

Effect of Hispanic Ethnicity and Language Barriers on Appendiceal Perforation Rates and Imaging in Children

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Objective To determine the association between Hispanic ethnicity and limited English proficiency (LEP) and the rates of appendiceal perforation and advanced radiologic imaging (computed tomography and ultrasound) in children with abdominal pain.

Study design We performed a secondary analysis of a prospective, cross-sectional, multicenter study of children aged 3-18 years presenting with abdominal pain concerning for appendicitis between March 2009 and April 2010 at 10 tertiary care pediatric emergency departments in the US. Appendiceal perforation and advanced imaging rates were compared between ethnic and language proficiency groups using simple and multivariate regression models.

Results Of 2590 patients enrolled, 1001 (38%) had appendicitis, including 36% of non-Hispanics and 44% of Hispanics. In multivariate modeling, Hispanics with LEP had a significantly greater odds of appendiceal perforation (OR, 1.44; 95% CI, 1.20-1.74). Hispanics with LEP with appendiceal perforation of moderate clinical severity were less likely to undergo advanced imaging compared with English-speaking non-Hispanics (OR, 0.64; 95% CI, 0.43-0.95).

Conclusion Hispanic ethnicity with LEP is an important risk factor for appendiceal perforation in pediatric patients brought to the emergency department with possible appendicitis. Among patients with moderate clinical severity, Hispanic ethnicity with LEP appears to be associated with lower imaging rates. This effect of English proficiency and Hispanic ethnicity warrants further investigation to understand and overcome barriers, which may lead to increased appendiceal perforation rates and differential diagnostic evaluation. (*J Pediatr* 2014;164:1286-91).

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Language, race, and ethnicity contribute to health care disparities in the US. Recent studies have shown that despite the steady improvements in the overall health of the US population, racial and ethnic minorities receive a lower quality of health services, are less likely to receive routine medical procedures, and have higher rates of morbidity and mortality compared with nonminorities.¹⁻⁴ Ethnic minorities with language barriers face even worse health care disparities than their English-proficient counterparts.^{5,6} Patients with limited English proficiency (LEP) have cited language barriers as their primary barrier to achieving equal access to health care.⁷ Language barriers may lead to misdiagnosis, increased resource utilization, and lack of adherence to physician recommendations,⁸⁻¹² and play an important role in increasing admission rates and increasing emergency department (ED) and inpatient lengths of stay.⁹⁻¹¹ In the Hispanic population, specifically, language barriers contribute to a distrust of the US medical establishment and actually may be a deterrent to needed health care visits.¹³⁻¹⁸

Appendicitis serves as a model disease for examining health care disparities in children given its acute nature, high prevalence, and known adverse outcomes associated with appendiceal perforation. More than 70 000 pediatric appendectomies are performed annually in the US, making it the most common surgical emergency in children.¹⁹ Delays in diagnosis lead directly to increased morbidity and mortality, and perforation rates remain >20%.²⁰⁻²² In addition, some studies

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| CT | Computed tomography |
| ED | Emergency department |
| LEP | Limited English proficiency |
| PAS | Pediatric Appendicitis Score |
| SES | Socioeconomic status |

have found higher rates of appendiceal perforation and poorer outcomes related to decreased health care access in minorities and patients on Medicaid.²³⁻²⁵ Recent studies have documented a lower negative appendectomy rate with increased use of imaging, especially in children aged <5 years.²⁶ However, to date, no study has examined the effect of LEP on appendiceal perforation rates or rates of advanced imaging (computed tomography [CT] and ultrasound) in children.

We designed the present study to examine whether ethnicity and language barriers influence the management and outcomes for children with appendicitis. We hypothesized that Hispanic ethnicity and LEP would be risk factors for increased appendiceal perforation rates and decreased use of advanced imaging in pediatric patients presenting to the ED with acute abdominal pain.

Methods

We conducted a planned secondary analysis of data from a prospective, multicenter, cross-sectional study to validate and refine a low-risk clinical decision rule for pediatric appendicitis.²⁷ Children were enrolled between March 1, 2009, and April 30, 2010, at 10 geographically and demographically distinct pediatric EDs that are members of the Pediatric Emergency Medicine Collaborative Research Committee of the American Academy of Pediatrics. These sites had a combined pediatric ED volume of >350 000 visits annually. The study was approved by the Institutional Review Board at each participating site. Seven Institutional Review Boards granted a waiver of written informed consent/assent and instead allowed verbal consent. At the 3 remaining sites, written consent from the guardians and assent from patients aged ≥ 7 years was obtained. Interpreters were used according to each hospital's LEP policies. Full study details have been published previously, with those aspects relevant to our aims described below.²⁷⁻³⁰

Data were analyzed from enrolled children aged 3-18 years who were brought to the pediatric ED with acute abdominal pain concerning for possible appendicitis. Here, possible appendicitis was defined as a significant suspicion for appendicitis as evidenced by the treating clinician's order for blood tests, advanced imaging studies, or a surgical consult to evaluate for appendicitis. Exclusion criteria included previous abdominal surgery, chronic abdominal pain/illness, pregnancy, sickle cell anemia, cystic fibrosis, abdominal trauma within the previous week, abdominal imaging before arrival at the site ED, or a medical condition hindering the provider's ability to obtain an accurate history.

A clinician (faculty, fellow, resident, nurse practitioner, or physician assistant) completed a standardized history and physical examination data collection form for each child. The child's guardian's self-reported ethnicity (Hispanic vs non-Hispanic) and primary language were recorded. LEP subjects were defined as those whose primary language spoken at home was not English. For LEP families, either

in-person or telephone interpretation was used to complete the study procedures, depending on the policies of the individual sites. Laboratory results, imaging results, and operative/pathology reports were obtained via abstraction from the patient's record.

The Pediatric Appendicitis Score (PAS) was used to determine the severity of presenting clinical illness, allowing for stratification of patients into categories of risk for possible appendicitis (0-3, low risk; 4-7, moderate risk; 8-10, high risk).^{31,32} PAS scores were calculated through evaluation of the data collected on the case report forms following the validated criteria.³² Duration of symptoms was collected in 12-hour increments up to 72 hours (after which it was categorized as 72+ hours). Duration of symptoms was dichotomized into less than or greater than 24 hours for analyses. The presence or absence of perforation was based on the attending surgeon's operative report.

Advanced imaging was defined as the use of either CT or ultrasound. Clinicians obtained imaging studies at their own discretion. The standard of care was that those patients with an equivocal presentation would undergo imaging versus surgical consult, and those with a high-risk presentation would be seen by a surgeon without delay; however, these decisions were left to the discretion of each provider. The completion of advanced imaging, time to imaging from ED presentation, and time from ED presentation to operating room were obtained from the electronic medical record.

Data were summarized using standard descriptive statistics. Owing to high colinearity between ethnicity and language, ethnicity and guardian's primary language were combined into the categories of English-speaking non-Hispanics, English-speaking Hispanics, and Hispanics with LEP. Patients who were non-Hispanic with LEP were excluded, because few participants met this profile. Patients without complete language and ethnicity data were excluded as well.

Appendiceal perforation and imaging rates in the ethnicity/language groups were compared using univariate and multivariate logistic regression. For the univariate comparisons, associations were assessed between our 2 outcomes and the following variables: ethnicity/LEP, age, sex, duration of pain, and a measure of clinical severity (PAS). Generalized estimating equations were used for the multivariate analysis to adjust for clustering within hospitals. Variables were included in the respective generalized estimating equation models if they were associated with each outcome on univariate analysis ($P < .05$). A priori, age and duration of pain before presentation were included in the regression analyses because they are known factors related to perforation. Biological markers known to be associated with appendiceal perforation, such as white blood cell count and other inflammatory markers, were not included in the regression as they were not felt to be in the causative pathway for appendiceal perforation. For all models, ethnicity/LEP was analyzed in the following categories: English-speaking non-Hispanic, English-speaking Hispanic, and Hispanic with LEP. English-speaking non-Hispanic patients served as the reference group.

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