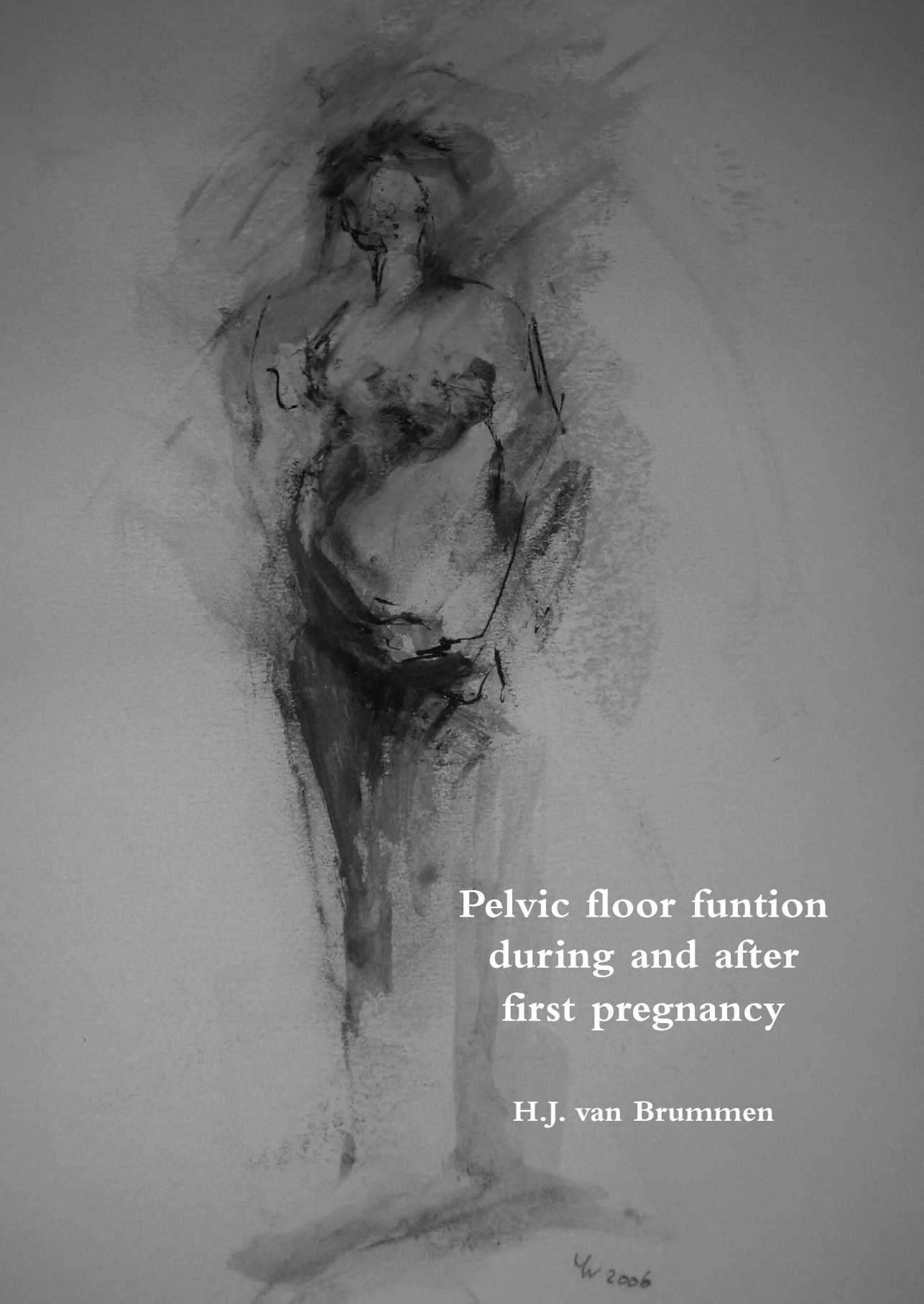
Pelvic floor funtion
during and after
first pregnancy
H.J. van Brummen
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# Pelvic floor function during and after first pregnancy

H.J. van Brummen

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# Pelvic floor function during and after first pregnancy

De bekkenbodemfunctie tijdens en na de eerste zwangerschap

(met een samenvatting in het Nederlands)

## Proefschrift

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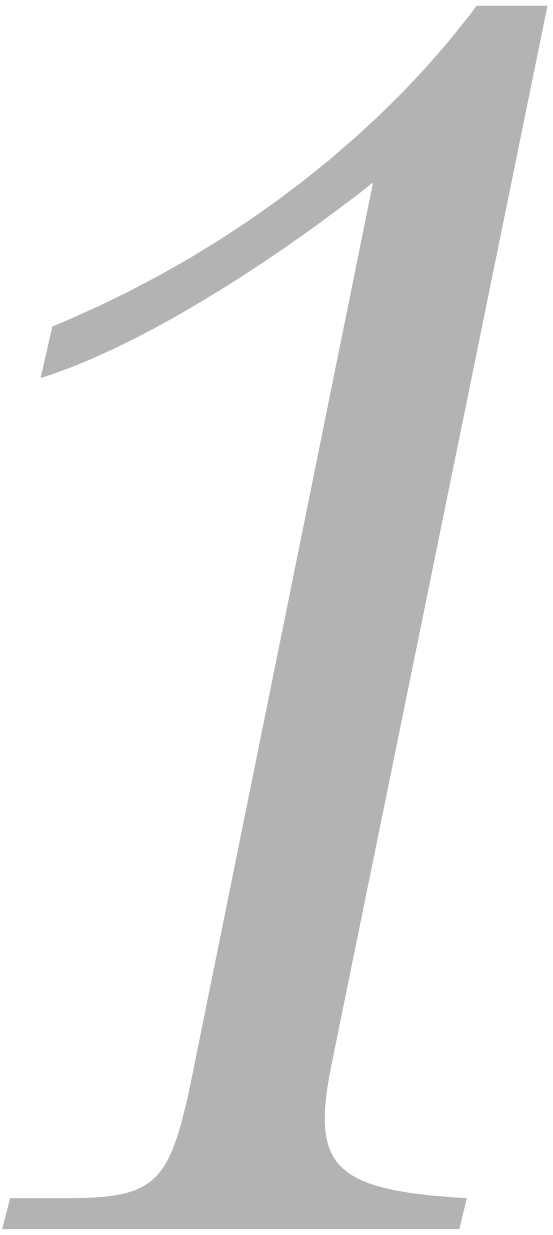
**Promotor**
Prof Dr. A.P.M. Heintz
Prof. Dr. H.W. Bruinse

**Co-promotor**
Dr. C.H. van der Vaart

## Contence

*Chapter 1*

# Introduction



Micturition symptoms, defecation symptoms and sexual dysfunction are all signs of impaired pelvic floor function. Pelvic floor symptoms are common during and after first pregnancy[1-10]. In research the focus has been on the prevalence incontinence symptoms and the associated risk factors. Little attention has been paid to the prevalence other pelvic floor symptoms like constipation, painful defecation, and overactive bladder symptoms.

The effect of pregnancy on micturition, defecation and sexuality is largely unstudied. These three functions of the pelvic floor may be impaired due to pregnancy-related factors, such as the pressure effects of the gravid uterus and the altered urine production and bladder capacity, and damage to the pelvic floor innervation and pelvic fibromuscular structures.

In a non-pregnant population of women, the health-related quality of life (HRQoL) is as negatively affected by overactive bladder symptoms (OAB) as it is by true urinary incontinence symptoms[11]. Fecal incontinence symptoms have also shown to negatively affect the quality of life postpartum[3, 12, 13]. The impact of pelvic floor symptoms on HRQoL has been largely unstudied[12].

Information on the effect of pregnancy and parturition on the pelvic floor function and the impact is, therefore, important.

## Pelvic floor symptoms

*Anatomy*

The pelvic floor is the lower border of the abdominal cavity and it includes the levator ani muscles, the urethral and anal sphincter and the endopelvic fascia with the related condensations such as the sacro-uterine, cardinal and pubourethral ligaments. The levator ani muscle is the largest component of the pelvic floor. This sheet-like collection of muscles has two major parts. The first are the paired iliococcygeus muscles, which form a continuous shelf over the outlet of the bony pelvis. The second part of the levator ani is the co-called pubovisceral muscle, which includes the puborectalis and the pubococcygeus muscles[14, 15]. These muscles form a U-shaped sling, encircling the urogenital hiatus. This hiatus is the midline space through which the vagina and the urethra pass. The levator ani has two important functions. First, it provides a constant basal tone, thereby keeping the urogenital hiatus closed[16–18]. If this basal tone is lost or diminished, the urogenital hiatus can widen, facilitating descent of the pelvic viscera. Second, the levator ani contracts reflexively in response to increased abdominal pressure, thereby supporting related organs. This action most likely contributes to the maintenance of continence[17, 19]. The levator ani complex is associated intimately with the anal and urethral sphincter mechanism. The anal sphincter includes two separate muscles, the internal and external anal sphincter. The internal anal sphincter is a layer of circular smooth muscle that is not under voluntary control. It is responsible for most of the resting tone of the anal canal. The external anal sphincter is a thicker ring-like skeletal muscle encircling the anal canal and merging with the puborectalis muscle posteriorly. Like the levator ani, the external anal sphincter maintains a constant basal tone but can also be contracted voluntarily. The urethral sphincteric mechanism is complex and includes both intrinsic and extrinsic sphincters[16]. The intrinsic or intramural sphincter consists of two layers: an inner longitudinal muscle and outer circular muscle, the sphincter urethrae. The external urethral sphincter mechanism consists of a proximal and distal component. In its proximal portion, the urethra rests on a sling formed by the vaginal wall. This sling is suspended laterally from the levator ani and the arcus tendinous fascia pelvis[20]. Thus, a contraction of the levator ani elevates and compress the proximal urethra[20]. In the distal urethra, two bands of skeletal muscle (the compressor urethrae and urethrovaginal sphincter muscles) arch over the ventral surface of the urethra. These muscles constrict the urethra when contracted. They are thought to contract reflexively with sudden increase in abdominal pressure, and they can also be contracted voluntarily[20].

Both the levator ani and the endopelvic fascia are important in maintaining the pelvic viscera in the normal anatomical position[16, 18, 21]. The role of the endopelvic fascia may be to fix the pelvic organs in an appropriate position over the levator plate via attachments to the side wall[16].

The levator ani and the sphincter muscles of the pelvic floor are innervated by anterior sacral nerve roots S2-S4. Direct motor branches of these nerve roots travel over the cranial surface of the pelvic floor, making them vulnerable to stretching or com-

pression during parturition. The external anal sphincter muscle and the striated urethral sphincter are innervated by the pudendal nerve, which also arises from sacral roots S2–S4.

*Impact of pregnancy on the pelvic floor*

The impact of pregnancy on the lower urinary tract and adjacent tissue is unclear because current knowledge is based on animal models or human studies with contradicting results. Recent studies have suggested that urinary incontinence (stress, urge and mixed incontinence) may represent symptoms with a common aetiology[22, 23]. Estrogen and progesterone receptors are present in the vagina, urethra, bladder and the pelvic floor, but with varying densities in the different areas[24-27]. The increased estrogen and progesterone levels during pregnancy induce tissue changes that influence the continence mechanism. But, the impact is unknown.

The hormonal moulding of the connective tissue that supports the bladder neck and proximal urethra may result in stress incontinence during pregnancy[28, 29]. During pregnancy there is an increased fluid intake, elevated urine production, and decreased functional bladder capacity in late pregnancy in late pregnancy because of pressure from an enlarged uterus. The combination of these factors may results in diurnal frequency and nocturia[30-32].

*Impact of childbirth on the pelvic floor*

During childbirth, the pelvic floor is exposed to direct compression from the fetal presenting part as well as the downward pressure from maternal expulsive efforts. These forces stretch and distend the pelvic floor, resulting in functional and anatomical alterations in the muscles, nerves, and connective tissue of the pelvic floor. Muscular injuries, such as lacerations of the perineum and external anal sphincter are most familiar. Little is known about the damage to the levator ani muscles during childbirth because these muscles are not usually visible at delivery. Lacerations of the perineal body are more evident at delivery. Because this structure is attached to both the pubovisceral muscle complex and the urogenital diaphragm[15], damage to the perineum may affect pelvic floor function. Impaired muscle function of the pelvic floor or of the urethral sphincter may occur after delivery. The strength of the pelvic floor is weak after nontraumatic vaginal delivery, weaker after spontaneous tears, but significant reduced after an episiotomy[33-35]. Posttraumatic fibrosis of the levator ani muscle may dispose to permanent weakness[36]. Magnetic resonance imaging of the levator ani muscle in 14 women showed that displacement of the perineum toward the sacrum persisted for up to 6 months after vaginal delivery, suggesting a delayed recovery of the connective tissue and muscle[37].

If the levator tone deteriorates, the pelvic organs become suspended over a widened urogenital hiatus by their ligaments and connective tissue supports[18, 38]. Under these circumstances, the endopelvic fascia will gradually stretch and weaken as a result of chronic tension[38]. Thus, decreased levator function may be the first step in a process that ultimately causes failure of the connective tissue support of the pelvic organs. In addition, an inherent weakness of the endopelvic fascia may contribute to the prob-

lem. Because the pelvic floor is weaker after vaginal delivery, childbirth is a potential cause of genital organ prolapse[33, 34]. In addition, evidence suggests that the pelvic floor neuropathy associated with childbirth may also play a role in the genesis of pelvic organ prolapse. Childbirth can also affect the pelvic floor by damaging the peripheral nerves that innervate the levator ani and sphincter muscles. It is hypothesized that childbirth causes stretching and/or compression of the pelvic floor as they traverse the pelvic floor. The resultant injury causes partial denervation of the pelvic floor musculature. Subsequently, recovery may occur as the denervated muscles are re-innervated by surrounding intact nerves.

Using neurophysiologic techniques to study the pelvic floor, denervation injuries of the pubococcygeus and external anal sphincter muscles have been demonstrated after 42-80% of vaginal deliveries[34, 39]. Denervation has not been seen after elective cesarean delivery, although it has been associated with cesarean delivery performed during labour[34, 39, 40]. Although many women demonstrate evidence of pelvic floor neuropathy in the immediate postpartum period, most will subsequently recover neuromuscular function and only a minority experience long-term sequelae[39, 41]. Women with prolonged nerve latency in the immediate postpartum period have been demonstrated to improve nerve conduction 2 months after delivery[39]. However, electrophysiologic evidence of denervation injury can be seen 5-6 years after delivery, and denervation injury may be cumulative with increasing parity[39, 41]. It is not known why some women recover neuromuscular function after childbirth and others demonstrate evidence of permanent damage. It has been hypothesized that repeated stretching of the pudendal nerve and its branches may results in recurrent nerve injuries, preventing recovery from the original insult[41].

The fascia and connective tissues of the pelvic floor may also be injured during labour and delivery. The mechanism of connective tissue injury and repair of the pelvis is poorly understood[42]. The endopelvic fascia is probably torn or ruptured rather than stretched during childbirth[16]. Isolated breaks in the endopelvic fascia have been implicated in the genesis of cystoceles, vaginal support defects, and genuine urinary stress incontinence[43]. After an acute injury to connective tissue, new collagen is formed. Because the new collagen is never as strong as the original connective tissue, the endopelvic fascia may be weaker after childbirth[42].

*Prevalence of urogenital symptoms*

Lower urinary tract symptoms (LUTS) are common during pregnancy and increase with increasing gestation until term[10, 30, 32]. After delivery, the symptoms promptly decrease, indicating that the pregnant uterus may play a role[10]. The prevalence of pelvic floor symptoms in fertile women varies depending on the target population, the definition and study design used, and for prevalence in puerperium the time after delivery.

Urinary stress incontinence is a frequently reported symptom, but the prevalence during pregnancy varies from 7% to 85%[10]. During puerperium, stress incontinence has been reported in 6% to 73% women[10]. The prevalence of stress incontinence five year after the first delivery has been reported to be 30%[10]. Stress incontinence rarely appears

for the first time after delivery if it was not already present in pregnancy[31, 44, 45].
Urge incontinence during pregnancy has been reported in 12-15% of the nulliparae [10, 45-47]. During puerperium, urge incontinence has been reported in 7% to 10%. The prevalence five years after delivery has been reported to be 15%.
The prevalence of urgency, diurnal frequency, and nocturia increase significantly during pregnancy and seem to be more frequent than urinary incontinence[30, 46]. The prevalence of frequency in late pregnancy is present in up to 95 percent of the women. [10] Urgency is present in 62 percent of the women in early pregnancy[10, 30, 48-51].
The prevalence five years after delivery has been reported to be 18% for the symptom urgency, 24% for diurnal frequency and 2% for nocturia. The prevalence for incomplete bladder emptying has reported to be thirty-two percent in early pregnancy[48].

*Prevalence of defecation symptoms*
The prevalences of fecal incontinence in the pre pregnancy period in nulliaparous women are reported to be between 0 and 1 percent and for flatus incontinence between 0.5 and 8 percent. In the third trimester of pregnancy fecal incontinence for solid and liquid stool is present in up to 3.5 percent of the women and flatus incontinence in up to 8 percent. After severe perineal laceration the rate of anal incontinence rises to 17% to 62%[52-58]. Fecal urgency is present in up to 9 percent of the women.[1, 3, 4, 8, 59, 60]. After childbirth the prevalences for fecal and flatus incontinence in primiparous women vary significantly depending on the definitions used, the study design, the follow-up period and the target population. After childbirth fecal incontinence is present in 1 to 12 percent and flatus incontinence in 5 to 25 percent of the women[1, 2, 4, 5, 59]. The reported prevalence of constipation during pregnancy in a literature review varued between 11-38%[61].

*Prevalence of sexual dysfunction*
Sexual functioning is a type of morbidity about which little has been studied. In the first three months after childbirth 22 to 86% of the women reported sexual problems, mainly perineal pain and dyspareunia[62-64].

*Risk factors for pelvic floor symptoms*
The factors that have been consistently associated with urinary incontinence are vaginal delivery, BMI and maternal age and a third or fourth degree anal sphincter tear with fecal incontinence. When correlating other variables with pelvic floor symptoms no consistent findings have been reported[10, 32, 41, 50, 65-67].
Foldspang et al and Schytt et all have also reported that urinary incontinence (UI) in the third trimester of pregnancy and in the first 2 months after childbirth are important predictors for urinary incontinence 1 year postpartum and may be with urinary incontinence symptoms later in life[68, 69]. Both studies however retrospectively collected data at one year postpartum on the presence of UI during pregnancy and in the first months after delivery.
Vaginal delivery may elicit pelvic floor complaints. An elective cesarean section has

been thought to protect the pelvic floor and the nervus pudendus against injury in several electrophysiological, urodynamic, and epidemiological studies[39, 49, 60, 70, 71]. An increasing number of studies has associated an episiotomy with either temporary or long lasting urinary incontinence[49, 71, 72]. Several studies shave shown the midline procedure in particular is associated with an increased risk of perineal laceration, reduces the pelvic floor strength, offers little protection against anal sphincter rupture[33, 35, 73-75]. The use of forceps has been related to delayed pudendal nerve terminal motor latency, severe perineal laceration, and the risk of anal sphincter rupture[39, 40, 55, 73]. A vacuum extraction may be associated with delayed postnatal pudendal nerve conduction, but seems less traumatic to the pelvic floor than a forceps procedure[70, 73, 75]. An episiotomy or a vacuum extraction at the fist delivery seems to increase the risk of long lasting urinary incontinence[10].
A high fetal weight or a large head circumference may cause partial denervation of the pelvic floor, but although no relationship was found in women with symptoms of urinary incontinence 3 months after delivery[34, 40, 60, 70, 71, 76, 77]. A prolonged stage of second stage labour may increase the pudendal nerve terminal motor latency, and alters the concentric needle electromyography but has only been associated with long lasting urinary incontinence in one study[34, 39, 40, 77].
Controversy exists about the impact of epidural anaesthesia during labour and stress incontinence after delivery[46, 78]. The relationship between type of delivery and sexual problems remained largely inconclusive. In research the focus has been on perineal pain/dyspareunia and mode of delivery. A review on postpartum sexual functioning and method of delivery reported a greater risk for perineal pain among women after assisted vaginal delivery[79 62, 63, 77, 80-82]. The reported associations between caesarean delivery (CD) and perineal pain/dyspareunia, and delay in resumption of sexual intercourse were inconsistent[63, 80-82].
Maternal risk factor for pelvic floor symptoms in fertile women are age, obesity and an increased body mass index[10]. During pregnancy stress incontinence occurred more frequently in obese women[83]. Smoking is the primary risk factor of emphysema and chronic bronchitis, irreversible disease that may increase intra- abdominal pressure[84]. Smoking has an anti-estrogenic effect and may interfere with the synthesis of collagen[84].

*Effect of pelvic floor symptoms on the quality of life*
Twenty-two percent of women with postnatal fecal incontinence reported to be negatively affected on their life style[3]. Dolan et al. reported that urinary incontinence during and after first pregnancy had an negative impact on the quality of life[12]. In non-pregnant young women overactive bladder symptoms are perceived as bothersome. Their HRQoL is at least as negatively affected by overactive bladder symptoms as by true urinary incontinence symptoms[11].

*Prenatal care*
The Dutch perinatal care system is based on risk-selection. Pregnancy and delivery are considered physiological events. Pregnant women are routinely monitored by a

midwife or a general practitioner (GP). Unless pregnancy is because of the medical history of a woman at increased risk, or until complications occur in pregnancy. As a result of this system, the proportion of perinatal care delivered by independent midwives and the proportion of home deliveries are high in The Netherlands as compared to other European countries. In 1993, midwives and GP's provided perinatal care to over 50 of all pregnant women and 32% of all women delivered at home.
In 2000 a total of 182.423 women delivered, 46% (85.417) was nulliparae. Of the nulliparae 26% delivered under the care of the midwife or GP's and 74% were cared for by the obstetrician. Sixteen percent of the nulliparae underwent a caesarean section and 21% percent had a instrumental delivery.

*Aims of the thesis*
At present, insight into the effects of pregnancy on pelvic floor function in nulliparous women is poor. There are several reasons for this oversight. First, most studies that evaluated the effect of pregnancy on the pelvic floor function have focused on incontinence symptoms. Secondly, if a prospective study design was used usually only one measurement in the third trimester was obtained. This has made it impossible to evaluate the contribution of pregnancy on these symptoms. Thirdly, very little is known about the effect of pelvic floor symptoms on the quality of life during and after first pregnancy. In non-pregnant young women overactive bladder symptoms are perceived as at least as bothersome as urinary incontinence symptoms and negatively affect the quality of life. It is known that especially in pregnancy overactive bladder symptoms are highly prevalent, but the effect on the quality of life is unknown. Fourthly, current topics suggest that childbirth influences sexual functioning, but the reported associations between CD and sexual dysfunction are inconsistent.

The aim of this thesis was fourfold:
1. to report on the prevalence of pelvic floor symptoms during and after first pregnancy
2. to investigate the effect of pregnancy and childbirth on pelvic floor symptoms
3. to study the consequence of pelvic floor symptoms on the quality of life during and after first pregnancy
4. to determine what factors influence the sexual function after first childbirth

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*Chapter 2*

# How do the prevalences of urogenital symptoms change during pregnancy?

H.J van Brummen
H.W. Bruinse
J.G. van der Bom
A.P.M. Heintz
C.H. van der Vaart

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## Abstract

**Aims:** The aim of this study was to report the changes in prevalences of urogenital symptoms during pregnancy and to evaluate the amount of bother nulliparous pregnant women experience from these symptoms.
**Methods:** We have used a prospective longitudinal cohort study design. Five-hundred and fifteen nulliparous women with a singleton pregnancy were recruited from ten midwifery practises between January 2002 and July 2003. The women received postal questionnaires. Urogenital symptoms were assessed with the Dutch version of the standardized and validated Urogenital Distress Inventory (UDI). We analyzed our data on item level and on the clustering of items.
**Results:** The prevalences of the frequency and urgency symptoms are high at 12 weeks (74% and 63%) and remain stable during pregnancy. The prevalences of urinary incontinence and voiding difficulties increase with gestational age. Frequency disappears in 12% in late pregnancy, urgency in 22% and stress incontinence in 23%. The prevalence of bothersome frequency symptoms is much higher than of urinary incontinence. (21% compared to 6%) All UDI subscales increase significantly during pregnancy.
**Conclusions:** Urogenital symptoms occur in almost all women during pregnancy. Whereas the prevalence of overactive bladder symptoms is high and remains stable from early pregnancy on, the prevalences of urinary incontinence symptoms increase with gestational age. Despite the high prevalences of symptoms the majority of women report not to be bothered by it.

## INTRODUCTION

Urogenital symptoms are common during pregnancy and the prevalences of the different symptoms increase with gestational age.[1-4] Urogenital symptoms represent disorders in the normal micturition cycle and can be divided into storage, voiding and post-micturition symptoms.[5] The prevalences of urogenital symptoms during pregnancy are high but vary depending on the definitions used, the study design and the target population.[2-4, 6-8]

Urogenital symptoms may be temporary or permanent. The bother these symptoms cause is both related to the severity of the symptom as well as the individual perception of it as a problem.[9] Urogenital symptoms are reported to be bothersome outside of pregnancy.[10] In research the attention has been mainly focused on the prevalences and the potential risk factors of urogenital symptoms during pregnancy. Although the prevalence during pregnancy is high, it is unknown if urogenital symptoms are perceived as bothersome by the women.

Therefore, the aim of this study was to report the changes in prevalence of urogenital symptoms during pregnancy and to evaluate the amount of bother nulliparous pregnant women experience from these symptoms.

## Material and Methods

*Study population*

We performed a prospective cohort study to examine the effect of pregnancy on urogenital symptoms. Between January 2002 and July 2003 1366 nulliparous pregnant women were recruited from eight midwifery practices in the Netherlands. Included were nulliparous women with a singleton and low-risk pregnancy between 12 and 18 weeks gestation. The women had to have a good knowledge of the Dutch language. Exclusion criteria were women with previous urogenital surgery, diabetes mellitus or neurological disorders. The midwives gave all consecutive nulliparous pregnant women information about the study and after one week eligible women were asked to participate in the study. Figure 1 shows the number of women that were included and excluded in the study. One hundred and twenty-two women were not eligible; three women had a twin pregnancy, 13 women had a miscarriage and 106 women did not have enough knowledge of the Dutch language. Twelve hundred and forty-four women met the inclusion criteria. Six hundred and seventy-three women (54%) participated in the study. The other 46 percent did not want to participate due to different reasons, such as time investment and the intimate nature of the questions. Since we were interested in the occurrence of symptoms at 12 and 36 weeks gestation, seventy-six (11,3%) women who delivered prematurely were excluded for the present analysis. Of the 597 participants at 12 weeks gestation 515 (86,3%) women returned and completed the two questionnaires. The Medical Ethics Committee of the University Medical Center Utrecht approved the study. All participants signed an informed consent.

*Measurements*

The women were asked to complete a self-report questionnaire at 12, 24 and 36 weeks gestation, and 3 and 12 months after delivery. For the purpose of this study we have used the questionnaires from 12 and 36 weeks gestation. The questionnaire consisted of the following items. Urogenital symptoms were assessed with the Dutch translation of the Urogenital Distress Inventory (UDI).[11, 12] The UDI is a standardized validated questionnaire. This questionnaire consists of 19 questions about urogenital symptoms and the experienced discomfort of these symptoms. Each item measures if a urogenital symptom is present and the amount of bother a woman experiences from that symptom. The amount of bother is measured on a 4-point Likert scale ranging from not at all, slightly, moderately and greatly bother. Bothersome urogenital symptoms were defined as reporting moderate or great bother from the symptom. A urogenital symptom was regarded as not bothersome if it was absent or present with none or only slight degree of self-reported bother.

Following the recommendation of the International Continence Society (ICS), and in concordance with other studies[5, 10, 13], we selected the following questions from the UDI for the storage symptoms: a woman was considered to have 'urgency' if she replied positively to the question "do you experience a strong feeling of urgency to empty your bladder?"; a woman was considered to have 'frequency' if she replied pos-

itively to the question "do you experience frequent urination?" ; a woman was considered to have 'stress incontinence' symptoms if she replied positively to the question "do you experience urinary leakage related to physical activity, coughing or sneezing?" and a woman was considered to have 'urge incontinence' if she replied positively to the question "do you experience urine leakage related to the feeling of urgency?". For the voiding symptoms we selected the following question: a woman was considered to have 'difficulty emptying' her bladder if she replied positively to the question "do you experience difficulty emptying your bladder?". For post-micturition symptoms we selected the following question; a woman was consider to have 'a feeling of incomplete bladder emptying' if she replied positively to the question "do you experience a feeling of incomplete bladder emptying?".
From the UDI the following two questions were selected for 'genital prolapse' symptoms. The first question was: "Have you seen a bulging or protrusion in the vaginal area?" The second question was: "Have you felt a bulging or protrusion in the vaginal area?" If a woman replied positively to one of the questions she was considered to have a genital prolapse. The following two question were selected for 'pelvic discomfort': "Do you experience a heaviness or dullness in the pelvic area?" and "Do you experience pain or discomfort in the lower abdomen?". The individual items from the UDI are also clustered in 5 subscales according to the Dutch version.[12] Five subscales from the UDI have been identified i.e. urinary incontinence, overactive bladder, obstructive micturition, discomfort/pain and genital prolapse. Each subscale has a range of 0 (no symptom) to 100 (all symptoms present with the highest degree of bother). This allowed us to analyze our data in two ways. First we analyzed our data on item level, secondly on the clustering of items.

*Statistics*
The statistical analysis was done in SPSS 10.0 for Windows. Except for mean values with standard deviation (SD), results were expressed as frequencies (percentage). To compare the changes in prevalences we have used a Students t-test for interval variables and Chi square test for categorical variables. A p-values $< 0.05$ was considered to be statistical significant.

## RESULTS

The mean age was 30,4 years (Standard Deviation (SD) 3,9, range 20-40) and the mean BMI was 23,7 (SD 3,9). At 12 weeks gestation 471 (91,5%) women experienced one or more urogenital symptoms and at 36 weeks 497 (96,5%) women. The mean number of symptoms was 3 (SD 1,7) at 12 weeks and 4 (SD 1,9) at 36 weeks gestation.

In table 1 the prevalence of urogenital symptoms according to gestational age are shown. Prevalences of frequency and urgency symptoms are high at 12 weeks gestation (74% and 63%) and remained stable during pregnancy. The prevalences of true urinary incontinence symptoms, voiding difficulties and pelvic discomfort increase with gestational age.

We looked at the onset of symptoms during pregnancy. Four hundred and nineteen women had the frequency symptom at 36 weeks gestation. Of these women 335 (85%) also had these symptoms at 12 weeks gestation. Eighty-four women develop the frequency symptoms during pregnancy. Stress incontinence is present in 217 women at 36 weeks gestation. In 143 of the 217 women (66%) this symptom was not present at 12 weeks gestation. In 80 of the 99 women (81%) who experience urge incontinence at 36 weeks gestation this symptom was not present at 12 weeks gestation. We also see that 234 of the 301 women (78%) who experience heaviness in the pelvic area developed this at 36 weeks gestation. The frequency symptom disappears in 12 percent (47/382), the urgency symptoms in 22 percent (80/323), the stress incontinence symptom in 23 percent (22/96), and the pelvic discomfort symptom in 20 percent (57/288).

Table 2 shows bothersome urogenital symptoms in relation to gestational age among 515 nulliparous pregnant women. The prevalence of bothersome frequency and urgency is much higher than that of bothersome urinary incontinence symptoms. To report how many women who experienced a symptom were bothered by it, we performed a second analysis. Among 419 women who reported that they had the frequency symptom at 36 weeks gestation 108 (25,8%) women were bothered by the symptom, for urgency 64 of the 351 (18,2%) women were bothered by the symptom, for urge incontinence 15 of the 99 (15,2%) were bothered the symptom and 29 of the 217 (13,4%) women who experiences stress incontinence are bothered by it.

Table 3 shows the mean scores on the five UDI subscales. During pregnancy, all UDI subscales scores increase significantly. Nevertheless, the scores on the urinary incontinence, obstructive micturition and genital prolapse are low, indicating little bother.

## Discussion

Urogenital symptoms occurred in almost all women during pregnancy. Whereas the prevalence of overactive bladder symptoms was high and stable from 12 weeks gestation on, the prevalence of true incontinence symptoms increased with gestational age. Despite the high prevalence of symptoms the majority of women reported not to be bothered by it. Remarkably, the prevalence of frequency and urgency symptoms was very high and was more often regarded as bothersome as compared to urinary incontinence symptoms. This was demonstrated an item level and also with the scores on the UDI subscales.

The strength of our study is that we have used a prospective longitudinal cohort study design and that we assessed urogenital symptoms with a standardized, validated questionnaire.[11, 12] In addition, we investigated urogenital symptoms during pregnancy in relation to the amount of bother women experience from these symptoms. There are also some limitations we need to address. First, the high prevalence of micturition symptoms recorded with the UDI may be the result of selection bias. Forty-six percent of the women who met the inclusion criteria did not want to participate in the study. The most common reasons were time investment and the intimate nature of the questions. We tried to avoid this bias as much as possible by emphasizing the importance of the woman's cooperation, regardless the presence of symptoms, in our study introduction letter, by the midwives and by the investigator. We were aware that there can also be other possible pregnancy related confounding factors, such as an urinary tract infection(UTI) or gestational diabetes, that could explain the high prevalence of urogenital symptoms. None of the women had an UTI when completing the questionnaire. Nine women develop a gestational diabetes but only dietary measurements were required. None of the nine women was insulin-dependent. Of these 9 women only 1 had frequency and urgency symptoms. These symptoms were present before the gestational diabetes occurred. Therefore, we feel that in our study these were not confounding factors. In other studies, the prevalence of frequency in late pregnancy is present in up to 95 percent of the women.[4] Urgency is present in 62 percent of the women in early pregnancy.[2-4, 6-8] Urinary incontinence in nulliparous women is present in up to 67 percent of the women.[2-4, 7] The prevalence for incomplete bladder emptying has reported to be thirty-two percent in early pregnancy.[6] Our findings are in concordance with these studies and therefore we feel that it is unlikely that there is significant selection bias.

Secondly, we did not measure the prevalence of urogenital symptoms before pregnancy. Due to our study design it would have been very difficult to recruit without significant selection bias 515 nulliparous women. The nulliparous pelvis probably represents the best available clinical model of normal function. Despite their presumed normality, there is a significant incidence of urogenital symptoms in nulliparae. Therefore it is difficult to describe the changes in symptoms that pregnancy is responsible for. The reported prevalences of urogenital symptoms in nulliparous non-pregnant women are 4 percent for the stress incontinence symptoms, 2 to 15 percent for urge incontinence and 8 percent for the genital prolapse symptom. [4, 14-17] The

prevalences we found in pregnancy are much higher than the prevalences in the pre pregnancy period. Therefore, we feel that pregnancy itself is an important factor for these changes.

Thirdly, urogenital symptoms were not confirmed with objective measures, such as urodynamics or pad-test. These objective measures are known to correlate moderately with the reported symptoms.[18, 19] Urinary symptoms are common in early pregnancy but in most women they are not associated with abnormal urodynamic findings.[20] We used a symptom-based definition of urogenital symptoms, based on the recommendations of the ICS.[5, 10, 21] Our results have to be viewed from this symptom-based point of view.

Genital prolapse grade 1 to 4 are reported to be 46 percent in late pregnancy.[8] Twenty-six percent of the women had a grade 2 prolapse or more according to the POP-Q scoring system. About half of all nulliparous pregnant women had a stage 2 genital prolapse according to the POP-Q in second or third trimester compared to 0 percent in an earlier study among nulliparous non-pregnant women.[22] We have used a symptom-based assessment as opposed to a gynaecologic examination in these two studies. Therefore, our study cannot be compared with these studies.

Fourthly, another factor that may have altered how bothered by urogenital symptoms these pregnant women are would be how much education about urogenital symptoms in pregnancy is given by their midwives. Since the majority of women were already experiencing symptoms by the 12 week, they may have brought it up to their midwife and have been reassured that this is normal and likely to resolve. This education may alter their perception of these symptoms and alter the response to the questionnaires. Education as part of routine obstetrical care is an unpredictable and unavoidable factor.

We were the first study to investigate the amount of bother women experience from urogenital symptoms. It is known that these symptoms are reported to be bothersome outside of pregnancy. Especially frequency and urgency are reported to be bothersome. Also during pregnancy these symptoms are the most bothersome. Symptoms become more bothersome with increasing gestational age. Outside of pregnancy incontinence symptoms are reported to be bothersome by women between 40 and 60 years of age. [Moller et al 2000] This is in contrast with our findings during pregnancy. In a study in younger women outside of pregnancy also frequency and urgency were reported to be bothersome. [van der Vaart et al 2002]

## Conclusions

Urogenital symptoms occur in almost all women during pregnancy. Whereas the prevalence of frequency and urgency symptoms is high and stable from 12 weeks gestation on, the prevalence of urinary incontinence symptoms increases with gestational age. Despite the high prevalence of symptoms the majority of women report not to be bothered by it.

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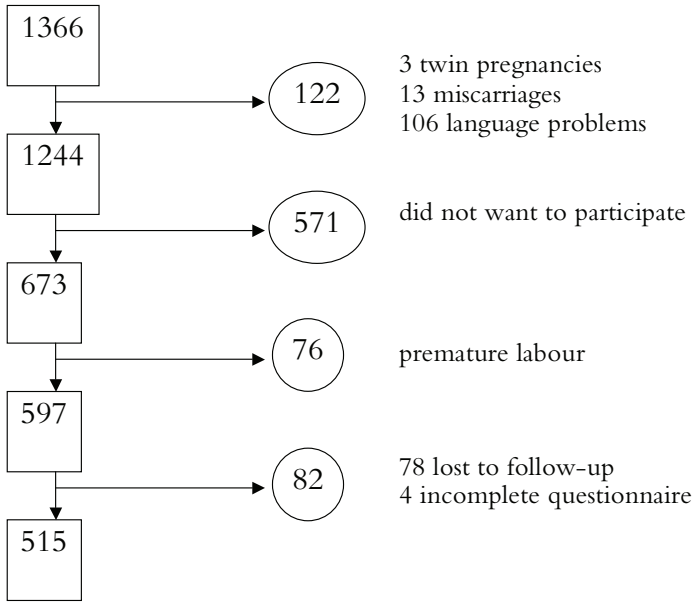


**Figure 1 The number of women in- and excluded from this present analysis**

The number of women excluded from the analysis and the reason why these women were excluded. Five hundred and fifteen women were included in the study. The values are numbers.

**Table 1 Prevalence of urogenital symptoms in relation to gestational age among 515 nulliparous pregnant women**

| | at 12 weeks gestation | at 36 weeks gestation |
|---|---|---|
| **frequency** | 382 (74.2%) | 419 (81.4%) |
| **urgency** | 323 (62.8%) | 351 (68.2%) |
| **urge incontinence** | 33 (6.4%) | 99 (19.2%) |
| **stress incontinence** | 96 (18.6%) | 217 (42.1%) |
| **difficulty emptying the bladder** | 72 (14.0%) | 138 (26.8%) |
| **incomplete bladder emptying** | 168 (32.6%) | 238 (46.2%) |
| **feeling prolapse** | 56 (10.9%) | 74 (14.4%) |
| **seeing prolapse** | 17 (3.3%) | 35 (6.8%) |
| **heaviness in pelvic area** | 86 (16.7%) | 301 (58.4%) |
| **pain or discomfort in lower abdomen** | 288 (55.9%) | 365 (70.9%) |

The values are numbers (percentages)

**Table 2 Bothersome urogenital symptoms in relation to gestational age among 515 nulliparous pregnant women**

| | at 12 weeks gestation N=515 | at 36 weeks gestation N=515 |
|---|---|---|
| **bothersome frequency** | 70 (13.6) | 108 (21.0) |
| **bothersome urgency** | 69 (13.4) | 64 (12.4) |
| **bothersome urge incontinence** | 2 (0.2) | 15 (2.9) |
| **bothersome stress incontinence** | 12 (2.3) | 29 (5.6) |
| **bothersome difficulty emptying the bladder** | 8 (1.6) | 28 (5.4) |
| **bothersome incomplete bladder emptying** | 12 (2.3) | 25 (4.9) |
| **bothersome feeling prolapse** | 5 (1.0) | 14 (2.7) |
| **bothersome seeing prolapse** | 3 (0.6) | 7 (1.4) |
| **bothersome heaviness or dullness in pelvic area** | 21 (4.1) | 50 (9.7) |
| **bothersome pain or discomfort in lower abdomen** | 10 (1.9) | 67 (13.0) |

The values are numbers (percentages)

**Table 3 Urogenital symptoms assessed with the UDI subscales according to gestational age**

| UDI subscales | at 12 weeks gestation | at 36 weeks gestation | p-values |
|---|---|---|---|
| overactive bladder | 22.1 (22.9) | 26.0 (23.5) | < 0.01 |
| urinary incontinence | 4.2 (10.8) | 10.7 (17.0) | < 0.01 |
| obstructive micturition | 6.3 (12.9) | 11.2 (18.3) | < 0.01 |
| discomfort | 10.8 (13.6) | 22.9 (29.3) | < 0.01 |
| genital prolapse | 2.1 (7.9) | 3.8 (11.7) | < 0.01 |

The values are means (SD)
Student's t test, $p < 0.05$ is statistical significant

*Chapter 3*

# The effect of vaginal and cesarean delivery on Lower Urinary Tract Symptoms: what makes the difference?

H.J. van Brummen
H.W. Bruinse
G. van de Pol
A.P.M. Heintz
C.H. van der Vaart

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## Abstract

**Aims:** A prospective cohort study was undertaken to evaluate the effect of pregnancy and childbirth in nulliparous pregnant women. The focus of this paper is on the difference in the prevalences and risk factors for LUTS between woman who delivered vaginally or by cesarean and secondly the effect of LUTS on the quality of life between these two groups was analyzed.
**Methods:** Included were 344 nulliparous pregnant women who completed four questionnaires with the Urogenital Distress Inventory and the Incontinence Impact Questionnaire. Two groups were formed: vaginal delivery group (VD), which included spontaneous vaginal delivery and an instrumental vaginal delivery, and cesarean delivery group (CD).
**Results:** No statistical significant differences were found in the prevalences of LUTS during pregnancy between the two groups. Three months after childbirth urgency and UUI are less prevalent in the CD group, but no statistical difference was found one year postpartum. Stress incontinence was significant more prevalent in the VD group at 3 and 12 months postpartum. The presence of SUI in early pregnancy is predictive for SUI both in the VD as in CD group. Woman who underwent a CD and had SUI in early pregnancy had an 18 times higher risk of having SUI in year postpartum. Women were more embarrassed by urinary frequency after a VD. After a CD, 9% experienced urge urinary incontinence. Urge incontinence affected the emotional functioning more after a caesarean, but the domain scores on the IIQ were low, indicating a minor restriction in lifestyle.
**Conclusions:** After childbirth SUI was significantly more prevalent in the group who delivered vaginally. Besides a vaginal delivery, we found both in the VD and in the CD group that the presence of SUI in early pregnancy increased the risk for SUI one year after childbirth. Further research is necessary to evaluate the effect of SUI in early pregnancy on SUI later in life. Women were more embarrassed by urinary frequency after a vaginal delivery. UUI after a CD compared to a vaginal birth limited the women more emotionally; no difference was found for the effect of SUI on the quality of life between the two groups.

## INTRODUCTION

Lower urinary tract symptoms (LUTS) are common during and after first pregnancy[1-6]. The effect of childbirth has been studied extensively. Rortveit et al[7] studied over 15,000 women and found an association between urinary incontinence and the mode of delivery (EPICONT study). SUI was found to be more prevalent after a cesarean delivery (CD) compared to nulliparous women and more prevalent after a vaginal delivery compared to a CD. No statistical differences were found for UUI or mixed incontinence.

The results of epidemiologic and pathophysiological studies assessing the relation between mode of delivery and urinary incontinence remain inconclusive[7-10]. The difference in methods, follow-up periods and number of participants may account for the inconsistency. The focus in research is on the effect of childbirth and the mode of delivery, not on the effect of pregnancy itself.

Assessment of LUTS and the effect of LUTS on the quality of life has been facilitated by the development of disease specific questionnaire like the Urogenital Distress Inventory (UDI) and Incontinence Impact Questionnaire [11, 12]. The application of these instruments enables an objective measurement of the prevalence and the impact of LUTS on a woman's daily lifestyle.

The aim of this study was two-folded. First, the focus of this paper is on the difference in the prevalences and risk factors for LUTS between woman who delivered vaginally or by cesarean and secondly the effect of LUTS on the quality of life between these two groups were analyzed.

## Material and Methods

*Study population*

A prospective cohort study was undertaken to investigate the impact of a first pregnancy and delivery on pelvic floor function. Between January 2002 and July 2003 one thousand and sixty candidates were recruited from ten midwifery practices in the Netherlands. Eligible women were nulliparous with a low-risk singleton pregnancy between 12 and 18 weeks gestation with a good knowledge of the Dutch language. Exclusion criteria were previous urogynaecological surgery, urogynaecological malformations, diabetes mellitus and neurological disorders. The participating midwives gave all consecutive nulliparous pregnant women verbal and written information about the study. After one week these women were asked by phone whether they were willing to participate.

The Medical Ethics Committee of the University Medical Centre Utrecht approved the study. All participants signed an informed consent.

*Measurements*

Women were asked to complete a self-report questionnaire at 12-18 and 36 weeks gestation, and 3 and 12 months after delivery. Urogenital symptoms were assessed with the Urogenital Distress Inventory (UDI).[11, 12] The UDI is a validated, standardized questionnaire and is translated into Dutch. Each item measures if a urogenital symptom is present. We followed the recommendation of the International Continence Society (ICS)[13]. We selected the following symptoms from the UDI: frequency, urgency, urge urinary incontinence (UUI) and stress urinary incontinence (SUI). The questions are shown in appendix A. Disease specific quality of life scores for pelvic floor symptoms were obtained from the Incontinence Impact Questionnaire (IIQ)[11, 12]. In the introduction of the IIQ it was stated that only women who experienced one or more pelvic floor symptom had to answer the IIQ. The validity of the Dutch version of this questionnaire was assessed and published before[12]. The impact of pelvic floor symptoms were measured on five domains; emotional functioning (Emot), physical functioning (Phys), social functioning (Soc), mobility (Mob) and embarrassment (Emb). The scores on the domains range from 0 to 100. A high score indicates that a person's well-being on that particular domain is negatively affected.

Two research groups were formed: vaginal delivery group (VD), which included spontaneous vaginal delivery and an instrumental vaginal delivery, and cesarean delivery group (CD). Body mass index (BMI) was calculated for all women ($kg/m^2$) at inclusion and at 12 months postpartum.

In the Netherlands the midwife is responsible for providing obstetrical care of healthy low risk pregnant women. If pregnancy-related problems appear, the obstetrician/gynecologists is consulted. Deliveries performed by midwives and gynecologists are registered in the Dutch National Obstetric Database (LVR). Obstetrical data of the participants were abstracted from this database.

*Statistics*

Values are presented as numbers (percentage) or mean (standard error (SE)). In univariate analysis, the Chi-square test and the fisher exact test were used to assess the significance of the associations for categorical variables and Students t-test for continuous variables. Because in table 4 the values were not normally distributed and the numbers were small (<n=30), the Mann-Whitney test was performed. Where appropriate odds ratios (OR) with 95% confidence intervals (CI) were calculated. Multivariate analysis was used to calculate adjusted odds ratios [95%CI] for factors that were significantly associated in the univariate analysis Data was analyzed using SPSS 11.5. A p-values $< 0.05$ was considered to be statistical significant.

## RESULTS

One hundred and six women were not eligible. Twelve women had a miscarriage, 2 a twin pregnancy and in 92 patients a language problem existed. Five hundred and twenty-four women agreed to participate in the study. The main reasons women refused to participate were time investment and the intimate nature of the questions. Fifty (9.5%) women were pregnant again when completing the fourth questionnaire and were excluded from this analysis. In this analysis 344 (72.6%) women, who returned all four questionnaires, were included. Non-respondents were compared with respondents, no statistical significant differences were found in age and obstetrical data.

Table 1 shows the characteristics of the two groups. None of the women were breastfeeding one year postpartum. Women who delivered by a cesarean were older (31.1-30.0 years, p= 0.017) and had a higher BMI at inclusion (26.3 -23.5 kg/m$^2$, p=0.001).

The point prevalences of LUTS according to mode of delivery with a follow-up of 12 months after childbirth are shown in table 2. No statistical significant differences were found between a vaginal delivery and a cesarean delivery in the prevalences of LUTS during pregnancy. Three months after childbirth urgency and UUI were less prevalent in the CD group, but no statistical difference was found one year postpartum. The prevalence of SUI increased from 8% at 3 months postpartum to 22% after one year in the CD group. SUI was significant more prevalent in the VD group at 3 and 12 months postpartum.

To analyze whether other factors influenced on the prevalence of LUTS one year postpartum, we performed an univariate analysis. Risk factors analyzed were: maternal age, BMI, presence of symptoms at 12 weeks gestation, physical exercising, smoking, alcohol use, weight gain in pregnancy, gestational age at delivery, duration of second stage of labour, infant birth weight, fetal presentation at delivery, and perineal state (no rupture, 1$^{st}$ or 2$^{nd}$ degree, 3$^{rd}$ or 4$^{th}$ degree, and episiotomy). In table 3, the statistical significant associations between these variables and LUTS one year after childbirth in the two groups are shown. The presence of SUI in early pregnancy was found to be predictive for SUI both in the VD as in CD group. Women with SUI in early pregnancy had a 5 times higher risk for SUI one year postpartum. Women in the CD group with SUI in early pregnancy had an 18 times higher risk for SUI in year postpartum.

Table 4 shows the effect of LUTS one year postpartum on the quality of life assessed with the IIQ according to the mode of delivery. Differences on the quality of life between the VD and the CD group were analyzed. Almost 26% of the women experienced frequency one year after a vaginal delivery and 15% after a CD. After a vaginal delivery, women with urinary frequency scored worse on the IIQ embarrassment subscale compared to women in the CD group. After a CD, 9% experienced urge urinary incontinence. In these women UUI had a negative effect on emotional functioning. The domain scores on the IIQ were low, indicating a minor restriction in lifestyle.

## Discussion

This study evaluated the impact of the first pregnancy and childbirth on the lower urinary tract function. By following the women from early pregnancy until one year postpartum, it was possible to analyze the effect of pregnancy on the prevalence of LUTS. Childbirth has been identified as a potential risk factor for the development of LUTS postpartum[1, 2, 10, 14–18]. We have analyzed the differences in the prevalences and risk factors for LUTS between women who delivered vaginally or by cesarean. In pregnancy, there were no statistical significant differences in the prevalences of LUTS between the group of women who delivered vaginally and the women who delivered by a cesarean. However, after childbirth SUI was significantly more prevalent in the VD group. In the VD as well as in the CD group the presence of SUI in early pregnancy gave an increased risk for SUI one year postpartum. We, therefore, think that further research is necessary to evaluate the effect of symptoms in early pregnancy on SUI later in life. UUI after a CD compared to a vaginal birth limited the women more emotionally; no difference was found for the effect of SUI on the quality of life between the two groups.

LUTS were already present in early pregnancy, and the prevalence increased with gestational age. After childbirth the prevalence of frequency and urgency declined rapidly, indicating that these symptoms are part of normal pregnancy. Possibly, the combination of pressure effects of the gravid uterus, altered urine production and a change in bladder capacity leads to an increase of the prevalence of frequency and urgency during gestation[17, 19-21]. Our study results are in agreement with previous reports on the prevalence of LUTS both antenatally and postnatally[1-3, 14, 16, 22].

This is the first study to evaluate the differences in the prevalences, risk factors and quality of life after a VD and a CD. One year after childbirth SUI was more prevalent in women who delivered vaginally. Vaginal delivery has been associated with urinary incontinence[1, 2, 10, 14-18]. Besides vaginal delivery, we also found this association between a higher BMI and SUI one year postpartum in the VD group. When correlating other variables with LUTS no consistent findings have been reported[1, 2, 10, 14-17]. Besides vaginal birth, SUI in early pregnancy was found to be predictive for the occurrence of SUI one year after delivery. This may imply that the changes occurring in lower urinary tract function during pregnancy are also of importance in developing LUTS postpartum. Foldspang et al and Schytt et all have also reported that UI in the third trimester of pregnancy and in the first 2 months after childbirth are important predictors for urinary incontinence 1 year postpartum [23, 24]. Both studies, however, retrospectively collected data at one year postpartum on the presence of UI during pregnancy and in the first months after delivery. Our participants were prospectively followed from 12 weeks gestation till one year after postpartum. Because of our study design recall bias is not likely to be a problem whereas with a retrospective design recall bias can be a major problem.

Few studies have been conducted to evaluate the impact of urinary incontinence on the health-related quality of life in women in the third trimester and three months postpartum[25]. One study was conducted to investigate the effect of urinary inconti-

nence on quality of life during and after first pregnancy by using the King's Health Questionnaire (KHQ)[25]. The domain scores on the KHQ were low, suggesting minimal restriction in lifestyle[25]. Due to the different aims of studies and different questionnaires used, we cannot compare our data with this study. But the domain scores on the IIQ in our study were low also, indicating a minor restriction in lifestyle. In this present study, the effect of LUTS on the quality of life was analyzed between women who delivered vaginally or by cesarean. May be, women have different expectations after a vaginal delivery than after a cesarean delivery. In addition, many women believe that urinary incontinence is a normal consequence of a vaginal delivery, thereby denying themselves treatment[26, 27]. Embarrassment and shame may play an important role in underreporting[28]. It is known that in adult women urinary incontinence can cause an impaired quality of life[29, 30]. Although UUI was found to be less prevalent after a cesarean, women felt emotionally more limitations than women who delivered vaginally. Urinary frequency after a VD affected the quality of life on the embarrassment subscale more negatively than after a CD. No data are available to compare our data.

The strength of this study is firstly its design: a prospective longitudinal cohort study with a follow-up period of one year after childbirth. Prospectively collected measurements of LUTS during pregnancy and the postpartum period provide better-validated data on the contribution of pregnancy and delivery on these symptoms. We could evaluate the effect of the mode of delivery on the prevalences of LUTS and add the presence of symptoms in early pregnancy as an independent risk factor. Secondly, LUTS were assessed with a standardized and validated questionnaire [11, 12]. In other studies the definitions and recommendations of the ICS were followed but not all studies used a standardized and validated questionnaire[1-3,14, 16, 22]. With the use of anonymous questionnaires we tried to avoid embarrassment and/or shame.

However, there are also some limitations in this study we need to address. First, the high prevalence of micturition symptoms recorded with the UDI may be the result of selection bias. Forty-six percent of the women who met the inclusion criteria refused to participate in the study. The most common reasons were time investment and the intimate nature of the questions. When we compared the obstetrical data of our study group it matched with the overall data of comparable pregnancies abstracted from the Dutch National Obstetrical Datasbase (LVR). The incidences of SVD, IVD and CD were equal. This made a selection bias not very likely.

Secondly, we used a symptom-based questionnaire, based on the recommendations and definitions of the ICS[13, 29, 30]. LUTS were not confirmed with objective measures, such as urodynamics or pad-test. The aim of this study was not to measure urinary leakage in an objective way, but rather to investigate the women's own experiences. These objective measures are known to correlate moderately with reported symptoms[31, 32 21]. The highest rates of symptoms were reported by questionnaires[33, 34] and the lowest by interview[35, 36] and objective measurements[37] . Other factors can influence LUTS during pregnancy as well such as a urinary tract infection (UTI) or gestational diabetes. In our study, none of the women had an UTI when completing any of the questionnaires. Nine women developed gestational diabetes but required only

dietary measurements. Of these 9 women only 1 had frequency and urgency symptoms and symptoms were already present before the gestational diabetes was diagnosed.

Thirdly, we did not measure the prevalence of urogenital symptoms before pregnancy. Due to our study design it would have been very difficult to recruit without significant selection bias 515 nulliparous women. The nulliparous pelvis probably represents the best available clinical model of normal function. Despite their presumed normality, there is a significant incidence of urogenital symptoms in nulliparae. Therefore, it is difficult to describe the changes in symptoms that pregnancy is responsible for. The reported prevalences of urogenital symptoms in nulliparous non-pregnant women are 4 percent for the stress incontinence symptoms, 2 to 15 percent for urge incontinence and 8 percent for the genital prolapse symptom[1, 14, 16, 18, 22]. The prevalences we found in pregnancy are much higher than the prevalences in the pre pregnancy period. Therefore, we feel that pregnancy itself is an important factor for these changes.

Another limitation is the significant differences between the two groups in BMI and age. Although women had a higher BMI in the CD group, we also found that in the VD group women with higher BMI were more at risk for SUI one year postpartum.

In conclusion, after childbirth SUI was significantly more prevalent in the group who delivered vaginally. Besides a vaginal delivery, we found both in the VD and in the CD group that the presence of SUI in early pregnancy increased the risk for SUI one year after childbirth. Further research is necessary to evaluate the effect of SUI in early pregnancy on SUI later in life. Women were more embarrassed by urinary frequency after a vaginal delivery. UUI after a CD compared to a vaginal birth limited the women more emotionally; no difference was found for the effect of SUI on the quality of life between the two groups.

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**Table 1 Characteristics of the study population**

| | | VD group | | CD group | | p-value |
|---|---|---|---|---|---|---|
| **Mode of delivery** | | | | | | |
| *Vaginal delivery (VD)* | | | | | | |
| | *spontaneous* | 223 | 64.8% | | | |
| | *instrumental* | 64 | 18.6% | | | |
| *Caesarean Delivery (CD)* | | | | 57 | 16.6% | |
| | *elective* | | | 24 | 7.0% | |
| | *emergency* | | | 33 | 9.6% | |
| | | mean | (SE) | mean | (SE) | |
| **Age at delivery** (years) | | 30.0 | (0.23) | 31.3 | (0.49) | 0.017 |
| **BMI at inclusion** (kg/m$^2$) | | 23.5 | (0.24) | 26.3 | (0.78) | 0.001 |
| **Neonatal data** | | | | | | |
| *gestation (days)* | | 280.5 | (0.65) | 277.1 | (1.74) | 0.066 |
| *birth weight (grams)* | | 3491 | (30.8) | 3577 | (82.7) | 0.272 |
| | | N=287 | % | N=57 | % | |
| **Marital state** | | | | | | |
| *married or cohabiting* | | 284 | 98.9% | 55 | 96.4% | 0.132 |
| *single or divorced* | | 3 | 1.1% | 2 | 3.7% | |
| **Educational level** | | | | | | |
| *primary* | | 12 | 3.2% | 4 | 7.0% | |
| *secondary or more* | | 275 | 96.8% | 53 | 93.0% | 0.379 |
| **Smoking one year postpartum** | | | | | | |
| *yes* | | 31 | 10.9% | 7 | 12.3% | 0.609 |
| *no* | | 256 | 89.1% | 50 | 87.7% | |
| **Perineal state after vaginal delivery** | | | | | | |
| *Intact* | | 44 | 15.3% | | | |
| *1st - 2nd degree tear* | | 89 | 31.0% | | | |
| *3rd - 4th degree tear* | | 16 | 5.6% | | | |
| *episiotomy* | | 138 | 48.1% | | | |

**Table 2 The prevalences of Lower Urinary Tract Symptoms in 344 women according to the mode of delivery**

| | VD N=287 % | CD N=57 % | p-value★ |
|---|---|---|---|
| **Frequency** | | | |
| *at 12-18 weeks gestation* | 72.4 | 69.6 | 0.721 |
| *at 36 weeks gestation* | 79.8 | 82.6 | 0.834 |
| *at 3 months pp* | 14.2 | 7.5 | 0.316 |
| *at 12 months pp* | 25.6 | 15.2 | 0.183 |
| **Urgency** | | | |
| *at 12-18 weeks gestation* | 60.5 | 52.2 | 0.326 |
| *at 36 weeks gestation* | 68.0 | 65.2 | 0.732 |
| *at 3 months pp* | 45.0 | 25.0 | **0.023** |
| *at 12 months pp* | 43.2 | 32.6 | 0.194 |
| **Urge Incontinence** | | | |
| *at 12-18 weeks gestation* | 5.3 | 8.7 | 0.320 |
| *at 36 weeks gestation* | 19.7 | 19.6 | 1,000 |
| *at 3 months pp* | 17.4 | 5.0 | **0.055** |
| *at 12 months pp* | 17.6 | 8.7 | 0.186 |
| **Stress Incontinence** | | | |
| *at 12-18 weeks gestation* | 18.9 | 23.9 | 0.422 |
| *at 36 weeks gestation* | 43.9 | 58.7 | 0.075 |
| *at 3 months pp* | 33.9 | 7.5 | **0.001** |
| *at 12 months pp* | 40.5 | 21.7 | **0.019** |

Chi-square test was performed to analyze statistical significant differences between the various modes of delivery and the prevalence of LUTS

p-value < 0.05 was considered statistical significant

VD = vaginal delivery

CD = cesarean delivery

★VD compared to CD

**Table 3 Risk factors for LUTS one year postpartum according to the mode of delivery**

| | **after VD** | | test | adjusted OR [95%CI] | **after CD** | OR [95%CI] | test |
|---|---|---|---|---|---|---|---|
| **Frequency** | frequency in early pregnancy | 4.1 [1.6-10.1] | *f* | | no factor found | | |
| **Urgency** | urgency in early pregnancy | 3.3 [1.8-6.0] | *f* | 3.4 [1.7-6.5] | no factor found | | |
| | BMI (kg/m$^2$) | 24.7 vs 23.1, p = 0.003 | *t* | 0.9 [0.9-1.0] | | | |
| | infant birth weight (grams) | 3418 vs 3549, p = 0.036 | *t* | 0.9 [0.98-0.99] | | | |
| | second stage of labour (minutes) | 52.4 vs 66.7, p = 0.014 | *t* | 1.1 [1.0-1.2] | | | |
| **Urge incontinence** | no factor found | | | | UUI in early pregnancy | 20.0 [1.8-22.0] | *f* |
| **Stress incontinence** | SUI in early pregnancy | 5.3 [2.5-11.0] | *f* | 5.5 [2.6-11.6] | SUI in early pregnancy | 18.7 [3.4-10.3] | *f* |
| | BMI (kg/m$^2$) | 24.5 vs 23.1, p = 0.016 | *t* | 1.1 [1.0-1.1] | | | |

OR's were calculated when a Fisher exact test was performed
When a Student's t-test was performed means with a p-vaue is presented
only significant factors are shown
*f* = a fisher exact test was performed
*t* = Student's t-test was performed

**Table 4 Lower urinary tract symptoms and the differences in quality of life according to the mode of delivery**

| | | VD | CD | p-value |
|---|---|---|---|---|
| **Frequency** | | 25.6% | 15.2% | |
| | *mobility* | 8.8 | 7.9 | 0.869 |
| | *physical functioning* | 1.2 | 0.0 | 0.527 |
| | *social functioning* | 0.0 | 0.0 | 1,000 |
| | *emotional functioning* | 5.5 | 1.6 | 0.081 |
| | *embarassment* | 9.9 | 2.4 | **0.031** |
| **Urgency** | | 43.2% | 32.6% | |
| | *mobility* | 5.9 | 6.3 | 0.885 |
| | *physical functioning* | 1.4 | 2.4 | 0.519 |
| | *social functioning* | 0.8 | 0.0 | 0.571 |
| | *emotional functioning* | 3.7 | 4.8 | 0.700 |
| | *embarassment* | 6.8 | 4.7 | 0.555 |
| **UUI** | | 17.6% | 8.7% | |
| | *mobility* | 9.4 | 16.7 | 0.336 |
| | *physical functioning* | 2.0 | 8.3 | 0.101 |
| | *social functioning* | 8.7 | 0.0 | 0.750 |
| | *emotional functioning* | 5.4 | 16.7 | **0.047** |
| | *embarassment* | 10.8 | 16.7 | 0.505 |
| **SUI** | | 40.5% | 21.7% | |
| | *mobility* | 5.4 | 4.2 | 0.756 |
| | *physical functioning* | 2.1 | 2.8 | 0.748 |
| | *social functioning* | 0.4 | 0.0 | 0.769 |
| | *emotional functioning* | 6.3 | 6.9 | 0.887 |
| | *embarassment* | 10.2 | 6.3 | 0.499 |

Values are means
$p<0.05$ was considered statistical significant

*Chapter 4*

# Bothersome Lower Urinary Tract Symptoms one year after first delivery: prevalences and the effect of childbirth

H.J. van Brummen
H.W. Bruinse
G. van de Pol
A.P.M. Heintz
C.H. van der Vaart

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## Abstract

**Aims:** The aim of this study was to assess the severity of both stress urinary incontinence and overactive bladder symptoms during and after first pregnancy with the use of a self-report health-related quality of life questionnaire and to assess the effect of pregnancy and childbirth on bothersome LUTS persisting one year after first childbirth.

**Methods:** A prospective cohort study was undertaken. 344 Women were included in this analysis. Women were asked to complete four self-report questionnaires. Urogenital symptoms were assessed with the Urogenital Distress Inventory (UDI). Each item measures if a urogenital symptom is present and the amount of bother a woman experiences from that symptom. The amount of bother is measured on a 4-point Likert scale ranging from not at all, slightly, moderately and greatly bother. Bothersome LUTS were defined as reporting moderate or great bother from the symptom. A LUTS was regarded as not bothersome if it was absent or present with none or only slight degree of self-reported bother. In this analysis we used three of the five subscales from the UDI; urinary incontinence, overactive bladder, and obstructive micturition. Each subscale has a range of 0 (no symptom) to 100 (all symptoms present with the highest degree of bother).

**Results:** Eighty-three of 344 (24.2%) women reported to experience moderately to greatly bothersome frequency symptom at 36 weeks gestation. After childbirth, there was statistical significant decline in the prevalence of bothersome frequency to 38 (9.6%) women (p=0.000). Bothersome stress urinary incontinence was present in 53 (15.4%) women at 36 weeks gestation and in 36 (10.5%) one year after childbirth. Fifty-eight (16.9%) women reported to have moderately to greatly bothersome urge urinary incontinence symptom and one year after childbirth 51 (14.8%) women were still bothered by it. After univariate and multivariate analysis, the predictive factors for the presence of bothersome stress urinary incontinence were an older maternal age (32.5 vs 30.3 years old at delivery) and the presence of bothersome stress urinary incontinence at 12 weeks gestation. Bothersome urge urinary incontinence was significantly associated with a lower educational level (OR 0.08 [0.02-0.36]). When comparing a cesarean delivery (CD) with spontaneous vaginal delivery (SVD), women after CD had more bothersome urge urinary incontinence. Women after a SVD developed more bothersome stress urinary incontinence. Both associations did not reach statistical significance, possible due to low numbers. During pregnancy, all UDI subscales scores increase significantly and after childbirth all scores decrease significantly compared to 36 weeks gestation. However, the score on the urinary incontinence subscale remained significantly higher one year postpartum compared to 12 weeks gestation, whereas the scores on the overactive bladder and obstructive micturition subscales are lower one year postpartum compared to 12 weeks gestation. Nevertheless, the scores on the urinary incontinence and obstructive micturition are low, indicating little bother.

**Conclusions:** The majority of women are not bothered by their LUTS after first delivery. Since the prevalence of bothersome symptoms is the highest at 36 weeks

gestation, they are probably part of a normal pregnancy. However, overactive bladder symptoms can be perceived as bothersome. Physiotherapy and bladder training can be offered to women with bothersome LUTS. Bothersome stress urinary incontinence in early pregnancy and an older maternal age were found to be predictive for bothersome SUI one year after first childbirth. A CD seemed to be protective for bothersome SUI one year postpartum, but bothersome urge incontinence was more prevalent after a CD compared to a vaginal delivery. More research with a larger power is necessary to make definite statements about the effect of the mode of delivery and bothersome urinary incontinence symptoms.

## INTRODUCTION

In the past decades, research on bladder symptoms during and after pregnancy has focused on urinary incontinence. Besides urinary incontinence, other lower urinary tract symptoms (LUTS) are common during pregnancy[1-7]. Urinary frequency is present in up to 95 percent of pregnant women and urinary urgency in 68 percent[1-7].
The results of epidemiologic and pathophysiological studies assessing the relation between mode of delivery and incontinence have been inconclusive[8-11]. The difference in methods, follow-up periods and number of participants may account for the inconsistency. Despite the high prevalence of overactive bladder symptoms (frequency and urgency) in pregnancy, the impact of childbirth on bladder overactivity has seldomly been studied in a pregnant population.
Assessment of lower urinary tract symptoms in women has been facilitated by the development of disease specific questionnaire like the Urogenital Distress Inventory (UDI)[12, 13]. The application of this instruments to women with antenatal and postnatal LUTS enables an objective measurement of the impact of symptoms and assesses the severity of the condition at a time when symptoms are common and often arise for the first time[7].
LUTS may be temporary or permanent. The bother these symptoms can cause is both related to the severity of the symptom as well as the individual perception of it as a problem[14]. LUTS are known to be bothersome outside of pregnancy[15]. In relation to pregnancy, one study was conducted which showed that urinary incontinence during and after first pregnancy also had a negative impact on daily life[16]. In a non-pregnant female population, overactive bladder symptoms (OAB) are reported to be as bothersome as true urinary incontinence symptoms[17]. Although the prevalence of these symptoms are high, it is unknown if primiparous women are bothered by it.
The aim of our study was to assess the severity of both stress urinary incontinence and overactive bladder symptoms during and after first pregnancy with the use of a self-report health-related quality of life questionnaire and to investigate the effect of pregnancy and childbirth on bothersome LUTS persisting one year after first childbirth.

## Methods

*Study population*

A prospective cohort study was undertaken to investigate the impact of a first pregnancy and delivery on pelvic floor function. Between January 2002 and July 2003 candidates were recruited from ten midwifery practices in the Netherlands. Eligible women were nulliparous with a low-risk singleton pregnancy between 12 and 18 weeks gestation with a good knowledge of the Dutch language. Exclusion criteria were previous urogynecological surgery, urogynecological malformations, diabetes mellitus and neurological disorders. The participating midwives gave all consecutive nulliparous pregnant women verbal and written information about the study. After one week these women were asked by phone whether they were willing to participate.

The Medical Ethics Committee of the University Medical Center Utrecht approved the study. All participants signed an informed consent.

*Measurements*

Women were asked to complete a self-report questionnaire at 12 and 36 weeks gestation, and 3 and 12 months after delivery. LUTS were assessed with the long version of the Urogenital Distress Inventory (UDI).[12,13] The UDI is a validated, standardized questionnaire and translated in Dutch. Each item measures if a urogenital symptom is present and the amount of bother a woman experiences from that symptom. The amount of bother is measured on a 4-point Likert scale ranging from not at all, slightly, moderately and greatly bother. Bothersome LUTS were defined as reporting moderate or great bother from the symptom. A LUTS was regarded as not bothersome if it was absent or present with none or only slight degree of self-reported bother. We followed the recommendation of the International Continence Society (ICS)[18]. The questions of the UDI and subscales used in this analysis are shown in appendix 1. The individual items from the UDI are also clustered in 5 subscales according to the Dutch version.[13] In this analysis we used three of the five subscales from the UDI; urinary incontinence, overactive bladder, and obstructive micturition. Each subscale has a range of 0 (no symptom) to 100 (all symptoms present with the highest degree of bother). This allowed us to analyze our data in two ways. First the data was analyzed on item level, secondly on the clustering of items.

Demographical variables, like age, weight gain, educational level, smoking habits and others, were collected from the participants and from the midwifes. Body mass index (BMI) was calculated for all women ($kg/m^2$) at inclusion and at 12 months postpartum. Educational level was dichotomized in primary school and secondary school or higher.

In the Netherlands the midwife is responsible for providing obstetrical care of healthy low risk pregnant women. If pregnancy-related problems appear, the obstetrician/gynecologists is consulted. Deliveries performed by midwives and gynecologists are registered in the Dutch National Obstetric Database. Obstetrical data of the participants were abstracted from this database.

*Statistics*

In univariate analysis, the fisher exact test was used to assess the significance of the associations for categorical variables and Students t-test for continuous variables. The Mann-Whitney test was performed if values were not normal distributed or if the sample was too small (< n=30). Where appropriate odds ratios (OR) with 95% confidence intervals (CI) were calculated. Multivariate analysis was used to calculate adjusted odds ratios for factors that were significantly associated in univariate analysis. A Wilcoxon's signed rank test was used for the matched UDI subscales. Data was analyzed using SPSS 12.0. A p-values < 0.05 was considered to be statistical significant.

## Results

One hundred and six women were not eligible;12 women had a miscarriage, 2 a twin pregnancy and 92 language problems. Figure 1 shows the number of women that were in-and excluded in the study. Five hundred and twenty-four women agreed to participate in the study. Fifty (9.5%) women were pregnant again when completing the fourth questionnaire and were excluded from the analysis. In this analysis 344 (72.6%) women, who returned all four questionnaires, were included. Women, who did not return all four questionnaires, did not differ in the prevalence of LUTS as compared to the women included in this analysis. Table 1 shows the characteristics of the study population. None of the women was breastfeeding one year postpartum.

Other factors can influence LUTS as well such as a urinary tract infection (UTI) or gestational diabetes. In our study, none of the women had an UTI when completing any of the questionnaires. Nine women developed gestational diabetes but required only dietary measurements. Of these 9 women only 1 had frequency and urgency symptoms and symptoms were already present before the gestational diabetes was diagnosed.

Table 2 shows the prevalence of bothersome LUTS in relation to gestational age. The prevalence of bothersome frequency and urgency is in pregnancy much higher than of bothersome urinary incontinence symptoms, whereas after childbirth bothersome urinary incontinence symptoms are more prevalent than overactive bladder symptoms. Eighty-three of 344 (24.2%) women reported to experience moderately to greatly bothersome frequency symptom at 36 weeks gestation. After childbirth, there was statistical significant decline in the prevalence of bothersome frequency to 38 (9.6%) women (p=0.000). Bothersome stress urinary incontinence was present in 53 (15.4%) women at 36 weeks gestation and in 36 (10.5%) one year after childbirth. Fifty-eight (16.9%) women reported to have moderately to greatly bothersome urge urinary incontinence symptom and one year after childbirth 51 (14.8%) women were still bothered by it.

Maternal-related factors analyzed were: maternal age, BMI, educational level, smoking, weight gain in pregnancy, gestational age at delivery. In table 3 the statistical significantly variables that were associated with bothersome LUTS one year after childbirth are shown. After univariate and multivariate analysis, the predictive factors for the presence of bothersome stress urinary incontinence were an older maternal age (32.5 vs 30.3 years old at delivery) and the presence of bothersome stress urinary incontinence at 12 weeks gestation. Bothersome urge urinary incontinence was significantly associated with a lower educational level (OR 0.08 [0.02-0.36]). After multivariate analyses no risk factors were identified for bothersome frequency and urgency. To get insight in the role of age on bothersome SUI, we analyzed age divided into 4 groups: under 25 years, 26-30 years, 31-35 years, and over 35 years of age. None of the women under 25 experienced bothersome SUI (N=0), between 26 and 30 years 2.8% experienced bothersome SUI (N=11), between 31 and 35 years 4.3% (N=17) and in the group of 36 and older 10.3% experienced bothersome SUI

(N=8). As a reference group we used the age group under 26, we found a trend that women over thirty years of age experienced more bothersome SUI (p=0.098). We also stratified the age categories for the other significant associated factor: SUI at 12 weeks gestation. After stratifying for age the factor of SUI at 12 weeks gestation remained statistical significant for all age groups except for the group under 26 years old.

Delivery-related factors on urinary incontinence analyzed were: the duration of second stage of labour, infant birth weight, mode of delivery (spontaneous vaginal delivery (SVD), instrumental vaginal delivery (IVD) and cesarean delivery (CD)) and perineal state (no rupture, 1st or 2nd degree, 3rd or 4th degree, and episiotomy). (shown in table 4) We found a trend that a CD was protective for persisting bothersome SUI one year postpartum compared to SVD. More women had bothersome urge urinary incontinence after a CD compared to SVD. These associations did not reach statistical significance, possibly because the number of women was too small.

Table 5 shows the mean scores on the three UDI subscales. During pregnancy, all UDI subscales scores increase significantly and after childbirth all scores decrease significantly compared to 36 weeks gestation. However, the score on the urinary incontinence subscale remained significantly higher one year postpartum compared to 12 weeks gestation, whereas the scores on the overactive bladder and obstructive micturition subscales are lower one year postpartum compared to 12 weeks gestation. Nevertheless, the scores on the urinary incontinence and obstructive micturition are low, indicating little bother. Bladder symptoms are mainly pregnancy related symptoms and can be perceived as bothersome.

## Discussion

A prospective cohort study was undertaken to evaluate the impact of the first pregnancy and childbirth on the pelvic floor. The aim of this study was to assess the severity of bladder symptoms during and after first pregnancy with the use of a self-report health-related quality of life questionnaire. The second aim of this study was to study the effect of the mode of delivery on bothersome LUTS persisting one year after first childbirth.

During pregnancy, the prevalence of bothersome LUTS increased significantly and declined after childbirth. However, the prevalence of bothersome stress and urge urinary incontinence remained significantly higher one year after first childbirth compared to 12 weeks gestation, whereas the prevalence of bothersome overactive bladder symptoms was lower one year postpartum compared to 12 weeks gestation. This was demonstrated on item level, but also with on the UDI subscales. At 36 weeks gestation the incidence of bothersome LUTS is the highest. This is probably due to the fact that bother in general may be the highest between 36 and 38 weeks gestation and is part of a normal pregnancy. Predictive factors for bothersome SUI one year postpartum were an older maternal age and having bothersome SUI at 12 weeks gestation. There was a trend that a caesarean section was protective for persisting bothersome SUI, but more women had urge urinary incontinence after a CD as compared to SVD. However, the number of women was too small to make definite statements. A lower educational level was found to be associated with bothersome UUI.

In a non-pregnant population, urinary incontinence and overactive bladder symptoms are reported to be bothersome by women[15, 17]. To our knowledge only one study was conducted to investigate the effect of urinary incontinence on quality of life during and after first pregnancy. The study of Dolan et al used the King's Health Questionnaire (KHQ)[16]. Fifty-four percent of the women with urinary incontinence in the third trimester of pregnancy experienced a negative impact on the quality of life. Three months after childbirth 71% percent of the women with urinary incontinence reported that their daily life activity was negatively affected by incontinence symptoms[16]. The domain scores on the KHQ were low, suggesting minimal restriction in lifestyle. Women with urge urinary incontinence or mixed urinary incontinence had worse quality of life scores before delivery than those with stress urinary incontinence alone. Three months after delivery this association could no longer be demonstrated.

Our findings were similar, but different questionnaires were used. We also found low scores on the UDI urinary incontinence subscale. But the participants in our study were followed until one year after childbirth. The follow-up period in the study by Dolan et al was three months after childbirth[16]. The amount of bothersomeness was assessed in our study. During pregnancy, especially overactive bladder symptoms can be perceived as bothersome. LUTS became more bothersome with increasing gestational age, but after childbirth the subscale scores declined. The UDI subscales scores after childbirth were low indicating little bother.

An older maternal age and the presence of SUI at 12 weeks gestation were found to be predictive for bothersome SUI one year after childbirth. Urinary incontinence antenatal and an older maternal age have been identified as risk factors for urinary incontinence postpartum and later in life[19, 20]. Bothersome UUI one year after childbirth was associated with a lower educational level. The bother these symptoms cause is both related to the severity of the symptom as well as the individual perception of it as a problem.[14] It has been hypothesized that women with a lower educational level predisposes to the use of avoiding and emotional-oriented coping strategies and to present themselves with relatively mild symptoms[14, 21, 22].

A trend that a CD was to be protective for bothersome SUI was found, but after a CD more bothersome UUI was reported. These associations did not reach significance. The numbers of women were too small in our study to make definite statements. The associations between the mode of delivery and incontinence have been intensively investigated before. Results of epidemiologic and pathophysiological studies assessing the relation between mode of delivery and incontinence have been inconclusive[8-11]. The difference in methods, follow-up periods and number of participants may account for the inconsistency. Rortveit et al.[11] studied over 15000 women and found an association between urinary incontinence and the mode of delivery (EPICONT study). SUI was found to be more prevalent after a CD compared to nulliparous women and more prevalent after a vaginal delivery compared to a CD. No statistical differences were found for UUI or mixed incontinence. The focus of this EPICONT study was moderate to severe urinary incontinence, and not bothersome LUTS. It is stated that bothersome symptoms were associated with the mode of delivery but data are not desribed. The focus of our study was to prospectively follow-up the prevalence of bothersome symptoms in nulliparous women throughout pregnancy and in the first year after childbirth. Our data confirm the EPICONT study that a CD seems to be protective for bothersome SUI. Because the data of bothersome symptoms are not shown, we cannot compare our prevalence data with the EPICONT study. The trend between CD and bothersome UUI might indicate that surgery is a risk for urge incontinence. More research with a larger power is necessary to make definite statements about the effect of the mode of delivery and bothersome urinary incontinence symptoms.

The pathophysiology for LUTS during and after first pregnancy is not yet clear. Urinary incontinence antenatal has been identified as an important risk factor for urinary incontinence postpartum and later in life[19, 20]. This finding suggests that the pregnancy process itself seems to be a potent cause of UI. The symptoms of frequency and urgency during pregnancy may arise because of hypersensitivity of the bladder stretch but also may occur when the bladder contracts inappropriately due to detrusor overactivity. There is an increase in number of voids in a 24-hour period between prepregnancy and pregnancy.[23] First sensation and maximum bladder capacity are lower in a pregnant population compared to a non-pregnant population[1, 24-26]. An increased fluid intake and urine production has been reported in pregnant women compared to non-pregnant women.[1, 25]. Possibly, the combination of pressure effects of the gravid uterus, altered urine production, increased glomular filtration

rates, temporary changes in urethrovesical angle and a change in bladder capacity leads to LUTS. Voiding difficulties, such as poor stream and incomplete bladder emptying, have not been objectively confirmed by urodynamic findings in early pregnancy.[27]

Unlike antenatal LUTS, postpartum symptoms are typically attributed to the pathophysiological changes that occur as a result of childbirth. During a vaginal delivery, the muscles, nerves and connective tissue of the pelvic floor and adjacent structures may sustain varying degree of injuries. Changes to the peripheral nerves have received considerable attention. The autonomic innervation of the bladder and the urethra may degenerate during pregnancy, and the regeneration after each delivery seems to be incomplete2[8-30]. Traumatic strechting and compression during delivery of the peripheral nerve supply to the pelvic floor may result in partial denervation of the striated muscles in and around the urethra[31].

Overactive bladder symptoms can be perceived as bothersome in late pregnancy and bothersome stress urinary incontinence is predictive for bothersome stress urinary incontinence one year after childbirth. Behavioural interventions for overactive bladder symptoms include lifestyle measures, scheduled voiding regimens, and pelvic floor muscle training. These interventions rely on systematic attempts by individuals to alter their actions to improve bothersome bladder symptoms[32, 33]. The marked benefit of intensive pelvic floor muscle training, seen in the first year after delivery, was not maintained 15 years later. Long-term adherence to training is low.[34] These interventions can be used alone or in combination with other forms of treatment, such as drug therapy. Research in a pregnant population has focused on stress urinary incontinence. No research is available about the effect of bladder training on overactive bladder symptoms in pregnant women. Antimuscarinics, like tolterodine®, are not safe to use in pregnancy and when breastfeeding. Since the prevalence of bothersome symptoms are low after childbirth no interventions are necessary and LUTS are a part of a normal pregnancy. But, future research is necessary to examine the effect of bladder training on bothersome overactive bladder symptoms during pregnancy. Pelvic floor muscle training can be offered to women with bothersome stress urinary incontinence in early pregnancy but further research is necessary to evaluate the long-term effect of the training.

The strength of this study is firstly the design: a prospective longitudinal cohort study. Prospectively collected measurements of LUTS during pregnancy and the postpartum period provide better validated data on the contribution of pregnancy and delivery on these symptoms. Our participants were prospectively followed from 12 weeks gestation till one year postpartum. Recall bias is not likely to be a problem whereas with a retrospective design recall bias can be a major drawback. Secondly, LUTS were assessed with a standardized validated questionnaire[12, 13]. The use of the UDI made it possible to analyze our data in two ways, first on item level and secondly on clustering of the items in the UDI subscales. In other studies the definitions and recommendations of the ICS were followed but not all studies used standardized and validated questionnaires[6, 20, 35-39].

However, this study has limitations as well. The high prevalence of pelvic floor symp-

toms recorded with the UDI may be the result of selection bias. One hundred and thirty women did not complete all 4 questionnaires. When comparing the data of these women with respect to the questionnaires that they did return, we could not demonstrate any significant differences in LUTS, demographical and obstetrical data. Therefore we believe that our study sample is representive for the whole group. Furthermore, the obstetrical data of our study group matches with the overall data of comparable pregnancies abstracted from the Dutch National Obstetrical Database. Apparently, our study group reflects the normal Dutch population well.

Secondly, we used a symptom-based questionnaire based on recommendations and definitions of the ICS[15, 17, 18]. Pelvic floor symptoms were not confirmed with objective measures, such as urodynamics or pad-test. The aim of this study was not to measure objectively, but rather to investigate the women's own experiences. In addition, the overactive bladder symptom complex is a clinical and not an urodynamic diagnosis.

In conclusion, the majority of women are not bothered by their LUTS after first delivery. Since the prevalence of bothersome symptoms is the highest at 36 weeks gestation these symptoms are probably part of a normal pregnancy. However, overactive bladder symptoms can be perceived as bothersome . Physiotherapy and bladder training can be offered to women with bothersome LUTS. Bothersome stress urinary incontinence in early pregnancy and an older maternal age were found to be predictive for bothersome SUI one year after first childbirth. A CD seemed to be protective for bothersome SUI one year postpartum, but bothersome urge incontinence was more prevalent after a CD compared to a vaginal delivery. More research with larger power is necessary to make definite statements about the effect of the mode of delivery and bothersome urinary incontinence symptoms.

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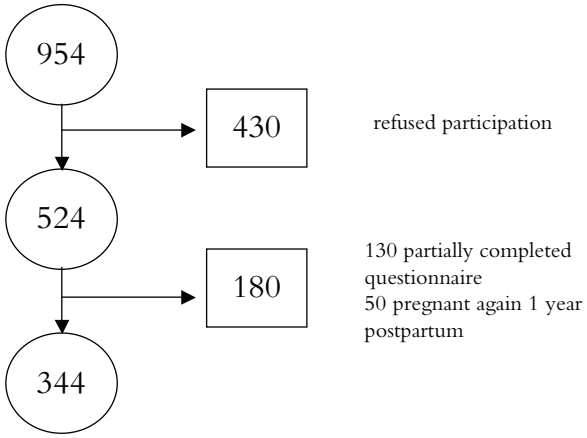
954
430
refused participation
524
130 partially completed questionnaire
50 pregnant again 1 year postpartum
180
344

**Figure 1**

**Table 1 Characteristics of the study population**

| | mean | SE |
|---|---|---|
| **Age at delivery** (years) | 30.4 | 0.19 |
| **BMI at inclusion** (kg/m$^2$) | 23.7 | 0.21 |
| | N=344 | % |
| **Marital state** | | |
| *married or cohabiting* | 332 | 96.5% |
| *single or divorced* | 12 | 3.5% |
| **Educational level** | | |
| *primary* | 14 | 4.1% |
| *secondary or more* | 330 | 95.9% |
| **Smoking one year postpartum** | | |
| *yes* | 41 | 12.0% |
| *no* | 301 | 88.0% |
| **Mode of delivery** | | |
| *Spontaneous Vaginal Delivery (SVD)* | 223 | 64.8% |
| *Instrumental Vaginal Delivery (IVD)* | 64 | 18.6% |
| *Vacuum extraction* | 57 | 16.6% |
| *Forceps delivery* | 7 | 2.0% |
| *Caesarean Delivery (CD)* | 57 | 16.6% |
| *elective* | 24 | 7.0% |
| *emergency* | 33 | 9.6% |
| **Perineal state after vaginal delivery** | | |
| *Intact* | 44 | 15.3% |
| *1st - 2nd degree tear* | 89 | 31.0% |
| *3rd - 4th degree tear* | 16 | 5.6% |
| *episiotomy* | 138 | 48.1% |
| | | |
| **Neonatal data** | mean | SE |
| *gestation (days)* | 279.8 | 0.56 |
| *birth weight(grams)* | 3512.2 | 28.98 |

**Table 2 The prevalence of bothersome LUTS**

| Bothersome LUTS | 12 weeks gestation | 36 weeks gestation | | 12 months postpartum | |
|---|---|---|---|---|---|
| | N (%) | N (%) | p-value | N (%) | p-value |
| frequency | 66 (19.2%) | 83 (24.2%) | # | 33 (9.6%) | # |
| urgency | 68 (19.8%) | 55 (16.0%) | # | 18 (5.2%) | # |
| SUI | 26 (7.6%) | 53 (15.4%) | # | 36 (10.5%) | # |
| UUI | 23 (6.7%) | 58 (16.9%) | # | 51 (14.8%) | # |
| difficult bladder emptying | 40 (11.6%) | 75 (21.8%) | # | 38 (11.0%) | |
| incomplete bladder emptying | 27 (7.8%) | 43 (12.5%) | # | 25 (7.3%) | |

values are number (percentages)

moderately to greatly bother was regarded to be a bothersome symptom

# NcNemar test $p < 0.05$ compared to 12 weeks gestation

**Table 3 The statistical significant associated factors for bothersome LUTS one year after childbirth in 344 primiparous women**

| | Bothersome SUI | | | | Bothersome UUI | | Bothersome frequency | | | | Bothersome urgency | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | univariate analysis | | multivariate anlysis | | univariate analysis | | univariate analysis | | multivariate anlysis | | univariate analysis | | multivariate anlysis | |
| | mean | p | B [95% CI] | p | mean | p | mean | p | B [95% CI] | p | mean | p | B [95% CI] | p |
| maternal age (years) | 32.5 (0.83) vs 30.3 | 0.040 | 1.18 [1.01-1.38] | 0.049 | | | | | | | | | | |
| | OR [95% CI] | p | | p | OR [95% CI] | p | OR [95% CI] | p | | p | OR [95% CI] | p | | p |
| educational level | | | | | 0.08 [0.02-0.36] | 0.006 | 0.09 [0.02-0.55] | 0.031 | 0.40 [0.05-3.45] | 0.213 | | | | |
| smoking | | | | | | | 13.7 [2.44-7.26] | 0.009 | 1.07 [0.21-13.11] | 0.694 | 6.75 [1.63-27.88] | 0.014 | 3.15 [0.58-16.89] | 0.549 |
| | 30.4 [5.56-166.7] | 0.000 | 30.4 [5.28-175.1] | 0.001 | | | 5.88 [6.67-12.5] | 0.000 | NA | | 6.06 [1.31-28.01] | 0.037 | 4.19 [0.78-22.56] | 0.368 |
| presence of symptom at weeks gestation | | | | | | | | | | | | | | |

Univariate anlysis was performed, p< 0.05 was considered statistical significant. Mulitvariate logistic regression analysis was performed with enter method

Mann-U Whitney test was performed for continous variables. Fisher exact test was performed for categorical variables

p= p-value, B [95% CI] = adjusted OR's

NA= can not be determined, the numbers are too small, but the OR's are not significant

**Table 4 The effect of childbirth on bothersome urinary incontinence symptoms**

| | Bothersome SUI | | | | Bothersome UUI | | | |
|---|---|---|---|---|---|---|---|---|
| | no | yes | p-value | OR [95%CI] | no | yes | p-value | OR [95%CI] |
| **Perineal state** | | | | | | | | |
| no rupture (N=44) | 88.2% | 11.8% | | | 80.0% | 20.0% | | |
| 2nd degree (N=89) | 92.3% | 7.7% | 0.657 | 0.66 [0.13-3.18] | 100.0% | 0.0% | 0.327 | 0.81 [0.71-1.01] |
| 3rd or 4th degree (N=16) | 92.9% | 7.1% | 0.464 | 0.88 [0.83-1.03] | 100.0% | 0.0% | 0.380 | 0.84 [0.74-1.02] |
| episiotomy (N=138) | 84.7% | 15.9% | 0.124 | 2.33 [0.73-7.44] | 84.2% | 15.8% | 0.712 | 1.30 [0.23-5.15] |
| **Mode of delivery** | | | | | | | | |
| SVD (N=223) | 88.6% | 11.4% | | | 93.5% | 6.5% | | |
| IVD (N=64) | 88.2% | 11.8% | 0.965 | 1.16 [0.23-5.71] | 87.5% | 12.5% | 0.844 | 0.78 [0.82-7.32] |
| CD (N=57) | 100.0% | 0.0% | 0.126 | 0.88 [0.83-0.94] | 50.0% | 50.0% | 0.104 | 1.08 [0.23-5.15] |
| Birth weight (grams) | 3509.2 | 3630.5 | 0.490 | | 3391.7 | 3555.6 | 0.122 | |
| Second stage of labour (minutes) | 53.3 | 61.8 | 0.464 | | 63.2 | 74.3 | 0.130 | |

SVD= spontaneous vaginal delivery
IVD= instrumental vaginal delivery
CD= cesarean delivery

**Table 5 Score on the UDI subscales in relation to pregnancy and childbirth**

| | 12 weeks gestation | 36 weeks gestation | | 3 months postpartum | | 1 year postpartum | |
|---|---|---|---|---|---|---|---|
| | mean(sd) | mean(sd) | | mean(sd) | | mean(sd) | |
| **Urinary incontinence** | 3.9 (10.22) | 11.1 (17.97) | # | 7.3 (13.89) | # | 8.2 (14.59) | # |
| **Overactive bladder** | 21.6 (22.67) | 25.7 (23.17) | # | 4.7 (11.89) | # | 5.5 (12.07) | # |
| **Obstructive micturition** | 6.2 (13.14) | 11.7 (19.03) | # | 3.8 (11.51) | # | 3.5 (10.7) | # |

# $p<0.05$ tested with a Wilcoxon signed rank test compared to 12 weeks gestation
The values are mean (standard deviation)

*Chapter 5*

# What is the effect of overactive bladder symptoms on woman's quality of life during and after first pregnancy?

H.J. van Brummen
H.W. Bruinse
G. van de Pol
A.P.M. Heintz
C.H. van der Vaart

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## Abstract

**Aims:** To evaluate the effect of overactive bladder symptoms (OAB) on the woman's quality of life (QoL) during and after first pregnancy, using self-report symptom-based QoL questionnaires.

**Methods:** In a prospective cohort study.,474 women were asked to complete four self-report questionnaires. Urogenital symptoms were assessed with the Urogenital Distress Inventory (UDI) and the Incontinence Impact Questionnaire (IIQ). A women was considered to experience 'dry' OAB if she replied positively to the following two questions "do you experience a strong feeling of urgency to empty your bladder?", and "do you experience frequent urination?". A women was considered to experience 'wet' OAB if she replied positively to all of the following questions "do you experience a strong feeling of urgency to empty your bladder?", "do you experience frequent urination?", and "do you experience urine leakage related to the feeling of urgency?".

**Results:** In all, 344 (72.6%) women, who returned all four questionnaires, were included in this analysis. After first childbirth there was a rapid decline in the prevalence of dry OAB (45.2% - 7.9%, $p<0.001$). In pregnancy the prevalence of wet OAB increased significantly, but a year after childbirth the prevalence of wet OAB decreased and was similar to that at 12 weeks gestation ($p= 0.289$). Women with wet OAB had higher scores on all IIQ domains than those with no OAB symptoms at 36 weeks gestation. Women with dry or wet OAB all had higher scores on the mobility domain than those with no OAB. The scores on the physical, social and emotional functioning domains were low, suggesting a minimal restriction of lifestyle.

**Conclusions:** OAB symptoms are common during pregnancy; dry OAB had no negative effect on QoL, whereas wet OAB comprised QoL both during and after pregnancy, mainly on the mobility and embarrassment domains. The urge urinary incontinence symptom in wet OAB seems to profoundly comprise QoL. Apparently, in young mothers with wet OAB limitations in mobility are especially stressful and these symptoms can be embarrassing.

## Introduction

In the past decades, research on bladder symptoms has focused on the impact of urinary incontinence (UI) on health-related quality of life (HRQoL) in adult women. In relation to pregnancy, one study showed that UI during and after first pregnancy also comprised the QoL[1]. Besides urinary incontinence, other lower urinary tract symptoms (LUTS) are common during and after first pregnancy[2-8]. Urinary frequency is present in up to 95 percent of pregnant women and urinary urgency in 68 percent[2-8].

There is still an ongoing discussion about the definition of overactive bladder (OAB) syndrome;in the latest recommendation the ICS updated the definition for OAB into urgency, with or without urge incontinence, usually with frequency and nocturia [9].

Although the prevalence of overactive bladder symptoms in pregnancy is high, the impact of bladder overactivity on quality of life has never been studied in a pregnant population. In a non-pregnant female population, the HRQoL is negatively affected by overactive bladder symptoms (OAB) as well as it is by true urinary incontinence symptoms[10]. Assessment of quality of life in women has been facilitated by the development of disease specific questionnaire like the Urogenital Distress Inventory (UDI) and the Incontinence Impact Questionnaire (IIQ)[11,12]. The application of QoL instruments to women with antenatal and postnatal urogenital symptoms allows the objective measurement of the impact of symptoms on lifestyle, and assesses the severity of the condition when symptoms are common and often arise for the first time.

Thus the aim of the present study was to evaluate the effect of OAB symptoms on the woman's QoL during and after first pregnancy, using self-report symptom-based questionnaires.

## METHODS

*Study population*

In a prospective cohort study we investigated the impact of a first pregnancy and delivery on pelvic floor function. Between January 2002 and July 2003 candidates were recruited from 10 midwifery practices in the Netherlands. Eligible women were nulliparous with a low-risk singleton pregnancy at 12 -18 weeks gestation, and with a good knowledge of the Dutch language. Exclusion criteria were previous urogynaecological surgery, urogynaecological malformations, diabetes mellitus and neurological disorders. The participating midwives gave all consecutive nulliparous pregnant women verbal and written information about the study; after one week these women were asked by phone whether they were willing to participate.

The Medical Ethics Committee of the University Medical Centre Utrecht approved the study, andall participants signed an informed consent.

*Measurements*

The women were asked to complete a self-report questionnaire at 12 and 36 weeks gestation, and 3 and 12 months after delivery. Urogenital symptoms were assessed with a validated questionnaire, the Dutch version of the Urogenital Distress Inventory (UDI) and the Incontinence Impact Questionnaire (IIQ)[11, 12]. Following the recommendation of the ICS[9], we selected the following questions from the UDI; a woman was considered to have urgency if she replied positively to the question "do you experience a strong feeling of urgency to empty your bladder?" ; a woman was considered to have frequency if she replied positively to the question "do you experience frequent urination?"; and a woman was considered to have urge incontinence if she replied positively to the question "do you experience urine leakage related to the feeling of urgency?". A women was considered to experience 'dry' OAB if she replied positively to the following 2 questions "do you experience a strong feeling of urgency to empty your bladder?", and "do you experience frequent urination?". A women was considered to experience 'wet' OAB if she replied positively to all of the following questions "do you experience a strong feeling of urgency to empty your bladder?", "do you experience frequent urination?", and "do you experience urine leakage related to the feeling of urgency?".

Disease specific QoL scores for pelvic floor symptoms were obtained from the Incontinence Impact Questionnaire (IIQ)[11, 12],in the introduction of which it is stated that only women who experienced one or more pelvic floor symptom on the UDI had to answer the IIQ. The validity of the Dutch version of this questionnaire was assessed and published previously[12]. The domains on the IIQ differed from the original version in one aspect; several questions about embarrassment were added to a separate domain. The impact of pelvic floor symptoms were measured on five domains; emotional functioning, physical functioning, social functioning, mobility and embarrassment. The scores on the domains were 0 -100, with a high score indicates that a person's well-being on that particular domain was worse.

In the Netherlands the midwife is responsible for providing obstetrical care of

healthy low risk pregnant women. If pregnancy-related problems appear, the obstetrician/ gynecologists is consulted. Deliveries by midwives and gynecologists are registered in the Dutch National Obstetric Database.; obstetrical data of the participants were obtained from this database.

*Statistics*

The Students t-test was used to analyse the effect of OAB symptoms on the domains of the IIQ. If the values were not normally distributed or there were few values (≤30) the Mann-Whitney *U*- test was performedwith a p-values $< 0.05$ considered to indicate statistical significance in both tests.

## RESULTS

In all 106 women were not eligible; 12had a miscarriage, two a twin pregnancy and 92 had language problems; 524 women (55%) agreed to participate in the study. The main reasons women that women refused to participate were time investment and the intimate nature of the questions. Fifty (9.5%) women were pregnant again at the time of the fourth questionnaire and were excluded from the analysis. Thus in this analysis, 344 (72.6%) women, who returned all four questionnaires, were included. Table 1 shows the characteristics of the study population. None of the women was breastfeeding one year postpartum.

The point prevalence of OAB and urge UI according to gestational age, with a follow-up of 12 months postpartum, is shown in table 2. After first childbirth there was a rapid decline in the prevalence of dry OAB (45.2% - 7.9%, $p< 0.001$). In pregnancy the prevalence of wet OAB increases significantly, but a year after childbirth the prevalence of wet OAB decreased and was similar to that at 12 weeks gestation ($p= 0.289$). There is no statistical significant difference in the prevalence of dry OAB ($p=0.689$) and wet OAB ($p= 0.289$) at 3 and 12 months after delivery.

Table 2 also shows the impact of OAB on the HRQoL at 36 weeks; women with wet OAB had higher scores on all IIQ domains than those with no OAB symptoms. In women with dry OAB the QoL was similar to those with no OAB symptoms. There were no statistical significant differences in scores on all IIQ domains between women with wet OAB at different gestation times. Women with dry or wet OAB all had higher scores on the mobility domain than those with no OAB. The scores on the physical, social and emotional functioning domains were low, suggesting a minimal restriction in lifestyle.

## Discussion

In the present study we evaluated the effect of OAB on the HRQoL during and after first pregnancy, assessed with self-report questionnaires. OAB symptoms were common during pregnancy; after childbirth there was a rapid decline in the prevalence of both dry and wet OAB symptoms. Dry OAB had no negative effect on QoL during and after first pregnancy, except for the mobility 12 months afte delivery. However, wet OAB comprised HRQoL both during and after pregnancy mainly on the IIQ mobility and embarrassment domains. Apparently, in young mothers with wet OAB, limitations in mobility are especially stressful and these symptoms are embarrassing.

To our knowledge only one study was reported investigating the effect of UI on QoL during and after first pregnancy, using the King's Health Questionnaire [1]; 54 % of the women with UI in the third trimester of pregnancy reported a negative impact on their QoL. Three months after childbirth 71% of the women with UI reported that their QoL was compriesed by their UI symptoms [1]. The domain scores on the King's Health Questionnaire were low, suggesting a minimal restriction in lifestyle. Women with urge UI or mixed UI had worse QoL scores before delivery than those with stress UI alone. Three months after delivery this association was no longer be apparent. The present participants were followed for a year after childbirth; on the emotional, social and physical functioning domains they had low scores, whereas the scores on the embarrassment and mobility domain were higher, indicating a restriction in lifestyle. Wet OAB comprised QoL both during and after pregnancy,with the main limitations on the mobility domain. However, the score of the mobility domain in these women with wet OAB decreased significantly after childbirth. Although the IIQ is a disease-specific questionnaire, we cannot exclude that the limitations in mobility of pregnancy itself is partly responsible for this difference.

The scores on the embarrassment domain did not decrease significantly after childbirth. Although it is known that in young, non-pregnant women urge UI and OAB symptoms are reported to be at least as bothersome as stress UI, and that these symptoms can resulted in a worse QoL, the effect of OAB during and after first pregnancy has not been evaluated previously [10, 13]. Young non-pregnant women felt limited in their mobility by OAB and urgeUI symptoms [10]. This finding is similar to the present results during and after first pregnancy.

The prevalence of wet OAB increased significantly with gestation and decreased rapidly after childbirth. The pathophysiology for OAB during pregnancy is not yet clear. Recent studies suggested that low levels of the reproductive hormone relaxin, increased glomular filtration rates, increased antenatal bladder neck mobility, the enlarged uterus and altered connective tissue composition, which reduced collagen strength, may contribute to urinary symptoms [2, 14]. The symptoms of frequency, urgency and urge UI during pregnancy may also arise because of hypersensitivity of the bladder stretch, but may also occur when the bladder contracts inappropriately due to detrusor overactivity. There are more voids in a 24-hour period from before pregnancy and pregnancy[15]. First sensation and maximum bladder capacity are lower

in a pregnant population than in a non-pregnant population[16-18], and greater fluid and urine production was reported in pregnant women than non-pregnant women. [17] Possibly, the combination of pressure effects of the gravid uterus, altered urine production and a change in bladder capacity leads to an increase of the prevalence of wet OAB during gestation.

Behavioural interventions for overactive bladder include lifestyle measures, scheduled voiding regimens, and pelvic floor muscle training. These interventions rely on systematic attempts by individuals to alter their actions to improve bothersome bladder symptoms. These interventions can be used alone or in combination with other forms of treatment, such as drug therapy. Although cure rates are relatively low, behavioural interventions are considered highly effective for improving urge UI, other OAB symptoms, and patients' QoL in a non pregnant population[19, 20]. Bladder training alone results in significant reduction of incontinence in older, community-dwelling women[20].

Research in a pregnant population has focused on stress UI; the marked benefit of intensive pelvic floor muscle training, seen in the first year after delivery, was not maintained 15 years later. Long-term adherence to training is low.[21] No research is available about the effect of bladder training on OAB symptoms in pregnant women. Antimuscarinics, like tolterodine®, are not safe to use in pregnancy and when breast-feeding. Future research is necessary to examine the effect of bladder training on OAB symptoms during pregnancy and whether combining behavioural and drug treatment after childbirth will result in better outcomes than either therapy alone.

The main strength of this study is its design: a prospective longitudinal cohort study with a follow-up period of one year after childbirth. Prospectively collected data during pregnancy and the postpartum period provide better validated data on the contribution of pregnancy and delivery on these symptoms than retrospective collected data. Second, OAB symptoms and the effect on QoL were assessed with standardized and validated questionnaires[11, 12]. The IIQ is a disease specific quality of life questionnaire especially developed for measuring the effect of pelvic floor symptoms on the HRQoL.

However, there were also limitations. The high prevalence of pelvic floor symptoms recorded with the UDI may be the result of selection bias;130 women did not complete all four questionnaires. We compared the data of these women with those from the returned questionnaires;there were no statistical significant differences in LUTS. Therefore, we think that the present study sample was representative of the whole group. Furthermore, the obstetrical data of our study group matched the overall data of comparable pregnancies abstracted from the Dutch National Obstetrical Database. The incidences of caesarean section, instrumental vaginal deliveries and spontaneous vaginal deliveries were similar. Apparently, the present study group reflected the normal Dutch population well. Thus we do not consider that the response rate (55%) limits the validity of the present data

We also used a symptom-based questionnaire based on recommendations and definitions of the ICS[9, 10, 13]. Pelvic floor symptoms were not confirmed with objective measures,e.g. urodynamics or a pad-test. The aim of the present study was not to

measure objectively but rather to investigate the women's experiences. In addition, the OAB symptom complex is a clinical and not an urodynamic diagnosis.
In conclusion, OAB was a common symptom during pregnancy; after childbirth there was a rapid decline in its prevalence. Dry OAB had no negative effect on QoLwhereas wet OAB comprised QoL both during and after pregnancy, mainly in the mobility and embarrassment domains. The urge UI symptom in wet OAB seems to profoundluy affect QoL; apparently, in young mothers with wet OAB limitations in mobility are especially stressful and these symptoms can be embarrassing. Attention needs to be paid to the negative effect of wet OAB on HRQoL in pregnant women, but especially after childbirth. Fortunately, mobility limitations will subside in most women with wet OAB after childbirth, but those with persistent symptoms should be actively screened for at the normal follow-up visits after delivery. As treatment options, e.g. physiotherapy during pregnancy or in combination with drug treatment postpartum, are available, these women can be offered some relieve of their symptoms.

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**Table 1 Characteristics of the study population**

| | | mean | SE |
|---|---|---|---|
| **Age at delivery** (years) | | 30.4 | 0.19 |
| **BMI at inclusion** (kg/m$^2$) | | 23.7 | 0.21 |
| | | N=344 | % |
| **Marital state** | | | |
| *married or cohabiting* | | 332 | 96.5% |
| *single or divorced* | | 12 | 3.5% |
| **Mode of delivery** | | | |
| *Spontaneous Vaginal Delivery (SVD)* | | 223 | 64.8% |
| *Instrumental Vaginal Delivery (IVD)* | | 64 | 18.6% |
| | *Vacuum extraction* | 57 | 16.6% |
| | *Forceps delivery* | 7 | 2.0% |
| *Caesarean Delivery (CD)* | | 57 | 16.6% |
| | *elective* | 24 | 7.0% |
| | *emergency* | 33 | 9.6% |
| **Perineal state after vaginal delivery** | | | |
| *Intact* | | 44 | 15.3% |
| *1st - 2nd degree tear* | | 89 | 31.0% |
| *3rd - 4th degree tear* | | 16 | 5.6% |
| *episiotomy* | | 138 | 48.1% |
| | | | |
| **Neonatal data** | | mean | SE |
| *gestation (days)* | | 279.8 | 0.56 |
| *birth weight(grams)* | | 3512.2 | 28.98 |

**Table 2 The prevalence of OAB symptoms during and after first pregnancy among 344 women, and the mean QoL scores at 36 weeks gestation and 1 year after delivery**

| Variable | No OAB | Dry OAB | Wet OAB |
|---|---|---|---|
| Prevalence, n (%) | | | |
| Gestation, weeks | | | |
| 12 | 171 (49.7) | 161 (46.9) | 12 (3.5) |
| 36 | 139 (40.4) | 155 (45.2) | 50 (14.6) |
| Months after delivery | | | |
| 3 | 305 (88.7) | 27 (7.8) | 12 (3.5) |
| 12 | 305 (88.7) | 27 (7.8) | 12 (3.5) |
| **QoL, mean (SEM) scores at:** | | | |
| *36 weeks gestation* | | | |
| mobility | 8.39 (1.47) | 12.15 (1.24) | 20.89 (3.83)‡ |
| physical functioning | 1.60 (0.48) | 1.86 (0.55) | 8.44 (2.45)‡ |
| social functioning | 0.00 (0.0) | 0.67 (0.31) | 6.33 (2.60)‡ |
| emotional functioning | 2.61 (0.75) | 3.05 (0.66) | 8.88 (2.15)† |
| embarrassment | 3.74 (0.92) | 4.25 (0.76) | 14.33 (2.86)‡ |
| *1 year after delivery* | | | |
| mobility | 1.71 (0.39) | 6.76 (2.28)⋆ | 14.58 (4.26)‡ |
| physical functioning | 1.10 (0.27) | 0.00 (0.0) | 1.38 (1.28) |
| social functioning | 0.25 (0.14) | 0.00 (0.0) | 0.00 (0.0) |
| emotional functioning | 3.31 (0.62) | 2.41 (1.70) | 6.25 (1.74) |
| embarrassment | 4.47 (0.76) | 5.79 (2.48) | 10.41 (3.68) |

The McNemar test was used to test the differences in prevalence vs 12 weeks gestation (see text)

⋆ $p<0.05$;† $p<0.01$; ‡ $p<0.001$, Student's t-test using 'no OAB'as the reference group

*Chapter 6*

# Defecatory symptoms during and after the first pregnancy: prevalences and associated factors

H.J. van Brummen
H.W. Bruinse
G. van de Pol
A.P.M. Heintz
C.H. van der Vaart

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## Abstract

**Aims:** A prospective cohort study was undertaken to evaluate the impact of pregnancy and the first delivery on the defecatory symptoms and to identify associated factors.

**Methods:** Included were 487 nulliparous pregnant women who completed four questionnaires.

**Results:** Flatus and fecal incontinence, constipation, and painful defecation are already present in early pregnancy and are significantly predictive for reporting symptoms after delivery, except for fecal incontinence. A 3rd/4th degree sphincter tear was significantly associated with fecal incontinence12 months postpartum and with de novo fecal incontinence, while other factors associated with de novo onset of symptoms were of borderline significance.

**Conclusions:** Defecation symptoms already present in early pregnancy are highly predictive for reported symptoms at 12 months postpartum except for fecal incontinence that is mainly related to anal sphincter lesion. Therefore, investigating the effects of childbirth in general on the anorectal function is not justified without knowledge of this function during pregnancy.

## INTRODUCTION

Pregnancy and vaginal delivery are considered to be of influence on the anorectal function. Prevalences rates for fecal or flatus incontinence before, during and after first pregnancy of 0-1%, 0-8 % and 2-26% have been reported[1-8]. In the last two decades, attention has been mainly focused on the association between pregnancy and delivery and the occurrence of flatus or fecal incontinence. A severe laceration of the anal sphincter is a risk factor for fecal incontinence[1, 3, 4, 6, 9-12]. But, when correlating other obstetrical variables with fecal incontinence symptoms no consistent findings are reported[1, 3, 4, 6, 9-12]. Despite the fact that anorectal function alters during and after pregnancy, little is known about the prevalence and associated risk factors for other defecatory symptoms, such as painful defecation, obstructive defecation and constipation during and after first pregnancy[13].
The aim of this study was to report on the prevalence of defecatory symptoms during and after first pregnancy and to identify associated factors.

## METHODS

*Study population*

A prospective cohort study was undertaken to investigate the impact of a first pregnancy and delivery on urogenital and anorectal symptoms. Between January 2002 and July 2003 one thousand and sixty nulliparous pregnant women were recruited from ten midwifery practices in the Netherlands. Eligible women had to be nulliparous women with a low-risk singleton pregnancy between 12 and 18 weeks gestation, and the women needed to have a good knowledge of the Dutch language. Exclusion criteria were previous anorectal surgery, inflammatory bowel disease, anorectal abnormalities, diabetes mellitus and neurological disorders. The participating midwives gave all consecutive nulliparous pregnant women verbal and written information about the study and after one week these women were asked to participate. Figure 1 shows the included and excluded women. One hundred and six women were not eligible. Five hundred and twenty-four women (55%) agreed to participate in the study. The main reasons women refused to participate were time investment and the intimate nature of the questions. Thirty-seven women were considered lost to follow-up, because less than three questionnaire were returned. Included were women who returned all questionnaire but who partially completed one questionnaire.

The Medical Ethics Committee of the University Medical Center Utrecht approved the study. All participants signed an informed consent.

*Measurements*

Women were asked to complete a self-report questionnaire at 12 and 36 weeks gestation, and 3 and 12 months after delivery. At the time of the study there was no validated questionnaire about defecatory symptoms available in Dutch. Questions about defecatory symptoms were selected from an instrument similar in lay-out to the UDI[14], we called the Defecatory Distress Inventory (DDI). This questionnaire was developed in our university center. After reading literature and the international definitions, interviewing patients who presented with constipation or fecal incontinence, and by interviewing three experts in the field from our hospital, a selection of questions was made. In appendix B the questions from the DDI to assess the presence of defecatory symptoms are shown. Each item measures whether a symptom is present or not. In a population based study in the Netherlands, a total of 2259 women answered a questionnaire on pelvic floor symptoms [15]. Factor analysis, using a principal axis factoring model with varimax rotation, showed four distinct domains (constipation, fecal incontinence, painful defecation and flatus incontinence). Cronbachs' alpha, as a measurement of internal consistency of these domains, ranged between 0.71-0.78. To analyze which associated factors could be identified for de novo symptom develop for the first time after childbirth, we divided our sample of 487 women in two subpopulations: Group 0 (reference group) consisted of women without defecatory symptoms during their first pregnancy and at 12 months after childbirth. Group 1 (de novo symptoms) consisted of women who did not experience symptoms during

pregnancy and developed defecatory symptoms after first childbirth. Excluded from this sub analysis were all women who reported defecatory symptoms during pregnancy. In the Netherlands, midwives are responsible for providing primary obstetrical care of healthy pregnant women. If pregnancy-related problems occur, the obstetrician/gynecologist is consulted. Deliveries performed by midwives and gynecologist are all registered in the Dutch National Obstetric Database (LVR). All obstetrical data of the participants were abstracted from this LVR. Educational level was dichotomized into primary school and secondary school or higher. Body Mass Index (BMI) was calculated ($kg/m^2$).

*Statistics*

Bivariate analyses were performed within the groups examining the association between maternal, obstetrical and neonatal variables and defecatory symptoms. In univariate analysis, the fisher exact was used to assess the significance of the associations for categorical variables and the non-parametric Mann-Whitney test for continuous variables. Where appropriated odds ratios (OR) with 95% confidence intervals (CI) were calculated. Multivariate analysis was used to calculate adjusted odds ratios for factors that were significantly associated in univariate analysis. Associated factors that were analyzed are maternal age, BMI at 12 months postpartum, educational level, chronic disease, medication use, marital state, defecatory symptoms at 12 weeks gestation, gestational age at delivery, duration of second stage of labour, infant birth weight, smoking, alcohol use, fetal presentation at delivery, mode of delivery and perineal state. The McNemar test was used for matched and paired data. Data were analyzed using SPSS 11.5. A p-values $< 0.05$ was considered to be statistical significant.

## RESULTS

Table 1 shows the characteristics of the study population. None of the women were still breastfeeding their child one year postpartum.
At 12 weeks gestation 274 (56.7%) women experienced one or more defecatory symptoms, at 36 weeks 223 (56.0%) women, three months postpartum 242 (53.1%) women and 12 months postpartum 191 (46.9%) women. The mean number of symptoms was 4.2 (SD 0.87) at 12 weeks, 4.3 (SD 0.88) at 36 weeks gestation, 4.3 (SD 0.82) 3 months postpartum and 4.2 (SD 0.75) 12 months postpartum. The point prevalences of defecatory symptoms according to gestational age with a follow-up of 12 months postpartum are shown in table 2. Almost all defecatory symptoms are already reported in early pregnancy, and remain more or less stable throughout pregnancy and after delivery. Except for the prevalence of fecal incontinence, that increases two-fold to 5.7 percent three months after delivery. However, one year after delivery the prevalence of fecal incontinence returns to early pregnancy values (3.3%). No statistical significant differences were found in the prevalence of fecal incontinence at 36 weeks gestation, 3 and 12 months postpartum compared to the prevalence at 12 weeks gestation.
In table 3 to 6 the associations between obstetric and non-obstetrical variables and defecatory symptoms 1 year after childbirth are shown. The variables that were statistical significantly associated with defecatory symptoms in univariate analysis are shown. In multiple logistic regression analysis, the main predictive factor for the presence of the constipation 12 months postpartum was the presence of the symptom at 12 weeks gestation (B 26.4 [8.5-81.6]). This same pattern was seen for the other defecatory symptoms. The only exception was fecal incontinence, in which a 3rd/4th degree sphincter tear was independently associated with the occurrence of fecal incontinence 12 months postpartum (B 6.8 [4.2-11.0]).
Sixty percent of the women who experienced constipation at 12 weeks gestation improved and did not experience constipation postpartum. Sixty-two percent of the women with painful defecation symptoms at 12 weeks gestation improved and were symptom free postpartum. Fifty-five percent of all women with flatus incontinence at 12 weeks gestation still experienced these symptoms after childbirth whereas 45% improved. Forty-four percent of women with fecal incontinence improved and were symptom free postpartum. Table 7 shows the prevalence of de novo defecatory symptoms with a follow-up period of one year after delivery. These women reported no symptoms during pregnancy and developed these symptoms after childbirth.
By evaluating symptoms during and after a first pregnancy it was possible to analyze potential associated risk factors for defecatory symptoms arising de novo after childbirth. The variables that were associated with de novo defecatory symptoms in univariate and multivariate analysis are shown in table 8. In women who developed de novo painful defecation after childbirth a higher infant birth weight was a statistical significant associated factor (3688 grams versus 3491grams, B1.001 [1.00-1.02], p=0.012). Women who developed de novo fecal incontinence were statistical significantly more likely to have had a 3rd/4th degree anal sphincter rupture (OR 8.0 [4.6-13.8]).

## Discussion

A prospective cohort study was undertaken to report on the prevalences and the onset of defecatory symptoms during and after first pregnancy and to identify associated factors for the occurrence of these symptoms. We showed that the occurrence of defecatory symptoms was not solely related to the postpartum period. Most symptoms were already present at 12 weeks gestation and this factor itself is highly predictive for reporting symptoms 12 months postpartum. Only the prevalence of fecal incontinence increases two-fold 3 months after delivery, but it returns to pregnancy levels at 12 months postpartum. A 3rd/4th degree anal sphincter tear was also associated with de novo developed fecal incontinence. De novo painful defecation was significantly associated with a higher infant birth weight.

*Prevalence*

In the present study fecal incontinence was already present in 3.9% at 12 weeks gestation and increases twofold three months postpartum (5.7%) and decreases to 3.3% one year after delivery. The same pattern was shown for flatus incontinence. When comparing our data with the literature on this subject, we found higher antenatal prevalences of both fecal and flatus incontinence[1-8, 16]. This difference may be due to the fact that we used a standardized self-report postal questionnaire, which was anonymously processed as compared to the data in other studies in which symptoms were assessed during an interview. Fecal incontinence symptoms are known to be embarrassing and therefore underreported[17]. Women are reluctant to consult a doctor about their fecal incontinence[3]. Possibly, the use of postal questionnaires made women more comfortable in answering questions on these anorectal symptoms.

Constipation was present at 12 weeks gestation in 8.9% of women and decreased to 4.2 % one year after childbirth. Our reported prevalence of constipation during pregnancy is slightly lower that that reported in a literature review (11-38%)[18]. This may be due to definitions used. In our study, women were considered constipated if they had less than 3 bowel movements a week in combination with straining in more than 25% of the time to have a bowel movement. This may account for the slightly lower reported prevalence in our study.

Almost one in 3 women reported to have symptoms of pain before, during or shortly after defecation as early as from 12 weeks gestation on. As far as we are aware, no comparable data are present in literature. The same is true for the symptoms of a sensation of anal blockage.

*Associated factors*

We decided not to ask at 12 weeks if woman had symptoms before pregnancy, because of the risk of recall bias. Therefore, we are not informed on the occurrence of defecatory symptoms in the first 12 weeks of pregnancy or before pregnancy. Although we did not have this information, it is striking that the most consistent predictive factor for the occurrence of symptoms one year after delivery was the presence of the symptom at 12 weeks gestation. It was equally significantly present in

both the univariate and multivariate analysis. Therefore, the changes occurring in anorectal function during pregnancy appear to be of more importance as compared to those induced by the delivery. The only exception is the occurrence of fecal incontinence, that was not only associated with the presence at 12 weeks, but also with the occurrence of an anal sphincter rupture during childbirth.

As has been shown in other studies, a 3rd or 4th degree anal sphincter tear was associated with fecal incontinence one year after childbirth.[1, 3, 4, 6, 8-12] . Three percent of women in our study developed de novo fecal incontinence after childbirth. This is similar to the percentage reported in other reports[1, 3, 8]. A forceps delivery has been associated with the development of fecal incontinence. In our study an instrumental delivery was performed in 17.5% of women. A vacuum extraction was performed in 16.2% and a forceps delivery in only 1.3% of cases. We did not find an association between fecal incontinence and a forceps delivery, but the number of forceps deliveries in our study is too small to make a definitive statement.

Flatus incontinence has also been associated with a third degree anal sphincter tear, higher maternal age and instrumental vaginal delivery[6, 12, 19]. A recent meta-analysis concluded that in 26.9% a disruption of the anal sphincter occurs with the first vaginal delivery[20]. As is clear from the prevalences figures on fecal incontinence after childbirth, these anatomical defect do not always result in anorectal symptoms[8, 21, 22]. Furthermore, none of these studies entered the presence of the symptom in pregnancy as a potential associated factor in the analysis. By doing so, we could not demonstrate an association between anal sphincter tear and flatus incontinence.

The presence of constipation at 12 weeks gestation and a lower BMI were associated with constipation 12 months postpartum. De novo constipation was borderline associated with "younger" age. As far as we know, no other data on the association between pregnancy variables and constipation are available in literature.

The strength of this study is that we have used a prospective longitudinal cohort study design with a follow-up period of one year after childbirth. By evaluating symptoms during and after a first pregnancy it was possible to separate defecatory symptoms arising after childbirth. For analyzing defecatory symptoms the same standardized questionnaire was used for all measurements. There are also some limitations we need to address. First, the high prevalence of defecatory symptoms recorded with the DDI might be the result of selection bias. Forty-six percent of the women who met the inclusion criteria refused to participate in the study. The most common reasons were time investment and the intimate nature of the questions. However, the mode of delivery in our study population was not different from the mode of delivery of low-risk Dutch nulliparous women in 2003. This makes a significant participation bias not likely.

Secondly, defecatory symptoms were not confirmed with objective measures and we did not assess defecatory symptoms with a validated questionnaire. We choose not to do objective tests because it would have affected the participation and continuation rates and consequently bias the final analysis. At time of the study no validated questionnaire to asses defecatory symptoms was available in the Dutch language. We develop a questionnaire after reading literature and interviewing patients. The same

lay-out as the Urogenital Distress Inventory was used[14]. The UDI is standardized and validated for the Dutch female population. Our questionnaire has good face validity and internal consistency. It must keep in mind that a self-report and thus symptom-based questionnaire was used.

In conclusion, defecation symptoms that are already present in early pregnancy are highly predictive for reporting symptoms at 12 months postpartum. The only exception is fecal incontinence, which is mainly related to anal sphincter lesion. Therefore, future investigations on the association between pregnancy/delivery and anorectal function have to include and correct for symptoms already present in early pregnancy.

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**Table 1 Patients characteristics and obstetrical and neonatal data**

| | | mean | SD |
|---|---|---|---|
| **Age at delivery** (years) | | 30.3 | 3.7 |
| **BMI at inclusion** (kg/m$^2$) | | 23.7 | 3.8 |
| | | N=487 | % |
| **Marital state** | | | |
| *married or cohabiting* | | 472 | 96.9% |
| *single or divorced* | | 15 | 3.1% |
| **Educational level** | | | |
| *primary* | | 25 | 5.1% |
| *secondary or more* | | 460 | 94.9% |
| **Smoking** | | | |
| *yes* | | 56 | 11.5% |
| *no* | | 431 | 88.5% |
| **Mode of delivery** | | | |
| *Spontaneous Vaginal Delivery (SVD)* | | 314 | 64.5% |
| *Instrumental Vaginal Delivery (IVD)* | | 85 | 17.5% |
| | *Vacuum extraction* | 79 | 16.2% |
| | *Forceps delivery* | 6 | 1.3% |
| *Caesarean Section* | | 88 | 18.0% |
| | *elective* | 38 | 7.8% |
| | *emergency* | 50 | 10.2% |
| **Perineal state after vaginal delivery** | | | |
| *Intact* | | 64 | 16.0% |
| *1st - 2nd degree tear* | | 124 | 31.1% |
| *3rd - 4th degree tear* | | 25 | 6.3% |
| *episiotomy* | | 186 | 46.6% |
| | | | |
| **Neonatal data** | | mean | SD |
| *gestation (days)* | | 278.2 | 13.3 |
| *birth weight(grams)* | | 3416.2 | 580.4 |

**Table 2 Point prevalence of defecatory symptoms during pregnancy and after first pregnancy for all participants**

| | 12 weeks gestation | 36 weeks gestation | | 3 months postpartum | | 12 months postpartum | |
|---|---|---|---|---|---|---|---|
| | N=487 | N=400 | p-value | N=457 | p-value | N=407 | p-value |
| constipation | 8.9% | 4.5% | 0.001 | 4.6% | 0.003 | 4.2% | 0.001 |
| painful defecation | 29.9% | 25.3% | 0.070 | 28.7% | 0.727 | 22.1% | 0.008 |
| sensation of anal blockage | 42.4% | 35.0 | 0.000 | 26.7% | 0.000 | 27.5% | 0.000 |
| feeling of incomplete evacuation | 10.8% | 9.5% | 0.609 | 12.4% | 0.326 | 12.5% | 0.302 |
| flatus incontinence | 34.6% | 42.3% | 0.005 | 31.9% | 0.162 | 30.5% | 0.206 |
| fecal incontinence | 3.9% | 3.0% | 0.286 | 5.7% | 0.248 | 3.3% | 1,000 |

values are percentages
the McNemar test was performed. Data is compared to 12 weeks
p-value < 0.05 was considered statistical significant

**Table 3 Univariate and multivariate analysis of statistical significant associated risk factors for constipation 1 year after delivery in 407 primiparous women**

| **Constipation** | | | **univariate analysis** | | **multivariate analysis** | |
|---|---|---|---|---|---|---|
| | | test | **mean** | **p** | **B[95%CI]** | **p** |
| BMI (kg/m2) | *yes* | M | 21.9 | 0.001 | 0.81 [0.67-0.98] | 0.038 |
| | *no* | | 24.1 | | | |
| | | | **OR [95% CI]** | **p** | | |
| symptom present at 12 weeks gestation | | X | 26.7 [9.2-78.1] | 0.000 | 26.4 [8.5-81.6] | 0.000 |

p=p-value p<0.05 was considered to be statistical significantM= Mann Whitney test

X= Fisher exact test

Multivariate logistic regression analysis was performed and values with p<0.05 were entered in the model

**Table 4 Univariate and multivariate analysis of statistical significant associated risk factors for painful defecation 1 year after delivery in 407 primiparous women**

| **Painful defecation** | | | **univariate analysis** | | **multivariate analysis** | |
|---|---|---|---|---|---|---|
| | | test | **mean** | **p** | **B[95%CI]** | **p** |
| age (years) | *yes* | M | 29.7 | 0.030 | 0.81 [0.67-0.98] | 0.038 |
| | *no* | | 30.8 | | | |
| | | | **OR [95% CI]** | **p** | | |
| symptom present at 12 weeks gestation | | X | 4.22 [2.6-6.9] | 0.000 | 4.12 [2.5-6.8] | 0.000 |

p=p-value p<0.05 was considered to be statistical significantM= Mann Whitney test

X= Fisher exact test

Multivariate logistic regression analysis was performed and values with p<0.05 were entered in the model

**Table 5 Univariate and multivariate analysis of statistical significant associated risk factors for flatus incontinence 1 year after delivery in 407 primiparous women**

| **Flatus incontinence** | | | **univariate analysis** | | **multivariate analysis** | |
|---|---|---|---|---|---|---|
| | | test | **mean** | **p** | **B[95%CI]** | **p** |
| BMI (kg/m2) | *yes* | M | 24.8 | 0.024 | 1.08 [1.02-1.13] | 0.008 |
| | *no* | | 24.1 | | | |
| | | | **OR [95% CI]** | **p** | | |
| symptom present at 12 weeks gestation | | X | 6.3 [3.9-10.0] | 0.000 | 6.82 [4.2-11.0] | 0.000 |

p=p-value p<0.05 was considered to be statistical significantM= Mann Whitney test

X= Fisher exact test

Multivariate logistic regression analysis was performed and values with p<0.05 were entered in the model

**Table 6 Univariate and multivariate analysis of statistical significant associated risk factors for fecal incontinece 1 year after delivery in 407 primiparous women**

| **Fecal incontinence** | | | **univariate analysis** | | **multivariate analysis** | |
|---|---|---|---|---|---|---|
| | | test | **mean** | **p** | **B[95%CI]** | **p** |
| birth weigth (grams) | *yes* | M | 3107 | 0.043 | 0.99 [0.99-1.01] | 0.421 |
| | *no* | | 3445 | | | |
| | | | **OR [95% CI]** | **p** | | |
| symptom present at 12 weeks gestation | | X | 22.8 [6.9-75.0] | 0.000 | 2.6 [0.9-12.1] | 0.771 |
| perineal state | | | | | | |
| | *no rupture* | | | | | |
| | *1st/2nd degree tear* | X | 0.58 [0.1-6.5] | 1.000 | | |
| | *3rd/4th degree tear* | | 15.17 [1.8-127.2] | 0.031 | 6.82[4.2-11.0] | 0.000 |
| | *episiotomy* | | 2.87 [0.5-14.1] | 0.304 | | |

p=p-value p<0.05 was considered to be statistical significantM= Mann Whitney test

X= Fisher exact test

Multivariate logistic regression analysis was performed and values with p<0.05 were entered in the model

**Table 7 The prevalence of de novo defecatory symptoms one year after first childbirth**

| | Group 0 | Group 1 |
|---|---|---|
| **constipation** | 318 (93.5%) | 7 (2.1%) |
| **painful defecation** | 215 (63.0%) | 40 (11.7%) |
| **flatus incontinence** | 167 (49.0%) | 29 (8.5%) |
| **fecal incontinence** | 322 (94.7%) | 9 (2.6%) |

The values are numbers (percentages)
Group 0 (no symptoms during and after pregnancy) is the reference group
Group 1 de novo symptoms developed after childbirth

**Table 8 The statistical significantly associated factors for de novo defecatory symptoms one year after childbirth**

| | | de novo symptoms | no symptoms | p-value | OR [95%CI] |
|---|---|---|---|---|---|
| **Constipation** | | | | | |
| | maternal age | 27.7(0.89) | 30.5(0.21) | 0.032 | |
| **Painful defecation** | | | | | |
| | weight gain in pregnancy (kilograms) | 13.7(0.29) | 12.3(0.71) | 0.024 | |
| | infant birth weight (grams) | 3688(77.9) | 3491(37.3) | 0.03 | |
| | maternal age (years) | 29.2(1.7) | 30.6 (0.7) | 0.017 | |
| **Flatus incontinence** | | | | | |
| | - | - | - | - | |
| **Fecal incontinence** | | | | | |
| | 3rd/4th degree rupture | 2.,6% | 4.3% | 0.019 | 8.0 [4.6-13.8] |

Values are means (SE) or percentages
Only significant association are shown, $p<0.05$ was considered statistical significant
$\chi 2$ and Mann-Whitney test were performed

*Chapter 7*

# Which factors determine the sexual function one year after childbirth?

H.J. van Brummen
H.W. Bruinse
G. van de Pol
A.P.M. Heintz
C.H. van der Vaart

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## Abstract

**Objective:** To evaluate which factors determine sexual activity and the satisfaction with the sexual relationship one year after the first delivery.
**Design:** Prospective longitudinal cohort study
**Setting:** Ten midwifery practices
**Population:** 377 nulliparous women were included.
**Methods:** The Maudsley Marital Questionnaire is a standardized and validated questionnaire with 15-items relating to marital and sexual adjustment, with a nine-point (0-8) scale appended to each question. Scores on the sexual scale (MMQ-S) range from 0 to 40. Higher scores are indicative of greater dissatisfaction. Sexual intercourse was dichotomized into having sexual intercourse or not having sexual intercourse. Several obstetrical and maternal factors were analyzed.
**Main outcome measurements:** Sexual intercourse and MMQ-S scale
**Results:** In multiple logistic regression analysis, the main predictive factor for no sexual intercourse one year postpartum was no sexual intercourse at 12 weeks of gestation (B 11.0 [4.01-30.4]). Women were 5 times less likely to be sexually active after a 3rd /4th degree anal sphincter tear as compared to women with an intact perineum (B 0.2 [0.04-0.93]).). Dissatisfaction with the sexual relationship one year after childbirth, assessed with the MMQ S-scale, is associated with not being sexual active at 12 weeks gestation (ß – 0.208, p=0.004) and with an older maternal age at delivery (ß 0.405, p=0.032).
**Conclusion:** An important prognostic factor for a dissatisfied sexual relationship one year postpartum was not being sexual active in early pregnancy. Satisfaction with the sexual relationship seems not to depend on pregnancy and parturition associated factors.

## Introduction

Although little has been published about mode of delivery and postpartum sexual functioning, popular media, like Parents Magazine, report that women are concerned about potential negative effects of vaginal childbirth on their sexual health. Current topics suggest that childbirth influences sexual functioning and discuss questions like "does cesarean delivery improves one's sex life?"[1]. Such media reports reflect the believes that women who have cesarean delivery (CD) have better subsequent sexual functioning as compared to women who had a vaginal delivery. In addition, between 7% and 24% of obstetricians and 4.4% of midwives preferred CD for themselves or for their partner if male[2-5]. Urogynecologists scored even higher with 45.5% who would prefer a primary elective cesarean delivery[5]. Factors like the fear of childbirth (27%), perineal injury (80-93%), fetal injury (24-39%), fear of anal (83%) or urinary incontinence (81%), sexual dysfunction (58-59%), convenience (17-39%) and pain (7%) are all mentioned as the reason why they would prefer an elective CD to vaginal delivery[2-5]. Women's concerns about sexual functioning after childbirth are not unfounded. In a recent review an association between assisted vaginal delivery and degree of perineal pain and dyspareunia was suggested[6]. However, the reported associations between CD and sexual dysfunction are inconsistent[7, 8].
The aim of this prospective study was to evaluate which factors determine sexual activity and the satisfaction with the sexual relationship one year after the first delivery.

## METHODS

*Study population*

A prospective cohort study was undertaken to investigate the impact of first pregnancy and delivery on the pelvic floor. Between January 2002 and July 2003 five hundred and twenty-four nulliparous pregnant women were recruited from ten midwifery practices in the Netherlands. Eligible women had to be nulliparous women with a low-risk singleton pregnancy between 12 and 18 weeks gestation and all women needed to have a good knowledge of the Dutch language. Exclusion criteria were previous anorectal or urogynaecological surgery, anorectal and urogenital abnormalities, diabetes mellitus and neurological disorders. The participating midwives gave all consecutive nulliparous pregnant women verbal and written information about the study and after one week these women were asked to participate by phone. The Medical Ethics Committee of the University Medical Centre Utrecht approved the study. All participants signed an informed consent.

*Measurements*

Women were asked to complete a self-report questionnaire at 12 and 36 weeks gestation, and 3 and 12 months after delivery. The Maudsley Marital Questionnaire (MMQ) was used to evaluate the satisfaction with the sexual relationship during and after pregnancy. The MMQ is a standardized and validated questionnaire with 15-items relating to marital and sexual adjustment, with a nine point (0-8) scale appended to each question[9-11]. Scores on the sexual scale (MMQ-S) range from 0 to 40, while those on the marital scale (MMQ-M) range from 0 to 80. Higher scores are indicative of greater adjustment problems. The sexual function scale consists of five questions shown in appendix C. Sexual intercourse is defined as the situation in which the erect penis enters the vagina at least for a short period, irrespectively of whether ejaculation occurs. Sexual intercourse was dichotomized into having sexual intercourse or not having sexual intercourse.

Data were analyzed on whether women had sexual intercourse first and thereafter on the MMQ sexual scale. Other potential determinants for sexual functioning in relation to childbirth that were analyzed included cohabiting (yes/no), maternal age, age of partner, duration of the relationship, perineal state (no rupture, 1st/2nd degree, 3rd/4th degree and episiotomy), mode of delivery (spontaneous vaginal delivery (SVD), instrumental vaginal delivery (IVD) or cesarean delivery (CD)), infant birth weight, second stage of labour, sexual activity at 12 weeks gestation, and sexual scale at 12 weeks gestation.

In the Netherlands the midwife is responsible for providing obstetrical care of healthy low risk pregnant women. If pregnancy-related problems occur, the obstetrician/gynaecologist is consulted. Deliveries performed by midwives and gynaecologists are registered in the Dutch National Obstetric Database (LVR). Obstetrical data of the participants were abstracted from this database.

*Statistics*

Values are expressed as number (percentages) or mean (standard error (SE)). In univariate analysis, the Fisher exact test was used to assess the significance of the associations for categorical variables and the Mann-Whitney test for continuous variables. Where appropriate odds ratios (OR) with 95% confidence intervals (CI) were calculated. Multivariate analysis was used to calculate adjusted odds ratios (B [95%CI]) for factors that had a p-value < 0.10 in univariate analysis. Multiple linear regression analyses were performed to identify associated factors for continuous variables. The McNemar test was used for matched and paired categorical data and paired continuous data were analyzed with the Wilcoxon signed rank test. Data was analyzed using SPSS 11.5. A p-values < 0.05 was considered to be statistical significant.

*Results*

Five hundred and twenty-four women agreed to participate in the study. Thirty-seven women were considered lost to follow-up because less than three questionnaires were returned and completed. Fifty women were excluded from the analysis because they were pregnant again when completing the final questionnaire. Nine women did not have a sexual relationship because they were single mothers and were also excluded for this analysis. In this analysis 377 women who returned both postpartum questionnaires were included. Women, who only returned one questionnaire postpartum, did not differ in sexual activity (at 3 months pp 82.1% versus 81.4% (p=1.000) as compared to the women included in this analysis. Table 1 shows the characteristics of the study population.

Table 2 shows the data on sexual function at 3 and 12 months after first delivery. Table 3 shows the univariate and multivariate analysis to identify possible determinants associated with sexual intercourse 12 months after childbirth. None of the women were breastfeeding their child. In multiple logistic regression analysis, the main predictive factor for no sexual intercourse one year postpartum was no sexual intercourse at 12 weeks of gestation (B 11.0 [4.01-30.4]). The other factor associated was a 3$^{rd}$ /4$^{th}$ degree anal sphincter rupture. Women who were not sexually active at 12 weeks gestation had a 11 times higher chance of not being sexually active one year postpartum. After a 3$^{rd}$ /4$^{th}$ degree anal sphincter tear women were 5 times less likely to be sexually active one year postpartum (B 0.2 [0.04-0.93]).

A multiple lineair regression analyses were performed to determine which factors could predict the satisfaction with the sexual relationship. Dissatisfaction with the sexual relationship one year after childbirth, assessed with the MMQ S-scale, is associated with not being sexual active at 12 weeks gestation (ß – 0.208, p=0.004) and with an older maternal age at delivery (ß 0.405, p=0.032). On the average those who did not have sexual intercourse at 12 weeks of gestation scored 0.208 higher in the MMQ S-scale, and an increase of one year in maternal age was associated with an increase in 0.405 in MM S-scale. To get a better insight in the relationship between maternal age and the satisfaction with the sexual relationship, we categorized the MMQ S-scale (range 0-34) in three different groups. The first group had a score between 0 and 10, the second group a score between 11 and 20 and the third group

21 to 34. The first group had a mean age at delivery of 30.1(0.21) years, the second group 30.7 (0.40) years of age and the third group 31.5 (0.77) years of age at delivery.

## Discussion

This prospective study in primigravid women shows that the satisfaction with sexual relationship one year after first delivery is not related to the mode of delivery. The most important predictive factor for being dissatisfied with the sexual relationship and for not being sexual active one year postpartum was not being sexual active in early pregnancy.

Several studies have shown that in the first three months after childbirth 22 to 86% of women report sexual problems[8, 12, 13]. The percentage of women who are sexually active at 3 and 12 months postpartum in our study is in concordance with other studies[13-15].

The focus of the MMQ is on the satisfaction with the sexual relationship[9-11]. To our knowledge we were the first to investigate which factors determine the satisfaction with sexual relationship one year after childbirth. We demonstrated that not being sexually active at 12 weeks of gestation and an older maternal age are important determinant factors for being dissatisfied with the sexual relationship 12 months postpartum. To our knowledge, no data in literature are available on the association between the satisfaction with the sexual relationship and potential determinants. Most research focused on perineal pain/dyspareunia in relation to mode of delivery. A recent review on postpartum sexual functioning and method of delivery reported a greater risk for perineal pain among women after assisted vaginal delivery[6-8, 12, 16-18]. The reported associations between CD and perineal pain/ dyspareunia, and delay in resumption of sexual intercourse were inconsistent[7, 8, 17, 18]. Because no questions about perineal pain/dyspareunia are included in the MMQ, we cannot make any statement about associations with type of delivery.

The relationship between maternal age and dissatisfaction with the sexual relationship cannot be explained by the possibility that other children may disproportionately burden older women, given that all women in this study were nulliparous. It may reflect life style and career differences between older and younger women. Or the association may have a more biologic basis that is related to the healing process, because in previous research the association between pain on sexual intercourse and an older maternal age was found[19].

Most studies on the effect of method of delivery on sexual functioning were of a retrospective design, did not used validated measures, or measured only short-term outcomes. Only one study used a validated sexual health measurement, but had a retrospective study design[12]. All studies, except one, had a follow-up time of less than 9 months. Unfortunately, this particular study with a follow-up period of 18 months also used a retrospective design[17]. Recall bias is a major drawback in all-retrospective studies, and therefore results from these types of studies have to be interpreted with caution. One study had a prospective design but a relative short follow-up period of 24 weeks after childbirth[8]. In these different studies, factors like assisted vaginal delivery, perineal damage, parity and marital state were suggested to be associated with sexual dysfunction after childbirth[7-12, 16-18]. In our prospective study, whether woman engaged in sexual intercourse one year postpartum was only independently associat-

ed with a 3rd/4th degree anal sphincter tear and being sexually activity in early pregnancy. It is known that perineal damage is associated with dyspareunia and pain can be of influence on whether women engaged in sexual intercourse[6-8, 12, 16-18]. Whether women were sexual active at 12 weeks gestation may be a reflection of the sexual function before pregnancy. We were not informed about sexual relationship before pregnancy and we cannot make any statement about the effect of the sexual relationship before pregnancy and the effect of this postpartum. Further research is necessary not only to confirm our data, but also to evaluate the effect of the sexual relationship before pregnancy, the effect of following pregnancies, other socio-demographic variables, cultural influences, and the partner's prospective.

There are some limitations we need to address. First, selection bias may be a problem. However, the mode of delivery in our study population was not different from the mode of delivery of low-risk Dutch nulliparous women. This makes a significant participation bias not likely.

Secondly, the validity of results on human sexuality can be impaired by terminological problems, which are difficult to manage adequately in questionnaire studies. From interview studies it is concluded that many female participants do not adequately understand the term "orgasms" or "intercourse"[20, 21]. We tried to avoid this by using a validated questionnaire for the Dutch population, to give good instruction and by emphasizing that the participants could also contact the main investigator if they had questions.

Thirdly, we were not informed about the interpretation of the partner about their sexual relationship. Women are reluctant to speak about their sexual relationship. To avoid low inclusion numbers we decided not to include the sexual partner and we focused on the women's own experience.

Fourthly, only 23 of the 377 women were not sexually active one year postpartum. This is a relatively small number of women. Further research with greater power is necessary to confirm our findings.

In conclusion, the most important prognostic factor for a dissatisfied sexual relationship one year postpartum was not being sexual active in early pregnancy. Satisfaction with the sexual relationship one year after first childbirth seems not to depend on pregnancy and parturition associated factors.

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**Table 1 Characteristics of the study population**

| | mean | SE |
|---|---|---|
| **Age at delivery** (years) | 30.3 | 0.18 |
| **BMI at inclusion** (kg/m$^2$) | 23.7 | 0.19 |
| | N=377 | % |
| **Marital state** | | |
| *married or cohabiting* | 365 | 96.9% |
| *single or divorced* | 12 | 3.1% |
| **Educational level** | | |
| *primary* | 19 | 5.1% |
| *secondary or more* | 358 | 94.9% |
| **Smoking** | | |
| *yes* | 43 | 11.5% |
| *no* | 334 | 88.5% |
| **Mode of delivery** | | |
| *Spontaneous Vaginal Delivery (SVD)* | 243 | 64.5% |
| *Instrumental Vaginal Delivery (IVD)* | 66 | 17.5% |
| *Vacuum extraction* | 61 | 16.2% |
| *Forceps delivery* | 5 | 1.3% |
| *Caesarean Delivery (CD)* | 68 | 18.0% |
| *elective* | 29 | 7.7% |
| *emergency* | 38 | 10.3% |
| **Perineal state after vaginal delivery** | | |
| *Intact* | 50 | 16.2% |
| *1st - 2nd degree tear* | 96 | 31.3% |
| *3rd - 4th degree tear* | 19 | 6.1% |
| *episiotomy* | 144 | 46.6% |
| | | |
| **Neonatal data** | mean | SE |
| *gestation (days)* | 278.2 | 0.68 |
| *birth weight(grams)* | 3416.2 | 33.9 |

**Table 2 Sexual function in primiparous women 3 and 12 months after delivery**

| | 3 months pp | | 12 months pp | | test | p-values |
|---|---|---|---|---|---|---|
| **Sexual intercourse** | *N* | *%* | *N* | *%* | | |
| yes | 307 | 81.4 | 354 | 93.9 | ⋆ | 0.000 |
| no | 70 | 18.6 | 23 | 6.1 | | |
| | *mean (SE)* | *range* | *mean (SE)* | *range* | | |
| **Sexual Scale MMQ** (range 0-40) | 11.09 (0.34) | 0-36 | 9.14 (0.33) | 0-34 | # | 0.000 |

The values are number (percentages) or means (standard error (SE))

⋆ Categorical values were compared with the McNemar test

# Continous variables were compared with Wilcoxon's signed rank test

**Table 3 Associated factors for sexual activity one year postpartum**

| | *univariate analysis* | | | | | | | *multivariate analysis* |
|---|---|---|---|---|---|---|---|---|
| | **Sexual intercourse** | | | | | | | |
| | **yes** | | **no** | | **p-value** | **test** | **OR [95%CI]** | **Adjusted OR [95% CI]** |
| | mean | SE | mean | SE | | | | |
| **maternal age (years)** | 30.29 | 0.19 | 31.77 | 0.67 | **0.041** | # | | 0.89 [0.74-1.06] |
| **BMI (kg/m2)** | 23.9 | 0.22 | 24.8 | 0.82 | 0.191 | # | | |
| **age of partner (years)** | 31.9 | 0.24 | 33.7 | 0.87 | **0.032** | # | | 0.99 [0.86-1.14] |
| **duration of relationship (years)** | 6.9 | 0.21 | 7.4 | 0.67 | 0.345 | # | | |
| **infant birth weight (grams)** | 3421.3 | 33.06 | 3604.9 | 44.59 | 0.062 | # | | 1.00 [0.99-1.001] |
| **second stage of labour** | 59.3 | 2.84 | 69.4 | 9.51 | 0.239 | # | | |
| | | | | | | | | |
| **mode of delivery** | N | % | N | % | | | | |
| SVD | 187 | 94.5 | 13 | 5.5 | r | | | |
| IVD | 51 | 91.1 | 5 | 8.9 | 0.556 | ⋆ | 0.71 [0.24-2.08] | |
| CD | 55 | 94.8 | 3 | 5.2 | 1,000 | ⋆ | 1.28 [0.35-4.63] | |
| **perineal state** | | | | | | | | |
| no rupture | 91 | 94.8 | 5 | 5.2 | r | | | |
| 1st/2nd degree | 73 | 92.4 | 6 | 7.6 | 0.310 | ⋆ | 0.42 [0.10-1.78] | |
| 3rd/4th degree | 13 | 81.3 | 3 | 18.7 | 0.078 | ⋆ | 0.27 [0.07-1.04] | **0.20 [0.04-0.93]** |
| episiotomy | 112 | 93.3 | 8 | 6.7 | 0.359 | ⋆ | 0.49 [0.12-1.89] | |
| **cohabiting** | | | | | | | | |
| yes | 346 | 93.8 | 23 | 6.2 | 1,000 | ⋆ | 1.02 [1.00-1.04] | |
| no | 8 | 100.0 | 0 | 0.0 | | | | |
| **sexual active at 12 weeks gestation** | | | | | | | | |
| yes | 323 | 97.0 | 10 | 3.0 | **0.000** | ⋆ | 12.8 [5.45-30.06] | **11.02 [4.01-30.4]** |
| no | 30 | 69.8 | 13 | 30.2 | | | | |

p< 0.05 was considered statistical significant and if significant it is highlighted in the table

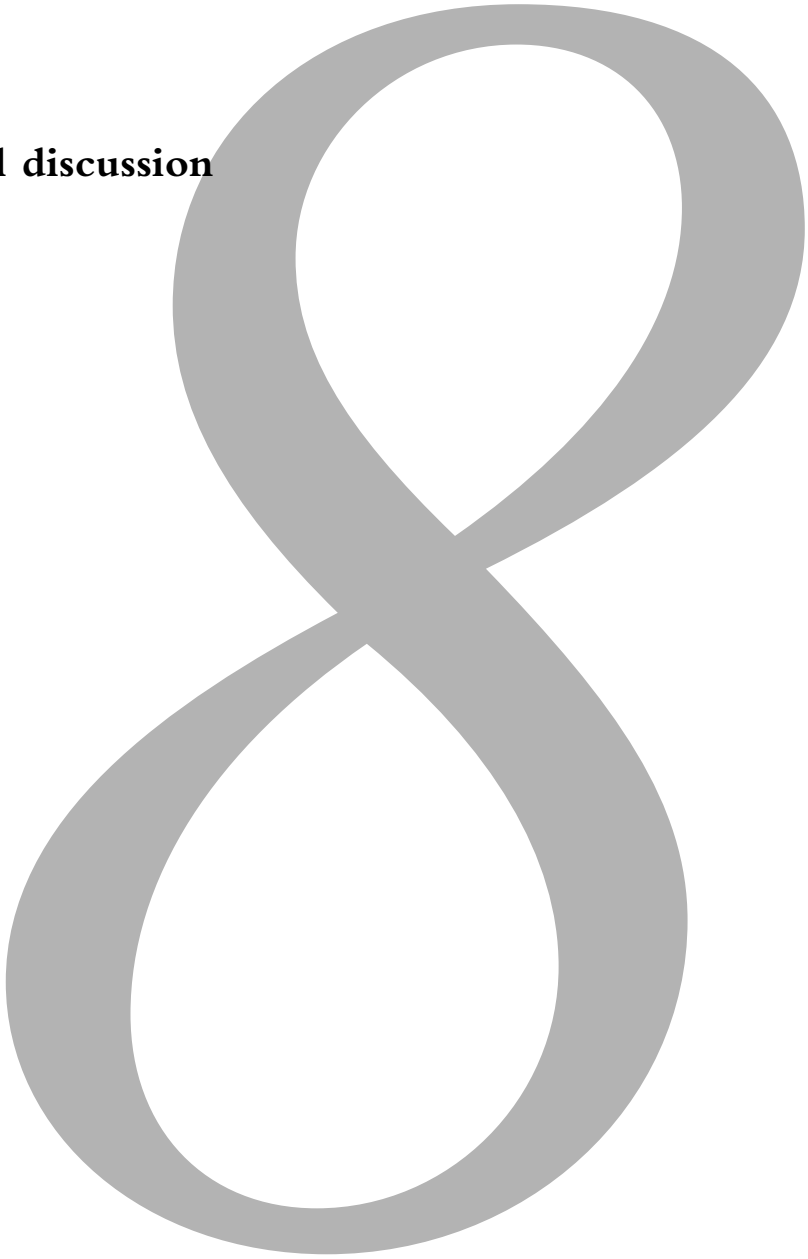
⋆ Categorical values were compared with the Fisher exact test

# Continous variables were compared with Mann U Whitney test

r = reference group

*Chapter 8*

# General discussion



In this thesis several questions regarding the prevalences of pelvic floor symptoms during and after first pregnancy and regarding the effects of pregnancy and delivery on pelvic floor function were addressed.

## UROGENITAL AND DEFECATORY SYMPTOMS

*Assessment of urogenital and defecatory symptoms*

Urogenital symptoms can be assessed objectively or subjectively. Objective test available are urodynamic investigation, pad tests and bladder diary. In 2002 Soroka et al[1] published a systematic review on pad tests, which showed a significant variability and repeatability of the pad test. Using a bladder diary, patients may register time of voiding and voided volume for a few days. This provides valuable information in initially detecting frequency, urgency and urge incontinence because it offers a quantitative measure of the symptomatic degree of motor urgency[2]. But, the accuracy of the self-reported diary is point of discussion[3-5]. Urodynamic testing has been the "golden standard" to assess urogenital symptoms for a long period, but it also has its limitations. The test-retest reproducibility and validity in several urodynamic tests are not convincing[6] and because urogenital symptoms may fluctuate[7] the assessment may be done on an asymptomatic day. *The bladder* is a notoriously bad witness, and the symptoms of frequency, nocturia and urgency may arise because of hypersensitivity of the bladder stretch but also may occur when the bladder contracts inappropriately due to detrusor over activity. Conventional urodynamic investigation fails to detect detrusor over activity in 62-74 percent of the women with frequency and/or urgency symptoms and in 53-62 percent of the women with urge incontinence symptoms[8-13]. Therefore, a normal urodynamic investigation cannot disprove the accuracy of a patient's history of urge incontinence, urgency and urge incontinence[14]. Subjective symptoms can measured with self-report questionnaires or in an interview. Khan et al looked whether the method of administration changed the outcome[15]. The authors concluded that postal questionnaire responses had a better relationship with urodynamics, both for urodynamic stress incontinence and detrusor overactivity, than interview-assisted questionnaire responses[15]. The International Continence Society (ICS) also uses definitions based on subjectively measured symptoms. But, using a questionnaire without objective assessment does not allow an accurate diagnosis of genuine stress incontinence or detrusor overactivity. The symptom of stress incontinence may be sensitive in predicting genuine stress incontinence, but there is a false-positive rate[16].

We choose to use the symptom-based ICS definitions for urogenital symptoms[17-19]. In our study, we followed a group of nulliparae prospectively from 12 weeks gestation until 1 year after delivery. A reference group of nulliparae without symptoms was used. The Urogenital Distress Inventory (UDI) was used to assess urogenital symptoms. The UDI is a standardized and validated questionnaire and translated in Dutch. This questionnaire consists of questions about urogenital symptoms and the discomfort experienced by these symptoms. Each item measures if a urogenital symptom is present and the amount of bother a woman experiences from that symptom. The

amount of bother is measured on a 4-point Likert scale ranging from no bother at all to slight, moderate and great bother.
Disease specific health related quality of life scores for pelvic floor symptoms were obtained from the Incontinence Impact Questionnaire (IIQ)[20 21]. The impact of pelvic floor symptoms were measured on five domains; emotional functioning, physical functioning, social functioning, mobility and embarrassment. The scores on the domains range from 0 to 100. A high score indicated that a person's well-being on that particular domain is negatively affected.
At the time of the study no validated questionnaire about defecatory symptoms was available in Dutch. Questions about defecatory symptoms were selected from an instrument similar in lay-out to the UDI[21], called the Defecatory Distress Inventory (DDI). This questionnaire was developed in our University centre. Questions were selected based on literature and international definitions and by interviewing patients with constipation or fecal incontinence, and by interviewing three experts in this field from our hospital. Each item measures whether a symptom is present or not. In a population based study in the Netherlands, a total of 2259 women answered a questionnaire on pelvic floor symptoms [22]. Factor analysis, using a principal axis factoring model with varimax rotation, showed four distinct domains (constipation, fecal incontinence, painful defecation and flatus incontinence). Cronbachs' alpha, as a measurement of internal consistency of these domains, ranged between 0.71 -0.78. Fecal incontinence symptoms are known to be embarrassing and therefore underreported[23]. Women are reluctant to consult a doctor about their fecal incontinence [24]. Possibly, the use of postal questionnaires made women more comfortable in answering questions on anorectal symptoms. We felt that postal questionnaires were the most appropriate way to assess defecatory symptoms. Therefore, we choose not to perform objective tests, like anal manometry, because it would have affected the participation and continuation rate and consequently bias the final analysis. So, our results have to be viewed from this symptom-based point of view.

*Prevalences for urogenital symptoms*
At the start of these investigations we were aware that other researchers already extensively addressed several questions regarding the prevalence for urogenital symptoms. The prevalence of urogenital symptoms in literature are high but vary depending on the definitions used, the study design, the follow-up period and the target population[25-30]. In many studies the definitions and recommendations of the ICS were followed but not all studies used standardized and validated questionnaires[25 31-36]. Not all studies collected the data prospectively. With a retrospective design recall bias is a major drawback. There was also a large variation in time at inclusion and follow-up period postpartum. Women were included at different times in pregnancy or in the puerperium and the follow-up period varied from 6 weeks postpartum to over a year. The target population differs between the studies. The distinction between primiparous and multiparous women has not always been made.
In our studies, urogenital symptoms were assessed with a standardized and validated questionnaire, Urogenital Distress Inventory (UDI) [20 21]. Our participants were

prospectively followed from 12 weeks gestation till one year postpartum. Prospectively collected measurements of LUTS during pregnancy and the postpartum period provide better validated data on the contribution of pregnancy and delivery on these symptoms. To measure the effect of pregnancy, we decided to only include nulliparous, healthy women with a singleton pregnancy.

Urogenital symptoms represent disorders in the normal micturition cycle and can be divided into storage, voiding and post-micturition symptoms[19]. Research on bladder symptoms during and after pregnancy has mainly focused on storage symptoms. Besides stress urinary incontinence, frequency and urgency are common symptoms during pregnancy[25-30 34-38 1-3,]. Our study results are in agreement with previous reports on the prevalence of lower urinary tract symptoms (LUTS) both antenatally and postnatally (Chapter 2 and 3). We found that voiding and post-micturition symptoms increase significantly with gestational age. In late pregnancy about half of the women experienced the feeling of incomplete bladder emptying in late pregnancy and 71% of the women experienced pain or discomfort in the vaginal area (Chapter 2).

In a non-pregnant population symptoms of bladder overactivity are increasingly becoming the subject of investigation. Information about the prevalences of dry and wet overactive bladder syndrome (OAB) are very scarce in pregnancy[28]. Although, there is still an ongoing discussion about the definition of OAB, the International Continence Society (ICS) has updated the definition for OAB into urgency, with or without urge incontinence, usually with frequency and nocturia [19]. We made the distinction between dry and wet OAB. Dry OAB was defined as having both the frequency and urgency symptoms. Wet OAB was defined as having frequency, urgency and urge incontinence. Dry and wet overactive bladder symptoms were pregnancy related symptoms. The prevalence of dry OAB was 45.2% in late pregnancy and 7.9% one year after first childbirth. Wet OAB (frequency, urgency and urge incontinence) was present in 14.6% in late pregnancy and in 3.5% one year after first childbirth (Chapter 5).

But there are some limitations we need to adress. Firstly, the nulliparous pelvis probably represents the best available clinical model of normal function. Despite their presumed normality, there is a significant incidence of urogenital symptoms in nulliparae. Therefore, it is difficult to describe the changes in symptoms that pregnancy is responsible for. The reported prevalences of urogenital symptoms in nulliparous non-pregnant women are 4 percent for the stress incontinence symptoms, 2 to 15 percent for urge incontinence and 8 percent for the genital prolapse symptom.[25 34-36 39] The prevalences we found in pregnancy are much higher than the prevalences in the pre pregnancy period. We feel that pregnancy itself is an important factor for these changes. Due to our study design, a prospective longitudinal cohort, we were not informed about the presence of symptoms before pregnancy and in the first 12 weeks of pregnancy. If this question had been included in the questionnaire recall bias might have become a problem. So, no statements can be made on the presence of urogenital symptoms before pregnancy and the effect of this postpartum.

*Prevalence for defecatory symptoms*

Prevalences rates for fecal or flatus incontinence before, during and after first pregnancy have been intensively studied[24 40-46]. When comparing our data with the literature on this subject, we found higher antenatal prevalences of both fecal and flatus incontinence[24 40-47]. Fecal incontinence was already present in 3.9% at 12 weeks gestation and increases twofold three months postpartum (5.7%) and decreases to 3.3% one year after delivery. This difference may be due to the fact that we used a standardized self-report postal questionnaire, which was anonymously processed as compared to the data in other studies in which symptoms were often assessed during an interview. Fecal incontinence symptoms are known to be embarrassing and therefore underreported[23]. Women are reluctant to consult a doctor about their fecal incontinence[24]. Possibly, the use of postal questionnaires made women more comfortable in answering questions on these anorectal symptoms.

In the last two decades, attention has been mainly focused on the association between pregnancy and delivery and the occurrence of flatus or fecal incontinence. Despite the fact that anorectal function alters during and after pregnancy, little is known about the prevalence of other defecatory symptoms, such as painful defecation, obstructive defecation and constipation during and after first pregnancy[48].

We showed that constipation was present at 12 weeks gestation in 8.9% of women and decreased to 4.2 % one year after childbirth (Chapter 6). Our reported prevalence of constipation during pregnancy is slightly lower that that reported in a literature review (11-38%)[49]. This may be due to definitions used. In our study, women were considered constipated if they had less than 3 bowel movements a week in combination with straining in more than 25% of the time to have a bowel movement. In other studies, women had to have less than 3 bowel movements per week to experience constipation and straining was not included in the definition. This may account for the slightly lower reported prevalence of constipation in our study. Almost one in 3 women reported to have symptoms of pain before, during or shortly after defecation as early as from 12 weeks gestation on. As far as we were aware, no comparable data were present in literature. Also no data were available for a sensation of anal blockage.

*Risk factors for urogenital symptoms*

With regard to the risk factors for urogenital symptoms, the effect of childbirth has received considerable attention. The focus has been on postpartum urinary incontinence symptoms. Factors that have been consistently associated with urinary incontinence are vaginal delivery, BMI and maternal age. When correlating obstetrical variables with urinary incontinence no consistent findings have been reported [25 26 34 35 50-52]. Besides a vaginal delivery, we also found the association between a higher BMI and SUI one year postpartum (Chapter 3) and bothersome stress incontinence symptoms were associated with an older maternal age at delivery (Chapter 4). Stress incontinence at 12 weeks gestation was found to be predictive for stress incontinence one year postpartum both in univariate and multivariate analysis. Foldspang et al and Schytt et al have reported that urinary incontinence in the third trimester of preg-

nancy and in the first 2 months after childbirth are important predictors for urinary incontinence 1 year postpartum[31 53]. However, both studies retrospectively collected data at one year postpartum on the presence of UI during pregnancy and in the first months after delivery. Our participants were prospectively followed from 12 weeks gestation till one year after postpartum. Due to our study design we were able to identify the presence of stress incontinence even in early pregnancy as an important predictive factor for symptoms after childbirth. Future research is necessary to evaluate the long-term effect.

Despite the high prevalence of overactive bladder symptoms (frequency and urgency) in pregnancy, the impact of pregnancy and childbirth on bladder overactivity has seldomly been studied in a pregnant population. After delivery, the symptoms promptly decrease, indicating that the pregnant uterus may play a role[29 52 54]. It was remarkable that in our study the most consistent predictive factor for the occurrence of lower urinary tract symptoms (LUTS) one year after delivery was the presence of the symptom at 12 weeks gestation. This was equally significant in both univariate and multivariate analysis. No obstetrical and neonatal risk factors were identified for overactive bladder symptoms. This implies that the changes occurring in lower urinary tract function during pregnancy are of much more importance than those induced by delivery itself.

*Risk factors for defecatory symptoms*

In the last decades, attention has been mainly focused on the association between childbirth and the occurrence of flatus or fecal incontinence. Severe laceration of the anal sphincter is a risk factor for fecal incontinence[24 40 42 44 55-58]. But, when correlating other obstetrical variables with fecal incontinence symptoms no consistent findings are reported[24 40 42 44 55-58]. Forceps delivery has been associated with the development of fecal incontinence. In our study an instrumental delivery was performed in 17.5% of women (Chapter 6). A vacuum extraction was performed in 16.2% and a forceps delivery in only 1.3% of cases. We did not find an association between fecal incontinence and a forceps delivery, but the number of forceps deliveries in our study is too small to make a definitive statement and in the Netherlands only an outlet forceps is performed[42]. Despite the fact that anorectal function alters during and after pregnancy, very little is known about the risk factors for other defecatory symptoms, such as painful defecation, obstructive defecation and constipation during and after first pregnancy[48].

The most consistent predictive factor for the occurrence of defecatory symptoms one year after delivery was the presence of the symptom at 12 weeks gestation. It was equally significantly present in both the univariate and multivariate analysis. A lower BMI was also associated with constipation 12 months postpartum. We decided not to ask at 12 weeks if woman had symptoms before pregnancy, because of the risk of recall bias. Therefore, we are not informed on the occurrence of defecatory symptoms in the first 12 weeks of pregnancy or before pregnancy. Although we did not have this information, our finding was remarkable. The changes occurring in anorectal function during pregnancy appear to be of more importance as compared to those

induced by the delivery. The only exception is the occurrence of fecal incontinence, that was not only associated with the presence at 12 weeks, but also with the occurrence of an anal sphincter rupture during childbirth. No previous study has entered the presence of the symptom in pregnancy as a potential associated factor in the analysis.

*Impact of urogenital symptoms on the quality of life*

The third research question of this study was what the consequences of urogenital symptoms were on the health related quality of life. Although the prevalence of overactive bladder symptoms in pregnancy is high, the impact of bladder overactivity on quality of life and the amount of bothersomeness have never been studied in a cohort of pregnant women[25-30 37]. Assessment of quality of life in women has been facilitated by the development of disease specific questionnaire like the Urogenital Distress Inventory (UDI) and the Incontinence Impact Questionnaire (IIQ)[20 21]. The application of quality of life instruments to women with antenatal and postnatal urogenital symptoms enables an objective measurement of the impact of symptoms on lifestyle and can assess the severity of the condition at a time when symptoms are common and often arise for the first time. On the emotional, social and physical functioning domains of the IIQ the scores were low, whereas the scores on the embarrassment and mobility domain were higher indicating a restriction in lifestyle. With respect to wet overactive bladder syndrome, we demonstrated that it negatively affected quality of life both during and after pregnancy. The main limitation in the woman's quality of life was found on the mobility domain. However, the score of the mobility domain in these women with wet OAB decreased significantly after childbirth (chapter 5). To our knowledge only one study was conducted to investigate the effect of urinary incontinence on quality of life during and after first pregnancy by using the King's Health Questionnaire (KHQ)[59]. Fifty-four percent of the women with urinary incontinence in the third trimester of pregnancy experienced a negative impact on the quality of life. Three months after childbirth 71% percent of the women with urinary incontinence reported that their quality of life was negatively affected by their incontinence symptoms[59]. The domain scores on the KHQ were low, suggesting minimal restriction in lifestyle. Women with urge urinary incontinence or mixed urinary incontinence had worse quality of life scores before delivery than those with stress urinary incontinence alone. Three months after delivery this association could no longer be demonstrated. A different questionnaire was used in our study, which makes it difficult to compare the two studies. The participants in our study were followed until one year after childbirth. Although the IIQ is a disease-specific questionnaire, we cannot rule out that the limitations in mobility is partly caused by pregnancy itself. The scores on the embarrassment domain did not decrease significantly after childbirth. Although it is known that in young, non-pregnant women urge incontinence and overactive bladder symptoms are reported to be at least as bothersome as stress urinary incontinence. The effect of OAB during and after first pregnancy has not been evaluated[17 18]. Young non-pregnant women felt limited in their mobility by OAB and UUI symptoms [18]. This finding is similar to our

results during and after first pregnancy. With the UDI it also possible to evaluate the amount of bother women experience from their LUTS. During pregnancy the scores on the overactive bladder subscale were found to be the highest compared to the other subscales, indicating that overactive bladders symptoms can be perceived as bothersome. LUTS become more bothersome with increasing gestational age, but after childbirth the subscales score declined. The UDI subscales scores after childbirth were low indicating little bother.

## Sexual health and satisfaction

The final research question of this thesis was which factors during and after pregnancy determines the sexual function one year after childbirth (chapter 7). It is believed that women who underwent a cesarean delivery (CD) have a better subsequent sexual functioning compared to women who had a vaginal delivery. In a recent review an association between assisted vaginal delivery and degree of perineal pain and dyspareunia was suggested[60]. However, the reported associations between CD and sexual dysfunction are inconsistent[61 62].

The Maudsley Marital Questionnaire (MMQ) is a standardized and validated questionnaire with 15-items relating to marital and sexual adjustment, with a nine point (0-8) scale appended to each question and is translated in Dutch[63-65]. Scores on the sexual scale (MMQ-S) range from 0 to 40, while those on the marital scale (MMQ-M) range from 0 to 80. Higher scores are indicative of greater adjustment problems. The focus of the MMQ is on the satisfaction with the sexual relationship[63-65]. We were not informed about the interpretation of the partner about the sexual relationship. Women are reluctant to speak about their sexual relationship. To avoid low inclusion numbers we decided not to include the sexual partner and we focused on the women's own experience.

To our knowledge we were the first to investigate which factors determine satisfaction with sexual relationship one year after childbirth. We demonstrated that not being sexual active at 12 weeks gestation and an older maternal age are important determinant factors for being dissatisfied with the sexual relationship 12 months postpartum. Most other research focused on perineal pain/dyspareunia in relation to mode of delivery. Because no questions about perineal pain/dyspareunia are included in the MMQ, we cannot make any statement about associations with type of delivery. Most studies on the effect of method of delivery on sexual functioning were retrospective, did not used validated questionnaires, or measured only short-term outcomes. The validity of results on human sexuality can be impaired by terminological problems, which are difficult to manage adequately in questionnaire studies. From interview studies it is concluded that many female participants do not adequately understand the term "orgasms" or "intercourse" [66 67]. We tried to avoid this by giving good instruction and by emphasizing that the participants could always contact the main investigator if they had questions. All studies, except one, had a follow-up time of less than 9 months. Unfortunately, this particular study with a follow-up period of 18 months also used a retrospective design[68]. Recall bias is a major draw-

back in all retrospective studies, and therefore results from these types of studies have to be interpreted with caution. Thompson et al used a prospective design but a relative short follow-up period of 24 weeks after childbirth[62]. One study used a validated sexual health measurement, but had a retrospective study design[69]. In these studies, an assisted vaginal delivery, perineal damage, parity and marital state were suggested to be associated with sexual dysfunction after childbirth[48 61-65 68-70]. In our prospective study, sexual intercourse one year postpartum was only independently associated with a 3rd or 4th degree anal sphincter tear and sexual activity in early pregnancy. It is known that perineal damage is associated with dyspareunia and pain can be of influence on whether women engaged in sexual intercourse[48 60-62 68-70]. Sexual activity at 12 weeks gestation may be a reflection of the sexual function before pregnancy. We were not informed about sexual relationship before pregnancy so we cannot relate the sexual relationship before pregnancy to the sexual relationship postpartum.

## Recommendations

The studies described in this thesis and available literature has shown that symptoms of pelvic floor dysfunction are common during and after first pregnancy. During pregnancy the prevalence of most pelvic floor symptoms increased with increasing gestational age. After childbirth the prevalence of pelvic floor symptoms decline. Despite the high prevalence of symptoms the majority of women is not bothered by it. But based on the results of our study, women with persistent and bothersome symptoms should be actively screened. In the Netherlands the follow-up visit after childbirth is 6 weeks after delivery. May be this follow-up visit should be delayed to 3 months postpartum. But a good alternative is to notify the general physician. Most symptoms will have disappeared within the first year postpartum. The GP can make regular check up's for these women at 3,6 and 12 months postpartum. Especially since treatment options, like physiotherapy alone or in combination with drug treatment postpartum, are available. Treatment can cure or at least relieve the symptoms. With regard to the risk factors for urogenital symptoms and defecatory symptoms, physicians and midwifes should be aware that the presence of the symptom in early pregnancy can be predictive for the presence of the symptom postpartum. Our data does not support the wide spread believe that childbirth is the major risk for pelvic floor symptoms. No obstetrical risk factors were found except for a 3rd/4th degree anal sphincter tear and fecal incontinence. During perinatal care the presence of pelvic floor symptoms should be addressed and may be physiotherapy or bladder training should be offered to those with bothersome symptoms. These interventions rely on systematic attempts by individuals to alter their actions to improve bothersome bladder symptoms [71 72]. The marked benefit of intensive pelvic floor muscle training, seen in the first year after delivery, was not maintained 15 years later. Long-term adherence to training is low.[73] But it helps sometime and can give an improvement on the health related quality of life. It has to be kept in mind that most symptoms will resolve after childbirth. May be no interventions are necessary and are

pelvic floor symptoms in most women a part of a normal pregnancy.
Overactive bladder symptoms affect the health related quality of life in primiparous women. Dry overactive bladder syndrome (OAB, frequency and urgency) had no negative effect on the quality of life whereas wet OAB negatively affected the quality of life both during and after pregnancy, mainly on the mobility and embarrassment domain. The urge urinary incontinence symptom in wet OAB seems to have a profound negative effect on the quality of life. Apparently, in young mothers with wet OAB limitations in mobility are especially stressful and these symptoms can be embarrassing. Attention needs to be paid to the negative effect of wet OAB on HRQoL in pregnant women but especially after childbirth. Fortunately, mobility limitations will subside in most women with wet OAB after childbirth, but those with persistent symptoms should be actively screened at the normal follow-up visits after delivery by their obstetrician, general practitioner or midwife. Since treatment options, like physiotherapy and bladder training during pregnancy or in combination with drug treatment postpartum, are available these women can be offered relieve of their symptoms.
With regard to sexual functioning one year after childbirth we showed that an important prognostic factor for a dissatisfied sexual relationship one year postpartum was not being sexual active in early pregnancy. Physicians should be careful to relate sexual dysfunction with childbirth and should always question the sexual relationship before and during pregnancy.

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*Chapter 9*

# Summary

This study evaluated the effects the first pregnancy and childbirth on the pelvic floor. Pregnancy and vaginal delivery can negatively affect pelvic floor function. Micturition symptoms, defecation symptoms and sexual dysfunction are all signs of an impaired pelvic floor function. These symptoms are known to have a high prevalence during and after pregnancy. In a non-pregnant population these symptoms are often experienced as bothersome. Efforts should be made to identify risk factors for different pelvic floor symptoms and the consequences of these symptoms on the quality of life. The studies in this thesis were all performed on a large cohort of healthy nulliparous women with a singleton pregnancy.

In *chapter 1*, the introduction, literature is reviewed and the aims of this theses consisting of 4 main questions are outlined:

1. to report on the prevalence of pelvic floor symptoms during and after first pregnancy
2. to investigate the effect of pregnancy and childbirth on pelvic floor symptoms
3. to study the consequence of pelvic floor symptoms on the quality of life during and after first pregnancy
4. to determine what factors can be of influence on the sexual function after first childbirth

In *chapter 2* the changes in the prevalence of urogenital symptoms during pregnancy among 515 nulliparous women are described. A second aim of this study was to evaluate the amount of bother women experience from these symptoms. For this analyses self-report questionnaires at 12 and 36 weeks gestation were used. The following urogenital symptoms were assessed with the Urogenital Distress Inventory (UDI): frequency, urgency, urge incontinence, stress incontinence, difficulty emptying, feeling of incomplete bladder, seeing a bulging or protrusion in the vaginal area, feeling a bulging or protrusion in the vaginal area, a heaviness or dullness in the pelvic area, and pain or discomfort in the lower abdomen. The individual items from the UDI were clustered in 5 subscales: urinary incontinence, overactive bladder, obstructive micturition, discomfort/pain and genital prolapse. Each subscale has a range of 0 (no symptom) to 100 (all symptoms present with the highest degree of bother). This allowed us to analyze our data in two ways. First we analyzed the data on item level, secondly on the clustering of items. At 12 weeks gestation 91,5% of the women experienced one or more urogenital symptoms and at 36 weeks 96,5%. Prevalences of frequency and urgency symptoms were high at 12 weeks gestation (74% and 63%) and remained stable during pregnancy. The prevalences of true urinary incontinence symptoms, voiding difficulties and pelvic discomfort increased with gestational age. Stress urinary incontinence was present in 42.2% of the women at 36 weeks gestation and urge urinary incontinence in 19.2%. The prevalence of bothersome frequency symptoms was much higher than of urinary incontinence. (21% compared to 6%). During pregnancy, all UDI subscales scores increased significantly ($p < 0.01$). Nevertheless, the scores on the urinary incontinence, obstructive micturition and genital prolapse were low, indicating little bother. It was concluded that urogenital

symptoms occured in almost all women during pregnancy. Whereas the prevalence of frequency and urgency symptoms was high from 12 weeks gestation onwards and remained stable during pregnancy, the prevalence of urinary incontinence symptoms increased with gestational age. Despite the high prevalence of symptoms the majority of women reported not to be bothered by it.

In *chapter 3,* the results are presented of a study, which determined the prevalences of LUTS both during and after pregnancy according to the mode of delivery and to analyze if, besides the presence of LUTS, the mode of delivery negatively affected the quality of life. Included were 344 nulliparous pregnant women who completed four questionnaires with the Urogenital Distress Inventory and the Incontinence Impact Questionnaire. The participants were divided into two groups according to the mode of delivery: vaginal delivery group (VD), which included spontaneous vaginal delivery and an instrumental vaginal delivery, and cesarean delivery group (CD). No statistical significant differences were found in the prevalences of LUTS during pregnancy between the two groups. Three months after childbirth urgency and UUI are less prevalent in the CD group, but the statistical difference has resolved one year postpartum. Stress incontinence was significant more prevalent in the VD group at 3 and 12 months postpartum. The presence of SUI in early pregnancy is predictive for SUI both in the VD as in CD group. Woman who underwent a CD and had SUI in early pregnancy had a 19 times higher risk of having SUI in year postpartum.
After a CD 9% experienced urge urinary incontinence. Urge incontinence affected the emotional functioning more after a caesarean compared to a vaginal birth, but the domain scores on the IIQ were low, indicating a minor restriction in lifestyle.
In conclusion, in pregnancy no statistical significant differences in the prevalences of LUTS were found between women who delivered vaginally and women who delivered by a cesarean. But, after childbirth SUI was significantly more prevalent in the group who delivered vaginally. Besides the mode of delivery, we did found another risk factor for SUI postpartum. In the VD as well as in the CD group the presence of SUI in early pregnancy gave an increased risk for experiencing SUI one year postpartum. Further research is necessary to evaluate the effect of symptoms in early pregnancy on SUI later in life. The mode of delivery and its effect the woman's quality of life was also assessed in women experiencing a LUTS. UUI after a CD limited the women emotionally more than after a vaginal birth; no difference was found for the effect of SUI on the quality of life between the two groups.

In *chapter 4,* the severity of bladder symptoms during and after first pregnancy with the use of a self-report health-related quality of life questionnaire (UDI and IIQ) was evaluated. Also the impact of the first delivery on bothersome lower urogenital symptoms one year after childbirth was studied. The use of this disease specific health related quality of life questionnaire made it possible to analyze the data on item level and secondly on the clustering of symptoms in the UDI subscales. Included were 344 nulliparous pregnant women who completed four questionnaires. Frequency, urgency, urge incontinence, stress incontinence were assessed. Eighty-three of 344

(24.2%) women reported to experience moderately to greatly bothersome urinary frequency at 36 weeks gestation. After childbirth, there was statistical significant decline in the prevalence of bothersome frequency to 38 (9.6%) women (p=0.000). Bothersome stress urinary incontinence was present in 53 (15.4%) women at 36 weeks gestation and in 36 (10.5%) one year after childbirth. Fifty-eight (16.9%). women reported to have moderately to greatly bothersome urge urinary incontinence symptom at 36 weeks pregnancy and one year after childbirth 51 (14.8%) women. After multivariate analysis, the predictive factors for the presence of bothersome stress urinary incontinence were an older maternal age (32.5 vs 30.3 years old at delivery) and the presence of bothersome stress urinary incontinence at 12 weeks gestation. Bothersome urge urinary incontinence was significantly associated with a lower educational level (OR 0.08 [0.02-0.36]). When comparing a cesarean delivery (CD) with spontaneous vaginal delivery (SVD), women after CD had more bothersome urge urinary incontinence. Women after a SVD developed more bothersome stress urinary incontinence. Both associations did not reach statistical significance, possible due to low numbers. During pregnancy, all UDI subscales scores increased significantly and the subscale scores declined after childbirth. However, the score on the urinary incontinence subscale remained significantly higher one year postpartum compared to 12 weeks gestation, whereas the scores on the overactive bladder and obstructive micturition subscales were lower after one year. Nevertheless, the scores on the urinary incontinence and obstructive micturition were low, indicating little bother. Bothersome overactive bladder symptoms were mainly pregnancy related symptoms and were perceived as bothersome by pregnant women. It was concluded that the majority of women are not bothered by their LUTS after first delivery. Since the prevalence of bothersome symptoms is the highest at 36 weeks gestation, they are probably part of a normal pregnancy. However, overactive bladder symptoms can be perceived as bothersome. Physiotherapy and bladder training can be offered to women with bothersome LUTS. Bothersome stress urinary incontinence in early pregnancy and an older maternal age were found to be predictive for bothersome SUI one year after first childbirth. A CD seemed to be protective for bothersome SUI one year postpartum, but bothersome urge incontinence was more prevalent after a CD compared to a vaginal delivery. More research with a larger power is necessary to make definite statements about the effect of the mode of delivery and bothersome urinary incontinence symptoms.

In *chapter 5*, the effect of overactive bladder symptoms on the woman's quality of life during and after first pregnancy using self-report symptom-based quality of life questionnaires was studied. Urogenital symptoms were assessed with the Urogenital Distress Inventory (UDI) and the Incontinence Impact Questionnaire (IIQ). A women was considered to experience dry OAB if she replied positively to the following 2 questions "do you experience a strong feeling of urgency to empty your bladder?", and "do you experience frequent urination?". A women was considered to experience wet OAB if she replied positively to all of the following questions "do you experience a strong feeling of urgency to empty your bladder?", "do you expe-

rience frequent urination?", and "do you experience urine leakage related to the feeling of urgency?". After first childbirth a rapid decline in the prevalence of dry OAB (45.2% - 7.9%, p=0.000) was found. During pregnancy the prevalence of wet OAB increased significantly to 14.6% at 36 weeks gestation, but one year after childbirth the prevalence of wet OAB decreased to 3.5% and was found to be similar to the prevalence at 12 weeks gestation (p= 0.289). Women with wet OAB had higher scores on all IIQ domains as compared to women with no OAB symptoms at 36 weeks gestation. Women with dry or wet OAB all had higher scores on the mobility domain as compared to women with no OAB. The scores on the physical, social and emotional functioning domains were low, suggesting minimal restriction in lifestyle. It was concluded that overactive bladder symptoms are common during pregnancy. Dry OAB had no negative effect on the quality of life whereas wet OAB negatively affected the quality of life both during and after pregnancy, mainly on the mobility and embarrassment domain. The urge urinary incontinence symptom in wet OAB seems to have a profound negative effect on the quality of life. Apparently, in young mothers with wet OAB limitations in mobility are especially stressful and these symptoms can be embarrassing.

In *chapter 6*, a prospective cohort study was undertaken to evaluate the impact of pregnancy and the first delivery on the defecatory symptoms and to identify associated factors. Defecatory symptoms were assessed with the Defecatory Distress Inventory (DDI). Symptoms analyzed were flatus incontinence, fecal incontinence, painful defecation, constipation, sensation of anal blockage and feeling of incomplete evacuation. At 12 weeks gestation 274 (56.7%) women experienced one or more defecatory symptoms, at 36 weeks 223 (56.0%) women, three months postpartum 242 (53.1%) women and 12 months postpartum 191 (46.9%) women. Flatus incontinence was present in 34.6% at 12 weeks gestation, the prevalence increased to 42.3% in late pregnancy and returned to 30.5% one year postpartum. Fecal incontinence was prevalent in 3.9% at 12 weeks gestation. The prevalence increased twofold to 5.7 percent three months after delivery. However, one year after delivery the prevalence of fecal incontinence returned to early pregnancy values (3.3%). No statistical significant differences were found in the prevalence of fecal incontinence at 36 weeks gestation, 3 and 12 months postpartum compared to the prevalence at 12 weeks gestation. All the other defecatory symptoms were already reported in early pregnancy, and remained more or less stable throughout pregnancy and after delivery. The main predictive factor for the presence of the constipation 12 months postpartum was the presence of the symptom at 12 weeks gestation (B 26.4 [8.5-81.6]). This same pattern was seen for the other defecatory symptoms. The only exception was fecal incontinence, in which a 3$^{rd}$ or 4$^{th}$ degree sphincter tear was independently associated with the occurrence of fecal incontinence 12 months postpartum (B 6.8 [4.2-11.0]). Women with de novo symptoms experienced no symptoms during pregnancy and developed symptoms after childbirth and these symptoms persisted until one year postpartum. The prevalence of de novo constipation was 2.1%, for de novo painful defecation 11.7%, for de novo flatus incontinence 8.5% and 2.6% devel-

oped de novo fecal incontinence for the first time after childbirth. By evaluating symptoms during and after first pregnancy it was possible to analyze potential associated risk factors for defecatory symptoms arising de novo after childbirth. Women who developed de novo painful defecation after childbirth gave birth to children with a statistical higher infant birth weight (3688 grams versus 3491grams, B1.001 [1.00-1.02], p=0.012). Women with de novo fecal incontinence were statistical significantly more likely to have had a 3rd or 4th degree anal sphincter rupture (OR 8.0 [4.6-13.8]). It was concluded that defecation symptoms that are already present in early pregnancy are highly predictive for reporting symptoms at 12 months postpartum. The only exception is fecal incontinence, which is mainly related to anal sphincter lesion. Therefore, future investigations on the association between pregnancy and delivery and anorectal function have to include and correct for symptoms already present in early pregnancy.

In *chapter* 7**,** the results were presented which factors determine sexual activity and the satisfaction with the sexual relationship one year after the first delivery. The Maudsley Marital Questionnaire (MMQ) was used to evaluate the satisfaction with the sexual relationship during and after pregnancy. The MMQ is a standardized and validated questionnaire with 15-items relating to marital and sexual adjustment, with a nine point (0-8) scale appended to each question. Higher scores are indicative of greater adjustment problems. Sexual intercourse is defined as the situation in which the erect penis enters the vagina at least for a short period, irrespectively of whether ejaculation occurs. In this analysis 377 women who returned the postpartum questionnaires were included. Three months after childbirth 81.7% were sexual active again and 12 months postpartum 93.9% of the women were sexual active. In multiple logistic regression analysis, the main predictive factor for no sexual intercourse one year postpartum was no sexual intercourse at 12 weeks of gestation (B 11.0 [4.01-30.4]). The other factor associated was a 3rd /4th degree anal sphincter rupture. Women who were not sexually active at 12 weeks gestation had a 11 times higher chance of not being sexually active one year postpartum. After a 3rd /4th degree anal sphincter tear women were 5 times less likely to be sexually active one year postpartum (B 0.2 [0.04-0.93]).
A multiple lineair regression analyses were performed to determine which factors could predict the satisfaction with the sexual relationship. Dissatisfaction with the sexual relationship one year after childbirth, assessed with the MMQ S-scale, is associated with not being sexual active at 12 weeks gestation (ß – 0.208, p=0.004) and with an older maternal age at delivery (ß 0.405, p=0.032). On the average those who did not have sexual intercourse at 12 weeks of gestation scored 0.208 higher in the MMQ S-scale, and an increase of one year in maternal age was associated with an increase in 0.405 in MM S-scale. To get a better insight in the relationship between maternal age and the satisfaction with the sexual relationship, we categorized the MMQ S-scale (range 0-34) in three different groups. The first group had a score between 0 and 10, the second group a score between 11 and 20 and the third group 21 to 34. The first group had a mean age at delivery of 30.1(0.21) years, the second

group 30.7 (0.40) years of age and the third group 31.5 (0.77) years of age at delivery. It was concluded that an important prognostic factor for a dissatisfied sexual relationship one year postpartum is not being sexual active in early pregnancy. Satisfaction with the sexual relationship seemed not to depend on pregnancy and parturition associated factors.

In *chapter 8,* the general discussion, all important findings of this thesis are discussed and recommendations for clinical practise were given.

# Appendices

*Appendix A*

# Nederlandse samenvatting

## BEKKENBODEMKLACHTEN TIJDENS EN NA DE EERSTE ZWANGERSCHAP

Bekkenbodemklachten zijn onder te verdelen in verschillende categorieën. Allereerst klachten die samenhangen met de blaas, namelijk urine verlies (incontinentie), vaak moeten plassen (frequency), sterke aandrang hebben om te plassen (urgency), en klachten waarbij er een gevoel is dat de blaas na het plassen niet goed leeg is (residu gevoel) of het moeizaam is om de blaas leeg te plassen. De tweede soort bekkenbodemklachten die we kunnen onderscheiden zijn klachten gerelateerd aan de ontlasting. Voorbeelden zijn het ongewild verlies van ontlasting (fecale incontinentie) of van windjes (flatus incontinentie), pijn tijdens of net na de ontlasting en obstipatie. De bekkenbodem speelt ook een belangrijk rol bij de seksualiteit. Het doel van het onderzoek was om het effect van de eerste zwangerschap op de bekkenbodem te onderzoeken, omdat we weten uit eerdere onderzoeken dat bekkenbodem klachten tijdens en na een zwangerschap vaak voorkomen. Vrouwen, die niet zwanger zijn, kunnen deze klachten als hinderlijk ervaren. Daarom is het belangrijk om risicofactoren te identificeren voor het ontstaan van bekkenbodem klachten en het effect van deze klachten op de kwaliteit van leven te bepalen.

*Hoe zijn we te werk gegaan?*
Allereerst wilden we dat vrouwen, die niet eerder zwanger zijn geweest (nullipara), aan het onderzoek zouden gaan deelnemen. De reden hiervoor was dat de bekkenbodem van vrouwen die nog niet zwanger zijn geweest het best mogelijk onderzoeksmodel is. Het ideale model is om vrouwen te onderzoek voor zij zwanger zijn en dan ze te vragen zwanger te worden. Dan heb je een meting voor de zwangerschap en kan je ze vervolgen tot 1 jaar na de bevalling. Alleen dit is niet werkzaam. Dus het best mogelijke model is om vroeg in de zwangerschap vrouwen, die voor het eerst zwanger zijn, te vragen om deel te nemen aan dit onderzoek. In Nederland is de zorg rond een zwangere als volgt geregeld. Een gezonde zwangerschap, dat wil zeggen een vrouw zonder medisch voorgeschiedenis zoals bijvoorbeeld hoge bloeddruk, suikerziekte of andere ziektes, wordt gecontroleerd door de verloskundige of door de huisarts. Als tijdens de zwangerschap complicatie optreden dan wordt de gynaecoloog ingeschakeld. Wij waren geïnteresseerd in vrouwen voor de eerste keer zwanger en zonder medische voorgeschiedenis. Daarom hebben wij aan 10 verloskundigen praktijken gevraagd of zij deel wilden nemen aan deze studie. De verloskundigenpraktijken waren allemaal gevestigd in de regio Utrecht. De deelnemers moesten aan de volgende voorwaarden voldoen: eenling zwangerschap, goede beheersing van de Nederlandse taal, en geen operatie in het verleden aan de blaas, urinewegen of de darmen, en de vrouwen mochten niet langer dan 17 weken zwanger zijn bij het invullen van de eerste vragenlijst. De verloskundigen hebben aan alle potentiële deelnemers zowel schriftelijk als mondeling het onderzoek toegelicht. Na 1 week zijn alle vrouwen gebeld om eventuele vragen te beantwoorden en om te vragen of zij deel wilden nemen. Deelname hield in dat de vrouwen 2 vragenlijsten tijdens de zwangerschap (bij 12-17 en 36 weken zwangerschap) en 2 na de bevalling (na 3 en 12 maanden) moesten invullen.

We hebben ze vervolgd tot 1 jaar na de bevalling (longitudinale cohort studie). Zij kregen de vragenlijsten thuis gestuurd en konden deze retourneren met een bijgevoegde antwoordenvelop. De gegevens van de bevalling zijn verzameld uit de Landelijke Verloskundige Registratie. In deze registratie worden zowel gegevens van bevallingen in het ziekenhuis als bevallingen thuis vastgelegd.
In totaal besloten 524 vrouwen om deel te nemen aan de studie. Dit was 55 procent van het totaal aantal potentiële deelnemers. Honderd en zes konden niet deelnemen aan de studie: 12 vrouwen vanwege een late miskraam, 2 vrouwen bleken zwanger te zijn van een meerling en 92 vrouwen beheersten de Nederlandse taal onvoldoende. Alle vragenlijsten waren op dezelfde manier opgebouwd. Plasklachten werden gemeten met de Urogenitale Distress Inventory (UDI), klachten van de ontlasting met de Defecatie Distress Inventory (DDI). De UDI en DDI meten hoe vaak een klacht voorkomt en hoeveel hinder vrouwen ondervinden van deze klacht (appendix A en B). Het is mogelijk om te bepalen hoe hinderlijk een vrouw een afzonderlijke klacht vindt en er bestaan subschalen. Deze subschalen zijn opgebouwd door verschillende vragen van de UDI en DDI te combineren en hebben een score van 0 tot 100. Honderd betekent dat vrouwen alle klachten uit de subschaal ervaren en dat zij deze klachten zeer hinderlijk vinden. Het effect van zowel plas- als ontlasting klachten op de kwaliteit van leven is bepaald met de Incontinence Impact Questionnaire (IIQ)(appendix C). De kwaliteit van leven wordt op verschillende niveaus gemeten; op mobiliteit, fysiek, sociaal en emotioneel functioneren en op schaamte. Voor seksuele problematiek hebben we gebruikt gemaakt van de Maudsley Marital Questionnaire (MMQ)(appendix D). Deze vragenlijst meet de kwaliteit van de seksuele relatie en de tevredenheid over de seksuele relatie. Alle gebruikte vragenlijsten waren in het Nederlands beschikbaar.

In ***hoofdstuk 1***, de introductie, worden de 4 belangrijkste onderzoeksvragen beschreven.
Het doel van de eerste onderzoeksvraag was te onderzoeken hoe vaak bekkenbodemklachten voorkomen tijdens en na de eerste zwangerschap. De tweede vraag had als doel het effect van een zwangerschap en bevalling op bekkenbodemklachten te bestuderen. Een derde doel van dit onderzoek onderzocht het effect van bekkenbodemklachten op de kwaliteit van leven en de laatste onderzoeksvraag was welke factoren invloed hebben op het seksueel functioneren na de eerste bevalling.

In ***hoofdstuk 2***, worden de veranderingen in het voorkomen (prevalenties) van plasklachten tijdens de zwangerschap beschreven. Vervolgens hebben we gekeken naar de mate van hinder die plasklachten tijdens de zwangerschap veroorzaken. Voor deze analyse hebben we gebruik gemaakt van de uitkomsten van de vragenlijsten die rond de 12-17 weken zwangerschap en 36 weken zwangerschap zijn ingevuld. Vijfhonderd en vijftien vrouwen hadden beide vragenlijsten ingevuld. Vroeg in de zwangerschap had 92% van de vrouwen 1 of meerdere plasklachten. Bij 36 weken dus laat in de zwangerschap steeg dit percentage naar 97%. Met name vaak moet plassen (74%) en een sterke aandrang om te plassen (63%) komen vaak vroeg in de

zwangerschap voor en blijven aanwezig tot het einde van de zwangerschap. Ongewild urine verlies en moeite met het ledigen van de blaas zijn klachten die tijdens de zwangerschap in voorkomen toenemen. Urineverlies bij lichamelijke inspanning, hoesten of niezen (stress incontinentie) komt rond de 36ste zwangerschapsweek voor bij 43% en urineverlies bij een sterke aandrang om te plassen(urge incontinentie) bij 19%.Vrouwen vonden vaak moeten plassen veel vervelender dan urineverlies (21% versus 6%). Ook de scores op de subschalen van de UDI nemen toe tijdens de zwangerschap. De scores voor overactieve blaasklachten zijn het hoogst, wat betekent dat vrouwen vaak moeten plassen en sterke aandrang om te plassen als vervelend ervaren. De scores op de andere subschalen waren laag wat betekent dat de vrouwen weinig hinder van deze klachten ondervonden. Uit deze analyse kwam naar voren dat plasklachten vaak voorkomen tijdens een eerste zwangerschap. Ondanks dat plasklachten vaak voorkomen, vinden de meeste vrouwen deze klachten niet hinderlijk.

In ***hoofdstuk 3*** is de onderzoekspopulatie onderverdeeld in 2 groepen. De eerste groep vrouwen is bevallen middels een keizersnede (sectio caesarea) en de andere groep is vaginaal bevallen. Onderverdeeld naar het type bevalling is beschreven hoe vaak plasklachten tijdens en na de eerste zwangerschap voorkomen, de risicofactoren en de gevolgen van deze klachten op de kwaliteit van leven. Voor deze analyse hebben we gebruikt gemaakt van alle 4 vragenlijsten; bij 12-17 en 36 weken zwangerschap en 3 en 12 maanden na de bevalling. Drie honderd en vierenveertig vrouwen hadden alle 4 de vragenlijsten ingevuld. We hebben de volgende plasklachten bekeken; urine verlies bij lichamelijke inspanning, urineverlies bij sterke aandrang om te plassen, vaak moeten plassen en sterke aandrang om te plassen. Alle plasklachten waren al vroeg in de zwangerschap aanwezig en namen toe tijdens de zwangerschap. Er was geen verschil in het voorkomen van klachten tijdens de zwangerschap. Na de bevalling komt urineverlies bij hoesten, niezen of lachen vaker voor bij vrouwen die vaginaal waren bevallen. Behalve de wijze van bevallen, is voor urineverlies bij hoesten, niezen en lachen een belangrijke risicofactor het feit of de vrouwen al vroeg in de zwangerschap deze klachten ervaarden. Dit gold zowel voor de vrouwen die vaginaal waren bevallen als voor vrouwen die met een keizersnede waren bevallen. Plasklachten kunnen de kwaliteitn van leven negatief beïnvloeden. Urineverlies bij aandrang komt bij 9 procent van de vrouwen voor 1 jaar na de keizersnede. De kwaliteit van leven wordt bij met name op het emotionele vlak negatief beïnvloedt door het urineverlies bij aandrang. De negatieve invloed is echter groter in de groep vrouwen die een keizersnede hebben ondergaan dan in de groep vrouwen die vaginaal zijn bevallen.

In ***hoofdstuk 4,*** is de ernst van urineverlies en overactieve blaasklachten (vaak moeten plassen en sterke aandrang om te plassen) en de invloed van de bevalling op deze hinderlijke klachten geëvalueerd. Door de ziekte specifieke vragenlijsten die we gebruikt hebben was het mogelijk om de mate van hinder van plasklachten te bepalen. In deze analyse werden wederom de gegevens van de 344 vrouwen die alle 4 de vragenlijsten hadden ingevuld gebruikt. Een klacht werd als hinderlijk gedefinieerd

als zij aangaf nogal tot hele erge hinder van de klacht ondervond. Tijdens de zwangerschap ondervond 24% van de vrouwen het hinderlijke symptoom vaak te moeten plassen, 15% hinderlijk urineverlies bij lichamelijke inspanning en 17% hinderlijk urineverlies bij een sterke aandrang om te plassen. Een jaar na de bevalling daalden alle percentage tot respectievelijk 10%, 11% en 15%. We vonden dat vrouwen, die het urineverlies bij lichamelijk inspanning als vervelend ervaren, ouder waren (33 versus 30 jaar) en vaker al klachten hadden vroeg in de zwangerschap. Vrouwen, die urineverlies bij een sterke aandrang als vervelend ondervonden, hadden een lager opleidingsniveau. Het onderscheid dat wij gemaakt hebben was tussen basis en middelbare school versus een vervolgopleiding. Er werden geen factoren gevonden die aan de bevalling gerelateerd waren. Overactieve blaasklachten kwamen met name in de zwangerschap voor. Het merendeel van de vrouwen ervaart plasklachten na de eerste bevalling niet als hinderlijk. Overactieve blaasklachten daarentegen kunnen tijdens de zwangerschap zeer vervelend zijn.

In ***hoofdstuk 5***, wordt het effect van een overactieve blaas op de kwaliteit van leven beschreven. Allereerst kan volgens internationale definities er een onderscheid gemaakt worden tussen droge overactieve blaasklachten en natte overactieve blaasklachten. Wij hebben de volgende definities gebruikt. Om droge overactieve blaasklachten te hebben moesten de volgende 2 vragen met ja worden beantwoord: Heeft u sterke aandrang om te plassen? en Vindt u dat u vaak moet plassen?. Voor natte overactieve blaasklachten moest naast deze 2 vragen ook positief geantwoord zijn op de vraag: Verliest u weleens urine bij een sterke aandrang om te plassen?. Na de eerste bevalling neemt het percentage vrouwen met droge overactieve blaasklachten sterk af van 45% tot 8%. Natte overactieve blaasklachten nemen toe in de zwangerschap tot 15% aan het einde van de zwangerschap en 4% heeft natte overactieve blaasklachten 1 jaar na de bevalling. Natte overactieve blaasklachten beïnvloedden de kwaliteit van leven op alle domeinen gemeten met de IIQ zowel tijdens als na de bevalling, met name op de domeinen mobiliteit en schaamte. Het symptoom urine verlies bij sterke aandrang om te plassen heeft een belangrijk negatief effect op de kwaliteit van leven bij natte overactieve blaasklachten. Natte overactieve blaasklachten beperkt jonge moeders in hun mobiliteit en deze klachten kunnen schaamte veroorzaken.

In ***hoofdstuk 6***, wordt het voorkomen van problemen met de ontlasting tijdens en na de eerste zwangerschap en mogelijke risicofactoren beschreven. Problemen met de ontlasting zijn gemeten met de DDI. Vroeg in de zwangerschap had 57% 1 of meerdere klachten, bij 36 weken zwangerschap 56% en 12 maanden na de bevalling 47%. Ongewild verlies van windjes komt voor bij 42% laat in de zwangerschap en bij 31% 1 jaar na de bevalling, ongewild verlies van ontlasting bij 4% vroeg in de zwangerschap, bij 6% 3 maanden na de bevalling en bij 3% 1 jaar na de bevalling. De belangrijkste voorspellende factor voor klachten gerelateerd aan de ontlasting is het voorkomen van klachten vroeg in de zwangerschap. Dit geldt voor alle klachten behalve voor ongewild verlies van ontlasting. Een forse scheur($3^{de}/4^{de}$ graads sphincter rup-

tuur) tijdens de bevalling verhoogd het risico voor ongewild verlies van ontlasting.
In ***hoofdstuk 7***, wordt beschreven welke factoren van invloed zijn op het seksueel functioneren na de eerste bevalling. Aan deze analyse hebben 377 vrouwen, die beide vragenlijsten hadden geretourneerd, meegedaan. Drie maanden na de bevalling waren 82% van de vrouwen weer seksueel actief en 12 maanden na de bevalling was dit percentage gestegen tot 94%. De belangrijkste voorspellende factor voor seksueel actief zijn 1 jaar na de bevalling was of vrouwen seksueel actief waren vroeg in de zwangerschap. Vrouwen tijdens de bevalling flink zijn ingescheurd waren minder vaak seksueel actief dan vrouwen bij dit niet was gebeurd. Ontevredenheid met de seksuele relatie was ook gerelateerd aan het niet seksueel actief zijn vroeg in de zwangerschap. Vrouwen die ontevreden waren met hun seksuele relatie waren gemiddeld ouder. Mogelijk dat het wel of niet seksueel actief zijn vroeg in de zwangerschap een reflectie is van het seksueel leven voor de zwangerschap. Tevredenheid was niet gerelateerd aan de wijze van bevallen.

In ***hoofdstuk 8,*** worden de resultaten uit dit onderzoek vergeleken met de resultaten uit eerdere studies en worden er klinische aanbevelingen gedaan.

*Conclusie*
Bekkenbodemklachten komen vaak voor tijdens en na de eerste zwangerschap. Het hebben van een bekkenbodemklacht vroeg in de zwangerschap heeft een duidelijke voorspellende waarde voor diezelfde klacht na de eerst bevalling.

*Aanbevelingen*
De studies beschreven in dit boekje laten zien dat bekkenbodemklachten vaak voorkomen tijdens en na de eerste zwangerschap. Tijdens de zwangerschap nemen de meeste klachten toe en na de bevalling nemen deze weer af. Ondanks het feit dat bekkenbodemklachten vaak voorkomen ondervindt de meerderheid van de vrouwen hiervan weinig hinder. Maar de vrouwen, die bekkenbodemklachten als hinderlijk ervaren en bij wie de klachten niet verdwijnen, zouden tijdens de controle 6-8 weken na de bevalling actief opgespoord moeten worden. Ook uit dit onderzoek is gebleken dat vrouwen zich schamen voor deze klachten en daarom deze klachten zelden uit zichzelf zullen noemen. Er moet dus actief door de verloskundige, huisarts of gynaecoloog naar gevraagd moet worden. Wat we wel in gedachte moeten houden is dat misschien het laatste bezoek niet 6 weken na de bevalling maar 3 maanden na de bevalling pas zou moeten plaatsvinden, want sommige klachten zullen nog verdwijnen met het verstrijken van de tijd. Het is zeker verstandig de vrouwen met persisterende en hinderlijke klachten nog een keer extra terug te zien. Een andere en voor Nederland goede optie is om de huisarts te informeren over de bestaande klachten en dat de huisarts de klachten verder vervolgd.
Men moet in gedachten houden dat het merendeel van de klachten verdwijnen in het eerste jaar na de bevalling. Bekkenbodemklachten die niet hinderlijk zijn of persisteren onderdeel zijn van een normale zwangerschap. Het is dus vooral van belang om alleen vrouwen met hinderlijke klachten op te sporen omdat er behandelingen

mogelijk zijn, zoals fysiotherapie eventueel in combinatie met medicijnen, die de klachten kunnen verlichten en soms zelfs verhelpen.
De belangrijkste factor die het risico op plasklachten en klachten met de ontlasting is de aanwezigheid van deze klacht vroeg in de zwangerschap. Ook hier geldt dat als de verloskundige, huisarts of gynaecoloog niet naar de klachten vraagt, deze onbesproken zullen blijven. Actieve opsporing van bekkenbodemklachten vroeg in de zwangerschap is noodzakelijk om vrouwen die een verhoogd risico hebben op te sporen. Indien vrouwen een klacht hebben en deze persisteert of de kwaliteit van leven wordt negatief beinvloedt, moeten de mogelijke behandelingen met de vrouw worden besproken.
Vrouwen zijn bang dat een vaginale bevalling hun seksuele gezondheid schaadt. Het blijkt dat dit niet zo is. Seksuele problematiek na de zwangerschap komt met name voor bij vrouwen die al vroeg in de zwangerschap geen goede seksuele relatie hadden en dit suggereert dat de seksuele relatie voor de zwangerschap veel belangrijker is dan de bevalling zelf. Slechts bij een kleine groep die fors inscheurt speelt de bevalling een rol met betrekking tot de seksuele relatie.

*Appendix B*

# Questionnaires

## UROGENITAL DISTRESS INVENTORY

| **LUTS** | **Subscale** | **UDI question** |
|---|---|---|
| frequency | OAB | do you experience frequent urination? |
| urgency | OAB | do you experience a strong feeling of urgency to empty your bladder? |
| SUI | UI | do you experience urinary leakage related to physical activity, coughing or sneezing? |
| UUI | UI | do you experience urine leakage related to the feeling of urgency? |
| difficult bladder emptying | Obstr | do you experience difficulty emptying your bladder? |
| feeling of incomplete bladder emptying | Obstr | do you experience a feeling of incomplete bladder emptying? |

OAB: overactive bladder
UI: urinary incontinence
Obstr: obstructive micturition

## DEFECATION DISTRESS INVENTORY

| **Symptom** | **Question** | **Scoring system** |
|---|---|---|
| Constipation* | Do you have less than 3 bowel movements a week?<br>Do you have to strain > 25% of the time to have a bowel movements? | Yes = symptom is present<br>No= symptom is absent |
| Sensation of anal blockage | Do you ever experience a sensation of anal blockage when you have your bowel movement? | Yes = symptom is present<br>No= symptom is absent |
| Feeling of incomplete evacuation | Do you experience a feeling of incomplete evacuation after bowel movement? | Yes = symptom is present<br>No= symptom is absent |
| Painful defecation** | Do you experience pain related to urgency for bowel movement? Do you experience pain during or shortly after a bowel movement? | Yes = symptom is present<br>No= symptom is absent |
| Fecal incontinence** | Do you experience incontinence for liquid stool?<br>Do you experience incontinence for solid stool? | Yes = symptom is present<br>No= symptom is absent |
| Flatus incontinence | Do you experience incontinence for gas? | Yes = symptom is present<br>No= symptom is absent |

A symptom is considered to be present if the corresponding question is answered positive.
* Symptom is considered to be present if both corresponding questions are answered positive
** Symptom is considered to be present if at least on of the corresponding questions is answered positive

## THE MAUDSLEY MARITAL QUESTIONNAIRE

| | **Questions of sexual scale MMQ** |
|---|---|
| Sexual intercourse | How often have you had sexual intercourse with your partner in the last month? |
| Satisfaction with sex | Are you satisfied with the present frequency of sexual intercourse? |
| Sexual enjoyment | Do you find sex enjoyable? |
| Likelihood to achieve an orgam | What proportion of the time, in relationship sex, do you experience a climax? |
| Physical contact | How did you feel during physical contacts between you and your partner? |

A nine point (0-8) scale is appended to each question

*Appendix C*

# Abbreviations

| | |
|---|---|
| BMI | Body Mass Index |
| CD | Caesarean Delivery |
| CI | Confidence Interval |
| DDI | Defecatory Distress Inventory |
| GP | General Practitioner |
| HRQoL | Health related quality of life |
| ICS | International Continence Society |
| IIQ | Incontinence Impact Questionnaire |
| IVD | Instrumental Vaginal Delivery |
| LUTS | Lower Urinary Tract Symptoms |
| MMQ | Maudsley Marital Questionnaire |
| OAB | Overactive Bladder Symptoms |
| OR | Odds Ratio |
| SD | Standard Deviation |
| SE | Standard Error |
| SUI | Stress Urinary Incontinence |
| SVD | Spontaneous Vaginal Delivery |
| UDI | Urogenital Distress Inventory |
| UI | Urinary Incontinence |
| UUI | Urge Urinary Incontinence |

*Appendix D*

# Dankwoord

De studies die worden beschreven in dit proefschrift hadden niet kunnen worden uitgevoerd zonder de medewerking van ruim 500 patiënten, de verloskundigen van de 10 deelnemende verloskundigen praktijken, de gynaecologen uit diverse ziekenhuizen in de regio Utrecht en de secretaresses uit het UMC Utrecht. Het is geweldig dat zo velen hebben meegewerkt aan dit onderzoek. Vooral de deelnemers ben ik veel dank verschuldigd, omdat zij veel tijd hebben besteed aan het invullen van de vragenlijsten van mijn onderzoek.
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Lieve (bijna) zeergeleerde Geerte, onze wetenschappelijke carrière is begonnen tijdens onze keuze co-schappen. Samen deden we onderzoek naar prolaps operaties, jij in Arnhem en ik in het UMCU. Twee wetenschappers waren geboren, alhoewel jouw hart meer bij de kliniek lag. Na hèt congres in Florence, kruisten onze paden elkaar weer. Waar Florence allemaal niet goed voor is geweest. Je was altijd een steun in de moeilijke tijden die elke promotie kent. Nu jij nog, ik weet zeker dat het je lukt!

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*Appendix E*

# List of co-authors

Hein W. Bruinse, PhD, MD, Department of Perinatology and Gynecology, University Medical Center Utrecht, Utrecht, the Netherlands

Johanna G. van der Bom, PhD, Department of Clinical Epidemiology, Leiden University Medical Center, Leiden, the Netherlands

Geerte van de Pol, MD, Department of Perinatology and Gynecology, University Medical Center Utrecht, Utrecht, the Netherlands

A. Peter. M. Heintz, PhD, MD, Department of Perinatology and Gynecology, University Medical Center Utrecht, Utrecht, the Netherlands

C. Huub van der Vaart, PhD, MD, Department of Perinatology and Gynecology, University Medical Center Utrecht, Utrecht, the Netherlands

*Appendix F*

# List of publications

by March 2006

Sacrospinous hysteropexy compared to vaginal hysterectomy as primary surgical treatment for a descensus uteri: effects on urinary symptoms
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British Journal of Urology International 2006, in press

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International Urogynecology Journal, 2006 in press

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BJOG 2006, in press

The effect of vaginal and cesarean delivery on Lower Urinary Tract Symptoms: what makes the difference?
H.J. van Brummen, H.W. Bruinse, G. van de Pol, A.P.M. Heintz, C.H. van der Vaart
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G. van de Pol, J.R.J.de Leeuw, H.J. van Brummen, H.W. Bruinse, A. P. M. Heintz, C. H van der Vaart.
Acta Scand Obstet Gynaecol 2006, in press

*Appendix G*

# Curriculum vitae

Henriette Jorien (Pien) van Brummen werd op 19 juli 1975 geboren in het St. Jans Gasthuis te Hoorn. Zij heeft in Barendrecht haar lagere school voltooid en ging vervolgens naar het Erasmiaans Gymnasium in Rotterdam. Zij deed in 1994 eindexamen in de vakken Latijn, Nederlands, Engels, Frans, Wiskunde A, Natuurkunde, Scheikunde en Biologie. In 1994 begon zij haar studie Geneeskunde aan de Rijksuniversiteit Utrecht. Voor haar wetenschappelijke stage heeft zij onderzoek gedaan bij het project *Zuigelingensterfte in multicultureel Nederland*. In de maanden april tot juli 1999 liep zij stage bij drs J.L van der Zwam, neuroloog in het Meander Medisch Centrum te Amersfoort. Eind augustus 1999 behaalde zij haar doctoraal examen en begon 1 september 1999 met haar coschappen.
Tijdens haar keuzecoschap bij de divisie gynaecologie in het UMC Utrecht heeft zij naast haar werkzaamheden op de afdeling en polikliniek gynaecologie onderzoek verricht naar de tevredenheid van patiënten en het vóórkomen van mictieklachten na 2 soorten verzakkingsoperaties, samen met Geerte van de Pol, onder begeleiding van dr C.H. van der Vaart en drs C.I.M. Aalders. Na haar artsexamen is zij blijven werken bij de divisie Perinatologie en Gynaecologie van het Universitair Medisch Centrum Utrecht en is zij begonnen met dit promotieonderzoek. Naast het verzamelen van data bleef zij actief betrokken bij de diagnostiek en behandeling van patiënten met urogenitale klachten zowel in het UMC Utrecht als bij Alant Vrouw. Op 1 september 2005 is zij begonnen met de opleiding tot huisarts in het cluster Utrecht. Zij is thans werkzaam als huisarts in opleiding bij de huisartsenpraktijk Boon-de Ruiter te Epe.

*Appendix G*

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