# Failing to follow up: predicting patients that will "no-show" for medically advised imaging following endourologic stone surgery

Rachel A. Moses, MD,<sup>1</sup> Lawrence M. Dagrosa, MD,<sup>1</sup> Elias S. Hyams, MD,<sup>1</sup> Peter L. Steinberg, MD,<sup>2</sup> Vernon M. Pais, MD<sup>1</sup>

<sup>1</sup>Section of Urology, Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire, USA <sup>2</sup>Division of Urology, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

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*Introduction:* The purpose of this study is to evaluate predictors of poor compliance after treatment of urinary stone disease.

Materials and methods: This study was a retrospective analysis of patients who underwent stent removal following percutaneous nephrolithotomy (PCNL) or ureteroscopy (URS) between 2008-2012. All patients were scheduled for follow up evaluation and renal ultrasound at 4-6 weeks following stent removal. Patients were stratified based on appointment compliance and demographic variables including gender, age, insurance type (Government Assisted Insurance [GAI] or Private Insurance [PI]), initial procedure, season, distance between home and clinic, average monthly gas price at follow up, and median education attainment. Logistic

### Introduction

Poor compliance with follow up after treatment of stone disease is a common problem encountered by urologists that may impact patient safety, quality of care, and clinic scheduling. Studies have demonstrated a significant rate of asymptomatic obstruction following endoscopic treatment, from residual stones or ureteral stricture that may adversely impact renal function over

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Address correspondence to Dr. Rachel A. Moses, Dartmouth Hitchcock Medical Center Section of Urology, One Medical Center Drive, Lebanon, NH 03756 USA regression was performed to determine independent predictors of missed follow up.

**Results:** A total of 301 patients were included, 153 women (51% female) with a mean age of  $54 \pm 14.2$  years. Of the cohort, 22.6% (n = 68) did not return for follow up. GAI was the only variable associated with a greater risk of non-compliance on univariate analysis (OR 2.13 [95% CI 1.12-3.86] p = 0.011) and multivariate analysis (OR 3.14.10 [95% CI 1.48-6.7], p < 0.01). Gender, age, procedure, season, distance, gas prices, and education were not significant predictors.

**Conclusion:** In our study, evaluating characteristics associated with missed follow up after stent removal for PCNL and URS, possession of GAI was the only factor associated with non-compliance. Urologists should be aware that persons with GAI may be at increased risk of missed follow up and should use this information to target interventions to improve compliance.

**Key Words:** kidney stone, ureteral stent removal, socioeconomic status, insurance

time.<sup>1,2</sup> Radiographic evaluation after stent removal following either ureteroscopy (URS) or percutaneous nephrolithotomy (PCNL) to screen for evidence of silent obstruction has been recommended.<sup>1-3</sup> At our institution, we recommend routine imaging within 4 to 6 weeks of treatment in these patients.

Missed patient visits are common across specialties and range from 12%-42%.<sup>2</sup> Factors associated with missed medical follow up in prior studies have included age, gender, distance from hospital, season, and insurance type.<sup>1,2,4-6</sup> No prior studies have specifically evaluated factors associated with poor compliance after treatment of kidney stones; however, for the aforementioned reasons this follow up is of particular importance. The objective of this study Failing to follow up: predicting patients that will "no-show" for medically advised imaging following endourologic stone surgery

was to evaluate characteristics of missed follow up in patients undergoing stone treatment, specifically radiographic evaluation following ureteral stent removal as recommended by their surgeon.

# Materials and methods

Institutional Review Board approval was obtained prior to the study. A retrospective chart review was performed on 479 patients undergoing ureteral stent removal between 2008 and 2012 at a single rural academic institution in a dedicated endourologic practice by a single board certified urologist. Only patients undergoing URS or PCNL with stent placement were included in the study. All were scheduled for clinic evaluation and ultrasound at 4-6 weeks following stent removal. Outpatient and inpatient hospital records were reviewed. Demographics included age, gender, insurance type including need based government assisted insurance (GAI) and privately funded insurance (PI), initial procedure (URS versus PCNL), distance in miles between home and the clinic appointment location, average gas price during the month of scheduled follow up, and median education level. Patients were excluded from the study if they were greater than 65 years with Medicare insurance or if they were self-pay due to the ambiguity of socioeconomic status inherent in these groups. This insurance classification has been used and described previously.7 Average monthly gas prices were obtained from the U.S. Energy Information Administration (EIA) recorded amounts for New England.<sup>8</sup> Finally, the median education level was obtained for each postal code using the U.S. Census Bureau data (based on percent with or without a college degree).

## Statistical analysis

Initially, patients were divided into two categories, those who were not compliant with follow up, and those who were. Baseline characteristics were compared between the two groups using Student t-tests for continuous variables and Chi square analysis for dichotomous variables, which included age, gender, initial procedure type, and distance between home and hospital. Next, univariate analysis was conducted for all demographic and study variables with age divided into four categories (< 20 years, 20-40 years, 40-60 years, and > 60 years) as well as distance (< 30 miles, 30-60 miles, 60-90 miles, and > 90 miles). Multiple logistical regression was performed with the dependent variable being noncompliance versus compliance with follow up and the independent variables being age, gender, insurance type, distance between home and imaging site, average monthly gas price, and median education attainment. All tests were set with a significance threshold of p <0.05, and regression coefficients were calculated with 95% confidence intervals. Analysis was performed using SPSS software (Armonk, NY, USA).9

# Results

Three hundred and one patients were included in the study. Fifty-one percent of the study population was female and the mean age was  $54 \pm 14.19$  years. The patients who were not compliant with follow up comprised 23% (68/301), and those who were compliant comprised 77% (233/301). Table 1 demonstrates a comparison of the characteristics of non-compliant and compliant patients. There was no statistically significant difference in age (52.03 years versus 54.6

	No	Yes	p value**	
	n = 68	n = 233	-	
Mean age (stdev)	52.03 (16.6)	54.63 (1.39)	0.19	
Female (%*)	39 (57)	114 (49)	0.27	
Initial procedure PCNL (%*)	14 (21)	57 (24)	0.56	
Distance in miles (stdev)	55.3(39.17)	68.16(205.41)	0.61	
Winter (%*)	27 (40)	77 (33)	0.31	
GAI* insurance (%*)	30 (44)	63 (27)	0.01	
Average gas price in dollars	3.04 (0.59)	3.01 (0.62)	0.625	
Percent with college degree	28.2 (14.7)	27.8(14.4)	0.461	
*percent within compliance group	Fischer exact t test for cor	tinuous variables		

TABLE 1. Comparison of follow up appointment compliance demographics

dichotomous and Fischer exact t-test for continuous variables

years p = 0.19), gender (57% female versus 49% female p = 0.27), initial procedure being PCNL (20.5% versus 24.5% p = 0.56), season being winter (40% versus 33% p = 0.31) or distance from hospital (55 mi ( $\pm$  39 mi) versus 68 mi. ( $\pm$  205 mi) p = 0.61). However, 44% (30/68) of non-compliant patients had GAI versus 27% (63/233) individuals who were compliant (p = 0.01). Figure 1 demonstrates the distribution of insurance type by distance group. The number of patients with GAI increased with increased distance from the hospital (p < 0.001). Table 2 displays univariate factors associated with missed appointments. On univariate analysis, possession of GAI proved to be the only significant factor associated with non-compliance (OR 2.13 [95% CI 0.710-3.7], p = 0.011). On multivariate logistic regression, Table 3, again, insurance was associated with non-compliance, with patients having GAI two times more likely to not return for follow up ([95% CI 1.23-4.1] p = 0.01). There were no other statistically significant factors associated with non-compliance. The probability model's diagnostic accuracy to predict failures was 77%, indicating a relatively reliable association between insurance type and clinic follow up.

### Discussion

Our data demonstrates that need-based GAI was associated with a higher rate of non-compliance with postoperative imaging following ureteral stent removal compared with PI. No other demographic variables were significantly associated with follow up. This finding is notable in identifying an at-risk population for poor compliance that may require additional attention to ensure that they have optimal long term outcomes, i.e. are appropriately evaluated for silent obstruction and have continuity of future care.

Our overall non-compliance rate mirrors those of other investigations. The overall rate in our study of 22.5% was similar to the 21% reported by Lee et al, who reported predictors of compliance with medical follow up in Singapore.<sup>4</sup> Insurance status was not evaluated in this study, however, as Singapore has a universal health care system. A US study by Weingarten et al evaluating follow up in a medical clinic found a greater risk of medical non-compliance in patients with GAI.<sup>10</sup>

In the United States, with a hybrid public and private system, insurance status is often representative

Variable	n (%)	OR	95% CI	p value	
Gender					
Female	153 (50.8)	1.00			
Male	148 (49.2)	1.40	(0.73-2.30)	0.37	
Age					
Up to 20 years	2(0.7)		1.00		
20 to 40 years	44 (14.6)	4.20	(0.25-70.07)	0.32	
40 to 60 years	152 (50.2)	1.76	(0.78-3.96)	0.17	
Greater than 60 years	104 (34.6)	1.2	(0.66-2.27)	0.53	
Distance from hospital					
Up to 30 miles	91 (30.2)	1.00			
30-60 miles	79 (26.2)	0.87	(0.37-2.16)	0.78	
60 to 90 miles	90 (29.9)	1.37	(0.56 - 3.34)	0.49	
Greater than 90 miles	41 (13.6)	0.95	(0.39-2.33)	0.91	
Season					
Winter	197 (65.4)	1.00			
Not winter	104 (34.6)	1.33	(0.76-2.33)	0.31	
Insurance					
Private	208 (69.1)	1.00			
Government assisted	93 (30.9)	2.13	(1.12-3.86)	0.01	
Initial procedure					
Ureteroscopy	230 (76.4)	1.00			
PCNL	71 (23.6)	0.80	(0.41-1.55)	0.51	

TABLE 2. Univariate analysis of factors associated with failed appointments with the corresponding number of subjects (n), odds ratios (OR), confidence intervals (CI), and p values (overall n = 301)

Failing to follow up: predicting patients that will "no-show" for medically advised imaging following endourologic stone surgery

Variable	OR	95% CI	p value	
Gender – Female	0.77	(0.44-1.36)	0.37	
Age				
Up to 20 years	1.00			
20 to 40 years	2.44	(0.14-44.06)	0.55	
40 to 60 years	1.71	(0.74-3.96)	0.21	
Greater than 60 years	1.32	(0.69-2.51)	0.40	
Distance from hospital				
Up to 30 miles	1.00			
30-60 miles	1.14	(0.44 - 2.94)	0.79	
60 to 90 miles	1.76	(0.697 - 4.45)	0.23	
Greater than 90 miles	1.04	(0.41-2.64)	0.93	
Winter	1.32	(0.74-2.37)	0.35	
Government assisted	2.10	(1.17-3.74)	0.01	
PCNL	0.77	(0.38-1.53)	0.45	
College degree (%)	1.008	(0.99-1.03)	0.49	
Monthly gas price (dollars)	1.213	(0.65-2.25)	0.54	

TABLE 3.	Multivariate a	analysis of	characteristics	associated with	non-compliance
		,			

of socioeconomic status,<sup>7,11</sup> thus patients may be more likely to have financial and logistical obstacles to seeking follow up care. Prior studies in addition to Weigarten's conducted in the United States have demonstrated this increased risk of noncompliance in those with need-based insurance.<sup>4,11-13</sup> Ironically, it is patients with lower socioeconomic status who may require need-based insurance who have higher rates of obesity, diabetes, and cardiovascular disease that are associated with higher risk of stone disease.<sup>14,15</sup> More specific studies of stone risk factors have demonstrated that patients with low socioeconomic status have higher risk urinary profiles for stone formation as well.<sup>7</sup>

We also evaluated distance and monthly gas prices and their association with compliance. A recent study by Courtemanche found that increasing gas prices were linked to a decrease in obesity rates, suggesting gas expense limits travel to restaurants with fattening foods, and increases the amount of walking.<sup>16</sup> Counter intuitively, the distance between patients' home and the hospital and gas prices were not statistically significant predictors of failure to follow up. This could potentially be because the majority of the patients lived relatively close to the hospital, 56.4% (170/301) lived within 30 miles. Furthermore, the majority of patients with GAI lived further away from the hospital, Figure 1. To our knowledge, no study has specifically evaluated the relationship between gas prices and appointment compliance in this region.

There were several limitations of our study that deserve mention. As the study was retrospective, it was subject to selection and information bias compared to a more prospective evaluation. Also, while the study had a relatively large number of patients, a better powered study may have greater ability to detect differences between groups. Additional administrative data may have been useful to include including previous appointment history and appointment wait time, however these were not available. Furthermore, obtaining the comorbidities for each patients and factoring them into the model may have yielded additional predictors of compliance based on health status. Finally, the rural location of the study site may



**Figure 1.** Distribution of patients with government assisted insurance (GAI) and private insurance for each distance group.

limit the generalizability of the study to urban and suburban locations. Additional studies of compliance with follow up after stone treatment is needed to identify risk factors for non-compliance in other settings to ensure all patient populations receive safe and appropriate follow up.

### Conclusion

Patients with GAI are at increased risk for noncompliance with follow up imaging after stone treatment. Additional attention to these populations is needed to ensure that safe and appropriate follow up occurs. Further studies are required to investigate means for improving compliance and education for patients after stone treatment.

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