Title

The Impact of Social Deprivation on Anterior Urethral Stricture Recurrence After Urethroplasty - A Trauma and Urologic Reconstructive Network of Surgeons (TURNS) Analysis.

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The Impact of Social Deprivation on Anterior Urethral Stricture Recurrence After Urethroplasty: A Trauma and Urologic Reconstructive Network of Surgeons Analysis

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Study Need and Importance: Urethroplasty is the gold standard treatment for urethral stricture disease. Mitigating clinical and patient factors has helped reduced stricture recurrence; however, stricture recurrence rates can be as high as 20%, suggesting that additional factors may contribute to stricture recurrence. Often overlooked, factors in a patient's environment can influence health outcomes and can be measured using a composite measure such as the Social Deprivation Index (SDI). We analyzed a multi-institutional series of patients who underwent an anterior urethroplasty and determined the impact of SDI on symptomatic stricture recurrence requiring re-treatment.

What We Found: In a cohort of 1460 men who underwent urethroplasty, stricture recurrence occurred in 129 men (8.8%) at a median follow-up of 367 days. The probability of stricture-free survival differed across SDI quartile ($P = .019$; Figure). In an adjusted model, there was a statistically significant association between SDI and recurrence (HR 1.08, 95 CI 1.01-1.15, $P = .015$). Patients in the fourth quartile for SDI were more likely to have a recurrence compared to the first quartile (HR 1.67, 95% CI 1.04-2.67, $P = .031$).

Limitations: Patients were selected from high-volume reconstructive surgeons, and the impact of SDI on recurrence likely is underestimated. Variations between institutions and surgeons can lead to selection bias. Limited follow-up may also lead to selection bias.

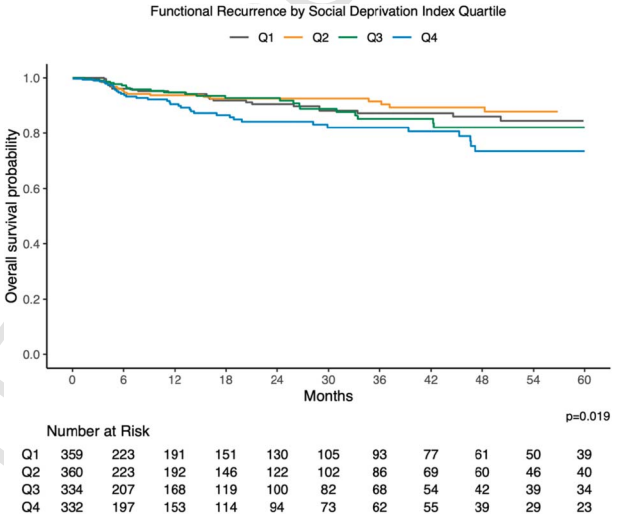

Figure. Functional recurrence-free survival by Social Deprivation Index quartile (Q).

Interpretation for Patient Care: Our work demonstrates that factors in a patient's environment are associated with stricture recurrence after urethroplasty. These findings are pertinent for preoperative counseling and posturethroplasty surveillance protocols. Taken together, this study adds to the growing literature on the significance of social determinants of health in urologic care and reinforces the need for ongoing investment and policy development to bridge gaps in health inequities.

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Original Clinical Article

The Impact of Social Deprivation on Anterior Urethral Stricture Recurrence After Urethroplasty: A Trauma and Urologic Reconstructive Network of Surgeons Analysis

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Purpose: Several factors influence recurrence after urethral stricture repair. The impact of socioeconomic factors on stricture recurrence after urethroplasty is poorly understood. This study aims to assess the impact that social deprivation, an area-level measure of disadvantage, has on urethral stricture recurrence after urethroplasty.

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Author Contributions: *Conception and design:* Patel, Li, Rourke, Smith, Alsikafi, Zhao, Peterson, Erickson, Breyer.
Data acquisition: Patel, Li, Smith, Myers, Broghammer, Buckley, Zhao, Breyer.
Data analysis and interpretation: Patel, Li, Smith, Voelzke, Myers, Broghammer, Buckley, Elliott, Vanni, Breyer.
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Statistical analysis: Patel, Li, Myers, Peterson, Erickson.
Supervision: Patel, Rourke, Smith, Voelzke, Broghammer, Alsikafi, Buckley, Zhao, Elliott, Vanni, Breyer.

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Materials and Methods: We performed a retrospective review of patients undergoing urethral reconstruction by surgeons participating in a collaborative research group. Home zip code was used to calculate Social Deprivation Indices (SDIs, 0-100), which quantifies the level of disadvantage across several sociodemographic domains collected in the American Community Survey. Patients without zip code data were excluded from the analysis. The Cox proportional hazards model was used to study the association between SDI and the hazard of functional recurrence, adjusting for stricture characteristics as well as age and BMI.

Results: Median age was 46.0 years with a median follow-up of 367 days for the 1452 men included in the study. Patients in the fourth SDI quartile (worst social deprivation) were more likely to be active smokers with traumatic and infectious strictures compared to the first SDI quartile. Patients in the fourth SDI quartile had 1.64 times the unadjusted hazard of functional stricture recurrence vs patients in the first SDI quartile (95% CI 1.04-2.59). Compared to anastomotic ± excision, substitution-only repair had 1.90 times the unadjusted hazard of recurrence. The adjusted hazard of recurrence was 1.08 per 10-point increase in SDI (95% CI 1.01-1.15, $P = .027$).

Conclusions: Patient social deprivation identifies those at higher risk for functional recurrence after anterior urethral stricture repair, offering an opportunity for preoperative counseling and postoperative surveillance. Addressing these social determinants of health can potentially improve outcomes in reconstructive surgery.

Key Words: social determinants of health, neighborhood disadvantage, urethral stricture, recurrence, urethroplasty

Urethroplasty is the gold standard treatment of urethral stricture disease. Successful treatment maintains a patent urethral lumen while sustaining patient satisfaction.[1] Nevertheless, stricture recurrence can occur after urethroplasty, and several clinical and patient-specific factors have been shown to influence stricture recurrence.[2-5] While knowledge of these risk factors has led to successful interventions, stricture recurrence rates can be as high as 20%, suggesting that other unmeasured factors may also contribute to stricture recurrence.

Social determinants of health, which are conditions in the patient's environment, can affect quality of life and health outcomes beyond patient and clinical factors. The level of social disadvantage an individual experiences in their community can be assessed using a composite measure such as the Social Deprivation Index (SDI).[6] Several studies have used SDI to demonstrate that patients living in areas of social disadvantage are at higher risk of chronic diseases, increased health care utilization, and earlier death due to limited access to care, poor infrastructural resources, and lack of social support.[7,8] Furthermore, health programs and policies that address fundamental issues due to social disadvantage such as food insecurity, safe housing, access to transportation, and access to care can help instruct more comprehensive understanding of multifactorial health issues such as urethral stricture disease, which requires access to specialized care.

While the impact of social determinants of health on surgical outcomes has been appreciated, their impact on urethroplasty outcomes remains unknown. Our study sought to determine the impact social deprivation has on urethral stricture recurrence after anterior urethroplasty. We hypothesize that patients in a more disadvantaged environment are at increased risk of urethral stricture recurrence. The findings of this study are pertinent for patient counseling and ongoing surveillance and can aid with risk stratifying which patients are at higher risk of urethral recurrence.

MATERIALS AND METHODS

Data Source

Trauma and Urologic Reconstruction Network of Surgeons (TURNS) is a multi-institutional surgical outcomes collaborative that prospectively collects data on reconstructive urological diseases. Men with urethral stricture disease who underwent an anterior urethroplasty between October 2006 and June 2020 were retrospectively identified from 10 centers in the TURNS database. Institutional Review Board approval was previously obtained at all participating institutions.

A total of 11,204 distinct surgeries corresponded to 5902 unique patients after removing duplicates and repeat operations for recurrence, selecting only the first surgery per patient. This group was narrowed down to 2275 patients with zip code data and 1972 with 5-digit zip codes. Of these, 1956 were mapped to Zip Code Tabulation Areas, and the final analysis included 1460 patients with available SDI data.

Exposure, Outcome, and Covariates

SDI, the primary exposure, is a composite measure of 7 demographic characteristics collected in the American Community Survey from 2011 to 2015 (Table 1). The domains include living under the federal poverty limit, single-parent families with dependents younger than 18 years, less than 12 years of education, nonemployed adults 16 to 64 years of age, households with no vehicles, households living in rented housing units, and households living in overcrowded housing units. Patient zip codes were crosswalked to Zip Code Tabulation Areas prior to

Table 1. *Social Characteristics by Social Deprivation Index Quartile*

Characteristic, median (IQR)	Q1 N = 369	Q2 N = 378	Q3 N = 355	Q4 N = 358
Population less than 100% FPL	5 (4–6)	10 (7–11)	13 (11–17)	21 (18–26)
Single-parent families with dependents <18 y	10 (8–12)	14 (11–16)	17 (14–20)	24 (20–28)
Population ≥25 with <12 y of education	4 (3–5)	7 (5–9)	9 (7–12)	18 (12–23)
Nonemployed of population 16-64 y	4.4 (3.5–5.2)	5.5 (4.7–6.5)	6.8 (5.4–8.4)	9.2 (7.5–12.2)
Households with no vehicle	2 (2-3)	5 (3–6)	7 (5–9)	11 (7–17)
Households living in renter-occupied housing units	17 (13–21)	26 (21–31)	34 (30–40)	50 (42–61)
Households living in crowded housing units	1.1 (0.5–1.7)	2.0 (1.1–3.0)	3.0 (1.9–4.1)	6.5 (3.6–10.4)

Abbreviations: FPL, federal poverty limit; IQR, interquartile range; Q, quartile.
All $P < .001$ (Kruskal-Wallis rank sum).

obtaining the SDI score for each patient. Higher SDI scores indicate greater social deprivation.

Our primary outcome was functional and symptomatic recurrence of urethral stricture, defined as recurrent urethral stricture requiring re-treatment (direct vision internal urethrotomy, dilation, clean intermittent catheterization, or revision urethroplasty).

Covariates included age, urethral segment involved (penile, bulbar, or penile-bulbar), stricture length, stricture etiology (idiopathic, external trauma, iatrogenic—trauma, iatrogenic—recurrent, iatrogenic—radiation, infectious, lichen sclerosus/balanitis, hypospadias), number of prior endoscopic procedures, and primary repair type (anastomotic ± excisional, excisional and substitution, substitution only, other only, urethrostomy only, meatotomy). Urethral stricture segment, location, and etiology are described based on a previously validated staging system for anterior urethral strictures.[9] In our adjusted models, variables were consolidated to allow model convergence due to data sparsity in categories. For stricture etiology, iatrogenic—trauma, iatrogenic—recurrent, and iatrogenic—radiation were combined into a single iatrogenic category. Similarly, infectious, lichen sclerosus/balanitis, and hypospadias etiology were grouped under "other." Meatotomy, urethrostomy only, and other only in repair type were combined into a single "other" category.

Statistical Analysis

The primary outcome was functional stricture recurrence, defined as any urethral stricture that required re-treatment post surgery because of obstruction and symptoms. We performed time-to-event analyses to study the effects of SDI on the outcome. Survival time was calculated as the time until the re-treatment date for patients with functional recurrence. If re-treatment was not required, participants were censored at the time of the most recent primary care physician or urologist visit. Follow-up time began from the date of surgery. Kaplan-Meier estimation and the log-rank test were used to compare stricture-free survival in each SDI quartile (Q; SDI scores 1-15, 16-37, 38-60, and 61-100). We calculated restricted mean survival time over 1, 3, and 5 years.

Using Cox proportional hazards regression, we generated hazard ratios (HRs) and 95% CIs to measure the unadjusted association between SDI score (per Q or 10-point increase) or stricture characteristics (urethral segment, stricture length, etiology) and functional stricture recurrence. An adjusted model was created to assess the direct effect of SDI on stricture recurrence independent of potential confounders (age, BMI) and mediators (stricture location/stage, stricture length, stricture etiology, number of prior endoscopic procedures, and primary repair type). Missing covariate data were imputed using multiple imputations by chained equations, generating 40 imputed datasets for adjusted models.[10] Two sensitivity analyses were performed. First, we assessed the interaction between smoking status and SDI to evaluate the presence of significant multiplicative interaction. Second, we modeled the association between SDI and functional recurrence using restricted cubic splines with knots placed at the 5th, 35th, 65th, and 95th percentiles of SDI, and plotted SDI vs predicted HRs, controlling for age, BMI, urethral segment, etiology, stricture length, prior endoscopic procedures, repair type, and smoking status. Multiple imputations were performed using the mice package in R. Kruskal-Wallis rank sum test was used to compare median values between SDI Qs. Categorical data were compared using χ^2 test. All statistical tests were performed using R statistical software (R version 4.3.1).[11]

RESULTS

Demographic and Clinical Characteristics

In our cohort, 1460 men met the inclusion criteria with a median age of 46.0 years and median follow-up time of 367 days. A total of 129 (8.8%) men experienced a functional recurrence. Baseline SDI and clinical characteristics by Q are presented in Tables 1 and 2, respectively.

Patients in the fourth SDI Q lived in neighborhoods with a significantly higher proportion of people living below the federal poverty limit (21% vs 5%, $P < .001$), single-parent families with dependents < 18 years of age (24% vs 10%, $P < .001$), people with < 12 years of education (18% vs 4%, $P < .001$), nonemployed of population between 16 and 64 years of age (9.2% vs 4.4%, $P < .001$), households with no vehicle (11% vs 2%, $P < .001$), households living in rental units (50% vs 17%, $P < .001$), and households living in crowded housing units (6.6% vs 1.1%, $P < .001$) compared to patients in Q1.

Men in Q4 had a lower proportion of bulbar urethral strictures (57% vs 70%, $P < .001$) and a higher proportion of penile urethral strictures (35% vs 20%, $P < .001$) compared to those in Q1 (Table 2). A greater proportion of men in Q4 experienced

Table 2. *Patient Characteristics Based on Social Deprivation Index Quartiles*

Characteristic	Q1 N = 369		Q2 N = 378		Q3 N = 355		Q4 N = 358		*P* value
Age at surgery									
Median (IQR), y	46	(32–58)	47	(33-60)	45	(34–59)	45	(32–60)	.8
Unknown, No.	7		8		14		19		
Followup in patients without recurrence, median (IQR), d	382	(109–1129)	379	(109–1013)	352	(111–797)	301	(111–797)	.5
Postoperative visits, median (IQR)	3	(2–5)	3	(2–5)	3	(2–5)	3	(2–6)	.5
BMI									
Median (IQR), kg/m^2	28	(25–32)	30	(26–34)	29	(25–34)	28	(24–33)	**.017**
Unknown, No.	12		11		6		9		
Smoking status, No. (%)									**.043**
Active smoker	26	(7.0)	40	(11)	48	(14)	43	(12)	
Former smoker	72	(20)	78	(21)	77	(22)	87	(24)	
Never smoker	271	(73)	259	(69)	230	(65)	228	(64)	
Unknown	0	(0)	1	(0.3)	0	(0)	0	(0)	
Prior endoscopic procedures									
Mean (SD)	2.39	(2.8)	2.69	(3.3)	2.50	(3.5)	1.83	(2.5)	**< .001**
Unknown, No.	0		1		1		4		
Stricture length, No. (%)									
1 (<2 cm)	167	(45)	145	(38)	146	(41)	143	(40)	.3
2 (2-7 cm)	156	(42)	195	(52)	166	(47)	166	(46)	.088
3 (>7 cm)	37	(10)	29	(7.7)	32	(9.0)	32	(8.9)	.7
Urethral segment, No. (%)									
1a	200	(54)	215	(57)	167	(47)	163	(46)	**.004**
1b	59	(16)	42	(11)	44	(12)	41	(11)	.2
2a	19	(5.1)	26	(6.9)	21	(5.9)	35	(9.8)	.075
2b	28	(7.6)	33	(8.7)	38	(11)	48	(13)	**.050**
2c	15	(4.1)	15	(4.0)	23	(6.5)	22	(6.1)	.3
2d	12	(3.3)	9	(2.4)	23	(6.5)	20	(5.6)	**.021**
3	16	(4.3)	16	(4.2)	18	(5.1)	11	(3.1)	.6
Etiology, No. (%)									
Idiopathic	187	(51)	205	(55)	179	(51)	153	(43)	**.017**
External trauma	79	(21)	65	(17)	50	(14)	52	(15)	**.035**
Iatrogenic—trauma	58	(16)	57	(15)	55	(16)	70	(20)	.3
Iatrogenic—recurrent	17	(4.6)	15	(4.0)	26	(7.4)	29	(8.2)	**.045**
Infectious stricture	13	(3.5)	5	(1.3)	6	(1.7)	22	(6.2)	**< .001**
Lichen sclerosus/BXO	8	(2.2)	17	(4.5)	16	(4.5)	12	(3.4)	.3
Iatrogenic—radiation	4	(1.1)	6	(1.6)	9	(2.5)	5	(1.4)	.5
Hypospadias stricture	2	(0.5)	4	(1.1)	12	(3.4)	11	(3.1)	**.010**
Unknown	1	(0.3)	4	(1.1)	2	(0.5)	4	(1.1)	
Repair type, No. (%)									
Anastomotic ± excisional	147	(40)	143	(38)	112	(32)	111	(31)	**.024**
Substitution only	132	(36)	124	(33)	123	(35)	133	(37)	.7
Excisional and substitution	36	(9.8)	37	(9.8)	38	(11)	36	(10)	> .9
Other only	10	(2.7)	9	(2.4)	23	(6.5)	26	(7.3)	**.001**
Urethrostomy only	0	(0)	0	(0)	2	(0.6)	0	(0)	.059
Meatotomy	0	(0)	1	(0.3)	1	(0.3)	0	(0)	.7
Cystoscopy performed, No. (%)	145	(40)	126	(34)	142	(40)	125	(36)	.2
Functional recurrence, No. (%)	33	(9.2)	26	(7.2)	28	(8.3)	42	(13)	.084

Abbreviations: BXO, balanitis xerotica obliterans; IQR, interquartile range; Q, quartile.

infectious (6.2% vs 3.5%, $P < .001$), iatrogenic urethral trauma (20% vs 16%, $P = .018$), and hypospadias strictures (3.1% vs 0.5%, $P = .021$) compared to those in Q1. A lesser portion of men in Q4 underwent anastomotic urethroplasty (31% vs 40%, $P = .024$) compared to those in Q1. There was no statistically significant difference in the proportion of patients with functional recurrence across the SDI Qs. The management of urethral stricture recurrence was not significantly different across Qs.

Urethral Stricture Recurrence

An analysis incorporating cubic splines showed that up until a score of 60, SDI does not appear to increase the HR of recurrence, while after 60 (ie, scores in Q4), HR increases as SDI increases (Supplementary Figure 1, https://www.jurology.com). Patients in SDI Q4 had 1.64 times the unadjusted hazard of functional stricture recurrence vs patients in SDI Q1 (95% CI 1.04-2.59; Table 3). After adjustment for age, BMI, urethral segment, etiology, stricture length, number of prior endoscopic procedures, and repair type, SDI retained a statistically significant association with stricture recurrence (HR 1.08, 95% CI 1.01-1.15, $P = .015$; Table 4). Substitution-only repair type was also a significant predictor in the adjusted model (HR 1.70, 95% CI 1.02-2.82, $P = .004$). An adjusted model with the same covariates and SDI Q retained statistical significance for patients in Q4 compared to patients in Q1 (HR 1.67, 95% CI 1.04-2.67, $P = .031$).

Table 3. *Unadjusted Association Between Social Deprivation Index Quartile and Stricture Recurrence*

	Stricture recurrence		Median follow-up period		
SDI quartile	No. of events	No. of patients	D	No. of unknown	HR (95% CI)
1 (ref)	33	369	389	9	1.00
2	26	378	375	16	0.80 (0.48–1.35)
3	28	355	360	19	0.95 (0.56–1.59)
4	42	358	309	25	**1.64 (1.04–2.59)**

Abbreviations: HR, hazard ratio; ref, reference; SDI, Social Deprivation Index.

Similarly, former and never smoking status were also significant predictors in the adjusted model. However, there was no significant evidence of interaction between smoking status and SDI on the hazard of stricture recurrence, with an adjusted HR for the interaction term of 0.97 (95% CI 0.84-1.13) for former or active smokers compared to never smokers ($P = .7$).

The Figure shows Kaplan-Meier survival curves depicting time until functional recurrence of urethral stricture post urethroplasty, stratified by SDI Q. The probability of stricture-free survival significantly differed across Qs ($P = .019$). At 1-year follow-up, the restricted mean survival time for patients in Q1, Q2, and Q3 was 11.6 months, while it was slightly lower for Q4 at 11.4 months. For the 3-year follow-up, the restricted mean survival time was 2.78 years for Q1, 2.82 years for Q2, 2.78 years for Q3, and 2.63 years for Q4. At the 5-year mark, patients in Q1, Q2, Q3, and Q4 exhibited restricted mean survival times of 4.48, 4.59, 4.43, and 4.17 years, respectively. The 5-year functional recurrence probabilities were 16% in Q1, 12% in Q2, 18% in Q3, and 27% in Q4.

Table 4. *Adjusted Hazard Ratios for Stricture Recurrence*[a]

Covariate	Adjusted hazard ratio[b] (95% CI)
Social Deprivation Index (+10)	**1.08 (1.01–1.15)**
Age	1.00 (0.98–1.01)
BMI	1.00 (0.97–1.03)
Urethral segment	
1 (ref)	1.00
2	0.83 (0.52–1.31)
3	0.56 (0.19–1.60)
Unknown	1.02 (0.44–2.34)
Etiology	
External trauma (ref)	1.00
Iatrogenic	1.60 (0.85–3.01)
Idiopathic	1.54 (0.87–2.74)
Other	1.64 (0.74–3.66)
Stricture length	1.01 (0.94–1.10)
Prior endoscopic procedures	1.05 (0.99–1.10)
Repair type	
Anastomotic ± excisional (ref)	1.00
Excisional and substitution	1.48 (0.78–2.79)
Other only	1.81 (0.70–4.70)
Substitution only	**1.70 (1.02–2.82)**
Smoking status	
Active smoker	1.00
Former smoker	**3.11 (1.19–8.08)**
Never smoker	**2.71 (1.09–6.74)**

Abbreviations: ref, reference.
[a] Hazard ratios were adjusted for all other covariates in the model.
[b] Missing data were imputed for 128/1460 patients in the adjusted model.

DISCUSSION

Our study highlights that men living in areas with greater social deprivation are at higher risk for functional recurrence after anterior urethral reconstruction. These findings underscore the importance of not only patient-level factors, but also social determinants of health that are important for success after urethroplasty. Our findings provide a broader context for understanding the factors that affect posturethroplasty outcomes.

Understanding the factors that portend urethroplasty success can help risk-stratify patients after urethral reconstruction. Several studies have demonstrated that 57% to 63% of stricture recurrences occur within the first year after urethral reconstruction, suggesting that close surveillance within the first year may help identify most recurrences.[12-14] While there is no consensus on what defines urethral stricture recurrence, postoperative surveillance protocols are difficult to implement with compliance rates for cystoscopy at only 54% at 1 year.[15] Here we demonstrate that the rates of surveillance cystoscopy within the first year after urethroplasty varied from 34% to 40% depending on Q. Taken together, it is critical to identify patients at substantial risk for recurrence and the interval for surveillance to help individualize follow-up protocols and provide realistic pre- and postoperative counseling. Our study adds to the existing literature regarding stricture recurrence by demonstrating that patients with the highest social deprivation experience higher rates of recurrence even after adjusting for clinical and patient-specific factors. Our study also shows that surgeons can easily access the SDI using a patient's address rather than using a detailed assessment of a patient's socioeconomic status. The findings of our study potentially can improve preoperative counseling on stricture recurrence and can help in identifying subgroup of patients who are at increased risk of stricture recurrence, which can help individualize posturethroplasty surveillance protocols.

Several socioeconomic factors are associated with the original choice of treatment for urethral stricture disease along with recurrence after urethral reconstruction. Work from Dornbier et al highlighted that at the national-level patients with higher incomes and private insurance were more likely to receive urethroplasty, regardless of prior

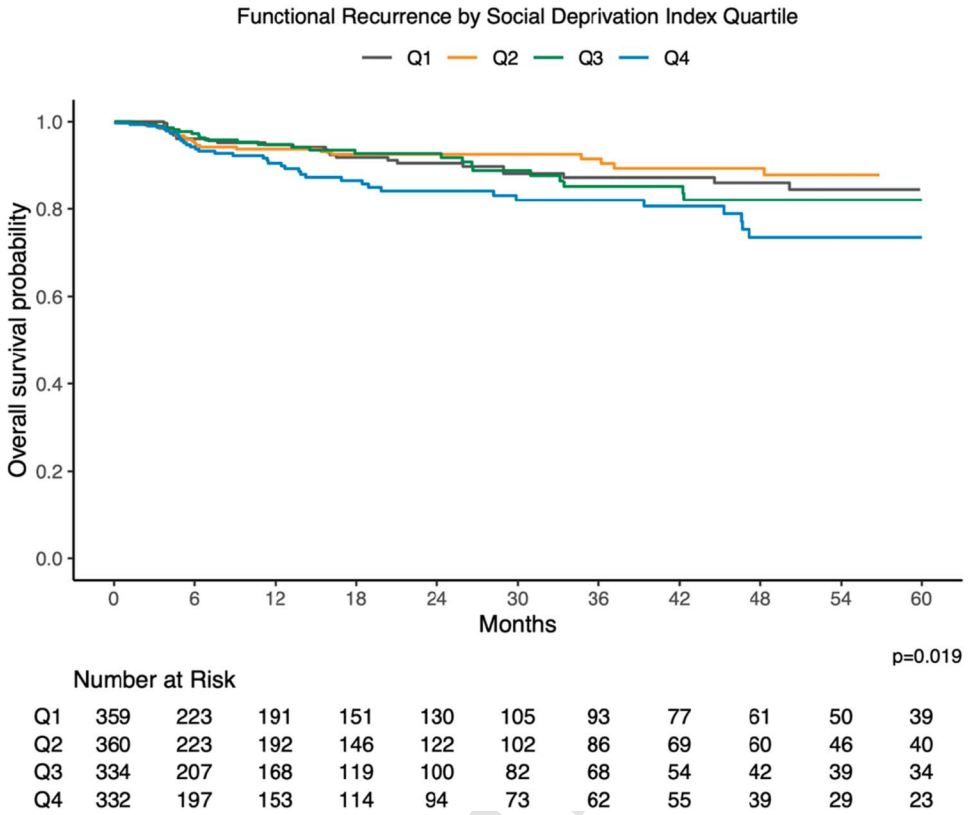

Figure. Functional recurrence-free survival by Social Deprivation Index quartile (Q).

treatment status.[4] A similar study using a private health care insurance claims database showed that patients with lower educational status had 2.7 to 12.8 times higher risk of recurrence after posterior urethroplasty compared to highly educated counterparts.[16] Our study expands on these findings as we found a significant increase in the rate of recurrence after anterior urethroplasty as SDI increases. Despite patients receiving care at high-volume genitourinary reconstructive academic centers in the United States, the rate of recurrence was significantly higher among those in the worst SDI Q, suggesting that nonclinical factors are also important prognostic factors for stricture recurrence after urethral reconstruction.

In our analysis, a negative association between active smoking and functional recurrence was observed, which has been previously presented.[17] The mechanistic underpinnings for these findings are not well understood. Our analysis demonstrated that the risk of stricture recurrence was not significantly impacted by the interaction between smoking status and SDI. Nevertheless, the association between smoking status and functional recurrence should be interpreted with caution. The relationships between covariates in a multivariable model—designed primarily to adjust for the primary exposure-outcome relationship between SDI and recurrence—can be susceptible to confounding influences. The observed protective association may not necessarily imply a causal relationship.[18] Given these considerations, it is essential to interpret this association with caution, and further studies are warranted to validate and understand the underlying mechanisms between smoking and outcomes in reconstructive surgery.

Our work adds to the limited but growing literature in urology that highlights the importance of social determinants of health in urologic care. For example, the odds of 90-day mortality following radical cystectomy significantly increase as the level of disadvantage increases.[19] Similarly, the overall survival and cancer-specific survival were significantly worse among patients with prostate cancer who lived in the most disadvantaged neighborhoods.[20] These health inequities can be rooted in structural and systemic barriers that can manifest as differential effects of financial toxicity,[21] lack of access to health care resources,[22] unequal treatment in health care, mistrust between providers and patients,[23] and barriers to travel for office visits.[24] Moreover, these studies and their likes emphasize the importance of understanding how social determinants affect outcomes and underscore the great efforts the urologic community needs to take to bridge these gaps through ongoing investments and conscientious policy creation.

Our work has limitations. Patients were referred to high-volume reconstructive surgeons with variable

referral patterns, which can limit follow-up data. Given the shorter follow-up data among Q4, it is likely that the impact of SDI on recurrence is likely underestimated in this study. Additionally, surgical techniques are not standardized among these surgeons and can be biased by prior training. The care provided in this setting may not represent the care provided at a population level. SDI is an area-level measure that utilizes zip code data and is not patient specific. Given the level of granularity available in the TURNS database, our analysis does not account for patient migration to other zip codes as we utilize the zip code at the time of surgery to determine SDI. As a result, of the original 5902, only 1460 (24.7%) were available for review, thus potentially significantly contributing to a selection bias because of the absence of the zip code in the dataset. Despite these limitations, we believe the findings in our study will be magnified in a larger population-level cohort.

CONCLUSIONS

We provide evidence that functional recurrence after anterior urethral reconstruction is partially reliant upon the patient's social determinants of health. SDI is an independent predictor of functional recurrence after anterior urethral reconstruction that has the potential to identify patients at high risk for recurrence, guide personalized surveillance protocols, and provide thorough surgical counseling. This also once again demonstrates the need for addressing these social determinants of health in our patient populations as discussed in other specialties such as oncology, pediatric urology, and endourology.

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