after the first childbirth[210,211]; the mother’s perception of the severity of any pelvic dysfunction would be influenced by these feelings. Therefore, assessing the severity of pelvic/perineal dysfunction in

the context of childbirth should take into account the burden of her physical symptoms along with the effect of the symptoms on her psychosocial maternal role. This study would explore these issues further.

5.2 Psychosocial health/morbidity and first childbirth

The scope of postpartum psychosocial ill-health merits further clarificaton if one is to assess the impact of postpartum pelvic dysfunction on psychosocial health and its meaning to the mother, especially after the first childbirth. 'Psychosocial health' is based on the following terminologies:

The term *psyche* – the soul, spirit or mind which is derived from Latin and from Greek (*psukhe*, breath, life, soul) and has been defined as 'the scientific study of the behaviour of organisms'[37]. Social – is concerned with the mutual relationship of human beings or of classes of human beings and is derived from Latin '*socialis*' meaning allied, from *socius* 'friend'. Health – the state of being well in body or mind (Old English '*haelth*' from Germanic)[213]. Thus, psychological and social health are inter-related with some overlap of functioning. The term postpartum psychosocial morbidity is said to encompass various dimensions of the mental, emotional and social state of the mother following childbirth. While recognizing the closeness of psychological and social health which may impact on hospital practice[214], each aspect has been addressed separately below, in an attempt to elucidate issues exclusive to each.

5.2 i) Postpartum psychological health/morbidity and scope of the problem

Professor Ian Brockington in the preface to his book, '*Motherhood and Mental Health'*[208] says that 'Childbearing, from the standpoint of psychological medicine, is the most complex event in human experience', and "It is a period of rapid biological, social and emotional transition".

Virtually, no life event rivals the neuro-endocrine and psychosocial changes associated with pregnancy and childbirth, particularly in primipara[209]. Following delivery there is a sudden fall in the levels of oestrogen and progesterone and an increase in the level of prolactin. With breast-feeding, prolactin levels rise further and continue to inhibit the oestrogen levels resulting in inhibition of the ovarian cycle and a state of relative oestrogen deficiency. This affects the emotional and psychological state of the mother.

The incidence of psychiatric illnesses rises during two phases of the postpartum period, one within 3 months and another between 10-24 months[215,216] following delivery. Postpartum emotional disorders are quite common, but many of the existing studies present conflicting data because of differing diagnostic criteria, different rating scales and different intervals from delivery, making comparisons difficult. Similarly, there is no uniformity in the terminology

used for the period following childbirth and various studies have called this period as the puerperium or the postnatal or postpartum period.

Exhaustion occurs until day 2 or 3 postpartum[217] and then euphoria, restlessness and a decreased need for sleep follow, also known as the 'pinks'[217]. In about 16% of women the elation is sufficiently marked to meet the diagnostic criteria for hypomania[209]. After the elation about 50% of mothers[209]experience brief episodes of weeping (50-70%), irritability (33%), anxiety (50%), forgetfulness (30%), headache (35%) and confusion (35%)[217]. This is known as the 'baby blues', which usually occur on days 4-5 and the labile mood lasts for 2-3 days[215,218]. This rarely occurs after day 10.

Postnatal blues are related to psychosocial factors, including relationship with the baby, the baby's father, his support, care from attendants, the mother's experience of delivery and her expectations from motherhood[217]. Conflicting reports of hormonal changes, such as fall/rise in levels of oestrogen and progesterone, raised prolactin level, raised cortisol level, reduced noradrenaline and low thyroxin and tri-iodothyronine have been said to be associated with the blues[215,219]. Genetic factors may make some women more vulnerable than others. Links between early postpartum mood and postnatal depression have been reported[221].

Postnatal depression and the rare puerperal psychosis are more serious disorders which need early recognition and appropriate management. In 1972, Pitt[218] pointed out that 'there is a grey area between the two extremes of blues and postpartum psychoses and that 'the understanding of the symptoms, aetiology and prognosis of postnatal depression states is notably deficient'.

Postnatal or postpartum depression is a common condition occurring in 10-20% of all newly delivered mothers at some stage within the first postpartum year[222,223]. It is ill-defined with no consensus even about the length of the postnatal period. Some researchers have limited their study to the first 6 weeks[209] after delivery, some to within 3 months[223,224] and others from 6 months to one year[225,226] when disease onset can occur[219]. It is a disabling condition of uncertain aetiology. Hormonal imbalance has been blamed but there is little hard evidence for this. It is more common in women with previous depressive illness, and may be a continuation of a mood disorder arising pre- or during pregnancy. Dysphoria, which is an emotional state of anxiety, restlessness and depressive symptoms[227] has been reported[223,224] as being a marker of postnatal depression. The childbirth and events surrounding it are imprinted in the mother's mind and mismanagement may lead to dysphoria and postnatal depression[229,230]. It is also more common in women without a supportive partner and poor socio-economic resources. Lack of support from family and friends tends to prolong it[209,231,232] and may be related to the nature of the illness which has been considered a continuum[233,234].

The prevalence of postpartum depression (p 34) does not represent the global picture[235] as more cited studies are from Western economically developed countries where a brief instrument, the Edinburgh Postnatal Depression Scale (EPDS) was used, which focused on depression and not other symptoms and disorders. Globally reports range from almost nothing to 60% with cross-cultural variables, differences in the perception of mental health and its stigma, different socio-economic factors (poverty, stress, etc.) and biological vulnerabilities promoting variations.

Postpartum depression presents with tearfulness, irritability[217,230], excessive anxiety about the baby's health, self-blame, loss of libido and complaints of a depressed mood[216,218,222,229]. The depressed mother is reluctant to handle the baby and may reject him/her. It may occur 6-9 months after delivery or 1-2 years after childbirth. Women have 16 times the normal risk for psychiatric admission in the first 30 days postpartum, but this is short term compared to the relative risk for depressive illness in mothers, which is increased for up to 2 years postpartum[209,223]. Kumar et al[228] followed first time mothers (n=114) using a psychiatric interview and reported depression in 16.6% at 3 months after delivery, 12.5% at 6 months, 8.3% at 12 months and 9% in 99 mothers at 4 years when one mother committed suicide. The continuing silent morbidity from depressive symptoms since Kumar et al's[228] report has resulted in escalating depression-related morbidity, and increased the frequencies of fatalities due to suicide published in the British Maternal Mortality reports[4-7] during the last decade.

The little published work on the recurrence of postnatal depression in subsequent pregnancies gives a high rate of 30%-75%[209,230,234-238]. Recurrence occurs where the stress of pregnancy, childbirth or after events (sometimes unrelated to childbirth) combine with the woman's previous personality, genetic factors and psychosocial stress (unemployed, multiparous) to precipitate postpartum depression in vulnerable women. Only few are caused by no obvious predisposing factor.

The EPDS, a self-report postnatal screening measure for depression, designed to be used in primary care, had a sensitivity of 86% and specificity of 78% at the recommended cut-off score of 12/13 for the sample studied[226,239,240]. Its limitations, including deliberate false negatives[241], cultural variations in self-reporting, inadequate responses or disagreement with the results[242], suggest that scores should be interpreted cautiously. A lower predictive value when compared to health visitors' reports has been observed[243]. Moreover, if depressed mood is considered as a continuum from mild to severe, it is better represented by dysphoria[229,244]. The EPDS was not recommended as a stand-alone screening tool by the National Institute of Health and Clinical Excellence (NICE) National Screening Committee; measuring disease by evaluating dysphoria as an alternative has been suggested[245], and this can be used in research

settings[245]. NICE recommended the Whooley questions[246] for the screening of postpartum depression. In those identified by screening as being at a higher risk of depression, further clinical evaluation using a diagnostic interview is advocated[245]. Depression if inadequately treated can cause both short and long-term maternal morbidity and adverse effects on the child[247,248].

Other postpartum mental disorders

Postpartum psychosis has an incidence of 0.2%, occurs early in the puerperium and requires urgent admission[217]. In some mothers it can pre-date antepartum psychosis in a subsequent pregnancy. Post-traumatic stress disorder can rarely follow a bad experience of childbirth[230]. Sometimes the less severe querulant reaction can occur after such a severe event[230].

5.2 ii) Postpartum social health/impairment and scope of the problem

Giving birth is a biological and cultural act[249]. In 'Woman Confined'[210], Oakley mentions that although in childbearing a woman performs "an animal act" human childbirth is "shaped by culture" and is closely linked to a society's articulation of the woman's position.

Social health following delivery is concerned with the mother having a healthy relationship with her child, the father, other relatives and friends, participating in domestic, leisure, and social activities and being re-employed as prior to child bearing[211], that is, if she chooses to do so. This would call for adaptation and inter-personal reorganisation because of the change in lifestyle, especially, after the first baby[157]. A reproductive maladaptation from one generation to another could occur[158,250,251].

The first childbirth is different from subsequent ones, not only by definition, but also in terms of women's own accounts of their obstetric histories. The adaptations that are required during and after the first childbirth are different and on the whole greater than those that attend other births. The mother has to establish a lifestyle routine and identity along with her entry to the full adult feminine role culturally equated with her socially constructed gender role and identity. Housework and child rearing are so intertwined that the first time mum has to adjust to two job transitions and 'sometimes balance this with her third job – employment, for the rest of her life'[210]. The mother would have to adjust to the reality of birth and the demands of the newborn or it may be to 'the requirements of the social role of the mother as located in a specific cultural context – marriage and the socially isolated and gender divided nuclear family'[252]. This can be affected by postpartum lifestyle changes and any psychological illness. Often she would be compelled to perform this role of 'good enough' mother, to the exclusion and denial of her needs and normally would cope with support from her partner, relatives and health personnel.

Social support is protective in that it facilitates coping with crisis and adaptation to change. However, some mothers do not get sufficient help and are unable to cope and end up in stress related illnesses[253]. Further aggravation of the social problems could be caused by financial pressures (especially, when involuntarily unemployed)[254], forced changes in the social networking, decreased leisure activities and boredom when confined to the house. Relationship with the partner can get strained, more so, if the couple were not well adjusted prior to the delivery. Impaired social health could precipitate psychological ill-health, such as postnatal depression. This in itself would prevent her from fulfilling her feminine role of mother, affect bonding, handling and feeding (especially, breast-feeding) the baby. Her behaviour and personality would change and have further repercussions upon her relationship with her partner[255,256], who would have to look after the mother and child, putting his earning capacity in peril. This psychosocial ill-health would have immediate effects on the family, along with long-term effects on the development of the child[247,248], the mother's relationships, future health[256,257] and role in the community.

Most mothers think of childbirth as the most significant life event, which they experience only once or twice. During the last century with progress in education and development of information technology, women have become gradually more informed and articulate about their expectations of pregnancy and delivery, so that each birth experience now carries an even greater emotional loading. During the last century, "the emphasis of most antenatal and postnatal care has been on the physical health of the mother and child while the emotional impact of such a life event receives little attention"[209]. Consumers are now requesting more attention. Howell et al[258] investigated the association of patient expectations/preparations and depression using telephone interviews on a sample (50% white, 27% Hispanic, 15% Afro-American) who had undergone caesarean (n=224) and vaginal delivery (n=495); 316 were primiparae and 403 multiparae. Depression was present at 2-6 weeks postpartum in 39% and 79% reported caesarean or episiotomy site pain, 32% urinary incontinence, 82 % breast pain and 98% vaginal bleeding. In their multivariable analysis depression was associated with more physical symptoms, physical function limitation, lack of social support, white race and perceived inadequacy in preparation. Further research into adequate childbirth preparation to reduce early postpartum depression is suggested. Although Brown and Lumley[259] had mentioned of an association between physical symptoms and postpartum depression, they had not investigated any association with expectations/preparation for the postpartum experience.

Just as pelvic floor disorders have been compartmentalised, so has psychosocial morbidity. The mind belongs to the psychiatrist or psychologist and social health is the premise of the social worker, but both should be integrated to deal effectively with the problem of postpartum

psychosocial ill-health. The relationship of pelvic/perineal dysfunction to postpartum psychosocial health or morbidity has not been investigated comprehensively but there is a need for such an evaluation to assess disease severity and anticipate maternal needs.

6. 'Expert Bodies' - views/recommendations on maternal health/morbidity

These Bodies considered postpartum maternal health as a neglected area and recognized the need for research into this field, with due attention to soft outcomes.

6.1 International Expert Body's views/recommendations: The **WHO report** (1985) on maternity care & maternal health/morbidity[260] describes difficulties facing the maternity services, which include problems ranging from deficient scientific understanding and uncontrolled technological exposure to widespread uncertainties about the relationship between care and outcome. In 1994, the **Vienna statement** (Vienna, Austria), on European Women's Health observed that, although, the WHO definition of health encompasses "Physical, social and mental well-being", these had not been applied to women and their health needs. Recommendations made were "To upgrade 'Maternal and Child Health' services, update woman-centred delivery practices, protect against inappropriate technology and promote breast-feeding".

6.2 British Expert Body's views/recommendations:

Amongst the British Law/Expert committees' reports on maternal health/morbidity, it was remarkable that the **Infanticide Act** (1939) was quick to recognise that if a mother with postnatal depression kills her own child "The mother cannot be found guilty of murder of her own child within twelve months of childbirth. She can however be prosecuted for the lesser offence of manslaughter of her child, known as infanticide". However, reasonable progress in the prevention of depression was not made. In 1983, the **King's Fund**[261], published a report on the need for developing support and recommended that a continence nurse adviser be established in each health district in the UK. This has developed over the years with leads for continence care in different regions but has been unable to reach out to many who are suffering silently. In 1992, the **House of Commons Select Committee Report on the Maternity Services**[262] was set up to conduct an enquiry, as there was discontent with the maternity services, despite the continuous fall in the perinatal mortality rate and a low maternal mortality rate. The memorandum on postnatal care submitted by the **RCOG** on Wednesday 13th November 1991 concluded: "Many hospitals lack well-defined policies regarding the various aspects of postnatal care including postnatal depression, nor have obstetricians developed a special interest or expertise in it. An investment in the social as well

as medical aspects of postnatal care offers the cheap way of improving the health of the society." The **House of Commons Health Committee Special Report on Maternity Services 1991-92, Vol 1**[263], from the **Supplementary memorandum submitted**, recommended: "Effects on the mother should be included in research projects. Maternal morbidity, 'both physical and mental, is a crucial yardstick in the measurement of obstetric care'. In 1992, **Report of the General Psychiatry Section of the Working Party on Postnatal Mental Illness**[264] reported that 1 in 10 women experienced postpartum depression. Their needs should be met. Education and training should give a greater emphasis to postpartum psychiatric morbidity. In 1993, in the conclusion of **Changing Childbirth Part 1: Report of the Expert Maternity Group**[263] considerable foresight in assessing maternity problems was shown: 'We believe that women and their families should be at the centre of maternity services which should be planned and provided with their interests and those of the babies in mind. The views of women who use the service should be regularly monitored and services adjusted to reflect their needs. Training programs should be developed for all staff to include psychosocial skills, ethics, communication, and equal opportunities.' In 1995, **Report of the Working Party of the Royal College of Physicians on Incontinence**[265] recommended the education of health professionals and public about incontinence. Research into preventive measures related to childbirth was suggested.

7. Childbirth in Britain today

The average number of children in a family is 2 and 74% are born to mothers ≥25 years of age. The average maternal age in 1998 was 28.3 years but in 2007 it was 29.3 years (ONS and OPCS Birth Statistics 1998)[266]. Most are hospital deliveries and over the years the age at first childbirth has risen. The Caesarean section rate, which was reported as 21.3% in the National Sentinel Caesarean Section Audit[267], is continuing to rise. The Maternal Mortality Rate in the 7th report was 13.1 per 100,000 maternities[5] and the Perinatal Mortality Rate 9.2 per 1000 total births[207]. The Death rate per 100,000 maternities following vaginal delivery was 48 (RR 1.0) and for caesarean section 172 (RR 3.7) [5]. Psychiatric causes of maternal death gained prominence during the last four triennia – the 5th, 6th, 7th Confidential Enquiries into Maternal Deaths[4-6] and the 8th report[7] now obtained from the Centre for Maternal and Child Enquiries (CMACE). Severe morbidity represented by 'near misses' was 12.0 per 1000 maternities for England and 3.8 per 1000 maternities with a severe morbidity to mortality ratio of 49:1 for Scotland[5] in the 7th report; in the 8th report the morbidity was reduced to 6.25 per 1000 maternities with a perinatal mortality of 52.7 per 1000 births for mothers with severe morbidity and a severe morbidity to mortality ratio of 79:1 for Scotland[7]. In the 7th CEMACH

report[6], psychiatric causes of maternal death moved to become the second most common cause of indirect maternal deaths. The 8th report[7] published this year has highlighted some of the successes over the last few years in preventing maternal deaths as the direct death rate has decreased from 6.24 per 100,000 maternities in 2003-2005 to 4.67 per 100,000 maternities in 2006-2008, but the overall mortality from caesarean births (n=116, 61%) remains double of non-instrumental vaginal delivery (n=62, 33%) and unfortunately, one caesarean fatality occurred where the indication was maternal request.

8. Final deliberations concerning the need for this study

The physical effects of postpartum incontinence, especially faecal, can be severe enough to have a detrimental but not yet quantifiable effect on postpartum psychosocial health. Similarly, postpartum dyspareunia could affect psychological, social and overall sexual health. The patient's reticence in discussing these health problems[146-150], along with the stigma[235] associated with puerperal mental disorders, would not encourage women to come forward to seek help. Lack of information and denial not only by patients but also by a proportion of healthcare personnel would cause under-reporting of these disorders. Despite continuing publications on the subject-area my critical appraisal of current publications, including reviews (vide pp 16-32) indicates the need for further research to improve our understanding of pelvic dysfunction for the prevention and earlier detection of symptoms.

It is recognised that vaginal delivery[48,100-125,162,164,172] may cause pudendal neuropathy or perineal trauma leading to incontinence. Direct muscular injury with third or fourth degree perineal tears, particularly following instrumental delivery[99,106,107,164,271-273], can result in anal sphincter incompetence and dyspareunia[130,133,144,145,183,186]. Primiparae are reportedly at higher risk[139,176,271,272]. The role of prophylactic caesarean needs definition[90,187,195-198,200].

Whilst there are advocates of elective caesarean section to prevent pelvic dysfunction[34,88] others are urging caution[89,93,95] for it would add to the already burgeoning caesarean rate; this includes a rise due to the attitude of obstetricians who would comply with maternal request caesarean[92,94] and relates to beneficience-based judgement[274]. The rise in the caesarean rate in the last two decades[268,275-282] and the associated morbidity/mortality[283,287-316,4-7], cost implications[302,303] and effects on future childbearing of those having caesarean births[287-295], cannot be discounted. The Nordic countries have now shown a considerable fall in the caesarean section rate, Canada has shown a falling trend and the rise has been stemmed in the USA[268]. However, the effect of the high caesarean rate will continue to be felt, with implications for future obstetric management[289,292,309] including trial of labour after caesarean[313] and gynaecological referrals. This gains greater significance when couples opt for more than

one child. An appraisal of the major surgical aspect of caesarean section and its possible effects both physical[287,295,309,311] and psychosocial[258,315,316] warrants further evaluation. While it is desirable that pelvic dysfunction is prevented, the place of prophylactic caesarean delivery needs further clarification not only for the personnel managing childbirth but also to help consumers make an informed choice[274] and pregnant women have started projecting their view-points regarding choice of mode[285] and randomisation[194]. Further research on the scope of pelvic dysfunction and its association with caesarean delivery would facilitate informed choice by defining any role of prophylactic caesarean.

My clinical experience and the initial sparse literature on the subject suggested that factors other than labour are also implicated in the causation of pelvic floor disorders, as incontinence, prolapse and haemorrhoids could occur in nulliparae[137-139], and in males[69]. The extent to which non-labour factors contribute to pelvic dysfunction is unclear, but would appear to be especially of relevance in mothers who are symptomatic without having delivered vaginally.

Most previous studies reflect the fragmentation of pelvic floor disorders into single symptoms, due to the trend in medicine for specialisation. However, one could deal more effectively with the presenting pelvic floor symptom if concomitant pelvic floor complaints were recognized and managed concurrently. Furthermore, both the physical and psychosocial aspects of postpartum pelvic dysfunction have not been researched jointly (vide pp 16-32), though more recent literature[69,258,259,317,318] has suggested that each is not an isolated topic and cannot be managed effectively in isolation. Despite reaching publication status and adding to our knowledge of pelvic dysfunction, the studies I have reviewed have limitations, related to their samples, such as those investigating participants attending a selective hospital clinic have reported on small caesarean samples [101,103,107], caesarean sample size [136] and type[135,161] were unreported, samples were of mixed parity[120] or included participants from different obstetric practices[85], again limits to data collection were imposed by methodologies e.g. postal surveys with fixed responses[120], sensitive information gathered from a family member representing the whole household[69], applying invasive technologies exclusive to research centres[100] or being lost to follow-up[152,164] with unplanned addition of extra patients to increase numbers following attrition[119], etc.; epidemiological studies have to compromise detail when investigating large numbers[151] whereas studies using invasive procedures usually have to recruit from those visiting clinics for treatments so the sample size is small[101]; it is widely recognised that no study is flawless. *I decided to address some of these limitations while investigating the emotional complexities of postpartum pelvic dysfunction.*

This study would investigate the severity of postpartum pelvic dysfunction in an unselected primiparous, large caesarean sample who had delivered at the same obstetric unit. In-depth medical interviews using closed and open format of questioning would be carried out at the participant's chosen venue, which would probably be their homes. It was surmised that domiciliary interviews would have to be undertaken as the sample were community dwelling primiparae and no funding was available to reimburse their visit to the hospital. This investigation would be a biopsychosocial approach to determine the obstetrical/biological predictors of pelvic floor symptoms and would evaluate its severity by categorizing the mother's perception of its severity. Taking the mother's perspective would have the potential to influence future management of these problems with a view to increasing maternal satisfaction and this was also advocated by Expert Bodies (vide page 39) and research methods relating health outcomes to patient perception[319]. Such an investigation by a practising Obstetrician and Gynaecologist had not been carried out before. *I decided to embark on this clinically important investigation of silent morbidity.*

The aim of this study to investigate the scope of pelvic dysfunction following caesarean when compared to that following non-instrumental vaginal delivery (without 3rd/4th degree tear), using a biopsychosocial approach is discussed next.

CHAPTER II

AIMS and OBJECTIVES

- To investigate any association of the different symptoms of postpartum pelvic dysfunction with obstetrical/biological factors and any inter-relationships between different pelvic floor symptoms in a sample of primiparous caesarean and vaginally delivered mothers.
- To estimate the prevalence and incidence of post-caesarean pelvic dysfunction in a large primiparous sample from a single obstetric unit. Primiparae who underwent non-instrumental vaginal delivery without sustaining a $3^{rd}/4^{th}$ degree perineal tear were to be the comparison group and they would be investigated as appropriate.
- To evaluate any association between postpartum pelvic/perineal dysfunction and psychosocial factors and estimate the severity of postpartum pelvic/perineal dysfunction objectively, and by measuring the maternal perception of its psychosocial impact.
- To assess maternal help-seeking behaviour following different modes of delivery as an indirect indicator of the severity of postpartum pelvic/perineal dysfunction.
- To investigate how women with postpartum pelvic dysfunction can be identified and offered appropriate care.

STRATEGY to ACHIEVE AIMS and OBJECTIVES

1) Collect the data from primiparae at ten months postpartum following the literature review.

2) Estimate the association of obstetrical/biological factors on postpartum stress incontinence, anal incontinence, sexual pelvic floor problems and haemorrhoids, using simple summary statistics and regression modelling.

3) Compare the prevalence and incidence of pelvic dysfunction in the different delivery groups within the data collected, and determine the prevalence of perineal trauma in the vaginally delivered mothers.

4) Explore the severity of postpartum pelvic/perineal dysfunction including its relationship with psychosocial factors by developing a tool to categorize maternal perception of psychosocial impairment, and by applying multivariable regression analyses, univariate analyses, and simple summary statistics.

5) Analyse maternal help-seeking behaviour through simple summary statistics.

6) Identify factors that predict postpartum pelvic dysfunction in order to improve detection and aid the future development of appropriate preventive/curative measures.

Following the data collection, the planned analyses expressed in actions 2 and 3 would be suitable for investigating the first two aims and objectives. These would provide the biological predictors of pelvic dysfunction in relation to this sample and define any causal links.

Investigations laid out in actions 4, 5 and 6 would satisfy the other three aims and objectives. These actions would investigate any relationships between maternal pelvic dysfunction and psychosocial variables and serve two purposes. Firstly, the assessment of the severity using the mother's perception of the interference with her psychosocial functioning would give a more complete picture of the scope of the problem and its relation to morbidity according to the mode of delivery. Secondly, any psychosocial associations identified in this manner could be developed as a screening tool for physical disorders. Screening for postpartum psychological morbidity is in place and developing this instrument to simultaneously predict pelvic dysfunction would improve detection of these disorders, as most sufferers do not come forward to seek help. Similarly, any association of perineal trauma with psychosocial disruption would be evaluated to assess the perceived severity. Help-seeking behaviour, although related to the severity of the physical morbidity, can also be modified by the maternal perception of severity; hence, developing a measure to quantify the mother's perception of the psychosocial impairment would be a significant component of this study. This could influence future planning of support services. The investigation on the psychosocial impact would be mainly exploratory, as investigation in this manner had not been carried out before. Interpretation would have to be tentative; future research would investigate further any significant associations or unusual results.

A diagram (Fig. xiii, fp 44) outlines my strategy to reach the above aims and objectives.

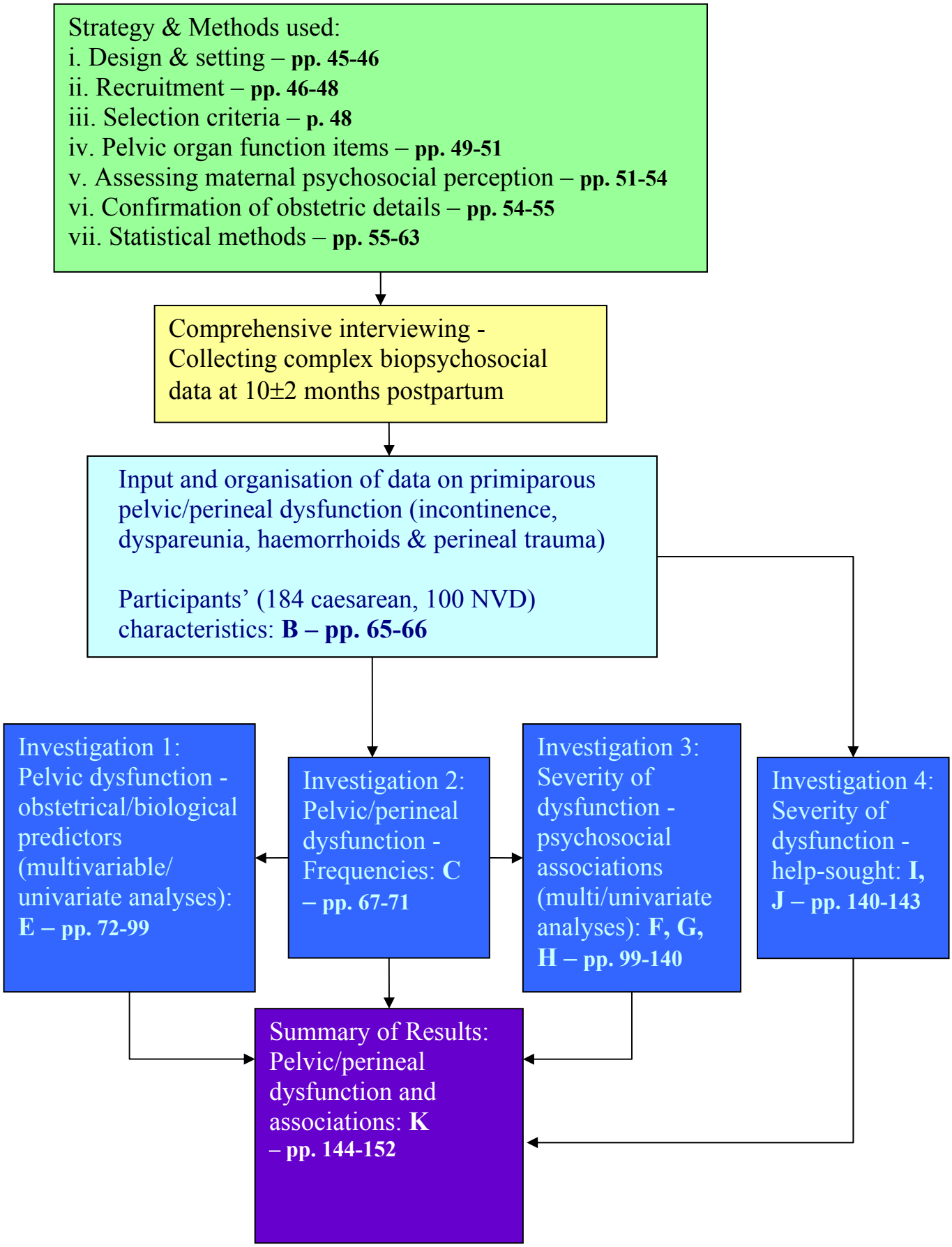


Fig. xiii **Outline of strategy to achieve aims and objectives**

CHAPTER III
METHODS

This study investigates pelvic dysfunction, which includes stress incontinence, anal (flatal & faecal) incontinence, dyspareunia and haemorrhoids, following caesarean delivery. Mothers who delivered normally (NVD) without sustaining a 3rd or 4th degree tear, served as a comparison group. It focuses on the mother's perception of her well being in order to understand the meaning of her symptoms, which would add to our current knowledge of delivering consumer oriented care. The study received Ethical Approval from the Dudley Ethics Committee and all participants took part voluntarily after giving written informed consent (Appendix B).

1. DESIGN

This was a one-shot observational study where primiparae were interviewed at home at their request. The interviewing carried out in the familiarity of one's home surroundings, used a structured format and the pattern followed was an adaptation of the standardized medical interview. The questions had a closed and open format and part of the questioning was based on a validated questionnaire[320]. The investigative technique for collecting and organizing data for this study represents innovative methodology carried out by a specialist practising Obstetrician and Gynaecologist, who followed an extension of medical interviewing suitable for sensitive topics; this was not only appropriate but also essential to investigate this under-researched subject area. Childbearing and the postnatal period are associated with complex physical and emotional changes in each mother and postal surveys or a closed format would not have revealed each individual's perception of the extent of psychosocial morbidity[321-325] associated with each pelvic floor symptom. A few mothers requested additional explanations to help them understand the meaning of questions associated with bowel (urgency and urge incontinence) or sexual (dyspareunia) symptoms. Face-to-face interviewing enabled to clarify these and thereby enhance the accuracy of responses besides allowing the interviewer to gain their trust by assuring confidentiality and reinforcing the anonymity of data reporting.

2. PARTICIPANTS' HOME & HOSPITAL ENVIRONS

2.1 Setting

Participants were drawn from the computerised database of the Dudley Group of Hospitals NHS Trust. The catchment area of the Dudley Group of Hospitals includes the Dudley Borough (population 300,000) and some from the neighbouring districts: Wolverhampton, Sandwell and Hereford & Worcester. The population live in both urban and rural areas, with

4.5% being ethnic minorities and the rest Caucasian (1991 Census)[326]. All participants had delivered at Wordsley Hospital, Dudley Group NHS Trust.

2.2 Relevant obstetrical statistics and practice

Data was collected from September 1998 to February 2000 regarding primiparae who had delivered during an eighteen month period (April 1997-September 1998). At the time Wordsley Hospital dealt with approximately 4000 deliveries annually. Midwives managed normal labour and delivery. Obstetricians carried out instrumental and caesarean births. Although mothers were given the option of adopting alternative positions in labour, the recumbent position was usually preferred. As a routine, a midwife attended the labour and the woman's partner remained with her. Information on labour and delivery was recorded contemporaneously with note-keeping including, labour ward partograms (Appendix D). The primigravid population constituted 32% of the deliveries; their total caesarean section rate was 13% with an elective caesarean rate of 5%. The instrumental delivery rate was 7.5%, 33% had episiotomies, 15% second degree tears and 0·6% third degree tears. Where indicated, the perineal trauma sustained was repaired using polyglycolic acid (Vicryl) suture material. All episiotomies were mediolateral. Perineal tears were recorded on the birth record by the attending doctor (registrar/consultant) or experienced midwife and categorized according to standard classification (vide Chapter 1, page 3).

3. PROCEDURES for:

3.1 Inviting participants

Letters were mailed to general practitioners of the region informing them about the study and to enquire as to whether they had objection to any of their patients taking part in the study. Nine months after delivery primiparae were sent letters inviting them to take part and informing them about the phone discussion that was to follow. All participants took part voluntarily and on phoning, their willingness to take part was confirmed. If interested, further discussion on the phone involved checking whether they met the inclusion criteria, explaining what participating in the study would involve, an appointment made for a home interview and the option given to opt out at any stage, if they changed their mind. Women, who preferred to be seen at Wordsley Hospital (Dudley Group, NHS Trust) for reasons such as, being closer to their place of work, were appointed to a bi-weekly clinic run for the study. These primiparae were believed to be in a stable phase of their postpartum physical and psychosocial recovery, so no or little ill-health was envisaged and only one encounter was considered adequate for the purposes of this investigation. The interview was the first time that the participant met the

interviewer (myself). The interviewer was not involved with the care of the participants; hence, any deterrent to responding accurately due to insider apprehension would have been minimised and more open responses would have been forthcoming.

A list of participants for each week was drawn and categorised into groups taking into account the area of residence and the time slots for the visits each day. When planning a visit to a certain area, an attempt was made to arrange visits so that the residential addresses belonged to the same or adjacent postal codes. However, this was successful only 50% of the time and often large distances had to be covered in a day. Calculating the mileage and approximate time needed to travel from one residence to another was essential to maintain punctuality and planning alterations, if there were any cancellations. Visiting socio-economically deprived and affluent areas on the same day involved attention to details of appearance, so that what was acceptable to one group did not alienate others. Very sensitive issues were being investigated and the time limited, so an early rapport which broke down any communication barriers was essential.

On the average, five phone calls were needed to arrange an interview, the first giving information, usually a second for confirming the appointment after she had discussed it with her partner, the third to remind her nearer the time, sometimes a fourth when on the road and a fifth if the woman did not respond to the doorbell. Occasionally, re-appointments for cancellations had to be made and the routine for arranging the meeting had to be repeated. The mother-baby unit was accepted as one and an extra waiting time for participants of not more than 10 minutes was promised when scheduling the visits. Usually, cancellations were because of baby problems (especially in the winter), sometimes due to unexpected commitments and rarely, because the mother had forgotten about her appointment.

The waiting time from the phone discussion to the interview was about three weeks. A list of participants who would accept an appointment at short notice was kept, to try to fill in vacant slots created by last minute cancellations. If participants cancelled appointments repeatedly, they were given the option of having their names taken off the appointments' list, but this only happened twice. One participant was a temporary worker with erratic job commitments and another had bereavement; but even they did not want to cancel until repeatedly given the option. One participant, a senior official transferred to Oxford, came during a short holiday to Dudley to participate in the study.

In order to give a wider choice to the participants, interviews were carried out on all days other than Sundays. Road markings and house numberings could be disorderly and unclear in the dark, so after the initial two weeks, interviews were carried out during daylight hours. This

shifted many appointments to weekends/holidays, as women (mainly vaginally delivered) who had gone back to full time work came home late.

Based on the evidence available at the time a power calculation would be a crude estimate at best. Furthermore, no study had investigated these pelvic floor symptoms in a similar sample. As all previous studies relating to incontinence or dyspareunia had small caesarean samples, the attempt to get sufficient caesarean (elective) participants from a single Obstetric unit meant that the recruitment period had to be wide. Yet, to ensure that the group of mothers under study did not become pregnant for a second time or obstetric practice did not change significantly, recruitment constraints were imposed. These concerns were reflected in the decision to limit this study to a definitive period to enable recruitment of a large primiparous elective caesarean sample.

3.2 Selecting participants

The details of participants obtained from the hospital's database were name, address, and telephone number, date of birth and date of delivery. Going by the maternity statistics during the eighteen month recruitment period approximately 96 primiparae would have delivered by elective caesarean, so the intention was to recruit the maximum number who underwent this mode of delivery during that period. Consecutive mothers delivered by caesarean were selected first. Consecutive vaginally delivered mothers who delivered on the same date, were of the same parity and lived in the same area of residence were selected next, which as well as convenience resulted in a fairly homogeneous group of mothers. Knowledge of names/ancestry helped predict ethnicity and cultural practices, and familiarity with these, facilitated early rapport at interviews.

The inclusion and exclusion criteria are shown in Table 1.

Inclusion criteria	Exclusion criteria
Primiparous with live birth	Pregnant
Singleton with cephalic presentation (NVD only)	Urinary/bowel diversion
English speaking	Having a neurological problem
Residing in catchment area or could be seen there	Previous urinary tract or anorectal surgery
	Serious medical disorder
	Serious psychiatric disorder
	Major operation following delivery
	For NVD only - 3rd & 4th degree tears

Table 1. Selection criteria

3.3 Interviewing participants

Participants were interviewed on average 10 months (SD ±2)[†] months after delivery. The comprehensive interview lasted from one to two hours with a longer period usually needed for mothers who had problems. A detailed plan of questioning (Appendix C) was set up to ensure similarity in the data collected at interview. Questions were about events at delivery and the puerperium, psychosocial, bowel, bladder and sexual functioning, along with other relevant medical history (including medication). Questions from a related validated questionnaire[320] were used as a script for enquiring about pelvic dysfunction and when questioning about the effect of these symptoms on psychosocial health. Both structured and open-ended questions were used, which were supported by a semi-structured format in order to obtain similar information from all participants. While the questioning aimed to investigate the postpartum period and focused on the mother's current complaints, pertinent questions about pregnancy and pre-pregnancy functioning were also included. Pre-delivery prevalence would help in estimating the postpartum incidence of incontinence, thus making it possible to assess associations with postpartum symptoms. The interview was piloted on twenty-two mothers who had been seen in the first two weeks of commencing the interviewing and minor alterations to the wording and layout of the interview script were carried out.

3.4 Pelvic organ function items

Questions about the delivery experience addressed the mode of delivery i.e. caesarean (emergency or elective) or NVD, analgesia used and pertinent communication with medical and midwifery staff. Questions relevant to vaginal delivery were about the onset of labour, whether spontaneous, the duration of the first and second stages along with active pushing, whether episiotomy was given or there were perineal lacerations, and whether any suturing was required. Enquiries were also made about problems with wound healing, such as haematoma, infection, pain relief and advice sought from health personnel for these problems. (Appendix C).

a) Bladder functioning: The questions related to urinary function were about frequency, nocturia, urgency, inability to empty the bladder, stress incontinence, passive incontinence and previous history of urinary disorders along with any treatment. Stress incontinence was the urinary pelvic floor symptom selected to represent bladder dysfunction for this study.

b) Bowel functioning: Specific questions about defecatory symptoms pertained to bowel habits, laxative use, consistency of stools, urgency, flatal incontinence, urge and passive incontinence, soiling, pad use, haemorrhoids and irritable bowel syndrome. Anal incontinence,

[†] where an average is given ± SD it refers to the mean

which comprised flatal and faecal incontinence (urgency, urge and passive incontinence, soiling, pad use), was the main bowel pelvic floor symptom evaluated. Haemorrhoids as a postpartum pelvic floor symptom were also evaluated.

Further questioning was intended to gather data for assessing the severity of the physical symptoms on the sufferer by asking about perineal protection and also their impact on her psychosocial health. If there was stress or faecal incontinence, did the mother need any perineal protection, what was the type of protection used and for how long? Questions were asked about its effect on her composure and mood as well as the impact on her personal and social life, childcare and relationship with her partner. Did the participant seek advice from health-care personnel, what advice was given, would further assessment be needed and what did she think caused her problem?

c) Sexual functioning: Towards the end of the interview, sexual health was targeted with structured and open-ended questioning. Questions were about the postpartum interval to first intercourse[327-330], dyspareunia, frequency of intercourse, sexual drive, and tiredness or change of lifestyle, which affected her sexual performance. Questions on sexual satisfaction were asked, though there was no direct questioning about orgasm. Was advice sought for sexual problems and what was the advice given? When replying to the questions, she was asked to compare her postpartum sexual performance with that prior to pregnancy. What constitutes normal sexual behaviour during pregnancy cannot be clearly defined and this aspect was not investigated. Participants were also questioned about the mode and any effect on infant feeding, menstrual history and contraception.

Postpartum dyspareunia was the sexual pelvic floor problem complained of by these mothers. It affected sexual functioning and impacted on psychological well-being and the relationship with her partner. However, sexual health is complex with interactions between the physiological and psychological (affective and cognitive) parts of the individual and dysfunction presenting as dyspareunia could involve any aspect (vide Chapter 1, pages 14-15) and impact on psychosocial health. Robson et al[330] had reported that the postpartum reduction of frequency of intercourse in relation to the subject's own pre-pregnancy baseline was a more sensitive measure of postpartum sexual ill-health than dyspareunia alone, as the former directly reflected the effect of other postpartum sexual symptoms due to the presence of the baby, changes in the partner and tiredness. This seemed a reasonable way of assessing the complex aetiology of postpartum sexual functioning as it took into account both the physical and psychosocial aspects. Hence, this method of assessment was applied to this study as it appeared that dyspareunia sometimes affected maternal psychosocial functioning of its own

accord but at other times affected her general sexual health, which in turn caused psychosocial morbidity.

Data obtained from the sexual health questioning which included sexual drive, frequency of intercourse, dyspareunia and satisfaction were analysed as 'general sexual health (GSH)'. A scoring system from 0-4 was introduced with scores 1-4 representing relationship with a partner and 0 in the absence of a partner. Scores 0 and 1 were considered as within normal limits of sexual functioning whereas 2-4 represented an increasing severity of sexual dissatisfaction, as follows:

0 – No partner or sexual relationship - satisfied with the situation

1 – Satisfied with sexual behaviour

2 – Reduced frequency than that prior to pregnancy because of tiredness or change in lifestyle

3 – Reduced frequency along with one or more symptoms, such as dyspareunia, reduced libido or abdominal wound pain at intercourse

4 – Never had intercourse after delivery or very infrequent intercourse (<6 times postpartum)

The last two categories (3 & 4) suggesting severe symptoms were combined as a group and analysed as severely impaired general sexual health (severe GSH). The postpartum prevalence of impaired GSH was evaluated along with its association with stress and anal incontinence. There was a possibility of vaginismus masquerading as dyspareunia in the last category (4), but as physical examination was not incorporated into the methodology this additional method could not be used for establishing or refuting the diagnosis. In addition, physical examination is invasive and nevertheless, may not have given a definitive diagnosis at this first time encounter due to the complexity of sexual perception (vide Chapter 1, pages 14-15).

3.5 Psychosocial function items

The psychosocial assessment tools developed as part of this study for quantifying the mother's perception of her psychosocial impairment due to pelvic/perineal dysfunction would grade psychological symptoms according to perceived maternal severity. This would add to any objective measures for evaluating the severity of the dysfunction. It would also have the advantage of allowing comparison with the quantitative data from the assessment of physical manifestations.

a) Psychological functioning: Postpartum psychological health was investigated by open ended and semi-structured questioning. The flow chart Fig. xiv (fp 51) depicts the pathway for semi-structured questioning which aided collection of similar aspects of information from

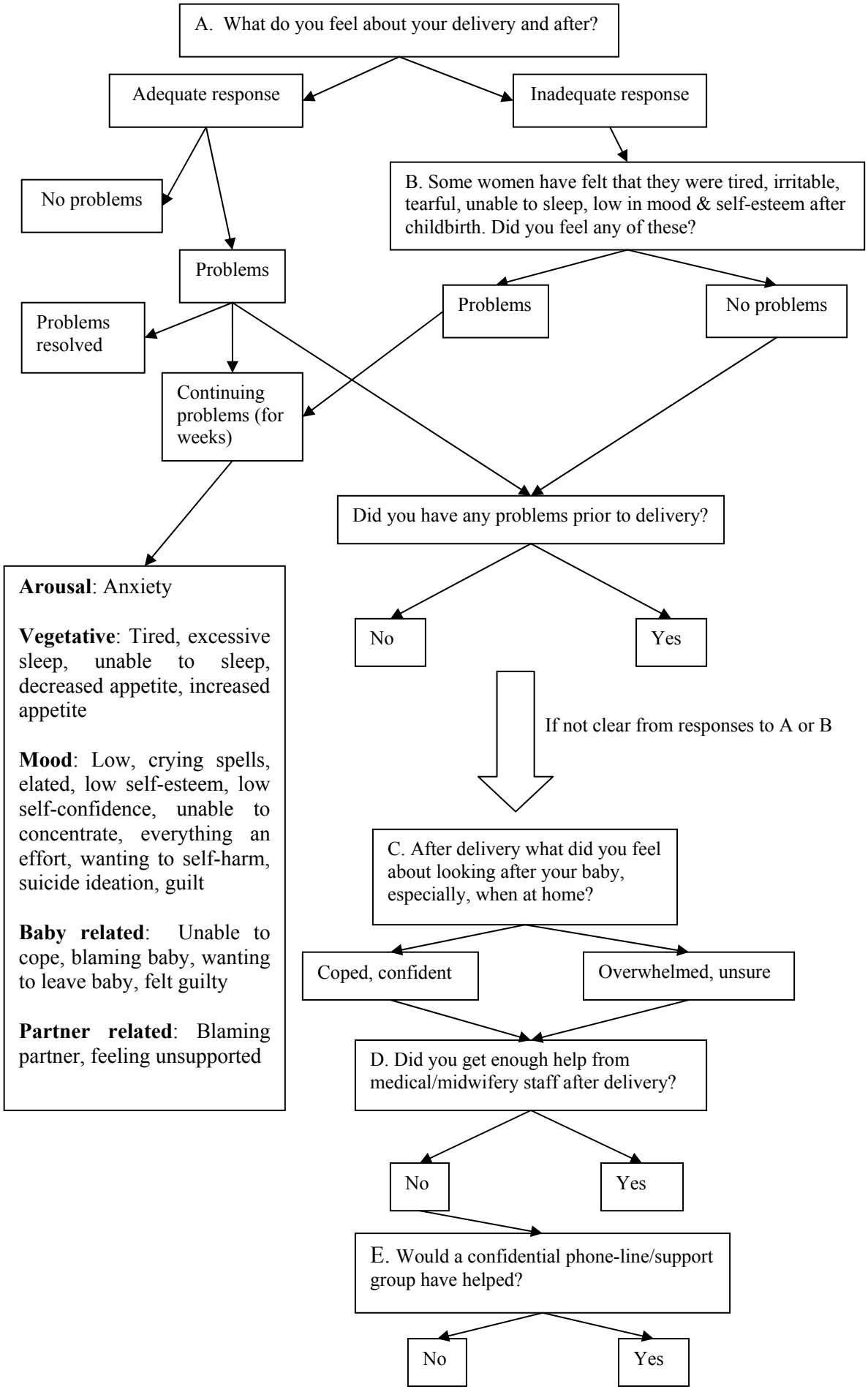


Fig. xiv Pathway for semi-structured questioning (psychological health)

participants, particularly when the maternal response to open questioning did not provide all the information needed for assessment; this generated uniformity in the responses collected.

The rich data gathered from the psychological questioning was analysed, with a view to detecting recurrent problems. It was then converted to a quantitative format so that this could be directly associated with other quantitative data obtained from estimating pelvic/perineal symptoms. The information from each mother regarding her feelings about her childbirth and postnatal period were examined in detail. Dysphoric symptoms were most prevalent. The data was cleaned and separated from the rest of the mother's complaints and classified as different categories of dysphoric symptoms. The categories of dysphoric symptoms which were represented were: vegetative symptoms (lack of energy, sleep disturbances, appetite loss or gain), arousal symptoms (anxiety) and mood symptoms (sad mood, reduced self-esteem, guilt, loss of interest, suicidal ideation). They were then converted to a scoring system with severity from 0-4 along with low subjective mood (adaptation of Campbell et al)[224], as follows:

0 – Well with no dysphoric symptoms

1 – With one dysphoric symptom

2 – With two dysphoric symptoms

3 – With three or more dysphoric symptoms. A probable psychiatric disorder still unrecognised was also given this score

4 – Diagnosed as a psychiatric disorder by medical personnel

The quantification of psychological symptoms from the participants' responses and their categorisation into levels of severity after scoring would correspond to the natural cluster of symptoms synonymous with mild to moderate depression and the pre-morbid state. Score 0 was considered as normal and 1-4 as gradually increasing severity of dysphoria. Scores 3 and 4 were categorized as severe dysphoria and this category of sufferers would include those with minor (low mood and three dysphoric symptoms) to major (low mood and ≥5 dysphoric symptoms) degrees[224] of depression. This would be in agreement with the suggestion of the National Screening Committee to use levels of dysphoria as an alternative to the EPDS when screening for depression (vide Chapter 1, pages 34-35).

The association of stress incontinence, anal incontinence, dyspareunia and haemorrhoids with dysphoric symptoms was to be analysed for all participants and then subgrouped according to the delivery mode.

b) Social functioning: Within the usual scheme of things, social functioning following the first delivery relates to the responsibilities of the woman's new role as a mother (vide Chapter

1, pages 36-37) and her relationship with her infant and her partner. In addition her maternal role would include her ability to resume previous activities associated with domestic work, social networking, leisure activities, employment (if she chooses to) and relationship with her partner at an appropriate post-delivery interval which is considered as being within a normal range[327,330-332] and is deemed to represent a satisfactory maternal transition[210,211]. Hence, in this study postpartum social health was explored mainly by structured questions, though an open-ended question was asked about her relationship with her partner. Social health questions were about her occupation, the postpartum interval to starting housework, leisure activities, social networking, resuming employment and the relationship with her partner. The interference of stress incontinence, anal incontinence, dyspareunia and haemorrhoids on childcare and social health was assessed for all participants and then according to the mode of delivery.

Responses to the above social health questions were scored and placed in an order from normal to an increasing severity of impairment (1-4). These were categorised into time intervals from delivery, which roughly corresponded to the average time scales when any abnormal physical functioning is known to revert to normalcy[327,331,332]. Category 1 was considered normal and 2, 3 and 4 impaired social health. However, when considering the category 'back to employment', only 3 and 4 were considered as being of significant social impairment as resuming employment would be affected by the mode of feeding the baby (distinction between bottle and breast-feeding mothers) with perhaps category 4 being of more relevance to those breast feeding. It was presumed that having to be physically present for breast-feeding would discourage these mothers from resuming employment, unlike the others who could delegate feeding the baby to others. Women who voluntarily opted not to go back to work were considered to have no impairment with regards to employment. Scoring was as follows:

1 – within 12 weeks – normal range

2 – 13-24 weeks – mild impairment of social health

3 – 25-36 weeks – moderate impairment of social health

4 – 37 weeks and above – severe impairment of social health

Additional evaluation of her social functioning was gauged by assessing her relationship with her partner, child, other family members, friends and healthcare personnel with whom she interacted in her new maternal role.

Further observations of psychosocial impact of pelvic/perineal dysfunction: During the interviewing, when women expressed their perception of well-being or of suffering due to the postpartum pelvic/perineal dysfunction, sometimes their body language corresponded with the positive or negative emotions expressed. A few sample descriptions illustrating the complexity of the individual's perception of health or morbidity and help-seeking behaviour, when there were concomitant morbidities, have been presented in the Results section (vide Chapter IV, page 140-142), for perception was personal and not necessarily in agreement with what a health professional would think about the clinical severity of a symptom.

3.6 Confirmation of the obstetric details

After the interviews, the obstetric details were confirmed from the handwritten, hospital obstetric records, including partograms and relevant medical (obstetrician's, anaesthetist's, paediatrician's) and midwifery notes. Occasionally, neonatal details had to be confirmed from computerised data in the neonatal unit. Confirmation of the mode of delivery was triangulated having first been obtained from the hospital's computerised database, then from the participants' responses and finally from the handwritten medical records. After re-confirming the identity from the hospital number, name, address, date of birth and the date of delivery with obstetric details, this information was transferred to a form for consistency. These obstetric details were:

I. Gestational age

II. Neonatal details – baby-weight and head circumference

III. Type of delivery – caesarean or vaginal

A. If caesarean

1. Type of caesarean

2. Indications for caesarean

3. Cervical dilation

4. Station of the presenting part (emergency caesarean only)

5. Type of anaesthesia

B. If NVD

1. Presentation and position of the baby

2. Onset of labour – spontaneous or induced

3. Indication for the induction of labour

4. Duration of labour – first and second stages and active pushing

5. Perineal trauma – episiotomy and/or tears

6. Type of analgesia

7. Induction of labour (IOL) for both NVD and emergency caesarean

Finally, all the information obtained was transferred to a dedicated database (Microsoft Excel). Because of the nature of this study when recruits were young primiparae seen well after the conventional postpartum assessment period, symptomatology was considered adequate to diagnose pelvic/perineal dysfunction. In the relevant care pathway of the hospital, urodynamic testing/videocystourethrography are used as a second line investigation after symptomatic diagnosis of urinary complaints and referrals are usually made after re-assessment, following a course of physiotherapy. Anorectal physiological tests and endosonography are not available on site and the clinical significance of invasive investigations remains contentious[333,334] with reports usually published from academic research centres.

4. STATISTICAL TESTS CARRIED OUT

All statistical analyses were initially carried out using SPSS 12.0.0 for Windows which was the current version at the original time of analysis. As the University stopped supporting the earlier versions of SPSS, SPSS 15.0.1 for Windows was used in evaluating the severity of pelvic/perineal dysfunction by investigating its impact on independent psychosocial variables. This created a technical problem as one of the functions of the older version, related to being able to assess associations with various levels of a chosen variable in a single model, was withdrawn in the newer version; only binary interaction was possible. This would have required several levels of each variable and entail many models being added to the existing numbers which would be cumbersome. To avoid an unwieldy thesis, variables with several levels were collapsed to one level to enable binary assessment, such as whether a psychosocial symptom was present or not. The psychosocial variable was used as a dependent variable, so various levels could not be assessed in a single model; this is illustrated (vide Chapter IV, pages 99-100) in relation to dysphoria as this psychological symptom is a continuum with various levels and detailed assessment would mean assessing each level.

The scale of the study was large and it was anticipated that this approach of comprehensive interviewing at home to evaluate the associations between the pelvic/perineal dysfunction and psychosocial items would generate a substantial amount of data. The data collected was to be subjected to a searching analysis[335-339] in order to define any previously suggested associations

of pelvic dysfunction with obstetrical variables in this predominantly caesarean sample. Limited exploration of unknown associations[337] was to be carried out particularly in relation to psychosocial severity. This would help fulfil the aims of this study and direct further research.

Participants' characteristics have been defined using counts and percentages for categorical variables, and mean ± standard deviation for continuous variables where the data is normally distributed. Categorical variables have been assessed for homogeneity using χ^2 test or Fisher's Exact test (where more than 20% of cells have a count of less than 5). Tests for normality have been performed on the data in order to appropriately choose whether parametric or non-parametric tests should be carried out. Normally distributed continuous variables in independent groups have been compared using independent *t* tests or ANOVA where appropriate. Median and interquartile range have been used to define patient characteristics for non-normally distributed data and the Kruskal-Wallis test has been used to compare three or more independent groups of such a sample. A two-sided test of significance has been used with a *p* value of 0.05 or less considered as statistically significant. McNemar's test has been used to assess if there was a significant shift in the symptomatic sample from prior to delivery when compared to that during the postpartum period.

Inferential analysis has been carried out to control for confounding in assessing any association between a pelvic floor symptom and an independent variable. Multivariable analysis was the form of inferential analysis applied to the data set to investigate associations between a pelvic floor symptom and independent variables selected from factors considered as being of significance in previous reports on pelvic dysfunction in vaginally delivered samples; also similarly analysed were associations of the symptom with obstetrical/biological factors where there was a paucity of previous research but a biological plausibility of an association existed, which additionally made clinical sense. Univariate analysis has been carried out to examine associations between a pelvic floor symptom and an obstetrical/biological variable depicted in the multivariable model or those not depicted in the model but clinically pertinent.

Multivariable analysis has been carried out using logistic regression modelling[338,340]. Backward elimination stepwise logistic regression modelling was used for this purpose. In this all variables are entered into the model and at each step, model variables are evaluated for entry or removal with the conditional statistic. The conditional statistic is based on the difference in the likelihood for each model. Models have been chosen to optimise sensitivity and specificity rather than just those with only statistically significant variables. These models are indicative and not perfect models, and the selection of steps has been influenced by whether or not they made clinical sense; hence, combinations of similar variables of clinical interest have been entered. The development of a regression model to control the simultaneous

effects of uncontrolled confounding factors and its presentation has been guided by discussions on modelling techniques and presentations of models[338,340-341]. The sensitivity and specificity of the selected step in the modelling process has been taken into account in the selection of the most suitable model. Sensitivity and specificity have been calculated using the SPSS default setting for the cut-off of 0.5. Tests to assess the goodness of fit and estimated shrinkage have been carried out to check if there had been any overfitting of models[340] with a cut-off of 0.85 being applied to the expected shrinkage as an indication of overfitting. Clinical judgement and further information on the associations have been used in interpreting associations. The modelling process by incorporating the effect of confounding factors has helped in the selection of variables with specific associations on which the final discussions and conclusions could be based. Where there is significance of an independent variable (index factor) at the univariate level but not at the multivariable level, further analysis (2x2 or 2x3 or 2x4 contingency table) has been carried out to find out any significant association with the factor presented in the multivariable model; a significant result in this second analysis would indicate that the significant factor in the multivariable model was highly associated with the index factor and this correlation has been depicted as a χ^2 test; where significance was reached in the second analysis the index factor did not display significance in the multivariable model.

A similar sequence of multivariable and univariate analysis (as above) has been carried out in evaluating the level of severity of the pelvic/perineal symptoms by assessing the significance of any associations with psychosocial symptoms. Multivariable models for the inferential analysis have been limited by the sample size and undergone similar tests to prevent overfitting. Further analysis has been carried out to find out why a significant result in the univariate analysis has not reached significance in the multivariable analysis.

Results of the limited univariate analyses of those variables, which had not been previously reported as having associations with pelvic floor symptoms (e.g. GSH) or of simple summary statistics applied to examine associations with those variables which could not be subjected to multivariable analyses because of small frequencies (e.g. new anal incontinence), have been presented. The impact of perineal trauma on psychosocial health has been described and undergone limited statistical evaluation in the multivariable and univariate analyses.

Limitations to an accurate prognostic model building for this study: Although the strategy for selecting factors for accurate model building suggested by Harrell et al[340], which states that "Early detection of those being predictive or of being measured reliably would result in models with less over-fitting" has been applied to this data set, there were certain limitations to model building. It was not possible to complete an accurate prognostic model that included all the outcome and independent variables selected because, even though causality was

suggested by previous research for certain associated obstetrical/biological factors, confirmation of these associations in this large predominantly post-caesarean sample with NVD participants who sustained lesser degrees of perineal trauma, was required. The relationship of pelvic dysfunction with the psychosocial factors in such a sample was unknown and one could not be certain at this first time evaluation. Hence, a proportion of the analyses would be exploratory. The proposed plan for the statistical analyses is discussed below.

5. THE TENTATIVE PLAN FOR THE STATISTICAL ANALYSES

A tentative plan for statistical analyses was laid down prior to data collection. As the selection of statistical tests to be applied would be determined by the sample characteristics and the frequencies of the various symptoms of pelvic/perineal dysfunction, a slight modification of this plan after the frequencies were known was permissible.

As part of the investigation, the prepartum and postpartum prevalence of stress incontinence and anal incontinence, and the postpartum prevalence of dyspareunia and haemorrhoids were to be determined. This would involve estimating the frequencies of postpartum stress incontinence, new stress incontinence, postpartum anal incontinence, new anal incontinence, sexual pelvic floor problem and haemorrhoids. The prevalence of stress incontinence during pregnancy, stress incontinence before pregnancy, anal incontinence during pregnancy and anal incontinence before pregnancy would help determine the postpartum incidence of incontinence. Once the estimated frequencies in this sample seen well after the conventional postpartum assessment period were established, appropriate statistical tests would be applied (e.g. multivariable and univariate analysis). Whether there was an association between pelvic dysfunction and selected obstetrical/biological factors and any impact on psychosocial health would be investigated for all the symptoms of pelvic/perineal dysfunction. The statistical plan is discussed below using postpartum stress incontinence as the symptom of interest.

i) Association of postpartum stress incontinence with obstetrical/biological predictors

An investigation of a possible association between obstetrical/biological factors with postpartum stress incontinence was planned. There was evidence from publications[107,121-124,135] that suggested associations of variables, such as age, baby weight and duration of labour with stress incontinence in vaginally delivered samples. The possible associations of each symptom of post-caesarean pelvic dysfunction with these variables were to be assessed using multivariable analysis. Other variables would also be included in the multivariable analysis which previous limited research and clinical experience had suggested exists but further research had not pursued this; such associations were with modes of analgesia, induction of

labour, cervical dilation, wound problems, anal incontinence, dyspareunia, breast-feeding and onset of menstruation. There was little evidence[121] of a transient association between epidural analgesia and postpartum stress incontinence following vaginal delivery whilst there was a biological plausibility of an association between the other variables and postpartum stress incontinence. These associations could be plausible in this predominantly caesarean (both elective and emergency) sample. However, breast-feeding and menstruation were excluded as too many confounding variables would have been introduced by their inclusion and, additionally, there was a risk of overfitting the model. This would be followed by univariate analysis to evaluate associations of postpartum stress incontinence with obstetrical/biological factors. Both multivariable and univariate analyses would be carried out for the all participant group and subgrouped as modes of delivery. The logistic regression modelling would evaluate any associations of these obstetrical/biological factors with postpartum stress incontinence. This is depicted in Table 2.

Dependent variable	**Independent variables (obstetrical/biological factors)**
Postpartum stress incontinence	Age
	Mode of delivery (MOD)
	All modes of analgesia
	Birth weight
	Head circumference
	Wound problems
	H/o stress incontinence
	Anal incontinence
	Dyspareunia

Table 2. Postpartum stress incontinence & probable obstetrical/biological predictors

The display of the logistic regression modelling: The results of logistic regression for obstetrical/biological predictors would be presented in a tabular form which would give the detailed statistics for the logistic regression in the step selected. As mentioned above (vide page 56) although all factors would be entered in the initial model, only the independent variables selected in the parsimonious step, as part of the modelling process, would be displayed. This format would be adapted to all the logistic regression models for each pelvic floor symptom presented. The tabular depiction of the univariate analysis would follow next.

ii) Assessing the severity of postpartum stress incontinence – identifying factors associated with the severity of pelvic dysfunction using statistical analyses

Severity would be assessed statistically by searching for any relationship of psychological ill-health and impaired social health with pelvic/perineal symptoms and obstetric/biological

factors. At first logistic regression analysis would be carried out to find out if there was any association of psychological symptoms and social ill-health represented by delayed postpartum resumption and interference with leisure activities, social networking, employment and sexual relationship with pelvic/perineal symptoms in the presence of pertinent obstetric/biological variables. The variables to be investigated are represented in Table 3:

Dependent variable	**Independent variables (pelvic/perineal symptom/obstetric variables)**
Psychosocial variable	Postpartum stress incontinence
	Postpartum anal incontinence
	Dyspareunia
	New stress incontinence
	Mode of delivery
	Wound problems

Table 3. Psychosocial variable and pelvic/perineal/obstetric variable

The parsimonious step selected in the modelling process for investigating psychosocial associations would be displayed in tabular form.

Further exploratory analyses would be carried out in keeping with the principle that "if a factor is truly unknown at baseline, that factor would not be necessarily related to another exposure and bias would not be introduced when assessing an exposure/outcome association"[343]. To determine any association of postpartum stress incontinence with sexual problems including dyspareunia, which formed part of the mother's sexual relationship with her partner (GSH), univariate analyses were to be carried out. All significant associations would be depicted in tabular form.

iii) Assessing the severity of postpartum stress incontinence using simple summary statistics and help seeking behaviour

Severity of incontinence would also be assessed by the type and duration of perineal protection needed and by simple summary statistics to evaluate symptom related disruption of the mother's relationship with her partner and with her child, and any help-seeking behaviour.

iv) Identifying factors to improve detection of postpartum stress incontinence

Finally, the results from the logistic regression modelling were to be evaluated to identify factors that could improve detection of postpartum stress incontinence and this would have implications for the future development of preventive/curative strategies. The general analysis plan for each pelvic floor symptom would follow that used for postpartum stress incontinence and would undergo slight modifications as and when necessary.

6. THE PLAN FOR THE STATISTICAL ANALYSES

The statistical plan was modified slightly for each subgroup according to the specific characteristics of the mode of delivery and the pelvic floor symptom being studied. The model for obstetrical/biological predictors for the emergency caesarean mothers would include cervical dilation and induction of labour and for vaginally delivered mothers include the duration of labour. The models for dyspareunia would not have prepartum dyspareunia which had not been addressed.

Table 4 (next page) depicts the independent variables with their parameters.

Independent variable	Name used in the Table	Number of parameters	Original level for classifying variables
Age	Age	1	
Mode of delivery	NVD, El CS, Em CS,	2	0, 1, 2
Analgesia	Nothing, Entonox, pethidine, spinal, epidural, general anaesthetic	4	0, 1,2,3,4,5
Birth weight	Birth weight	1	
Head circumference	Head circumference	1	
Wound problems	Wound problems	1	0,1
Postpartum stress incontinence	Postpartum SI	1	0,1
Stress incontinence during pregnancy	SI during pregnancy	1	0,1
Stress incontinence before pregnancy	Pre-pregnancy SI	1	0,1
Postpartum anal incontinence	Postpartum AI	1	0,1
Anal incontinence during pregnancy	AI during pregnancy	1	0,1
Anal incontinence before pregnancy	Pre-pregnancy AI	1	0,1
Dyspareunia	Dyspareunia	1	0,1
Duration of labour	Duration 1st stage, duration 2nd stage, active pushing	2	1,2,3
Cervical dilation (Em CS)	Undilated cervix, early labour, late labour	2	*0,1,2
Induction of labour (Em CS)	Induction of labour	1	0,1

*vide Methods ElCS=elective caesarean EmCS=emergency caesarean SI=stress incontinence AI=anal incontinence NVD=non-instrumental vaginal delivery

Table 4. Details of obstetrical/biological independent variables

Where the Cochrane criteria would not be satisfied, data would be combined to form larger subgroups as recommended by Bland et al[343]. Other than overcoming the small frequency problem, regrouping would help with the modelling process by improving the precision of the estimates.

Details of independent variables used for assessing psychosocial associations are depicted in Table 5:

Variable	**Name used in the table**	**Number of parameters**	**Original level for classifying variables**
Postpartum stress incontinence	Postpartum SI	1	0,1
Postpartum anal incontinence	Postpartum AI	1	0,1
Dyspareunia	Dyspareunia	1	0,1
New stress incontinence	NSI	1	*0,1
Mode of delivery	NVD, caesarean	1	*0, 1
Cervical dilation (Em CS)	Undilated and early labour, Late labour	1	*0,1
Duration of 2nd stage (NVD)	Less than one hour, more than one hour	1	0,1
Perineal status (NVD)	Perineal trauma, intact perineum	1	*0,1

*vide Methods Em CS=emergency caesarean NSI-New stress incontinence NVD=non-instrumental vaginal delivery

Table 5. Details of independent variables used for assessing psychosocial associations

When using a psychosocial variable as the dependent variable, having no symptoms was the parameter against which the other parameter with symptoms were to be compared.

The best model would be selected on the ability of the model to predict the dependent variable.

CHAPTER IV
RESULTS

This chapter starts with recruitment details (A) followed by the description of the participants (B). This is followed by a description of the frequencies of interest (C) in this investigation. The statistical plan after measuring the frequencies is discussed next (D). The univariate analyses followed by multivariable analyses for selecting obstetrical/biological predictors of pelvic floor symptoms are presented next (E). The univariate analyses assessing any association of obstetrical/biological variables with new anal incontinence are placed after the multivariable analysis for postpartum anal incontinence. Univariate analyses followed by multivariable analyses for any association of psychosocial symptoms with pelvic floor symptoms follow on (F). The univariate analyses for defining the place of dyspareunia and overall sexual health as a social health evaluation tool and any association with other pelvic floor symptoms are represented next (G). The univariate analyses for the severity of new anal incontinence, the univariate analyses for haemorrhoids and the description of the severity of perineal trauma (H) follow this. Next, severity as depicted by real-life descriptions of maternal perception along with coping strategies for incontinence which necessitated perineal protection, help-seeking behaviour and any effect of the pelvic dysfunction on her relationship with the child, husband and the planning of future pregnancies follows on (I,J). Finally, a brief summary of the pertinent findings from the analyses of the results is presented (K).

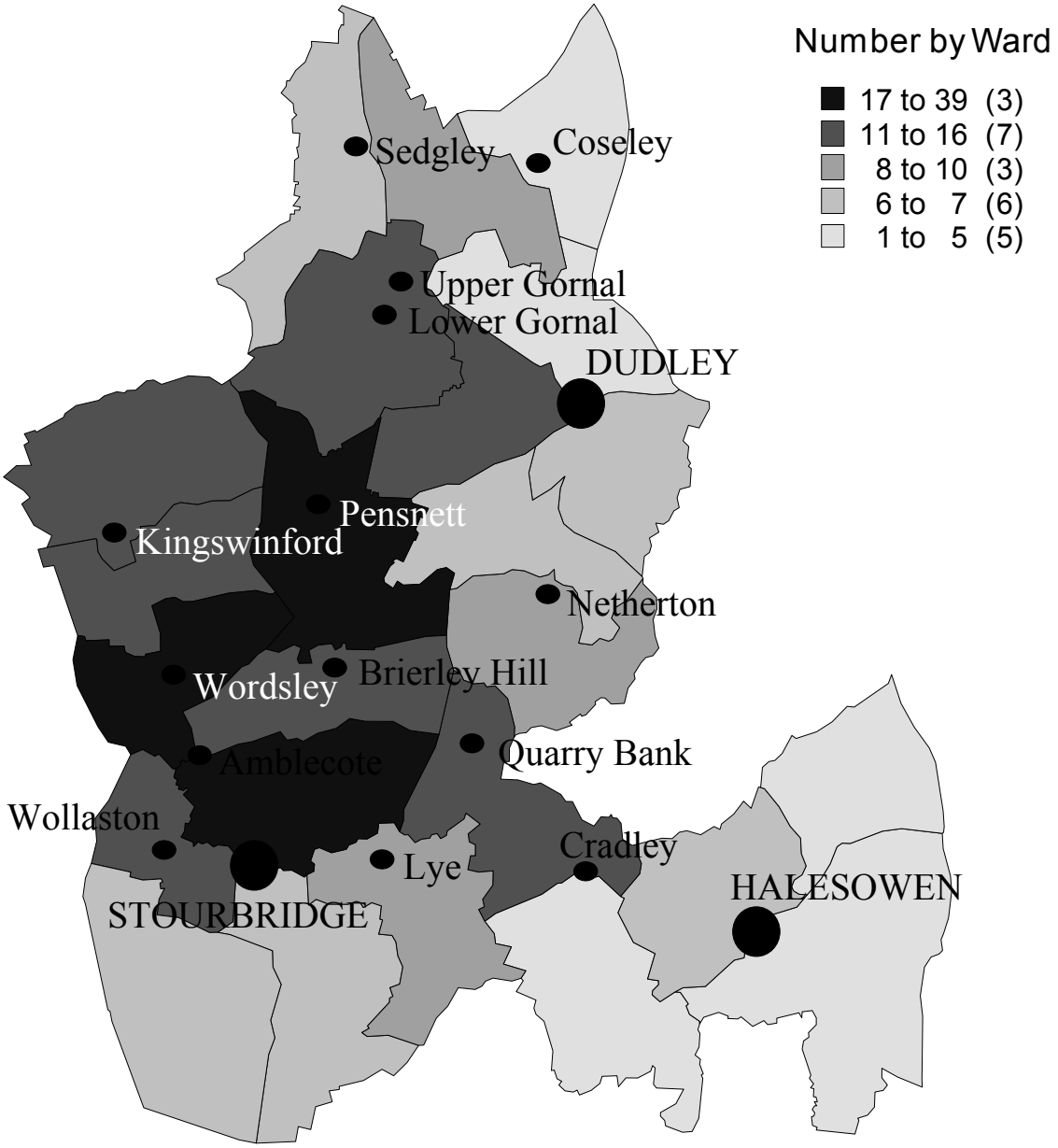
A. RECRUITMENT DETAILS

On the average, recruitment of one participant involved a letter of invitation and approximately five phone calls (vide Chapter III, page 47). The total number of letters of invitation sent was 566 (346 targeting caesarean mothers and 220 following vaginal delivery). Of these mothers 126 (22.3%) had moved from their registered address and could not be contacted by letter or phone. Of the 440 mothers who could be contacted another 105 (18.6%) were ineligible for various reasons such as being wrongly coded as primiparous, pregnant again, having undergone an operation, suffering from a severe psychiatric or medical/neurological problem, having an urinary tract or bowel diversion, immigrating or having an ill baby, and the study had to be concluded. Three hundred and thirty five (213 caesarean and 122 vaginally delivered) mothers were eligible to participate. Of the eligible mothers 49 (27 caesarean, 22 vaginally delivered) declined to take part giving a response rate of 85%. All interviews undertaken were completed.

B. DESCRIPTION of the PARTICIPANTS

This is the preliminary description of the participants who were recruited to the study. The sample selected was representative of the study population at the time with 13/284 (4.6%) of the participants being Afro-Caribbean/ethnic minorities and the rest Caucasians (271/284 = 95.4%). In total 286 mothers were interviewed 10±2 SD months after delivery, but two were excluded from the analysis, as there was missing data due to which the notes could not be completed. Of the 284 participants included for the purposes of this study, 184 had been delivered by caesarean section (104 emergency, 80 elective). One hundred women with cephalic presentations who underwent NVD served as the comparison group.

A map (Fig. xv, fp 65) of the number recruited along with explanation (Fig. xvi, fp 65) of the distribution of Townsend scores[344] for the catchment area, together with a map of the distribution of participants according to Wards (Fig. xvii, fp 65) are presented. This is indicative of the socio-economic background of the participants according to their area of residence. Approximately 20% of participants came from the least socially deprived areas and 20% from the most deprived areas. The mean age of the caesarean group was 28.5±5 SD and that of the NVD group 27.5±4 SD. Distribution of all participants back at work according to occupational status showed that 67 (24%) were professionals, 31 (10%) belonged to the clerical and allied occupations, 23 (8%) to skilled/semi-skilled occupations and 163 (58%) were housewives. Forty-one (22%) of the caesarean mothers were professionals, 20 (10%) clerical workers, 12 (7%) skilled/semi-skilled workers and 111 (61%) were housewives of whom 47 (26%) had not resumed previous employment. Of the NVD mothers 26 (26%) were professionals, 11 (11%) clerical workers, 11 (11%) skilled/semi-skilled workers and 52 (52%) were housewives of which 18 (18%) had not resumed previous employment. Family income was not asked. There was no significant difference between caesarean and vaginally delivered groups with regards to occupational status (χ^2=2.767, df=3, p=0.429), demographic and obstetric details are given in Table 6 (page 66).



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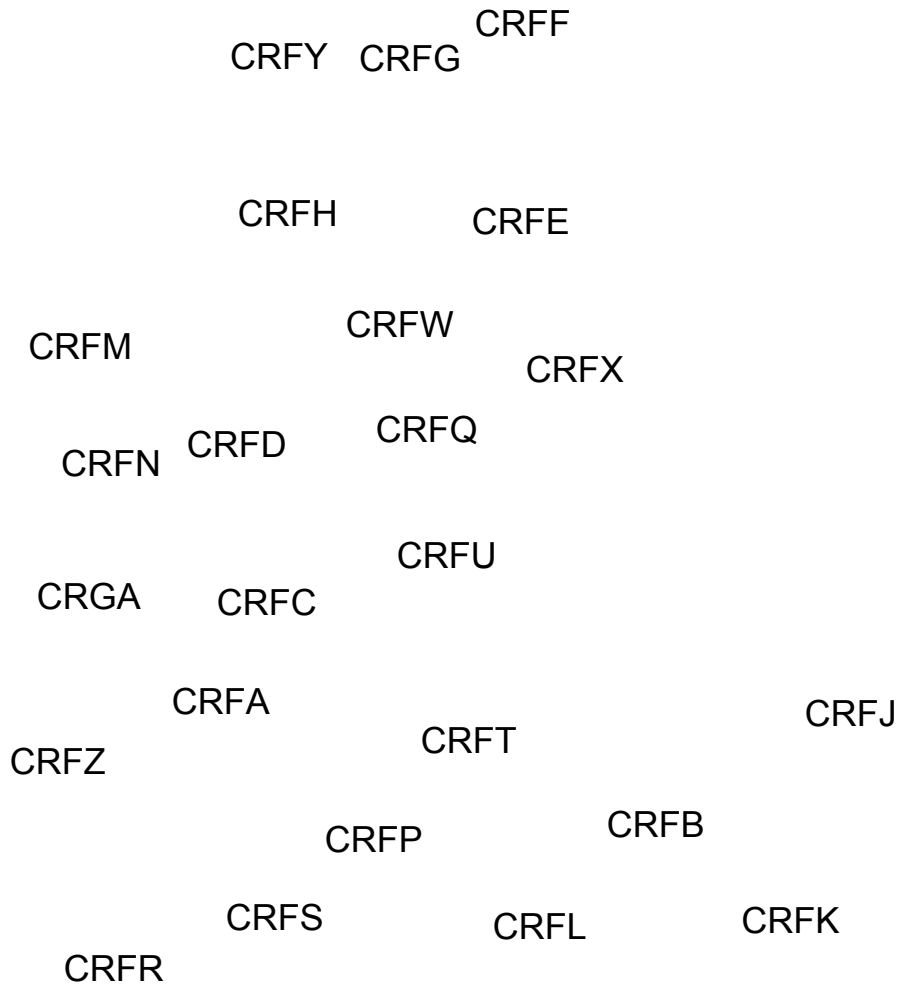
August 2001

WARD	WARD NAME	NUMBER
CRFA	Amblecote	39
CRFB	Belle Vale and Hasbury	7
CRFC	Brierley Hill	14
CRFD	Brockmoor and Pensnett	17
CRFE	Castle and Priory	4
CRFF	Coseley East	1
CRFG	Coseley West	8
CRFH	Gornal Wood	11
CRFJ	Halesowen North	2
CRFK	Halesowen South	2
CRFL	Hayley Green	3
CRFM	Kingswinford North and Wall Heath	13
CRFN	Kingswinford South	14
CRFP	Lye and Wollescote	9
CRFQ	Netherton and Woodside	7
CRFR	Norton	6
CRFS	Pedmore and Stourbridge East	6
CRFT	Quarry Bank and Cradley	13
CRFU	St.Andrews	8
CRFW	St.James	12
CRFX	St.Thomas	6
CRFY	Sedgley	6
CRFZ	Wollaston and Stourbridge West	14
CRGA	Wordsley	21



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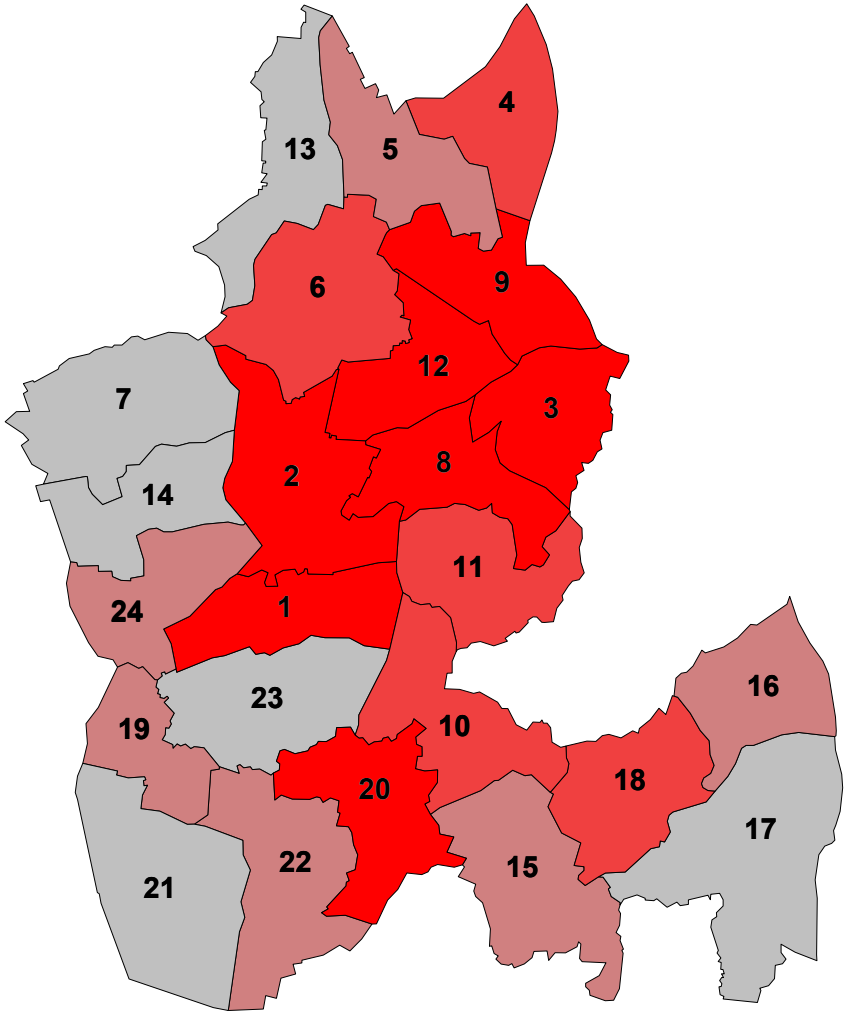
TOWNSEND SCORE
Townsend Score by electoral ward



Source: 1991 Census

		TOWNSEND
13	Sedgley	-3.8
17	Halesowen South	-3.7
7	Kingswinford North and Wall Heath	-3.2
14	Kingswinford South	-2.2
23	Amblecote	-2.1
21	Norton	-2
22	Pedmore and Stourbridge East	-1.9
24	Wordsley	-1.8
15	Hayley Green	-0.4
19	Wollaston and Stourbridge West	0.35
16	Halesowen North	0.59
5	Coseley West	1.16
18	Belle Vale and Hasbury	1.35
10	Quarry Bank and Cradley	2.31
6	Gornal Wood	2.34
4	Coseley East	3.68
11	St Andrews	3.68
2	Brockmoor and Pensett	5.12
20	Lye and Wollescote	5.12
8	Netherton and Woodside	5.26
12	St.James	5.38
1	Brierley Hill	6.07
3	St.Thomas	6.14
9	Castle and Priory	6.88

Produced by: Public Health Information

	caesarean elective n=80	caesarean emergency n=104	NVD n=100	P value
Maternal age (years)†	28.8±5	28.2±5	27.5±4	0.109¶
Ethnicity- Caucasian/ Asian/ Afro-Caribbean	77/2/1	98/3/3	96/4/0	
Gestational age (weeks) ††	38±0.5	39.5±1	39±1.5	<0.001***‡
Indications: Fetal distress	0	53		
Breech	48	10		
Failure to progress	0	27		
Pre-eclampsia	5	5		
Cephalo-pelvic disproportion	12	0		
Intra-uterine growth retardation	3	0		
Women's request	3	0		
Miscellaneous	9	9		
Not in labour	80	20		
Early labour (cervical dilation <8cm)	0	63		
Late labour (cervical dilation ≥8cm)		21		
Induced labour		51	16	
Birth weight (kg)†	3.1±0.7	3.1±0.7	3.2±0.4	0.331¶
Head circumference (cm)†	35±3	34±4	34±2	0.186¶

†values given as mean ± standard deviation †† values given as median and interquartile range ¶ ANOVA
‡ Kruskal-Wallis (KW) test - value=35.678, df=2

Table 6. Details of mothers giving birth by caesarean section & NVD

Graph histograms were drawn to assist in choosing the appropriate statistical tests for the sample and the figures follow page 66. The best fitting outlines have been imposed on the histogram. A normal distribution was shown for maternal age (Fig. xviii, fp 66), baby birth weight (Fig. xix, fp 66) and head circumference (Fig. xx, fp 66). Gestational age was skewed to the left (Fig. xxi, fp 66). When the variables maternal age, baby's birth weight and head circumference were analysed using *t* tests no statistically significant difference between the caesarean and NVD group was demonstrated. Gestational age showed a statistically significant difference as women who underwent an elective caesarean section had a lower median gestational age than the emergency caesarean and NVD groups.

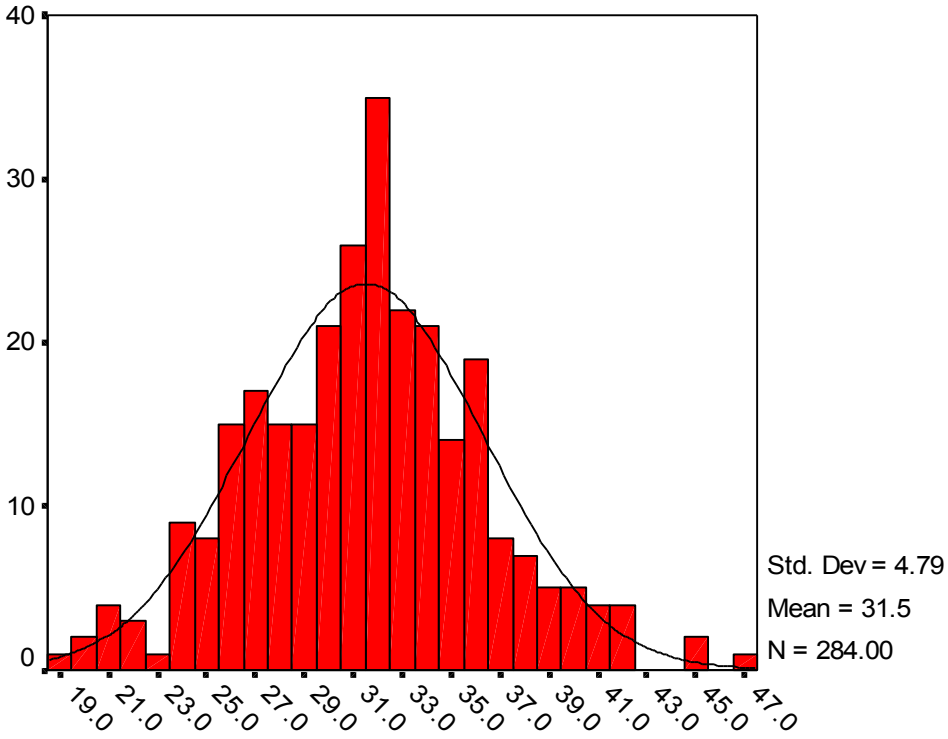


Fig. xviii. Distribution of age (/years)

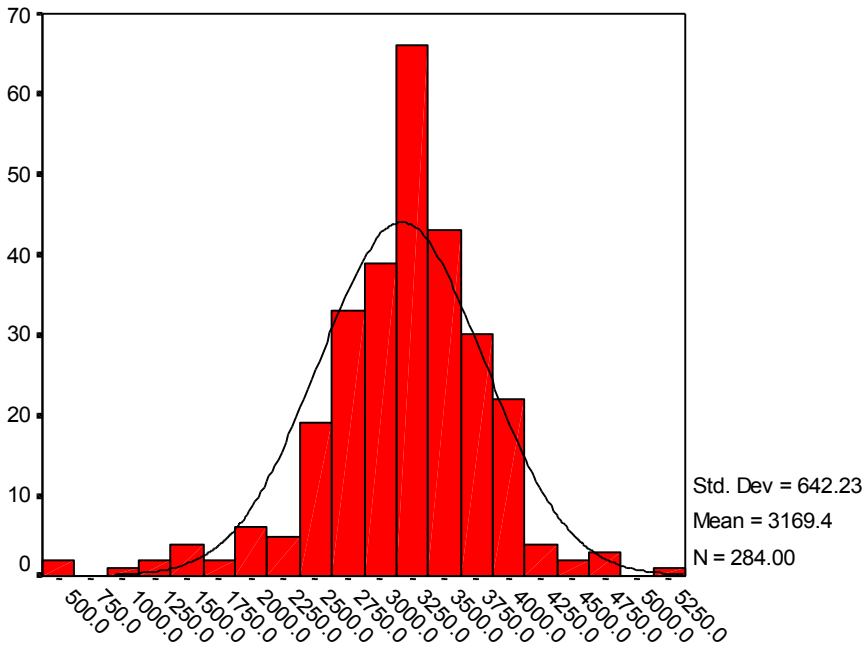


Fig. xix. Distribution of birth weight (/g)

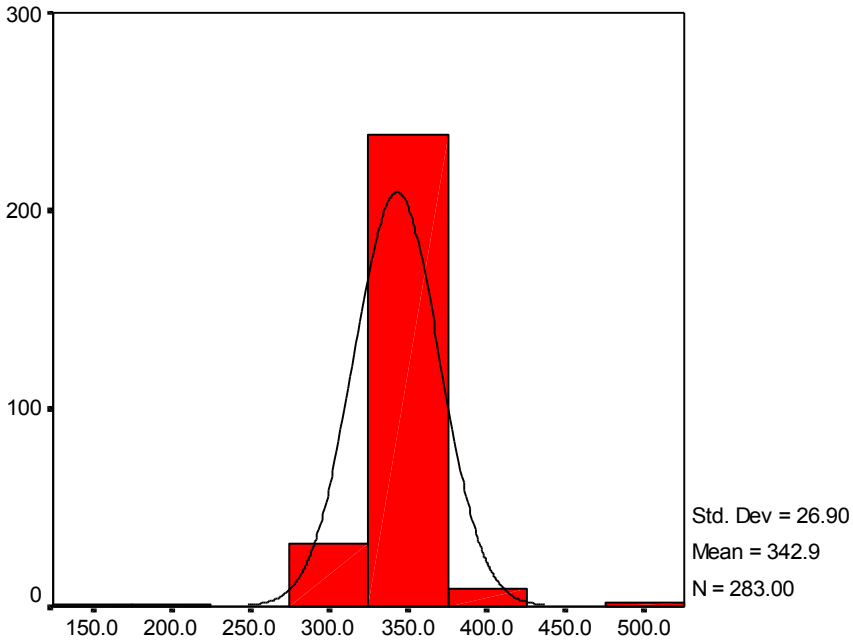


Fig. xx. Distribution of head circumference (/cm)

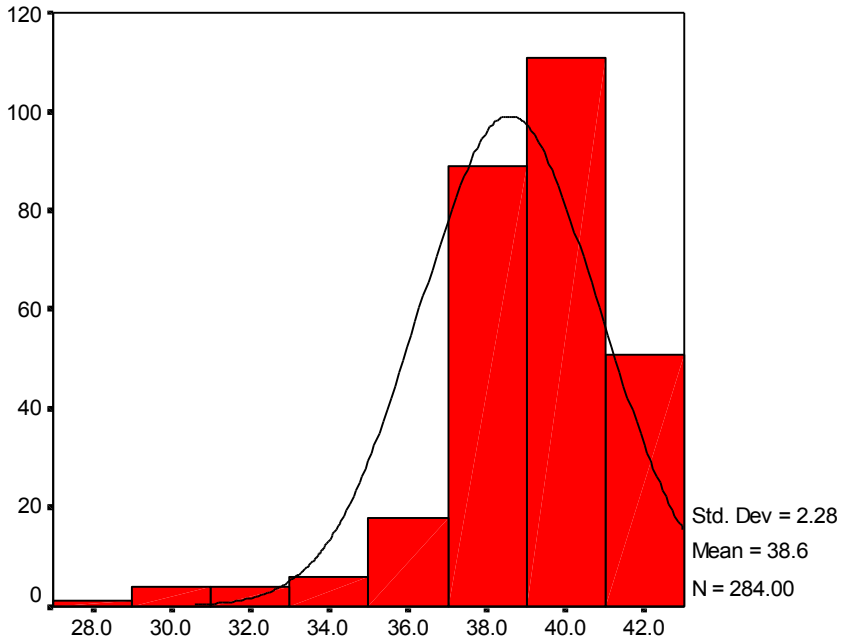


Fig. xxi. Distribution of gestational age (/weeks)

C. FREQUENCIES (PREVALENCE & INCIDENCE) of PELVIC DYSFUNCTION and PERINEAL TRAUMA

Estimation of the prevalence and incidence of the pelvic floor symptoms helped establish that this was a considerable problem following both modes of delivery, including elective caesarean. No mother complained of symptoms of uterovaginal prolapse. The frequencies are described below:

1. Prevalence of stress incontinence

i) Stress incontinence prior to delivery

The frequency of stress incontinence before delivery is represented below (Table 7).

Absence or presence of symptoms	Pre-pregnancy stress incontinence		Stress incontinence during pregnancy	
	Frequency	Percent	Frequency	Percent
No	266	93.7	218	76.8
Yes	18	6.3	66	23.2
Total	284	100.0	284	100.0

Table 7. Stress incontinence before delivery

ii) Stress incontinence after delivery – postpartum prevalence

The postpartum prevalence of stress incontinence is depicted in Table 8.

Absence or presence of symptoms	Frequency	Percent
No	170	59.9
Yes	114	40.1
Total	284	100.0

Table 8. Postpartum stress incontinence

There were 114 (40.1%) mothers with postpartum stress incontinence. Of these 60 belonged to the caesarean group (representing 32.6% of caesarean mothers) and 54 underwent a normal vaginal delivery (representing 54% of the vaginally delivered mothers). Among the elective caesarean mothers there were 26 (33%) who complained of postpartum stress incontinence and among the emergency caesarean mothers there were 34 (33%) who complained of postpartum stress incontinence.

2. Prevalence of anal incontinence

i) Anal incontinence prior to delivery

Table 9 (next page) represents the frequency of anal incontinence before delivery (Table 9).

Absence or presence of symptoms	Pre-pregnancy anal incontinence		Anal incontinence during pregnancy	
	Frequency	Percent	Frequency	Percent
No	157	55.3	155	54.6
Yes	127	44.7	130	45.4
Total	284	100.0	284	100.0

Table 9. Anal incontinence prior to delivery

ii) Anal incontinence after delivery – postpartum prevalence

The postpartum prevalence of anal incontinence is depicted in Table 10.

Absence or presence of symptoms	Frequency	Percent
No	146	51.4
Yes	138	48.6
Total	284	100

Table 10. Postpartum anal incontinence

There were 138 (48.6%) mothers with postpartum anal incontinence. Of these 94 belonged to the caesarean group (representing 51% of caesarean mothers) and 44 underwent a normal vaginal delivery (representing 44% of the vaginally delivered mothers). Among the elective caesarean mothers there were 42 (53%) who complained of postpartum anal incontinence and among the emergency caesarean mothers there were 52 (50%) who complained of postpartum anal incontinence.

3. Prevalence of postpartum dyspareunia

Sexual Pelvic Floor Problems were represented by postpartum dyspareunia only which have been referred to as dyspareunia in the text. There were 96 (34%) participants with dyspareunia. Of these 50 belonged to the caesarean group (representing 27% of caesarean mothers) and 46 underwent a normal vaginal delivery (representing 46% of the vaginally delivered mothers). Among the elective caesarean mothers there were 22 (28%) who complained of dyspareunia and among the emergency caesarean mothers there were 28 (27%) who complained of dyspareunia.

4. Postpartum prevalence of multiple pelvic floor symptoms

Postpartum double (stress and anal) incontinence was reported by 43 following a caesarean representing 23% of the caesarean group (20 (25%) elective, 23 (22%) emergency) and 26 following NVD representing 26% of the NVD group. Double incontinence along with dyspareunia was reported by 21 following a caesarean representing 11% of the group (11 (14%) elective, 10 (10%) emergency) and 12 following NVD representing 12% of the NVD group.

5. Postpartum onset of incontinence or postpartum incidence

These were symptoms of incontinence noted for the first time after delivery which also have been referred to as new symptoms.

i) New Stress Incontinence – Incidence

Seventy (25%) participants developed new stress incontinence. Of these 31 belonged to the caesarean group (representing 17% of the caesarean group) and 39 to the NVD group (representing 39% of the NVD group). Of the elective caesarean mothers 12 (15%) complained of new stress incontinence and of the emergency caesarean mothers 19 (18%) complained of new stress incontinence.

ii) New Anal Incontinence – Incidence

Ten participants developed new anal incontinence. Of these, 4 (2%) belonged to the caesarean group and six (6%) to the NVD group.

6. Prevalence of haemorrhoids

Haemorrhoids occurring postpartum were complained of by eight mothers and have been included in the type of pelvic floor symptoms. These were present in three (2% of the caesarean group) and five (5% of the NVD group).

7. Prevalence of perineal trauma

There were 16 mothers with an episiotomy, 4 with an episiotomy and tear, 22 with a second degree tear and 18 with a first degree tear whereas 40 had an intact perineum.

8. Prevalence of perineal trauma and postpartum stress incontinence

There were 54 mothers who had postpartum stress incontinence after a normal vaginal delivery. Of these mothers there were 21/54 = 38.9% in the group who had an intact perineum,

10/54 = 18.5% of those who had an episiotomy, 3/54 = 5.6% of those who had an episiotomy and tear, 11/54 = 20.4% of those who sustained a second degree tear and 9/54 = 16.7% of those who sustained a first degree tear.

9. Prevalence of perineal trauma and postpartum anal incontinence

There were 44 mothers who had postpartum anal incontinence after a normal vaginal delivery. Of these mothers there were 20/44 = 45.5% of the group who had an intact perineum, 4/44 = 9.1% of those who had an episiotomy, 1/44 = 2.3% of those who had an episiotomy and tear, 10/44 = 22.7% of those who sustained a second degree tear and 9/44 = 20.5% of those who sustained a first degree tear.

10. Prevalence of perineal trauma and dyspareunia

There were 46 mothers who had dyspareunia after a normal vaginal delivery. Of these mothers there were 17/46 = 42.5% of the group who had an intact perineum, 9/46 = 45% of those who had an episiotomy, 11/46 = 50% of those who sustained a second degree tear and 9/46 = 50% of those who sustained a first degree tear.

The continuity of pelvic dysfunction in some participants

Eighteen mothers had stress incontinence prior to pregnancy, which persisted through pregnancy to after delivery, with equal representation in the groups according to the mode of delivery. There were a total of sixty-six mothers with stress incontinence during pregnancy and of the new additions (n=48), nine of those who had an emergency caesarean delivery became continent, eight who had an elective caesarean became continent and five in the NVD group regained continence (n=22).

There were 127 mothers who had anal incontinence prior to pregnancy who continued to have it after delivery. During pregnancy three others developed anal incontinence and two became asymptomatic after delivery. McNemar's test revealed that there was no significant shift in the population of these women with stress incontinence or anal incontinence before pregnancy, when pregnant, and after delivery.

The data for dyspareunia and haemorrhoids did not extend retrospectively to the prepartum phase, so similar observation for these two symptoms was not possible. The much smaller frequencies of new symptoms of anal incontinence and haemorrhoids would restrict the statistical tests carried out on this data set and not allow for multivariable logistic regression analyses. The analyses of the impact of perineal trauma on psychosocial health had to be

limited for similar reasons. There was very little missing data so strategies to deal with this problem were not required [251]. In displaying the findings of this study stress incontinence has been abbreviated to SI, anal incontinence to AI and general sexual health to GSH.

D. MINOR MODIFICATION OF THE STATISTICAL PLAN

The statistical plan prior to estimating frequencies was modified slightly as planned to fit in with the frequencies determined after describing the data obtained.

Dysphoria appeared to be the most prevalent psychological symptom. The Cochrane criteria were not satisfied in relation to the level 4 of scoring for dysphoria so data were combined to form a larger subgroup (3 & 4 combined, Chapter III, page 63) as recommended by Bland et al[343]. Other than overcoming the small frequency problem, regrouping helped with the modelling process by improving the precision of the estimates. The number of independent variables was reduced, in order to prevent over-fitting of the model[340]. The model used for assessing the associations of dysphoria (or a social variable) with pelvic/perineal dysfunction and relevant independent variables is depicted in Table 11 below:

Dependent variable	**Independent variables (pelvic/perineal symptom/obstetric variables)**
Dysphoria (4 levels) or severe dysphoria (3 & 4 levels combined)	Postpartum stress incontinence Postpartum anal incontinence Dyspareunia New stress incontinence Mode of delivery Wound problems

Table 11. Dysphoria and pelvic/perineal/obstetric variable

Other relevant observations: The sample sizes for new stress or new anal incontinence were comparatively smaller. However, these categories were retained in the analysis plan as their inclusion in this chapter and the Discussion chapter would highlight the significance of evaluating incidence and prevalence as separate entities with likely differences in the precipitating aetiological factors and the maternal response to them. Haemorrhoids and perineal trauma also had small frequencies. A reduction in the general analysis plan for these symptoms was carried out and more caution would be applied to interpretations. A group of vaginally delivered mothers felt that perineal trauma had a greater impact on their psychosocial health than their pelvic dysfunction. The impact of perineal trauma on psychosocial health in these mothers has been described as it reflects the clinical importance of recognising the mother's perception of the severity of concurrent symptoms, which is

personal and may not relate to statistical significance. This has implications for developing relevant support.

Although this statistical plan gives a general description of the variables to be used in the multivariable logistic regression analyses, a few variables need further explanation and these have been added in relation to their respective models, as appropriate. Among these variables 'wound problems' has been defined first as it is associated with pelvic dysfunction and also perineal trauma and is used in the modelling process from the start of this investigation into obstetrical/biological predictors of stress incontinence.

Wound problems related to abdominal wounds and perineal trauma following caesarean or vaginal delivery. Problems with healing, such as haematoma, infection, discharge, gaping, analgesia for prolonged periods and continuing scar tenderness (even at the time of the interview), were all classified under one term as wound problems. One hundred and six participants complained of wound problems which included problems with the abdominal wound (28 (35%) elective, 41 (39%) emergency) or the perineal wound (37 (37%) NVD).

E. ANALYSES for the OBSTETRICAL/BIOLOGICAL PREDICTORS

Data analyses and description as planned has been set out in the following pages.

The aim of this analysis was to identify associations between a pelvic floor symptom such as postpartum stress incontinence (SI), and new stress incontinence, postpartum anal incontinence (AI), new anal incontinence and dyspareunia, and obstetric factors such as analgesia, mode of delivery, wound problems, fetal factors and other biological factors, along with age. Analyses have been carried out as an overall group and subgrouped into delivery modes as overall caesarean, elective caesarean, emergency caesarean and vaginal delivery.

The investigation of any association of pelvic dysfunction with obstetrical/biological predictors was carried out using multivariable analyses to adjust for confounders with backward elimination stepwise logistic regression being selected for this. During the description of the multivariable analyses, variables entered into the model are listed, the goodness of fit of the model along with tests to assess overfitting are presented and finally the step selected with details of variables in the step are discussed. Univariate analyses carried out using variables in the multivariable model followed by those medically relevant but not in the model are depicted. Besides, limited univariate analyses of variables which were not reported as being associated with pelvic floor symptoms in such a sample or which could not be subjected to multivariable analyses because of small frequencies, have been carried out.

For each pelvic floor symptom at first there is a tabular depiction of the multivariable analysis to assess associations between a pelvic floor symptom and obstetrical/biological

variables as planned (vide Chapter III, pages 56-57, 62), with the most parsimonious step in the logistic regression modelling being selected. Details of the independent variables entered at the start of the modelling process are mentioned in the introduction to each tabular representation for a pelvic floor symptom. Whilst most variables are consistent for each subgroup a few are specific for a particular mode only, e.g. early/late labour for the emergency caesarean or duration of 1st/2nd stages of labour for the vaginally delivered. The tabulated depiction of the univariate analysis contains the variables selected by the multivariable model followed by another depicting analysis with other clinically relevant variables. This plan is followed for each symptom.

1. Postpartum stress incontinence and obstetrical/biological predictors

Postpartum stress incontinence was prevalent in 114 participants. Significant obstetrical/biological predictors were identified by carrying out logistic regression modelling with postpartum stress incontinence entered as the dependent variable and variables such as age, mode of delivery, analgesia, birth weight, head circumference, wound problems, stress incontinence during pregnancy, postpartum anal incontinence and dyspareunia as the independent variables (listed on page 62), followed by the univariate analyses.

i) All participants

The results of the multivariable analysis using independent variables listed above are presented in Table 12. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 13a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 13b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
NVD	71			2	.003			
El CS	80	- 1.231	.392	1	.002	.292	.135	.630
Em CS	102	-1.044	.360	1	.004	.352	.174	.713
SI during pregnancy	61	1.652	.344	1	<.001	5.218	2.657	10.247
Postpartum AI	123	.929	.301	1	.002	2.533	1.404	4.570
Dyspareunia	86	1.009	.308	1	.001	2.744	1.501	5.014
Constant		-.886	.330	1	.007	412		

n^x= number SI=stress incontinence AI=anal incontinence El CS=elective caesarean Em CS=emergency caesarean NVD=non-instrumental vaginal delivery

Table 12. Multivariable analysis of postpartum SI & obstetrical/biological predictors (all participants)

Step 6 of the stepwise logistic regression, with 77.6% specificity and 69.3% sensitivity, was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2=5.961, df=7, p=0.544 suggested a good fit and its expected shrinkage of 0.98 indicated it was not overfitted, thus suitable for multivariable analysis.

	Delivery mode			SI during pregnancy		Postpartum AI		Dyspareunia	
Postpartum SI	NVD	El CS	Em CS	No	Yes	No	Yes	No	Yes
Yes	54	26	34	70	44	45	69	57	57
No	46	54	70	148	22	101	69	131	39
Total	100	80	104	218	66	146	138	188	96
P value	0.001			0.001		0.001		<0.001	

SI = stress incontinence AI=anal incontinence El CS=elective caesarean Em CS=emergency caesarean NVD=non-instrumental vaginal delivery

Table 13a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and postpartum SI

	Analgesia						WPr	Age	Bwt	Hcirc
Postpartum SI	Non	Entonox	Pethidine	Epidural	Spinal	GA	Yes*	Mean	Mean	Mean
Yes	4	16	22	24	37	11	50	31	3350	346
No	6	14	19	39	66	25	54	30	3129	342
Total	10	30	41	63	103	36				
P value	0.184						0.022	0.584	0.280	0.415

SI=stress incontinence Non=none WPr=wound problems Bwt=birth weight Hcirc=head circumference GA=general anaesthetic *Frequency of the number of problems can be determined by subtracting the yes from the total frequency

Table 13b. Univariate analysis of further medically relevant obstetrical/biological variables and postpartum SI

Significant multivariable predictors, also consistent at the univariate level (Table 13a), were stress incontinence during pregnancy, postpartum anal incontinence and dyspareunia. Elective and emergency caesarean were significantly associated but negatively when compared to vaginal delivery. Wound problems was significant at the univariate level (Table 13b) but not at the multivariable level; a 2x3 tabular analysis including wound problems and the mode of delivery showed a significant correlation, χ^2=14.11, df=2, p=0.0008.

ii) Overall caesarean (both elective and emergency)

The results of the multivariable analysis using listed independent variables (vide page 73) are presented in Table 14 (next page). Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 15a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 15b (next page).

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
SI during pregnancy	45	1.619	.394	1	.000	5.048	2.331	10.936
Postpartum AI	93	1.091	.369	1	.003	2.976	1.443	6.140
Dyspareunia	50	.796	.389	1	.041	2.217	1.034	4.754
Birth weight		.000	.000	1	.280	1.000	1.000	1.001
Head circumference		-.010	.009	1	.284	.990	.973	1.008
Constant		-.017	2.389	1	.994	.983		

n^x= number with SI=stress incontinence AI=anal incontinence

Table 14. Multivariable analysis of postpartum SI and obstetrical/biological predictors (overall caesarean)

Step 4 of the stepwise logistic regression, which had 92.6% specificity and 48.3% sensitivity, was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2= 7.844, df=8, p=0.449 suggested a good fit and the expected shrinkage of 0.96 indicated that it was not overfitted, thus suitable for multivariable analysis.

	SI during pregnancy		Postpartum AI		Dyspareunia		Bwt	Hcirc
Postpartum SI	No	Yes	No	Yes	No	Yes	Mean	Mean
Yes	31	29	17	43	34	26	3366	344
No	107	17	73	51	100	24	3328	342
Total	138	46	90	94	134	50		
P value	0.001		0.001		0.001		0.381	0.390

SI=stress incontinence AI=anal incontinence Bwt=birth weight Hcirc=head circumference

Table 15a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and postpartum SI

	Analgesia			WPr
Postpartum SI	Spinal	Epidural	GA	
Yes	26	23	11	25
No	63	36	25	35
Total	89	59	36	
P value	0.466			0.520

SI=stress incontinence WPr=wound problems GA=general anaesthetic

Table 15b. Univariate analysis of further medically relevant obstetrical/biological variables and postpartum SI

Significant multivariable predictors, also consistent at the univariate level (Table 15a), were stress incontinence during pregnancy, postpartum anal incontinence and dyspareunia. No other significant factors were evident from Table 15b.

iii) Elective caesarean

The results of the multivariable analysis using listed independent variables (vide page 73) are presented in Table 16. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 17a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 17b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
SI during pregnancy	22	1.553	.600	1	0.01	4.726	1.458	15.325
Postpartum AI	42	1.372	.595	1	0	3.944	1.229	12.655
Dyspareunia	22	1.148	.601	1	.021	3.151	.970	10.238
Constant		-2.414	.556	1	.000	.089		

n^x= number with SI=stress incontinence AI=anal incontinence

Table 16. Multivariable analysis of postpartum SI and obstetrical/biological predictors (elective caesarean)

Step 6 of the stepwise logistic regression, which had 87.0% specificity and 69.2% sensitivity, was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2= 3.558, df=4, p=0.469 suggested a good fit and the expected shrinkage of 0.95 indicated that it was not overfitted, thus suitable for multivariable analysis.

	SI during pregnancy		Postpartum AI		Dyspareunia	
Postpartum SI	No	Yes	No	Yes	No	Yes
Yes	12	14	6	20	13	13
No	46	8	32	22	45	9
Total	58	22	38	42	58	22
P value	0.001		0.002		0.003	

SI=stress incontinence AI=anal incontinence

Table 17a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and postpartum SI

	Analgesia		
Postpartum SI	Spinal	Epidural	GA
Yes	19	3	4
No	44	3	7
Total	63	6	11
P value	0.586		

SI=stress incontinence GA=general anaesthetic

Table 17b. Univariate analysis of further medically relevant obstetrical/biological variables and postpartum SI

The significant multivariable predictors, also consistent at the univariate level (Table 17a), were stress incontinence during pregnancy and postpartum anal incontinence. Dyspareunia almost reached significance. No other significant factors were evident from Table 17b.

iv) Emergency caesarean

The results of the multivariable analysis using listed independent variables (vide page 73) are presented in Table 18. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 19a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 19b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
SI during pregnancy	23	2.02	.579	1	<.001	7.592	2.442	23.602
Postpartum AI	51	1.208	.523	1	.021	3.346	1.200	9.329
Dyspareunia	28	.805	.540	1	.135	2.238	.777	6.443
Undilated cervix	19			2	.014			
Early labour	70	-.699	.644	1	.278	.497	.141	1.758
Late labour	13	1.475	.854	1	.084	4.369	.819	23.308
Constant		-1.865	.669	1	.005	.155		

n^x= number with SI=stress incontinence AI=anal incontinence

Table 18. Multivariable analysis of postpartum SI and obstetrical/biological predictors (emergency caesarean)

Step 7 of the stepwise logistic regression, which had 91.2% specificity and 55.9% sensitivity, was selected. Cervical dilation and induction of labour were the independent variables added as specific to this mode. The model's goodness of fit (Hosmer & Lemeshow) of χ^2=6.620, df=6, p=0.357 suggested a good fit and the expected shrinkage of 0.94 indicated that it was not overfitted, thus suitable for multivariable analysis.

	SI during pregnancy		Postpartum AI		Dyspareunia		Un cx	E lab	L lab
Postpartum SI	No	Yes	No	Yes	No	Yes			
Yes	19	15	11	23	35	17	4	18	4
No	61	9	41	29	41	11	16	5	9
Total	80	24	52	52	76	28	20	70	13
P value	0.001		0.120		0.098		0.824		

SI=stress incontinence AI=anal incontinence Un cx=Undilated cervix E lab=early labour L lab=late labour

Table 19a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and postpartum SI

	Analgesia			IOL	
Postpartum SI	Spinal	Epidural	GA	No	Yes
Yes	7	26	7	17	17
No	19	33	18	36	34
Total	26	59	25	53	51
P value	0.576			0.891	

SI=stress incontinence GA=general anaesthetic IOL=induction of labour

Table 19b. Univariate analysis of further medically relevant obstetrical/biological variables and postpartum SI

The significant multivariable predictors, also consistent at the univariate level (Table 19a), were stress incontinence during pregnancy and postpartum anal incontinence. Emergency caesarean carried out when in late labour appeared to go towards significance. No other significant factors were evident from Table 19b.

v) Vaginal delivery

The results of the multivariable analysis using the listed independent variables (vide page 73) are presented in Table 20. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 21a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 21b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
SI during pregnancy	16	2.622	1.013	1	.010	13.76	1.889	100.294
Postpartum AI	25	1.339	.739	1	.070	3.814	.895	16.246
Dyspareunia	27	1.374	.731	1	.060	3.952	.942	16.568
Wound problems	31	1.906	.831	1	.022	6.724	1.319	34.277
Duration 1st stage		-.097	.108	1	.369	.907	.734	1.122
Duration 2nd stage		-.674	.386	1	.081	.510	.239	1.086
Constant		-.822	.969	1	.396	.439		

n^x= number SI=stress incontinence AI=anal incontinence

Table 20. Multivariable analysis of postpartum SI and obstetrical/biological predictors (vaginal delivery)

Step 5 of the stepwise logistic regression, which had 60.0% specificity and 78.8% sensitivity, was selected. The duration of the 1st/2nd stages of labour were the independent variables added as specific to this mode. The model's goodness of fit (Hosmer & Lemeshow) of χ^2=5.300, df=8, p=0.725 suggested a good fit and the expected shrinkage of 0.86 suggested that it was not overfitted, thus suitable for multivariable analysis.

	SI during pregnancy		Postpartum AI		Dyspareunia		WPr	Dur 1st	Dur 2nd
Postpartum SI	No	Yes	No	Yes	No	Yes			
Yes	39	15	28	26	23	31	25	7.077	1.848
No	41	5	28	18	31	15	16	7.450	2.245
Total	80	20	56	44	54	46			
P value	0.035		0.422		0.016		0.021	0.607	0.107

SI=stress incontinence AI=anal incontinence WPr=wound problems Dur 1st=duration 1st stage Dur 2nd=duration 2nd stage

Table 21a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and postpartum SI

	Analgesia			
Postpartum SI	Non	Entonox	Pethidine	Epidural
Yes	4	16	22	12
No	6	14	19	**7**
Total	10	30	41	19
P value	0.354			

SI=stress incontinence non=none

Table 21b. Univariate analysis of further medically relevant obstetrical/biological variables and postpartum SI

The significant multivariable predictors, also consistent at the univariate level (Table 21a), were stress incontinence during pregnancy and wound problems. Postpartum anal incontinence, dyspareunia and duration of the second stage of labour (1.15 vs. 1.35 hours) appeared to go towards significance but the second stage was negatively associated. No other significant factors were evident from Table 21b.

2. New stress incontinence and obstetrical/biological predictors

New stress incontinence, representing postpartum onset stress incontinence, was manifest in 70 participants. Significant obstetrical/biological predictors were identified by carrying out logistic regression modelling with new stress incontinence entered as the dependent variable and variables such as age, mode of delivery, birth weight, head circumference, wound problems, postpartum anal incontinence and dyspareunia as the independent variables (listed on page 62), followed by the univariate analyses as planned (vide page 73).

i) All participants

The results of the multivariable analysis using independent variables listed above are presented in Table 22. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 23a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 23b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
NVD	71			2	.004			
El CS	80	-1.238	.410	1	.003	.290	.130	.648
Em CS	103	-.947	.365	1	.008	.382	.187	.781
Postpartum AI	123	.486	.317	1	.125	1.626	.874	3.026
Dyspareunia	86	.724	.318	1	.023	2.063	1.107	3.847
Constant		-1.020	.330	1	.002	.361		

n^x= number with AI=anal incontinence El CS=elective caesarean Em CS=emergency caesarean NVD=non-instrumental vaginal delivery

Table 22. Multivariable analysis of New SI and obstetrical/biological predictors (all participants)

Step 5 of the stepwise logistic regression, which had 95.9% specificity and 10.2% sensitivity, was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2= 4.682, df=7, p=0.699 suggested a good fit and the expected shrinkage of 0.97 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Delivery mode			Postpartum AI		Dyspareunia	
New SI	NVD	El CS	Em CS	No	Yes	No	Yes
Yes	39	12	19	31	39	36	34
No	61	68	85	115	99	152	62
Total	100	80	104	146	138	188	96
P value	0.001			0.215		0.004	

SI=stress incontinence AI=anal incontinence El CS=elective caesarean Em CS=emergency caesarean NVD=non-instrumental vaginal delivery

Table 23a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and New SI

	Analgesia						WPr	Age	Bwt	Hcirc
New SI	Non	Entonox	Pethidine	Epidural	Spinal	GA		Mean	Mean	Mean
Yes	1	12	17	13	21	6	28	31	3209	342
No	9	18	24	50	82	30	32	31	3156	343
Total	10	30	41	63	103	36				
P value	0.016						0.289	0.999	0.550	0.847

SI=stress incontinence Non=none GA=general anaesthetic WPr=wound problems Bwt=birth weight Hcirc=head circumference

Table 23b. Univariate analysis of further medically relevant obstetrical/biological variables and New SI

The significant multivariable predictor, also consistent at the univariate level (Table 23a), was dyspareunia. Both types of caesarean were significantly associated although negatively. Analgesia was significant at the univariate level (Table 23b) but not at the multivariate level; a 2x4 tabular analysis showed mode of delivery having a significant correlation with it: χ^2= 26.32, df=3, p=0.00008.

ii) Overall caesarean

The results of the multivariable analysis using listed independent variables (vide page 79) are presented in Table 24. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 25a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 25b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
Postpartum AI	20	.677	.409	1	.098	1.968	.883	4.386
Constant		-1.972	.322	1	.000	.139		

n^x= number with AI=anal incontinence

Table 24. Multivariable analysis of New SI and obstetrical/biological predictors (overall caesarean)

Step 7 of the stepwise logistic regression, which had 100% specificity and 0% sensitivity, was the model that could be selected.

	Postparpartum AI	
New SI	No	Yes
Yes	11	20
No	79	74
Total	90	94
P value	0.101	

SI=stress incontinence AI=anal incontinence

Table 25a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and New SI

	Dyspareunia		Analgesia			Bwt	Hcirc	WPr
New SI	No	Yes	Epidural	Spinal	GA	Mean	Mean	
Yes	19	12	12	13	6	3196	343	11
No	115	38	47	75	30	3113	341	20
Total	134	50						
P value	0.125		0.677			0.571	0.577	0.799

SI=stress incontinence GA=general anaesthetic Bwt=birth weight Hcirc=head circumference WPr=wound problems

Table 25b. Univariate analysis of further medically relevant obstetrical/biological variables and New SI

Postpartum anal incontinence was going towards significance and this was consistent with the univariate results but the model was poor and could not predict. No other significant factors were evident from Table 25b.

iii) Elective caesarean

The results of the multivariable analysis using listed independent variables (vide page 79) are presented in Table 26. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 27a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 27b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
Head circumference		-.017	.012	1	.145	.983	.961	1.006
Wound problems	28	1.136	.659	1	.085	3.115	.856	11.329
Constant		3.566	3.986	1	.371	35.361		

n^x= number with

Table 26. Multivariable analysis of New SI and obstetrical/biological predictors (elective caesarean)

Step 5 of the stepwise logistic regression, which had 100.00 % specificity but 8.3% sensitivity, was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2= 8.508, df=8, *p*=0.386 suggested a good fit and the expected shrinkage of 0.87 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Hcirc	WPr
New SI	Mean	
Yes	350	5
No	332	7
P value	0.072	0.749

Hcirc=head circumference WPr=wound problems

Table 27a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and New SI

	Analgesia			Postpartum AI		Dyspareunia		Bwt
New SI	Spinal	Epidural	GA	No	Yes	No	Yes	Mean
Yes	8	2	2	5	7	7	5	3076
No	55	4	9	33	35	51	17	2860
Total	63	6	11	38	42	58	22	
P value	0.381			0.660		0.233		0.162

SI=stress incontinence AI=anal incontinence GA=general anaesthetic Bwt=birth weight

Table 27b. Univariate analysis of further medically relevant obstetrical/biological variables and New SI

No significant predictor was identified by the multivariable or univariate analyses (Tables 27a & b) but wound problems approached significance (Table 26) and head circumference was close to significance (Table 27a).

iv) **Emergency caesarean**

The results of the multivariable analysis using listed independent variables (vide page 79) are presented in Table 28. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 29a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 29b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
Postpartum AI	51	1.361	.661	1	.039	3.899	1.068	14.232
Dyspareunia	28	.806	.676	1	.233	2.239	.595	8.426
Undilated cervix	19			2	.002			
Early labour	70	-1.908	.868	1	.028	.148	.027	.812
Late labour	13	.816	1.013	1	.420	2.262	.311	16.475
Birth weight		.001	.001	1	.024	1.001	1.000	1.002
Wound problems	41	-.769	.648	1	.235	.464	.130	1.650
Constant		-5.071	1.676	1	.002	.006		

n^x= number with AI=anal incontinence

Table 28. Multivariable analysis of New SI and obstetrical/biological predictors (emergency caesarean)

Step 4 of the stepwise logistic regression, which had 96.4% specificity and 36.8% sensitivity, was selected. Cervical dilation and induction of labour were the independent variables added as specific to this mode of delivery. The model's goodness of fit (Hosmer & Lemeshow) of χ^2 =9.034, df=8, p=0.339 suggested a good fit and the expected shrinkage of 0.90 indicated that it was not overfitted, so suitable for multivariable analysis.

	Postpartum AI		Dyspareunia		WPr	Bwt	Un cx	E lab	L lab
New SI	No	Yes	No	Yes		Mean			
Yes	6	13	12	7	6	3407	2	5	2
No	46	39	64	21	13	3064	1	6	3
Total	52	52	76	28			3	11	5
P value	0.076		0.39		0.606	0.045	0.154		

SI=stress incontinence AI=anal incontinence WPr=wound problems Bwt=birth weight Un cx=Undilated cervix
E lab=Early labour L lab=Late labour

Table 29a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and New SI

	Analgesia			IOL		Hcirc
New SI	Spinal	Epidural	GA	No	Yes	Mean
Yes	6	10	4	10	9	346
No	20	43	21	43	42	339
Total	26	53	25	53	51	
P value	0.930			0.872		0.176

SI=stress incontinence GA=general anaesthetic IOL=induction of labour Hcirc=head circumference

Table 29b. Univariate analysis of further medically relevant obstetrical/biological variables and New SI

The significant multivariable predictors, also consistent at the univariate level (Table 29a), were postpartum anal incontinence and birth weight. An emergency caesarean when the cervix was undilated was significantly associated at the multivariable level. There was no significant predictor in the univariate analysis although postpartum anal incontinence was close to it (Table 29a).

v) Vaginal delivery

The results of the multivariable analysis using listed independent variables (vide page 79) are presented in Table 30 (next page). Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 31a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 31b.

Independent variables							C.I.	
	n^x	B	S.E.	df	Sig	OR	Lower	Upper
Postpartum AI	25	.671	.624	1	.282	1.957	.575	6.652
Dyspareunia	27	.687	.629	1	.275	1.988	.579	6.827
Wound problems	31	1.187	.761	1	.119	3.277	.738	14.557
Duration 1st stage		-.124	.104	1	.233	.883	.720	1.083
Constant		1.783	2.203	1	.418	5.946		

n^x= number with AI=anal incontinence

Table 30. Multivariable analysis of New SI and obstetrical/biological predictors (vaginally delivered)

Step 5 of the stepwise logistic regression, which had 86.8 % specificity and 35.0 % sensitivity, was selected. The duration of the 1st/2nd stages of labour were the independent variables added as specific to this mode of delivery. The model's goodness of fit (Hosmer & Lemeshow) of χ^2=6.001, df=8, p=0.647 suggested a good fit and the expected shrinkage of 0.88 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Postpartum AI		Dyspareunia		WPr	Dur 1st
New SI	No	Yes	No	Yes		
Yes	20	19	17	22	17	7.057
No	36	25	37	24	12	7.421
Total	56	44	54	46		
P value	0.537		0.095		0.192	0.579

SI=stress incontinence AI=anal incontinence WPr=wound problems Dur 1st=duration 1st stage

Table 31a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and New SI

	Analgesia				Bwt	Hcirc	Dur 2nd
New SI	Non	Entonox	Pethidine	Epidural	Mean	Mean	Mean
Yes	1	12	17	9	3263	344	1.217
No	9	18	24	10	3220	341	1.255
Total	10	30	41	19			
P value	0.260				0.637	0.580	0.847

SI=stress incontinence Non=none Bwt=birth weight Hcirc=head circumference Dur 2nd=duration 2nd stage

Table 31b. Univariate analysis of further medically relevant obstetrical/biological variables and New SI

No variable gained significance as a predictor in both the multivariable and univariate analyses Tables 31a & b) although dyspareunia went towards significance (Table 31a).

3. Postpartum anal incontinence and obstetrical/biological predictors

Postpartum anal incontinence was prevalent in 138 participants. The significant obstetrical/biological predictors were identified by carrying out logistic regression modelling with postpartum anal incontinence entered as the dependent variable and variables such as age, mode of delivery, analgesia, birth weight, head circumference, wound problems, pre-pregnancy stress incontinence, stress incontinence during pregnancy and dyspareunia as the independent variables (listed on page 62), followed by the univariate analyses (vide page 73). The results are tabulated below.

i) All participants

The results of the multivariable analysis using listed independent variables (vide above) are presented in Table 32. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 33a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 33b (next page).

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
NVD	71			2	.102			
El CS	80	.704	.350	1	.044	2.023	1.018	4.018
Em CS	104	.590	.332	1	.076	1.804	.941	3.458
Postpartum SI	101	1.017	.278	1	<.001	2.765	1.603	4.767
Constant		-.923	.303	1	.002	.398		

n^x= number with El CS=elective caesarean Em CS=emergency caesarean NVD=non-instrumental vaginal delivery SI=stress incontinence

Table 32. Multivariable analysis of postpartum AI and obstetrical/biological predictors (all participants)

Step 9 with 70.0% specificity and 50.4% sensitivity which was parsimonious was selected. The goodness of fit (Hosmer & Lemeshow) of χ^2=2.711, df=4, p=0.607 suggested a good fit and the expected shrinkage of 0.99 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Delivery mode			Postpartum SI	
Postpartum AI	NVD	El CS	Em CS	No	Yes
Yes	44	42	52	69	69
No	56	38	52	101	45
Total	100	80	104	170	114
P value	0.478			0.001	

AI=anal incontinence SI=stress incontinence El CS=elective caesarean Em CS=emergency caesarean NVD=non-instrumental vaginal delivery

Table 33a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and postpartum AI

	Analgesia						WPr	Age	Bwt	Hcirc
Postpartum AI	Non	Entonox	Pethidine	Epidural	Spinal	GA		Mean	Mean	Mean
Yes	7	16	16	34	48	17	52	31	3191	343
No	3	14	25	29	55	19	71	30	3289	341
Total	10	30	41	63	103	36				
P value	0.477						0.640	0.406	0.261	0.654

AI=anal incontinence Non=none GA=general anaesthetic WPr=wound problems Bwt=birth weight Hcirc=head circumference

Table 33b. Univariate analysis of further medically relevant obstetrical/biological variables and postpartum AI

The elective caesarean mode of delivery and postpartum stress incontinence were significant multivariable predictors for postpartum anal incontinence with the latter predictor consistent in the univariate analysis (Table 33a). No other significant factors were evident from Table 33b.

ii) Overall caesarean

The results of the multivariable analysis using listed independent variables (vide page 85) are presented in Table 34. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 35a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 35b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
SI during pregnancy	45	.388	.399	1	.331	1.474	.674	3.223
Postpartum SI	60	1.101	.369	1	.003	3.008	1.459	6.202
Dyspareunia	50	.481	.370	1	.194	1.618	.783	3.342
Head circumference		.006	.006	1	.277	1.006	.995	1.017
Constant		-2.614	1.956	1	.182	.073		

n^x= number with SI=stress incontinence

Table 34. Multivariable analysis of postpartum AI and obstetrical/biological predictors (overall caesarean)

Step 6 with 73.7% specificity and 54.8% sensitivity was selected. The model's goodness of fit (Hosmer & Lemeshow) was χ^2=6.544, df=8, p=0.587 which suggested a good fit and the expected shrinkage of 0.92 indicated that it was not overfitted, thus suitable for multivariable analysis.

	SI during pregnancy		Postpartum SI		Dyspareunia		Hcirc
Postpartum AI	No	Yes	No	Yes	No	Yes	Mean
Yes	70	24	51	43	62	32	345
No	68	22	73	17	72	18	341
Total	138	46	124	60	134	50	
P value	0.438		0.001		0.046		0.444

AI=anal incontinence SI=stress incontinence Hcirc=head circumference

Table 35a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and postpartum AI

	Analgesia			WPr
Postpartum AI	Epidural	Spinal	GA	
Yes	33	44	33	21
No	26	44	26	31
Total	69	88	59	
P value	0.668			0.687

AI=anal incontinence WPr=wound problems GA=general anaesthetic

Table 35b. Univariate analysis of further medically relevant obstetrical/biological variables and postpartum AI

The significant multivariable predictor, also consistent at the univariate level (Table 35a), was postpartum stress incontinence. Dyspareunia was significant at the univariate level (Table 35a) but not at the multivariable level; a 2x2 tabular analysis including dyspareunia and postpartum stress incontinence, which reached significance in the multivariable model, showed a significant correlation with it: χ^2=20.75, df=1, *p*=0.00005. No further significant factors were evident from Table 35b.

iii) Elective caesarean

The results of the multivariable analysis using listed independent variables (vide page 85) are presented in Table 36. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis, are presented in Table 37a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 37b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
Age		.068	.047	1	.151	1.070	.976	1.174
SI during pregnancy	22	.329	.623	1	.597	1.390	.410	4.712
Postpartum SI	26	1.421	.610	1	.020	4.140	1.253	13.680
Dyspareunia	22	.711	.629	1	.259	2.036	.593	.6.994
Head circumference		.007	.008	1	.376	1.007	.992	1.002
Constant		-5.179	3.149	1	.100	.006		

n^x= number with SI=stress incontinence

Table 36. Multivariable analysis of postpartum AI and obstetrical/biological predictors (elective caesarean)

Step 6 with 73.7% specificity and 54.8% sensitivity was selected. The model's goodness of fit (Hosmer & Lemeshow) was χ^2=6.554, df=8, *p*=0.587, suggesting a good fit and the expected shrinkage of 0.92 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Age	SI during pregnancy		Postpartum SI		Dyspareunia		Hcirc
Postpartum AI		No	Yes	No	Yes	No	Yes	Mean
Yes	33	26	12	22	20	27	15	349
No	32	32	10	32	6	31	7	346
Total		58	22	54	26	58	22	
P value	0.282	0.582		0.002		0.132		0.780

AI=anal incontinence SI=stress incontinence Hcirc=head circumference

Table 37a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and postpartum AI

	Analgesia			WPr
Postpartum AI	Epidural	Spinal	GA	
Yes	4	32	6	18
No	2	31	5	24
Total	6	63	11	
P value	0.756			0.196

AI=anal incontinence WPr=wound problems GA=general anaesthetic

Table 37b. Univariate analysis of further medically relevant obstetrical/biological variables and postpartum AI

The significant multivariable predictor, also consistent at the univariate level (Table 37a), was postpartum stress incontinence. No further significant factors were evident from Table 37b.

iv) Emergency caesarean

The results of the multivariable analysis using listed independent variables (vide page 85) are presented in Table 38. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 39a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 39b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
Age		-.068	.049	1	.162	.934	.849	1.028
Postpartum SI	34	1.365	.512	1	.008	3.916	1.437	10.676
Dyspareunia	28	.303	.499	1	.543	1.354	.510	3.598
Induction of labour	50	-.984	.494	1	.046	.374	.142	.983
Undilated cervix	19			2	.084			
Early labour	70	.326	.644	1	.612	1.386	.392	4.895
Late labour	13	-1.380	.901	1	.125	.252	.043	1.470
Birth weight		.000	.000	1	.254	1.000	1.000	1.001
Constant		.525	1.707	1	.759	1.690		

n^x= number with SI=stress incontinence

Table 38. Multivariable analysis of postpartum AI and obstetrical/biological predictors (emergency caesarean)

Step 5 with 72.5% specificity and 66.7% sensitivity was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2=5.608, df=8, p=0.577 suggested a good fit and the expected shrinkage of 0.94 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Age	Postpartum SI		Dyspareunia		Bwt	IOL	Un cx	E lab	L lab
Postpartum AI		No	Yes	No	Yes	Mean	Yes			
Yes	31	29	23	34	26	3261	23	9	31	5
No	32	41	11	100	24	3093	29	11	29	8
Total		70	34	134	50			20	70	13
P value	0.253	0.001		0.001		0.645	0.327	0.498		

AI=anal incontinence SI=stress incontinence Bwt=birthweight IOL=induction of labour Un cx=Undilated cervix E lab=Early labour L lab=Late labour

Table 39a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and postpartum AI

	Analgesia			WPr
Postpartum AI	Epidural	Spinal	GA	
Yes	29	12	11	3
No	24	13	14	7
Total	53	25	25	
P value	0.650			0.418

AI=anal incontinence WPr=wound problems GA=general anaesthetic

Table 39b. Univariate analysis of further medically relevant obstetrical/biological variables and postpartum AI

The significant multivariable predictor for postpartum anal incontinence, also consistent at the univariate level (Table 39a), was postpartum stress incontinence. Induction of labour showed a negative association with postpartum anal incontinence. Dyspareunia was significant at the univariate level (Table 39a) but not at the multivariable level; a 2x2 tabular analysis including dyspareunia and postpartum stress incontinence, which reached significance in the multivariable model, showed a significant correlation with it: χ^2=5.141, df=1, *p*=0.023. No further significant factors were evident from Table 39b.

v) Vaginal delivery

The results of the multivariable analysis using listed independent variables (vide page 85) are presented in Table 40. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 41a whereas any association with other clinically relevant obstetrical/biological variables is depicted in Table 41b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
SI during pregnancy	16	-.523	.672	1	.437	.593	.159	2.214
Postpartum SI	33	.972	.606	1	.109	2.643	.806	8.671
Duration 1st stage		-.155	.083	1	.061	.857	.729	1.007
Constant		.474	.742	1	.523	1.606		

n^x= number with SI=stress incontinence

Table 40. Multivariable analysis of postpartum AI and obstetrical/biological predictors (vaginally delivered)

Step 9 with 72.7% specificity and 60.0% sensitivity was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2=7.245, df=8, p=0.510 suggested a good fit and the expected shrinkage of 0.89 indicated that it was not overfitted, thus suitable for multivariable analysis.

	SI during pregnancy		Postpartum SI		Dur 1st
Postpartum AI	No	Yes	No	Yes	Mean
Yes	38	8	18	26	5.967
No	42	12	28	28	8.313
Total	80	20	46	54	
P value	0.688		0.422		0.001

AI=anal incontinence SI=stress incontinence Dur 1st=duration 1st stage

Table 41a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and postpartum AI

	Analgesia				WPr	Dur 2nd
Postpartum AI	Non	Entonox	Pethidine	Epidural		Mean
Yes	7	16	16	5	13	1.148
No	3	14	25	14	16	1.314
Total	10	30	41	19		
P value	0.157				0.531	0.375

AI=anal incontinence Non=none WPr=wound problems Dur 2nd=duration 2nd stage labour

Table 41b. Univariate analysis of further medically relevant obstetrical/biological variables and postpartum AI

There were no significant multivariable predictors but duration of the first stage of labour (5.96 vs. 8.31 hours) was close to significance (Table 40), and significant in the univariate analysis (Table 41a). No further significant factors were evident from Table 41b.

4. New anal incontinence (incidence) and obstetrical/biological associations

New symptoms of anal incontinence (new anal incontinence) refers to symptoms manifest for the first time after delivery. The small frequency of new symptoms of anal incontinence made the application of multivariable analyses inappropriate for assessing any obstetrical/ biological associations. Therefore, limited univariate analysis has been carried out using Chi-squared tests for any association with wound problems and *t* tests for continuous obstetric variables.

4a. New anal incontinence and obstetrical/biological associations (Chi-squared tests)

i) All participants

Ten mothers had new anal incontinence. Of these mothers with new anal incontinence six (representing 60% of this group) also had wound problems and 4 (representing 40% of this group) did not have wound problems. A statistically significant association was not reached.

ii) Caesarean group

Of these mothers with new anal incontinence three (representing 75% of this group) also had wound problems and one (representing 25% of this group) did not have wound problems. A statistically significant association was not reached. There was only one emergency caesarean participant with new anal incontinence who had wound problems. All the elective caesarean participants (three, representing 100% of this group) did not have wound problems. A statistically significant association was not reached.

iii) NVD group

Three participants with new anal incontinence (representing 50% of this group) did not have wound problems and three (representing 50% of those with new anal incontinence) had wound problems. A statistically significant association was not reached.

4b. New anal incontinence and labour (emergency caesarean)

Three of 63 (5%) emergency caesarean mothers in early labour and one of 20 (5%) in late labour developed new anal incontinence. This was not a statistically significant difference (Fisher's Exact test value=3.496, p=0.184).

4c. New anal incontinence and 2nd degree tear

New symptoms were reported by one (3%) with an intact perineum and five (23%) with a 2nd degree tear reaching statistical significance (Fisher's Exact value=9.697, p=0.014).

4d. New anal incontinence and obstetrical associations (*t* tests)

The association of the various groups with new anal incontinence and obstetric variables such as birth-weight, head circumference (all groups), cervical dilation (emergency caesarean only), duration of 1st/2nd stages and active pushing in labour (NVD only) were compared using *t* tests. The elective caesarean mothers with new anal incontinence showed a statistically significant association for head circumference (t=2.345, df=101, p=0.021) and the emergency caesarean mothers with birth weight (t=2.113, df=102, p=0.037). The NVD mothers with new anal incontinence did not show a statistically significant association.

5. Postpartum Dyspareunia and obstetrical/biological predictors

Postpartum dyspareunia is referred to as dyspareunia. The data on dyspareunia was limited to the postpartum period only. Dyspareunia was prevalent in 96 participants. Significant obstetrical/biological predictors were identified by carrying out logistic regression modelling

with dyspareunia entered as the dependent variable and variables such as age, mode of delivery, analgesia, birth weight, head circumference, wound problems, pre-pregnancy stress incontinence, stress incontinence during pregnancy, postpartum stress incontinence and postpartum anal incontinence as the independent variables (listed on page 62), followed by the univariate analyses (vide page 73). The results are tabulated in the following pages.

i) All participants

The results of the multivariable analysis using listed independent variables (vide above) are presented in Table 42. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis, are presented in Table 43a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 43b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
NVD	71			2	.076			
El CS	80	-.677	.368	1	.066	.508	.247	1.045
Em CS	102	-.724	.346	1	.036	.485	.246	.955
Wound problems	105	.818	.287	1	.004	2.267	1.291	3.979
Postpartum SI	101	1.036	.290	1	<0.001	2.818	1.597	4.973
Constant		-.999	.338	1	.003	.368		

n^x= number with SI=stress incontinence, El CS=elective caesarean Em CS=emergency caesarean NVD=non-instrumental vaginal delivery

Table 42. Multivariable analysis of dyspareunia and obstetrical/biological predictors (all participants)

Step 8 with 83.8% specificity and 44.2% sensitivity was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2= 3.254, df=7, p=0.861 suggested a good fit and the expected shrinkage of 0.98 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Delivery mode			WPr	Postpartum SI	
Dyspareunia	NVD	El CS	Em CS		No	Yes
Yes	46	22	28	43	39	57
No	54	58	76	53	131	57
Total	100	80	104		170	114
P value	0.006			0.043	<0.001	

NVD=non-instrumental vaginal delivery El CS=elective caesarean Em CS=emergency caesarean WPr=wound problems SI=stress incontinence

Table 43a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and dyspareunia

	Analgesia						Age	Bwt	Hcirc
Dyspareunia	Non	Entonox	Pethidine	Epidural	Spinal	GA	Mean	Mean	Mean
Yes	2	14	20	26	24	10	31	3159	342
No	8	16	21	52	64	26	32	3095	338
Total	10	30	41	78	88	36			
P value	1.101						0.289	0.691	0.468

Bwt=birth weight Hcirc=head circumference Non=none GA=general anaesthetic

Table 43b. Univariate analysis of further medically relevant obstetrical/biological variables and dyspareunia

Significant multivariable predictors, also consistent at the univariate level (Table 43a), were postpartum stress incontinence and wound problems. No mode of delivery was a significant predictor although emergency caesarean delivery showed a significant, albeit negative, association and elective caesarean was close to significance. No further significant factors were evident from Table 43b.

ii) Overall caesarean

The results of the multivariable analysis using listed independent variables (vide page 92) are presented in Table 44. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 45a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 45b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
Age		.062	.036	1	.081	.940	.876	1.008
Pre-pregnancy SI	12	1.434	.711	1	.044	4.195	1.041	16.908
Postpartum SI	60	.847	.387	1	.029	2.332	1.092	4.984
Wound problems	68	.745	.366	1	.042	2.106	1.028	4.312
Head circumference		.011	.007	1	.103	.989	.977	1.002
Constant		.3902	2.416	1	.106	49.498		

n^x= number with SI=stress incontinence

Table 44. Multivariable analysis of dyspareunia and obstetrical/biological predictors (overall caesarean)

Step 5 with 9.3% specificity and 26.0 % sensitivity was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2=4.627, df=8, p=0.797 suggested a good fit and the expected shrinkage of 0.96 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Age	Pre-pregnancy SI		Postpartum SI		WPr	Hcirc
Dyspareunia	Mean	No	Yes	No	Yes		Mean
Yes	31	42	8	24	26	19	328
No	32	130	4	100	34	31	340
Total		172	12	124	60		
P value	0.316	0.001		0.001		0.064	0.466

SI=stress incontinence WPr=wound problems Hcirc=head circumference

Table 45a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and dyspareunia

	Analgesia		
Dyspareunia	Epidural	Spinal	GA
Yes	16	24	10
No	43	64	26
Total	59	88	36
P value	0.997		

GA=general anaesthetic

Table 45b. Univariate analysis of further medically relevant obstetrical/biological variables and dyspareunia

Significant multivariable predictors consistent at the univariate level (Table 45a) were pre-pregnancy stress incontinence, postpartum stress incontinence and wound problems; age approached significance (Table 44). No other significant factor was evident from Table 45b.

iii) Elective caesarean

The results of the multivariable analysis using listed independent variables (vide page 92) are presented in Table 46. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 47a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 47b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
Age		-.149	.061	1	.015	.862	.765	.971
Pre-pregnancy SI	6	2.689	1.339	1	.045	14.716	1.067	202.905
Postpartum SI	26	1.181	.649	1	.069	3.257	.912	11.624
Wound problems	28	1.477	.637	1	.020	4.381	1.257	15.268
Constant		2.440	1.846	1	.186	11.478		

n^x= number with SI=stress incontinence

Table 46. Multivariable analysis of dyspareunia and obstetrical/biological predictors (elective caesarean)

Step 6 with 93.1% specificity and 50.0% sensitivity was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2=7.101, df=8, *p*=0.526 suggested a good fit and the expected shrinkage of 0.89 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Age	Pre-pregnancy SI		Postpartum SI		WPr
Dyspareunia		No	Yes	No	Yes	
Yes	32	17	5	9	13	7
No	32	57	1	45	13	15
Total		74	6	54	26	
P value	0.305	0.001		0.002		0.028

SI=stress incontinence WPr=wound problems

Table 47a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and dyspareunia

	Analgesia		
Dyspareunia	Epidural	Spinal	GA
Yes	2	19	1
No	4	44	10
Total	6	63	11
P value	0.334		

GA=general anaesthetic

Table 47b. Univariate analysis of further medically relevant obstetrical/biological variables and dyspareunia

The significant multivariable predictors, consistent at the univariate level (Table 47a), were pre-pregnancy stress incontinence and wound problems and postpartum stress incontinence was close to significance (Table 46). No other significant factor was evident from Table 47b.

iv) Emergency caesarean

The results of the multivariable analysis using listed independent variables (vide page 92) are presented in Table 48. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 49a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 49b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
Postpartum SI	34	.937	.510	1	.066	2.552	.939	6.936
Postpartum AI	51	.356	.496	1	.474	1.427	.540	3.774
Undilated cervix	19			2	.361			
Early labour	70	.361	.686	1	.599	1.434	.374	5.499
Late labour	13	-.916	1.060	1	.387	.400	.050	3.196
Head circumference		-.010	.009	1	.285	.990	.972	1.008
Spinal	25			2	.366			
Epidural	53	.255	.627	1	.685	1.290	.377	4.410
General anaesthetic	24	.917	.701	1	.190	2.503	.634	9.881
Constant		1.138	3.077	1	.712	3.120		

n^x= number with SI=stress incontinence, AI=anal incontinence

Table 48. Multivariable analysis of dyspareunia and obstetrical/biological predictors (emergency caesarean)

Step 6 with 93.1 % specificity and 50.0 % sensitivity was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2=6.353, df=8, p=0.608 suggested a good fit and the expected shrinkage of 0.93 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Postpartum SI		Postpartum AI		Un cx	E lab	L lab	Hcirc	Analgesia		
Dyspareunia	No	Yes	No	Yes				Mean	Epidural	Spinal	GA
Yes	15	13	11	17	5	21	2	3261	14	5	9
No	55	21	41	35	15	49	11	3093	39	20	16
Total	70	34	52	52	20	70	13		53	25	25
P value	0.098		0.185		0.535			0.645	0.134		

SI=stress incontinence AI=anal incontinence Un cx=Undilated cervix E lab=Early labour L lab=Late labour Hcirc=head circumference GA=general anaesthetic

Table 49a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and dyspareunia

	WPr	IOL
Dyspareunia		
Yes	12	14
No	16	14
P value	0.124	0.905

WPr=wound problems IOL=induction of labour

Table 49b. Univariate analysis of further medically relevant obstetrical/biological variables and dyspareunia

Significant multivariable predictors were absent; postpartum stress incontinence was close to significance and this was consistent with the results of the univariate analysis (Table 49a). No further significant factors were evident from Table 49b.

v) Vaginal delivery

The results of the multivariable analysis using listed independent variables (vide page 92) are presented in Table 50. Univariate analysis of obstetrical/biological variables selected by the multivariable analysis are presented in Table 51a whereas any association with other clinically relevant obstetrical/biological variables are depicted in Table 51b.

Independent variables	n^x	B	S.E.	df	Sig	OR	C.I.	
							Lower	Upper
Pre-pregnancy SI	5	-1.963	1.200	1	.102	.140	.013	1.476
Postpartum SI	33	1.633	.642	1	.011	5.118	1.453	18.025
Duration 2nd stage		.591	.349	1	.091	1.806	.911	3.578
Constant		-1.668	.730	1	.021	.185		

n^x= number with SI=stress incontinence

Table 50. Multivariable analysis of dyspareunia and obstetrical/biological predictors (vaginally delivered)

Step 9 with 61.3% specificity and 74.1% sensitivity was selected. The model's goodness of fit (Hosmer & Lemeshow) of χ^2 =10.570, df=8, *p*=0.227 suggested a good fit and the expected shrinkage of 0.89 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Pre-pregnancy SI		Postpartum SI		Dur 2nd
Dyspareunia	No	Yes	No	Yes	Mean
Yes	44	2	15	31	2.235
No	50	4	31	23	1.970
Total	94	6	46	54	
P value	0.521		0.013		0.234

SI=stress incontinence Dur 2nd=duration 2nd stage

Table 51a. Univariate analysis of obstetrical/biological variables selected by multivariable analysis and dyspareunia

	Analgesia				WPr	Dur 1st
Dyspareunia	Non	Entonox	Pethidine	Epidural		Mean
Yes	2	14	20	10	25	7.794
No	8	16	21	9	21	6.839
Total	10	30	41	19		
P value	0.314				0.531	0.183

WPr=wound problems Dur 1st=duration 1st stage Non=none

Table 51b. Univariate analysis of further medically relevant obstetrical/biological variables and dyspareunia

The significant multivariable predictor, also significant at th univariate level (Table 51a), was postpartum stress incontinence. Duration of the second stage of labour went towards significance (Table 50). No further significant factors were evident from Table 51b.

6. Haemorrhoids and obstetrical/biological associations

The frequencies of women with postpartum haemorrhoids were small so multivariable analyses would be inappropriate and simple summary statistics were carried out.
Six mothers with haemorrhoids had wound problems whilst two did not have these problems.

F. THE SEVERITY of PELVIC/PERINEAL DYSFUNCTION – ANALYSES for associations with PSYCHOSOCIAL VARIABLES (dysphoria & social ill-health)

The severity of pelvic dysfunction has been assessed in the first instance by evaluating its effect on the sufferer's psychosocial health using both multivariable and univariate analysis (vide Chapter III, page 57). The association of dyspareunia with psychosocial health, including overall sexual functioning and its relation to other pelvic floor symptoms, is explored next using univariate analyses. Other indicators of severity, such as the need for medical consultation, the perineal protection needed for incontinence and the interference with her relationship with her baby are discussed further on in this chapter.

A small cross-section of real-life descriptions of what participants experienced have been inserted to illustrate that perception was very personal to each individual. Even when the pelvic floor symptom was objectively severe, the patient could perceive it as tolerable whereas what may be considered as objectively satisfactory, e.g. a scar healed by primary intention, could cause severe symptoms affecting psychosocial/sexual health. Hence, considering the mother's perception was necessary to assess the impact of the dysfunction and developing measures to quantify it would be clinically important.

Psychological health was assessed mainly with regard to dysphoric symptoms as responses to the open questioning revealed that disturbance of mood was the symptom-complex that was widely prevalent. Two mothers presented with post-traumatic stress reaction following emergency caesarean delivery. The number of participants with diagnosed depression according to the mode of delivery has been reported in this section along with phrases expressing the mother's feelings. Any dysphoric symptoms reported, in addition to the presence of a low subjective mood, were grouped into four categories with increasing severity from no symptom to a diagnosis of depression (vide Chapter III, page 51-52). The category with one dysphoric symptom and low subjective mood was considered as mild dysphoria and that with two dysphoric symptoms along with a low subjective mood was considered as moderate dysphoria (this category would include individuals with sub-clinical mood

disorders). There were very few in the last category (4) which was collapsed to merge[253] with category 3 (subgroup I, Table 52) and depicted in subgroup II as severe dysphoria (this category would include individuals with minor to major depression).

Subgroups	**Distribution of dysphoric symptoms**				
	0	**1#**	**2#**	**3#**	**4#**
I	None	1 symptom	2 symptoms	≥3 symptoms	depression*
II	None	Dysphoria (1) (mild)	Dysphoria (2) (moderate)	≥3 symptoms or depression (severe)	

* Diagnosed depression # accompanying low subjective mood

Table 52. The subgroups of dysphoric symptoms

In the stress incontinent post-caesarean sample, 21 (35%) did not experience dysphoria, 18 (30%) had mild-moderate dysphoria and 21 (35%) had severe dysphoria whereas similar figures for the vaginally delivered were 20 (37%), 14 (26%) and 20 (37%), respectively. Amongst those with anal incontinence following a caesarean, 41 (44%) did not have dysphoria, 29 (31%) had mild-moderate dysphoria and 24 (25%) had severe dysphoria with similar figures for the vaginally delivered being, 17 (39%), 17 (39%) and 10 (23%), respectively. Among those complaining of dyspareunia, 19 (38%) did not experience dysphoria, 16 (32%) had mild-moderate dysphoria and 15 (30%) had severe dysphoria following caesarean delivery and similar figures for the vaginally delivered were 11 (24%), 12 (26%) and 23 (50%), respectively.

Social variables analysed were related to the interference and delay in resuming relevant postpartum social activities, which the mother attributed to her pelvic dysfunction (vide Chapter III, pages 59-60). In order to investigate if there was a significant relationship between a psychosocial variable and pelvic floor symptoms, logistic regression modelling was used to adjust for confounding variables and then univariate analyses were carried out. Clinical knowledge influenced the selection of independent biological/obstetrical factors which could be confounding variables along with the pelvic floor symptoms, with the most likely factors being chosen first so as not to overload the models. Evaluation of any such relationship in this manner had not been carried out in previous studies and the objective was to identify any associations between psychosocial variables which could be used by health care personnel to evaluate 'silent' pelvic dysfunction and develop further research on biopsychosocial assessment of these symptoms with a view to developing relevant support services.

Analyses are represented in tabular form with the multivariable analysis presented first followed by the univariate analysis represented in two Tables, one of which includes

biological/obstetric factors presented in the multivariable analysis, and the second includes those biological/obstetric factors not in the multivariable depiction but which could have an association. Details of the independent variables entered at the start of the modelling process are mentioned in the introduction to each tabular representation.

1. Pelvic/perineal dysfunction and impaired psychological health (dysphoria)

Severe dysphoria, which corresponded with mild to major depression, was selected as the outcome variable as it represented the level of psychological ill-health which was necessary to reveal an association with pelvic floor symptoms because mild-moderate dysphoria did not reach a significant association (p=0.315, OR 0.714, CI 0.369, 1.378) with these symptoms.

Psychological ill-health (severe dysphoria) was the outcome variable in the logistic regression modelling and the independent variables entered were postpartum stress incontinence, postpartum anal incontinence, dyspareunia, new stress incontinence, obstetric factors and wound problems (listed on page 63); this was followed by the univariate analyses.

i) All participants

The results of the multivariable analysis using independent variables listed above are presented in Table 53. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 54a whereas any association with other relevant pelvic/perineal symptoms are depicted in Table 54b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum AI	84	-.443	.282	1	.117	.642	.369	1.117
Dyspareunia	61	.803	.287	1	.005	2.231	1.272	3.914
Constant		-.587	.260	1	0.02	1.798		

n^x= numbers with AI=anal incontinence

Table 53. Multivariable analysis of pelvic/perineal and obstetric variables with severe dysphoria

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 5) of χ^2=0.804, df=2, *p*=0.669 suggested a good fit and the expected shrinkage of 0.99 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Postpartum AI		Dyspareunia	
Severe Dysphoria	No	Yes	No	Yes
Yes	48	34	44	38
No	98	104	144	58
Total	146	138	188	96
P value	0.347		0.050	

AI=anal incontinence

Table 54a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with severe dysphoria

	Postpartum SI		New SI		WPr
Severe Dysphoria	No	Yes	No	Yes	
Yes	41	41	57	25	50
No	129	73	157	45	56
Total	170	114	214	70	
P value	0.166		0.050		.028

SI=stress incontinence WPr=wound problems

Table 54b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with severe dysphoria

Dyspareunia was significantly associated with severe dysphoria but postpartum anal incontinence was not; this was consistent at the univariate level (Table 54a). New stress incontinence and wound problems were significantly associated at the univariate level (Table 54b) but not at the multivariable level and a 2x2 analysis with dyspareunia showed significant correlations as, χ^2=3.945, df=1, p=0.047 and χ^2=9.300, df=1, p=0.0002, respectively.

ii) Overall caesarean

The results of the multivariable analysis using independent variables listed (vide page 101) are presented in Table 55. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 56a whereas any association with other relevant pelvic/perineal symptoms are depicted in Table 56b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	42	.848	.408	1	.038	2.334	1.049	5.192
Postpartum AI	65	-.358	.389	1	.358	.699	.326	1.499
Constant		-.592	.267	1	.027	.553		

n^x= numbers with SI=stress incontinence AI=anal incontinence

Table 55. Multivariable analysis of pelvic/perineal and obstetric variables with severe dysphoria

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 4) of χ^2=0.405, df=2, p=0.816 suggested a good fit and the expected shrinkage of 0.98 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Postpartum SI		Postpartum AI	
Severe Dysphoria	No	Yes	No	Yes
Yes	64	39	26	24
No	60	21	64	70
Total	124	60	90	94
P value	0.086		0.339	

SI=stress incontinence AI=anal incontinence

Table 56a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with severe dysphoria

	Dyspareunia		New SI		WPr
Severe Dysphoria	No	Yes	No	Yes	
Yes	35	15	82	21	26
No	99	35	71	10	43
Total	134	50	153	31	
P value	0.785		0.148		0.113

SI=stress incontinence WPr=wound problems

Table 56b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with severe dysphoria

Postpartum stress incontinence was significantly associated with severe dysphoria but postpartum anal incontinence was not; this was consistent at the univariate level (Table 56a). No other significant factors were evident from Table 56b.

iii) Elective caesarean

The results of the multivariable analysis using independent variables listed (vide page 101) are presented in Table 57. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 58a whereas any association with other relevant pelvic/perineal symptoms are depicted in Table 58b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Dyspareunia	22	-1.405	.727	1	.053	.245	.059	1.021
Wound problems	26	1.287	.562	1	.022	3.620	1.203	10.896
Constant		1.350	.653	1	0.04	3.857		

n^x= numbers with

Table 57. Multivariable analysis of pelvic/perineal and obstetric variables with severe dysphoria

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 3) of χ^2=0.168, df=1, *p*= 0.920 suggested a good fit and the expected shrinkage of 0.98 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Dyspareunia		WPr
Severe Dysphoria	No	Yes	
Yes	14	8	9
No	44	14	19
Total	58	22	
P value	0.536		0.101

WPr=wound problems

Table 58a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with severe dysphoria

	Postpartum SI		Postpartum AI		New SI	
Severe Dysphoria	No	Yes	No	Yes	No	Yes
Yes	13	9	10	12	35	8
No	41	17	28	30	33	4
Total	54	26	38	42	68	12
P value	0.692		0.780		0.330	

SI=stress incontinence AI=anal incontinence

Table 58b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with severe dysphoria

Wound problems reached a significant association with severe dysphoria in the multivariable analysis and went towards significance at the univariate level (Table 58a). Dyspareunia almost reached significance. No other significant factors were evident from Table 58b.

iv) Emergency caesarean

The results of the multivariable analysis using independent variables listed (vide page 101) are presented in Table 59. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 60a whereas any association with other relevant pelvic/perineal symptoms are depicted in Table 60b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	22	1.121	.574	1	.051	3.069	.997	9.446
Postpartum AI	35	-.601	.547	1	.272	.548	.188	1.603
Undilated cervix	8	.917	.810	1	.258	2.502	.511	12.250
Constant		.085	.413	1	0.84	1.089		

n^x= numbers with SI=stress incontinence AI=anal incontinence

Table 59. Multivariable analysis of pelvic/perineal and obstetric variables with severe dysphoria

Cervical dilation, which was specific for this subgroup, was the additional independent variable added in the multivariable analysis. The model's goodness of fit (Hosmer & Lemeshow) of the selected model (Step 3) of χ^2= 1.476, df=3, p= 0.688 suggested a good fit and the expected shrinkage of 0.97 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Postpartum SI		Postpartum AI		Un cx	E lab	L lab
Severe Dysphoria	No	Yes	No	Yes			
Yes	36	24	16	12	8	14	3
No	34	10	36	40	12	56	10
Total	70	34	52	52	20	70	13
P value	0.064		0.421		0.498		

SI=stress incontinence AI=anal incontinence Un cx=Undilated cervix E lab=early labour L lab=Late labour

Table 60a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with severe dysphoria

	Dyspareunia		New SI		WPr
Severe Dysphoria	No	Yes	No	Yes	
Yes	21	7	47	13	17
No	55	21	38	6	24
Total	76	28	85	19	
P value	0.110		0.295		0.119

SI=stress incontinence WPr=wound problems

Table 60b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with severe dysphoria

Postpartum stress incontinence almost reached a significant association with severe dysphoria. This was consistent at the univariate level (Table 60a). No other significant factors were evident from Table 60b.

v) Vaginal delivery

The results of the multivariable analysis using independent variables listed (vide page 101) are presented in Table 61. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 62a whereas any association with other relevant pelvic/perineal symptoms are depicted in Table 62b.

Independent variables							C.I.	
	n^x	B	S.E.	df	Sig.	OR	Lower	Upper
Postpartum SI	33	1.716	.780	1	.028	5.560	1.205	25.651
Intact perineum	13	-1.490	.857	1	.082	.225	.042	1.207
Duration of 2nd stage	15	21.035	9486.226	1	.998	.000	.000	.
Constant		.255	.532	1	.632	1.29		

n^x= number with SI=stress incontinence

Table 61. Multivariable analysis of pelvic/perineal and obstetric variables with severe dysphoria

Duration of the second stage of labour and perineal status, which were specific for this subgroup, were the additional independent variables added in the multivariable analysis. The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 3) of χ^2=1.515, df=4, p=0.824 suggested a good fit and the expected shrinkage of 0.91 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Postpartum SI		Perin status		Dur 2nd
Severe Dysphoria	No	Yes	Trauma	Intact	Mean
Yes	12	20	21	11	1.248
No	34	34	39	29	0.500
Total	46	54	60	40	
P value	0.037		0.316		0.426

SI=stress incontinence AI=anal incontinence Perin=perineal Dur 2nd=duration 2nd stage

Table 62a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with severe dysphoria

	Postpartum AI		Dyspareunia		New SI		WPr
Severe Dysphoria	No	Yes	No	Yes	No	Yes	
Yes	22	10	9	23	17	24	24
No	34	34	45	23	44	15	13
Total	56	44	54	46	61	39	
P value	0.428		0.007		0.069		0.020

AI=anal incontinence SI=stress incontinence WPr=wound problems

Table 62b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with severe dysphoria

Postpartum stress incontinence was significantly associated with severe dysphoria which was consistent at the univariate level (Table 62a). Intact perineum went towards significance, albeit negatively. Dyspareunia and wound problems were significantly associated at the univariate level (Table 62b) but not at the multivariable level; a 2x2 tabular analysis with postpartum stress incontinence showed significant correlation with these variables as, χ^2=5.704, df=1, p=0.016 and χ^2=6.808, df=1, p=0.009, respectively.

2. Pelvic/perineal dysfunction and impaired social health

Association of symptoms of pelvic/perineal dysfunction with various maternal social functions was evaluated. Impaired social health was the outcome variable and the independent variables entered were postpartum stress incontinence, anal incontinence, dyspareunia, obstetric factors and wound problems.

2.1 Pelvic/perineal dysfunction and impaired social health (leisure activities)

Interference with resuming leisure activities (LA, in Table headings)

Impaired social health (leisure activities) was the outcome variable and the independent variables entered were postpartum stress incontinence, anal incontinence, dyspareunia, mode of delivery and wound problems (listed on page 63); this was followed by the univariate analyses.

i) All participants

The results of the multivariable analysis using independent variables listed on page 106 are presented in Table 63. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 64a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 64b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	75	.773	.369	1	.036	2.165	1.051	4.463
Postpartum AI	82	-.418	.372	1	.261	.658	.317	1.365
Constant		-1.362	.290	1	.000	.256		

n^x= number with SI=stress incontinence AI=anal incontinence

Table 63. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (LA)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 4) of χ^2=3.513, df=5, p=0.621 suggested a good fit and the expected shrinkage of 0.98 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Postpartum SI		Postpartum AI	
Leisure Activities	No	Yes	No	Yes
Yes	58	48	52	54
No	112	66	94	84
Total	170	114	146	138
P value	0.476		0.074	

SI=stress incontinence AI=anal incontinence

Table 64a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (LA)

	Dyspareunia		New SI		Delivery mode		WPr
Leisure Activities	No	Yes	No	Yes	Caesarean	Vaginal	
Yes	68	38	13	33	41	37	63
No	120	58	141	37	143	63	43
Total	188	96	214	70	184	100	
P value	0.657		0.207		0.008		0.012

SI=stress incontinence WPr=wound problems

Table 64b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (LA)

Postpartum stress incontinence was significantly associated with interference in resuming leisure activities but this was not consistent with the univariate analysis (Table 64a). Delivery mode and wound problems were significantly associated at the univariate level (Table 64b) but

not at the multivariable level; a 2x3 and 2x2 tabular analysis with postpartum stress incontinence showed significant correlation as, χ^2=14.545, df=2, *p*=0.0006 and χ^2=17.413, df=1, *p*=0.00006, respectively.

ii) Overall caesarean

The results of the multivariable analysis using independent variables listed (vide page 106) are presented in Table 65. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 66a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 66b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	34	1.070	.519	1	.039	2.917	1.054	8.073
Postpartum AI	52	-.517	.516	1	.317	.597	.217	1.641
Wound problems	41	.546	.497	1	.272	1.727	.652	4.575
Constant		-1.712	.439	1	.000	.181		

n^x= numbers with SI=stress incontinence AI=anal incontinence

Table 65. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (LA)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 3) of χ^2= 2.293, df= 5, p=0.807 suggested a good fit and the expected shrinkage of 0.95 indicated that it was not overfitted, thus suitable for multivariable analysis.

	Postpartum SI		Postpartum AI		WPr
Leisure Activities	No	Yes	No	Yes	
Yes	46	24	32	38	27
No	78	36	58	56	42
Total	124	60	90	94	
P value	0.858		0.120		0.007

SI=stress incontinence AI=anal incontinence WPr=wound problems

Table 66a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (LA)

	Dyspareunia		New SI	
Leisure activities	No	Yes	No	Yes
Yes	52	18	56	14
No	82	32	97	17
Total	134	50	153	31
P value	0.959		0.559	

SI=stress incontinence

Table 66b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (LA)

A significant association was reached by postpartum stress incontinence in the multivariable analysis but not at the univariate level (Table 66a). Wound problems was significant at the univariate level (Table 66a) but not at the multivariable level indicating the effect of other factors in the multivariable model; a 2x2 tabular analysis showed postpartum stress incontinence as having a correlation going towards significance: χ^2=2.958, df=1, *p*=0.082. No other significant factors were evident from Table 66b.

iii) Elective caesarean

The results of the multivariable analysis using independent variables listed (vide page 106) are presented in Table 67. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 68a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 68b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	34	1.078	.664	1	.104	2.938	.800	10.786
Postpartum AI	52	-.897	.579	1	.121	.408	.131	1.268
Constant		-1.544	.552	1	.005	.214		

n^x= number with SI=stress incontinence AI=anal incontinence

Table 67. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (LA)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 3) of χ^2=0.691, df=2, *p*=0.708 suggested a good fit and the expected shrinkage of 0.97 indicated that it was not overfitted, thus suitable for the analysis.

	Postpartum SI		Postpartum AI	
Leisure Activities	No	Yes	No	Yes
Yes	22	8	13	17
No	32	18	25	25
Total	54	26	38	42
P value	0.530		0.479	

SI=stress incontinence AI=anal incontinence

Table 68a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (LA)

	Dyspareunia		New SI		WPr
Leisure Activities	No	Yes	No	Yes	
Yes	23	7	26	4	15
No	35	15	42	8	13
Total	58	22	68	12	
P value	0.718		0.419		<0.001

SI=stress incontinence WPr=wound problems

Table 68b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (LA)

No independent variable was significantly associated (Table 67) which was consistent with the univariate analysis (Table 68a) although postpartum stress incontinence went towards it. Wound problems was significant at the univariate level (Table 68b) but not at the multivariate level; a 2x2 tabular analysis showed postpartum stress incontinence as having a correlation close to significance: χ^2= 2.8667, df=1, *p*=0.060.

iv) Emergency caesarean

The results of the multivariable analysis using independent variables listed (vide page 106) are presented in Table 69. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 70a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 70b (next page).

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	34	1.138	.537	1	.034	3.121	1.090	8.938
Postpartum AI	52	-.565	.531	1	.288	.569	.201	1.611
Late labour	13	-.276	.754	1	.714	.759	.173	3.323
Constant		-1.448	.383	1	.000	.235		

n^x= numbers with SI=stress incontinence AI=anal incontinence

Table 69. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (LA)

Cervical dilation, which was specific for this subgroup, was the additional independent variable added in the multivariable analysis. The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 4) of χ^2=5.148, df=5, p=0.398 suggested a good fit and the expected shrinkage of 0.95 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Postpartum SI		Postpartum AI		Un cx	E lab	L lab
Leisure Activities	No	Yes	No	Yes			
Yes	36	16	19	21	7	11	2
No	46	18	33	31	13	59	11
Total	70	34	52	52	20	70	13
P value	0.261		0.251		0.146		

SI=stress incontinence AI=anal incontinence Un cx=Undilated cervix E lab=early labour L lab=Late labour

Table 70a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (LA)

	Dyspareunia		New SI		WPr
Leisure Activities	No	Yes	No	Yes	
Yes	29	11	30	10	12
No	47	17	55	9	29
Total	76	28	85	19	
P value	1.000		0.284		0.515

SI=stress incontinence WPr=wound problems

Table 70b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (LA)

Postpartum stress incontinence reached significance in the multivariable analysis. No factor reached significance in the univariate analysis (Tables 70a & b).

v) Vaginal delivery

The results of the multivariable analysis using independent variables listed (vide page 106) are presented in Table 71. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 72a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 72b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	54	.736	.511	1	.150	2.088	.766	5.688
Constant		-1.692	.411	1	.000	.184		

n^x= number with SI=stress incontinence

Table 71. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (LA)

Duration of the second stage of labour and perineal status, which were specific for this subgroup, were the additional independent variables added in the multivariable analysis. The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 5) of χ^2= 0.226, df=2, p=0.893 suggested a good fit and the expected shrinkage of 0.91 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Postpartum SI	
Leisure Activities	No	Yes
Yes	12	24
No	34	30
Total	46	54
P value	0.256	

SI=stress incontinence

Table 72a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (LA)

	Postpartum AI		Dyspareunia		New SI		Perin status		WPr
Leisure Activities	No	Yes	No	Yes	No	Yes	Trauma	Intact	
Yes	20	16	16	20	17	19	25	11	16
No	36	28	38	26	44	20	35	29	21
Total	56	44	54	46	61	39	60	40	
P value	0.630		0.347		0.176		0.404		0.510

AI=anal incontinence SI=stress incontinence WPr=wound problems Perin=perineal

Table 72b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (LA)

Postpartum stress incontinence was the independent variable selected but it did not reach significance, which was consistent with the univariate analysis (Table 72a). No other significant factors were evident from Table 72b.

2.2 Pelvic/perineal dysfunction and impaired social health (social networking)

Interference with resuming social networking (SN, in Table headings)

Impaired social health (social networking) was the outcome variable and the independent variables entered were postpartum stress incontinence, anal incontinence, dyspareunia, mode of delivery and wound problems (listed on page 63); this was followed by the univariate analyses.

i) All participants

The results of the multivariable analysis using independent variables listed above are presented in Table 73. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 74a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 74b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	101	-.232	.372	1	.533	.793	.382	1.645
Caesarean mode	184	.891	.376	1	.018	2.438	1.166	5.099
Constant		-1.952	.334	1	.000	0.14		

n^x= number with SI=stress incontinence

Table 73. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (SN)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 4) of χ^2=0.166, df= 2, p=0.820 suggested a good fit and the expected shrinkage of 0.99 indicated that it was not overfitted, thus suitable for the analysis.

	Postpartum SI		Delivery mode	
Social Networking	No	Yes	Caesarean	Vaginal
Yes	22	19	22	22
No	148	95	162	78
Total	170	114	184	100
P value	0.467		0.030	

SI=stress incontinence

Table 74a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (SN)

	Postpartum AI		Dyspareunia		New SI		WPr
Social Networking	No	Yes	No	Yes	No	Yes	
Yes	20	21	25	16	26	15	14
No	126	117	163	80	188	55	92
Total	146	138	188	96	214	70	
P value	0.932		0.521		0.180		0.572

SI=stress incontinence AI=anal incontinence WPr=wound problems

Table 74b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (SN)

The caesarean mode of delivery was significantly associated with impaired social networking, which was consistent with the univariate analysis (Table 74a). No other significant factors were evident from Table 74b.

ii) Overall caesarean

The results of the multivariable analysis using independent variables listed (vide page 112) are presented in Table 75. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 76a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 76b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum AI	94	1.266	.732	1	.084	3.548	.845	14.898
Wound problems	69	-.777	.742	1	.295	.460	.107	1.966
Constant		-2.190	.630	1	.001	.112		

n^x= number with AI=anal incontinence

Table 75. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (SN)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 4) of χ^2=1.300, df=2, p=0.522 suggested a good fit and the expected shrinkage of 0.97 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Postpartum AI		WPr
Social Networking	No	Yes	
Yes	9	11	9
No	81	83	60
Total	90	94	
P value	0.537		0.814

AI=anal incontinence WPr=wound problems

Table 76a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (SN)

	Postpartum SI		Dyspareunia		New SI	
Social Networking	No	Yes	No	Yes	No	Yes
Yes	12	8	15	5	14	6
No	112	52	119	45	139	25
Total	124	60	134	50	153	31
P value	0.389		0.804		0.125	

SI=stress incontinence

Table 76b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (SN)

No independent variable was significantly associated with impaired social networking but postpartum anal incontinence went towards significance although not evident in the univariate analysis (Table 76a). No other significant factors were evident from Table 76b.

iii) Elective caesarean

The results of the multivariable analysis using independent variables listed (page 112) are presented in Table 77. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 78a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 78b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum AI	42	-1.109	.869	1	.202	.330	.060	1.812
Constant		-2.441	.435	1	.000	.087		

n^x= number with AI=anal incontinence

Table 77. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (SN)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 4) of χ^2=2.579, df=2, p=0.275 suggested a good fit and the expected shrinkage of 0.96 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Postpartum AI	
Leisure activities	No	Yes
Yes	5	2
No	33	40
Total	38	42
P value	0.262	

AI=anal incontinence

Table 78a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (SN)

	Postpartum SI		Dyspareunia		New SI		WPr
Social Networking	No	Yes	No	Yes	No	Yes	
Yes	5	2	6	1	5	2	3
No	49	24	52	21	63	10	25
Total	54	26	58	22	68	12	
P value	0.578		0.619		0.234		0.757

SI=stress incontinence WPr=wound problems

Table 78b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (SN)

No independent variable was significantly associated with impaired social networking and this was consistent with the univariate analysis (Tables 78a & b).

iv) Emergency caesarean

The results of the multivariable analysis using independent variables listed (page 112) are presented in Table 79. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 80a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 80b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum AI	52	.921	.637	1	.148	2.512	.721	8.746
Constant		-2.024	.318	1	.000	.132		

n^x= number with AI=anal incontinence

Table 79. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (SN)

Cervical dilation, which was specific for this subgroup, was the additional independent variable added in the multivariable analysis. The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 4) of χ^2=1.102, df=6, p=0.981 suggested a good fit and the expected shrinkage of 0.92 indicated that it was not overfitted, thus suitable for the analysis.

	Postpartum AI	
Social Networking	No	Yes
Yes	4	9
No	48	43
Total	52	52
P value	0.223	

AI=anal incontinence

Table 80a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (SN)

	Postpartum SI		Dyspareunia		New SI		WPr	Un cx	E lab	L lab
Social Networking	No	Yes	No	Yes	No	Yes				
Yes	7	6	9	4	9	4	6	2	12	4
No	63	28	67	24	76	15	35	18	58	9
Total	70	34	76	28	85	19		20	70	13
P value	0.121		0.754		0.268		0.074	0.204		

SI=stress incontinence WPr=wound problems Un cx=Undilated cervix E lab=early labour L lab=Late labour

Table 80b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (SN)

No independent variable was significantly associated with impaired social networking and this was consistent with the univariate analysis (Tables 80a & b). Wound problems was close to significance in the univariate analysis (Table 80b).

v) **Vaginal delivery**

The results of the multivariable analysis using independent variables listed (page 112) are presented in Table 81. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 82a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 82b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Wound problems	31	.895	.679	1	.187	2.448	.647	9.264
Intact perineum	16	.328	.708	1	.644	1.388	.346	5.563
Constant		-1.867	.607	1	.002	.155		

n^x= number with

Table 81. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (SN)

Duration of the second stage of labour and perineal status, were specific for this subgroup, and were the additional independent variables added in the multivariable analysis. The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 5) of χ^2=5.953, df=5, p=0.311 suggested a good fit and the expected shrinkage of 0.92 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Perin status		WPr
Social Networking	Trauma	Intact	
Yes	12	9	5
No	48	31	32
Total	60	40	
P value	0.429		0.267

Perin=perineal WPr=wound problems

Table 82a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (SN)

	Postpartum SI		Postpartum AI		Dyspareunia		New SI		Dur 2nd
Social Networking	No	Yes	No	Yes	No	Yes	No	Yes	Mean
Yes	10	11	11	10	10	11	12	9	1.315
No	36	43	45	34	44	35	49	30	1.523
Total	46	54	56	44	54	46	61	39	
P value	0.896		0.330		0.569		0.947		0.314

SI=stress incontinence AI=anal incontinence Dur 2nd =Duration 2nd stage

Table 82b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (SN)

No independent variable was significantly associated with impaired social networking. This was consistent with the univariate analysis (Tables 82a & b).

2.3 Pelvic/perineal dysfunction and impaired social health (employment)

Interference with resuming employment (Emp, in Table headings)

Impaired social health (employment) was the outcome variable and the independent variables entered were postpartum stress incontinence, anal incontinence, dyspareunia, obstetric factors and wound problems (listed on page 63); this was followed by the univariate analyses.

i) All participants

The results of the multivariable analysis using independent variables listed on page 117 are presented in Table 83. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 84a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 84b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	101	.648	.285	1	.023	1.912	1.093	3.345
Dyspareunia	86	-.467	.296	1	.115	.627	.351	1.120
Caesarean mode	184	.676	.314	1	.031	1.967	1.064	3.636
Constant		-.961	.325	1	.003	.382		

n^x= numbers with SI=stress incontinence

Table 83. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (Emp)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 3) of χ^2=5.440, df=5, p=0.365 suggested a good fit and the expected shrinkage of 0.98 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Postpartum SI		Dyspareunia		Delivery mode	
Employment	No	Yes	No	Yes	Caesarean	Vaginal
Yes	113	73	128	58	83	32
No	57	41	60	38	101	68
Total	170	114	188	96	184	100
P value	0.119		0.309		0.032	

SI=stress incontinence

Table 84a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (Emp)

	Postpartum AI		New SI		WPr
Employment	No	Yes	No	Yes	
Yes	95	91	142	44	43
No	51	47	72	26	63
Total	146	138	214	70	
P value	0.900		0.627		0.989

AI=anal incontinence SI=stress incontinence WPr=wound problems

Table 84b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (Emp)

Postpartum stress incontinence and the caesarean mode were significantly associated with interference in resuming employment, which was consistent with the univariate analysis. No further factor was significant from Table 84b.

ii) Overall caesarean

The results of the multivariable analysis using independent variables listed (vide page 117) are presented in Table 85. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 86a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 86b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	34	-.320	.447	1	.473	.726	.302	1.742
Postpartum AI	52	.751	.424	1	.077	2.118	.922	4.864
Wound problems	41	.335	.408	1	.411	1.398	.628	3.111
Constant		-.652	.440	1	.138	.521		

n^x= numbers with SI=stress incontinence AI=anal incontinence

Table 85. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (Emp)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 3) of χ^2=1.954, df=5, *p*=0.857 suggested a good fit and the expected shrinkage of 0.96 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Postpartum SI		Postpartum AI		WPr
Employment	No	Yes	No	Yes	
Yes	87	40	64	63	31
No	37	20	26	31	38
Total	124	60	90	94	
P value	0.366		0.855		0.979

SI=stress incontinence AI=anal incontinence WPr=wound problems

Table 86a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (Emp)

	Dyspareunia		New SI	
Employment	No	Yes	No	Yes
Yes	93	34	108	19
No	41	16	45	12
Total	134	50	153	31
P value	0.747		0.715	

SI=stress incontinence

Table 86b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (Emp)

No independent variable reached significance which was consistent with the univariate analysis (Tables 86a & b), although postpartum anal incontinence was close to significance (Table 85).

iii) Elective caesarean

The results of the multivariable analysis using independent variables listed (vide page 117) are presented in Table 87. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 88a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 88b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Wound problems	28	.519	.473	1	.272	1.681	.665	4.249
Constant		-.232	.279	1	.406	.793		

n^x= number with

Table 87. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (Emp)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 3) of χ^2=0.052, df=2, p=0.974 suggested a good fit and the expected shrinkage of 0.98 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	WPr
Employment	
Yes	7
No	21
P value	0.533

WPr=wound problems

Table 88a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (Emp)

	Postpartum SI		Postpartum AI		Dyspareunia		New SI	
Employment	No	Yes	No	Yes	No	Yes	No	Yes
Yes	35	18	25	28	39	14	46	7
No	19	8	13	14	19	8	22	5
Total	54	26	38	42	58	22	68	12
P value	0.496		0.727		0.954		0.930	

SI=stress incontinence AI=anal incontinence

Table 88b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (Emp)

Although wound problems was the independent variable present in the selected step, it did not reach a significant association, which was consistent with the univariate analysis (Tables 88a & b).

iv) Emergency caesarean

The results of the multivariable analysis using independent variables listed (vide page 117) are presented in Table 89. Univariate analysis of pelvic/perineal symptoms selected by the

multivariable analysis are presented in Table 90a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 90b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	34	-.303	.445	1	.495	.738	0.31	1.765
Postpartum AI	52	.710	.419	1	.090	2.033	.894	4.622
Constant		-.470	.377	1	.212	.625		

n^x= number with SI=stress incontinence AI=anal incontinence

Table 89. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (Emp)

Cervical dilation, which was specific for this subgroup, was the additional independent variable added in the multivariable analysis. The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 3) of χ^2=0.578, df=2, p=0.749 suggested a good fit and the expected shrinkage of 0.98 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Postpartum SI		Postpartum AI	
Employment	No	Yes	No	Yes
Yes	52	22	39	35
No	18	12	13	17
Total	70	34	52	52
P value	0.548		0.182	

SI=stress incontinence AI=anal incontinence

Table 90a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (Emp)

	Dyspareunia		New SI		WPr	Un cx	E lab	L lab
Employment	No	Yes	No	Yes				
Yes	54	8	62	12	24	3	12	3
No	22	20	23	7	17	17	58	10
Total	76	28	85	19		20	70	13
P value	0.778		0.729		0.762	0.830		

SI=stress incontinence WPr=wound problems Un cx=Undilated cervix E lab=early labour L lab=Late labour

Table 90b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (Emp)

No independent variable reached significance, which was consistent with the univariate analysis (Tables 90a & b), although anal incontinence appeared to go towards it.

v) Vaginal delivery

The results of the multivariable analysis using independent variables listed (vide page 117) are presented in Table 91. Univariate analysis of pelvic/perineal symptoms selected by the

multivariable analysis are presented in Table 92a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 92b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	19	2.234	.754	1	.003	9.337	2.132	40.891
Dyspareunia	27	-1.542	.678	1	.023	.214	.057	.808
Intact perineum	29	-1.803	.899	1	.045	.165	.028	.960
Constant		-1.167	.576	1	.043	.311		

n^x= number with SI=stress incontinence

Table 91. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (Emp)

The duration of the second stage of labour and perineal status, specific for this subgroup, were the additional independent variables added in the multivariable analysis. The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 4) of χ^2=2.821, df=5, p=0.727 suggested a good fit and the expected shrinkage of 0.92 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Postpartum SI		Dyspareunia		Perin status	
Employment	No	Yes	No	Yes	Trauma	Intact
Yes	26	33	19	24	37	22
No	20	21	35	22	23	18
Total	46	54	54	46	60	40
P value	0.06		0.456		0.896	

SI=stress incontinence Perin=perineal

Table 92a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (Emp)

	Postpartum AI		New SI		WPr
Employment	No	Yes	No	Yes	
Yes	31	28	34	25	12
No	25	16	27	14	25
Total	56	44	61	39	
P value	0.124		0.210		0.96

AI=anal incontinence SI=stress incontinence WPr=wound problems

Table 92b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (Emp)

Postpartum stress incontinence, dyspareunia and intact perineum were significantly associated with a delay in resuming employment but the latter two factors were negatively associated.

Association with postpartum stress incontinence was consistent with the univariate analysis (Table 92a); no further factor was significant from Table 92b.

2.4 Pelvic/perineal dysfunction and impaired social health (sexual relationship)

Interference with resuming sexual relationship (Sex relat, in Table headings)

Impaired social health (sexual relationship) was the outcome variable and the independent variables entered were postpartum stress incontinence, anal incontinence, dyspareunia, obstetric factors and wound problems (listed on page 63); this was followed by the univariate analyses.

i) All participants

The results of the multivariable analysis using independent variables listed above are presented in Table 93. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 94a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 94b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum AI	124	.654	.333	1	.049	1.924	1.002	3.695
Wound problems	106	.582	.328	1	.076	1.790	.941	3.402
Constant		-1.489	.166	1	.000	.226		

n^x= number with AI=anal incontinence

Table 93. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (Sex relat)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 4) of χ^2=0.054, df= 2, p=0.973 suggested a good fit and the expected shrinkage of 0.80 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Postpartum AI		WPr
Sexual Relationship	No	Yes	
Yes	21	32	29
No	125	106	77
Total	146	138	
P value	0.091		0.004

AI=anal incontinence WPr=wound problems

Table 94a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (Sex relat)

	Postpartum SI		Dyspareunia		New SI		Delivery mode	
Sexual Relationship	No	Yes	No	Yes	No	Yes	Caesarean	Vaginal
Yes	33	20	33	20	40	13	45	19
No	137	94	155	76	174	57	139	81
Total	170	114	188	96	214	70	184	100
P value	0.447		0.406		0.793		0.293	

SI=stress incontinence

Table 94b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (Sex relat)

Postpartum anal incontinence was significantly associated with interference in resuming sexual relationship and wound problems was close to significance. This was consistent at the univariate level (Table 94a); no further factor was significant from Table 94b.

ii) Overall caesarean

The results of the multivariable analysis using independent variables listed (vide page 123) are presented in Table 95. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 96a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 96b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Induction of labour	51	.814	.512	1	.112	2.256	.826	6.161
Constant		-1.838	.407	1	.000	.159		

n^x= number with

Table 95. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (Sex relat)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 5) of χ^2=1.141, df=2, p=0.565 suggested a good fit and the expected shrinkage of 0.96 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Induction of labour	
Sexual Relationship	No	Yes
Yes	33	14
No	100	37
Total	133	51
P value	0.713	

Table 96a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (Sex relat)

	Postpartum SI		Postpartum AI		Dyspareunia		New SI		WPr
Sexual Relationship	No	Yes	No	Yes	No	Yes	No	Yes	
Yes	24	12	13	23	22	14	31	5	18
No	100	48	77	71	112	36	122	26	51
Total	124	60	90	94	134	50	153	31	
P value	0.258		0.213		0.0781		0.822		0.150

SI=stress incontinence AI=anal incontinence WPr=wound problems

Table 96b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (Sex relat)

Induction of labour was the independent variable in the step selected but did not reach significance. This was consistent at the univariate level (Tables 96a). Dyspareunia went towards significance only at the univariate level (Table 96b) reflecting the effect of other variables at the multivariable level.

iii) Elective caesarean

The results of the multivariable analysis using independent variables listed (vide page 123) are presented in Table 97. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 98a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 98b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Dyspareunia	22	1.070	.595	1	.072	2.917	.908	9.369
Constant		-1.833	.381	1	.000	.160		

n^x= number with

Table 97. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (Sex relat)

The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 4) of χ^2=2.923, df=2, p=0.232 suggested a good fit and the expected shrinkage of 0.97 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Dyspareunia	
Sexual Relationship	No	Yes
Yes	8	7
No	50	15
Total	58	22
P value	0.020	

Table 98a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (Sex relat)

	Postpartum SI		Postpartum AI		New SI		WPr
Sexual Relationship	No	Yes	No	Yes	No	Yes	
Yes	8	7	5	10	10	5	8
No	46	19	33	32	58	7	20
Total	54	26	38	42	68	12	
P value	0.633		0.450		0.058		0.017

SI=stress incontinence AI=anal incontinence WPr=wound problems

Table 98b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (Sex relat)

No independent variable was significantly associated although dyspareunia was close to significance. This was consistent at the univariate level (Table 98a). Wound problems was significant at the univariate level (Table 98b) only reflecting the effect of other variables at the multivariable level.

iv) Emergency caesarean

The results of the multivariable analysis using independent variables listed (vide page 123) are presented in Table 99. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 100a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 100b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I.	
							Lower	Upper
Postpartum SI	34	-.750	.584	1	.199	.473	.150	1.484
Postpartum AI	52	.775	.520	1	.136	2.170	.784	6.008
Constant		-1.577	.394	1	.000	.207		

n^x= number with SI=stress incontinence AI=anal incontinence

Table 99. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (Sex relat)

Cervical dilation, which was specific for this subgroup, was the additional independent variable added in the multivariable analysis. The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 4) of χ^2=2.187, df=4, p=0.701 suggested a good fit and the expected shrinkage of 0.96 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Postpartum SI		Postpartum AI	
Sexual Relationship	No	Yes	No	Yes
Yes	16	5	8	13
No	54	29	44	39
Total	70	34	52	52
P value	0.034		0.250	

SI=stress incontinence AI=anal incontinence

Table 100a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (Sex relat)

	Dyspareunia		New SI		WPr	Un cx	E lab	L lab
Sexual Relationship	No	Yes	No	Yes				
Yes	14	7	21	0	10	6	11	4
No	52	21	64	19	31	14	59	9
Total	76	28	85	19	10	20	70	13
P value	0.650		0.053		0.964	0.230		

SI=stress incontinence WPr=wound problems Un cx=Undilated cervix E lab=early labour L lab=Late labour

Table 100b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (Sex relat)

Postpartum stress and anal incontinence were the independent variables selected but neither reached significance although stress incontinence was significant in the univariate analysis. A non-significant association between these were shown in a 2x2 tabular analysis. No further factor was significant although new stress incontinence was close to significance (Table 100b).

v) Vaginal delivery

The results of the multivariable analysis using independent variables listed (vide page 123) are presented in Table 101. Univariate analysis of pelvic/perineal symptoms selected by the multivariable analysis are presented in Table 102a whereas any association with other relevant pelvic/perineal symptoms and obstetric variables are depicted in Table 102b.

Independent variables	n^x	B	S.E.	df	Sig.	OR	C.I. Lower	C.I. Upper
Postpartum SI	33	-2.066	.998	1	.038	.127	.018	.896
Postpartum AI	25	.934	.997	1	.297	2.546	.439	14.760
Duration of 2nd stage	16	-1.726	1.235	1	.162	.178	.016	2.005
Wound problems	31	2.131	1.069	1	.046	8.421	1.051	68.409
Constant		-2.619	.698	1	.000	.073		

n^x= number with SI=stress incontinence AI=anal incontinence

Table 101. Multivariable analysis of pelvic/perineal and obstetric variables with impaired social health (Sex relat)

Duration of the second stage of labour and perineal status, which were specific for this subgroup, were the additional independent variables added in the multivariable analysis. The goodness of fit (Hosmer & Lemeshow) of the selected model (Step 3) of 2.478, df=6, *p*=0.871 suggested a good fit and the expected shrinkage of 0.85 indicated that it was not overfitted, thus suitable for the multivariable analysis.

	Postpartum SI		Postpartum AI		WPr	Dur 2nd
Sexual Relationship	No	Yes	No	Yes		Mean
Yes	9	8	8	9	11	1.136
No	37	46	48	35	26	1.360
Total	46	54	56	44		
P value	0.511		0.445		0.002	0.234

SI=stress incontinence AI=anal incontinence WPr=wound problems Dur 2nd=Duration 2nd stage

Table 102a. Univariate analysis of pelvic/perineal and obstetric variables selected by multivariable analysis with impaired social health (Sex relat)

	Dyspareunia		New SI		Perin status	
Sexual Relationship	No	Yes	No	Yes	Trauma	Intact
Yes	11	6	9	8	12	5
No	43	40	52	31	48	35
Total	54	46	61	39	60	40
P value	0.478		0.461		0.512	

SI=stress incontinence Perin=perineal

Table 102b. Univariate analysis of other relevant pelvic/perineal and obstetric variables with impaired social health (Sex relat)

Wound problems and postpartum stress incontinence were significantly associated with delay in resuming sexual relationship. The former was consistent at the univariate level (Table 102a). No further factor was significant from Table 102b.

G. THE SEVERITY of PELVIC/PERINEAL DYSFUNCTION - ANALYSES for any association with GENERAL SEXUAL HEALTH

The severity of pelvic dysfunction as reflected by its effect on sexual functioning and hence the mother's social relationship with her partner/husband was investigated using dyspareunia and overall sexual health as indices of sexual functioning and maternal wellbeing. Mothers complained of incontinence as affecting their sexual relationship and overall sexual health, and the extent of the psychosocial morbidity would be inadequately measured if reduction of the frequency of intercourse was not included in the assessment as it was the most frequent sexual symptom. It was converted to a scoring system by adapting Robson et al's previous observations[330]; their sample had similar presenting sexual symptoms which they concluded reflected the pattern of postpartum lifestyle changes that is characteristic of postpartum maternal sexual behaviour. It was represented in general sexual health (GSH) which included either satisfaction with sexual health (score 0,1) or dissatisfaction due to reduced frequency of intercourse scored 2-4 (vide Chapter III, page 151).

There were 105 mothers who reported less frequent intercourse due to postpartum lifestyle changes (score 2). Of these 32 represented 40% of the elective caesarean mothers, 43 (41%) emergency caesarean, and 30 (30%) of the vaginally delivered. There were 82 mothers who reported less frequent intercourse due to other sexual problems (score 3); of these 19 represented 24% of the elective caesarean, 28 (27% of the emergency caesarean), and 35 (35% of the vaginally delivered). There were 27 mothers who reported less frequent intercourse (≤ 6 times) or abstinence since delivery (score 4). Of these 8 represented 10% of the elective caesarean, 13 (7% of the emergency caesarean), and 12 (12% of the vaginally delivered). Limited univariate analyses (Chi-squared tests) were undertaken to define the relationship and this would be exploratory with any significant findings investigated in future research.

1. Postpartum stress incontinence and general sexual health (GSH)

i) All participants

Of the mothers who had postpartum stress incontinence there were twenty-three (representing 20.2% of this sample) mothers who were satisfied with their general sexual health, 39 (34.2%) who had a slightly reduced frequency of intercourse, 34 (29.8%) who had a reduced frequency along with other sexual symptoms and 18 (15.8%) who had severe problems (Table 103). A statistically significant association between postpartum stress incontinence and impaired GSH was identified ($\chi^2 = 10.830$, df=4, $p = 0.022$).

		Postpartum stress incontinence		
		No	Yes	Total
General sexual health	No partner/no relationship, satisfied	2 1.2%		2
	Satisfied with sex relationship	45 26.5%	23 20.2%	68
	Less frequent - lifestyle changes	66 38.8%	39 34.2%	105
	Less frequent: dyspareunia, low libido, etc.	48 28.2%	34 29.8%	82
	Never or <6 times since delivery	9 5.3%	18 15.8%	27
	Total	170 100.0%	114 100.0%	284 100.0%

Table 103. Postpartum stress incontinence and GSH (all participants)

ii) Caesarean group

Of the mothers with postcaesarean stress incontinence twelve (representing 20% of this sample) were satisfied with their general sexual health, 23 (38%) had a slightly reduced frequency of intercourse, 16 (27%) had reduced frequency with other sexual problems and 9 (15%) had severe problems. Chi-squared tests did not show a statistically significant association. Among the emergency caesarean mothers, 5 (14.7%) were satisfied, 14 (41.2%) had a slightly reduced frequency of intercourse, 10 (29.4%) had a reduced frequency along with other sexual symptoms and 5 (14.7%) had severe problems as shown in Table 104. Chi-squared tests suggested a weak association between postpartum stress incontinence and impaired GSH ($\chi^2 = 7.031$, df=3, p =0.067).

		Postpartum stress incontinence		
		No	Yes	Total
General sexual health	Satisfied with sex relationship	21 30%	5 14.7%	26
	Less frequent - lifestyle change	29 41.4%	14 41.2%	43
	Less frequent: dyspareunia, low libido, etc.	18 25.7%	10 29.4%	28
	Never or <6 times since delivery	2 2.9%	5 14.7%	7
	Total	70 100.0%	34 100.0%	104 100.0 %

Table 104. Postpartum stress incontinence and GSH (emergency caesarean)

iii) NVD group

Of the mothers with postpartum stress incontinence there were eleven (20.4%) who were satisfied with their general sexual health, 16 (29.6%) had a slightly reduced frequency, 18 (33.3%) had reduced frequency with other sexual problems and 9 (16.7%) had severe problems. A statistically significant association was not reached.

2. New stress incontinence and general sexual health (GSH)

i) All participants

Among the participants with new stress incontinence only 12 (representing 17.1% of this sample) were satisfied, 21 (30%) had slightly reduced frequency, 25 (36.7%) had in addition other sexual symptoms and 12 (17.1%) had severe symptoms (Table 105). A statistically significant association was shown between new stress incontinence and impaired GSH (Fisher's Exact test – 10.005, p=0.032).

		New stress incontinence		
		No	Yes	Total
General sexual health	No partner/no relationship, satisfied	2 0.9%		2
	Satisfied with sex relationship	56 36.2%	12 17.1%	68
	Less frequent – lifestyle changes	84 39.3%	21 30.0%	105
	Less frequent: dyspareunia, low libido, etc.	57 26.6%	25 35.7%	82
	Never or <6 times since delivery	15 7.0%	12 17.1%	27
	Total	214 100.0%	70 100.0%	284 100.0%

Table 105. New stress incontinence and GSH (all participants)

ii) Caesarean group

Four (12.9%) mothers with new stress incontinence were satisfied with their overall sexual health, 11 (35.5%) had a slightly reduced frequency, 9 (29%) had in addition other sexual symptoms and 7 (22.6%) had severe symptoms (Table 106, next page). A Fisher's Exact test showed a statistically significant association (Fisher's Exact test –10.264, p= 0.027).

		New stress incontinence		
		No	Yes	Total
General sexual health	No partner/no relationship, satisfied	2 1.3%		2
	Satisfied with sex relationship	41 26.8%	4 12.9%	45
	Less frequent – lifestyle changes	64 41.8%	11 35.5%	75
	Less frequent: dyspareunia, low libido, etc.	38 24.8%	9 29.0%	47
	Never or <6 times since delivery	8 5.2%	7 22.6%	15
	Total	153 100.0%	31 100.0%	184 100.0 %

Table 106. New stress incontinence and GSH (overall caesarean)

Of the mothers with new stress incontinence who had an elective caesarean delivery there was 1 (8.3%) who was satisfied, 4 (33.3%) had a slightly reduced frequency, 3 (25%) had in addition other sexual symptoms and 4 (33.3%) had severe symptoms. It went towards significance (Fisher's Exact test – 7.482, p=0.090) (Table 107).

		New stress incontinence		
		No	Yes	Total
General sexual health	No partner/no relationship, satisfied	2 2.9%		2
	Satisfied with sex relationship	18 26.5%	1 8.3%	19
	Less frequent – lifestyle changes	28 41.2%	4 33.3%	32
	Less frequent: dyspareunia, low libido, etc.	16 23.5%	3 25.0%	19
	Never or <6 times since delivery	4 5.9%	4 33.3%	8
	Total	68 100.0%	12 100.0%	80 100.0%

Table 107. New stress incontinence and GSH (elective caesarean)

Of the mothers with new stress incontinence who underwent an emergency caesarean, 3 (15.8%) were satisfied with their general sexual health, 7 (36.8%) had a slightly reduced

frequency, 6 (31.6%) had in addition other sexual symptoms and 3 (15.8%) had severe symptoms. On analysis statistical significance was not reached.

iii) NVD group

Eight (20.5%) mothers with new stress incontinence were satisfied with their general sexual health, 10 (25.6%) had a slightly reduced frequency, 16 (41%) had in addition other sexual symptoms and 5 (12.8%) had severe symptoms. Statistical significance was not reached.

3. Postpartum anal incontinence and general sexual health (GSH)

i) All participants

Of the mothers with anal incontinence twenty-nine (representing 21% of this sample) were satisfied with their general sexual health, 52 (37.7%) showed a reduced frequency of intercourse, 40 (29%) had reduced frequency with other sexual symptoms and 17 (12.3%) had severe symptoms. Statistical significance was not reached.

ii) Caesarean group

Of the mothers with anal incontinence there were twenty-one (representing 21% of this sample) who were satisfied with their general sexual health, 40 (42.6%) showed reduced frequency of intercourse, 24 (25.5%) had a reduced frequency with other sexual symptoms and 10 (10.6%) had severe symptoms. Statistical significance was not reached.

iii) NVD group

Of the mothers with anal incontinence nine (representing 20.5% of this sample) were satisfied with their overall sexual health, 12 (27.3%) had a slightly reduced frequency of intercourse, 16 (36.4%) had reduced frequency with other sexual symptoms and 7 (15.9%) had major problems. A statistically significant association was not reached.

4. Dyspareunia and general sexual health (GSH)

i) All participants

Of the mothers with dyspareunia there were 9 (representing 9.4% of this sample) who were satisfied, 23 (24%) had slightly reduced frequency than prior to pregnancy because of change in lifestyle, 55 (57.3%) had in addition other sexual symptoms and 9 (9.4%) had severe problems (Table 108). A statistically significant association was reached between dyspareunia and impaired GSH (χ^2=61.086, df=4, p= <0.001).

		Dyspareunia		
		No	Yes	Total
General sexual health	No partner/no relationship, satisfied	2 1.1%		2
	Satisfied with sex relationship	59 31.4%	9 9.4%	68
	Less frequent – lifestyle changes	82 43.6%	23 24.0%	105
	Less frequent: dyspareunia, low libido, etc.	27 14.4%	55 57.3%	82
	Never or <6 times since delivery	18 9.6%	9 9.4%	27
	Total	188 100.0%	96 100.0%	284 100.0%

Table 108. Dyspareunia and GSH (all participants)

ii) Caesarean group

Of the mothers with dyspareunia there were 8 (representing 16.0% of this sample) who were satisfied with their general sexual health, 12 (24%) had slightly reduced frequency than prior to pregnancy because of a change in lifestyle, 26 (52%) had additional sexual symptoms and 4 (8%) had severe problems, depicted in Table 109. Statistical significance was reached between dyspareunia and impaired GSH (Fisher's Exact test – 23.880, p= <0.001).

		Dyspareunia		
		No	Yes	Total
General sexual health	No partner/no relationship, satisfied	2 1.5%		2
	Satisfied with situation	37 27.6%	8 16%	45
	Less frequent – lifestyle changes	63 47%	12 24%	75
	Less frequent: dyspareunia, low libido, etc.	21 15.7%	26 52.0%	47
	Never or <6 times since delivery	11 8.2%	4 8%	15
	Total	134 100.0%	50 100.0%	184 100.0%

Table 109. Dyspareunia and GSH (overall caesarean)

Of the emergency caesarean mothers with dyspareunia 1 (3.6%) were satisfied, 3 (10.7%) had slightly reduced frequency than prior to pregnancy because of a change in lifestyle, 21 (75%)

had in addition other sexual symptoms and 3 (10.7%) had severe problems (Table 110). A statistically significant association was reached between dyspareunia and impaired GSH (χ^2= 49.531, df=3, *p*= <0.001).

		Dyspareunia		
		No	Yes	Total
General sexual health	Satisfied with situation	25 32.9%	1 3.6%	26
	Less frequent – lifestyle changes	40 52.6%	3 10.7%	43
	Less frequent: dyspareunia, low libido, etc.	7 9.2%	21 75.0%	28
	Never or <6 times since delivery	4 5.3%	3 10.7%	7
	Total	76 100.0%	28 100.0%	104 100.0%

Table 110. Dyspareunia and GSH (emergency caesarean)

Seven (31.8%) of the elective caesarean mothers with dyspareunia were satisfied with their general sexual health, 9 (40.9%) had slightly reduced frequency than prior to pregnancy because of a change in lifestyle, 5 (22.7%) had in addition other sexual symptoms and 1 (4.5%) had severe problems. Statistical significance was not reached.

ii) NVD group

One (representing 2.2% of this sample) of the mothers with dyspareunia was satisfied with her overall sexual health, 11 (23.9%) had slightly reduced frequency than prior to pregnancy because of change in lifestyle, 29 (63%) had in addition other sexual symptoms and 5 (10.9%) had severe problems (Table 111, next page). A statistically significant association was reached between dyspareunia and impaired GSH (χ^2=36.347, df=3, *p*= <0.001).

		Dyspareunia		
		No	Yes	Total
General sexual health	Satisfied with situation	22 40.7%	1 2.2%	23
	Less frequent – lifestyle changes	19 35.2%	11 23.9%	30
	Less frequent: dyspareunia, low libido, etc.	6 11.1%	29 63.0%	35
	Never or <6 times since delivery	7 13.0%	5 10.9%	12
	Total	54 100.0%	46 100.0%	100 100.0%

Table 111. Dyspareunia and GSH (vaginally delivered)

H. THE SEVERITY of PELVIC/PERINEAL DYSFUNCTION and PSYCHOSOCIAL/ SEXUAL HEALTH

1. New anal incontinence and impaired psychosocial/sexual health

The negative psychosocial impact of the new onset symptoms was manifest as dysphoria (an emotional state of anxiety, depressive symptoms and restlessness) which the mother attributed to symptoms of new anal incontinence, that was persisting at the time of the interview. Only univariate analyses have been carried out to find out the pattern and this would be useful for future research. Following the univariate analyses the clinical presentation and extracts from the comments of a few mothers with new anal incontinence are presented. These are expected to facilitate our understanding of the concept of severity from the mother's perspective.

1a. New anal incontinence and dysphoria

Psychological ill-health represented as dysphoric symptoms was compared in those with and without new anal incontinence and Chi-squared tests of significance carried out. When the all participant group was analysed 3 (representing 30% of this sample) of participants with new anal incontinence had no symptoms of dysphoria, 1 (10%) had one symptom, 5 (50%) had two symptoms, 1 (10%) had three or more symptoms but none had a diagnosed psychiatric disorder. No statistical significant association was reached at the 5% level but a trend at 10% (Fisher's exact test– 5.892 with p=0.079) suggested a weak association.

1b. New anal incontinence and social health

Starting housework – There was no delay in 9 (representing 90% of this sample) participants with new anal incontinence, none with slight delay, 1 (10%) with moderate delay, and none with a considerable delay. A statistically significant association was reached (Fisher's exact test – 8.519 and p=0.045).

Starting leisure activities – Four (40%) of the mothers with new anal incontinence showed no delay, 3 (30%) slight delay and 3 (30%) considerable delay. A statistically significant association was not reached.

Starting employment – Four (40%) of the mothers with new anal incontinence had no delay, 2 (20%) had slight delay and 4 (40%) had a moderate delay. A statistically significant association was reached (Fisher's Exact – 7.537, p=0.033).

1c. New anal incontinence and general sexual health – Sexual functioning in mothers with new anal incontinence was assessed with regards to resuming sexual relationship with partner, dyspareunia and general sexual health. They were subgrouped as modes of delivery.

i) Overall group of participants

Resuming sexual relationship – Six (representing 60% of this sample) mothers with new anal incontinence had no problems, 3 (30%) had slight delay and 1 (10%) had considerable delay. Statistically significant association between new anal incontinence and resuming sexual relationship was shown (Fisher's Exact test – 7.504, p=0.052).

Dyspareunia – Seven (70%) mothers with new anal incontinence did not complain of dyspareunia and 3 (30%) did so. A statistically significant association was not reached.

General sexual health – Four (40%) mothers with new anal incontinence were satisfied while 3 (30%) had slightly reduced frequency than prior to pregnancy because of a change in lifestyle, 1 (10%) had in addition other sexual symptoms and 2 (20%) had severe problems. A statistically significant association was shown between new anal incontinence and GSH (Fisher's Exact test – 9.159, p=0.042).

ii) Caesarean group

Resuming sexual relationship – Two (representing 50% of this sample) mothers with new anal incontinence did not perceive any delay and another 2 (50%) some delay. A statistically significant association was not reached.

Dyspareunia – Three (representing 75% of this sample) mothers with new anal incontinence did not complain of dyspareunia and 1 (25%) complained of it. A statistically significant association was not reached.

General sexual health – Two (representing 50% of this sample) mothers with new anal incontinence were satisfied while 1 (25%) had slightly reduced frequency than prior to pregnancy because of change in lifestyle, none had in addition other sexual symptoms and 1 (25%) had severe problems. A statistically significant association between new anal incontinence and GSH was reached (Fisher's Exact test – 10.137, p=0.015).

iii) NVD group

Resuming sexual relationship – Four (representing 66% of this sample) mothers with new anal incontinence had no delay, 1 (17%) had slight delay and 1 (17%) a significant delay (Table 76). A significant association was almost reached between new anal incontinence and interference with resuming a sexual relationship (Fisher's Exact Test – 1.640, p=0.066).

Dyspareunia – Four (representing 67% of this sample) mothers with new anal incontinence did not complain of dyspareunia and 2 (33%) did. A statistically significant association was not reached.

General sexual health – Two (representing 33% of this sample) mothers with new anal incontinence were satisfied while 2 (33%) had a slightly reduced frequency than prior to pregnancy because of change in lifestyle, 1 (17%) had in addition other sexual symptoms and 1 (17%) had severe problems. A statistically significant association was not reached.

2. Haemorrhoids and psychosocial health

Small numbers precluded a multivariable analysis. All the results of the statistical analyses in this group and the previous symptom (new anal incontinence) need to be interpreted very cautiously because of very small numbers.

2a. Haemorrhoids and dysphoria

Using univariate analysis mothers with haemorrhoids were investigated to assess whether there was any relationship with dysphoria. Of these mothers with haemorrhoids there was 1 mother who did not have dysphoric symptoms, 2 who had one (mild dysphoria), 4 who had two dysphoric systems (moderate dysphoria) and 4 who had ≥3 symptoms (severe dysphoria). A statistically significant association was reached (χ^2=7.943, df=3, p=0.043).

2b. Haemorrhoids and social health

Five mothers did not have any delay in resuming employment but three had some delay. The statistical association was close to significance (Fisher's Exact test – 5.314, p=0.060).

3. Perineal trauma and impaired psychosocial/sexual health

3a. Perineal trauma and psychological health

No statistically significant association was found between perineal trauma and psychological health with regards to dysphoria.

3b. Perineal trauma and social health

Of the 60 participants with perineal trauma there were 35 mothers who had both perineal trauma and pelvic dysfunction (mainly stress incontinence). Of these mothers pelvic dysfunction was more of a problem affecting activities in five (two with anal incontinence, one with stress incontinence and two with combined deep dyspareunia and stress incontinence). The others were not concerned about the pelvic dysfunction which did not affect their activities and was considered to be getting better in the majority. Thus any dissatisfaction in these mothers can be attributed primarily to the perineal trauma. Hence, in discussing the impact for all practical purposes any confounding in the results would be mainly present in the six patients mentioned above.

There is a lack of recognition of the fact that lesser degrees of perineal trauma (as in this sample) may interfere with normal psychosocial and sexual functioning; besides some mothers experienced significant psychosocial sequelae. Of the 60 mothers with perineal trauma, 30 complained of the negative effects on personal/social interactions. In a few mothers the effect of perineal trauma on social health was also reflected by other difficulties in the relationship with the husband/partner, infant and colleagues at her place of work. Eight mothers reported a very strained relationship with their partners and three others had divorced.

One mother reported that there was no bonding with her baby and another was unable to cope, so sent the baby to her grandparents. Four reported that their babies were having sleep problems until ten months of age and one mentioned that she had never enjoyed her baby. Few mentioned that colleagues at their place of work wouldn't empathise with their 'baby problems'.

Most sufferers were reticent about their problems and did not seek support from health carers. In several mothers, however, closer relationships developed as they interacted and

received support, from their close relatives and friends. Two mothers mentioned that the delivery experience discouraged them from a future pregnancy, though perineal trauma added to the severity of the morbidity. These mothers reported a "horrendous delivery" and a "very traumatic delivery". One mother with perineal trauma mentioned that intercourse was painful and that "it felt like scraping a blackboard". Incidentally this mother had requested an episiotomy at the time of delivery, which was later given on medical grounds. Women with an intact perineum also had relationship problems with three reporting strained relationships and one had separated.

I. THE SEVERITY – MATERNAL COMMENTS

1. Real life description of maternal perception

1a. The following accounts are taken from the comments of mothers with severe physical manifestations of pelvic dysfunction which the sufferers felt caused concomitant severe psychological symptoms and interfered with social activities.

i) New anal incontinence and stress incontinence: A 27 year old who had delivered vaginally at 41 weeks gestation, complained of episodes of urge and passive faecal incontinence (solid/liquid) along with occasional soiling and frequent flatal incontinence. Symptoms were controlled with Loperamide (anti-diarrhoeal) but she had to wear a liner continuously. She was embarrassed and apprehensive as it 'leaked'. It put her off sexual intercourse which was also painful and there was a strain in her relationship with her husband. The incontinence affected childcare, housework, social networking and leisure activities. She said that the incontinence made her feel "weepy, very tired, very low, quite vulnerable, anxious, etc". She also suffered from postpartum stress urinary incontinence, occasionally, but she felt that this did not interfere with her usual activities and did not bother her.

ii) Stress incontinence, dyspareunia and new anal incontinence: A 34 year old had an elective caesarean at 38 weeks for a breech presentation and suffered multiple symptoms of anal incontinence following delivery which required continuous perineal protection. The incontinence caused her to be "irritable, weepy and lose all confidence". She could not relax, was embarrassed about it, particularly when with her husband with whom she no longer had a sexual relationship and they slept separate. She had not bonded properly with her baby and did not want another baby. Unfortunately, the severe psychosocial impact of the physical symptoms was misunderstood by her local health carers who called it 'hormonal', so she went to a homeopath who diagnosed her as being depressed and had started her on homeopathic

anti-depressants. She also suffered from frequent stress urinary incontinence which also contributed to her restricted life-style.

iii) Dyspareunia, anal incontinence (faecal) and stress incontinence: A 20 year old who had an elective caesarean for breech presentation at 40 weeks suffered faecal incontinence and occasional urgency and soiling. She wore continuous perineal protection, felt embarrassed and the bowel symptoms interfered with her lifestyle. Her sexual relationship suffered, sexual intercourse was painful and infrequent and associated with soreness over the abdominal wound. She commented "I am tired all the time. I feel alone and very scared, especially when with the baby as I have to stop activities and rush to the toilet". She also had infrequent stress urinary incontinence which she observed did not affect her lifestyle.

iv) Anal (flatal incontinence), haemorrhoids and dyspareunia: A 38 year old, who delivered vaginally at 39 weeks gestation, complained of frequently occurring flatal incontinence. She was deeply embarrassed about this and said that her husband also complained about it. It made her "frumpy, run down, very low, weepy, really upset, short tempered and irritable". Sexual intercourse was very infrequent as she felt very apprehensive and "tight inside". It put her off having another child. She also reported of having haemorrhoids but was not troubled by this.

Two of these mothers with severe physical and psychosocial symptoms perceived their symptoms as severe enough to seek help from health carers while another intended to do so.

1b. The effect on the sufferer when the physical burden of incontinence was perceived as less severe is exemplified in the following extracts; both felt that the depression was due to the childbirth experience and not their anal incontinence. Personalised interviews detected this.

i) New anal incontinence, depression and unsatisfactory birth experience: A 28 year old had an emergency caesarean for fetal distress in labour at 40 weeks gestation. She was very disappointed about the caesarean as she had wanted a vaginal delivery. Initially she had been weepy, irritable and very tired. She had coped badly in looking after the baby and had not bonded with the baby. She said "I did not want to be with the baby. I felt guilty and frightened of this feeling in me". A diagnosis of depression was made and she was started on anti-depressants. She had three episodes of passive incontinence to liquid stool and occasional urge incontinence since delivery. She was not bothered by this new onset incontinence which she felt was improving and that her depression was related to her childbirth experience.

ii) New anal incontinence, depression and unsatisfactory birth experience: A 22 year old complained of urgency and occasional urge incontinence of faeces following a vaginal delivery at 39 weeks. She had baby blues initially. She said "I can cry for the slightest things, cannot concentrate and have mood swings. People at my work place did not empathize with

my problems". She was angry with her husband, did not have a sexual relationship and had concerns about another pregnancy. She was diagnosed as depressed and was on anti-depressants with counselling. She stopped working. She felt that her depression was not related to her anal incontinence but to her vaginal delivery.

These comments indicate that the perception of the severity of a pelvic floor symptom was very personal and exclusive to that individual and has implications for developing appropriate support services.

2. Impact on relationships with partner and/or infant

The following table (Table 112) illustrates the repercussion of pelvic/perineal dysfunction on relationships with partner and/or infant. The extent to which pelvic dysfunction and perineal trauma contributed to these problems is difficult to say as some couples also had an unsatisfactory experience of childbirth.

Mode	**Relationship with partner n(%)**			**Relationship with infant n(%)**			**Effect on partner n(%)**		**Not pregnant again n(%)**
	strain	separate	divorce	bonding	cope	blame *	upset	vase.#	
Overall CS	3(1.6)	2(1.8)	5(2.7)	6(3)	31(16)	0	4(2)	1(0.5)	11(6)
Em CS	1(0.9)	0	1(0.9)	2(0.9)	14(13)	0	3(2.8)	0	8(7.6)
El CS	2(2.5)	2(2.5)	4(5)	4(5)	17(21)	0	1(1.2)	1(1.2)	3(3.6)
NVD	11(11)	0	4(4)	2(2)	11(11)	1(1)	0	2(2)	5(5)

*Blamed child # underwent a vasectomy El CS=elective caesarean Em CS=emergency caesarean NVD=non-instrumental vaginal delivery n=number

Table 112. Other adverse affects of severe pelvic/perineal dysfunction

Although the numbers having problems are small (Table 112) the intense psychosocial negative effects are evident in both the caesarean and the vaginally delivered groups. Depression was diagnosed in 16 (9%) of the mothers following emergency caesarean section, 7 (9%) following elective caesarean and 6 (6%) following vaginal delivery.

J. THE SEVERITY – HELP SOUGHT

Table 113 depicts the severity of the pelvic dysfunction as represented by perineal protection needed and medical advice sought when pelvic/perineal dysfunction was thought of as severe.

Symptom with mode	Continuous pad use	Frequent changing of underwear	Occasional changing of underwear	Saw GP	Planning to see GP
1. Postpartum SI					
CS	13(7%)	24(13%)	23(13%)	2(1%)	3(2%)
NVD	17(17%)	21(21%)	16(16%)	5(5%)	4(4%)
2. Postpartum AI					
CS	3(2%)			2(1%)	1(0.5%)
NVD	1(1%)			1(1%)	0
3. Dyspareunia					
CS				13(7%)	1(0.5%)
NVD				10(10%)	2(2%)

SI=stress incontinence AI=anal incontinence CS=caesarean section NVD=non-instrumental vaginal delivery

Table 113. Severe direct and indirect effects of pelvic/perineal dysfunction

Despite having pelvic dysfunction of a degree that could appear to be severe to an observer few sought medical advice. All three mothers with new anal incontinence who needed continuous perineal protection consulted medical professionals. There was only one mother with a prepartum onset of faecal urgency and urge incontinence, who used continuous perineal protection.

K. SUMMARY of RESULTS

The scope of pelvic dysfunction and perineal trauma which includes the prevalence/incidence and severity is presented in the following discussion. At first the frequencies of the symptoms are depicted followed by the results of the investigation for obstetrical/biological predictors and then the analyses for assessing the severity of the pelvic/perineal dysfunction mainly related to psychological, social and overall sexual health.

1. Frequencies (prevalence and incidence) of symptoms of pelvic/perineal dysfunction

1a. Prevalence of pelvic dysfunction

The postpartum prevalence of pelvic dysfunction in this sample indicates that it is common following both elective and emergency caesarean delivery as well as non-instrumental vaginal delivery (Table 114).

Pelvic dysfunction	Mode of delivery		
	Caesarean (elective, emergency)	Non-instrumental vaginal delivery	Total
Stress Incontinence	60(33%)	54(54%)	114(100%)
Anal Incontinence	94(51%)	44(44%)	138(100%)
Dyspareunia	50(27%)	46(46%)	96(100%)
Haemorrhoids	3(2%)	5(5%)	8(100%)

Table 114. Prevalence of postpartum pelvic dysfunction

1b. Pre-delivery prevalence and postpartum incidence of pelvic dysfunction

This was relevant to anal incontinence and stress incontinence only. A significant proportion of this sample had symptoms prior to delivery which persisted after birth. During pregnancy there was an increase in the symptomatology in a few mothers which reverted back to normal continence after delivery. When compared to caesarean birth, vaginal delivery increased the frequencies of symptoms of new stress incontinence (17% vs. 39%) and new anal incontinence (2% vs. 6%).

1c. Multiple symptoms of pelvic dysfunction

Double incontinence (stress and anal) was present in 69 (23% of caesarean, 26% of NVD) mothers and double incontinence with dyspareunia in 33 (11% of caesarean, 12% of NVD).

1d. Perineal trauma

Non-instrumental vaginal delivery can be followed by lesser degrees of perineal trauma in a substantial number of mothers and there were 60 (60%) in this sample. Stress incontinence or anal incontinence was reported by a few mothers who had sustained perineal trauma and the frequency of these symptoms was comparable to that following an intact perineum.

2. Pelvic dysfunction and obstetrical/biological predictors and associations

The following discussion summarises the results of the statistical analyses (Results E-H) to identify any obstetric/biological predictors of postpartum stress incontinence, new stress incontinence, postpartum anal incontinence, new anal incontinence, dyspareunia, and haemorrhoids. The pertinent results (Tables 12-102) of the backward elimination stepwise logistic regression analyses for each symptom along with univariate analysis are summarised below. Participants are analysed as an overall group and then subdivided as modes of delivery.

Presented in each Table is the *p* value, the odds ratio (OR) and 95% confidence intervals for each obstetric/biological variable selected for the reduced model. The majority of the predictors tabulated are significant at the 5% or 10% level whilst the few numbers in parenthesis give a general feel of how far removed from significance these independent variables are. The significant associations at the 5% level with a positive beta value have been selected as predictors of interest and represent possible causative links.

2a. Postpartum stress incontinence and obstetrical/biological predictors

The significant obstetrical/biological variables in the multivariable analyses which were consistent with the results of the univariate analyses were mode of delivery (all participant group), stress incontinence when pregnant, postpartum anal incontinence and dyspareunia. Wound problems was only significant at the univariate level.

The multivariable associations are represented in Table 115.

Pelvic floor symptom	**Predictors and associations**				
Postpartum SI	**El CS, Em CS, NVD**	**Postpartum AI**	**Dyspareunia**	**SI when pregnant**	**Miscellaneous**
All participants	0.002, 0.004, 0.003	0.002	<0.001	<0.001	NI, NI
All caesarean	NI	0.003	0.041	<0.001	NI, NI
El CS	NI	0.021	0.056	0.010	NI, NI
Em CS	NI	0.021	NI	<0.001	0.014*, 0.084**
NVD	NI	0.070	0.060	0.010	0.022#, 0.081††

*=pre-labour **=late labour #=wound problems ††=duration of 2nd stage NI=not in the model SI=stress incontinence AI=anal incontinence El CS=elective caesarean Em CS=emergency caesarean NVD=non-instrumental vaginal delivery

Table 115. Postpartum stress incontinence and obstetrical/biological predictors

When postpartum stress incontinence was used as an outcome variable and multiple regression analysis carried out for all participants, the statistically significant predictors were stress incontinence during pregnancy, postpartum anal incontinence and dyspareunia. Although these variables retained a significant association when subgrouped according to mode of delivery, the caesarean mothers appeared to show a stronger relationship with dyspareunia than the vaginally delivered but the significance was lost when subdivided into caesarean types. Pre-labour emergency caesarean was a significant predictor for postpartum stress incontinence and emergency caesarean when carried out in late labour appeared to go towards significance. In addition a statistically significant predictor for vaginally delivered mothers was the presence of wound problems whilst a shorter second stage appeared to go towards significance.

2b. New stress incontinence and obstetrics/biological predictors

The significant obstetrical/biological variables in the multivariable analyses which were consistent with the results of the univariate analyses were mode of delivery (all participant group), postpartum anal incontinence, dyspareunia and birth weight (emergency caesarean). Head circumference was close to significance (0.072, elective caesarean group) at the univariate level. The multivariable associations are displayed in Table 116.

Pelvic floor symptom	**Predictors and associations**				
New SI	**El CS, Em CS, NVD**	**Dyspareunia**	**Postpartum AI**	**Miscellaneous**	
All participants	0.003, 0.008, 0.004	0.023	(0.122)	NI	NI, NI
El CS	NI	NI	NI	0.085#	NI, (0.145)§
Em CS	NI	NI	0.039	0.002*	0.028**, 0.024§§
NVD	NI	(0.275)	(0.282)	(0.119)#	(0.233)†, NI

*=pre-labour **=early labour # =wound problems †=duration of 1st stage §=head circumference §§=birth weight
NI=not in model SI=stress incontinence, AI=anal incontinence El CS=elective caesarean Em CS=emergency caesarean
NVD=non-instrumental vaginal delivery

Table 116. New stress incontinence and obstetrical/biological predictors

Using new stress incontinence as the dependent variable, statistically significant predictors in the all participant group were the vaginal mode of delivery and dyspareunia. When sub-grouped into separate modes of delivery postpartum anal incontinence, pre-labour delivery and birth weight were significant predictors for emergency caesarean mothers and wound problems went towards significance for the elective caesarean mothers.

2c. Postpartum anal incontinence and obstetrical/biological predictors

The significant obstetrical/biological variable in the multivariable analyses which was consistent with the results of the univariate analyses amongst all subgroups other than vaginal

delivery, was postpartum stress incontinence. Dyspareunia was significant for the overall caesarean and emergency caesarean groups and duration of the first stage for the vaginally delivered at the univariate level. The multivariable associations are displayed in Table 117.

Pelvic floor symptom	**Predictors and associations**		
Postpartum AI	**El CS, Em CS, NVD**	**Postpartum SI**	**Miscellaneous**
All participants	0.044, 0.076, 0.102	<0.001	NI, NI
All caesarean	NS	0.003	NI, NI
El CS	NI	0.020	NI, NI
Em CS	NI	0.008	0.084*, 0.046≠
NVD	NI	(0.109)	NI, 0.061†

*=pre-labour ≠ =IOL †=duration of 1st stage NI=not in model SI=stress incontinence AI=anal incontinence El CS=elective caesarean Em CS=emergency caesarean NVD=non-instrumental vaginal delivery

Table 117. Postpartum anal incontinence and obstetrical/biological predictors

When postpartum anal incontinence was used as the outcome variable and logistic regression modelling carried out for the overall group of participants, statistically significant predictors were the elective caesarean mode and postpartum stress incontinence. On further analysis sub-grouped as different modes of delivery the significant association with postpartum stress incontinence was maintained by the caesarean mothers but not the vaginally delivered mothers. In the emergency caesarean cohort induction of labour reached significance but it was negatively associated whilst in the vaginally delivered duration of the first stage almost reached significance.

2d. New anal incontinence and labour (emergency caesarean)

Three of 63 (5%) emergency caesarean mothers in early labour and one of 20 (5%) in late labour developed new anal incontinence. This was not a statistically significant difference (Fisher's exact test value=3.496, p=0.184).

2e. New anal incontinence and 2nd degree tear

New symptoms were reported by one (3%) with an intact perineum and five (23%) with a 2nd degree tear. This reached a statistically significant difference (Fisher's Exact value=9.697, p=0.014).

2f. New anal incontinence and obstetric variables

On performing t-tests a significant association with head circumference (t=2.345, df=101, p=0.021) was reached for the elective caesarean mothers and with birth weight for the emergency caesarean mothers (t=2.113, df=102, p=0.037).

2g. New stress incontinence and new anal incontinence – comparison of *t*-tests

When compared with mothers with new anal incontinence, mothers with new symptoms of stress urinary incontinence (n=70) who were assessed using multivariable analysis showed a similar pattern of association with birth weight in the emergency caesarean cohort (p=0.024, OR 1.001, 95% CI 1.000, 1.002) but not with head circumference in the elective caesarean cohort (p=0.145, OR .983, 95% CI .981, 1.006).

2h. Dyspareunia and obstetric/biological predictors

The significant obstetrical/biological variables in the multivariable analyses which were consistent with the results of the univariate analyses were mode of delivery (all participant group), postpartum stress incontinence and wound problems (all participant, overall caesarean and elective caesarean groups). The multivariable associations are represented in Table 118.

Pelvic floor symptom	**Predictors and associations**			
Postpartum dyspareunia	**El CS, Em CS, NVD**	**Postpartum SI**	**SI before pregnancy**	**Miscellaneous**
All participants	0.066, 0.036, 0.076	<0.001	NI	0.004#, NI, NI
All caesarean	NI	0.029	0.044	0.042#, 0.081‡, 0.103§
El CS	NI	NI	NI	0.019#, 0.015‡, NI
Em CS	NI	0.066	NI	NI, NI, NI
NVD	NI	0.011	0.102	0.090††, NI, NI

*=pre-labour # =wound problems ‡=age ††=duration of 2nd stage §=head circumference NI=not in model SI=stress incontinence El CS=elective caesarean Em CS=emergency caesarean NVD=non-instrumental vaginal delivery

Table 118. Postpartum dyspareunia and obstetrical/biological predictors

Statistically significant predictors for all participants were emergency caesarean, postpartum stress incontinence and wound problems. When subgrouped as separate modes of delivery, the statistically significant association of dyspareunia and postpartum stress incontinence was maintained by the overall caesarean and vaginally delivered groups, but for wound problems it was only maintained by the overall caesarean and elective caesarean groups. In addition stress incontinence before pregnancy was a significant predictor for the overall caesarean and elective caesarean groups of mothers. Age went towards significance for the overall caesarean group, postpartum stress incontinence went towards significance for the elective and emergency caesarean groups and duration of the second stage of labour for the vaginally delivered mothers.

3. The severity of pelvic/perineal dysfunction including psychosocial impact

This section contains a summary of the statistical analyses as a measurement of severity. The significant associations with the independent variables at the 5% level and those going towards significance are included. Dysphoria as the psychological state of having dysphoric symptoms of varying severity which the mother attributed to her symptoms of pelvic/perineal dysfunction is the psychological variable of note with severe dysphoria being of particular relevance as it would include those mothers with minor to major degrees of depression[224] (vide Chapter III, page 52). For assessing social health the particular maternal social activity that was interfered with, and its postpartum resumption delayed due to the physical manifestation of the particular symptom has been included in the evaluation of her perceived disease severity.

3a. Dysphoria and associations with pelvic floor symptoms

Mild-moderate dysphoria was not significantly associated with the symptoms of pelvic/perineal dysfunction whereas severe dysphoria was. The significant biological/obstetric variables associated with severe dysphoria in the multivariable analyses which were consistent with the results of the univariate analyses were dyspareunia (all participants), postpartum stress incontinence (overall caesarean, emergency caesarean, vaginal delivery) and wound problems (elective caesarean). In the vaginally delivered, an intact perineum went towards significance only in the multivariable analysis, albeit negatively. Table 119 represents significant multivariable associations mentioned in 3a – 3e (next page).

Groups for analysis	Assoc. of severe dysphoria (*p*=)	Assoc. of LA (*p*=)	Assoc. of SN (*p*=)	Assoc. of emp. (*p*=)	Assoc. of sex relat. (*p*=)
All participants	Dyspareunia (0.005)	Postpartum SI (0.036)	CS mode (0.018)	Postpartum SI (0.023), CS mode (0.031)	Postpartum AI (0.049) Wound problems (0.076)
Overall CS	Postpartum SI (0.038)	Postpartum SI (0.039)	Postpartum AI (0.084)	Postpartum AI (0.077)	NS
El CS	Wound problems (0.022)	Postpartum SI (0.104)	Postpartum AI (NS)	NS	Dyspareunia (0.072)
Em CS	Postpartum SI (0.051)	Postpartum SI (0.034)	Postpartum AI (NS)	Postpartum AI (0.090)	Postpartum AI (NS)
NVD	Postpartum SI (0.028), *intact per. (0.082)	NS	NS	Postpartum SI (0.003), *intact per. (0.045)	Wound problems (0.049)

*= negative Assoc.=association CS=caesarean section El CS=elective Em CS=emergency NVD=non-instrumental vaginal delivery NS=non-significant LA=leisure activities SN=social networking emp=employment sex relat=sexual relationship per=perineum

Table 119. Psychosocial associations of pelvic/perineal dysfunction

New stress incontinence had a significant association with severe dysphoria in the all participants group and was close to significance in the vaginally delivered group at the univariate level only. Similarly in the vaginally delivered dyspareunia and wound problems were significantly associated with severe dysphoria at the univariate level.

3b. Leisure activities and associations with pelvic floor symptoms

Interference with resuming leisure activities was significantly associated with postpartum stress incontinence when analysed as the all participant group and this appeared to be mainly contributed to by the caesarean mothers.

In the univariate analyses the delivery mode and wound problems were significantly associated with impairment in resuming leisure activities and this was inconsistent with the results of the multivariable analyses.

3c. Social networking and associations with pelvic floor symptoms

The results of the multivariable analyses identified the caesarean mode to be significantly associated with interference with resuming social networking and this was consistent with the results of the univariate analyses. Interference with resuming social networking was weakly associated with postpartum anal incontinence in the overall caesarean group of mothers.

3d. Employment and associations with pelvic floor symptoms

The results of the multivariable analyses identified postpartum stress incontinence to be significantly associated with interference in resuming employment for the vaginally delivered group; this was consistent with the results of the univariate analyses.

In the overall group interference with resuming employment was significantly associated with the caesarean mode and also with postpartum stress incontinence, with the latter being mainly related to the vaginally delivered. When analysed as the overall caesarean and emergency caesarean groups, postpartum anal incontinence went towards significance. In the vaginally delivered an intact perineum reached significance, albeit negatively.

3e. Sexual relationship and associations with pelvic floor symptoms

The significant biological/obstetric variables in the multivariable analyses which were associated with interference with resuming a sexual relationship with partner and were consistent with the results of the univariate analyses were postpartum anal incontinence (for all participants) and dyspareunia for the elective caesarean subgroup. Wound problems gained significance when analysed as the vaginally delivered subgroup.

Although interpreting the associations of psychosocial variables with pelvic dysfunction in this manner is a first time evaluation, the above analyses reveal a certain pattern of

associations of pelvic dysfunction with psychosocial health, which may be symptom specific and deserves further evaluation.

3f. New anal incontinence and impaired psychosocial health

When new anal incontinence was analysed using univariate methods to find an association with dysphoria amongst the overall group, statistically significant association was not reached at the 5% level but at the 10% level (Fisher's Exact test – 5.892 with p=0.079), suggesting a weak association. When the all participant group was analysed for an association with social variables a significant association between new anal incontinence and delayed resumption of employment (Fisher's Exact test – 7.537, p=0.033) was reached. When analysed as the overall group a statistically significant association was almost reached between new anal incontinence and a delay in resuming a sexual relationship (Fisher's Exact test – 7.504, p=0.052). In the vaginally delivered group analyses revealed a weak association with new anal incontinence and a delay in resuming a sexual relationship (Fisher's Exact test – 1.640, p=0.066).

These results have to be interpreted with caution because of small numbers.

3g. Haemorrhoids and impaired psychosocial health

Univariate analysis demonstrated a statistically significant association between haemorrhoids and dysphoria (χ^2=7.943, df=3 p=0.043). Two mothers found it distressing enough to seek treatment. When all the categories of social health were considered the category back to employment was the only category which went towards statistical significance in the overall group of participants (Fisher's Exact test – 5.314, p=0.060). Again the small numbers preclude a meaningful interpretation.

3h. Pelvic dysfunction and impaired general sexual health

Resumption of a sexual relationship with her husband/partner is part of the mother's social health functioning and has been discussed above. However, sexual relationship is a complex issue with a close relationship with dyspareunia and other aspects of sexual health and the results of the previous univariate analyses (Chi-squared tests) to explore any association between a pelvic floor symptom and impaired general sexual health are discussed next.

i) Postpartum stress incontinence and impaired general sexual health

When analysed as the overall group of participants, a statistically significant association (χ^2=10.830, df=4, p=0.022) with impaired general sexual health was reached. This seemed to be mainly contributed to by the emergency caesarean mothers as when this group was similarly analysed the association with impaired general sexual health was close to significance (χ^2=7.031, df=3, p=0.067).

ii) Postpartum anal incontinence and impaired general sexual health

When analysed similarly no significant association was reached between mothers who had postpartum anal incontinence and impaired general sexual health.

iii) Dyspareunia and impaired general sexual health

When analysed similarly a significant association was reached between mothers with dyspareunia and impaired general sexual health for all participants (χ^2=61.086, df=4, p= <0.001), the caesarean (Fisher's Exact test – 23.880, p= <0.001) and the vaginally delivered (χ^2=36.347, df=3, p= <0.001) groups.

iv) New stress incontinence and impaired general sexual health

When analysed similarly using univariate analysis a significant association was reached between mothers with new stress incontinence and impaired general sexual health for the overall group (Fisher's Exact test – 10.005, p=0.032), went towards significance for the caesarean mode (Fisher's Exact test – 7.482, p=0.090) but not for the vaginally delivered.

v) New anal incontinence and sexual relationship

Significance was reached between new anal incontinence and impaired general sexual health (Fisher 's Exact test – 9.159, p=0.042). In the overall caesarean group new anal incontinence was significantly associated with impaired general sexual health (Fisher's Exact test – 10.137, p= 0.015) but not dyspareunia.

3i. Maternal perception of severity of multiple symptoms of pelvic/perineal dysfunction

In complex clinical presentations when a mother had multiple symptoms of the same pelvic organ e.g. anal incontinence with urgency, flatal and faecal incontinence due to deficient bowel continence function or multiple symptoms of different compartments e.g. stress urinary and faecal incontinence from bladder and bowel dysfunction or when presenting with a pelvic/perineal symptom due to pelvic floor and perineal trauma, her perception of severity and her judgement in attributing it to a specific disorder took up greater significance.

The above is a brief discussion of the pertinent findings in this chapter the latter part of which was mainly exploratory. Further interpretation of these research findings and their relation to other reported studies along with relevance to future research is discussed in the next chapter**.**

CHAPTER V

DISCUSSION

This investigation of obstetrical and biological predictors of postpartum pelvic/perineal dysfunction has confirmed significant biopsychosocial morbidity arising from it. The severity of this morbidity was estimated by quantifying maternal perception of physical symptoms. The participants, who took part voluntarily, comprised the largest primiparous caesarean sample from a single obstetric unit who were interviewed using this biopsychosocial approach that was adapted from previous methodology. A primiparous sample was targeted to enable one to separately identify the effects of the caesarean and vaginal modes of delivery and avoid the cumulative effect of successive vaginal deliveries on the pelvic floor[154]. This also meant that recruitment had to be stopped at a pre-determined point in time to enable recruitment of women before they got pregnant again or obstetric practice changed. Prior to confirming associations, it was necessary to determine frequencies of those affected i.e. prevalence and incidence, in order to guide the selection of appropriate statistical tests and gauge the scope of the problem. The dearth of similar studies limits the discussion somewhat, but a discourse on the pertinent biopsychosocial associations ensuing from this investigation will add to current knowledge about these problems, and generate future research. As mentioned in the Introduction (pages 16-32; 40-42), since my background literature review and related publication[90], there have been other reports on certain aspects of my researched subject area, but the results have not been robust enough to advocate elective caesarean (vide Chapter 1, page 30-31) as primary prevention for postpartum pelvic/perineal dysfunction nor have conclusions from studies (vide Chapter 1, pages 16-20) about other modifiable obstetrical/biological risk factors been consistent to allow for universal application of preventative measures based on these risk factors. Furthermore, tools to evaluate severity according to the sufferer's perception have been lacking (vide Chapter 1, pages 31-33), thereby supporting the need for further research as carried out in this study.

Having targeted an unselected maternal population at 10 months postpartum, this investigation has determined that pelvic dysfunction was common in this population after both elective (n=80) and emergency caesarean (n=104) as well as after non-instrumental vaginal delivery (n=100). Amongst these young primiparae (mean age 28 years), stress incontinence was manifest in 114/284 (40%), anal incontinence in 138/284 (48%), dyspareunia in 96/284 (34%) and haemorrhoids in 8/284 (3%). The comparison of frequencies between the two modes i.e. caesarean (elective, emergency) versus the vaginally delivered, has established that

stress incontinence was prevalent in 60 (33%, 33%) caesarean versus 54 (54%) vaginally delivered, anal incontinence in 94 (53%, 50%) caesarean versus 44 (44%) vaginally delivered, dyspareunia in 50 (28%, 27%) caesarean versus 46 (46%) vaginally delivered. The postpartum incidence (new symptoms onset after delivery) of stress incontinence was prevalent in 31 (17%) of the post-caesarean and 39 (39%) vaginally delivered, and new anal incontinence in four (2%) post-caesarean and six (6%) vaginally delivered; cautious interpretation of analyses is needed for small frequencies but they convey a certain pattern of associations, which are clinically important and would guide future research. Post-caesarean double (stress and anal) incontinence was present in 23% (20 (25%) elective; 23 (22%) emergency) mothers and in 26 (26%) following vaginal delivery. Furthermore, the presence of double incontinence with dyspareunia was manifest in 11 (14%) elective, 10 (10%) emergency, and 12 (12%) vaginally delivered, again this has not been reported before. That any symptom of pelvic dysfunction namely, stress incontinence, faecal and flatal incontinence, dyspareunia and haemorrhoids, could be prevalent after an elective caesarean and be comparable in frequency and severity with manifestations following an emergency caesarean in this relatively large caesarean sample, is a new finding. Lesser degrees of perineal trauma were present in 60 (60%) of the vaginally delivered sample, all of whom underwent a non-instrumental vaginal delivery without sustaining 3rd or 4th degree perineal tear. That both lesser degrees of perineal trauma (1st or 2nd degree, episiotomy, episiotomy with tear) and an intact perineum were associated with incontinence and dyspareunia in a significant number of vaginally delivered mothers and that they were comparable, has not been reported previously. These findings reflect the complex pathophysiology (vide Chapter 1, pages 7-16) of pelvic/perineal dysfunction and maternal perception which deserve detailed evaluation and careful interpretation.

The concept of different magnitudes of severity of postpartum pelvic/perineal dysfunction has been further elucidated by the clinical observations and analyses carried out in this study. In the few mothers who presented with pelvic/perineal symptoms which noticeably appeared as being severe to a health professional (myself), as for instance, where a perceptibly upset mother reported continuous pad usage for faecal incontinence following an elective caesarean or where there were multi-organ symptoms (double incontinence without/with dyspareunia), the mother's psychosocial health was affected and she sought medical help; in these circumstances it was evident that the mother's assessment of the magnitude of severity matched the health professional's judgement and appropriate help was sought. However, in the majority where the mother was unforthcoming, severe disease was less obvious, as for example, where intermittent perineal protection was used for incontinence or where dyspareunia was experienced, and it was slowly but progressively impairing her psychosocial

health, the mother's perception of symptomatic severity even though of great significance in modulating her help seeking behaviour, was less understood by health professionals (vide Chapter IV, page 141, 1st paragraph) whom she approached. Inappropriate advice could be given by health professionals who were less familiar in assessing psychosocial severity related to maternal perceptions that was not quantifiable; health professionals could underestimate the psychosocial impact of the symptoms or be dismissive about its significance to the mother and hence, she could feel discouraged in seeking help. Therefore, it was necessary to research measures not only to detect physical disease but also to quantify maternal psychosocial perception[202,203,319,349], which would initiate management tailored to psychosocial severity when any physical disease was identified or help sought. This study has clarified certain associations to promote disease detection and in addition a measure to quantify the sufferer's impaired psychosocial health resulting from postpartum pelvic/perineal dysfunction has been developed; this would facilitate the delivery of individualised care. Moreover, as this study indicates that no mode of delivery can entirely protect from the biopsychosocial morbidity of postpartum pelvic/perineal dysfunction, predictors and associations are crucial in enabling early detection and possible prevention.

By using backward conditional logistic regression as the main method of statistical analysis this study has adjusted for confounding variables and added robustness to its new findings regarding various associations. Rigorous methods in model selection were applied such as assessing the appropriateness of the model fitted (Hosmer-Lemeshow test) and applying shrinkage tests to confirm that the models were not over-fitted (vide Chapter III, page 57) as these results would be a useful guide for future research and its translation into clinical practice. In addition, the interviewing for this study was quite comprehensive and generated a substantial amount of information, which on analysis gave a broad-based picture of the issues involved in pelvic dysfunction, both physical and psychosocial. Notwithstanding the sensitive and personal nature of the symptoms and the widely known attitude of the sufferer in silently accepting her predicament[146-150], the initial approach and interviewing using the structured, semi-structured, closed and open format[321] of questioning helped the participants articulate their problems better. A homogeneous sample falling within the confines of the selection criteria for the organ systems being investigated (vide Chapter 1, pages 9-16) was recruited. A woman with an exclusion criterion specific for a particular pelvic floor symptom was excluded, even though the condition may not have affected the selection for the other symptoms e.g. a mother with an ileostomy was excluded as it affects bowel function even though it does not interfere with urinary continence.

This method of comprehensive interviewing at the participant's preferred venue (home), using an adaptation of the standardized medical interviewing technique, has never been used before in researching postpartum pelvic/perineal dysfunction by a practising obstetrician and gynaecologist; this can be said to be one of the strengths of the study. In this detailed interviewing, content validity was added by the wide range of selected questions along with face validity[322], which was further enhanced by application of the interviewer's clinical knowledge and by including questions from a validated questionnaire[320] to the interview script (vide Chapter III, page 49). Moreover, the same female clinician interviewer, who had previously seen such patients in hospital clinics and was familiar with the subject area, contacted, explained and interviewed the women which avoided discrepancy from inter-observer variation. Women seemed to trust and were able to disclose sensitive personal information because of the non-judgemental empathic approach. This art had been developed by the interviewer as part of the specialty training requirements while working under a senior consultant who had a special interest in diseases related to mind-body interaction such as high-risk complicated pregnancies with psychosocial aggravating factors or psychosexual issues which needed sensitive attention. Listening to the patient to get a precise medical history along with meticulous note-keeping was an important aspect of such training. Clinical knowledge also helped in the differential diagnosis of presenting symptoms which helped with responses to participant queries regarding seeking help when they were directed to obtain GP care; treatment was not part of the study design. A response rate of 85% and being able to clearly define symptoms, when clarification was sought by participants, were added strengths of the comprehensive interviewing for this study by an obstetrician/gynaecologist.

The women participated voluntarily and went to great lengths to take part (vide Chapter III, page 47) despite not being remunerated. They wished not only to help themselves but also future mothers with wide dissemination of the findings – presentations and publications from the findings are continuing. Although the participants seemed highly motivated with only seven of the elective caesarean cohort declining to take part at the outset, the low elective caesarean rate meant that the recruitment period had to be relatively lengthy in order to recruit a large primiparous caesarean sample, particularly after an elective caesarean. This was inevitable to enable recruitment of a homogeneous sample from a single unit. Visiting participants at their homes for personalised interviews at a chosen time when they were likely to be undisturbed promoted successful interviews. Other researchers on the subject have had problems in the recruitment of large caesarean samples from a single unit[119]. In Handa et al's[108] study 51.8% refused to participate so they were underpowered to detect a doubling of the odds. Carrying out multicentre studies could help to circumvent this problem but they have

their drawbacks including attrition if prospective as in MacArthur's study[172] where there was a 54% response; besides there are funding implications. More recently difficulties have been encountered in recruiting participants into large surveys[194].

Postal questionnaires can target large samples but can lead to misinterpretation of questions or under-reporting when investigating sensitive issues such as postpartum incontinence[147-149] or sexual problems[117]. In Williams et al's[136] self-report survey about enduring perineal morbidity after childbirth the questionnaire was made up of eight questions only, yet the response rate was a mere 23% (vide Chapter 1, page 19). Similarly, in MacArthur et al's postal survey[12], where several researchers and ancillary staff were involved in assessing self-reported postpartum symptoms and their relation to obstetric analgesia, limited questioning (one side of an A4 sheet) was used to augment response. Enquiries probed the presence or absence of a symptom, i.e. stress incontinence with only (No, Yes) responses along with their duration. These methods would be of limited use for an in-depth study of a new and complex subject as in this investigation. With large surveys it is possible to neglect the null hypothesis but a low response rate would not be representative of the diseased sample and limited questioning to increase the response rate would constrain the data gathered. A factor reaching statistical significance in a small sample may be worthy of attention if it is clinically/socially important as typified by presentations of multiple symptoms of new anal incontinence in this study.

The only other study specifically investigating pelvic dysfunction, which was similar to this study in the inclusion of all physical symptoms and assessing their emotional effect, was a general population survey (n=1546) by MacLennan et al[69], where respondents were interviewed at home regarding symptoms in any of their family members. However, the mean age (44.5 years) of their participants was much higher than that of the recruits in this study. Whilst their prevalence of urinary incontinence of 35% (n=546) and of faecal incontinence of 3.5% (n=54), were comparable to this study, their reported rate of dyspareunia 3.9% (n=43) was much lower. The highly sensitive nature of the subject could have discouraged disclosure to another family member. The prevalence of haemorrhoids in this study of 3% was much lower than their report (30%) and this could reflect their older multiparous sample and the selective inclusion in this study of primiparae with medically diagnosed haemorrhoids. In contrast to this study, they did not compare elective with emergency caesarean cohorts.

This study has identified non-instrumental vaginal delivery as a significant predictor for stress incontinence (p=0.003) but not for dyspareunia (p=0.076) whereas the caesarean mode is a significant predictor for anal incontinence (p=0.044) – unreported before. Additionally, although stress incontinence is reported to be more frequent after vaginal delivery it is not uncommon after a caesarean, and the postpartum prevalence of anal incontinence is slightly

higher in caesarean mothers than in the vaginally delivered; there are two reports[158,160] of a similar though not identical pattern of prevalence of incontinence. One of these studies[158] reported significantly more bowel problems in the post-caesarean than in the vaginally delivered mothers but the bowel symptoms were not specified; moreover differences between mode-related frequencies of urinary incontinence persisted only until 8 weeks postpartum. They did not investigate beyond 6 months postpartum as in this study nor did they classify symptoms in such detail. The second publication[160] with a similar pattern of incontinence was an incidental report from the randomized controlled breech trial (n=1596) where participants filled in mailed questionnaires regarding incontinence on the phone or at interview. In contrast to this study their[160] observed frequencies of incontinence were considerably lower (vide Chapter 1, page 22).

Main theme – *Stress Incontinence and New Stress Incontinence*

The adjusted results of the multivariable analysis for obstetric/biological predictors of postpartum stress incontinence were delivery mode, stress incontinence during pregnancy, postpartum anal incontinence and dyspareunia, which were consistent with the results of the univariate analysis. The exception was wound problems which in the all participant group showed significance at the univariate level but not at the multivariable level because of it being displaced by the delivery mode for this group which was significantly correlated with it (p=0.008). Wound problems was also significantly associated with postpartum stress incontinence at the univariate level in the vaginally delivered (p=0.022). With regards to new symptoms of stress incontinence, the significant obstetrical/biological predictors were the vaginal mode of delivery and dyspareunia, whereas postpartum anal incontinence, baby birth weight and a caesarean carried out in early labour were predictors for the emergency caesarean subgroup whilst wound problems went towards significance for the elective caesarean subgroup. Additionally stress incontinence during pregnancy was not a predictor for new stress incontinence as it was for postpartum stress incontinence indicating probable inherent differences as yet unresearched.

Amongst other new findings, this study reports that stress incontinence during pregnancy is a predictor for postpartum stress incontinence (p=<.001, OR 5.22, CI 2.66, 10.25) in the all participant group and this significance was maintained when analysed as the elective, emergency or the vaginally delivered subgroups. Other authors have suggested that pregnancy[126,128,130,163,176] or hereditary factors[125] could be a causative factor in the manifestation of postpartum stress incontinence. However, these studies[125,126,128,130,176] did not elucidate any association of stress incontinence during pregnancy with postpartum stress incontinence in clearly defined subgroups elective and emergency caesarean along with the non-instrumental

vaginally delivered, using the analytic approach applied to a large primiparous caesarean sample, as in this study.

Chaliha et al[345], used a urinary symptom questionnaire (similar to a validated instrument) and subtracted cystometry to evaluate nulliparous (n=161) urinary incontinence. Of these only 31 (n=9 elective) had a caesarean delivery, and urodynamic findings confirmed genuine stress incontinence in all symptomatic mothers. As 9% (n=3) women had urinary incontinence following a caesarean delivery when not in the second stage of labour the authors inferred that any alteration in urinary continence was related to factors associated with pregnancy or the first stage of labour. In this relatively large caesarean sample studied, although stress incontinence was prevalent in mothers after pre-labour caesarean or during pregnancy, duration of the first stage of labour did not reach a significant association with postpartum stress incontinence (p=0.369) in the regression analysis.

The reported prevalence in this study of stress incontinence during pregnancy (23%) and after delivery (38%) in these young primiparae was comparable to that reported by Mørkved et al[103], who reported urinary incontinence in 42% during pregnancy and in 38% postpartum. Although their multiparous participants were of a similar age (mean 28 years) as in this study, only 13 had been delivered by an elective caesarean. It is pertinent to note that in this study new symptoms (postpartum onset) of stress incontinence did not contribute greatly to overall postpartum prevalence of these symptoms as many were symptomatic before onset of labour; this could reflect the limited effect of intrapartum factors on the continence mechanism. It reinforces the fact that postpartum incidence should be considered when estimating the contribution of intrapartum factors to the prevalence of postpartum stress incontinence.

Furthermore, this study reports of transient incontinence in several participants with symptom onset during pregnancy and spontaneous resolution after delivery. Forty-eight women developed new symptoms of stress incontinence during pregnancy and of these 22 (48%) mothers recovered after delivery. Perhaps, this spontaneous phenomenon is a manifestation of pelvic dysfunction as a reversible neuromuscular disorder which was hypothesised by AH Kegel[70]. Having observed stress incontinence in nulliparae, he reported that physiological disturbances and an inherent weakness of the pelvic floor were more important in the causation of stress incontinence than childbirth injuries, with the initial muscular dysfunction followed by dysfunction of the fascial support. He successfully treated stress incontinence both postpartum and in nulliparae by muscle re-education which improved the function of the pubococcygeus (vide Chapter 1, pages 8 & 14). Although scant controversial evidence was published previously; more recent literature[190-192,199,346] supports this method of management.

The findings in this report of incontinence during and prior to pregnancy indicate that there could have been an inherent pelvic floor weakness in some of these mothers but assessing pelvic muscle strength was not part of the study design. Moreover, pelvic examination is considered as invasive and would have affected recruitment of this unselected population, besides the impracticality of carrying it out at the participants' homes. Pre-pregnancy stress incontinence in this relatively young sample is in keeping with reports both past[137] (vide Chapter 1, Chart 1 f, fp 16) and recent[138] that nulliparous urinary incontinence can manifest in young women even with a good pelvic floor. WJA Francis[126] reported stress incontinence during pregnancy and pre-pregnancy in primiparae as in this study, but in contrast to this study did not report symptoms in the puerperium, implying that pregnancy was implicated in stress incontinence in this sample and not delivery. Could changes in the management of pregnancy/labour or life-style changes affecting maternal physiology have lead to an increase in postpartum stress incontinence as was observed in this study and other reports since then? A few other studies have reported that pregnancy increases the risk of stress incontinence[69,130,174,176]. This study has added new analytic evidence to these reports by clearly confirming stress incontinence during pregnancy as being a predictor of post-caesarean stress incontinence as well as stress incontinence following non-instrumental vaginal delivery.

In addition, this study reports pre-pregnancy incontinence followed through to pregnancy and postpartum in a proportion of mothers who were later delivered by the caesarean or the vaginal mode. No shift in this primiparous population was observed using the McNemar's test; this would suggest the possibility of an inherent weakness of the pelvic floor or yet unknown causative factors unrelated to childbearing. However, new symptoms of stress incontinence developed during pregnancy, perhaps, indicating the effect of hormones (vide Chapter I, page 15) or mechanical factors acting during pregnancy on the neuromuscular mechanism that maintains continence.

Predictors for postpartum stress incontinence reported in this study are postpartum anal incontinence and dyspareunia. This observation could be applied to the concomitant detection and management of these disorders for future research as there is reticence[146,147] and there are barriers to[347,348] disclosing symptoms despite negative psychosocial affects. This was recently highlighted by Herbison et al[202] who reported that patients wanted future research to include the development of methods to help reach the silent 'suffering majority' whilst others stressed the need for promoting relevant health education[258] with some sufferers considering incontinence a normal aspect of aging[174].

As in this study, a high prevalence of urinary incontinence was reported (44.6%) from a multicentre survey by Wilson et al[168] who investigated using a self-report questionnaire. These

authors[168] observed that the first caesarean delivery did not offer any protection, but, after ≥2 caesarean deliveries, a 15% reduction in postpartum urinary incontinence could occur. The picture remains unclear. Other factors such as analgesia for a caesarean could be implicated. Casey et al[107] reported that caesarean delivery (type not differentiated) reduced the risk of stress incontinence but this was not evident if the caesarean was carried out under an epidural analgesia. Although this study investigated any association of postpartum stress incontinence with analgesia, including an epidural, analgesia was only significant at the univariate level in patients with new stress incontinence when analysed as the all participant group; it was displaced in the multivariable analysis by the delivery mode which was more closely correlated (vide Chapter IV, page 81). Leighton et al[121] reported that epidural use was associated with urinary incontinence immediately postpartum and resolved after three months but in this study the association persisted at ten months postpartum deserving future research.

Moreover in this study, late labour appeared to go towards a significant association with postpartum stress incontinence for the emergency caesarean mothers, but for mothers with new stress incontinence early labour went towards significance suggesting that different factors were implicated in either sample. Amongst other obstetric/biological predictors investigated, birth weight (≥ 3500grams) albeit not significant with postpartum stress incontinence was significantly associated with symptoms of new stress incontinence (p=0.024, OR 1.00, CI 1.00, 1.00) in the emergency caesarean subgroup only – another new finding. Besides, a prolonged duration of the second stage of labour (1.53 vs. 1.15 minutes) seemed to reduce the risk of postpartum stress incontinence. Any harmful effect of a prolonged second stage of labour on the perineum remains contentious in the current literature[123,124], although a previous report indicated that it is not associated with stress incontinence[122]; this has been further elucidated in this study. This new finding could relate to obstetric practice where the attending health professional does not encourage active pushing after full cervical dilatation in a labouring woman with a non-compromised baby until the head has descended low in the pelvis, resulting in a shorter active phase and possibly less local tissue/neurological impact; this deserves further investigation as it is relevant to obstetric decision-making in its potential role as a modifiable risk factor in labour.

Wound problems showed a significant association with postpartum stress incontinence in both the caesarean and vaginally delivered. Wound problems also went towards significance with new stress incontinence but only in the elective caesarean subgroup. Is this association related to the type of collagen in these mothers which made them vulnerable to the healing of abdominal and perineal wounds and impacted on the mechanism of bladder continence? Further investigation is suggested.

Main theme – *Anal Incontinence and New Anal Incontinence (postpartum onset)*

The univariate analysis for biological/obstetrical associations of anal incontinence (both pre- and postpartum onset) was consistent with the multivariable analysis confirming postpartum stress incontinence as a predictor for postpartum anal incontinence amongst the all participant group and the overall caesarean subgroup. Dyspareunia was a significant predictor for postpartum anal incontinence amongst the emergency caesarean at the univariate level but not at the multivariable level as postpartum stress incontinence was significantly correlated and displaced it in the multivariable model (vide Chapter IV, page 88). Only univariate analysis could be applied to the small sample with new anal incontinence but a significant association was reached with head circumference and baby birth weight.

The prevalence of postpartum faecal incontinence in this study was comparable to the report of Meyer et al[159] who used questionnaires, clinical examination and anal physiological tests in nulliparae (n=149) and observed faecal incontinence in 5.5% after vaginal delivery as in this study but urinary incontinence was lower (21%) in their sample. They observed that an increase in infant weight was significantly correlated with reduction in intra-anal pressure, but any clinical significance was unclear. In contrast, in this study where symptomatology was the only form of investigation, new anal incontinence was significantly associated (t=2.113, df=102, p=0.037) with birth weight (≥ 3500 grams) but only in the emergency caesarean subgroup. Again this study reports a significant association of head circumference (t=2.345, df=101, p=0.021) with new anal incontinence in the elective caesarean subgroup. A similar pattern of association was reported by Nazir et al[132] in their investigation using bowel symptom questionnaire, vector volume manometry and transanal ultrasound when a relationship of head circumference with abnormal transanal ultrasound was observed, although the association with mode (n=10 CS, n=76 VD) or its clinical relevance was unclear. This study reports that factors acting prior to and during pregnancy increase the risk of anal incontinence which is then manifest after caesarean or vaginal delivery, thereby stressing the importance of including pre-delivery data in assessing the impact of delivery on postpartum pelvic/perineal dysfunction which has been missed in several studies[129,130,132,161].

The prevalence of postpartum anal incontinence in this study is also at the upper range of such disorders which have been published[106]. The inclusion of all the symptoms of anal incontinence in this study i.e. urge, flatal incontinence, faecal incontinence and soiling along with urgency (vide Chapter III, page 50) would have contributed to the higher frequencies. In an earlier report, MacArthur et al[120] did not include flatal incontinence and in their later report[106] urgency was not included whereas Sultan et al[101] had missed urge incontinence. The effect on bowel continence of factors acting at delivery would be mainly reflected in the

postpartum incidence of anal incontinence. In this study although new symptoms (postpartum onset) contributed to the postpartum prevalence of these symptoms of anal incontinence, it was considerably less than that observed for stress incontinence. Onset of symptoms of anal incontinence during pregnancy occurred in three mothers and resolved in two (67%) following delivery. It is crucial to our understanding of this dysfunction that these frequencies would reflect persistent inherent problems in a significant proportion of these primiparae.

It was decided to relate symptoms directly to obstetric factors, as in the retrospective study by MacArthur et al[120]. They reported an incidence of faecal incontinence of 4%, which was comparable to this study, but the elective caesarean cohort in their mixed parous sample was asymptomatic. Symptoms of faecal incontinence were reported in 6/109 (5.5%) who had delivered by emergency caesarean in labour. As the authors did not include flatal incontinence, they would have underestimated. Recall bias is a possibility in retrospective studies including this one, but this is less likely to occur after the first childbirth, as noted in previous studies where there has been a good recall of events surrounding delivery[155,156] in primiparae which was consistent with medical records[157,158].

Again, this study is the first to report new symptoms of anal incontinence in primiparae following pre-labour caesarean, which was severe enough, to necessitate continuous perineal protection against faecal incontinence. This would call to question the assumption that anal incontinence is caused solely by the effect of labour on the pelvic floor and can be always avoided by performing a pre-labour caesarean section.

In two prospective studies concluding that the caesarean mode protects from anal incontinence, Sultan et al[101,272], used symptomatology, anal endosonography and anorectal tests and reported an incidence of anal incontinence of 4% and 13% respectively. The former[101] frequency (comparable to this study) was the incidence of faecal incontinence reported in vaginally delivered controls who underwent non-instrumental delivery. The latter[272] report of a higher frequency, could be attributed to the inclusion of instrumental vaginal deliveries and those who had sustained 3rd/4th degree tears – both factors are known[164,182,183] to increase the risk of anal incontinence; the strict exclusion of both from this study gave a clearer picture of the impact of other childbearing related variables in this low risk primiparous sample. Despite abnormal anorectal test results[101] in those delivered by emergency caesarean, their small caesarean sample (7 elective, 16 emergency) was asymptomatic; in this study with larger elective and emergency caesarean samples clinically significant incontinence of comparable frequency and severity followed either caesarean type.

Participants were recruited to this study at ten months postpartum when the neuromuscular mechanism of the pelvic floor (vide Chapter 1, pages 8-14) is expected to have been restored

along with resolution of most postpartum pelvic/perineal symptoms[269]. Zetterström et al[269], observed an improvement in the severity of symptoms of anal incontinence between 5-9 months after a vaginal delivery, possibly due to the compensation of the pelvic floor musculature, including the puborectalis, after infants were weaned off breastfeeding. They noted a prevalence of anal incontinence of 22 (7%) prior to pregnancy, which was lower than this report. The authors observed that a longer 1st stage and total duration of labour was associated with anal incontinence but in this study duration of labour was not a significant predictor although a relatively long first stage was negatively associated with postpartum anal incontinence (*p*=0.06, OR 0.86, CI 0.73, 1.01), suggesting a reduction in the risk. Casey et al[107] have reported an association of anal incontinence with oxytocin augmentation. There is a clinical plausibility that in this study the longer first stage was related to labour without augmentation with oxytocin which progressed physiologically at a slower pace with less injury to the tissues during cervical dilatation and fetal descent. This needs further study.

Additionally, this study's report of an increase in the risk of symptoms of anal incontinence in emergency caesarean mothers, who were operated upon when the cervix was undilated (p=0.08) but not when in late labour (p=0.13) is in contrast to the findings of Fynes et al[119]. Fynes et al[119] introduced these criteria of early and late labour to assess the relationship between the timing of caesarean delivery and anal sphincter injury in primiparae. The authors reported abnormal anorectal physiological tests after emergency caesarean in late labour (cervical dilation=≥8cm), but not in early labour (cervical dilation=<8cm). Their small caesarean sample (8 elective, 26 emergency) was asymptomatic, leaving the clinical significance of these abnormal results unclear. In contrast to their report[119], the findings from this study indicate that the aetiopathogenesis of anal incontinence in the caesarean cohort would have been initiated pre-delivery in most participants.

Furthermore, this study has found that there is an increased risk of anal incontinence with lesser degrees of perineal trauma (Fisher's Exact value=9.697, *p*=0.014), another new observation. Reports on lesser degrees of perineal damage and anal incontinence are scarce[178,140]. A probable relationship between lesser degrees of perineal trauma and anal incontinence was observed by Abramowitz et al[178] when they prospectively investigated postpartum anal incontinence and reported an incidence of 12% at 6-8 months postpartum. The caesarean cohort (n=31) in their mixed parous sample was symptom free. Their sample also included those with 3rd/4th degree tears but they did not classify the tears according to degree and estimate the frequency of anal incontinence with each type as in this study where the lesser degree tears were clearly delineated and the frequency of incontinence with each type determined. As only 45% of those with anal incontinence sustained postpartum sphincter

damage the authors[178] concluded that anal sphincter damage was not the sole cause of anal incontinence. Crawford et al[140], who investigated at a similar postpartum interval as this study, reported an incidence of postpartum anal incontinence of 6% in their vaginally delivered controls (n=35) without 3rd/4th degree tears, which was lower than that observed in this report. However, their sample size was smaller (n=70) and they did not categorize their controls further into subgroups or relate each group to anal incontinence, as in this study. In contrast, in this study, mothers who had sustained 1st or 2nd degree tears (n=60) not only reported symptoms of anal incontinence (n=24) but also symptoms of stress incontinence (n=33) and dyspareunia (n=29); those with an intact perineum (n=40) also reported anal incontinence (n=20), stress incontinence (n=21) and dyspareunia (n=17). This new finding that pelvic dysfunction is not uncommon in those with lesser degrees of perineal trauma or an intact perineum suggests that prevalence is not necessarily related to overt pelvic/perineal damage; other non-labour factors would have contributed to incontinence in those with an intact perineum in this study, as pelvic muscle strength may not relate to postpartum incontinence[350].

In this study significantly more mothers developed new onset anal incontinence after 1st or 2nd degree tears and this has implications for training as it could reflect non-recognition of 3rd/4th degree tears. Usually a suspected 3rd or 4th degree tear is confirmed after a detailed inspection of the perineum at delivery by an experienced health professional. Depending on the presenting clinical picture, various layers of the perineum, vagina, anal sphincters and rectal mucosa (vide Chapter I, pages 8-13) may need to be examined under suitable analgesia and lighting to define the extent of any damage[22] and the strategy for appropriate care. However, identifying the different layers of the disrupted anatomy of the perineal pouches and neighbouring tissue (vide Chapter I, page 8, 10-13) in a mother who has just delivered can be problematic and a third degree tear may be misdiagnosed as a second degree tear by the relatively less experienced, although the reported rate of a third degree tear of 0.6% at this hospital during the study period (vide Chapter III, page 46) is comparable to other studies[351]. Alternatively, this may be due to chance or it could be that lesser degree tears may have a greater influence on the development of anal incontinence than previously recognized.

Objective tests may have helped in further clarifying the issues related to the increase in frequency of anal incontinence after second degree tears or following pre-labour caesarean delivery. However, the use and true clinical significance of specific physiological testing and imaging, which has remained confined to research centres, remains unclear[141,142,132,352], with the significance of retaining symptoms as prognostic criteria for bowel continence remaining high. Bollard et al[133] in their 34-year follow-up using questionnaire, endo-anal ultrasound and manometry found an association of forceps-assisted delivery with sphincter tear but not with

incontinence. Frudinger et al[134] on their ten year prospective study using questionnaire and anal endosonography observed that the continence of women diagnosed with sonographically diagnosed tears did not deteriorate after ten years. In Sentovich et al's[142] endosonographic investigation of a nulliparous sample, 20% of those with external and internal anal sphincter defects were asymptomatic leading them to conclude that these defects were possibly due to a variant of normal anatomy or due to other trauma that could be mislabelled as childbirth related. Although continuing advances in imaging techniques, including recent technology such as planar endosonography and 3D magnetic resonance imaging[141,143-145,353], can advance our understanding of presentations of pelvic/perineal dysfunction, these investigative procedures can cause discomfort and are not widely available; their role would be limited to investigating symptomatic patients where conservative management is not an option. Therefore, the first step in detecting and assessing pelvic/perineal dysfunction, i.e. the scope of the problem, for the majority whether in research or clinical practice will remain the evaluation of symptoms as designed for this study.

When evaluating the relationship between pelvic floor symptoms, interesting findings emerged with previously suggested associations assessed and new associations identified. Postpartum anal incontinence was significantly associated with postpartum stress incontinence both in the univariate (p=0.001) and multivariable analyses (p=<.001, OR 2.77, CI 1.61, 4.77) in the all participant and caesarean subgroups but not the vaginally delivered (p=0.109). Postpartum anal incontinence was associated with dyspareunia in the overall caesarean and emergency caesarean subgroups when using univariate (p=0.001) but not multivariable analysis (p=0.061). Association between pelvic/perineal symptoms was also reflected clinically in the presentation of multiple pelvic floor symptoms involving one organ system, as in anal incontinence, or several organ systems as in double incontinence without/with dyspareunia or in the presentation of pelvic dysfunction along with perineal trauma in the same individual, thereby signifying that the same aetiological factors could be causing pelvic/perineal pathologies. As discussed (vide Chapter 1, page 7), the common embryological origin and close anatomical/physiological functioning of the pelvic organs/floor and perineum makes these concomitant presentations of symptoms a distinct possibility and if these have a common aetiopathology, dealing effectively with one symptom would have the potential for ameliorating the morbidity of multiple symptoms – a theme for future exploration.

Main theme – *Dyspareunia*

Dyspareunia was significantly associated with postpartum stress incontinence in the all participant group both at the multivariable level (p=<0.001, OR 2.82, CI 1.60, 4.98) and the univariate (0.001) level of analysis and this was observed with all subgroups. A significant

association between dyspareunia and pre-pregnancy stress incontinence was reached with the post-caesarean mothers both in the multivariable (p=0.044, OR 4.20, CI 1.04, 16.91) and the univariate (0.001) analyses and this was observed with both caesarean subgroups but not for the vaginally delivered (p=0.102). These new findings of the significant associations between dyspareunia as the dependent variable and stress incontinence as the independent variables, at different phases around pregnancy, may be related to aetiological factors that could act pre-delivery on both compartments (vide Chapter 1, pages 8-16) or act in conjunction with other risk factors at delivery, resulting in an increased risk of multiple postpartum pelvic/perineal symptoms that deserve more scrutiny. There is limited literature[75] suggesting a relationship between the bladder and sexual activity (vide Chapter 1, page 15), but this study confirms a significant association specifically between dyspareunia and stress incontinence both postpartum and pre-pregnancy and this has not been reported before. Interestingly, amongst obstetric predictors for the vaginally delivered duration of the second stage of labour, was weakly associated with dyspareunia (p=0.09, OR 1.81, CI 0.91, 3.58) – a new observation.

This study has reported for the first time regarding a high prevalence of dyspareunia associated with both caesarean and normal vaginal delivery, yet only 23 (24%) of those reporting had sought medical attention. In contrast to previous studies[110-118,354], the reported higher prevalence in this study compares with recent studies[118,186,187] and could be explained by the individualized and comprehensive approach in extracting information and the trend in the latter part of the last century for slightly more openness about these problems, which many consider too embarrassing to discuss. However, none of these studies[118,186,187] investigated a large primiparous caesarean sample and other than one publication[187], there have been no reports about similar frequencies of dyspareunia following elective or emergency caesarean as observed in this study.

The prevalence of dyspareunia following vaginal or caesarean delivery in this study is similar to that observed by M Goetsch[118] who in her follow-up of patients in a private clinic, reported an incidence of dyspareunia of 29% following a caesarean and of 42% following vaginal delivery but their sample was small (n=62). MacLennan et al[69] noted that dyspareunia was more common in women following the first childbirth and they associated the latter with perineal and vaginal suturing of trauma sustained at childbirth. Although another study[104] has reported of perineal discomfort, discomfort during intercourse and a delay in resuming intercourse beyond the median time of 3 months in primiparae who had postpartum perineal wound problems with disruption of sutures within the first month, they did not report specifically about dyspareunia as in this study. This study reports of dyspareunia in 29 mothers with perineal trauma but a significant association between dyspareunia and wound problems

was not reached, thereby indicating that other factors than perineal healing problems were associated with dyspareunia in this study sample and needed to be addressed in future investigations.

This investigation reports a lower prevalence of post-caesarean dyspareunia than that after non-instrumental vaginal delivery as also observed by Griffiths et al[186] in their self-report survey but unlike this study they had a small elective caesarean (n=19) sample and did not carry out an in-depth study. In contrast to this study, Barrett et al[187] in their postal survey reported no difference in sexual functioning between the post-caesarean and vaginally delivered at 6 months postpartum but their elective caesarean sample was small (n=30) and they did not investigate associations with incontinence or other obstetric/biological predictors as in this study.

Unlike the study by Grant et al[111] where the authors reported persistent dyspareunia due to repair of perineal trauma using glycerol impregnated sutures, this study reports of dyspareunia at 10 months postpartum even though polyglycolic acid (Vicryl) was used as the suture material, indicating that perhaps other factors rather than the type of suture material were responsible for the dyspareunia in this sample. Grant et al[110], in another study, surveyed vaginally delivered women (n=400) regarding resumption of sexual intercourse and pain-free intercourse. Resumption of intercourse occurred in 78%, which was similar to this study, but in contrast to this investigation, any association of dyspareunia to incontinence was not investigated by the authors. Bex and Hofmeyr[112] did not observe perineal pain following a second degree tear but this study reports dyspareunia not only after a second (11/22) but also after a first degree tear (9/18) as well as with an intact perineum (17/40). Relevant studies[110-118,186,187,189] have not investigated any association of dyspareunia to overall sexual functioning and the mother's perception about it, as in this study. It is often presumed that the mother would have sexual dysfunction because of dyspareunia but sexual functioning and satisfaction are complex issues; in this study, a few mothers did not experience sexual dysfunction despite complaining of dyspareunia.

Wound problems were reported in this study related to the healing of caesarean or perineal wounds and scar tenderness (vide Results, page 72), and the independent variable 'wound problems' was significantly associated with dyspareunia in the all participant group both at the multivariable (p=0.004, OR 2.27, CI 1.30, 3.98) and the univariate level of analyses (p=0.043) being contributed to by the overall caesarean (p=0.042, OR 2.11, CI 1.03, 4.31), specifically the elective caesarean subgroup (p=0.020, OR 4.38, CI 1.23, 15.27). Wound healing problems from perineal wounds were observed by Larsson et al[104] who studied wound healing by evaluating redness, oedema and antibiotics given. Twenty-two percent of those who had

episiotomies and 33% of those with spontaneous lacerations had healing problems but dyspareunia was mainly associated with episiotomies. In this study dyspareunia was depicted as being significantly associated with wound problems in the post-caesarean but not the vaginally delivered. Could these findings also indicate that these mothers experienced dyspareunia due to their perception of an abdominal scar with problems continuing at ten months postpartum? They had not expected this after an elective caesarean – a plausible explanation that deserves further investigation. This demonstrates the complexity of assessing these postpartum problems (vide Chapter 1, pages 14-15, 28-29) and why this study also considered evaluating the effect of pelvic/perineal dysfunction on overall sexual and psychosocial health when evaluating severity rather than relying solely on quantitative measures of only physical manifestations.

A reduced frequency of coitus at seven months postpartum as compared to that prior to pregnancy was reported by Robson et al[330], and in this study, women reported a similar behaviour. As other sexual factors are closely related to dyspareunia and could cause the mother to delay resuming her sexual relationship or cause sexual dissatisfaction in the presence or absence of dyspareunia, a more complete picture of sexual functioning was obtained by including these factors along with reduced frequency of intercourse and referred to in the categories of general sexual health. Postpartum stress incontinence showed a significant association with impaired general sexual health when analysed as the all participant group ($p=0.022$) but a weak association amongst the emergency caesarean ($p=0.067$). New stress incontinence showed a significant association with impaired general sexual health when analysed as the all participant group ($p=0.032$) and all caesarean ($p=0.027$) mainly contributed to by the elective caesarean subgroup ($p=0.090$) but not the vaginally delivered. Postpartum anal incontinence did not reach a significant association with general sexual health. Dyspareunia was significantly associated with impaired general sexual health for the all participant and other subgroups ($p=<0.001$). Amongst the few mothers who had severe symptoms of impairment of general sexual health, psychogenic factors[71,72,78] may have contributed more to the clinical presentation but this could not be ascertained using this study design and needs further exploration.

Main theme – *Severity of incontinence*

The severity of incontinence in this study was also assessed by looking at its direct effects such as the continuous wearing of pads or intermittent perineal protection. This study reports three categories of perineal protection for stress incontinence with 17% using continuous perineal protection, 21% frequently changing underwear and 16% occasionally changing underwear in the vaginally delivered group; similar values for caesarean mothers were 7%, 13% and 13% which would indicate a less severe manifestation after caesarean delivery but again this is subject to maternal perception. Some women were greatly inconvenienced by these problems, which affected their psychological, personal and social life. Others perceived the symptoms as less severe. Sandvik et al[166] in a community survey (n=1993) used a severity index (frequency x amount of urinary loss), which correlated with pad weighing. Their reported incidence was mild urinary incontinence in 46%, moderate in 27%, and severe in 27%. However, stress incontinence was not investigated as a separate symptom. In MacLennan's study[69] the severity of urinary incontinence was noted by the use of the extra protection, which was needed in 13.8% of women and was comparable to this study, in which 10% mothers used incontinence pads continuously but they did not observe a certain pattern of protection associated with either mode as in this report.

Other studies have reported of "unrecognised cases" of stress incontinence, anal incontinence and dyspareunia due to the reticence of the sufferers[146-150]. Even now, many cases go undetected as reported in this study and in other reports[355,202]. Patients' juries[202], in response to suggestions for further research into urinary incontinence, requested the development of mechanisms to reach "the silent majority" of sufferers. Hence, the aim of this study to detect predictors and associations to help identify these symptoms and evaluate their severity in a postpartum sample has been warranted. Psychosocial outcomes following childbirth as a measure of severity of pelvic/perineal dysfunction have been relatively ignored (vide Chapter 1, pages 31-33), as they are difficult to measure. This study has addressed this problem by using a combined methodology for comprehensive data collection which mothers seemed comfortable with and then categorizing the psychosocial symptoms quantitatively for analyses to determine any associations with other quantitative data obtained by assessment of physical symptoms.

The negative effects with multiple symptoms could be devastating to the sufferer e.g. mothers with multiple symptoms of new anal incontinence had impaired psychosocial health; they were amongst the few mothers who sought help for severe pelvic/perineal symptoms. Two of these mothers were dissatisfied with the health professionals' responses (vide chapter IV, pages 140-141) to their complaint of incontinence so would have benefited from a

multidisciplinary assessment with specialists evaluating symptoms concurrently. In fact, in these situations where the frequencies are low, statistical significance may not equate with clinical significance, but their clinical importance justifies attention by researchers and clinicians; they have been retained in this discourse.

Main theme – *Severity manifest as impaired Psychological health*

In contrast to this study, the assessments of severity in past studies did not use a consumer orientated psychosocial approach specific to the postpartum period, which was based on the mother's perspective, as was developed for this study. Previous studies had not classified the severity of perineal dysfunction following vaginal delivery in this manner, nor had a large caesarean sample been recruited and assessed as in this study. Thompson et al[158] reported depression in a population-based study but could not relate it specifically to the pelvic floor symptom.

In this study a different methodology was used for classifying data prior to analysis in order to be able to include the wide range of maternal responses to the comprehensive questioning on pelvic/perineal dysfunction and psychosocial health. An adaptation of the observations of previous researchers (Campbell et al[224], Robson et al[330]), was used to categorize the data for this study. These authors[224,330] had analysed presenting symptoms in their participants that were similar to that obtained for this study such as manifest dysphoria and reduced frequency of intercourse, and found that their methods were appropriately suited for the assessment of the psychological[224] or sexual relationships[330] associated with overall sexual health of their postpartum samples. Data from this study was sorted and placed into a scoring system with an increasing order of severity based on the above studies[224,330] (vide Chapter III, page 50-52).

Dysphoria of varying degrees of severity, which the mother attributed to her symptoms of pelvic/perineal dysfunction, was the psychological symptom-complex widely prevalent in this sample. Although mild-moderate dysphoria (subclinical mood symptoms) did not reach statistical significance with pelvic floor symptoms (p=0.315), severe dysphoria did (vide Chapter IV, page 102). Severe dysphoria was of clinical significance as it would include those mothers with minor to major degrees of depression[224] (vide Chapter III, 51-52). The significant biological/obstetric variables in the multivariable analyses associated with severe dysphoria which were consistent with the results of the univariate analyses were dyspareunia, postpartum stress incontinence and wound problems. The relevance of the study findings obtained when investigating the associations of severe dysphoria with pelvic/perineal dysfunction is discussed next.

It was noted by Macaulay et al[205] that concurrent emotional and psychiatric difficulties (anxiety, depression, phobia) in 62% of incontinent women attending a urodynamic clinic (mean age 46.6 years) were resolved after symptomatic relief of genuine stress incontinence. In this study, where women were seen only on one occasion and were much younger than in Macaulay et al's study[205], the suggestion of any association between psychological symptoms and stress incontinence was confirmed by using regression analysis. A significant association between severe dysphoria and postpartum stress incontinence was reached when analysed as the caesarean (p=0.038, OR 2.33, CI 1.05, 5.19) and also the vaginally delivered subgroups (p=0.028, OR 5.57, CI 1.21, 25.65). Severe dysphoria reached a statistically significant association with dyspareunia in the all participant group (p=0.005, OR 2.23, CI 1.27, 3.91). In addition, in the elective caesarean subgroup severe dysphoria was significantly associated with wound problems (p=0.022, OR 3.62, CI 1.20, 10.90), perhaps indicating the impact of failed expectations as mothers with elective caesarean delivery did not expect these persisting problems. Bodner et al[98] reported a significant increased febrile morbidity including wound infections in their low-risk sample who underwent an elective caesarean for breech presentation or for maternal request when compared with mothers of similar parity and age who had a spontaneous vaginal delivery, but they did not evaluate associated mood symptoms as this study has done.

These findings suggest that mothers with postpartum mood symptoms could have an underlying morbidity both from dyspareunia or stress incontinence whereas for anal incontinence the picture is unclear. Although statistical significance was not reached (p=0.117), individuals suffering from anal incontinence complained of anhedonia, particularly when unexpected as after an elective caesarean. In addition, severe dysphoria was negatively associated with an intact perineum albeit weakly (p=0.082, OR 0.225, CI 0.04, 1.21), suggesting that perhaps such a delivery outcome could be a way to reduce the traumatic aspects that lead to severe dysphoria. How these findings could be translated into obstetric practice remains to be seen in future evaluations as it appears that elective caesarean delivery sometimes advocated to avoid perineal trauma would also result in symptoms of severe dysphoria if associated with problems in wound healing including, persisting scar tenderness.

The scant publications on haemorrhoids include a publication which reports that they are bothersome during the immediate postpartum period[21] but this was not evaluated further. MacLennan et al[69] used the SF36 questionnaire (short form) which revealed lower physical and mental scores for those with incontinence and prolapse but lower physical scores only for vaginal repairs and haemorrhoids. The non-specific SF36 questionnaire has limitations in addressing specific symptoms. In this study both the post-caesarean and the vaginally

delivered complained of pain and/or bleeding due to haemorrhoids. Haemorrhoids and severe dysphoria were significantly associated (χ^2=7.943, df=3, p=0.043) and it appeared to be interfering with resuming employment (Fisher's Exact test – 5.314, p=0.060), but cautious interpretation of these findings is suggested because of small numbers.

Main theme – *Severity manifest as impaired Social health*

A scoring system for assessing social health was also devised after taking into account what is presumably a normal postpartum interval for reverting back to normal functioning[327,331,332]. Normal social functioning was placed at the start (the '0' level), and gradually increasing impairment as expressed by a delayed resumption of maternal social activities due to continuing interference of these activities by pelvic/perineal symptoms was categorized as different levels of severity; it was assessed by developing a measurement tool based on previous methodology but adapted to maternal functioning (vide Chapter III, page 52-53).

It is usually assumed that only severe incontinence can cause a disruption of personal and social life, but the sufferer's perception may not match the severity[171] and this was recognized and analysed in detail in this study. Wyman et al[206] investigated the psychological impact of urinary incontinence in women attending a urodynamic clinic and observed that urinary incontinence has multiple and broad reaching effects that influence daily activities, social interactions and self-perception of health. Norton[207] similarly reported regarding the negative effects of urinary incontinence on the family, relationships and employment.

In this study, for assessing social health impairment, the particular maternal social activity that was interfered with and its postpartum resumption delayed due to the physical manifestation of the particular pelvic floor symptom, was included in the new tool for the evaluation of maternal perception of disease severity. Although impairment of leisure activities was selectively associated with wound problems in the all participant and the caesarean groups at the univariate level this was not evident at the multivariable level. Instead at the multivariable level, interference and delay with leisure activities occurred in mothers suffering from postpartum stress incontinence (p=0.036, OR 2.17, CI 1.051, 4.46) when analysed as the all participant group. Those mothers who underwent a caesarean mainly reported about such interference (p=0.039, OR 2.91, CI 1.05, 8.07) whereas the vaginally delivered group did not complain of interference with leisure activities and a non-significant association was reached (p=0.150).

This study also reports on the association between pelvic/perineal dysfunction and resuming social networking. Impairment of social networking was selectively associated with the

delivery mode, specifically the overall caesarean in the all participant group and with postpartum anal incontinence in the caesarean subgroup at the univariate level. This was consistent with the multivariable analysis which showed a significant association with the caesarean mode of delivery (p=0.018, OR 2.44, CI 1.17, 5.10). Interference with resuming social networking was weakly associated with postpartum anal incontinence when analysed as the overall caesarean subgroup (p=0.084, OR 3.54, CI 0.85, 14.90). In the vaginally delivered subgroup, the independent variables selected were non-significant. Thus, in contrast to those delivered by a caesarean, women who delivered vaginally did not perceive that symptoms of pelvic/perineal dysfunction interfered with their leisure activities or their social networking.

The multivariable analysis revealed a significant association with postpartum stress incontinence and delay in resuming employment which was consistent with the univariate analysis mainly experienced by the vaginally delivered women whereas women who had post-caesarean anal incontinence found this to interfere significantly with resuming employment. Investigation of incontinence and dyspareunia were included in a study[151] by Saurel-Cubizolles et al, where the relationship between non-specific postpartum physical/emotional problems and social functioning was being investigated in primiparae/secundiparae recruited from France (n=632) and Italy (n=723). Although the prevalence of faecal incontinence (5.0%) and dyspareunia in women from France would compare with that in this study, their reported prevalence of urinary incontinence (5.0%) was considerably lower. The authors reported that employment was not clearly associated with physical or mental health but this differs from the findings of this study. This study has confirmed that postpartum stress incontinence can interfere with resuming employment and significantly delayed resumption (p=0.023, OR 1.91, CI 1.09, 3.35) which was mainly contributed to by the vaginally delivered subgroup (p=0.003, OR 9.34, CI 2.13, 40.89). In addition, the caesarean mode of delivery was significantly associated with a delay in resuming employment (p=0.031, OR 1.97, CI 1.07, 3.64) and post-caesarean anal incontinence was weakly associated with a delay in resuming employment (p=0.077, OR 2.12, CI 0.92, 4.86). Interestingly, in the vaginally delivered mothers, an intact perineum was negatively associated with interference in the resumption of employment, perhaps signifying that women with no perineal trauma faced less interference with resuming employment (p=0.045, OR 0.17, CI 0.03, 0.96). In women delivered by elective caesarean, 'wound problems' was the independent variable included in the model selected, but it did not have a significant association (p=0.272, OR 1.68, CI 0.67, 4.24), so this remains to be assessed in a future study. Unlike their study[151], the large homogenous sample investigated in this study from a single obstetric unit would have resulted in more uniform reporting of symptoms by the

participants and thereby, would facilitate a better understanding of the associations of postpartum pelvic/perineal dysfunction – a clear benefit for this first time study.

New findings regarding the association between pelvic dysfunction and resuming a sexual relationship with the partner are also reported for the first time. Findings of the univariate analysis were consistent with the multivariable analysis. Delayed resumption of a sexual relationship was significantly associated with postpartum anal incontinence (p=0.049, OR 1.92, CI 1.02, 3.70) when the analysis included all participants and 'wound problems' were weakly associated (p=0.076, OR 1.79, CI 0.94, 3.40). Interference with resuming a sexual relationship was also weakly associated with dyspareunia in the elective caesarean subgroup of participants (p=0.072, OR 2.92, CI 0.91, 9.34) but not in the other delivery groups. With regards to the vaginally delivered subgroup 'wound problems' reached significance (p=0.046, OR 8.42, CI 1.05, 68.40). These associations appear to suggest that sexual functioning is associated with each individual's response to her perception of incontinence or other postpartum factors (see Chapter 1, page 15) and that dyspareunia is not always related to it. These new findings on the impact of pelvic/perineal dysfunction on social health were made possible by the categorization of the maternal perception of severity and need further evaluation.

The emergency caesarean mothers were the only group who had slightly less relationship problems (0.9%) compared to the other groups (elective 4%, vaginal 5%) and less coping and bonding problems with the infant as compared to the elective caesarean mothers, but their partners were more upset with the experience of delivery (vide Chapter IV, page 142, Table 112). They were the group who were most disappointed by the delivery, so that 8 (7.6%) of the group did not want to conceive again. The comments of the mothers indicate that although any mode of delivery can lead to perceived maternal dissatisfaction, the experience of the emergency caesarean mothers was considered as marginally worse. Post-traumatic stress reaction (n=2) was confined to the emergency caesarean cohort only; this agrees with previous reporting[315]. Although mothers reported bonding and coping problems with the infant (vide Chapter IV, page 142), which are a known sequelae of psychological ill-health[247,248], this was not addressed in detail in this study. Both pelvic dysfunction and perineal trauma in a few mothers made a significant contribution to a strain in the relationship with their partner resulting in separation and in extreme cases divorce. These unsatisfactory outcomes cannot be considered trivial, yet many women chose not to come forward to report disease and seek medical help, with only 4% experiencing incontinence and 24% with dyspareunia actually doing so. They were either too embarrassed or found it very inconvenient, or believed that symptoms would gradually resolve.

Previous comments (see Chapter IV, pages 140-142) from mothers with new anal incontinence and multiple presenting symptoms indicate that the observed severe physical burden of new anal incontinence matched the sufferer's perception of severity and was expressed as severely impaired psychosocial health. However, when the physical symptoms of anal incontinence were perceived as less severe, other factors such as an unsatisfactory childbirth experience could impact on psychosocial health.

The perception of the severity of the symptoms was influenced by the mother's recollection of the events surrounding delivery and in the immediate postpartum phase. Smooth management of delivery, appropriate communication by medical and midwifery staff, adequate support by spouse, family, midwives and health visitors helped cope with problems and produced more satisfaction from childbirth. Most of these primiparae expressed satisfaction with childbirth though a sizeable group were far from satisfied. The threshold for tolerance of incontinence and other pelvic floor symptoms is not known. This report suggests that the response is wide and specific to each individual. This study also supports the need for following women beyond the early weeks postpartum as has been conventional, as pelvic/perineal dysfunction can persist beyond ten months post-partum and the onset of depression can occur late in the first postpartum year.

Final perspective on associations and severity

The mode of delivery as a significant predictor is implicated in putting a woman at a higher risk for pelvic dysfunction i.e. postpartum stress incontinence, new stress incontinence anal incontinence and dyspareunia. However, with regards to postpartum stress incontinence and dyspareunia it was the vaginal mode of delivery that was significantly associated whereas for anal incontinence it was the elective caesarean mode of delivery – a new finding. That all modes of delivery could increase the risk of postpartum pelvic dysfunction significantly with no mode being wholly protective has implications for management of delivery, particularly after previous pelvic floor damage. That pelvic dysfunction with multiple presentations can follow caesarean birth, even pre-labour, is reported by this study. The higher prevalence rate of dyspareunia in post-caesarean mothers than most previous reports again suggests that factors other than pelvic floor damage sustained at vaginal birth may be implicated.

This study reports that pregnancy also plays a significant role in the prevailing pelvic dysfunction. Again, certain pelvic floor symptoms appear to be significantly associated with other pelvic floor symptoms probably reflecting their close embryological, anatomical and physiological relationship (vide Chapter I, pages 7-15) so that a common pathology could

affect parallel organ systems. Thus during pregnancy, the hormonal effect on the pelvic floor could change the physical consistency of the collagen causing undue relaxation of the pelvic floor, thereby interfering with the distal urethral compensatory mechanism and result in stress incontinence (vide Chapter I, page 15) as well as affecting the pelvic floor mechanisms promoting bowel continence. This on its own or combined with the possible neurological or direct pelvic floor damage, even of lesser degree, would explain the statistically significant association between head circumference or birth weight with the risk of new stress or new anal incontinence in mothers who underwent caesarean delivery. Again, this could be the effect of as yet unknown biomechanical factors that made these mothers more susceptible to postpartum pelvic dysfunction which generally has received little attention in clinical research.

The natural history of the disease is not known with certainty and the condition can be transient or permanent with exacerbations and remissions. In fact, some mothers who had developed symptoms during pregnancy regained continence after delivery but it was not possible to study the course of the disease any further in this study. It could be that the endocrinological changes (vide Chapter I, page 15) during pregnancy (oestrogen, progesterone, relaxin)[79-84] and their effects on the pelvic floor muscle and ligaments via the relevant steroid receptors probably have an impact on pelvic dysfunction. Possibly, the stretch on these hormonally (steroids, relaxin) relaxed pelvic tissues by a growing fetus, during the third trimester (vide Chapter 1, page 13), causes damage to the pelvic floor by an unknown mechanism akin to 'stretch injury' observed in relation to sporting activities. The pudendal nerve gives a variable nerve supply (vide Chapter I, page 12) to the pelvic floor and there are other direct branches from the sacral plexus supplying the pelvic floor from its superior surface, which could be affected by the stretch and pressure of a growing fetus leading to neurological damage (neuropathy) which in turn leads to damage to the pelvic floor. This could partly explain the aetiology behind the manifestation of new anal incontinence in mothers who underwent an elective caesarean or pre-labour emergency caesarean delivery.

While the risks of stress incontinence and anal incontinence are increased by both pregnancy and childbirth, this study shows that the risk with pregnancy seems to be higher for stress incontinence than for anal incontinence. The prevalence of anal incontinence though affected by pregnancy showed only a small rise during pregnancy and a small increase after delivery. This could be because of similarities as well as dissimilarities between the anatomical and pathophysiological correlates of urinary and bowel continence (vide Chapter I, page 12-13). On principle the mechanisms which preserve urinary and bowel continence, are broadly speaking similar but they are not identical and differences exist in the finer details. The urinary tract does not have an internal sphincter like the bowel nor such a sophisticated sphincter

mechanism, so it is more reliant on pelvic floor integrity along with the distal urethral mechanism. This could explain the increase in the prevalence of stress incontinence during pregnancy and the spontaneous reversal to normal continence postpartum in fifty percent mothers in this study.

The damage started in some of these primiparae prior to pregnancy. Stress incontinence before pregnancy was also a statistically significant predictor for dyspareunia in the elective caesarean cohort. None of the mothers with pelvic dysfunction prior to pregnancy gained continence during pregnancy. It could be that these mothers had an intrinsic vulnerability to pelvic dysfunction that was aggravated by the endocrinological effects and stretching of tissues during pregnancy and at delivery (vide Chapter I, page 13).

There was a significant association between wound problems and stress incontinence or dyspareunia, even after an elective caesarean, and this could reflect a susceptibility to pelvic dysfunction in these individuals perhaps related to their collagen type. Whilst the healing of wounds is related to factors such as surgical technique, infection, etc. it is also dependent on the health and response of the local connective tissue/collagen to surgical trauma and repair. The caesarean procedure has become safer over the years (vide Chapter I, page 6) and is continuing to evolve. A continuous appraisal of the surgical technique and outcome is ongoing, yet there would be variations in maternal response and this should be taken into consideration in the evaluation of obstetric outcomes and advice. Perhaps the same characteristic of the connective tissue that may have affected wound healing in these mothers also promoted derangement of the fascial/ligamentous and muscular supports of the pelvic organs, resulting in stress incontinence or dyspareunia. A significant proportion of vaginally delivered mothers with an intact perineum reported incontinence or dyspareunia. This suggests that factors other than childbirth related overt perineal trauma increased the risk of pelvic dysfunction in some of these mothers who may have had an inherent constitutional vulnerability.

Previous studies (vide Chapter I, page 15) have researched steroid receptors in the pelvic floor/organs of non-pregnant women but similar research in the pregnant female may not be possible. Future advances in basic science may make it possible to investigate this further by growing tissue in a pregnancy-like internal milieu and trying to analyse this tissue for changes that weaken pelvic supports. If the present day pelvic floor evolved from the rectus abdominis (vide Chapter I, pages 4-5), could it undergo pathological changes like this muscle? The rectus abdominis is a sheet of muscle which can stretch excessively and can be torn by excessive force, so could the pelvic floor respond similarly with the stretch during pregnancy and labour or even earlier? It has retained steroid receptors, which are at a higher concentration in the

female pelvic floor (vide Chapter I, page 15) than in the rectus abdominis or the male pelvic floor. Pregnancy itself and other intrinsic factors such as the properties of collagen and connective tissue, hereditary susceptibility, altered rectal sensation, and obstetric procedures may be contributing more to postpartum pelvic dysfunction than reported so far.

The role of pre-labour factors including pregnancy is an important association to be taken into consideration in future research. Has the disease changed over time or was there an underlying modification which surreptitiously entered obstetric practice without robust evidence and increased the prevalence of postpartum symptoms? Although limited previous literature has suggested (vide Chart 1 fp 16) pregnancy as being more detrimental for bladder continence than the puerperium, this study has shown a significant onset of new symptoms during pregnancy and another rise after delivery, postpartum onset however contributes to less than 50% of the postpartum prevalence implying a lesser contribution of intrapartum factors to disease manifestation.

Using a different approach to explore the scope of pelvic dysfunction in a large caesarean sample with a comparative group of non-instrumental vaginally delivered mothers has given some answers but raised many questions. The study defines the importance of determining disease prevalence but the equally important estimation of postpartum incidence along with evaluation of the psychosocial severity of physical symptoms in order to address the scope adequately; such an investigation was facilitated by using a biopsychosocial approach. This consumer-orientated approach to detection of postpartum pelvic/perineal dysfunction was appropriately adapted to maternal conditions for this sample and would help in developing instruments for detection and prevention of the disease.

The findings are of high clinical relevance but with strict selection criteria whether these findings can be extrapolated to different populations is not known. It is an observational study with strict inclusion/exclusion criteria so the ability to generalise would be limited. The study was carried out under the constraints of funding, manpower and time limit so randomisation was not possible nor could it have been carried out prospectively as a cohort with a control group. The size of the sample could not be increased by extending the recruitment period to prevent recruits from getting pregnant again as only primiparae were being recruited. Besides the aim to determine the scope of this sensitive problem with an individualised psychosocial impact would not have been captured by a large survey with limited pre-determined responses. There is a potential for a response bias but the inclusion of almost all elective caesarean mothers who could have delivered at the time and a consecutive selection of the other recruits would have limited this. In recalling the events of delivery and pre-delivery a recall bias is possible but this would be minimal after childbirth, especially the first, which previous studies

have reported remains embedded in the mind of the mother and is comparable with medical records. The interview was not taped but rapid field notes were taken for the part of the interview script which consisted of the semi-structured open format of questioning, so some data could have been lost in using this method. However taking notes rapidly was not unfamiliar to the researcher and taping an interview can make the interviewee self-conscious and discourage disclosure of sensitive facts, besides discouraging voluntary recruitment. Pad-usage for incontinence was the only objective indicator for this study but inclusion of objective urodynamic, imaging and anorectal tests would have made the study invasive with cost implications along with the potential difficulty in attracting an unselected population and addressing the patient's perception of severity. Additional information had been solicited from general practitioners at the formulation stage to exclude patients who should not participate in this observational in-depth study; there was no reason as to why these English speaking recruits would not be able to respond adequately to questions about delivery, the presence/ absence and any effect of pelvic/perineal symptoms. Caucasian participants comprised 96% of this sample so extrapolation to other more ethnically diverse samples remains to be tested.

This study has reported that caesarean delivery, including elective caesarean and pre-labour emergency caesarean, are significantly associated with hidden postpartum pelvic/perineal dysfunction. Vaginal delivery with lesser degrees of perineal trauma is also implicated to a considerable extent. This study's findings could be evaluated further for translation into obstetric practice. In many instances there is only a fine dividing line between the decision for and against intervention in a current or future child birth and consumer choice is being promoted. Conversion of the mother's perception into an appropriate postpartum evaluation tool would help assess disease severity and aid decision making. It could be included in the measure for a risk/benefit calculation of the mode of delivery and prevention of pelvic/perineal dysfunction. This study has given some insight into developing such a consumer-orientated assessment tool for postpartum pelvic/perineal dysfunction. It needs further evaluation in future research.

I would also like to add regarding the implications of being an insider researcher in this investigation and my relationship with the researchees, which would further reflect on any of my limitations and potential as a researcher for this type of study. Insiderness has many meanings[356,357] and I will explain the concept of insiderness with regards to research ethics, gender and relationship with the recruits. I had moved to the area just before the study was initiated, so I was not familiar with the hospital staff, nor had I seen any of the recruits beforehand or was involved in their care. Therefore, even though an insider researcher, my circumstance would have made it easier to obtain truthful responses. They were assured that

refusal to take part would not adversely affect any future treatment which they sought. The design and methodology of the study left them free to decide whether they wanted to participate or leave at any stage. Besides the standard information about the study, I was able to provide participants additional information, if requested, from the start and assure them about anonymity and confidentiality. As a professional insider, I had access to the medical records of the recruits but I confirmed the medical details only after interviewing them so had no pre-formed ideas about their obstetric performance or influence on their responses. Next in assessing the effect of insiderness I will ascribe status, such as gender, for with regards to this, I was similar to the recruits. I knew what being a patient meant as I was bedridden for months due to multiple road-traffic injuries and had to take precautions to prevent bladder and bowel symptoms. The recruits were unaware of my experience so interview reciprocity was avoided, but it may have been relatively easier for me to understand their concerns and this would have helped in gaining rapport and collecting data on sensitive issues. Again by being an insider my subjectivity could have had the potential to distort findings related to, for instance, coding the psychological information obtained, but the conversion to quantitative format with the additional comments of an independent professional who was my guide would have minimised this if it did arise. There was no control hierarchy and I went with an open mind which along with my neutral dressing facilitated disclosure of information and promoted good communication. After noting the hidden biopsychosocial morbidity at the start, as an insider I was able to contribute to the local care pathway by approaching the Clinical Director who appointed a specialist midwife and organised a confidential support phone-line to advise mothers with related problems (flyer copied into appendix E).

As intended, I have at the end of my investigation on pelvic/perineal dysfunction addressed the aims within the constraints of the facilities available, and managed to:

1) **Recruit a large primiparous caesarean (including pre-labour elective) sample from a single obstetric unit**
2) **Collect data by in-depth interviews at home**
3) **Analyse for obstetrical/biological predictors after adjusting for confounders**
4) **Determine the prevalence and incidence of pelvic/perineal dysfunction**
5) **Develop an evaluation technique to quantify maternal perception of severity which was acceptable to participants and easy to use**
6) **Assess disease severity by evaluating biopsychosocial interactions**
7) **Assess help-seeking behaviour**

I can leave the reader with the following conclusions and implications…

Chapter VI
CONCLUSIONS & IMPLICATIONS

CONCLUSIONS:

1. Pelvic dysfunction (stress incontinence, anal incontinence and dyspareunia) is common in a large primiparous caesarean (n=80 elective, n=104 emergency) or a vaginally delivered sample without instrumentation or $3^{rd}/4^{th}$ degree tears.

2. Symptoms of stress incontinence, anal incontinence and dyspareunia are comparable after pre-labour elective caesarean or emergency caesarean.

3. Non-instrumental vaginal delivery (without $3^{rd}/4^{th}$ degree tears) is a significant predictor for postpartum stress incontinence and new stress incontinence whereas elective caesarean is a significant predictor for postpartum anal incontinence.

4. Stress incontinence during pregnancy is a significant predictor for postpartum stress incontinence and pre-pregnancy stress incontinence is a predictor for postpartum dyspareunia, indicating pre-delivery vulnerability that effects postpartum manifestations.

5. Postpartum anal incontinence is significantly associated with postpartum stress incontinence, suggesting that a similar pathology was acting simultaneously on both organ systems.

6. Pre-labour factors appear to influence the postpartum prevalence of pelvic dysfunction with pregnancy selectively increasing the risk for stress incontinence more than anal incontinence.

7. Pelvic dysfunction is a continuum with exacerbations and remissions in susceptible women so mode of delivery is not the sole contributor to increasing maternal risk.

8. New (postpartum onset) symptoms of stress incontinence contribute to the postpartum prevalence more than is the case for anal incontinence, perhaps referring to intrapartum factors acting on a more vulnerable urinary continence mechanism.

9. Wound problems are significantly associated with post-caesarean dyspareunia, especially after elective caesarean, and possibly with non-instrumental vaginal delivery but the analytic evidence for the latter is weak.

10. Even though the frequency of new anal incontinence is low, it is manifest after every mode and the impact can be severe; continuous pad use for faecal incontinence was reported by two mothers after pre-labour elective caesarean delivery.

11. A significant proportion of vaginally delivered mothers have lesser degrees (1st and 2nd degree) of perineal trauma.

12. Stress incontinence, anal incontinence and dyspareunia are commonly manifest after perineal trauma or an intact perineum and comparable in frequency and severity irrespective of the perineal status.

13. The baby's birth weight is a significant predictor for new stress incontinence.

14. Postpartum stress incontinence, anal incontinence, dyspareunia, haemorrhoids and perineal trauma result in significant physical morbidity reflected in mode-related patterns of perineal protection and have a considerable impact on overall sexual and psychosocial health.

15. General sexual health is significantly affected by pelvic/perineal dysfunction and in a few sufferers considerable impairment occurs. Although dyspareunia is not significantly associated with new anal incontinence, impaired general sexual health is significantly associated.

16. Quantification of psychological symptoms (dysphoria) from the participants' responses at interview is a useful method to categorise levels of psychological severity, which can then be related to relevant quantitative physical assessments.

17. Severe dysphoria has been found to have a statistically significant association with postpartum stress incontinence and dyspareunia after either the caesarean or the vaginal mode and exceptionally with wound problems in the elective caesarean.

18. Impairment of social health due to pelvic/perineal dysfunction relates to interference with: leisure activities – significantly impaired in those with post-caesarean stress incontinence but non-significant in the vaginally delivered;

social networking – significantly impaired after the caesarean mode, particularly in those presenting with anal incontinence but non-significant in the vaginally delivered;

employment – significantly impaired in those delivered by the caesarean mode, particularly in those with anal incontinence, and in those with stress incontinence after vaginal delivery;

sexual relationship – significantly impaired in those with postpartum anal incontinence, in the elective caesarean mothers with dyspareunia and the vaginally delivered with wound problems.

19. Perceived dissatisfaction with the management of childbirth or the puerperium can negatively impact on psychosocial health with emergency caesarean mothers being most at risk; two of these mothers presented with post-traumatic stress reaction.

20. An intact perineum in the vaginally delivered appears to reduce the progress towards severe dysphoria and interference with resuming employment.

21. Assessing the severity of new symptoms would facilitate understanding of the scope of pelvic/perineal dysfunction as it generates a new response from the first-time mother who is simultaneously adapting to the postpartum psychosocial needs of the family.

22. Assessment of severity using a biopsychosocial approach as relevant to postpartum maternal functioning seems more meaningful as objective tests to measure the severity of flatal incontinence and dyspareunia do not exist and the mother's emotional state does affect the perception of incontinence and dyspareunia.

23. The clinical significance of the mother's perception of the severity of physical symptoms of new anal incontinence and perineal trauma and her decision to attribute it to a particular symptom reflects the complexity of the issue and its being inclusive to each mother.

24. A new approach to assessing the scope of postpartum pelvic/perineal dysfunction including the psychosocial impact was developed in this study by adapting the observations of previous researchers whose samples presented with similar symptoms. It was relatively easy to work with and seemed acceptable to patients.

Clinically important but more tentative associations (statistically significant with small sample size or going towards significance)

1. New symptoms (postpartum onset) of anal incontinence are associated with increased baby birth weight (≥ 3500 gm) in those delivered by emergency caesarean.

2. A significant association of head circumference with new anal incontinence (postpartum onset) is observed in mothers who were delivered by an elective caesarean.

3. A longer duration of the second stage of labour appears to reduce the risk of postpartum stress incontinence whereas a longer duration of the first stage of labour appears to reduce the risk of postpartum anal incontinence, perhaps pointing to the different mechanisms for maintaining bladder and bowel continence.

IMPLICATIONS for

i) Current Practice and Research

1. Management of childbirth should continue according to the evolving clinical situation bearing in mind that a pre-labour caesarean delivery may not prevent pelvic dysfunction.

2. Screening for pelvic/perineal dysfunction should be used not only postpartum but also prior to it, including pre-pregnancy, in order to identify those at a higher risk of postpartum onset.

3. Severity as judged by associated biopsychosocial ill-health is particularly relevant in assessing the scope of childbirth related pelvic/perineal dysfunction and introducing tools relevant to postpartum maternal functioning are more appropriate. These should be added to the current methods of assessing obstetric outcomes including maternal satisfaction.

4. The quantification of psychological symptoms (dysphoria) from the participants' responses and their categorisation into levels of severity after scoring is suitable for current applications and should be further evaluated.

5. Professionals need to be alert to the possibility of postpartum psychosocial problems such as depression presenting concomitantly with the physical morbidity from incontinence and sexual dysfunction.

6. Identification and early treatment need to be prioritised as many affected mothers in this study chose not to come forward to seek help despite detrimental effects on their personal/social relationships.

7. In today's litigious climate good communication during and after delivery should be further prioritized, especially in the management of emergency caesarean deliveries.

8. Ongoing training of trainees regarding detection and suturing of perineal trauma after delivery while the mother is still on the labour ward (currently being encouraged) would reduce the incidence of mismanaged perineal trauma.

9. A multidisciplinary approach to managing pelvic/perineal dysfunction and further training of clinicians in applying a biopsychosocial approach to postpartum assessment tools should be encouraged.

10. Easier access to incontinence, sexual and psychological health services would encourage consumers to report these problems and obtain appropriate support.

11. A consumer orientated psychosocial assessment tool to assess severity would help evaluate consumer needs.

12. Customised support after childbirth with selective access to consultant advice well after the traditional six week check up (should extend to one year) will benefit many mothers.

ii) Future Research

This project suggests that further research is needed in the following areas:

1.Prospective studies to investigate the findings of this study taking into account the difficulty in recruiting a big enough caesarean sample and the uncertainty of the outcome of any pregnancy.

2. Clinical and basic research into constitutional factors and ethnicity in the causation of pelvic dysfunction and the effects of pregnancy hormones on the collagen of the pelvic floor.

3. Longer follow up to look at the natural history of the disease.

4. Comparative studies on the scope of postpartum pelvic/perineal dysfunction including psychosocial ill-health and its economic burden along with economic costing of the different modes of delivery, to help future obstetric decision making by allowing selection of the most cost-effective mode.

This study has been able to add to the current evidence concerning obstetrical/biological predictors of pelvic/perineal dysfunction, as well as identifying new predictors and biopsychosocial associations of pelvic/perineal dysfunction. A considerable hidden morbidity was revealed in this young maternal population following both caesarean (even pre-labour) and non-instrumental vaginal delivery. This in-depth examination of a complex subject was only made possible by using a biopsychosocial approach, that is to say, by incorporating an expanded medical interviewing technique for data collection and applying new scoring systems, adapted from previous postpartum research to categorise maternal psychosocial perceptions of disease severity.

It improves our understanding of the disease and should help to foster further research on the assessment of the disease and its detection, thereby aiding the development of appropriate preventive and curative management strategies. *At the end of this study, I have managed to advance existing knowledge on the subject* (please find appended details of a few publications from this study in Appendix A).

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APPENDIX A: Published papers

List of Scientific Publications related to research for PhD:

1. Lal M, Pattison HM, Allan TF, Callender R. '*Does Post-caesarean Dyspareunia reflect Sexual Malfunction, Pelvic Floor and Perineal Dysfunction?'* **J Obstet Gynaecol 2011**; 31(7): 617-630.

2. Lal M. '*Physical and mental wellbeing is compromised by biopsychosocial disease: would a paradigm shift sustainably advance human health?*' Published in the **handbook of the 1st World Congress of Obstetrics, Gynaecology & Andrology (WCOGA2011.com) and** the **J Obstet Gynaecol 2011;** 31(S1).

3. Lal M, Pattison H, Allan T, Callender R. '*Postcesarean Pelvic Floor Dysfunction Contributes to Undisclosed Psychosocial Morbidity'* J Reprod Med 2009; 54: 53-60.

4. Lal M, Callender R. '*Psychosociocultural factors modulate outcomes in Gynaecology and Obstetrics: East & West'* Published in the **handbook and also as an article in the proceedings of the XVth Congress of the International Society of Psychosomatic Obstetrics & Gynaecology (ISPOG)**, Kyoto, Japan **(2007)**.

5. Lal M, Pattison HM, Allan TF, Callender R. '*Post-caesarean pelvic floor dysfunction impacts on maternal psychosocial health*' Published in the **handbook of the XVIII FIGO Congress (2006)**.

6. Lal M. '*Current thoughts on the Prevention of Postpartum Onset of Anal Incontinence: Caesarean vs. vaginal delivery'* Published as an article on **20th January 2006**, on **www.siicsalud.com (web version)** and in **February 2006** in **their journal in English** (translated into Spanish & Portuguese).

7. Lal M. '*Childbearing related Post-traumatic stress disorder in clinical research and practice'* Published as an abstract in the conference handbook of the **Biennial Scientific Meeting of the International Marcé Society** at the Medical School, Keele University **(2006)**.

8. Lal M, Pattison HM, Allan TF, Callender R. '*Multiple Post-Caesarean Pelvic floor symptoms and their psychological impact in young primiparae'* Published as an abstract in the conference handbook of the **Biennial Scientific Meeting of the International Marcé Society** at St. Catherine's College, Oxford and also in the **Archives of Women's Mental Health (2004 & 2005,** respectively**).**

9. Lal M, Pattison HM, Allan TF, Callender R. '*Severe Psychological & Social consequences of pelvic floor dysfunction in primiparae'* Published as an abstract in the **J Psychosomatic Obstet Gynecol** and as a short article in the **Proceedings of the 14th World Congress of the ISPOG (2004)**.

10. Lal M, Pattison HM, Allan TF, Callender R. '*Postpartum dyspareunia reflects sexual malfunction, pelvic floor and perineal dysfunction: Caesarean vs Vaginal'* Published as an abstract in the **J Psychosomatic Obstet Gynecol** and as a short article in the **Proceedings of the 14th World Congress of ISPOG (2004)**.

11. Lal M. *'Prevention of urinary and anal incontinence: role of elective caesarean delivery'* – a review' Published in **Current Opinion in Obstetrics & Gynecology 2003**; 15 (5): 439-448.

12. Lal M, Mann CH, Callender R, Radley S. '*Does cesarean delivery prevent anal incontinence?*' Published in **Obstetrics & Gynecology 2003**; 2: 305-312.

13. Lal M, Pattison HM, Allan TF et al. '*Pelvic dysfunction, caesarean delivery and psychological health'* Published in the **Journal of Reproductive and Infant Developmental Psychology 2002**; 20(3): 188.

14. Lal M, Callender R, Mann CH, Radley S. '*Caesarean section, pelvic dysfunction and primiparous health'* Published in **J Obstet Gynaecol 2002**; 22(1): S57.

15. Lal M, Mann CH, Callender R, Radley S. '*Patterns of faecal incontinence*' Published in the Meeting **Handbook of the Colo-proctological Section, Royal Society of Medicine,** and in **Colorect Dis 2000**; 2: 178-179.

In press:

16. Lal M. Contributing two chapters to a review book titled '***Biopsychosocial Obstetrics and Gynaecology*' In press.**

Citations: My work in this subject area has been well cited with entry into the Cochrane Database, Oxford, in January 2010.

1. **Does cesarean delivery prevent anal incontinence?**
   www.ncbi.nlm.nih.gov/pubmed/12576254
   by M Lal - 2003 - Cited by 90 –

2. **Prevention of urinary and anal incontinence ... - UK PubMed Central**
   ukpmc.ac.uk/abstract/MED/14501249
   by M Lal - 2003 - Cited by 23 –

3. **Postcesarean pelvic floor dysfunction ... - UK PubMed Central**
   ukpmc.ac.uk/abstract/MED/19301567
   by M Lal - 2009 - Cited by 9 –

4. **Psychosomatic approaches to obstetrics ... - UK PubMed Central**
   ukpmc.ac.uk/abstract/MED/19280487
   by M Lal - 2009 - Cited by 2 –

APPENDIX B: Consent Form

RESEARCH CONSENT FORM	
TITLE OF PROJECT: SYMPTOMS AFTER CHILDBIRTH	
The patient should complete the whole of this sheet herself	**Please cross out as necessary**
Have you read the patient information sheet?	**YES / NO**
Have you had the opportunity to ask questions and discuss this study?	**YES / NO**
Have you received satisfactory answers to all your questions?	**YES / NO**
Have you received enough information about the study?	**YES / NO**
Who have you spoken to? Dr / Mr / Mrs Do you understand that you are free to withdraw from the study: • at any time • without giving a reason for withdrawing • without affecting your future medical care ?	**YES / NO**
Do you agree to take part in this study?	**YES / NO**
Signed……Date……... NAME (in block letters)……..	
Witness...……Date……... NAME (in block letters)……..	

APPENDIX C: Prompts for interview

YOUR CAESAREAN SECTION

Identity of participant –

Date of delivery – **Duration of gestation –**

1. Why did you require a caesarean section?.....

.....

.....

2. Did you feel you were given enough information about why you needed a caesarean section?

YES ☐ NO ☐

IF NO please state why not.....

.....

3. Who gave you this information?

DOCTOR ☐ MIDWIFE ☐ BOTH ☐

4. How long after you received this information was your caesarean section carried out?

>15 minutes ☐ 15-30minutes ☐ 30-60 minutes ☐ 120-180 minutes ☐ <180 minutes ☐

5. What type of anaesthetic did you receive?

General ☐ Epidural ☐ Spinal ☐

6 . Did you require painkillers after discharge from hospital

YES ☐ NO ☐

If YES, how long for?.....

7. Did you have any problems with your wound after discharge from hospital?

YES ☐ NO ☐

If YES, state what problems.....

8. Did you seek advice from any of the following about your wound?

Hospital doctor ☐

Hospital midwife ☐

Hospital physiotherapist ☐

Community midwife ☐

GP ☐

Health visitor ☐

9. How soon after discharge did you begin the following activities?

Housework .....

Shopping .....

Driving .....

Paid work .....

Social activities .....

Other activities .....

Sexual relationship with partner .....

COMMENTS

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BOWEL PROBLEMS

1. Have you ever had a bowel problem? yes ☐ no ☐

2. Bowel function after delivery
When asking the questions, ask the women to think about their function/symptoms **before** and **during** and **after** their pregnancy

You will see that some questions ask if you have a problem **occasionally**, or **most of the time**;
Occasionally = less than half of the time.
Most of the time = more than half of the time.

		Before	During	After
2a. How often do/did you open your bowels?	More than 3 times a day	☐	☐	☐
	2-3 times a day	☐	☐	☐
	Once a day	☐	☐	☐
	Every 1-3 days	☐	☐	☐
	Less than every 3 days	☐	☐	☐*
	Less than once a week	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2b. Are your motions usually	Watery	☐	☐	☐
	Sloppy	☐	☐	☐
	Soft and formed	☐	☐	☐
	Hard	☐	☐	☐

2c. Do you ever have to rush to the toilet to open your bowels?	Never	☐	☐	☐
	Occasionally	☐	☐	☐
	Most of the time	☐	☐	☐
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2d. Can you hold onto your motions for more than 5 minutes?	All of the time	☐	☐	☐
	Most of the time	☐	☐	☐
	Occasionally	☐	☐	☐*
	Never	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2e. Do you have bouts of diarrhoea with crampy pains?	Never	☐	☐	☐
	Occasionally	☐	☐	☐
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

		Before	During	After
2f. Can you control the passage of flatus/wind from your back passage?	All of the time	☐	☐	☐
	Most of the time	☐	☐	☐*
	Occasionally	☐	☐	☐*
	Never	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

		Before	During	After
2g. Do you get any soiling of your underwear?	Never	☐	☐	☐
	Occasionally	☐	☐	☐*
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

		Before	During	After
2h. Do you wear a pad?	Never	☐	☐	☐
	Occasionally	☐	☐	☐*
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

		Before	During	After
2i. Does stool leak before you can get to the toilet?	Never	☐	☐	☐
	Occasionally	☐	☐	☐*
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

		Before	During	After
2j. Do you leak stool for no obvious reason and without feeling that you want to go to the toilet?	Never	☐	☐	☐
	Occasionally	☐	☐	☐*
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

		Before	During	After
2k. Do you have to strain to open your bowels?	Never	☐	☐	☐
	Occasionally	☐	☐	☐
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

		Before	During	After
2l. How long do you spend in the toilet, on average, for each bowel action?	less than 5 minutes	☐	☐	☐
	5 to 10 minutes	☐	☐	☐
	10 to 20 minutes	☐	☐	☐
	more than 20 minutes	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2m. Do you feel that you cannot completely empty your bowel?	Never	☐	☐	☐
	Occasionally	☐	☐	☐
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2n. Do you use a finger to help open your bowels?	Never	☐	☐	☐
	Occasionally	☐	☐	☐*
vagina ☐ *anus* ☐ *perineum* ☐	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2o. Have you ever had a loss of sensation around your perineum?	All of the time	☐	☐	☐
	Most of the time	☐	☐	☐
vagina ☐ *anus* ☐	Occasionally	☐	☐	☐*
	Never	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2p. Do you have the urge to open your bowels but are unable to pass a motion?	Never	☐	☐	☐
	Occasionally	☐	☐	☐
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2q. Do you use laxatives?	Never	☐	☐	☐
	Less than once a week	☐	☐	☐
(Write their names here)	More than once a week	☐	☐	☐*
	Every day	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

If symptomatic* answer sections 3, 4 & 5

3. Does your bowel problem affect any of your activities?

	LOC	OTHER		LOC	OTHER		LOC	OTHER
Yes, often	☐	☐	**Yes, sometimes**	☐	☐	**No**	☐	☐

3a. If yes, in what way?.....

3b. Check on specific activities

3c. Does it affect?

	Loss of control	Other bowel problem
Childcare	YES ☐ NO ☐	YES ☐ NO ☐
Housework	YES ☐ NO ☐	YES ☐ NO ☐
Paid work	YES ☐ NO ☐	YES ☐ NO ☐
Social activities	YES ☐ NO ☐	YES ☐ NO ☐
Other activities	YES ☐ NO ☐	YES ☐ NO ☐
Relationship with partner	YES ☐ NO ☐	YES ☐ NO ☐

3d. How does it affect these activities? LOC.....

OTHER

3e. How does it affect feelings/well-being/relationships? LOC.....

OTHER.....

4a. Have you been to the doctor about your bowel problem?

	LOC	OTHER		LOC	OTHER
YES	☐	☐	**NO**	☐	☐

4b. If YES what treatment did the doctor give or arrange for you

	LOC	OTHER		LOC	OTHER
No treatment	☐	☐	**Hospital appointment**	☐	☐
Physiotherapy	☐	☐	**Operation**	☐	☐
Suppositories	☐	☐	**Treatment not from Dr**	☐	☐
Laxatives	☐	☐	**Other (specify)**	☐	☐
High fibre diet	☐	☐	**……**		

If NO, why do you think you didn't go to the doctor (i.e. were they too embarrassed?)

LOC…….|OTHER……..

4c. Check on medical consultations	**LOC**	**OTHER**
Who gave treatment?……	**|**	**……..**
Were you satisfied with the treatment you had?	**|**	**……..**
Are you still receiving treatment?……	**|**	**……..**
Will you be seeking further treatment?……	**|**	**……..**

5a. What do you think caused your bowel problem? .....

.....

5b. Did you expect to suffer with bowel symptoms after your baby was born?.....

.....

5c. What symptoms did you expect after your baby was born?.....

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COMMENTS.....

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History of previous illnesses (related to bowel symptoms):

URINARY SYMPTOMS

1. Have you ever had urinary problems? yes ☐ no ☐

2. Urinary function after delivery
When asking the questions, ask the women to think about their function/symptoms **before** and **during** and **after** their pregnancy

You will see that some questions ask if you have a problem **occasionally**, or **most of the time**;
Occasionally = less than half of the time.
Most of the time = more than half of the time.

		Before	During	After
2a. During the day, how many times do you urinate, on average?	1 to 6 times	☐	☐	☐
	7 to 9 times	☐	☐	☐
	10 to 12 times	☐	☐	☐
	13 or more times	☐	☐	☐

2b. During the night, how many times do you have to get up to urinate, on average?	Never	☐	☐	☐
	1 time	☐	☐	☐
	2 times	☐	☐	☐*
	3 times or more	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2c. Do you have to rush to the toilet to urinate?	Never	☐	☐	☐
	Occasionally	☐	☐	☐
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2d. Do you have difficulty completely emptying your bladder?	Never	☐	☐	☐
	Occasionally	☐	☐	☐
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2e. Does urine leak before you can get to the toilet?	Never	☐	☐	☐
	Occasionally	☐	☐	☐*
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

		Before	During	After
2f. Does urine leak when you are active, exert yourself, cough or sneeze?	Never	☐	☐	☐
	Occasionally	☐	☐	☐*
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

2g. Does urine leak for no obvious reason and without feeling that you want to go to the toilet?	Never	☐	☐	☐
	Occasionally	☐	☐	☐*
	Most of the time	☐	☐	☐*
	All of the time	☐	☐	☐*
*If symptomatic after delivery *;*				
How many months after delivery did this start?	☐ *months*			
How long did the symptoms last?	☐ *months*			
Are symptoms improving?	*yes* ☐ *no* ☐			

If symptomatic* answer sections 3, 4 & 5

3a. Does your urinary problem affect any of your activities?

	LOC	OTHER		LOC	OTHER		LOC	OTHER
Yes, often	☐	☐	**Yes, sometimes**	☐	☐	**No**	☐	☐

If yes, in what way?.....

3b. Check on specific activities, does it affect?

Childcare	**YES** ☐ **NO** ☐
Housework	**YES** ☐ **NO** ☐
Paid work	**YES** ☐ **NO** ☐
Social activities	**YES** ☐ **NO** ☐
Other activities	**YES** ☐ **NO** ☐
Relationship with partner	**YES** ☐ **NO** ☐

3c. How does it affect these activities?.....….....

……..

3d. How does it affect feelings/well-being/relationships?.....……

….....……..…….....

4a.Have you been to the doctor about your urinary problem?

YES ☐ **NO** ☐

4b. If YES what treatment did the doctor give or arrange for you

No treatment	☐	**Hospital appointment**	☐
Physiotherapy	☐	**Operation**	☐
Suppositories	☐	**Treatment not from Dr**	☐
Laxatives	☐	**Other (specify)**	☐
High fibre diet	☐		

If NO, why do you think you didn't go to the doctor (i.e. were they too embarrassed?)

……..……

4c. Check on medical consultations

Who gave treatment?……..……..

Were you satisfied with the treatment you had? …….……..

Are you still receiving treatment?……...

Will you be seeking further treatment?…….....

5a. What do you think caused your urinary problem? .....

.....

5b. Did you expect to suffer with urinary symptoms after your baby was born?.....

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5c. What symptoms did you expect after your baby was born?.....

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COMMENTS.....

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History of previous illnesses (related to urinary symptoms):

RESUMPTION OF SEXUAL RELATIONSHIPS

Some women who have had a baby experience other health problems and some find it difficult to talk about these. This is because they can be embarrassing, even though they are commonly experienced. Only by finding more about these symptoms can we aim to improve women's post natal health. All information will be treated in strictest confidence.

1. Have you tried intercourse since the birth of your baby? (Tick one box only)

Have not tried to have intercourse yet ☐
Have tried and been able to have intercourse ☐
Have tried and been unable to have intercourse ☐
Do not have a partner ☐

2. If you have tried intercourse, how many weeks after the birth of your baby did you try? (enter number of weeks) ☐ ☐

3. If you have tried to have intercourse, did you have any of the following problems? (Tick all relevant boxes and go to (Q.5)

I am not interested ☐
My husband/ partner is not interested ☐
I am too tired ☐
My husband/ partner is too tired ☐
It was sore or difficult ☐
It is sore at entry ☐
It is sore deep inside ☐
We did not have any problems ☐
Other (e.g. Frequency of intercourse compared to pre-pregnancy, satisfaction, wound pain, etc.)
.....
.....

4. If you have not tried to have intercourse, is this for any of the following reasons? (Tick all relevant boxes)

I am not interested ☐
My husband partner is not interested ☐
I am too tired ☐
My husband/ partner is too tired ☐
I am worried it will be difficult or sore ☐
My partner is worried it will be difficult or sore ☐
I am worried that I might fall pregnant again ☐
Other (please give details).....
.....

5. Did you receive any advice during or after your pregnancy on resuming intercourse?

YES ☐ **NO** ☐

What advice did you receive?.....

.....

Who from?

Hospital doctor	☐	**GP**	☐
Hospital midwife	☐	**Hospital physiotherapist**	☐
Community midwife	☐	**Health visitor**	☐

Other (please state)?.....

.....

6. Have you sought any advice since your pregnancy about intercourse?

YES ☐ **NO** ☐

If YES, who from?

Hospital doctor	☐	**GP**	☐
Hospital midwife	☐	**Hospital physiotherapist**	☐
Community midwife	☐	**Health visitor**	☐

Other (please state)?.....

.....

COMMENTS (frequency, satisfaction, wound pain, etc.)

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For Vaginal Deliveries (To replace the first page related to caesarean)

Identity of participant –

Date of delivery – **Duration of gestation in weeks**

Alternative questions regarding mode for mothers who had a vaginal delivery

Labour - spontaneous
induced

Duration (approximately, if known) - 1st stage
- 2nd stage
- active pushing

Episiotomy – Yes No

Tear – Yes No Whether sutured? Yes No

Analgesia used (continue as with caesarean section)

APPENDIX D: Partogram

APPENDIX E: Future and extended work from study

Further extensions from this study are outlined below.

1. The information leaflet below was given to all women delivered in Wordsley Hospital, Dudley Group, three months after the onset of this study following my discussion with the Clinical Director. This was after I had identified the silent morbidity of pelvic/perineal dysfunction in this population who wanted support from the hospital regarding these problems but previously no provision for such support was in place.

……

THE DUDLEY GROUP OF HOSPITALS NHS TRUST

Women & Children's Service

We hope that your experience at Wordsley Maternity Unit has been a positive one for you and your family. If you have any concerns that you would like to discuss, we have a 24 hour telephone answer service. If you would like to leave:

- **Your name**
- **Your telephone number**

We will contact you, within a few days to make arrangements to discuss your concerns with the midwife counsellor.

Our answerphone number is

…….

2. I carried out a research centre feasibility study about using the methodology followed in this pilot study for the detection of pelvic/perineal dysfunction at three overseas medical school/hospitals in India. Slight modification of a probe was needed to tailor it to the cultural values of the population at one of the centres. There was a silent morbidity from incontinence and sexual problems in the population of nulliparae at these centres and the centres had the infrastructure to carry out such research so they could be included in future collaborations.

3. I have submitted a research proposal requesting funding to enable me to investigate further the findings from this study in conjunction with gaps in the literature suggesting continuing unmet needs of this population of sufferers in the UK and overseas. Reduction of morbidity with capacity building has been included in this proposal.