

BRIEF REPORT

Geographic Variability in Diagnosis and Antibiotic Prescribing for Acute Respiratory Tract Infections

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ABSTRACT

Introduction: Antibiotic prescribing rates vary substantially across regions in the USA. Whether these differences are driven primarily by a greater tendency to treat certain infections (i.e., overtreatment) in certain regions or differences in the tendency to diagnose certain infections (i.e., overdiagnosis) is poorly understood.

Methods: We examined data from 2012 to 2013 using the National Ambulatory Medical Care Survey, which is a nationally representative

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sample of visits to office-based physicians. For each of nine geographic regions, we examined the relationship between the visit rate/1000 population for respiratory diagnoses for which antibiotics were prescribed to the visit rate/1000 population for selected respiratory diagnoses where antibiotic therapy may be warranted.

Results: The visit rate for all respiratory conditions resulting in an antibiotic prescription was lowest (109/1000 population) in the Pacific Region and highest (176/1000, 95% CI 138–213) in the East South Central Region. The diagnosis rate for selected respiratory conditions where antibiotic therapy may be warranted was also lowest (119/1000, 95% CI 91–147) in the Pacific Region and highest (189/1000, 95% CI 153–225) in the East South Central Region.

Conclusion: Antibiotic prescribing rates for respiratory conditions vary by region and are strongly associated with the rate with which selected respiratory conditions are diagnosed.

Keywords: Antibiotic; Infection; Respiratory tract infections; Stewardship

INTRODUCTION

Antibiotic prescribing rates vary widely across US geographic regions [1, 2]. Factors underlying this variation are poorly understood. Respiratory conditions account for the largest

percentage of antibiotics prescribed and are associated with high rates of inappropriate use [3]. Outpatient antibiotic stewardship efforts have focused on reducing unnecessary treatment for patients diagnosed with viral respiratory conditions. However, overdiagnosis of respiratory conditions that may warrant antibiotic therapy, (e.g., bacterial sinusitis) via incomplete application of stringent diagnostic criteria may also lead to inappropriate antibiotic use. A better understanding of the extent to which both treatment patterns and diagnostic practices contribute to variability in antibiotic prescribing rates would help to inform antibiotic stewardship interventions. Our objective was to assess the association between geographic differences in the visit rate for selected respiratory conditions that may warrant treatment and the rate of antibiotic prescribing for respiratory conditions overall.

METHODS

We examined data from the National Ambulatory Medical Care Survey (NAMCS) from 2012 to 2013, the most recent years available at the time of the analysis. NAMCS samples visits to office-based physicians and includes data on diagnoses based on International Classification of Diseases, Ninth Revision, Clinical Modification codes and medications prescribed. For 2012–2013, NAMCS classified the geographic location of the visit into nine regions (Fig. 1). For each region we calculated: (1) the visit rate per 1000 population for any respiratory diagnosis for which antibiotics were prescribed [3] to serve as a reference for regional variability in antibiotic prescribing and (2) the visit rate (regardless of antibiotic prescription) per 1000 population for acute respiratory tract infections for which antibiotic therapy may be warranted (ARTI+: otitis media, pharyngitis, pneumonia, sinusitis) to account for regional variability in diagnosis assignment. The association between these two rates was assessed using Pearson's correlation coefficient. This article does not contain any new studies with human or animal subjects performed by any of the authors.

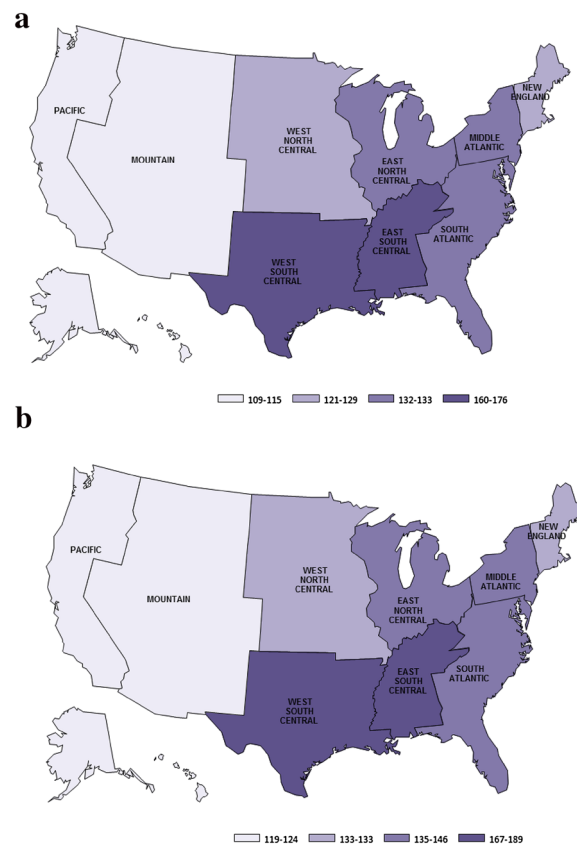


Fig. 1 **a** Regional variation in the rate of all respiratory visits prescribed antibiotics per 1000 population. **b** Regional variation in the rate of ARTI+ visits (regardless of antibiotic prescription) per 1000 population. ARTI+ acute respiratory tract infections for which antibiotic therapy may be warranted. New England (CT, MA, ME/NH/RI/VT). Middle Atlantic (NJ, NY, PA). East North Central (IL, IN, MI, OH, WI). West North Central (IA, KS, MN, MO, NE/ND/SD). South Atlantic (FL, GA, MD, NC, SC, VA, DC/DE/WV). East South Central (AL, KY, MS, TN). West South Central (AR, LA, OK, TX). Mountain (AZ, CO, UT, ID/NM/MT/NV/WY). Pacific (CA, OR, WA, AK/HI)

RESULTS

During 2012–2013, the visit rate for all respiratory conditions resulting in an antibiotic prescription was lowest (109/1000 population, 95% CI 87–131) in the Pacific Region and highest (176/1000, 95% CI 138–213) in the East South Central Region (Fig. 1a). The diagnosis rate for ARTI+ conditions was also lowest (119/1000, 95% CI 91–147) in the Pacific Region and

highest (189/1000, 95% CI 153–225) in the East South Central Region (Fig. 1b). The relationship between these rates across regions exhibits a highly positive correlation ($r^2 = 0.98$, $p < 0.01$, Fig. 2). The percentage of all respiratory visits diagnosed as ARTI+ (regardless of antibiotic prescription) varied in a similar fashion across regions from 37% in the lowest to 49% in the highest region. However, among visits during which an ARTI+ diagnosis was assigned, the percentage resulting in an antibiotic prescription was 61% and did not vary across regions ($p = 0.32$), indicating that there were no differences in the tendency to treat patients once the diagnosis was assigned.

DISCUSSION

Overall antibiotic prescribing rates for respiratory conditions vary by region and are strongly associated with the rate with which ARTI+ conditions are diagnosed. We did not observe differences in the tendency to treat patients with these infections. Together this suggests that regional differences in diagnostic practices may contribute to variability in antibiotic prescribing and possibly to antibiotic overuse. Outpatient stewardship interventions that focus on improving the accuracy of diagnosis might reduce inappropriate antibiotic prescribing.

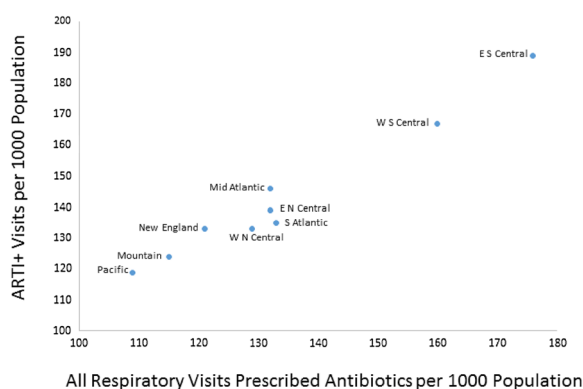


Fig. 2 Correlation between the ARTI visit rate per 1000 population and the rate with which all respiratory visits are prescribed antibiotics per 1000 population. ARTI+ acute respiratory tract infections for which antibiotic therapy may be warranted

Another potential explanation for regional variation in ARTI+ diagnoses is the possibility of regional differences in the true incidence of certain respiratory infections such as pneumonia. However, pneumonia only accounts for 4% of respiratory diagnoses prescribed antibiotics in outpatient settings [3]. Whether or not the true incidence of more common conditions such as sinusitis and otitis media varies regionally is uncertain but could contribute to our finding that the rate of diagnosis for ARTI+ conditions varies regionally.

Previous studies have shown that multiple factors are associated with differences in antibiotic prescribing for respiratory conditions including race [4], local efforts promoting stewardship [5, 6], geographic region [1, 2], and specialty [7]. Our data suggest that diagnostic practices may also contribute.

Our study has limitations. Detailed clinical information is not available to confirm the accuracy of diagnoses assigned or the appropriateness of antibiotic prescribing. Studies are needed to confirm that differences in diagnosis rates represent differences in practice rather than disease incidence. Multiple social and behavioral factors that may vary geographically are not measurable with these data and could contribute to a patient's tendency to seek care or a physician's tendency to prescribe antibiotics.

CONCLUSION

Substantial variability in the rate of antibiotic treatment for respiratory conditions and strong correlation with the rate of diagnosis of respiratory conditions that may warrant antibiotic treatment suggest that interventions focused on improving the quality and accuracy of diagnosis assignment may reduce antibiotic overuse.

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Disclosures. Adam L. Hersh, Daniel J. Shapiro, Andrew T. Pavia, Katherine E. Fleming-Dutra and Lauri A. Hicks have nothing to disclose.

Compliance with Ethics Guidelines. This article does not contain any new studies with human or animal subjects performed by any of the authors.

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