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Does perception of catheterization limit its use in pediatric UTI?

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Summary

Introduction
Urinary tract infections (UTIs) affect 3–8% of febrile children annually, but correctly diagnosing UTI in young children can present a challenge. Diagnosis requires a non-contaminated urine sample, which requires catheterization or suprapubic aspiration in infants and young children that have not completed toilet training. To improve adherence to these guidelines, it is critical to understand the barriers to urine testing and catheterization.

Objective
The purpose of this study was to investigate parental perception of pediatric UTI evaluation to better understand factors that impede urine testing prior to treatment of suspected UTI.

Study design
We conducted an electronic, cross-sectional survey via social media targeting parents of children with a history of UTI. Participants were queried regarding demographics, urine specimen collection method, factors influencing urine collection method, and perception of the experience. Multivariable logistic regression was used to assess factors associated with catheterization distress and urine testing.

Results
Of 2726 survey respondents, > 80% were female and White; 74% of the children with a history of UTI were female. Fifty-six percent of parents perceived extreme distress with catheterization. Among parents whose child was catheterized, extreme distress was less likely perceived if the parent was White (OR 0.6, 95% CI 0.4–0.9) or if the child was circumcised (OR 0.7, 95% CI 0.4–0.98). Among those whose child was not catheterized, extreme distress was more likely if parents had a college education (OR 3.2, 95% CI 2.2–4.5) and the child was more than 1 year old (OR 1.7, 95% CI 1.2–2.5). Catheterization was less likely to be withheld if parents had a college education (OR 0.1, 95% CI 0.1–0.2), and if the child was circumcised (OR 0.5, 95% CI 0.3–0.8) or had only one UTI (OR 0.6, 95% CI 0.4–0.8) (Table).

Discussion
Parental education level, child age, and circumcision status play an important role in the subjective distress associated with catheterization. This highlights the substantial impact of parental factors on adherence to guidelines for children suspected of UTI. For example, college-educated parents were more likely to be offered catheterization. However, these parents are also more likely to associate the catheterization experience with extreme distress, possibly limiting their likelihood of consent to this procedure. More studies are required to better understand the impact of these factors on catheterization. But, it is clear that parental input has a substantial impact on the evaluation of their child's suspected UTI.

Table Factors associated with not being catheterized among those whose child should have been offered catheterization based on age and lack of toilet training (A), and associated with parental perception of catheterization as "extreme distress" among those whose children were not catheterized (B).

	(A) Not offered catheterization (n = 396)			(B) Extreme distress, not catheterized (n = 1051)		
	Frequency, n (%)	OR (95% CI)	p	Frequency, n (%)	OR (95% CI)	p
Annual income (US$)						
< 25,000	55 (14)	–		220 (21)	–	
25,000–49,999	89 (22)	1.0 (0.63–1.57)		299 (28)	1.0 (0.76–1.34)	
50,000–74,999	69 (17)	1.2 (0.73–2.04)		199 (19)	0.9 (0.68–1.32)	
75,000–99,999	69 (17)	1.1 (0.66–1.85)		124 (12)	0.3 (0.22–0.42)	
> 100,000	115 (29)	1.2 (0.69–2.05)	< 0.001	208 (20)	0.4 (0.27–0.54)	< 0.001
Education						
≤ High school	72 (18)	–		254 (24)	–	
Some college	140 (35)	0.9 (0.61–1.28)		531 (50)	1.0 (0.77–1.26)	
≥ College degree	185 (47)	0.1 (0.08–0.22)	< 0.001	267 (25)	3.2 (2.25–4.46)	< 0.001
Ethnicity						
Non-White	68 (17)	–		205 (19)	–	
White	328 (83)	1.0 (0.66–1.38)	0.498	846 (81)	1.0 (0.81–1.32)	0.952
Sex						
Female	278 (70)	–		770 (73)	–	
Circumcised male	81 (20)	0.5 (0.32–0.76)		52 (5)	0.9 (0.73–1.21)	
Not circumcised male	38 (10)	1.1 (0.62–1.88)	< 0.001	229 (22)	1.2 (0.74–1.79)	0.010
Number of UTIs						
> 1	166 (42)	–		625 (59)	–	
1	230 (58)	0.6 (0.42–0.78)	0.025	426 (41)	1.0 (0.69–1.38)	0.337

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Introduction

Urinary tract infection (UTI) affects 3–8% of febrile children annually and imposes a significant economic burden estimated at > US$180 million annually as a result of both direct and indirect costs [1]. Correctly diagnosing UTI in young children can present a challenge as signs and symptoms may be non-specific. Furthermore, collecting urine can be challenging in this age group. Guidelines from the American Academy of Pediatrics and the National Institute for Health and Care Excellence recommend urine testing if treating a child for a suspected UTI [2,3]. Specifically, a non-contaminated urine sample should be collected, which requires catheterization or suprapubic aspiration in infants and young children that have not completed toilet training as the diagnosis of UTI cannot be established reliably through culture of urine collected in a bag.

To improve adherence to these guidelines, it is critical to understand the barriers to urine testing and catheterization. Studies have traditionally focused on the practice patterns of physicians, but this study surveys a sample of all parents of children with a UTI within the United States to investigate factors that impeded appropriate urine testing prior to treatment of suspected UTI in children.

Materials and methods

Study design

An electronic, cross-sectional survey via social media was conducted targeting parents of children with a history of UTI. Facebook advertisements were developed to reach self-identified parents in the United States between the ages of 20 and 60 years in the United States, targeting those with interests in "parenting," "pediatrics," "urology," and "urinary tract." Potential participants were provided a link to an informational page about the survey. Participants who elected to participate could progress to the survey itself only after providing consent. No personally identifying information was collected and the survey software declined repeat survey entries from a single Internet protocol address to reduce the likelihood of repeat participants. Participants completing the survey were offered a US$10 gift card from Starbucks for completion. This incentive was chosen because of evidence supporting small, guaranteed dollar amounts versus larger, lottery-based amounts in optimizing the response rates. Study data were collected until the sample size was met, requiring less than a 1-week period in July 2014 and managed using Research Electronic Data Capture (REDCap). This study was approved by the University of California, San Francisco Committee on Human Research.

Survey instrument

The survey was developed and pilot tested using the faculty and fellows in the division of Pediatric Urology at the University of California, San Francisco, with the specific goal of eliciting feedback on the survey design and was revised based on the feedback received from the pilot study. The survey tool consisted of up to 37 questions and took less than 10 min to complete. The respondents provided their demographic information as well as the sex, circumcision status, age, and toilet-training status of the child at the time of their most recent UTI. Parents then specified the urine specimen collection method, factors influencing urine collection method, and perception of the experience.

Statistical analyses

The responses are reported as the proportion of total respondents. Participant demographics were compared with one-way ANOVA for continuous variables and chi-square test for categorical variables. Multivariate logistic regression analysis was performed with the following a priori predictor variables: annual household income, education of survey participant, ethnicity of survey participant, family history of UTI, sex and circumcision status of child, number of previous UTIs of child, and age at first UTI. Of note, income, education, and ethnicity were treated as independent variables as the literature evaluating socioeconomic status suggests that they are not always correlated [4]. Specifically, to assess for factors associated with failure to offer appropriate urine collection, a multivariate analysis was performed between children who were inappropriately not offered catheterization and those who were offered appropriate urine collection (including individuals appropriately offered catheterization and those who are toilet trained). Results were considered significant if $p < 0.05$. Statistical analysis was preformed using STATA (Stata Corp, College Station, TX, USA).

Results

A total of 7549 participants clicked on the Facebook advertisement. Of these, 2993 (40%) started the survey and 2726 (36%) completed the survey in its entirety (Fig. 1). Of the participants who completed the survey, 2253 (82.6%) were identified as female and 2199 (81%) were identified as White. The majority of participants reported having a female child (2,256, 74%). Of the male children, most were circumcised (613, 77%) (Table 1).

All participants were queried regarding their perception of the catheterization experience and their responses were stratified by whether their child was catheterized during his/her evaluation for UTI. Of 1877 participants whose child had not been catheterized, 56% (1051) reported they associate "extreme distress" with the concept of catheterization. Similarly, of 849 participants whose child had been catheterized, 49% (418) reported "extreme distress." For comparison, participants were queried regarding their perception of distress with other medical interventions and most participants perceived "extreme distress" if their child was to have a blood test (73%), suprapubic aspiration (59%), or undergo surgery (60%). In contrast, fewer

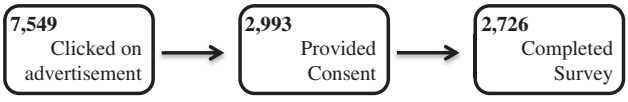

Figure 1 Flowchart for survey participants.

Table 1 Demographic characteristics of survey respondents.

Characteristic	Frequency, *n* (%)
Parent	
Sex	
Female	2253 (83)
Ethnicity	
White	2199 (81)
African-American	185 (7)
Asian	79 (3)
Other	263 (10)
Education[a]	
Some high school	98 (4)
High school/equivalent degree	400 (15)
Some college	1162 (43)
Bachelor's degree	757 (28)
Graduate education	310 (11)
Annual income (US$)	
< 25,000	422 (16)
25,000–49,999	604 (22)
50,000–74,999	470 (17)
75,000–99,999	483 (18)
> 100,000	746 (27)
Child	
Sex	
Male[a]	793 (26%)
Circumcised	613 (77%)
Uncircumcised	180 (23%)
Female	2256 (74%)
Age at first UTI	
< 1 month	47 (2%)
1–11 months	454 (15%)
1–2 years	714 (23%)
2–5 years	974 (32%)
6–12 years	687 (23%)
13–17 years	172 (6%)
Number of UTIs	
1	1208 (40%)
2–5	1203 (40%)
6–10	419 (14%)
> 10	219 (7%)
Toilet trained[a]	
Yes	1988 (65%)
No	794 (26%)
In process	266 (9%)

UTI = urinary tract infection.
[a] Assessed at most recent UTI if multiple UTIs.

participants perceived extreme distress if their child had an ultrasound (11%), was prescribed a medication (17%), or received an injection (37%). Participants who had a college education were more likely to report extreme distress despite the catheterization status of their child (child catheterized, OR 2.3, 95% CI 1.2–4.4; child not catheterized, OR 3.2, 95% CI 2.2–4.5).

An analysis was performed among participants who reported "extreme distress" stratified by whether their child had been catheterized. In both groups, the child having one versus more than one UTI was not found to be statistically significantly related to participants reporting extreme distress with the concept of catheterization. Participants whose child was catheterized were less likely to report extreme distress if they self-identified as White (OR 0.6, 95% CI 0.4–0.9), reported a history of UTI in another family member (OR 0.3, 95% CI 0.2–0.4), or if their child was a circumcised boy (OR 0.7, 95% CI 0.4–1.0, compared with girls). Participants whose child was not catheterized were more likely to report extreme distress if their annual household income exceeded US$75,000 yearly (OR 0.3, 95% CI 0.2–0.4) or if their child was aged 1–2 years (OR 1.7, 95% CI 1.2–2.5, compared with children < 1 month) (Table 2).

Before empiric antibiotic treatment for UTI, children who were not toilet trained should have been catheterized for urine testing. Participants were queried regarding the toilet training status of their child at the time of their most recent UTI. In fact, 244 children who should have been catheterized reported that this was not offered to them. Participants who had a college education were less likely to have catheterization withheld (OR 0.1, 95% CI 0.1–0.2, compared with high school education). Other factors associated with decreased odds for catheterization being withheld were circumcised boys (OR 0.5, 95% CI 0.3–0.8, compared with girls) and having a history of only one UTI (OR 0.6, 95% CI 0.4–0.8, compared with those with > 1 UTI) (Table 3).

Discussion

The current cross-sectional survey examines the parental perception of evaluation of UTI among Facebook users across the United States. We found that most participants perceive the catheterization experience as one associated with "extreme distress," regardless of whether their child was catheterized. Although it is unknown how much disease-specific distress parents are experiencing due to concern for a UTI, it remains remarkable that the experience of catheterization was perceived approximately as distressful as their child undergoing surgery and, interestingly, also as distressful as their child having a blood test. Finding catheterization as "extremely distressful" may not be novel, but the severity of this finding is remarkable and may provide an opportunity for education regarding catheterization. The likelihood of perceiving extreme distress with catheterization was increased among parents with a college education. Interestingly, the perception of distress was mitigated among those who identify as White or who have a circumcised boy and increased among those with a larger annual household income as well as those with a child aged 1–2 years. To better understand the practice of catheterization, participants were also queried regarding their recollection of being offered catheterization when they should have been. In fact, it was found that participants were *less* likely to have catheterization withheld if they were college educated, had a circumcised boy, or their child had only one UTI.

The impact of parental perceptions on children's care is critical and has been explored in other aspects of pediatric health. Watson et al. [5] studied the antibiotic prescribing practices of pediatricians. A phone survey of parents revealed a direct correlation of parental beliefs about the need for antibiotic treatment of upper respiratory

Table 2 Factors associated with parental perception of catheterization as "extreme distress" stratified by whether child was catheterized, $n = 1{,}469$.

	Child catheterized, $n = 418$			Child not catheterized, $n = 1051$		
	Frequency, *n* (%)	OR (95% CI)	*p*	Frequency, *n* (%)	OR (95% CI)	*p*
Annual income (US$)						
< 25,000	36 (9%)	–		220 (21%)	–	
25,000–49,999	80 (19%)	1.2 (0.56–2.21)	0.682	299 (28%)	1.0 (0.76–1.34)	0.964
50,000–74,999	101 (24%)	1.4 (0.69–2.69)	0.377	199 (19%)	0.9 (0.68–1.32)	0.740
75,000–99,999	80 (19%)	1.1 (0.54–2.21)	0.798	124 (12%)	0.3 (0.22–0.42)	<0.001
> 100,000	121 (29%)	0.7 (0.35–1.33)	0.262	208 (20%)	0.4 (0.27–0.54)	<0.001
Education						
≤ High school	24 (6%)	–		254 (24%)	–	
Some College	78 (19%)	4.4 (2.13–9.00)	<0.001	531 (50%)	1.0 (0.77–1.26)	0.891
≥ College degree	316 (76%)	2.3 (1.18–4.40)	0.015	267 (25%)	3.2 (2.25–4.46)	<0.001
Ethnicity						
Non-White	91 (22%)	–		205 (19%)	–	
White	327 (78%)	0.6 (0.41–0.88)	0.008	846 (81%)	1.0 (0.81–1.32)	0.776
Family history of UTI						
Yes	311 (74%)	–		797 (76%)	–	
No	107 (26%)	0.3 (0.22–0.41)	<0.001	254 (24%)	1.0 (0.74–1.19)	0.610
Sex						
Female	303 (72%)	–		770 (73%)	–	
Circumcised male	28 (7%)	0.7 (0.44–0.98)	0.041	52 (5%)	0.9 (0.73–1.21)	0.625
Not circumcised male	87 (21%)	1.6 (0.91–2.88)	0.103	229 (22%)	1.2 (0.74–1.79)	0.530
Number of UTIs						
>1	277 (66%)	–		625 (59%)	–	
1	141 (34%)	1.0 (0.69–1.38)	0.878	426 (41%)	1.0 (0.69–1.38)	0.878
Age at first UTI						
<1 month	16 (4%)			5 (<1%)	–	
1–11 months	129 (31%)	1.3 (0.68–2.33)	0.467	87 (8%)	1.3 (0.80–2.03)	0.317
1–2 years	88 (21%)	1.3 (0.69–2.47)	0.418	271 (26%)	1.7 (1.17–2.52)	0.006
2–5 years	55 (13%)	1.2 (0.61–2.31)	0.615	411 (39%)	1.4 (1.00–1.96)	0.054
6–12 years	106 (25%)	1.5 (0.73–2.94)	0.285	220 (21%)	1.3 (0.89–1.89)	0.176
13–17 years	24 (6%)	2.9 (1.06–7.82)	0.037	56 (5%)	1.1 (0.69–1.87)	0.623

UTI = urinary tact infection.

infections and their physician's prescribing practices. These parents either sought out physicians who were willing to prescribe antibiotics for viral illnesses, or the physicians were responding to the demand by the parent for a prescription [6]. This close relationship between parents' and physicians' practices suggests that adherence to guidelines for the management of UTI requires educating not only physicians of correct practices, but also parents.

The American Academy of Pediatrics guidelines for UTI management strongly recommends obtaining a urine specimen through catheterization or suprapubic aspiration if a clinician empirically treats a febrile infant for presumed UTI [2]. Cultures of specimens from urine collection bags have an unacceptably high false-positive rate and are only valid if they yield negative results. Notably, these guidelines acknowledge that although catheterization is invasive, there is a preponderance of benefit over harm. However, Copp et al. [7] demonstrated that adherence to this guideline is poor, finding that 32% of children < 2 years had no urinalysis or culture performed for an antibiotic-treated UTI episode. Although the failure to adhere to guidelines is clear, the cause of this failure has not been well studied. Platt et al. [8] found compliance with urine testing was significantly poorer among children < 3 years versus children aged 3–16 years, 28% versus 68%, respectively. This decreased compliance among infants and young children versus older children may suggest that the method of obtaining the urine for testing, which requires catheterization or suprapubic aspiration primarily in the youngest age group, is the culprit. For catheterization to occur, parental consent for the procedure is required. In fact, a recent survey of physician practice patterns surrounding UTI management sited parental reluctance for catheterization as a factor contributing to lack of catheterization [9].

Parental factors influencing urine testing have not been well studied, but factors influencing a parent's decision to provide consent for his/her child to participate in clinical trials have been studied by Hoberman et al. [10]. They found that graduating from college was associated with a lower likelihood of providing consent, although ethnicity and the child's sex were not relevant. Interestingly, the current study documented a relationship between graduating from college and reporting "extreme distress" associated with catheterization, which may impact the likelihood of consenting to catheterization and thereby decrease adherence to guidelines.

Table 3 Factors associated with failure to offer appropriate urine collection.

	Not offered catheterization,[a] $n = 244$	Offered catheterization or toilet trained, $n = 2482$	OR (95% CI)	p
	Frequency, n (%)	Frequency, n (%)		
Annual income, US$				< 0.0001
$< 25,000$	42 (17)	381 (15)	–	
25,000–49,999	67 (27)	540 (22)	0.994 (0.630–1.566)	
50,000–74,999	45 (19)	425 (17)	1.222 (0.733–2.038)	
75,000–99,999	43 (18)	440 (18)	1.104 (0.660–1.845)	
$> 100,000$	47 (19)	696 (28)	1.186 (0.686–2.049)	
Education				< 0.0001
$\leq$ High school	66 (27)	436 (18)	–	
Some college	136 (56)	1031 (42)	0.880 (0.605–1.280)	
$\geq$ College degree	42 (17)	1015 (41)	0.131 (0.076–0.223)	
Ethnicity				0.498
Non-White	43 (18)	481 (19)	–	
White	201 (82)	2001 (81)	0.954 (0.659–1.380)	
Sex				< 0.0001
Female	178 (73)	1830 (74)	–	
Circumcised male	31 (13)	142 (6)	0.497 (0.323–0.763)	
Not circumcised male	35 (15)	510 (21)	1.077 (0.618–1.875)	
Number of UTIs				0.025
> 1	111 (45)	1531 (62)	–	
1	133 (55)	951 (38)	0.573 (0.422–0.779)	

[a] Analysis is among those whose child should have been offered catheterization based on age and lack of toilet training.

Kozyrskyj [11] studied the child and household factors predictive of non-adherence to evidence-based antibiotic prescribing in children with viral respiratory tract infections. Interestingly, they found a direct relationship between adherence to guidelines and annual household income with a decrease in antibiotic prescription, according to guidelines, as household income increases. Although this study did not find a relationship between income and being offered catheterization, we did find that parents with a college education, which is associated with increased household income, were more likely to have been treated according to the guidelines; they were less likely to have catheterization withheld when it was indicated [12].

Compiling the above findings highlights the substantial impact of parental factors on adherence to guidelines for children suspected of UTI. For example, college-educated parents are more likely to be offered catheterization. However, these parents are also more likely to associate the catheterization experience with extreme distress, possibly limiting their likelihood of consent to this procedure. More studies are required to better understand the impact of these factors on catheterization. But it is clear that parental input has a substantial impact on the evaluation of their child's suspected UTI.

Study limitations

By nature of the study design, the survey respondents were limited to those who use social media. Furthermore, advertisements were targeted at those who reported interests in "parenting," "pediatrics," "urology," and "urinary tract" thus potentially created selection bias. That is, participants may have had a unique experience with UTI leading them to invest time to complete this survey. Additionally, the population of individuals who answered this survey on Facebook is not representative of the entire population with $>$ 80% of participants identifying as White and female. However, this method allowed us to sample parents across the nation. Pew Research Center found that approximately 71% of online American adults are Facebook users, 50% of whom log onto their account at least once a day [13]. Therefore, this platform for survey distribution may, in fact, more accurately reflect the United States platforms than others. When evaluating questionnaire responses, electronic delivery modes have actually been found to be more accurate, timely, and equivalent to those obtained with paper survey questionnaires [14–16]. E-mail is subject to demographic bias because of reduced access to e-mail by those with lower income, less employment, and lower education [17]. As such, it is plausible that Facebook is a superior platform for this survey. Not only has it been utilized in urologic research previously [18,19], but Facebook and other social networking sites are being widely used to recruit study participants, including traditionally difficult to reach populations such as adolescent and Hispanic populations [20–22]. All advertisements for this study were published in English, but we aimed to improve the diversity of our participants by using advertisements featuring children of different ethnicities. Lastly, utilizing a simple study design with pretesting minimized common limitations of survey research, including misinterpretation and survey fatigue. However, as with any survey, these results depend on the accuracy of participants' recollection and understanding of their UTI evaluation.

Conclusions

This survey of parents of children with UTI demonstrates that parental education level and income, family history of UTI, circumcision status, and age all play an important role in the subjective distress associated with catheterization. To improve adherence to guidelines, targeting only physician practice patterns is insufficient; parental characteristics and concerns may also be targeted for intervention.

Conflicts of interest

None.

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