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Resident Knowledge of Urine Testing and Treatment Over Four Years

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Abstract

We surveyed residents at two academic medical centers regarding urinary testing and treatment as they progressed through training. Demographics and self-reported confidence were compared to overall knowledge using clinical vignette-based questions. Overall knowledge was 40% in 2011, and 48%, 55%, and 63% in subsequent years ($p < 0.001$).

Background

Infectious Diseases Society of America (IDSA) guidelines recommend against treating asymptomatic bacteriuria (ABU), except during pregnancy and before urologic surgery expected to cause mucosal bleeding¹. Despite this, ABU is commonly treated which contributes to increased medication costs², *Clostridium difficile* infection³, and multi-drug resistant organisms⁴.

Prescriber characteristics are associated with over-treatment of ABU, potentially allowing targeting of interventions to improve management. In one study, patients admitted to internal and family medicine services received unnecessary antimicrobials more often than those admitted to surgery or obstetrics/gynecology services⁴. Prescriber-level barriers to appropriate ABU management include inappropriate urine testing, poor knowledge of guidelines, and fear of causing⁵. We hypothesized that progression through residency, clinical experience, or educational interventions would improve resident's knowledge regarding urinary testing and treatment.

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Previous Presentation

None

Methods

Subjects

Subjects were recruited from Jackson Memorial Hospital/University of Miami Miller School of Medicine and the University of Minnesota Medical School. Each first-year resident in internal medicine or medicine-pediatrics ($n = 63$) as of July 1, 2011, received email invitations to participate. Surveys were sent to the same residents in the summers of 2012, 2013, and 2014. Institutional Review Boards at both institutions approved the study.

Survey Instrument

A 19-question internet-based survey was developed as published previously⁶ and used annually (supplemental material). Briefly, respondents reported demographics (age, sex, residency-type, and training site), ABU-related education (i.e., awareness/reading of IDSA ABU guidelines, or participation in an infectious disease rotation during the past 12 months), and clinical experience (how many patients with UTI personally managed in the past three months).

Respondents answered ten multiple-choice questions based on scenarios commonly encountered by residents in internal medicine and medicine-pediatrics programs. Six vignettes described non-surgical scenarios and four described surgical scenarios. Six board-certified infectious disease physicians piloted the vignettes and questions. For one question, three physicians indicated that either of two answers could be considered correct, whereas the other three choose one of those same two answers. For another question, two reviewers disagreed with the other four as to the correct answer; consequently, this question was excluded from analysis. This left nine analyzed questions, of which eight had a single correct answer and one had two correct answers. Overall knowledge was defined as the percentage correct among the nine validated vignette-based questions. Correct answers were not provided after survey completion.

Finally, respondents assessed their ability to differentiate ABU from UTI, to determine if a urine culture requires treatment, and to use antimicrobials in general. Knowledge self-assessment was measured using a five-point Likert scale where 5 = very confident, 4 = confident, 3 = neutral, 2 = not confident, and 1 = not confident at all. Because few respondents reported being “very confident” or “not confident at all”, these responses were combined with “confident” and “not confident”, respectively.

Statistical Methods

Demographics, education, experience, and self-assessed knowledge were assessed for associations with knowledge on overall, surgical, and non-surgical questions. Between-group comparisons of overall knowledge were performed using Student's t-test, one-way analysis of variance (ANOVA), and chisquare test for linear trend, as appropriate. Parametric tests were used after verifying that the data were normally distributed; results of nonparametric tests, conducted in parallel, were similar and are not reported. Because of the anonymous nature of the survey, the annual surveys could not be linked to individuals, and their results were treated as if they were independent results. A Bonferroni correction was

used to adjust ANOVA results for multiple between-group comparisons. Analyses were performed using SPSS or R.

Results

Results from 2011 were published previously⁶; here we present results from the entire study period. Of 296 surveys, 125 (42.2%) were returned (33 annually, except 26 in 2012). Male and female respondents were balanced, with a median age of 28 years. More respondents categorized themselves as internal medicine than medicine-pediatric residents. Over time a greater percentage of respondents were from the University of Minnesota.

Knowledge was low overall, especially for non-surgical vignettes. However, there was a significant increase over the four-year study, as reflected in the mean percentage of correct answers by year, both overall (40%, 48%, 55%, and 63%; $p < 0.001$) and separately for surgical (56%, 64%, 71%, 74%; $p = 0.049$) and non-surgical vignettes (28%, 37%, 46%, 53%; $p = 0.001$).

Educational and clinical experiences are described in Table 1. Respondent self-knowledge is detailed in Table 2. Increasing confidence with training was documented in all domains, but was only significant for “ability to correctly use antimicrobials,” where the percentage of respondents reporting being confident or very confident rose from 9% to 58%.

Univariate and multivariate analyses were conducted to identify predictor variables (demographics, experience, and self-assessed knowledge) associated with knowledge overall and separately in non-surgical and surgical cases. Although there were sporadic weak associations, none were significant in more than a single year’s survey (data not shown).

Discussion

Overall knowledge of urine testing and treatment increased during residency but remained sub-optimal (63% at the end of training). This suggests that education and experience have some effect on resident knowledge; however, current training is insufficient to effectively teach management of urinary testing and treatment. None of the assessed variables had a consistent association with knowledge, which makes targeting future interventions difficult.

Several aspects of our study limit generalizability. Firstly, our response rate of 42% is low, but consistent with other resident surveys^{6,7}. Secondly, responses from different years were deidentified prior to analysis and could not be individually linked over time, and were analyzed as if each survey was independent from those of prior and subsequent years. Thirdly, our survey could not capture all possible respondent exposures prior to or during the study, including new curricula, different attending physicians, and quality improvement interventions. Finally, the preponderance of responses from one study site in the later years of the survey is unexplained, although not statistically significant.

Interestingly, whereas measured overall knowledge showed an absolute increase of 23% (40% to 63%), respondent’s self-reported ability to correctly use antimicrobials in general showed a much larger increase of 49% (9% to 58%). This may reflect differences between

resident's confidence with antimicrobials in general vs. in specific urinary cases. Alternatively, knowledge deficits may be more obvious when assessed in specific cases than in general. Residents across disciplines report desiring more education and feedback on their use and prescribing of antimicrobials⁸. Numerous studies and meta-analyses show that multifactorial educational interventions improve overall knowledge on surveys, inappropriate ordering of urine cultures, treatment of ABU, and costs^{2,5,8}. Multifactorial interventions are necessary to change antimicrobial prescriptions, including one-on-one discussions with another health professional, local versions of guidelines, active small-group sessions, individualized feedback (audit and feedback), and computer assistance^{9,10}.

In summary, overall knowledge of urine testing and treatment increased during residency but remained low and not associated with variables previously thought to influence knowledge.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Respondent reported education and clinical experience, assessed 2011 through 2014.

Education or experience category, % responding affirmatively	Year surveyed (number of respondents)			
	2011 (n = 33)	2012 (n = 26)	2013 (n = 33)	2014 (n = 33)
Know of IDSA [*] guideline regarding asymptomatic bacteriuria (ABU)	39	38	73	73
Read some of IDSA ABU guideline	12	15	18	24
Read all of IDSA ABU guideline	3	4	9	15
Infectious diseases rotation [†]	12	12	36	39
Number of patients with urinary tract infection managed in past 3 months				
0	3	0	9	3
1	30	35	56	21
2	45	31	15	42
3	12	15	12	18

^{*} IDSA = Infectious Diseases Society of America.

[†] At least 2 weeks on infectious diseases service in the last 12 months.

Table 2.

Self-assessed ability to perform specific clinical tasks, assessed 2011 through 2014.

Clinical task	Self-assessed ability, column %	Year surveyed (number of respondents)				P value
		2011 (n= 33)	2012 (n= 26)	2013 (n= 33)	2014 (n= 33)	
Ability to differentiate	Not Confident	18	12	3	3	0.24
ABU* and UTI†	Neutral	27	19	24	12	
	Confident	46	50	64	67	
Ability to determine if urine culture result requires treatment	Not Confident	27	4	3	12	0.08
	Neutral	42	35	36	30	
	Confident	21	43	52	42	
Ability to correctly use antimicrobials	Not Confident	30	4	0	6	< .001
	Neutral	49	54	33	21	
	Confident	9	23	58	58	

* ABU = asymptomatic bacteriuria.

† UTI = urinary tract infection.