

Inappropriate Antibiotic Prescribing for Respiratory Conditions Does Not Improve Press Ganey Patient Satisfaction Scores in the Emergency Department

Michael S. Pulia,¹ Steven Hesse,² Rebecca J. Schwei,¹ Lucas T. Schulz,³ Ajay Sethi,⁴ and Azita Hamedani¹

¹BerbeeWalsh Department of Emergency Medicine, University of Wisconsin Madison School of Medicine and Public Health, Madison, Wisconsin, USA, ²University of Wisconsin-Madison School of Medicine and Public Health, Madison, Wisconsin, USA, ³Department of Pharmacy, Madison, Wisconsin, USA, and ⁴Department of Population Health, Madison, Wisconsin, USA

Background. The literature has mixed results regarding the relationship between antibiotic prescribing and patient satisfaction in the emergency department (ED) for antibiotic-inappropriate respiratory diagnoses. The objective of the study was to determine if ED patients who receive nonindicated antibiotic prescriptions for respiratory tract conditions have increased Press Ganey patient satisfaction scores compared with those who do not receive antibiotics.

Methods. This was a retrospective observational study. Using an administrative electronic health record data set from 2 EDs in the Midwest, we identified 619 ED encounters resulting in discharge for antibiotic-inappropriate respiratory diagnoses with a corresponding Press Ganey patient satisfaction survey. We compared sociodemographics, encounter variables, and overall Press Ganey patient satisfaction scores between those who did and did not receive antibiotics. We analyzed Press Ganey scores by categorical score distribution and as a dichotomized scale of top box (5) vs other scores. A logistic regression estimated the odds of a top box Press Ganey patient satisfaction score based on antibiotic prescribing while controlling for other covariates.

Results. In the final sample, 158 (26%) encounters involving antibiotic-inappropriate respiratory diagnoses involved an antibiotic prescription. There were no differences in sociodemographic, encounter or categorical, or top box Press Ganey overall patient satisfaction scores between the groups that did and did not receive inappropriate antibiotics. In the fully adjusted regression model, antibiotic prescriptions were not associated with increased odds of top box Press Ganey patient satisfaction score (odds ratio, 0.78; 95% CI, 0.53–1.14).

Conclusions. Our findings suggest that nonindicated antibiotic prescribing for respiratory tract conditions is not a primary driver of overall Press Ganey scores in the ED.

Keywords. antibiotics; antibiotic stewardship; patient satisfaction; respiratory tract infection.

Antibiotics are unique therapeutic agents that diminish in effectiveness over time due to emergent bacterial resistance. A report by the Centers for Disease Control and Prevention (CDC) suggested that 2.8 million Americans are sickened by antibiotic-resistant bacterial infections each year, with 35 000 dying as a result [1]. The unnecessary prescription of antibiotics in the health care setting is one factor that has accelerated the emergence of antibiotic-resistant bacteria [2]. A significant amount of misuse involves respiratory conditions, with as many as 60% of antibiotic prescriptions for these conditions being identified as inappropriate [3–8]. Antibiotic-inappropriate respiratory

diagnoses, such as viral infections (eg, influenza) or noninfectious conditions (eg, asthma, allergic rhinitis), may account for up to 5% of all emergency department (ED) visits, and treatment in this setting has been associated with a higher percentage of unnecessary antibiotic prescribing as compared with other outpatient settings [5, 7, 9, 10]. Individual patients are at substantial risk of harm from unnecessary antibiotics due to the potential for serious adverse drug reactions and *Clostridioides difficile* colitis (12 800 deaths in the United States annually) [1, 11, 12].

Despite tremendous resources dedicated to raising awareness regarding the appropriate use of antibiotics, sustainable improvements in outpatient antibiotic prescribing remain elusive [10, 13]. Many logistical and system characteristics such as limited patient follow-up, physician performance metrics, incomplete patient information, and patient pressures influence the decisions made by ED providers [14, 15]. Provider perceptions of patient expectations and concerns over satisfaction are consistently identified as drivers of antibiotic prescribing across various health care settings [15–19]. However, previous studies investigating the actual relationship between antibiotic

Received 3 April 2020; editorial decision 28 May 2020; accepted 2 June 2020.

Correspondence: M. Pulia, MD, MS 800 University Bay Drive, Suite 310, MC 9123, Madison, WI 53705 (mspulia@medicine.wisc.edu).

Open Forum Infectious Diseases®

© The Author(s) 2020. Published by Oxford University Press on behalf of Infectious Diseases Society of America. This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs licence (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial reproduction and distribution of the work, in any medium, provided the original work is not altered or transformed in any way, and that the work is properly cited. For commercial re-use, please contact journals.permissions@oup.com
DOI: 10.1093/ofid/ofaa214

prescribing and patient satisfaction have had mixed results. Although some studies have reported an association between antibiotic prescriptions for respiratory tract infections and increased overall patient satisfaction, others have found no such relationship [20–24]. Based on the current literature, additional clarification is needed to better understand the relationship between antibiotic prescribing and patient satisfaction in the ED for antibiotic-inappropriate respiratory diagnoses. Future patient- and provider-level antibiotic stewardship interventions could be informed by further elucidation of this association (eg, patient education) or lack thereof (eg, provider education).

In this study, we evaluated the relationship between antibiotic prescribing and overall Press Ganey patient satisfaction scores, a commonly used health care quality metric, using a retrospective observational study of electronic health record (EHR) data linked to Press Ganey survey responses. The primary objective of this study was to examine the impact of antibiotic prescribing on overall Press Ganey patient satisfaction scores among patients discharged from the ED with respiratory conditions that should not routinely be treated with antibiotics. Given the established misconceptions some patients have about the role of antibiotics in managing infectious conditions [25, 26], we hypothesized that those who were prescribed antibiotics for nonindicated respiratory conditions would have increased Press Ganey scores compared with patients who were not prescribed antibiotics for these conditions.

METHODS

Study Design and Setting

This was a retrospective observational study that used data from an EHR database (Epic, Verona, WI, USA) linked via patient medical record number with results from Press Ganey patient satisfaction surveys. This study was conducted among patients presenting to 2 Midwestern EDs in the same health care system, which combined have ~70 000 patient-visits per year. This study was approved by the University of Wisconsin-Madison Health Sciences Institutional Review Board.

In the system where this study was conducted, Press Ganey patient satisfaction surveys are distributed to ED patients who are discharged to home. Before February 1, 2015, a random sample of 167 discharged ED patients per month received a paper survey that was completed by the patient and returned to the hospital via mail. Beginning on February 1, 2015, all patients with a valid email address on record receive an electronic survey, and those without receive a paper survey by mail. Deceased patients, prisoners, and patients who requested privacy, left against medical advice, or without being seen were excluded from receiving a survey.

Selection of Participants

All ED visits between January 1, 2010, and December 31, 2016, with completed Press Ganey patient surveys and a respiratory

diagnosis code were included in the initial sample (Figure 1). We identified diagnostic codes for antibiotic-inappropriate respiratory diagnoses using a 3-tiered *International Classification of Diseases* (ICD)-based scheme published by CDC investigators [4]. The 3 tiers divide ICD codes based on whether antibiotics are “almost always indicated” (Tier 1; pneumonia, urinary tract infections, other miscellaneous bacterial infections), “may be indicated” (Tier 2; acne, gastrointestinal infections, pharyngitis, sinusitis, skin, cutaneous and mucosal infections, suppurative otitis media), or are “not indicated” (Tier 3; asthma, allergy, bronchitis, bronchiolitis, influenza, nonsuppurative otitis media, other gastrointestinal conditions, other genitourinary conditions, viral pneumonia, viral upper respiratory infections, other skin, cutaneous, and mucosal conditions) [4, 27]. Any encounters involving Tier 2 or Tier 3 respiratory diagnoses were then considered for inclusion in our analysis.

We excluded patient encounters that did not contain a response to the Press Ganey patient satisfaction survey question “Overall rating of care received during your visit.” To avoid misclassification of appropriate antibiotic prescribing for co-occurring infections of any type, we excluded encounters with any Tier 1 diagnosis codes. We also excluded patients who had a Tier 2 diagnosis code for acute exacerbation of chronic obstructive pulmonary disease (COPD), chronic bronchitis, or emphysema because there is evidence that antibiotics reduce treatment failure for acute exacerbations of COPD managed in the outpatient setting [28, 29].

All encounters were then categorized into either having received an antibiotic or not having received an antibiotic. ICD9 and ICD10 codes that had identical code descriptions were combined into 1 category. Combined ICD9 and ICD10 codes were included in the sample if there was at least 1 encounter where an antibiotic was prescribed and 1 encounter where an antibiotic was not prescribed. At this point, if the encounter had >1 Tier 2 or Tier 3 respiratory diagnosis code, it was categorized based on the first respiratory code that was listed, as coders enter diagnoses based on relevance to the encounter. Next, we collapsed the specific diagnosis codes into 8 clinical syndrome-based groupings. Pharyngitis and sinusitis were the 2 broad disease groupings in the antibiotics “may be indicated” tier. Codes for asthma/allergy, bronchitis/bronchiolitis, croup, influenza, respiratory signs and symptoms, and unspecified upper respiratory tract infections were the clinical syndrome-based groupings in the antibiotics “not indicated” tier. To identify conditions for which there was actual practice variability involving antibiotic prescribing, we then excluded clinical syndromes that did not have a distribution of at least 10% of encounters receiving an antibiotic (asthma/allergy and croup). Finally, to ensure independence of observations, for any patient with multiple encounters in the data set ($n = 6$), only the initial encounter was included.

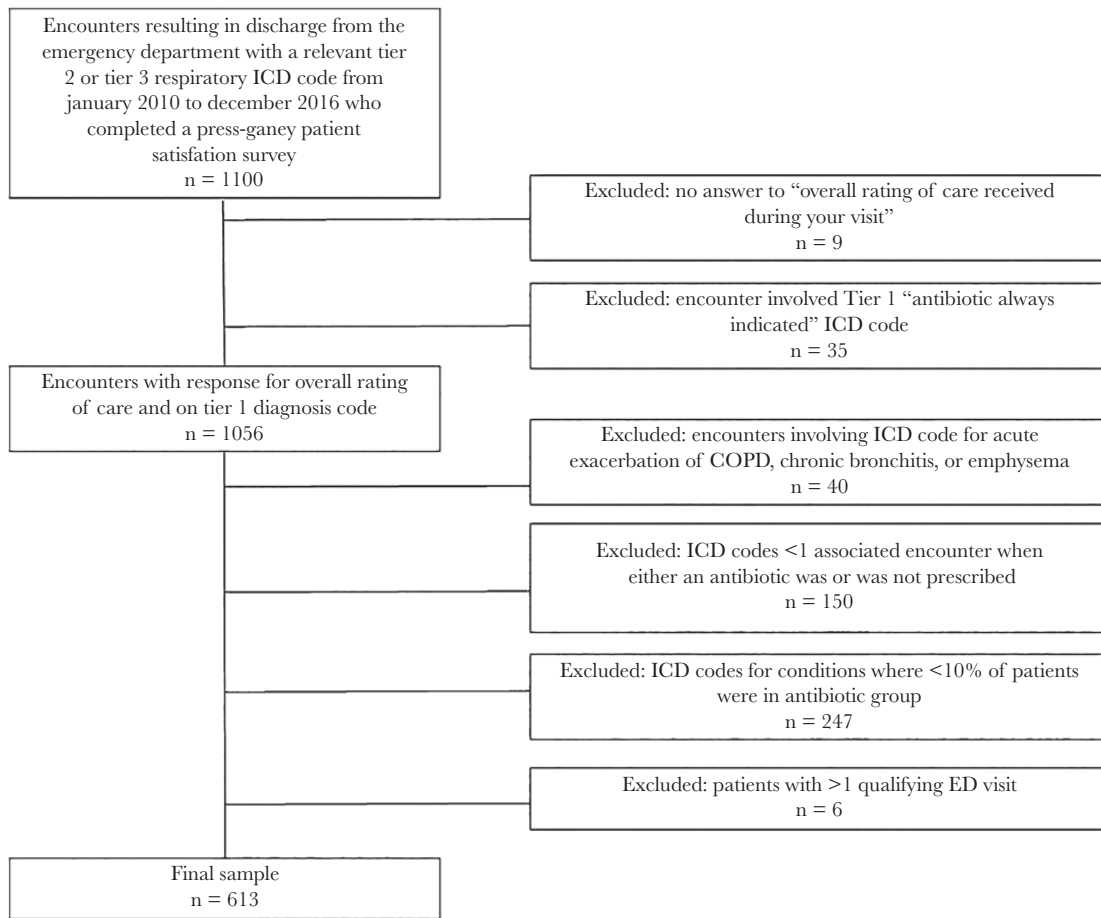


Figure 1. Case selection flowchart.

Outcomes

For the primary outcome, we measured overall satisfaction based on patients' responses to the Press Ganey survey question "Overall rating of care received during your visit" for all patients. The question is scored on a 5-point Likert scale (1 = very poor, 2 = poor, 3 = fair, 4 = good, and 5 = very good). We compared the 2 groups based on categorical score distribution and dichotomized top box vs non-top box scores (Table 1). The top box outcome, scores dichotomized into 5 vs any other score (1–4), was included, as this is often used in public reporting of Press Ganey patient satisfaction scores and for national benchmarking [30]. Individual clinical syndromes were also compared using distribution of scores and top box (Table 2).

We extracted sociodemographic variables that included gender, race (American Indian or Alaska native, Asian, black, white, or patient declined to answer) and age from the EHR. We categorized age into patients <18 years of age, patients 18–64 years of age, and patients ≥65 years of age. We also extracted several clinical encounter variables including patient insurance status (Medicaid, Medicare, private insurance, or no insurance), ED site (university hospital or community hospital), Emergency Severity Index Triage Score (ESI), length of stay

(hours), and time to provider (minutes). ESI is measured on a scale of 1 to 5, with 1 being resuscitation and 5 being nonurgent. Time to provider was the time a patient went from being registered in the ED until the first resident or attending physician signed up for the patient.

Analysis

We compared differences in sociodemographic and clinical encounter variables between patients who received and did not receive an antibiotic. Differences across categorical variables were compared using chi-square tests. Given the skewed distribution of the Press Ganey scores, we compared differences in the distribution of the 5-level Press Ganey scores by antibiotic group and by broad disease groups using the Wilcoxon rank sum test. We built a multivariable logistic regression model to estimate the odds of top box Press Ganey overall patient satisfaction scores among patients who had an antibiotic prescribed. We included demographic variables (age, gender, race), variables that have been previously shown to be related to Press Ganey scores (insurance, length of stay, time to provider) [31], and other variables we thought may influence Press Ganey scores (triage acuity and ED site). First we created the original model

Table 1. Baseline Characteristics of the Participants

	Overall (n = 613)	No Antibiotic (n = 455)	Antibiotic (n = 158)	PValue ^a
Age, y				.211
<18	160 (26.1)	127 (27.9)	33 (20.9)	
18–65	299 (48.8)	215 (47.3)	84 (53.2)	
≥65	154 (25.1)	113 (24.8)	41 (26.0)	
Female	359 (58.6)	272 (59.8)	87 (55.1)	.300
Race				.372
White	544 (88.7)	405 (89.0)	139 (88.0)	
Black	30 (4.9)	22 (4.8)	10 (6.3)	
Asian	29 (4.7)	20 (4.4)	7 (4.4)	
American Indian or Alaska Native	4 (0.7)	2 (0.4)	2 (1.3)	
Patient declines to answer	6 (1.0)	6 (1.3)	0 (0.0)	
Primary insurance				.434
Private	453 (73.9)	340 (74.7)	113 (71.5)	
Medicare	133 (21.7)	97 (21.3)	36 (22.8)	
Medicaid	19 (3.1)	14 (3.1)	5 (3.2)	
No insurance	8 (1.3)	4 (0.9)	4 (2.5)	
Triage acuity				.753
1 (resuscitation)	1 (0.2)	1 (0.2)	0 (0.0)	
2 (emergent)	100 (16.3)	79 (17.4)	21 (13.3)	
3 (urgent)	368 (60.0)	271 (59.6)	97 (61.4)	
4 (less urgent)	137 (22.4)	99 (21.8)	38 (24.1)	
5 (nonurgent)	7 (1.1)	5 (1.1)	2 (1.3)	
Mean length of stay (SD), h	3.4 (1.8)	3.4 (1.9)	3.4 (1.6)	.779
Mean time to provider (SD), min	37.8 (46.6)	37.0 (48.0)	39.9 (42.6)	.496
ED site				.388
University hospital	573 (93.5)	423 (93.0)	150 (94.9)	
Community hospital	40 (6.5)	32 (7.0)	8 (5.1)	
Press Ganey patient satisfaction score categories				.080
Very poor (1)	13 (2.1)	8 (1.8)	5 (3.1)	
Poor (2)	23 (3.8)	16 (3.5)	7 (4.4)	
Fair (3)	62 (10.1)	51 (11.2)	11 (7.0)	
Good (4)	135 (22.0)	90 (19.8)	45 (28.5)	
Very good (5)	380 (62.0)	290 (63.7)	90 (57.0)	
Dichotomized Press Ganey patient satisfaction score				.131
Non–top box	233 (38.0)	165 (36.3)	68 (43.0)	
Top box	380 (62.0)	290 (63.7)	90 (57.0)	

Data are presented as No. (%) unless otherwise indicated.

^aComparison of the group that had antibiotics prescribed and the group that did not have antibiotics prescribed; chi-square was used to test differences across categorical variables, the *t* test was used for differences in mean length of stay and time to provider, and the Wilcoxon rank sum test was used for differences in distribution of Press Ganey patient satisfaction scores.

with all of the covariates, we then created a reduced model that included demographic variables as well as the variables that had a *P* value <.25 in univariate analysis. Next, we compared the 2 models using the likelihood ratio test and determined that the original model did not have significantly better fit than the reduced model, and therefore we proceeded with the reduced model for this analysis. For all analyses, we determine a priori that our type 1 error rate would be 5%. All data were analyzed using Stata 15 (StataCorp, College Station, TX, USA).

RESULTS

Figure 1 describes how we arrived at a final sample size of 613 patient encounters. Of these encounters, 158 (26%) received an antibiotic. Table 1 describes the sociodemographic and clinical

encounter characteristics of the sample overall and by antibiotic group. Fifty-nine percent of the sample were female, 89% were white, and 74% had private insurance, and this is consistent with the population served by the 2 EDs. The majority of patient encounters had a triage acuity of 3, the mean length of stay in the ED was 3.4 hours, the mean time to provider was 38 minutes, and 94% of encounters took place at the university hospital, as the community site was only open during the final 18 months of our data collection period. Overall, 62% of the patients in the sample reported a very good (top box) overall Press Ganey patient satisfaction score. There were no significant differences in sociodemographic or clinical encounter variables, including the categorical distribution of Press Ganey scores, between the antibiotic and no antibiotic groups. Table 2 describes

Table 2. Comparisons of Press Ganey for Diagnostic Groupings Overall and by Antibiotic Group (n = 613)

	Overall		No Antibiotic		Antibiotic			PValues ^a	
	No.	No. (%)	Median Press Ganey (IQR) ^b	Top Box Press Ganey, No. (%)	No. (%)	Median Press Ganey (IQR)	Top Box Press Ganey, No. (%)	Median Press Ganey	Top Box Press Ganey
Diagnosis groupings where antibiotics may be indicated									
Pharyngitis	125	70 (56.0)	5 (4.0, 5.0)	41 (58.6)	55 (44.0)	5 (4.0, 5.0)	33 (60.0)	.892	.872
Sinusitis	41	18 (43.9)	5 (3.0, 5.0)	11 (61.1)	23 (56.1)	5 (4.0, 5.0)	14 (60.9)	.988	.987
Diagnosis groupings where antibiotics are not indicated									
Respiratory signs and symptoms	258	218 (84.5)	5 (4.0, 5.0)	139 (63.8)	40 (15.5)	4 (4.0, 5.0)	19 (47.5)	.065	.052
Unspecified upper respiratory tract infections	126	108 (85.7)	5 (4.0, 5.0)	68 (63.0)	18 (14.3)	4 (4.0, 5.0)	8 (44.4)	.304	.137
Bronchitis or bronchiolitis	48	28 (58.3)	5 (4.5, 5.0)	21 (75.0)	20 (41.7)	5 (4.0, 5.0)	14 (70.0)	.894	.701
Influenza	15	13 (86.7)	5 (5.0, 5.0)	10 (76.9)	2 (13.3)	5 (5.0, 5.0)	2 (100.0)	.448	.466

Abbreviation: IQR, interquartile range.

^aComparing differences in distribution of Press Ganey categories (Wilcoxon rank sum) or top box score (chi-square) between patients who had antibiotics prescribed and those who did not.

distribution and top box Press Ganey scores for each clinical syndrome group overall and by antibiotic group. The largest group was the respiratory signs and symptoms–based codes, which had 258 patient encounters, followed by unspecified upper respiratory tract infections, with 126 patient encounters. There were no significant differences in distribution of Press Ganey scores or percentage of top box score for any of the clinical syndrome groups.

Table 3 describes the unadjusted and adjusted odds of top box overall Press Ganey patient satisfaction scores by antibiotic status, sociodemographic variables, and clinical encounter variables. In the unadjusted comparisons, adults who were 65 years of age or older had 1.58 increased odds of top box Press Ganey scores compared with adults from 18 to 65 years of age (95% CI, 1.06–2.38). In the unadjusted analysis, patients who received care at the community ED had 2.59 increased odds of top box scores compared with the university ED (95% CI, 1.17–5.17). Additionally, in unadjusted comparisons for every hour that length of stay increases, patients had 10% lower odds of top box scores (OR, 0.90; 95% CI, 0.83–0.98), and for every additional minute it took to be seen by a provider, patients had 1% lower odds of top box scores (OR, 0.99; 95% CI, 0.98–0.99). In the fully adjusted model, patients who had an antibiotic prescription had 0.78 odds of top box scores compared with patients who did not have an antibiotic prescribed, but this result was not statistically significant (OR, 0.78; 95% CI, 0.53–1.14). In the fully adjusted model, only time to provider remained significant. The logistic regression model had adequate goodness of fit using the Pearson statistic, as the P value was not significant (.358).

DISCUSSION

Our study is only the third study to examine the association of unnecessary antibiotic prescribing for respiratory diagnoses

in the ED with overall patient satisfaction and the first to do so using Press Ganey patient satisfaction survey results. This is an important distinction from previous studies examining this relationship, which measured satisfaction through surveys developed and administered as part of a research protocol. Interviewing patients about their preferences for antibiotics before the physician encounter may alter their expectations and resultant satisfaction, and physicians may modify interactions and prescribing behavior in response to the ongoing study [24].

Table 3. Unadjusted and Adjusted Odds of Top Box Press Ganey Overall Patient Satisfaction Score by Antibiotic Status and Sociodemographic and Clinical Encounter Variables (n = 613)

	Unadjusted Odds Ratio	Adjusted Odds Ratio	Confidence Interval
Antibiotic prescribed	0.75	0.78	0.53–1.14
Age, y			
<18	1.08	1.18	0.77–1.80
18–65	Ref	Ref	Ref
≥65	1.58 ^a	1.36	0.66–2.34
Female	1.1	0.94	0.66–1.34
Race			
White	Ref	Ref	Ref
Other	0.63	0.61	0.36–1.02
Insurance			
Private	Ref	Ref	Ref
Medicare, Medicaid, or no insurance	1.38	1.24	0.75–2.08
ED site			
University	Ref	Ref	Ref
Community	2.59*	2.05	0.91–4.64
Length of stay, h	0.90*	0.97	0.87–1.08
Time to provider, min	0.99**	0.99	0.98–0.99**

Abbreviation: ED, emergency department.

*P < .05; **P < .001.

Despite ongoing concerns about construct validity, Press Ganey is the most widely utilized patient satisfaction instrument in the United States and thus our findings reflect how satisfaction is actually measured and benchmarked for the majority of emergency providers [32–34]. Additionally, this is the first study examining this relationship in nearly a decade, a time period that was marked by substantial efforts to improve public awareness of antibiotic resistance and an increased emphasis on the ED as a critical setting for antibiotic stewardship [11, 35, 36].

The observed overall antibiotic prescribing rate for antibiotic-inappropriate respiratory diagnoses of 26% is consistent with the 30% estimated from studies using national samples, suggesting that our encounter identification approach was effective and that local prescribing patterns mirror general practice [4, 9]. After controlling for patient demographic and operational variables, we failed to detect any significant difference in overall Press Ganey patient satisfaction scores between patients who were given nonindicated antibiotics for respiratory conditions in the ED and those who were not. When we looked at this relationship for grouped diagnostic codes (eg, sinusitis), there were also no significant differences.

Our findings are consistent with Ong et al.'s null result on the relationship between satisfaction and antibiotic prescribing for upper respiratory infections among patients treated in academic medical center EDs [24]. These findings partially conflict with Stearns et al.'s finding of an association between satisfaction and antibiotic prescribing at metropolitan EDs, which was not observed at the matched Veterans Affairs EDs in their study [20]. The discordant result observed within the Stearns et al. study highlights that systems and operational factors (eg, crowding) inherent to the care setting (eg, VA vs non-VA EDs) may supersede the influence of encounter-specific factors, such as the decision to prescribe antibiotics, on patient satisfaction. For instance, recently published research suggests that emergency physician satisfaction scores vary significantly based on the ED site [37]. Additionally, detailed analysis of themes in online patient reviews found that satisfaction varies by setting according to unique themes (urgent care vs ED Yelp reviews) [38]. In the emerging area of telemedicine, a recently published research letter found a significant increase in patient satisfaction when antibiotics were prescribed for respiratory tract infections. This raises substantial concerns for pressure to prescribe for providers working within a direct-to-consumer telemedicine platform [21].

The systems-based influence on satisfaction is reflected in our data, as the only significant relationship observed in the adjusted multivariate analysis was decreased satisfaction as time to provider increased, something directly linked to operational factors such as overcrowding and inpatient boarding. As satisfaction appears to be influenced by systems factors outside of the physician's control, use of these scores to directly determine physician compensation and/or job security may incentivize

providers to inappropriately acquiesce to overt or perceived patient expectations around antibiotics in an attempt to exert some influence on the metric [19]. As antibiotic prescribing uniquely impacts public health and carries a substantial risk of adverse drug reactions, the routine use of satisfaction metrics in these encounters should be reevaluated [39]. This conclusion is emphasized in recent work demonstrating an association between satisfaction and adverse health outcomes [40].

Although there is no direct link between antibiotic prescribing and satisfaction scores in the literature, various provider types, including those working in the ED, report that they believe antibiotics contribute to patient satisfaction and this belief influences their antibiotic decision-making [15–17, 19]. These qualitative results have been replicated in observational experiments. Mangione-Smith et al. observed that the provider's perception of parental expectation was the only significant driver of inappropriate antibiotic prescribing for children with respiratory tract infections [18]. Similarly, Ong et al. found that there was a 5.3 increase in odds of antibiotic prescribing for respiratory tract infections in the ED when the provider believed the patient expected an antibiotic [24]. Interestingly, both of these studies identified a substantial deficit in the provider's ability to accurately gauge patient expectations [18, 24]. They also both found that communication regarding the diagnosis, not antibiotic prescribing, was actually associated with satisfaction [18, 24]. Most patients do not have a preexisting expectation for receiving an antibiotic; however, providers often perceive that patients do have preexisting expectations about antibiotics [18, 24, 41]. An intervention involving a communication facilitation tool for respiratory tract infections may help ED providers overcome some of these misconceptions. It may also be helpful to strategically identify and target communication for the minority of patients who actually do have an inappropriate expectation of receiving an antibiotic so that providers could focus their communication efforts on this more challenging encounter while reducing prescribing pressure during the majority of cases.

There are several limitations to this study. First, only a subset of patients returned satisfaction surveys. Low response rates are a widely reported issue with Press Ganey surveys in general, so when working with these data there always exists a possibility that the responders may not be representative of the entire patient population that receives care in the ED, particularly those without an email address. Additionally, Press Ganey surveys require a certain level of health literacy to complete, which means that groups with low health literacy are likely underrepresented in our sample. It may be that health literacy is associated with a better understanding of appropriate antibiotic use, and this sampling bias may have been one reason why we did not find an association between patient satisfaction and antibiotic utilization. Finally, while Press Ganey surveys are widely used, there are concerns about whether these scores, as currently

administered, represent a valid construct of patient satisfaction [34]. However, Press Ganey is the current gold standard metric to benchmark patient satisfaction and is commonly used as a metric to benchmark physicians. Finally, the generalizability of our findings may be limited, as we only included data from 1 health care system.

CONCLUSIONS

In summary, we observed no association between overall Press Ganey patient satisfaction scores and antibiotic prescription among ED patients with antibiotic-inappropriate respiratory diagnoses. In conjunction with previous literature, these results should give providers the confidence to utilize evidence-based antibiotic prescribing practices for respiratory conditions without undue concern about a potential adverse impact on patient satisfaction [18, 24]. Future antibiotic stewardship intervention studies should focus on improving communication between patients and providers around antibiotic expectations and decision-making.

Acknowledgments

Financial support. This work was supported by the Agency for Healthcare Research and Quality (K08HS024342 to M.S.P.) as well as the Clinical and Translational Science Award (CTSA) program through the National Institutes of Health National Center for Advancing Translational Sciences (UL1TR002373).

Potential conflicts of interest. The financial conflicts of interest potentially related to the subject material of this study are as follows: Dr. Pulia has served as a site subinvestigator for industry initiating studies (sponsored by Roche and RPS/Lumos Diagnostics) conducted at the University of Wisconsin-Madison. No other co-authors have any conflicts of interest to report. The author has submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

Author contributions. M.S.P., S.H., and R.J.S. contributed to study conception, contributed to the design, analysis, and interpretation of data, and drafted the manuscript. L.T.S., A.S., and A.H. contributed to study design, analysis and interpretation of the data, and critical revision of the manuscript. All authors have reviewed, provided intellectual feedback, and approved the final version of the manuscript. M.S.P.'s funding from AHRQ supported this work, and M.S.P. takes responsibility for the paper as a whole.

References

- Centers for Disease Control and Prevention. Antibiotic resistance threats in the United States. 2019. Available at: <https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf>. Accessed 5 May 2020.
- Ranji SR, Steinman MA, Shojania KG, et al. Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies. Agency for Healthcare Research and Quality; 2006. *Antibiotic Prescribing Behavior*; vol. 4.
- Centers for Disease Control and Prevention. Antibiotic use in the United States, 2017: progress and opportunities. Available at: <https://www.cdc.gov/antibiotic-use/stewardship-report/pdf/stewardship-report.pdf>. Accessed 6 December 2018.
- Fleming-Dutra KE, Hersh AL, Shapiro DJ, et al. Prevalence of inappropriate antibiotic prescriptions among US ambulatory care visits, 2010-2011. *JAMA* 2016; 315:1864-73.
- Shapiro DJ, Hicks LA, Pavia AT, Hersh AL. Antibiotic prescribing for adults in ambulatory care in the USA, 2007-09. *J Antimicrob Chemother* 2014; 69: 234-40.
- Gonzales R, Malone DC, Maselli JH, Sande MA. Excessive antibiotic use for acute respiratory infections in the United States. *Clin Infect Dis* 2001; 33:757-62.
- Gonzales R, Camargo CA Jr, MacKenzie T, et al; IMPAACT Trial Investigators. Antibiotic treatment of acute respiratory infections in acute care settings. *Acad Emerg Med* 2006; 13:288-94.
- Centers for Disease Control and Prevention. Office-related antibiotic prescribing for persons aged ≤14 years—United States, 1993-1994 to 2007-2008. *Morb Mortal Wkly Rep* 2011; 60:1153-6.
- Palms DL, Hicks LA, Bartoces M, et al. Comparison of antibiotic prescribing in retail clinics, urgent care centers, emergency departments, and traditional ambulatory care settings in the United States. *JAMA Intern Med* 2018; 178:1267-9.
- Donnelly JP, Baddley JW, Wang HE. Antibiotic utilization for acute respiratory tract infections in U.S. emergency departments. *Antimicrob Agents Chemother* 2014; 58:1451-7.
- May L, Cosgrove S, L'Archeveque M, et al. A call to action for antimicrobial stewardship in the emergency department: approaches and strategies. *Ann Emerg Med* 2013; 62:69-77.e2.
- Shehab N, Patel PR, Srinivasan A, Budnitz DS. Emergency department visits for antibiotic-associated adverse events. *Clin Infect Dis* 2008; 47:735-43.
- Durkin MJ, Jafarzadeh SR, Hsueh K, et al. Outpatient antibiotic prescription trends in the United States: a national cohort study. *Infect Control Hosp Epidemiol* 2018; 39:584-9.
- Lewis PJ, Tully MP. The discomfort caused by patient pressure on the prescribing decisions of hospital prescribers. *Res Social Adm Pharm* 2011; 7:4-15.
- May L, Gudger G, Armstrong P, et al. Multisite exploration of clinical decision making for antibiotic use by emergency medicine providers using quantitative and qualitative methods. *Infect Control Hosp Epidemiol* 2014; 35:1114-25.
- Petursson P. GPs' reasons for "non-pharmacological" prescribing of antibiotics. A phenomenological study. *Scand J Prim Health Care* 2005; 23:120-5.
- Szymczak JE, Feemster KA, Zautis TE, Gerber JS. Pediatrician perceptions of an outpatient antimicrobial stewardship intervention. *Infect Control Hosp Epidemiol* 2014; 35(Suppl 3):S69-78.
- Mangione-Smith R, McGlynn EA, Elliott MN, et al. The relationship between perceived parental expectations and pediatrician antimicrobial prescribing behavior. *Pediatrics* 1999; 103:711-8.
- Zgierska A, Rabago D, Miller MM. Impact of patient satisfaction ratings on physicians and clinical care. *Patient Prefer Adherence* 2014; 8:437-46.
- Stearns CR, Gonzales R, Camargo CA Jr, et al. Antibiotic prescriptions are associated with increased patient satisfaction with emergency department visits for acute respiratory tract infections. *Acad Emerg Med* 2009; 16:934-41.
- Martinez KA, Rood M, Jhangiani N, et al. Association between antibiotic prescribing for respiratory tract infections and patient satisfaction in direct-to-consumer telemedicine. *JAMA Intern Med* 2018; 178:1558-60.
- Gonzales R, Steiner JF, Maselli J, et al. Impact of reducing antibiotic prescribing for acute bronchitis on patient satisfaction. *Eff Clin Pract* 2001; 4:105-11.
- Hamm RM, Hicks RJ, Bembien DA. Antibiotics and respiratory infections: are patients more satisfied when expectations are met? *J Fam Pract* 1996; 43:56-62.
- Ong S, Nakase J, Moran GJ, et al; EMERGENCY ID NET Study Group. Antibiotic use for emergency department patients with upper respiratory infections: prescribing practices, patient expectations, and patient satisfaction. *Ann Emerg Med* 2007; 50:213-20.
- Cals JW, Boumans D, Lardinois RJ, et al. Public beliefs on antibiotics and respiratory tract infections: an Internet-based questionnaire study. *Br J Gen Pract* 2007; 57:942-7.
- Kuzujanakis M, Kleinman K, Rifas-Shiman S, Finkelstein JA. Correlates of parental antibiotic knowledge, demand, and reported use. *Ambul Pediatr* 2003; 3:203-10.
- Harris AM, Hicks LA, Qaseem A; High Value Care Task Force of the American College of Physicians and for the Centers for Disease Control and Prevention. Appropriate antibiotic use for acute respiratory tract infection in adults: advice for high-value care from the American College of Physicians and the Centers for Disease Control and Prevention. *Ann Intern Med* 2016; 164:425-34.
- Vollenweider DJ, Frei A, Steurer-Stey CA, et al. Antibiotics for exacerbations of chronic obstructive pulmonary disease. *Cochrane Database Syst Rev* 2018; 10:CD010257.
- Dobler CC, Morrow AS, Beuschel B, et al. Pharmacologic therapies in patients with exacerbation of chronic obstructive pulmonary disease: a systematic review with meta-analysis. *Ann Intern Med* 2020; 172:413-22.
- Press Ganey Associates, Inc. Scoring quick guide for quick reports. Available at: https://helpandtraining.pressganey.com/lib-docs/default-source/ip-training-resources/Scoring_Quick_Guide_for_Quick_Reports.pdf?sfvrsn=0. Accessed 28 November 2018.
- Handel DA, French LK, Nichol J, et al. Associations between patient and emergency department operational characteristics and patient satisfaction scores in an adult population. *Ann Emerg Med* 2014; 64:604-8.
- Lang SC, Weygant PL, Darling T, et al. Measuring the correlation between emergency medicine resident and attending physician patient satisfaction scores using press ganey. *AEM Educ Train* 2017; 1:179-84.
- Emergency Physicians Monthly. 2 + 2=? Seven things you may not know about Press Ganey statistics. Available at: <http://epmonthly.com/article/227-seven-things-you-may-not-know-about-press-ganey-statistics/>. Accessed 28 November 2018.

34. Pines JM, Penninti P, Alfaraj S, et al. Measurement under the microscope: high variability and limited construct validity in emergency department patient-experience scores. *Ann Emerg Med* **2018**; 71:545–54.e6.
35. Pulia M, Redwood R, May L. Antimicrobial stewardship in the emergency department. *Emerg Med Clin North Am* **2018**; 36:853–72.
36. Centers for Disease Control and Prevention. Be Antibiotics Aware Partner Toolkit | U.S. Antibiotic Awareness Week. **2018**. Available at: <https://www.cdc.gov/antibiotic-use/week/toolkit.html>. Accessed 6 December 2018.
37. Sharp B, Johnson J, Hamedani AG, et al. What are we measuring? Evaluating physician-specific satisfaction scores between emergency departments. *West J Emerg Med* **2019**; 20:454–9.
38. Agarwal AK, Mahoney K, Lanza AL, et al. Online ratings of the patient experience: emergency departments versus urgent care centers. *Ann Emerg Med* **2019**; 73:631–8.
39. Shehab N, Lovegrove MC, Geller AI, et al. US emergency department visits for outpatient adverse drug events, 2013–2014. *JAMA* **2016**; 316:2115–25.
40. Fenton JJ, Jerant AF, Bertakis KD, Franks P. The cost of satisfaction: a national study of patient satisfaction, health care utilization, expenditures, and mortality. *Arch Intern Med* **2012**; 172:405–11.
41. Butler CC, Rollnick S, Pill R, et al. Understanding the culture of prescribing: qualitative study of general practitioners' and patients' perceptions of antibiotics for sore throats. *BMJ* **1998**; 317:637–42.