



Variation in the Intensity of Hematuria Evaluation: A Target for Primary Care Quality Improvement

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ABSTRACT

BACKGROUND: Hematuria is a common clinical finding and represents the most frequent presenting sign of bladder cancer. The American Urological Association recommends cystoscopy and abdomino-pelvic imaging for patients aged more than 35 years. Nonetheless, less than half of patients presenting with hematuria undergo proper evaluation. We sought to identify clinical and nonclinical factors associated with evaluation of persons with newly diagnosed hematuria.

METHODS: We performed a retrospective cohort study, using claims data and laboratory values. The primary exposure was practice site, as a surrogate for nonclinical, potentially modifiable sources of variation. Primary outcomes were cystoscopy or abdomino-pelvic imaging within 180 days after hematuria diagnosis. We modeled the association between clinical and nonclinical factors and appropriate hematuria evaluation.

RESULTS: We identified 2455 primary care patients aged 40 years or more and diagnosed with hematuria between 2004 and 2012 in the absence of other explanatory diagnosis; 13.7% of patients underwent cystoscopy within 180 days. Multivariate logistic regression revealed significant variation between those who did and did not undergo evaluation in age, gender, and anticoagulant use ($P < .001$, $P = .036$, $P = .028$, respectively). Addition of practice site improved the predictive discrimination of each model ($P < .001$). Evaluation was associated with a higher rates of genitourinary neoplasia diagnosis.

CONCLUSIONS: Patients with hematuria rarely underwent complete evaluation. Although established risk factors for malignancy were associated with increasing use of diagnostic testing, factors unassociated with risk, such as practice site, also accounted for significant variation. Inconsistency across practice sites is undesirable and may be amenable to quality improvement interventions.

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Hematuria is a common clinical finding and represents the most frequent presenting symptom/sign of urothelial carcinoma of the bladder, particularly among persons aged 40 years and older.¹ Proper evaluation of hematuria is necessary to identify the 1 person in 10 who may have a life-threatening malignancy or other treatable condition.² The American Urological Association (AUA) Best Practice Guidelines recommend that all patients aged 35 years or more presenting with asymptomatic hematuria (>3 red blood cells per high-power field), for which benign causes have been ruled out, undergo cystoscopy. In addition, these guidelines recommend evaluation of the renal parenchyma and urothelium, with computed tomography (CT) urography being the preferred imaging modality.³ Current literature suggests that less than half of patients diagnosed with hematuria are subsequently referred to a urologist for evaluation.⁴⁻⁶ Although urinary tract infection, benign prostatic hyperplasia, and urolithiasis represent common nonmalignant causes of hematuria,⁷ failure to adequately evaluate patients with hematuria risks delaying the diagnosis of potentially lethal malignancies, such as bladder cancer, and is therefore a significant quality of care concern.

Few studies have investigated sources of variation in the evaluation of patients presenting with asymptomatic hematuria.^{6,8} The prevalence of microscopic hematuria in the adult population ranges from 2.4% to 31.1%, and up to 3.3% of these individuals will have an underlying urothelial malignancy.⁹ Conversely, 9% to 18% of patients with hematuria will have no underlying pathology, drawing into question the utility of ubiquitous hematuria evaluations.¹⁰ The potential impact of addressing variation at this proximal point in the care pathway could be substantial in terms of both quality of care and optimization of healthcare value.¹¹⁻¹⁵

We sought to identify both relevant clinical factors (eg, age and smoking status) and nonclinical factors (eg, practice setting and payer) associated with timely cystoscopic or radiologic evaluation of persons with newly diagnosed hematuria in a major academic health system. We hypothesized that both clinically relevant and nonclinical factors would influence the likelihood and intensity of hematuria evaluation.

MATERIALS AND METHODS

After receiving approval from the Vanderbilt University Medical Center (VUMC) Institutional Review Board, we

performed a retrospective cohort study to identify variation in patterns and intensity of hematuria evaluation among patients aged 40 years or more with a first diagnosis of hematuria in a primary care setting. As a surrogate for nonclinical, potentially modifiable sources of variability, the exposure of interest was practice site. The primary outcome of interest was receipt of cystoscopy or imaging evaluation performed within 180 days of hematuria diagnosis.

CLINICAL SIGNIFICANCE

- A minority of patients with hematuria underwent appropriate evaluation consisting of cystoscopy and abdominopelvic imaging.
- Although established risk factors for malignancy were associated with increasing use of diagnostic testing, factors unassociated with risk, such as practice site, also accounted for significant variation.
- Such inconsistency across practice sites is undesirable and may be amenable to quality improvement interventions, thereby improving care of hematuria-associated diseases, such as urothelial carcinoma.

Data Source and Management

We accessed VUMC's Research Derivative, an enterprise-wide data repository that contains administrative and clinical information, including a complete record of visits and admissions, laboratory data, and diagnosis and procedure codes, on every patient treated in the Vanderbilt health system. We obtained additional data points, such as smoking history, marital status, and insurance coverage, through manual chart review of the electronic medical record. Study data were stored and

managed using the secure REDCap electronic data capture platform hosted at the VUMC.¹⁶

Cohort Definition

We identified 6585 patients in the Research Derivative who were aged 40 years or more and diagnosed with a first episode of hematuria between 2004 and 2012 by urinalysis (>3 red blood counts per high power field) or *International Classification of Diseases, Ninth Revision (ICD-9)* diagnosis codes for hematuria (599.7, 599.70, 599.71 or 599.72) at one of the VUMC's 19 primary care clinics. To be included in the study, patients must have had records for 1 year before the date of hematuria diagnosis.

Patients were excluded if they had a urinary tract infection (defined as a urinalysis positive for both leukocyte esterase and urine nitrites, or a positive urine culture) within 4 weeks before or 1 week after the index hematuria episode (n = 590, 9.0%). We convened a panel of content experts to develop a set of explanatory diagnoses and procedures that would preclude the need for a hematuria evaluation (for a complete list, see [Supplemental Table 1](#), online). We then used *Physicians Current Procedural Terminology Coding System, 4th Edition* and ICD-9 codes to exclude patients with an explanatory diagnosis or procedure within 180 days preceding their hematuria diagnosis (n = 3540, 53.8%). This yielded a final cohort of 2455 patients.

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