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# Reduction in maternal anxiety following prenatal pediatric urology consultation

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**Introduction:** Fetal anomalies detected on prenatal ultrasound can elicit maternal psychological distress and may be associated with increased risk of adverse fetal outcomes. Prenatal consultation with pediatric specialists may allay parental worries by improving clarity surrounding a fetal diagnosis, establishing a postnatal management plan, and providing expert advice. We sought to determine whether maternal anxiety and worry decreased following prenatal pediatric urology consultations among a cohort of pregnant women whose fetuses were diagnosed with urologic anomalies.

**Methods:** Pregnant women referred to pediatric urologists for prenatal consultation through our Fetal Maternal Center following detection of a urologic anomaly were recruited from February 2021 to March 2022 inclusive. Participants completed questionnaires before and after prenatal pediatric urology consultation assessing maternal current state anxiety (S-Anxiety) on the State-Trait Anxiety Inventory (STAI) and self-reported worry surrounding the fetal diagnosis. Differences in anxiety and worry before versus after prenatal consultation were analyzed using paired t-tests and McNemar's tests.

**Results:** 26 pregnant women completed pre- and post-visit questionnaires. Most participants (92.3%) received prenatal pediatric urology consultation for anomalies of the fetal kidney(s), including hydronephrosis and suspected multicystic dysplastic kidney. The proportion of participants reporting extreme or moderate levels of worry surrounding the fetal diagnosis significantly decreased from 69.2% prior to prenatal pediatric urology consultation, to 30.8% after consultation ( $p=0.02$ ). Reductions in worry after prenatal consultation were reported among 80.8% of participants. Average state anxiety on the STAI similarly significantly decreased from 35.2 ( $\pm 9.4$ ) before prenatal consultation to 31.4 ( $\pm 11.1$ ) after consultation. Differences in reductions in anxiety and worry did not significantly differ among participants attending prenatal consultations in-person or *via* telehealth.

**Conclusions:** Among a cohort of pregnant women diagnosed with fetal anomalies of the urinary tract, anxiety and worry surrounding the fetal diagnosis significantly decreased after prenatal in-person or telehealth consultations with pediatric urologists.

KEYWORDS

pregnancy, prenatal diagnosis, urology, CAKUT, referral and consultation

## Introduction

Congenital anomalies of the kidney and urinary tract (CAKUT) are among the most common malformations identified on prenatal imaging with an overall incidence of 1 to 4 in 1,000 pregnancies, accounting for 15-20% of all prenatally diagnosed anomalies (1, 2). Hydronephrosis, renal agenesis, and multicystic dysplastic kidney (MCDK) are some of the most frequent CAKUT diagnosed by prenatal ultrasound and may necessitate consultation with pediatric urologists prior to birth (1). Disclosure of such fetal diagnoses to prospective mothers may elicit maternal psychological distress, including feelings of anxiety, depression, loneliness, guilt, fear, sadness, or hopelessness (3, 4). Elevated maternal stress during pregnancy may also elicit physiological changes that alter the intrauterine environment and increase the risk of adverse fetal outcomes (5-8). Heightened stress and psychological distress during pregnancy have been linked to increased risks of preterm birth, low birth weight, and adverse neurodevelopmental outcomes in childhood (5, 7, 8).

Prenatal identification of congenital anomalies enables timely referral to pediatric specialists at the time of prenatal diagnosis, providing an opportunity for specialists to relay necessary information, determine early management plans, and establish open lines of communication with affected families. Specialists may utilize prenatal consultations to counsel pregnant women and their partners regarding prenatal interventions, postnatal management, and expectations for fetal and postnatal outcomes (9, 10). Such consultations may also lead to a reduction in maternal anxiety and stress by offering verbal reassurance that mothers and babies are receiving optimal care, communicating treatment plans to parents, and educating parents about potential long- and short-term consequences of the diagnosis (11). Prenatal pediatric specialist consultation may ultimately allay parental fears and worries that occur following the initial disclosure of a fetal anomaly.

The aim of this study was to evaluate maternal anxiety and worry before versus after prenatal pediatric urology consultations among mothers of fetuses prenatally diagnosed with a urologic anomaly. We hypothesized that maternal anxiety

and worry would decrease following prenatal pediatric urology consultation.

## Methods

We prospectively recruited pregnant women with fetuses diagnosed with suspected urologic anomalies who were referred to the Fetal Maternal Center (FMC) at our tertiary care pediatric hospital. All participants were prospectively recruited from February 2021 to March 2022 inclusive. Pregnant women at least 18 years of age attending in-person or telehealth prenatal pediatric urology consultations who could read and speak English or Spanish were eligible for participation. All eligible participants were contacted either in-person prior to consultations or *via* phone call prior to telehealth consultations by the study's research coordinators. Eligible participants were identified by reviewing clinical schedules. Consultations were performed by one of three pediatric urologists who routinely see patients prenatally at the FMC.

Study participants completed two questionnaires up to one week before and after prenatal pediatric urology consultations. Study materials were available in both English and Spanish, with investigator-created survey questions translated to Spanish in-house by certified translators and standardized measures were validated in both English and Spanish. Both pre- and post-visit questionnaires were completed by participants on personal computers or mobile devices using online REDCap forms or *via* paper forms in the clinic, depending on appointment modality and participant preference. Questionnaires included relevant sociodemographic and medical questions, the General Anxiety Disorder 7-item (GAD-7) to assess generalized anxiety and to provide data regarding baseline characteristics of participants, the State-Anxiety (S-Anxiety) scale of the State-Trait Anxiety Inventory for Adults (STAI) to assess current state anxiety, and a Likert scale question regarding worry surrounding the urologic diagnosis specifically. The S-Anxiety scale of the STAI is a 20-item questionnaire assessing individuals' current feelings of apprehension, tension, nervousness, and worry, with higher scores representing higher anxiety (12). The S-Anxiety

scale has been validated as a sensitive indicator of changes in current anxiety among individuals before versus after psychological interventions (12). In addition to measuring differences in mean S-Anxiety scores before versus after pediatric urology consultations, S-Anxiety scores were also compared to population normative data from working adult females aged 23-32 years of age using two-sample t-tests (12). Participants who omitted more than two questions on the S-Anxiety scale and those who did not complete post-visit surveys were excluded from data analysis. Differences in state anxiety and worry before versus after pediatric urology consultation, and differences in the extent of reduction in anxiety and worry before versus after consultation were assessed using t-tests and McNemar's tests between sub-groups; this included patients who attended visits in-person versus *via* telehealth and participants who had undergone consultation with other pediatric specialists prenatally versus those who had not. Correlations between S-Anxiety scores and level of self-reported worry in pre-visit questionnaires were assessed using the Spearman rank-order correlation.

This study was approved by the Institutional Review Board (IRB) at our hospital (IRB # XXXX-20-00612). All participants provided written informed consent prior to completing questionnaires.

## Results

Among 32 pregnant women who provided informed consent and were enrolled into the study, 26 completed both pre- and post-visit surveys with sufficient data completeness and were included in analysis. The majority of women (92.3%; n=24) received consultation for potential anomalies of the fetal kidney (s), including hydronephrosis or suspected multicystic dysplastic kidney (MCDK). Prenatal consultations were conducted in-person for 53.8% (n=14) of participants, and *via* telehealth for the remaining 46.2% (n=12; Table 1). Overall, 57.5% of participants had seen other pediatric specialists prenatally for their current pregnancy (n=15; Table 1). Consultations occurred either in the second (30.8%; n=8) or third (69.2%; n=18) trimesters among all study participants. Over 80% (n=21) of participants reported using the internet to learn more about the suspected urologic diagnosis prior to prenatal pediatric urology consultation (Table 1). GAD-7 scores indicated that most women (76.9%, n=20) had minimal generalized anxiety on pre-visit questionnaires, with 23.1% (n=6) experiencing mild generalized anxiety.

Prior to pediatric urology consultation, 69.2% (n=18) of women reported moderate or extreme levels of worry regarding the fetal urologic diagnosis. After prenatal pediatric urology consultation, the proportion of women reporting extreme or moderate worry regarding the fetal urologic diagnosis significantly decreased to 30.8% (n=8; p=0.02; Table 2; Figure 1). Overall, 80.8% (n=21) of participants reported some degree of

reduction in worry regarding their baby's urologic diagnosis after their prenatal consultation with the pediatric urologist. Mean state anxiety (S-Anxiety) on the STAI prior to prenatal pediatric urology consultation was 35.2 (± 9.4), and significantly decreased to 31.4 (± 11.1) after prenatal consultation (p=0.02; Table 2). Mean S-Anxiety did not significantly differ from mean population normative data (36.2 ± 11.0 among working females ages 19-39 years) on either the pre-consultation (p=0.99) or post-consultation (p=0.08) surveys. The degree of reduction in self-reported worry or anxiety following prenatal pediatric urology consultation did not significantly differ depending on whether pediatric urology consultation occurred in-person or *via* telehealth (p=0.33; p=0.56). While a greater proportion of participants who had undergone consultation with other pediatric specialists for their current pregnancy reported moderate to extreme worry surrounding the fetal urologic diagnosis prior to pediatric urology consultation, compared to those who had not undergone other specialist consultations (60.0% vs. 40.0%), this difference was not significantly different (p=0.43). The degree of reduction in self-reported worry and S-Anxiety scores did not significantly differ among patients who had undergone prior specialist consultation versus those who had not (p=0.35, p=0.23 respectively). In the cohort overall, increased S-Anxiety scores were associated with increased levels of self-reported worry surrounding the fetal diagnosis (Spearman's rho = 0.44; p=0.04).

Following pediatric urology consultation, 96.2% (n=25) of participants reported that the urologist made a clear plan for their baby following birth, and 88.5% (n=23) reported that they felt reassured about their baby's condition. Additionally, 88.5% (n=23) of participants reported that they felt more informed about their baby's urologic diagnosis after prenatal pediatric urology consultation. Overall, 84.6% (n=22) of participants were very satisfied with their prenatal pediatric urology consultation, and 100.0% (n=26) would recommend prenatal pediatric urology consultation for other women whose fetuses were prenatally diagnosed with a urologic anomaly.

## Discussion

Prenatal diagnosis and pediatric specialist consultation following detection of a suspected fetal anomaly have numerous benefits, including enabling specialists to influence perinatal management and establishing a care plan for the immediate postnatal period (13). Prenatal diagnosis of hydronephrosis allows for timely postnatal follow up and management, enabling the early identification of the etiology of hydronephrosis, and facilitating appropriate management to protect against adverse patient outcomes (1, 14). When hydronephrosis occurs due to ureteropelvic junction obstruction (UPJO), prenatal diagnosis can improve attendance at postnatal follow-up visits, lead to timely surgical management, and protect renal function (15). Prenatal detection

**TABLE 1** Characteristics of 26 women receiving prenatal pediatric urology consultations who completed pre- and post-visit questionnaires.

	n	%
Mean age (SD) in years	30.6 (± 3.9)	
<b>Race/Ethnicity</b>		
Hispanic	16	61.5%
White	7	26.9%
Asian	2	7.7%
Unknown	1	3.8%
<b>Primary Language</b>		
English	20	76.9%
Spanish	6	23.1%
<b>Marital Status</b>		
Married	17	65.4%
Single	8	30.8%
Divorced	1	3.8%
<b>Highest Education Level</b>		
Some high school	1	3.8%
High school graduate	5	19.2%
Some college	4	15.4%
Associate's degree	3	11.5%
Bachelor's degree	10	38.5%
Master's degree	3	11.5%
<b>Household Income</b>		
Less than \$20,000	5	19.2%
\$20,000 to \$34,999	5	19.2%
\$35,000 to \$49,999	4	15.4%
\$50,000 to \$74,999	1	3.8%
\$75,000 to \$99,999	1	3.8%
Over \$100,000	8	30.8%
<b>Timing of Prenatal Urologist Consultation</b>		
Second trimester	8	30.8%
Third trimester	18	69.2%
<b>Parity at Prenatal Urologist Consultation</b>		
Nulliparous	15	57.7%
Parous	11	42.3%
<b>Appointment Modality</b>		
In-person	14	53.8%
Telehealth	12	46.2%
<i>(Continued)</i>		

**TABLE 1** Continued

	n	%
<b>Seen other Prenatal Specialists for Current Pregnancy</b>		
Yes	15	57.7%
No	10	38.5%
Unknown	1	3.8%
<b>Reason for Urology Consult</b>		
Issue with fetal kidney(s)	24	92.3%
Issue with fetal bladder	1	3.8%
Issue with fetal genitals	1	3.8%
Unknown	1	3.8%
<b>Mother's Perception of Issue Severity</b>		
Major Issue	6	23.1%
Minor Issue	12	46.2%
Unsure of severity	8	30.8%
<b>Used Internet for Information regarding Fetal Urologic Issue</b>		
Yes	21	80.8%
No	4	15.4%
Unknown	1	3.8%

and early management are also beneficial for other congenital urologic conditions including MCDK and genital anomalies (16). Prenatal pediatric urology consultations for suspected fetal MCDK allow specialists to share important information with parents regarding precautions for children with solitary kidney, as well as to identify bilateral MCDK and contralateral renal anomalies that may impact fetal viability and postnatal care (16). Similarly, prenatal diagnosis of genital anomalies can inform early management, ease parental distress, and guide parental decision-making (17). Additionally, as shown in the findings presented above, prenatal consultations may reduce maternal stress and anxiety surrounding fetal diagnoses.

There is increasing interest in identifying prenatal maternal psychological factors that may impact fetal development and postnatal outcomes (5–8). Receiving a prenatal diagnosis of a fetal anomaly may elicit emotional distress and moral challenges in the prospective mother, which may negatively impact both the pregnant woman and the developing fetus (5–8, 18, 19). Elevated maternal anxiety and chronic stress during pregnancy have been linked to increased risks of gestational diabetes, pre-eclampsia, pre-term birth, low birth weight, intrauterine growth restriction, and adverse fetal neurodevelopmental outcomes (20–22). While multiple mechanisms are likely at play in the association between maternal stress and adverse fetal outcomes, it is hypothesized that maternal distress may increase fetal

TABLE 2 Reported levels of worry about fetal urologic issue and state anxiety score on the State Trait Anxiety Inventory (STAI) among 26 pregnant women before and after prenatal urology appointment.

	Before Urology Visit		After Urology Visit		p-value
	n	%	n	%	
<b>Level of Worry</b>					
Extreme	6	23.1%	0	0.0%	0.02
Moderate	12	46.2%	8	30.8%	
Slight	5	19.2%	14	53.8%	
No Worry	3	11.5%	4	15.4%	
<b>Average (SD) STAI Score</b>	35.2 (9.4)		31.4 (11.1)		0.02

exposure to cortisol *via* activation of the maternal hypothalamic-pituitary-adrenal axis (22). The extent of distress experienced by expectant mothers after receipt of a fetal diagnosis is highly variable and may depend on the individual's psychological baseline, the severity of the diagnosis, parental perceptions and expectations, and the quality of prenatal communication and management by healthcare providers (11, 23, 24). As we found in the present study, women's self-reported level of worry surrounding their fetal diagnosis before prenatal pediatric urology consultation ranged from no worry to extreme worry. Effective communication between the prenatal specialist and prospective parents is essential, as we found in this study that maternal anxiety and worry surrounding the fetal diagnosis may significantly decrease after pediatric urology consultation.

In our patient sample, almost 50% of study participants received prenatal consultations *via* telehealth, and experienced similar reductions in anxiety and worry as participants who attended in-person consults. Telehealth for prenatal care specifically has shown to decrease anxiety and stress surrounding pregnancy (25, 26), and provides a more feasible method for parents to meet with pediatric specialists. Pregnant women also frequently report using technology to gather information regarding pregnancy concerns or fetal diagnoses (27). In the present study, over 80% of participants reported using the internet to seek information regarding their fetal diagnosis prior to pediatric urology consultation. Online information related to pregnancy and fetal development may not be consistent, accurate, or relevant (27), necessitating the need for clear information to be shared during ensuing pediatric specialist consultations.

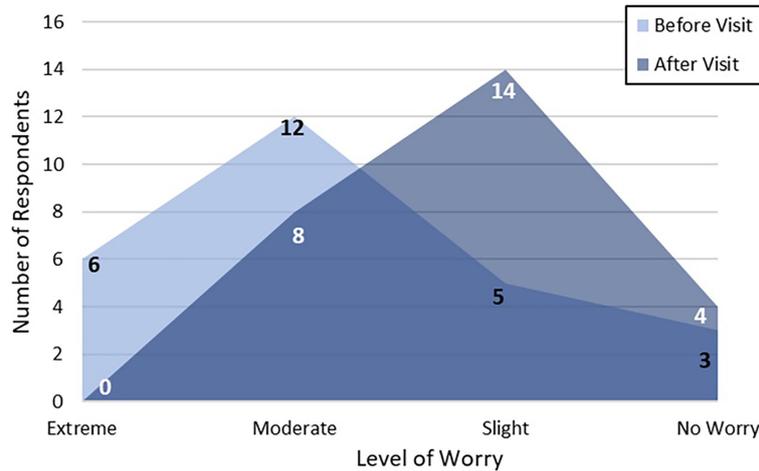
Prenatal pediatric specialist consultations provide an opportunity for physicians to communicate with parents regarding prenatal interventions and postnatal care and can allay parental fears and concerns. Hodgson et al. reported that parental coping following fetal diagnosis was closely linked to the nature of health professional communication (18). When communicating with prospective mothers and fathers, relaying information in an honest, timely, personal, empathic, detailed, and straightforward way allows for increased confidence by mothers in their treating physicians (18). In addition to

significant reductions in worry and anxiety following prenatal pediatric urology consultation in this study, over 80% of participants reported additional benefits including feeling more informed about the fetal diagnosis, having a clear plan for their baby after birth, and feeling highly satisfied with their appointment. As such, when a urologic finding is discovered prenatally, routine involvement of pediatric urologists in the prenatal period is recommended.

## Limitations

This study is not without its limitations. This study includes a limited number of participants and may not be representative of all pregnant women with fetal urologic anomalies who present for prenatal pediatric urologic care. Due to the relatively small sample size of this study, it was not possible to pursue analyses that were adjusted for covariates, or to identify whether certain patient or clinical factors were more strongly associated with maternal anxiety or worry. Similarly, this study was not powered to identify the impact of prenatal urology consultations among patients with diagnoses specifically affecting the fetal bladder or genitalia, and a larger study would be required to evaluate these diagnoses. As the majority of participants in the present study had diagnoses affecting the fetal kidneys, the results presented may be more representative of patients with prenatally diagnosed renal issues rather than all urologic diagnoses.

The anxiety levels of participants' partners were not measured, and thus the effects of partner anxiety on participant anxiety and the changes in partner anxiety following prenatal consultation could not be assessed. While beyond the scope of the current study, this could be explored in a future study. Additionally, although we attempted to recruit all English- and Spanish-speaking patients presenting for prenatal pediatric urology consultation during the study period, there is the possibility of selection bias in this sample. Due to logistical limitations, some potential participants could not be approached for study participation prior to urology consultations, and thus could not be included in the study. Additionally, two women during the



**FIGURE 1**  
Self-reported worry among 26 pregnant women receiving prenatal pediatric urology consultations, before versus after pediatric urologist visit.

study time period were identified by the neonatologist to have extreme levels of distress associated with serious fetal anomalies and requested that these mothers not be recruited to participate. As such, these individuals were not included in the study, which may have resulted in a selection of included participants who reported overall lower worry and anxiety than is representative of all patients seen at our Fetal Maternal Center for urologic anomalies. Despite these limitations, we believe that these findings provide evidence that pregnant women may experience reductions in anxiety and worry surrounding fetal diagnoses after receiving prenatal pediatric urology consultation.

## Conclusion

The findings from this study indicate that pregnant women experience significant reductions in anxiety and worry surrounding fetal urologic diagnoses after in-person or telehealth prenatal pediatric urology consultation. Patients who received prenatal pediatric urology consultations in this study also reported that such consults allowed for a clear plan was to be established for postnatal care, asserted improved knowledge regarding the fetal diagnosis, and were highly satisfied with their consultations. As such, we advocate for more routine involvement of pediatric urologists in prenatal care when a prenatal urologic diagnosis is discovered.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving human participants were reviewed and approved by Children’s Hospital Los Angeles. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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