A peer-reviewed version of this preprint was published in PeerJ on 27 July 2016.

View the peer-reviewed version (peerj.com/articles/2283), which is the preferred citable publication unless you specifically need to cite this preprint.

Demircan N, Özmen Ü, Köktürk F, Küçük H, Ata Ş, Harma M, Arıkan İİ. 2016. What are the probable predictors of urinary incontinence during pregnancy? PeerJ 4:e2283 https://doi.org/10.7717/peerj.2283

What are the possible determinants of urinary incontinence during pregnancy? Results of a pilot study

Nejat Demircan, Ülkü Özmen, Fürüzan Köktürk, Hamdi Küçük, Şevket Ata, Müge Harma, İnan İlker Arıkan

Objectives: This study was conducted to determine the frequency, predisposing factors and impact of urinary incontinence (UI)during pregnancyon quality of life (QOL). **Materials and Method:**A preliminary cross-sectional survey was carried out among pregnant women from January to June of 2014. A total of 132 pregnant women were enrolled. We used a questionnaire form for sociodemographic features, ICIQ-SF-Turkish version to determine the occurrence and characteristics of UI and Wagner's Quality of Life scale to assess impact on QOL. **Results:**Urinary incontinence was present in 56 out of 132 pregnant women (42.4%); these women were referred to as the UI-present group. The remaining 76 women comprised the UI-absent group. The overall mean age was 27.5 ± 5.1 y (p=0.780), median height in UI-present group was 160 cm (min-max: 153-176, p=0.037 <0.05) and median BMI was 28.7 kg/m^2(min-max: 22.4-50.0, p=0.881).For women in the UI-present group, urine leakage occurred once a week (n=18, 32.1%) to twice or thrice a week (n=8, 14.3%), few times a day (n=14, 25%), once a day (n=5, 8.9%) and always (n=8, 14.3%). The pregnant women in the UI-present group mainly reported a small amount of urine leakage (n=33, 58.9%) or a moderate amount of leakage (n=4, 7.1%). There were statistically significant relationships between QOL scores and frequency of UI (p=0.002 <0.05) as well as the amount of leakage (p=0.002 <0.05). Impact on QOL scores ranged from mild (n=33, 58.9%) or moderate (n=4, 7.1%) to severe (n=4, 7.1%) levels. QOL has 'mildly deteriorated'. The following features were found to favour the onset of UI: age of pregnant woman (OR= 0.845, 95% CI 0.268-2.669), occupational status (OR=1.800, 95% CI 0.850-3.810), anaemia (OR=0.939, 95% CI 0.464-1.901), parity (OR=0.519, 95% CI 0.325-0.829), miscarriage in previous pregnancies (OR=1.219, 95% CI 0.588-2.825) and living in rural vs urban settlement (OR=1.800, 95% CI 0.887-3.653).Heigt (p= 0,037<0.05), educational status (p=0.016 <0.05), miscarriage, parity and place of living (p=0.002, p=0.006, p=0.020 <0.05 respectively)were significant in favour of UI-present. **Conclusions:**Urinary incontinence was frequently encountered among pregnant women (42.1%). Urinary incontinence distorted the QOL in pregnant women at a mild level and caused life style changes. Frequency and amount of UI were the significant factors in deterioration. Age, parity, miscarriage, being housewife, place of living (rural) and anaemia

were the factors in favour of onset of UI during pregnancy. Among them, height, educational status (primary-intermediate school graduate), place of living (rural), miscarriage and parity were statistically significant predictors. It is necessary to pay attention to UI and its impact on women's health during pregnancy.

WHAT ARE THE POSSIBLE DETERMINANTS OF URINARY INCONTINENCE DURING PREGNANCY? RESULTS OF A PILOT STUDY

Nejat Demircan[1*], Ülkü Özmen[2], Fürüzan Köktürk[3], Hamdi Küçük[1], Şevket Ata[4], Müge Harma[2], İnan İlker Arıkan[2]

Bülent Ecevit University [1] Faculty of Medicine, Department of Family Medicine, [2] Department of Gynecology-Obstetrics, [3] Department of Biostatistics, [4] Faculty of Science and Literature

[*]**Corresponding Author:** Nejat Demircan, Bülent Ecevit University, Faculty of Medicine, Department of Family Medicine, Esenköy, Kozlu, Zonguldak, Turkey 67300
nejatdemircan@gmail.com

Abstract

Objectives: This study was conducted to determine the frequency, predisposing factors and impact of urinary incontinence (UI) during pregnancy on quality of life (QOL).

Materials and Method: A preliminary cross-sectional survey was carried out among pregnant women from January to June of 2014. A total of 132 pregnant women were enrolled. We used a questionnaire form for sociodemographic features, ICIQ-SF-Turkish version to determine the occurrence and characteristics of UI and Wagner's Quality of Life scale to assess impact on QOL.

Results: Urinary incontinence was present in 56 out of 132 pregnant women (42.4%); these women were referred to as the UI-present group. The remaining 76 women comprised the UI-absent group. The overall mean age was 27.5 ± 5.1 y (p=0.780), median height in UI-present group was 160 cm (min-max: 153-176, p=0.037 <0.05) and median BMI was 28.7 kg/m^2 (min-max: 22.4-50.0, p=0.881). For women in the UI-present group, urine leakage occurred once a week (n=18, 32.1%) to twice or thrice a week (n=8, 14.3%), few times a day (n=14, 25%), once a day (n=5, 8.9%) and always (n=8, 14.3%). The pregnant women in the UI-present group mainly reported a small amount of urine leakage (n=33, 58.9%) or a moderate amount of leakage (n=4, 7.1%). There were statistically significant relationships between QOL scores and frequency of UI (p=0.002 <0.05) as well as the amount of leakage (p=0.002 <0.05). Impact on QOL scores ranged from mild (n=33, 58.9%) or moderate (n=4, 7.1%) to severe (n=4, 7.1%) levels. QOL has 'mildly deteriorated'. The following features were found to favour the onset of UI: age of pregnant woman (OR= 0.845, 95% CI 0.268-2.669), occupational status (OR=1.800, 95% CI 0.850-3.810), anaemia (OR=0.939, 95% CI 0.464-1.901), parity (OR=0.519, 95% CI 0.325-0.829), miscarriage in previous pregnancies (OR=1.219, 95% CI 0.588-2.825) and living in rural vs urban settlement (OR=1.800, 95% CI 0.887-3.653). Heigt (p= 0,037<0.05), educational status (p=0.016 <0.05), miscarriage, parity and place of living (p=0.002, p=0.006, p=0.020 <0.05 respectively) were significant in favour of UI-present.

Conclusions: Urinary incontinence was frequently encountered among pregnant women (42.1%). Urinary incontinence distorted the QOL in pregnant women at a mild level and caused life style changes. Frequency and amount of UI were the significant factors in deterioration. Age, parity, miscarriage, being housewife, place of living (rural) and anaemia

were the factors in favour of onset of UI during pregnancy. Among them, height, educational status (primary-intermediate school graduate), place of living (rural), miscarriage and parity were statistically significant predictors. It is necessary to pay attention to UI and its impact on women's health during pregnancy.

Keywords: Anaemia**,** life quality, miscarriage, parity, pregnancy, urinary incontinence, women's health, rural vs urban, housewife

Abbreviations: BMI, body mass index; CI, confidence interval; OR, odds ratio; QOL, quality of life; UI, urinary incontinence.

1-Introduction

Urinary incontinence (UI) has been defined by the International Continence Society as 'the complaint of any involuntary leakage of urine'. Urinary incontinence occurs when intravesical pressure is lower than urethral closure pressure, and it may result from bladder or urethral impairment. When closure pressure is lower than bladder pressure, leakage occurs**.** It is not really known why, how and to what extent this disorder arises [1, 2]**.** Urinary incontinence is a common health problem worldwide. It could affect the life of patients and their families, with physical-hygiene, psychosocial and economic outcomes [3, 4]. By definition, any patient with even one episode of UI at any time is regarded as a case. Urinary incontinence is seen more frequently in females than males, and it can affect all ages [5]. It can also significantly impact quality of life (QOL) and be an economic burden (having to purchase sanitary pads, for example). Urinary incontinence can cause social withdrawal and impairment in QOL. It is accepted as a typical result of aging or being pregnant; thus, women often seek medical help when UI has reached its later stages [6-8].

There are some studies conducted on the prevalence of UI, and a large prevalence range has been reported. Rates of prevalence varied between 12% and 53% in a review of 48 epidemiological studies. The median prevalence of female UI was determined to be 27.6% (range: 4.8%-58.4%) in different non-institutional populations. Its prevalence during pregnancy ranged from 32%-64% [5, 7, 9, 11]. The prevalence of UI increases as term approaches during pregnancy (12% at the end of pregnancy) and decreases after childbirth [1]**.**

The studies on UI among women in Turkey revealed a prevalence rate of 16.4%-49.7%. Also, the overall prevalence of UI in a study of pregnant women by Kocaoz et al. was 27%. This variation is most likely due to alterations in study design, questionnaire type, selection criteria and definitions [12-16].

Several risk factors for UI have been defined, such as age, childbirth, menopause and smoking. Urinary incontinence is less frequently found in nullipara women. Individual variation in the predisposition for UI has also been noted [15]. The prevalence reaches a maximum during pregnancy and diminishes postpartum. Caesarean sections seem to be associated with lower rates of stress incontinence than vaginal deliveries. The suspected probable risk factors are likely to have an effect at different times and on different portions of the urethral sphincter complex [16-22]. Studies have shown that experiencing UI during pregnancy is a major risk factor for persistence of the problem later in life [1, 23, 24].

Zonguldak is a city located on the Black Sea Coast in north-western Turkey, with a population of 595,907 (294,679 males and 301,228 females; 363,707 in urban areas and 232,200 in rural areas). Bülent Ecevit University (BEU) Hospital is a referral health centre serving in this location. It has a daily outpatient-office count of about 1,500 and covers 550 beds. Between 2011 and 2013, the annual birth count at the centre's obstetrics clinic ranged from approximately 534 to 880, and the annual count of obstetrical examinations was approximately 2,300. Some pregnant patients have been admitted to emergency room at the centre with complaints of UI mixed with early membrane rupture. It is necessary to strictly follow up with pregnant women as well as other patients during periodical examinations in all aspects of health, including UI. In general, UI is unfortunately considered to be a typical occurrence during pregnancy, and it might persist long after delivery.

2-Aim

The authors aimed to investigate the frequency of UI among pregnant women as well as the possible etiologic or predisposing factors and its impact on QOL, including social and health effects.

3-Patients and Methods

The present study was a preliminary investigation constructed as a cross-sectional survey. It was carried out at the obstetrics outpatient unit of the Gynaecology and Obstetrics Department at Bülent Ecevit University Ibni Sina Health and Research Center. This is a referral centre for the city of Zonguldak and its towns and villages. The annual count of births carried out at the centre ranged between 534 and 880 from 2009-2014. From January to December of 2013, the total number of births at the centre was 534. The study was preliminarily carried out from January to July of 2014 to obtain a general overview of UI in the region. As a simple randomisation technique, a table of random numbers was used to select patients. A total of 132 pregnant women were eligible according to the inclusion and exclusion criteria.

In order to collect the data, three surveys were used: (1) A questionnaire form that defined the demographic and personal features of the participants according to the relevant literature, (2) The Turkish version of the International Consultation on Incontinence Questionnaire Short Form (ICIQ-SF) [Supplement 1, ϕ] and (3) Wagner's Quality of Life (QOL) scale [Supplement 2, μ] [16].

The questionnaire was composed of information about socio-demographic features (age, height, weight, BMI, educational status and occupational information). It also included questions pertaining to obstetric and urogynaecologic history (gravidity; parity; type of birth; instrumented delivery; birth weight of the heaviest infant; symptoms related to menopause; hormone replacement therapy; prior gynaecologic operation; any infection during the present or previous pregnancies; episiotomy; intrauterine growth retardation; history of urinary system disease, including urinary infections; urinary system surgeries undergone; history of UI in previous pregnancies and the frequency of voiding per day). The questionnaire also included information regarding personal habits (smoking and usage of alcoholic beverages or caffeinated drinks, such as cola, coffee or tea).

The authors also used the ICIQ-SF, a concise questionnaire that has been widely used and is disease specific [16]. The Turkish version of the ICIQ-SF was validated by Cetinel et al. (2004). We used the parts related to the frequency and severity of urine leakage [15, 16].

The researchers also carried out Wagner's QOL scale, introduced by Wagner et al. (1996). The Turkish version of the scale was developed by Karan et al. (2000). This scale constitutes 28 questions related to the presence of UI in pregnant women and impact of UI on their daily lives and in psychosocial situations. Participants were asked to answer each question by selecting one of the following options: 'no', 'mild', 'moderate' and 'severe'. The answers were scored as 0, 1, 2 and 3, respectively. Consequently, a total score of 0 signified that there was not any incontinence or any psychosocial problem, 1-28 denoted the presence of a mild disorder, 29-56 denoted a moderate disorder and 57-84 indicated a severe disorder [16, 25].

The study protocol was approved by the Ethical Committee at the BEU Faculty of Medicine according to the Declaration of Helsinki, with approval number 2011-99-19/07 [Supplement 3, Ψ].

A written informed consent form [Supplement 4, ʊ] was signed by each participant. The questionnaires were carried out at the obstetrics-gynaecology outpatient clinic via face-to-face interviews with participants. Two resident physicians were trained in the administration of questionnaires. It took about 40-50 minutes to interview each participant. A conscious effort was made to eliminate interviewer bias, as the residents involved in the study had been trained to conduct the questionnaires beforehand. Ethnicity was not indicated because all patients shared a similar ethnic background.

Inclusion and Exclusion Criteria

Pregnant women above 18 years of age without any acute or chronic disease were included in the study. Pregnant women in the high-risk category were excluded. Individuals were also excluded based on the following: the presence of any systemic or chronic diseases, such as diabetes mellitus or any condition of increased blood glucose levels or disturbed glucose states; hypertension (blood pressure over 125/85 mmHg); hepatitis or any state with elevated liver enzymes; any neurological disease; Cushing's disease; asthma; cardiac failure; central nervous system disorders or urinary tract infection or stones, etc. Women with previous urogynaecologic diseases and obvious neuropathies leading to UI were also excluded from the study. Other risk factors for UI were also asked, including smoker status and use of medications (such as alpha-blockers and cholinergic or anticholinergic drugs), sedatives, myorelaxants, diuretics and angiotensin-converting enzyme inhibitors. Patients who smoked and used such substances were also excluded from participation.

Statistical Analysis

All data were analysed using SPSS Version 19.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Categorical variables were presented as frequencies and percentages, and continuous variables were expressed as mean ± SD. The normality of the distribution of continuous variables was tested using the Shapiro-Wilk test. Differences in continuous variables between groups were examined using the independent sample t-test or nonparametric Mann-Whitney U test. The comparison of results between three or more groups was made using the Kruskal-Wallis test. The Dunn's test was used as a post hoc test if the Kruskal-Wallis test was statistically significant. Categorical values were compared using a chi-square test. Multivariate logistic regression analysis was performed to assess independent risk factors. A p-value of <0.05 was considered statistically significant.

4-Results

Fifty-six women (42.4%) declared the presence of UI, so they were categorised as the UI-present group. Seventy-six women (57.6%) did not experience UI, so they were classified as the UI-absent group.

Age: The mean age of all participants was 27.5 ± 5.1years. Two age groups were formed: 18-35 and ≥ 35 years . There was no significant difference in terms of existence of UI with respect to age groups ($p=0.146>0.05$, Table 1).

Height: There was a significant difference between UI-present and UI-absent groups according to body height ($p=0.037<0.05$, Table 1).

BMI: There was no significant difference between UI-present and UI-absent groups according to BMI values (p=0.881 >0.05, Table 1).

Occupational status: Over two-thirds of the participants were housewives (that is, they had no occupation other than carrying out housework) in the UI-present group (n=39, 69.6%) and UI-absent group (n=53, 69.7%). There was no significant difference in terms of the occurrence of UI between those working and those not working (p =0.122 >0.05, Table 1). In logistic analyses, however, state of working was in favour of the presence of UI. There was no significant difference with respect to occupational status between UI-present and UI-absent groups (p=0.064>0.05, table 6).

Educational level: Being primary or intermediate school graduate were significant features between UI-present and absent groups (p =0.016<0.05, table 1).

Place of living: The location (rural or urban) of one's residence was significant in logistic regression analyses (p=0.020). Hence, living in a rural area was in favour of occurrence of UI.

Gestational features: With respect to parity, gestational weeks, multiple pregnancies, interval between pregnancies and the occurrence of miscarriage or anaemia, the results of statistical analyses are presented in Table 2. There was no significant difference according to gestational weeks or trimesters because all participants were in their third trimester (p=0.908 >0.05). There was no significant difference in the occurrence of UI according to parity values (p=0.358 >0.05), history of multiple pregnancies (p=0.747 >0.05) or interval between previous pregnancies (p=0.283>0.05, Table 2). There was a statistically significant relationship between history of miscarriage and presence of UI in logistic regression analyses (p=0.002 <0.05, table 6).

When the history of previous pregnancies was further analysed, no statistically significant relationship was found with respect to history of preterm labour (p=0.474), anomalous babies (p=0.827), chronic disease—if present—during previous pregnancies (p=0.828), or anaemia (p=0.862, Table 2). Regarding the present pregnancy, there was no significant difference in the occurrence of UI according to vitamin usage (p=0.166), weight gain (p=0.995), exercise (p=0.099), sexual intercourse (p=0. 366).

Anaemia: Participants who had mean blood haemoglobin values below 11.5 mg/dl were accepted as anaemic during the study. There was no significant difference in the presence of anaemia between UI-present and absent groups (p=0.862 <0.05, Table 2). However, in logistic regression analyses, anaemia was a predictor of the occurrence of UI, but not significant (table 6).

Frequency and amount of UI: With respect to frequency of UI reported in the UI-present group, there were occasions of urinary leakage once a week or less in 18 participants (32.1%), twice or thrice a week in 8 participants (14.3%), once a day in 5 participants (8.9%), a few times a day in 14 participants (25.0%) and constantly throughout the day in 8 participants (14.3%, Table 3).

Among those in the UI-present group, mainly a small amount of urine leaked in 33 participants (58.9%), a moderate amount leaked in 4 participants (7.1%) and large amount in 4 also (7.1%, table 3).

According to life style changes, UI affected the activities related to shopping or excursions outside the home in 13 participants (23.2%) and also 14 participants (25,0%) needed wearing pads or protectors (table 5).

With respect to Wagner's QOL scores, the majority of UI-present women (n=33, 58.9%) were impaired at a mild level, the remainder at a moderate level (n=4, 7.1 %) and a severe level (n=4, 7.1%, Table 4). There were statistically significant relationships between QOL scores and frequency of UI as well as the amount of leakage (p=0.002 and p=0.002 <0.05, respectively, Kruskal-Wallis test). Thus, in general, the present study revealed that the presence of UI mildly impaired the quality of most of the participants' lives.

Statistical importance tests were also performed for history of preterm labour (p=0.341), babies small for gestational age (p=1.000), anomalous babies (p= 1.000), alcohol intake (no participant had alcohol intake), vitamin intake (p=0.166), exercise (p=0.099), age of first birth (p=0.390) and sexual intercourse (p=0.366). None of these variables were significantly related to the occurrence of UI.

According to logistic regression analyses, the following factors were designated to favour the existence of UI: age (OR=0.845, 95% CI 0.268-2.669), occupational status (OR=1.800, 95% CI 0.850-3.810), anaemia (OR=0.939, 95% CI 0.464-1.901), parity (OR=0.519, 95% CI 0.325-0.829), miscarriage in previous pregnancies (OR=1.219, 95% CI 0.588-2.825) and place of living (rural vs urban, OR=1.8, 95% CI 0.887-3.653).

Miscarriage, parity and place of living (living in a rural settlement) were statistically significant predictors of the occurrence of UI (p=0.002, p=0.006 and p=0.020 <0.05, respectively, table 6).

5-Discussion

The present study found that the UI frequency was 42.4% among 132 pregnant women at the BEU Faculty of Medicine Health and Research Center. The participants were randomly selected according to the table of random numbers.

The rate of UI in the current study is consistent with UI studies among women in Turkey that have revealed a prevalence rate of 16.4%-49.7% [12-16]; this study is also consistent with data in the literature that show a prevalence rate of 32-64% [26-28]. However, in a study by Sharma et al. (2009), UI prevalence was cited at a rate of 25.8% in 240 pregnant women [29].

The most thoroughly studied risk factors have been age, parity and obesity. The occurrence of UI increases with age [1, 30-35]. How these factors (and others) performed in the current study is discussed below.

Age: UI regularly increases in prevalence with age in both parous and nulliparous women. With time, the aging effect tends to scale down the risk ascribable to obstetrical factors; any causal agent linked to the obstetrical trauma is prone to diminish gradually [1]. In the present study, the participants shared similar ages in both UI-present and absent groups. The majority of participants were young pregnant women in the age group of 21-29 years. The mean age was 27.6 ± 5.3 years. Age was a possible predictor in developing UI, but there was no statistically significant relationship between the existence of UI and age (OR=0.845, 95% CI 0.268-2.669, p=0.782>0.05, Table 6). There was also no significant difference between UI-

present and absent groups with respect to age (p=0.780 >0.05, Table 1). In a study by Zhu et al. in which 20,000 Chinese women between 20 and 99 years of age participated, it was found that age, multiparity and vaginal delivery were major risk factors for UI. In that study, the UI prevalence rate was lower than that found in the present study, and the ages of participants were much higher (mean: 45 ± 16 y) given that the researchers studied women in the general population [35].

Height: In this study, there was a significant difference between UI-present and absent pregnant women with respect to height, consistent with the literature (p=0.037 <0.05, Table 1). Vahdatpour et al. found a direct and significant relationship between height and rate of urine leakage. With aging and an increasing number of deliveries, taller women were more prone to develop prolapse and weakening of pelvic floor muscles; consequently, they were more likely to develop UI and experience increased severity of complications [36].

Obesity or increased BMI: This is a predisposing factor in the onset of UI [1, 32-34, 37]. However, inconsistent with prior studies, the current study revealed that there was no significant difference between UI-present and absent women with regard to BMI (Table 1). It was found that BMI was not significant statistically in logistic regression analysis (p=0.998>0.05, OR=1.000, 95% CI 1.000-1.000, Table 6). Vahdatpour et al. also did not find a significant relationship between BMI and urine leakage [36]. Seshan and Muliira similarly found that age and BMI were not significant predictors of UI. This was contrary to other research in which BMI was reported to be a major factor in determining UI because increased abdominal weight led to continuous strain over pelvic tissues, causing pelvic muscles to be persistently stretched and muscles and nerves to weaken over time [34, 38, 39].

Occupational status: In the current study, the majority of the women with UI (69.6%) dealt with household chores, and there was no significant relationship between UI-present and absent groups according to occupational status (p=0.965 >0.05, Table 1). Logistic regression analysis revealed that occupational status might be a predictor of the occurrence of UI (OR=0.897, 95% CI 0.392-2.055), but it was not statistically significant (p=0.798 >0.05, table 6). It may be that the women who worked outside of the home might have been more eager than housewives to cope with UI, but this was not analysed in the current study. However, this should be investigated in future studies. In the UI investigation by Seshan and Muliira, the majority of women who experienced an onset of UI worked within the home as either housewives or housemaids/helpers (57% and 16%, respectively, p<0.01) [34].

Educational level: There was a significant difference with respect to educational level between UI-present and UI-absent groups (p =0.016<0.05, table 1). Being primary or intermediate school graduate were significant factors.

Place of living: The location (rural or urban) of one's residence was significant in logistic regression analyses (p=0.020). Hence, living in a rural area was in favour of occurrence of UI. Being a primary school or intermediate school graduate or living in a rural area could be regarded as features of lower class, so it might effect on living conditions including health states.

Parity: Previous observations have suggested that parity, or pregnancy itself, might contribute to the onset of UI independently of the mode of delivery. Consistent with the literature, the present study denoted that parity was statistically a predictor of the onset of UI (p=0.006 <0.05, OR=0.519, 95% CI 0.325-0.829, Table 6) [1, 15]. Hansen et al. demonstrated

that, with adjustment for potential risk factors, UI in pregnant women was 3.3 times more prevalent than UI occurring in a control group of nulliparous women [40].

The interval between pregnancies was not statistically significant in terms of the occurrence of UI (p=0.159 >0.05, Table 2).

Trimesters: All participants in the present study were in the same (third) trimester. Most of the patients had been referred to the health centre, a tertiary level of care, by their primary or secondary healthcare providers in the region. This referral is often carried out at a time near suspected birth. As stated above, no statistical difference was found with respect to trimesters because all of the participants were in their third trimester (p=0.09 >0.05). Patients may have preferred to visit the health centre shortly before delivery. In a study by Abdullah et al., all participants were also in their third trimester at a tertiary health centre [41].

Miscarriage: The relationship between history of miscarriage and presence of UI was statistically significant (p=0.041 <0.05 in chi-square test, Table 2 and p=0.002 <0.05 in logistic regression analysis, Table5). In the study by Seshan and Muliira, the participants with UI had one or more miscarriages in the past (79% of the total participants, p<0.01), supporting the current findings [34]. Findik et al. stated in their study that among women who had experienced miscarriage, the rate of stress incontinence was significantly high. In addition, as the number of miscarriages increased, the rate of stress incontinence also increased, but the rate of urgent UI was not influenced by miscarriage [38]. However, in the current study, distinctions between types of UI were not made. In the study by Seshan et al., there was a significant difference with respect to miscarriage between women with and without UI (p<0.01), and the majority of women with UI had experienced 1-2 miscarriages. Thus, miscarriage was a predictor of the occurrence of UI [34].

Anaemia: Prior to the onset of the study, any chronic disease patients were excluded from participation. Participants having mean blood haemoglobin values below 11.5 mg/dl were accepted as anaemic during the study. There was not any significant difference in anaemia between UI-present and UI-absent groups (p=0.862 <0.05). Anaemia presented in the current study most likely developed during pregnancy due to insufficient iron intake, though women deficient in iron, folate and vitamin B12 were prescribed supplements beforehand in order to participate in the study. Logistic regression analysis revealed that anaemia was indicated in favour of the onset of UI; as the anaemia worsened, the possibility of developing UI increased (table 6). Though it was not significant in logistic analysis, to our knowledge, this is the first time that anaemia has been noted in the literature to be a predictor of UI.

Alcohol intake: The authors did not find significance with respect to alcohol intake because no participant had used alcohol. This is contrary to the results of Zhu et al.

Rural or urban settlement: There was also significance found with respect to rural and urban settlement (p=0.020, 95% CI 0.887 and 3.653); this is not consistent with Zhu et al. [35].

QOL scores: The current study revealed that QOL scores were mildly impacted in the majority (n=33, 58.9%) of women with UI (Table 4). Among social complaints impacted by UI, those related to wearing pads or protectors were the most encountered requirements leading to increase in economic cost. This result was consistent with the study by Kocak et al [6]. There were significant relationships between QOL scores and both the frequency and the amount of UI

(p=0.002 and p=0.002 <0.05, respectively). In the study by Kocaoz et al., there was no significant relationship between the amount of UI and mean QOL score; however, there was a statistically considerable relationship between frequency of UI and mean QOL score, signifying that increased frequency of UI significantly impacted women's QOL [16]. UI had moderate to severe impact on QOL in 10% to 22% of the individuals [5].
Seshan and Muliira found that the majority of women with UI experienced symptoms at a moderate level [34]. Adamczuk et al. studied stress UI and its impact on QOL. They found that UI turned out to be a depressing factor, and it was associated with lower QOL [42].

Restrictions of the study: All of the participants were in their third trimester. This is probably because they came to the hospital at a time shortly before giving birth due to social, cultural or (most probably) economic reasons. Some women were also unwilling to talk about their symptoms because of being ashamed and thus chose not to participate. Therefore, the rate of UI cases might have been underestimated.

As the present study was a preliminary investigation, the authors intended to carry out a more detailed survey with a larger study group according to a power analysis to determine the prevalence of UI and its impact on women's health in terms of QOL throughout the region, which has other secondary healthcare hospitals. Some births and obstetrical examinations are held at those hospitals. Thus, we cannot generalise this study's results to the overall population within the region.

Treatment options: Treatment options, such as pelvic floor muscle exercises, have been available for UI and discussed in the relevant literature, though they were not investigated in the current study. Hence, dealing with UI in pregnancy is important with respect to daily healthcare services from a therapeutic point of view [43].

6-Conclusions

Urinary incontinence was frequently encountered among pregnant women (42.1%) at a tertiary clinic in the region of Zonguldak, Turkey. Urinary incontinence distorted the QOL in pregnant women at a mild level and caused life style changes in which requirement of wearing pads or protectors was mostly encountered increasing economic cost. Frequency and amount of UI were the significant factors in deterioration. Age, height, parity, miscarriage, occupational status and anaemia were the factors in favour of onset of UI. Among them, height, miscarriage and parity were the significant predictors of onset of UI in pregnancy. Though it was not significant in logistic analyses, anaemia was noted to be a predictor of UI for the first time, to our knowledge, in the literature. Place of settlement (rural vs urban), educational status were significant factors between UI-present and absent. It is necessary to pay more attention to diagnosing UI during pregnancy, to understand its impact on women's health and to properly treat patients. These results could be referred to implement proper preventive measures and policy evolution for UI and health services in the population.
Further prospective investigations with larger survey participants are necessary to estimate the exact prevalence and health outcomes of UI in the population, as the current study is a preliminary investigation.

Conflict of interest: There was no conflict of interest.

Acknowledgements: The researchers hereby would like to thank Mr Abdullatif Kaya, Mr Tahir Güven, Mr Yunis Yıldırım, Dr Belis Bengü Yıldırım and Dr Suat Bıçak and the other

the staff of the hospital for convenience of the study at Bulent Ecevit University Faculty of Medicine and Ibni Sina Health Center of the University, Zonguldak, Turkey.

References:

1-Fritel X, Ringa V, Qubioeuf E and Fauconnier A, Female urinary incontinence, from pregnancy to menopause: a review of epidemiological and pathophysiological findings, *Acta Obstetricia et Gynecologica Scandinavica,*2012, Nordic Federation of Societies of Obstetrics and Gynecology. 2012;**91**:901–910.

2- DeLancey JOL. Why do women have stress urinary incontinence? *Neurourol Urodyn*. 2010;**29**:13–7.

3- Hunskaar S, Lose G, Sykes D, Voss S. The prevalence of urinary incontinence in women in four european countries. *BJU Int*. 2004;**93**:324-30.

4- Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, et al. The standardization of terminology of lower urinary tract function: report from the standardisation sub-committee of the International Continence Society. *Neurol Urodyn*. 2002;**21**:167-178.

5- Minassian VA, drutz HP, Al-Badr A. Urinary incontinence as a worldwide problem. *Int J Gynecol Obstet.* 2003;**82**:327-338.

6- Kocak I, Okyay P, Dundar M, Erol H, Beser E. Female urinary incontinence in the West of Turkey: prevalence, risk factors and Impact on Quality of Life. *European Urology.* 2005;**48**:634–641.

7- Hampel C, Wienhold D, Benken N,Eggersmann C, Thuroff JW. Prevalence and natural history of female incontinence. *Eur Urol.*1997;**32(**Suppl2):3-12.

8- Bo K, Talseth T, Holme I. Single blind, randomized controlled trial of pelvic floor exercises, electrical stimulation, vaginal cones and no treatment in management of genuine stress incontinence in women. *BMJ*. 20 February 1999;**318**:487-493.

9- Ebbesen MH, Hunskaar S, Rortveit G,Hannestad YS. Prevalence, incidence and remission of urinary incontinence in women: longitudinal data from the Norwegian HUNT study (EPINCONT)*BMC Urol.* 2013;**13**:27. Doi:10.1186/1471-2490-13-27.

10- Mokinen JI, Gronroos M, Kiilholma PJA et al: The prevalence of incontinence in a randomized population of 5247 adult Swedish women. *Intl Urogyn J.* 1992;**3**(2):110-113.

11- Bo K, Haakstad LAH, Voldner N. Do pregnat women exercise their pelvic Floor muscles? *Intl Urogyn J.* 2007;**18**:733–736.

12- Maral I, Ozkardes, H, Peskircioglu L, Bumin MA. Prevalence of stress urinary incontinence in both sexes at or after age 15 years: a cross-sectional study. *J Urology.*2001;**165**:408–412.

13- Ozerdogan N, Kizilkaya Beji N, Yalcin O. Urinary incontinence: its prevalence, risk factors and effects on the quality of life of women living in a region of Turkey. *Gyn and Obst Invest.* 2004;**58:**145–150.

14- Filiz TM, Uludag C, Cinar N, Gorpelioglu S, Topsever P. Risk factors for urinary incontinence in Turkish women. A cross-sectional study.*Saudi Med J.*2006;**27**(11):1688-92.

15- Cetinel B, Demirkesen O, Tarcan T, Yalcin O, Kocak T, Senocak M, Itil I. Hidden female urinary incontinence in Urology and Obstetrics and Gynecology Outpatient Clinics in Turkey: what are the determinants of bothersome urinary incontinence and help-seeking behavior? *Intl Urogyn J*. 2007;**18**:659–664.

16- Kocaoz S, Talas MS, Atabekoglu CS. Urinary incontinence in pregnant women and their quality of life. *J Clin Nursing*. 2010;**19**:3314–3323 doi: 10.1111/j.1365 2702.2010.03421.

17- Thom D, Brown JS. Variation in estimates of urinary incontinence prevalence in the community: effects of differences in definition, population characteristics, and study type. *J Am Geriatr Soc*. 1998;**46**:473-480.

18- Elving LB, Foldspang A, Lam GW. Descriptive epidemiology of urinary incontinence in 3,100 women age 30-59. *Scand J Urol Nephrol*. Suppl 1989;**125**:37-43.
19- Brown JS, Grady D, Ouslander JG, Herzog AR, Varner RE, Posner SF. Prevalence of urinary incontinence and associated risk factors in postmenopausal women. Heart and Estrogen/Progestin Replacement Study (HERS) Research Group. *ObstandGyn J* 1999;**94**(1):66-70.
20- Buchsbaum GM, Chin M, Glantz C. Prevalence of urinary incontinence and associated risk factors in a cohort of nuns. *ObstGyn*. 2002;**100**:226-9.
21-Bump RC, McClish DM. Cigarette smoking and pure genuine stress incontinence of urine: A comparison of risk factors and determinants between smokers and nonsmokers. *Am J Obst Gyn*. 1994;**170**:579-82.
22-Falconer C, Ekman G, Malmstrom A. Decreased collagen synthesis in stresincontinent women. *Obst Gynl*. 1994;**84**:583-6.
23- Mason L, Glenn S, Walton I, Appletion C. The prevalence of stress incontinence during pregnancy and following delivery. *Midwifery*. 1999;**15**(2):120-128
24- Viktrup L, Rortveit G, Lose G. Risk of urinary incontinence twelve years after the first pregnancy and delivery. *ObstandGyn*. 2006;**108:**248-254.
25- Karan A, Aksaç B, Ayyıldız H, Işıkoğlu M, Yalçın O, Eskiyurt N, Quality of life and its relation with objective assessment parameters in urinary incontinent patients. *Turkish J o Geriatrics*, 2000;**3**(3): 102-6.
26- Van Brummen HJ, Bruinse HW, Van de Pol G, Heintz APM, Van der Vaart CH. The effect of vaginal and cesarean delivery on lower urinary tract symptoms: what makes the difference? *IntlUrogynJ*. 2007;**18**:133-139.
27- Sangsawang B, Sangsawang N. Stress urinary incontinence in pregnant women: a review of prevalence, pathophysiology, and treatment. *IntlUrogynJ*. 2013;**24**:901-12.
28- Hunskaar S, Burgio K, Clark A, Lapitan MC, Nelson R, Sillen U, et al. Epidemiology of urinary incontinence (UI) and feacal incontinence (FI) and pelvic organ prolapsed (POP). In incontinence (Abrams P, Cardozo L, Khoury S, Wein A eds). 3rd International Consultation on Incontinence. *Health Publication* 2005;**Vol 1**: Basics & Evaluation, Chapter 5.pp.255-312.
29- Sharma JB, Aggarwal S, Singhal S, Kumar S, Roy KK. Prevalence of urinary incontinence and other urological problems during pregnancy: a questionnaire based study. *ArchofGynandObst*. 2009;**279**:845-51.
30- Bump RC, Norton PA. Epidemiology and natural history of pelvic floor dysfunction. *Obst Gyn Clin North Am*. 1998;**25**:723-746.
31- Samuelsson EC, Victor FTA, Svardsudd KF. Five year incidence and remission rates of female urinary incontinence in a Swedish population less than 65 years old. *AmJObstandGyn*. 2000;**183**:568-74.
32- Wesnes SL, Rordvit G, Bo K, Hunskaar S. Urinary incontinence during pregnancy. *ObstandGyn* 2007;**109**:922–928.
33- Scarpa KP, Herrmann V, Palma PCR, Riccetto CLZ, Morais SS. Prevalence and correlates of stress urinary incontinence during pregnancy: a survey at UNICAMP Medical School, Sa˜o Paulo, Brazil. *IntlUrogynJ*. 2006;**17**:219–223.
34- Seshan V, Muliira JK, Self-reported urinary incontinence and factors associated with symptom severity in community dwelling adult women: implications for women's health promotion, *BMC Women's Health* 2013,**13**:16 http://www.biomedcentral.com/1472-6874/13/16
35- Zhu L, Lang J, Liu C, Han S, Huang J and Li X, The epidemiological study of women with urinary incontinence andrisk factors for stress urinary incontinence in China, *Menopause:The Journal of The North American Menopause Society*, 2009,**16** (4): 831/836, DOI:0.1097/gme.0b013e3181967b5d

36- Vahdatpour B, Zargham M, Chatraei M, Bahrami F, and Alizadeh F, Potential risk factors associated with stress urinary incontinence among Iranian women *Adv Biomed Res.*2015, **4**:205. Published online 2015 Sep 28. doi: 10.4103/2277-9175.166141

37- Findik RB, Unluer AN, Şahin E, Bozkurt OF, Karakaya J, Unsal A, Urinary incontinence in women and its relation with pregnancy, mode of delivery, connective tissue disease and other factors, *Adv Clin Exp Med* 2012, **21**(2): 207–213.

38- Townsend MK, Danforth KN, Rosner B, Curhan GC, Resnick NM, Grodstein F: Body mass index, weight gain, and incident urinary incontinence in middle-aged women. *Obstetric Gynecol* 2007, **110**:346–356.

39- Hunskaar S: A systematic review of overweight and obesity as risk factors and targets for clinical intervention for urinary incontinence in women. *Neurourol Urodyn* 2008, **27**(8):749–57.

40- Hansen BB,Svare J, Viktrup L, Jørgensen T, and Gunnar Lose G, Urinary incontinence during pregnancy and 1 year afterdelivery in primiparous women compared with a control group of nulliparous women, *Neurourology and Urodynamics* 2012,**31**:475–480.

41-Abdullah B, Ayub SH, Mohd Zahid AZ, Noorneza AR, Mohamad Rodi Isa, Ng PY, Urinary incontinence in primigravida: the neglected pregnancy predicament, *European Journal of Obstetrics & Gynecology and Reproductive Biology*2016, **198**:110–115

42-Adamczuk J, Szymona-Pałkowska K, Robak JM, Rykowska-Górnik K,Steuden S, Kraczkowski JJ, Coping with stress and quality of life in women with stress urinary incontinence, *Prz Menopauzalny* 2015; **14**(3): 178-183. DOI: 10.5114/pm.2015.54342

43- Sangsawang B and Sangsawang N, Is a 6-week supervised pelvic floor muscle exercise program effective in preventing stress urinary incontinence in late pregnancy in primigravid women?: a randomized controlled trial, *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 2016;**197** (2016) 103–110

Table 1(on next page)

Socio-demographic features of the participants

Table 1 Socio-demographic features of the participants

	Urinary Incontinence			
	Present	**Absent**	**Total**	**Statistics**
Socio-demographic features	n=56 (%)	n=76 (%)	n=132 (%)	P
Age (years), mean ± Sd	26.7±5.4	28.2±4.9	27.5 ± 5.1	0.780 $
Age group (years)				0.146 $
18 -35	50 (89.3)	69 (90.8)	119 (90.2)	
≥35	6 (10.7)	7 (9.2)	13 (9.8)	
Height (cm)				0,037 $ *
Median	160,0	160,0	160,0	
(Min-Max)	(153.0-176.0)	(147.0-173.0)	(147.0-176.0)	
BMI (kg/m^2)				0.881$
Median	28.7	29.2	29.1	
(Min-Max)	(22.4-50.0)	(22.5-50.7)	(22.4-50.7)	
Education				0.016 £*
Primary school	11(19,6)	32 (42,1)	43 (32,6)	
Intermediate	11(19.6)	5 (6.6)	16 (12.1)	
High school	19 (33.9)	24 (31.6)	43 (32.6)	
University	15 (26.8)	15 (19.7)	30 (22.7)	
Occupation				0.122£
Working	21 (37,5)	19 (25)	40 (30.3)	
Not-working	35 (62,5)	57 (75)	92 (69.7)	

$ Mann-Whitney test, £ Chi-square (χ^2) test, *Statistically significant

Table 2 (on next page)

Presence of urinary incontinence (UI) with respect to multiple pregnancy, interval between pregnancies, miscarriage, gestational weeks, parity and anemia

Table 2 The statistical analysis of presence of urinary incontinence (UI) with respect to multiple pregnancy, interval between pregnancies, miscarriage, gestational weeks, parity and anemia

	UI Present	UI Absent	Overall	Statistics
Variables	n (%)	n (%)	n (%)	P
Multiple pregnancy (n, %)				0.747 [£]
Present	1 (1.8%)	2 (2.6%)	3 (2.3%)	
Absent	55 (98.2%)	74 (97.4%)	129 (97.7%)	
Interval between pregnancies (n, %)				0.283[£]
primigravida	29 (51.8)	33 (43.4)	62 (47.0)	
<2 years	17 (30.4)	18 (23,7)	35 (26.5)	
2-5 years	6 (10.7)	14 (18.4)	20 (15.2)	
>5 years	4 (7.1)	11 (14.5)	15 (11.4)	
Miscarriage (n, %)				0,526[£]
Present	16 (28.6)	18 (23.7)	34 (25.8)	
Absent	40 (30.3)	58 (76.3)	98 (74,2)	
Gestational weeks				0.908[$]
Median	38	38	38	
(Min-Max)	(33.0 - 40.0)	(33.0 - 40.0)	(33.0 - 40.0)	
Parity				0.358 [$]
Median	1.0	2.0	2.0	
(Min-Max)	1-4	1-8	1-8	
Anemia (n%)				0.862 [£]
Present	22 (39,3)	31 (40.8)	53 (40.2)	
Absent	34 (60.7)	45 (59.2)	79 (59.8)	

[£] Chi-square (χ^2) test, [$] Mann-Whitney test

Table 3(on next page)

Frequency and amount of leakage in pregnant women with urinary incontinence

Table 3 Frequency and amount of leakage in pregnant women with urinary incontinence (UI) (n=56) [£]

Characteristics of UI	n (%)
Frequency	
Never	3 (5.4)
Once a week or less	18 (32.1)
Twice or three times a week	8 (14.3)
Once a day	5 (8.9)
Few times a day	14 (25.0)
Always	8 (14.3)
Amount	
None	15 (26.8)
Small	33 (58.9)
Moderate	4 (7.1)
Large	4(7.1)

[£] Chi-square (χ^2) test

Table 4(on next page)

Impact on quality of life (QOL) of pregnant women with urinary incontinence

Table 4 Impact on quality of life (QOL) of pregnant women with urinary incontinence (UI) [¥]

		QOL Score	
Impact on QOL	**n=56 (%)**	**Mean**	**sd**
(0)Not at all	15 (26.8)	0	0
(1-28) Mild	33 (58.9)	10.1	7.2
(29-56) Moderate	4 (7.1)	36.3	5.4
(57-84) Severe	4 (7.1)	66.4	6.3

[¥] **Kruskal-Wallis Test**

Table 5(on next page)

Table 5 Life style changes due to urinary incontinence among pregnant women

Table 5 Life style changes in urinary incontinence group (n=56)

Item impacted	n	(%)
Affect shopping or excursions outside the home	13	(23,2 %)
Affect working performance and friendship	5	(8,9%)
Affect daily home activities	4	(7,1%)
Affect general health status	7	(12,5%)
Affect sexual relations	7	(12,5%)
Makes you nervous and anxious	6	(10,7%)
Need wearing pad or protector	14	(25,0%)

PeerJ Preprints | https://doi.org/10.7287/peerj.preprints.1898v1 | CC-BY 4.0 Open Access | rec: 25 Mar 2016, publ: 25 Mar 2016

Table 6(on next page)

Table 6 Logistic Analyses of predisposing Factors for Urinary Incontinence

Table 6 Variables for developing urinary incontinence (UI)

according to logistic regression analysis (n=56) [£]

Variables for developing UI	B	SE	df	P	OR	95% CI Lower	95% CI Upper
Age groups	-0.154	0.556	1	0.782	0.845	0.268	2.669
Miscarriage	0.996	0.296	1	0.002 *	1.219	0.588	2.825
Occupational status	0.511	0.276	1	0.064	1.800	0.850	3.81
BMI	0.013	0.041	1	0.998	1.000	1.000	1.000
Anemia	0.435	0.274	1	0.112	0.939	0.464	1.901
Parity	0.656	0.239	1	0.006 *	0.519	0.325	0.829
Rural vs urban	-0.642	0.276	1	0.020 *	1.800	0.887	3.653

[£] Multivariate logistic regression analysis , [*] Statistically significant