

Urinary tract infection in pregnant women attended in Primary Health Care: a clinical and epidemiological analysis

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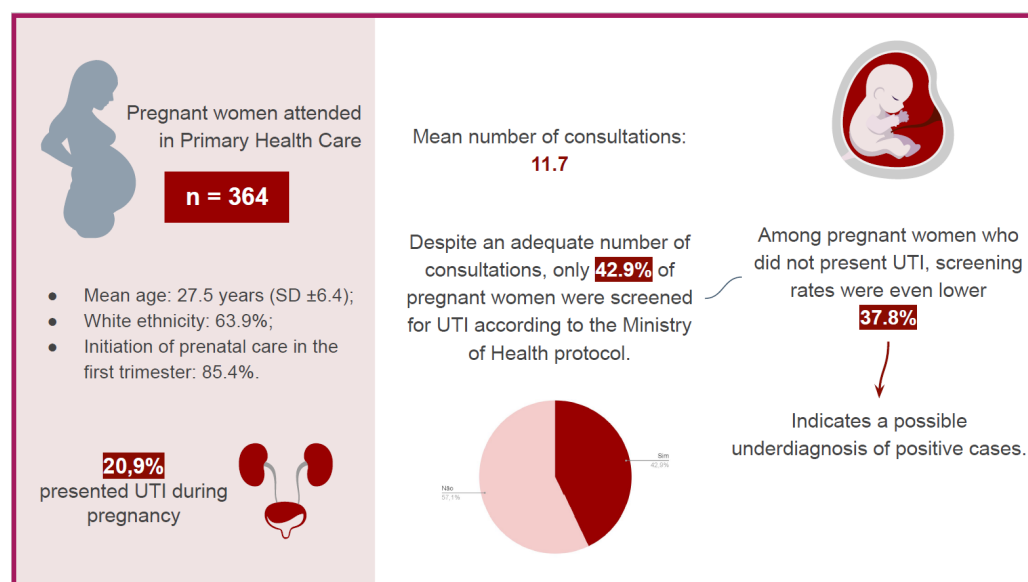
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Graphical Abstract

Highlights

- At least one-fifth of pregnant women attended in Primary Health Care presented UTI during pregnancy.
- Fewer than half of the pregnant women were screened for UTI according to the Ministry of Health protocol.
- Inadequate UTI screening during prenatal care suggests underdiagnosis of this condition.



Abstract

This study evaluated the prevalence of Urinary Tract Infection (UTI) in pregnant women receiving care in Primary Health Care (PHC) and analyzed its association with sociodemographic aspects, adequacy of prenatal care according to the guidelines of the Brazilian Ministry of Health (MoH), and pregnancy outcomes. A cross-sectional study was conducted in PHC units in Marau/RS, Brazil, with pregnant women of any age and expected date of delivery between February 2019 and June 2020. Data were collected from medical records, and descriptive statistics as well as the distribution of UTI outcomes and adverse pregnancy events were presented (chi-square test or Fisher's exact test; statistical significance set at 5%). A total of 364 pregnant women were included, of whom 20.9% had UTI. Despite an adequate number of consultations, fewer than half (42.9%) underwent urine testing as recommended by the MoH protocol. A statistically significant association was observed between paid employment, performance of at least one qualitative urine test and urine culture during prenatal care, compliance with the MoH protocol, and the occurrence of UTI ($p < 0.05$). UTI was present in approximately one-fifth of the pregnant women. Fewer than half were screened for UTI according to the MoH protocol, a concerning scenario given the potential for underdiagnosis and consequent lack of treatment of this infection.

Keywords: Urinary Tract Infections. Prenatal Care. Clinical Protocols.

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INTRODUCTION

Urinary Tract Infection (UTI) is considered the most frequent condition during the pregnancy–puerperal period. During pregnancy, anatomical and physiological adaptations occur in the female body, such as relaxation of the urinary tract musculature due to progesterone action, increased glomerular filtration rate (GFR), and uterine compression against adjacent organs, leading to urinary stasis¹. In association with reduced cellular immunity, these alterations create a favorable environment for the proliferation of microorganisms, making pregnant women more susceptible to this type of infection and its complications. Studies report a prevalence of UTI during pregnancy ranging from 8% to 20%^{1,2,3}.

During pregnancy, most cases correspond to asymptomatic bacteriuria (AB), which may represent up to two-thirds of the total. Previous data demonstrate a prevalence of 2% to 10% of AB in pregnancy^{4,5}. However, UTI during pregnancy has a high potential for complications and should be screened for and treated with antibiotics, even in cases of AB^{1,3,4,6,7}. Evidence indicates that 1% to 4% of pregnant women with untreated AB will develop pyelonephritis^{8,9}.

Although common, this type of infection re-

quires careful attention, as progression to pyelonephritis often necessitates hospitalization^{3,5}. Furthermore, several studies provide evidence of potential obstetric complications, including anemia, sepsis, preeclampsia¹⁰, preterm labor, and low birth weight^{5,11,12,13}.

Therefore, prenatal follow-up is crucial for UTI screening. Routine urine culture is considered the gold standard for diagnosis, especially of AB, and should be performed in all pregnant women during the first and third trimesters of pregnancy to reduce the risk of complications associated with this infection².

In this context, Primary Health Care (PHC), through the Brazilian Unified Health System (SUS), plays a fundamental role in ensuring appropriate access to prenatal care, screening protocols, diagnostic methods, and adequate treatment, thereby making a unique contribution to reducing maternal and neonatal morbidity and mortality.

Accordingly, the objective of the present study was to evaluate the prevalence of UTI in pregnant women attended in PHC and its relationship with sociodemographic aspects, adequacy of prenatal care according to national guidelines, and potential adverse pregnancy outcomes.

METHODS

This was a cross-sectional study conducted in the Primary Health Care (PHC) setting of the municipality of Marau, Rio Grande do Sul, Brazil. The non-probabilistic convenience sample comprised pregnant women of any age with an Expected Date of Delivery (EDD) between february 28, 2019, and june 30, 2020, in order to include women who had attended at least one prenatal consultation during 2019. Exclusion criteria were: pregnancies ending in miscarriage, medical records without prenatal follow-up data, and women whose prenatal follow-up in PHC was discontinued before the 14th week of gestation.

Data collection was performed through the analysis of electronic medical records from the G-MUS (Municipal Health Management) system, including sociodemographic and clinical data such as age, skin color, education level, and employment status. Health-related information was also collected regarding the presence of comorbidities, including

systemic arterial hypertension (SAH), diabetes mellitus (DM), dyslipidemia, hypothyroidism, epilepsy, renal, respiratory and cardiac diseases, and psychiatric comorbidities. Additionally, data related to pregnancy and delivery were retrieved: singleton or multiple pregnancy, whether the pregnancy was planned/desired, parity, gestational trimester at the initiation of prenatal care, qualitative urine test (QUT) and urine culture performed in each trimester, number of prenatal consultations, gestational age, and delivery complications.

For the definition of the variable “positive UTI diagnosis”, either a positive urine culture or a record of UTI treatment in the medical file was considered. Age categories were defined according to the legal age of majority and the criterion of Advanced Maternal Age¹¹. Urine testing was assessed according to the Ministry of Health protocol, which recommends the performance of both QUT and urine culture in the first and third trimesters of preg-

nancy². Patients who underwent additional tests beyond those recommended were also considered within protocol compliance. The stratification of the number of prenatal consultations was based on the minimum of six recommended visits. Preterm birth was defined as delivery before 37 weeks of gestation. Adverse delivery outcomes included oligohydramnios, premature rupture of membranes, preeclampsia and eclampsia, gestational diabetes mellitus, hemorrhage, hypertension, macrosomia, repeat cesarean section, and fetal distress.

Statistical analysis was performed using IBM SPSS Statistics (open distribution), including calculations of absolute and relative frequencies for categorical variables, and measures of dispersion and central tendency for continuous variables, to characterize the sociodemographic, clinical, and obstetric profile. The prevalence of UTI among pregnant women was calculated using frequency, with the number of positive urine cultures as the

numerator and the total number of women analyzed as the denominator.

Two analyses were conducted to verify the distribution of variables: in the first, the dependent variable was UTI diagnosis (positive or negative), and the independent variables were sociodemographic and clinical data, in order to assess the relationship of these factors with UTI occurrence. In the second, the dependent variables were type of delivery, prematurity, and other adverse pregnancy outcomes, and the independent variable was the presence of UTI, in order to evaluate the relationship between UTI and these outcomes. For this purpose, the Chi-square test and/or Fisher's exact test were employed, with a 5% level of statistical significance.

This study followed Resolution nº 466/2012 of the National Research Ethics Commission (CONEP) and was approved by the Research Ethics Committee for Human Subjects of the Federal University of Fronteira Sul (UFFS), approval number 4.769.903.

RESULTS

The final sample of the study consisted of 364 pregnant women, selected according to the established inclusion and exclusion criteria. Sociodemographic, clinical, and gestational characteristics are detailed in Table 1.

Regarding the sociodemographic profile, most women were aged between 18 and 34 years (77.2%), with a mean age of 27.5 years (SD ± 6.4), of White ethnicity (63.9%), had completed high school (44.7%), were employed in paid work (58.9%), and had no comorbidities (55.5%). With respect to pregnancy-related data, the majority were multiparous (64.3%), initiated prenatal care in the first trimester (85.4%), had a singleton pregnancy (97.8%), reported an unplanned pregnancy (65.2%), and attended six or more prenatal consultations (98.0%). The mean number of prenatal consultations was 11.7 (SD ± 3.7). Concerning delivery-related outcomes, there were 20 preterm births (7%) and 62 cases (17%) associated with other adverse outcomes.

Regarding the performance of urine tests during

prenatal care, 92.3% (n = 336) of the sample underwent at least one qualitative urine test (QUT) and urine culture; however, only 42.9% (n = 156) completed both tests in the first and third trimesters, as recommended by the Ministry of Health protocol.

Among all participants, 20.9% (n = 76) presented UTI during the study period, with 4.9% (n = 18) experiencing more than one episode.

The association between the presence or absence of UTI and sociodemographic and gestational characteristics is presented in Table 1. A statistically significant difference was observed regarding paid employment (25.6%; $p = 0.034$), performance of at least one QUT and urine culture during prenatal care (22.0%; $p = 0.043$), and adherence to the Ministry of Health protocol for QUT and urine culture (30.1%; $p < 0.001$).

Furthermore, among the women who presented UTI, 23.7% experienced recurrent infection, and in 38% of cases the Ministry of Health protocol for prenatal care was not followed.

Table 1 - General characteristics and distribution of UTI occurrence during prenatal care according to socio-demographic and gestational characteristics in Primary Health Care (2019–2020), Marau, RS (n = 364).

Variable	General characterization	UTI (n = 76)	No UTI (n = 288)	p*
	n (%)	n (%)	n (%)	
Age				0.874
< 18 years	18 (4.9)	4 (22.2)	14 (77.8)	
18 – 34 years	281 (77.2)	57 (20.3)	224 (79.7)	
35 – 45 years	65 (17.9)	15 (23.1)	50 (76.9)	
Skin color (n = 360)				0.215
White	230 (63.9)	52 (22.6)	178 (77.4)	
Non-White	130 (36.1)	24 (18.5)	106 (81.5)	
Education (n = 255)				0.612
Incomplete elementary school	45 (17.7)	9 (20.0)	36 (80.0)	
Complete elementary school	63 (24.7)	12 (19.0)	51 (81.0)	
Complete high school	114 (44.7)	27 (23.7)	87 (76.3)	
Higher education	33 (12.9)	10 (30.3)	23 (69.7)	
Employment status (n = 278)				0.034
Paid work	164 (58.9)	42 (25.6)	122 (74.4)	
Unpaid work	114 (41.1)	18 (15.8)	96 (84.2)	
Comorbidities				0.170
Yes	162 (44.5)	38 (23.5)	124 (76.5)	
No	202 (55.5)	38 (18.8)	164 (81.2)	
Type of pregnancy (n = 360)				0.469
Singleton	352 (97.8)	75 (21.3)	277 (78.7)	
Twin	8 (2.2)	1 (12.5)	7 (87.5)	
Planned pregnancy (n = 359)				0.400
Yes	125 (34.8)	25 (20.0)	100 (80.0)	
No	234 (65.2)	51 (21.8)	183 (78.2)	
Parity (n = 360)				0.274
Primigravida	128 (35.7)	24 (18.8)	104 (81.2)	
Multigravida (≥ 2 pregnancies)	231 (64.3)	51 (22.1)	180 (77.9)	
Start of prenatal care (n = 356)				0.069
1st trimester	304 (85.4)	71 (23.4)	233 (76.6)	
2nd trimester	47 (13.2)	4 (8.5)	43 (91.5)	
3rd trimester	5 (1.4)	1 (20.0)	4 (80.0)	
Number of prenatal consultations				0.211
≤ 5	7 (2.0)	1 (14.3)	6 (85.7)	
6 – 16	323 (88.7)	64 (19.8)	259 (80.2)	
≥ 17	34 (9.3)	11 (32.4)	23 (67.6)	
Performance of QUT and urine culture at least once during prenatal care*				0.043
Yes	336 (92.3)	74 (22.0)	262 (78.0)	
No	28 (7.6)	2 (7.1)	26 (92.9)	
Performance of QUT and urine culture according to MoH protocol²				< 0.001
Yes	156 (42.8)	47 (30.1)	109 (69.9)	
No	208 (57.1)	29 (13.9)	179 (86.1)	

UTI = Urinary Tract Infection; QUT = Qualitative Urine Test; *Chi-square test or Fisher's exact test; **Systemic arterial hypertension, diabetes mellitus, dyslipidemia, hypothyroidism, epilepsy, renal, respiratory and cardiac diseases, and psychiatric comorbidities; *Positive UTI cases without any tests performed were identified through records of treatment in medical files. Source: Authors, 2023.

Table 2 - Distribution of pregnancy outcomes according to the occurrence of UTI during prenatal care in Primary Health Care (2019–2020), Marau, RS (n = 288).

ITU	n (%)	n (%)	
Gestational age			p*
	Preterm	Term	0.245
Yes (62)	6 (9.7)	56 (90.3)	
No (225)	14 (6.2)	211 (93.8)	
Outros desfechos adversos no parto**			
	Sim	Não	0.062
Yes	18 (23.7)	58 (76.3)	
No	44 (15.3)	244 (84.7)	

**UTI = Urinary Tract Infection; *Chi-square test or Fisher's exact test; Other adverse outcomes include: oligohydramnios, premature rupture of membranes, preeclampsia and eclampsia, gestational diabetes *mellitus*, hemorrhage, hypertension, macrosomia, repeat cesarean section, and fetal distress. Source: Authors, 2023.

DISCUSSION

The present study demonstrated a prevalence of approximately 20% of UTI among pregnant women attended in PHC, as well as its association with sociodemographic and clinical aspects. This percentage is similar to that reported by the Ministry of Health, ranging from 10% to 20%^{2,10}, and exceeds findings from Bangladesh, with 8.9% prevalence¹⁴. A nationwide study in the United States reported a prevalence of 18% of UTI during pregnancy; however, it showed considerable variability across states, from 11% to 26%¹⁵. In addition to geographic variation, differences in prevalence rates may be explained by methodological and sampling differences, such as whether the population was drawn from primary care, hospital-based, or community-based settings, as well as variations in prenatal UTI screening protocols across countries.

The predominance of White ethnicity, completion of high school, and employment in paid work may be explained by the sociodemographic distribution of the population in the state of Rio Grande do Sul^{16,17}. Furthermore, the age range of 18–34 years represents the majority of pregnant women of legal adult age but below Advanced Maternal Age, which reduces the incidence of comorbidities and the risks of adverse pregnancy outcomes.

Regarding employment status, the study showed that pregnant women with paid work had a higher probability of UTI occurrence during pregnancy. In a study evaluating the same aspect, no statistically significant difference was observed for paid employment in relation to UTI prevalence in pregnant women¹⁸. A possible explanation for this rela-

tionship would be the influence of workplace environment and routine on fluid intake and urinary frequency throughout the day—factors associated with UTI development¹⁵. However, the lack of evidence in the literature on this relationship requires further studies.

With respect to gestational characteristics, the study demonstrated a predominance of multiparous women, with singleton and unplanned pregnancies, initiation of prenatal care in the first trimester, and more than six prenatal consultations. In this context, the high proportion of women with access to six or more prenatal visits (98%) demonstrates compliance with the minimum recommended by the Ministry of Health. Moreover, the mean number of consultations (11.7 ± 3.7) approximates the ideal frequency based on monthly consultations until 28 weeks, biweekly consultations between 28 and 36 weeks, and weekly consultations between 36 and 41 weeks, as recommended by the Ministry of Health². This finding highlights adequate access of pregnant women to health services, representing one of the key factors for proper and continuous pregnancy follow-up.

The sociodemographic and gestational characteristics of women who developed UTI during pregnancy followed the same pattern as the general profile of pregnant women. This finding is consistent with a study conducted in Rio de Janeiro regarding maternal age, number of pregnancies, and trimester at initiation of prenatal care. However, it differed in relation to skin color, where the majority were classified as Brown, and in employment sta-

tus, with the majority being unpaid¹⁸. Other studies have also found an association between multiparity and a higher prevalence of UTI^{15,19}. Conversely, a study conducted in Israel reported a predominant profile of primigravid women with comorbidities such as diabetes and hypertension²⁰, which was not observed in the present study, where there was a balanced distribution between women with and without comorbidities. These observations underscore the importance of conducting studies across diverse health services and regions in order to understand the population profile, thereby assisting in the implementation of appropriate follow-up and screening policies.

With regard to the performance of urine tests during prenatal care, more than 90% of the sample underwent at least one QUT and urine culture; however, only 42.9% did so in accordance with the Ministry of Health protocol.

Among women who did not present UTI during pregnancy, 62.1% did not undergo urine tests as recommended by the Ministry of Health. This rate suggests the possibility of undiagnosed UTI cases. This factor may have influenced both the prevalence reported in the study, which may be underestimated, and the measurement of possible adverse outcomes associated with UTI during pregnancy. In this context, a Brazilian study that evaluated prenatal care in relation to UTI management in the public health system found that 62% of cases were considered inadequate¹⁵. Another study conducted in the municipality of Rio Grande, which assessed the quality of prenatal care using criteria that included the performance of urine tests, found a prevalence of inadequate prenatal care of 58.2%²¹.

When the prenatal testing protocol is not correctly followed, infectious conditions may not be identified and, consequently, may not be treated, potentially progressing to more severe outcomes and representing one of the main causes of progression to pyelonephritis. Data from a study conducted in Rio Grande, RS, showed that among 23.6% of women who did not undergo urine testing as recommended during prenatal care, 2.9% required hospitalization for UTI treatment during pregnancy²². Thus, although this was not the primary focus of the present study, it may be suggested that the risk of hospitalization tends to increase in the population that does not receive adequate screening according to the Ministry of Health protocol.

In this regard, the positive impact of an adequate number of consultations is limited by the low effectiveness of these visits in terms of screening and treatment of pregnancy-complicating factors.

A cohort study conducted in Pelotas, RS, identified that the proportion of preventable infant deaths through adequate maternal care during pregnancy increased from 39.9% to 50% over an 11-year period, even though the number of prenatal consultations increased and care began earlier in gestation²³. Thus, routine screening and treatment of UTI in prenatal care can be understood as a facilitated opportunity to prevent increased risk of pre-eclampsia, preterm delivery, and other pregnancy complications¹⁰.

Recent studies have found a statistically significant association between the occurrence of UTI during pregnancy and preterm delivery^{19,20}. In agreement, a study conducted in the United States found a relationship between UTI and preterm birth among pregnant women hospitalized or treated in emergency departments²⁴. In the Netherlands, one study reported a two-fold higher risk of spontaneous preterm delivery in women who presented symptomatic UTI during the second and third trimesters²⁵. A Brazilian study found a preterm birth rate of 20.7% within the sample of women with UTI¹⁸. In the present study, approximately 10% of women with UTI during pregnancy had preterm delivery, and about one-quarter presented other adverse pregnancy outcomes. In addition to the limitation of a reduced sample size, the lack of statistical significance between these variables may be explained by the fact that the study population was drawn from routine prenatal care, most of whom were low-risk (in terms of age and absence of comorbidities), as well as by the possible treatment of positive UTI cases, which may have reduced the inflammatory effects associated with the early induction of labor. Nevertheless, the percentages are noteworthy, and adequate screening could help reduce these figures.

Regarding the performance of urine tests, the relevance lies in the higher rate of UTI diagnosis precisely among women who underwent testing or complied with the Ministry of Health protocol. This result highlights the importance of properly conducting screening tests in prenatal care for identifying positive cases.

The limitations of this study are related to the use of secondary data, which are susceptible to information bias. In addition, detection bias may have occurred, given the greater likelihood of infection being identified in individuals who underwent more tests. Finally, selection bias may also be present due to exclusion criteria and sample size, which may not have been optimal for some analyses and may have influenced the results.

CONCLUSION

Pregnant women attended in PHC in the studied municipality were predominantly within the age group considered low gestational risk, of White ethnicity, with completed high school education, in paid employment, without comorbidities, multiparous, with unplanned pregnancies, and who initiated prenatal care in the first trimester. UTI was present in approximately one-fifth of the sample. Despite the number of prenatal

consultations being consistent with the recommended minimum and average, the quality of follow-up can be improved, particularly with regard to UTI screening, since fewer than half of the women were screened according to the Ministry of Health protocol. This scenario is concerning, as it is associated with underdiagnosis of this infection, leading to non-treatment and consequently increased risk of complications.

CRedit author statement

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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