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(Article begins on next page)
Abstract:

Background: Acute respiratory infections (ARIs) are the most common symptomatic reason to seek ambulatory care in the United States, but many ARI visits may not be necessary.

Methods: We identified ARI visits to 14 primary care practices between May 2011 and May 2012 and randomly selected 500 visits, 439 of which were new ARI visits. We separated non-visit-required information (e.g., history of present illness [HPI], past medical history, etc.) from information that required an office visit (e.g., physical exam, testing, etc.). Reviewing non-visit-required information, we identified the diagnosis and whether an office visit appeared necessary. Independently, we reviewed the visit-required information and determined if the visit changed management.

Results: The 439 ARI patients had an average age of 45 years and symptoms for 8 days. Based on non-visit-required information, 72% (316/439) of visits did not appear to require an office visit. The most common diagnoses were non-specific upper respiratory infection (39%), sinusitis (24%), and bronchitis (22%). The HPI diagnosis was an exact match for clinicians’ diagnosis in 67% (213/316) of visits. After reviewing the visit-required information, management did not change for 87% (276/316) of visits.

Conclusions: About 2/3 of primary care ARI visits are not necessary for appropriate management. Improved, accurate, reliable pre-visit triage and management could reduce the burden of ARI visits on primary care.
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### Glossary of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ARI</td>
<td>Acute Respiratory Infection</td>
</tr>
<tr>
<td>CDC</td>
<td>Centers for Disease Control</td>
</tr>
<tr>
<td>CHF</td>
<td>Congestive Heart Failure</td>
</tr>
<tr>
<td>CXR</td>
<td>Chest X-ray</td>
</tr>
<tr>
<td>ED</td>
<td>Emergency Department</td>
</tr>
<tr>
<td>HPI</td>
<td>History of Present Illness</td>
</tr>
<tr>
<td>ICD-9</td>
<td>International Classification of Diseases, Ninth Revision</td>
</tr>
<tr>
<td>NS URI</td>
<td>Non-specific Upper Respiratory Infection</td>
</tr>
<tr>
<td>UHS</td>
<td>University Health Services</td>
</tr>
<tr>
<td>URI</td>
<td>Upper Respiratory Infection</td>
</tr>
<tr>
<td>UTI</td>
<td>Urinary Tract Infection</td>
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Introduction

Most acute respiratory infections (ARIs) – including non-specific upper respiratory infections (NS URIs), otitis media, sinusitis, pharyngitis, acute bronchitis, influenza, and pneumonia – are self-limited, do not require medical evaluation, and can be managed with over-the-counter medications. Despite this, ARIs strain the healthcare system. ARIs are the most common reason patients seek ambulatory care in the United States, accounting for approximately 120 million visits per year or about 10% of all ambulatory visits.¹

For patients, clinic visits are inconvenient, requiring time and costing money.² For the typical visit, patients spend an average of 28 minutes waiting in clinic and an additional 15 minutes with the physician.³,⁴ Factoring in travel time and missed work, ARI visits place a burden on patients seeking care when office visits may not be necessary.

ARI visits also result in antibiotic prescriptions,⁵ many of which are inappropriate.⁶,⁷ ARIs account for 50% of antibiotic prescriptions to adults and 75% of antibiotic prescriptions to children.⁸ Unnecessary antibiotics increase healthcare costs, expose patients to adverse drug reactions, and increase the prevalence of antibiotic-resistant bacteria.⁹,¹⁰ Starting in the mid-1990s, the Centers for Disease Control (CDC) as well as various state and local health departments launched interventions to promote appropriate antibiotic prescriptions. For example, the CDC collaborated with the American Academy of Pediatrics and the American Academy of Family Physicians to publish “The Principles” for appropriate use of antibiotics for pediatric upper respiratory infections.⁵ From 1995 to 2006, there was a sustained decrease in ARI-associated antibiotic prescription rates.⁵ This decrease was observed in physician practices and was associated with a decrease in visits for otitis media in children less than 5 years as well as a decrease in antibiotic prescription for non-antibiotic appropriate ARI diagnoses. These findings were promising; however, there was a substantial increase in broad-spectrum antibiotic prescription—azithromycin and quinolones—during this 12 year study period.⁵ Increased usage of broad-spectrum antibiotics raises concern for the emergence of antibiotic-resistant bacteria.

Unnecessary antibiotic usage also exposes patients to adverse drug reactions.⁹,¹⁰ Shehab et al. used nationally representative surveillance data to estimate and compare the numbers and rates of adverse events attributable to systemic antibiotics.¹⁰ This investigation estimated that adverse events attributable to antibiotics caused more than 142,000 emergency department (ED) visits per year. The overall rate of ED visits for antibiotic-associated adverse events was 10.5 ED
visits per 10,000 outpatient prescription visits. Nearly 80% of ED visits for antibiotic-associated adverse events among patients receiving ambulatory care were the result of allergic reactions. Less common adverse events were undesirable pharmacologic or idiosyncratic effects, such as diarrhea, dizziness, and headache, while a patient was receiving therapy at recommended doses (19%), unintentional overdoses (<1%), and unintentional exposures (<1%). Further efforts to improve appropriate antibiotic prescription for ARI are needed.

There have been limited attempts to address the high costs and volume of primary care visits for ARI. Programs that have been implemented to decrease visits and health care costs for ARI have shown mixed results. A Cold Self-Care Center was established in a prepaid ambulatory care setting at the University of Massachusetts in 1975. The University Health Services (UHS) provided a prepaid health plan for over 20,000 students and their dependents as well as 1,000 faculty, staff and their dependents. The development of the Cold Self-Care Center was prompted by large numbers of patients visiting the Health Center for relatively minor upper respiratory diseases and the UHS philosophy stressing the promotion of activities which increased patient involvement, responsibility, and initiative. Patients assessed their own symptoms using a checklist or modified algorithm. If serious symptoms were present, then the patient was directed to see a nurse practitioner. If no serious symptoms were present, then the patient was given printed handouts for specific home remedies and over the counter medications for symptom relief. This system was designed to promote the patient’s decision-making power. The patient also maintained the option to receive professional care. General satisfaction with the Cold Self-Care Center was high, with speed and ease of use cited most often as reasons for satisfaction. Of users, 20% referred themselves immediately to professional care and 6% anticipated seeking professional care for any subsequent cold. Importantly, no significant adverse effects of self-treatment were noted. Health care savings after the implementation of the Cold Self-Care Center were estimated at over $46,000 during a two year period. This triage intervention was able to successfully decrease visits for uncomplicated ARI and decrease health care costs while maintaining a high level of patient satisfaction.

In contrast, a practice that implemented an upper respiratory infection (URI) clinical guideline for initial telephone assessment of patients found that use of the guideline failed to decrease clinic visits, decrease antibiotic use, or reduce health care costs. The clinical guideline recommended that eligible patients with respiratory symptoms be initially assessed by telephone,
using a carefully constructed clinical algorithm. When a presumptive URI diagnosis was established, treatment advice was given by telephone with patient instruction to present for office visit if the symptoms worsened, persisted or changed. The guideline strongly recommended against the use of antibiotics for the treatment of URI. Eligible patients had to be generally healthy without any underlying conditions, prolonged or severe symptoms, or evidence of other specific diagnoses. When the guideline was implemented in four health clinics for a 21-day period, it was found that only 13% of patients with URI symptoms were eligible. The guideline failed to decrease clinic visits because the likelihood of a subsequent office visit increased from pre- to post-guideline, although the majority of patients had no further diagnoses other than URI. Antibiotic use for the initial URI diagnosis declined from 24% pre-guideline to 16% post-guideline, but antibiotic use during 21-day follow up did not change. Lastly, the guideline failed to have a statistically significant reduction in the cost of care.

Although there is limited documentation of success with pre-visit triage and management for ARI, similar triage interventions have been successful for other medical conditions for which patients commonly seek care. A randomized control trial by Barry et al. compared telephone management of suspected urinary tract infection (UTI) in women to office management. The study randomly assigned women calling their usual provider with a suspected, uncomplicated UTI to receive either telephone management or usual office-based care. All women had urinalyses and urine cultures and all women were treated with 7 days of antibiotics. If UTI symptoms were still evident at either the 3- or 10-day follow-up, the patient was asked to make an appointment to see her practitioner. The study found no significant difference in symptom scores or patient satisfaction between the telephone and office visit groups suggesting that telephone management of UTI may be comparable with usual office care. UTI management is similar to ARI in that both medical conditions are generally uncomplicated and high in volume accounting for a significant proportion of health care costs. Improved, accurate, reliable pre-visit triage and management could reduce the burden of ARI office visits on primary care and the healthcare system.

Despite the fact that patients make visits for self-limited ARIs, ARI visits are inconvenient and expensive, and ARI visits often result in inappropriate antibiotic prescriptions, it is unknown what proportion of ARI visits are necessary. To measure the proportion of ARI visits that could have been managed without a visit, we conducted a retrospective chart review.
Methods
Overview

From a network of primary care practices, we randomly selected 500 ARI visits from May 2011 to May 2012. From the visit documentation, we verified the visit was for a new ARI. We separated information that could be gathered without an office visit (e.g., history of present illness [HPI], past medical history, etc.) from information that required an office visit (e.g., physical exam findings, testing, etc.). Reviewing non-visit-required information, we determined the diagnosis (HPI diagnosis) and whether or not an office visit was necessary. Independently, we reviewed the visit-required information to determine the clinician's diagnosis and compared the HPI diagnosis to the clinician's diagnosis. We determined that a visit had ultimately been unnecessary if there was a match between the HPI diagnosis and clinician’s diagnosis or, for cases with discrepant diagnoses, if no change in management occurred based on the office visit.

Data Sources

We identified all primary care visits to 14 Brigham and Women’s Primary Care Practice Based Research Network Clinics from May 2011 to May 2012 with one of the top three diagnoses representing an ARI visit based on International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9). We included NS URI (ICD-9 460, 464, and 465), acute bronchitis (ICD-9 466 and 490), influenza (ICD-9 487), non-streptococcal pharyngitis (ICD-9 462), streptococcal pharyngitis (ICD-9 034.0), otitis media (ICD-9 381 and 382), sinusitis (ICD-9 461 and 473), and pneumonia (ICD-9 481-486). From these visits, we randomly selected 500 visits to further analyze. During the review of 500 visits, we excluded visits for which the patient was not currently experiencing ARI symptoms, follow-up visits, visits for symptoms lasting longer than 30 days, or if there was insufficient information to determine if the patient made a new visit for an acute ARI.

Data Extraction

We extracted inclusion and exclusion criteria and data about each ARI into a study-specific database (Microsoft Access 2010). We extracted the visit date, patient sex, age, and co-morbidities (e.g., diabetes, CHF, chronic lung disease). We imported the corresponding visit documentation for each ARI visit from the online medical record and separated the visit
documentation into two parts. The first part was information in the visit documentation that could be gathered without an office visit. This included the chief complaint, the history of present illness (HPI), past medical history, medications, allergies, procedures, family history, and social history, and review of systems when available. The second part was information that required an office visit. This included physical exam findings, labs, other tests that were ordered at the visit, interventions performed in-office, and the physician’s assessment and plan.

We initially extracted data from the first part of the documentation for each visit—non-visit-required information. During this extraction, we gathered data on symptom duration (if noted) and the presence or absence of the following symptoms in the visit documentation: cough, cough with phlegm, cough with colored sputum, chest congestion, sore throat, fevers, chills, ear pain, red eyes, headache, fatigue, myalgias, nasal symptoms, sinus symptoms, wheezing, and shortness of breath. We used this information to determine whether a visit was necessary or unnecessary for further management. We then selected a primary ARI diagnosis for each visit. We labeled this the primary HPI diagnosis and chose from NS URI, otitis, sinusitis, pharyngitis, bronchitis, influenza, and pneumonia. In addition, when relevant, we assigned secondary diagnoses and noted other reasons a visit might be indicated (e.g., comorbidities or immunosuppressive medications).

After analysis of the non-visit-required information was complete, we randomized the order of the visits and independently, blinded to previously extracted data, extracted visit-required information. We extracted data on the presence or absence of the following physical exam findings: inflamed or enlarged tonsils, abnormal findings on auscultation, enlarged lymph nodes, fever, abnormal findings on ear exam, red/watery eyes, inflamed oropharynx/post-nasal drip, and sinus tenderness. We also extracted data on whether the following interventions were performed during the office visit: sputum culture, rapid influenza testing, rapid group A streptococcal testing, throat culture, blood work, nebulizer treatment, and chest x-ray (CXR). For each ARI visit, we recorded whether the following occurred: an antibiotic prescription, a non-antibiotic prescription, referral to the emergency department, referral to a specialist, admission to the hospital, and revisit to clinic within 2 weeks of initial appointment. Lastly, based on the assessment and plan that was documented by the clinician, we extracted the clinician’s primary diagnosis and secondary diagnosis if available.
A second reviewer determined the necessity of office visit based on the HPI information for a randomly-selected, 10% of the total visits and found 84% concordance (37/44) in visit necessity with the primary reviewer.

Data Analysis

We measured the proportion of visits that could be managed without office visit versus the proportion of visits that required office visit for further evaluation or management. We compared the HPI diagnosis to the clinician’s diagnosis to determine the proportion of visits for which the HPI diagnosis and clinician’s diagnosis was an exact match. Finally, we examined visits that had a discrepancy between the HPI diagnosis and clinicians’ diagnosis to determine whether the visit resulted in a change in antibiotic management.
Results

Visit Flow

During the study period from May 2011 to May 2012, there were 58,398 visits to the 14 primary care practices with an ARI diagnosis. We randomly selected 500 of these visits. We excluded 61 of these visits for the following reasons: 13 with insufficient documentation; 10 without ARI symptoms; 24 were follow-up visits for ARIs; and 14 visits had symptom duration > 30 days. After these exclusions, there were 439 new ARI visits available for data extraction and analysis (Figure 1).

Visit Characteristics

Among the 439 visits, the average age of the patients in the sample was 45 years. The sample was 71% women. Sampled visits included 31 (7%) patients with diabetes, 3 (< 1%) with CHF, and 62 (14%) with chronic lung disease, most commonly asthma. The mean duration of ARI symptoms was 8 days.

The most common symptoms were cough in 282 (64%) visits, sore throat in 241 (55%) visits, and nasal symptoms such as runny nose or stuffy nose in 208 (47%) visits. The most common findings on physical exam involved the oropharynx (redness, post nasal drip) in 130 (30%) visits, nasal mucosal abnormalities in 89 (20%) visits, and abnormal findings on auscultation in 68 (15%) visits. Clinicians ordered rapid testing for group A streptococci in 80 (18%) visits and CXRs in 37 (8%) visits. Other, less commonly used office interventions included throat culture in 26 (6%) visits and blood tests in 24 (5%) visits. Patients were referred to specialists in 20 (5%) visits, with 17 of these referrals to otorhinolaryngology. The most common reasons for referral to otorhinolaryngology were recurrent sinus symptoms (8), severe otitis media (3), and throat discomfort (3). Clinicians prescribed antibiotics in 213 (49%) visits and non-antibiotic prescriptions were given in 123 (28%) visits.

Visit Classification

Based on the non-visit-required information, 72% (316/439) of visits did not require an office visit (Figure 2). The most common diagnoses were NS URI (39%), sinusitis (24%), and bronchitis (22%). The HPI diagnosis was an exact match with the clinician’s diagnosis in 67% (213/316) of these visits.
There were 33% (103/316) of visits for which the HPI diagnosis and the clinician's diagnosis was not an exact match. Of these 103 visits, 61% (63/103) of visits had no change in antibiotic management despite a mismatch between HPI diagnosis and the clinician’s diagnosis. For example, a visit may have been assigned an HPI diagnosis of NS URI and a clinician’s diagnosis of bronchitis; however, there was no change in antibiotic management that occurred during the office visit. Combining these 63 visits with the 213 visits for which there was an exact match between HPI diagnosis and clinician’s diagnosis, 87% (276/316) of visits not requiring office visit based on non-visit-required information indeed could have been managed without an office visit.

This left 13% (40/316) of visits that, based on non-visit-required information, did not require an office visit, but for which an office visit resulted in a change in antibiotic management (Table 1). In 50% (20/40) of these visits, the HPI diagnosis was NS URI while the clinicians’ diagnoses were bronchitis (8), sinusitis (6), otitis (3), pharyngitis (2), and pneumonia (1); all these visits resulted in an antibiotic prescription. In 28% (11/40) of visits, the HPI diagnosis was bronchitis without antibiotic prescription while the clinicians’ diagnoses were sinusitis (5), pneumonia (3), NS URI (2), and otitis (1); all these visits resulted in an antibiotic prescription.

Considered together, for the 13% (40/316) for which the visit changed management, the treating clinician prescribed an antibiotic for a potentially antibiotic-appropriate diagnosis (65%; 26/40); prescribed an antibiotic for a non-antibiotic-appropriate diagnosis (25%; 10/40); or avoided an antibiotic prescription for patients with an HPI diagnosis of sinusitis (10%; 4/40).

For the 28% (123/439) of visits requiring an office visit for management based on non-visit-required information, the most common diagnoses were otitis media (32%), pneumonia (32%), and pharyngitis (28%). The HPI diagnosis matched the clinician's diagnosis for 77% (95/123) of these visits. This left 23% (28/123) of visits with a mismatch between the HPI diagnosis and clinicians’ diagnosis (Table 2). Most of these visits were for antibiotic-appropriate diagnoses such as otitis media or pneumonia or non-antibiotic-appropriate diagnoses with secondary diagnoses or comorbidities which made a visit necessary.
Discussion

In this retrospective chart review of randomly selected ARI visits, we initially determined that 72% did not require an office visit based on information that could be collected without a visit. Of these, after reviewing information collected at the visit, the visit neither resulted in a change in the diagnosis or a change in antibiotic management for 87%. The remaining 13% of visits had a change in antibiotic management, but some of the antibiotic prescribing was for non-antibiotic-appropriate diagnoses. Overall, 63% (276/439) of all visits were determined to be unnecessary and the visit did not result in a change in antibiotic management.

Reducing ARI visits could decrease a significant source of burden on the healthcare system. ARI visits are not individually complex or expensive, but because they collectively account for about 10% of ambulatory visits, reducing ARI visits could liberate much needed primary care capacity. Reduction in the number of ARI visits could decrease a portion of outpatient care costs, which account for 41% of total healthcare costs. Avoiding unnecessary ARI visits could be part of paying for value-based healthcare, shifting the focus from volume and profitability of services provided by physicians to patients’ needs and outcomes achieved.

Reducing ARI visits could save valuable time and money for patients. For the typical visit, patients spend an average of 28 minutes waiting in clinic and an additional 15 minutes with the physician. Factoring in travel time and missed work, ARI visits place a burden on patients seeking care when office visits may not be necessary.

Reducing unnecessary ARI visits has the potential to decrease inappropriate antibiotic prescribing. ARI visits often result in inappropriate antibiotic prescriptions which increase healthcare costs, expose patients to adverse drug reactions, and increase the prevalence of antibiotic-resistant bacteria.

Attempted solutions to reduce ARI visits have shown mixed results. A Cold Self-Care Center established to promote self-reliance for patients with minor upper respiratory diseases found a decrease in visits and costs for common colds. Patients were able to assess their own symptoms using a checklist or modified algorithm, and if no serious symptoms were present, they were given information on home remedies and over the counter medications for symptom relief. Cold Self-Care patients were satisfied with convenience, speed, and ease-of-use. In contrast, a practice that implemented an upper respiratory infection clinical guideline for initial telephone assessment of patients found that only 13% of patients were eligible due to underlying
conditions, prolonged or severe symptoms, or symptoms suggestive of a specific diagnosis other than URI. The guideline failed to decrease clinic visits, antibiotic use, or cost of care.\textsuperscript{12}

Despite these varied results, patients desire accessibility and convenience that may be offered by pre-visit interventions. A study surveying patients at a health retail clinic found that the majority of patients cite convenience as the reason for seeking retail clinic care with 95\% of patients reporting satisfaction with the provided care and 98\% of patients responding that they would visit again for their healthcare needs.\textsuperscript{15} Furthermore, evidence shows that overall costs of care was lower in retail clinics compared to physician offices for matched cases, and the expected increase in antibiotic prescribing at retail clinics did not occur.\textsuperscript{16} The same study also found that the quality of care in retail clinics was similar to care provided in physician offices. The popularity and growth of retail health clinics is an indication that patients would welcome cost-effective, time-saving, and convenient care that does not necessarily involve direct physician interaction.

When implementing a clinical intervention to triage patients with ARI, it is important to understand the reason why patients seek care for ARIs. A major reason is antibiotic prescription with studies showing that patients who visit a physician for ARI desire antibiotics at rates as high as 60\% to 75\%.\textsuperscript{17-19} However, we previously found that 39\% of patients visiting an urgent care center desired antibiotics, suggesting that patients may be seeking care for reasons other than antibiotic prescription.\textsuperscript{20} Other reasons for seeking care included patient desire for a diagnosis and reassurance from a physician.\textsuperscript{20} Less common reasons were to get a non-antibiotic treatment recommendation or prescription, to have testing carried out, and to obtain an estimate of how long the symptoms would last. Patients want an in-person evaluation and assurance that nothing serious is going on.\textsuperscript{12} These reasons should be addressed when planning an intervention to triage patients with ARI symptoms. Improved, accurate, reliable pre-visit triage and management could reduce the burden of ARI office visits on primary care and the healthcare system.

Although such a model for ARI has yet to be documented, telephone encounters for management of depression\textsuperscript{21}, asthma\textsuperscript{22}, and urinary tract infections\textsuperscript{13} have been successfully implemented. These telephone encounters work best when a patient-physician relationship already exists and physical examination is unnecessary. Online communication is another promising area with one study finding that two-thirds of respondents would be interested in an e-mail visit for management of a simple medical problem.\textsuperscript{23} Internet-based medical visits, or
eVisits, allow patients to seek diagnosis and treatment from their doctor over a secure website without physician office visit. One study that surveyed first time eVisit users at a large family medicine practice found that this modality decreases costs without increasing the risk of inappropriate or incomplete care.\textsuperscript{24} Such “structured e-Visits” are gaining in popularity due to patients desire for electronic access to healthcare providers, but there is a lack of published research on outcomes associated with these visits.
Limitations

Our study has limitations that should be considered. First, we used billing codes to identify potential ARI visits. The visits we reviewed had been, in effect, pre-screened to be likely to contain an ARI visit. True, de novo visits might include additional uncertainty. However, we previously found billing codes to have a high sensitivity (98%), specificity (96%), and positive predictive value (96%). For the present study, we found a high positive predictive value for new ARI visits (88%; 439/500), but cannot comment on sensitivity or specificity. In addition, for ARI visits that we “missed” because they had non-ARI billing codes, we cannot comment on the necessity of the visit or the accuracy of the HPI diagnosis. In actual, prospective non-visit-based clinical care, clinicians will be able to identify “red flags” that should indicate the necessity of a visit.

Second, this was a retrospective study, dependent on documentation. The documentation does not always neatly reflect the clinicians’ thought process during the office visit. Documentation may also be subject to confirmation bias. Although we conceived of the HPI diagnosis and the clinicians’ diagnosis as separate, their documentation are not independent. Third, in reality diagnoses are subject to uncertainty, but we considered the HPI diagnosis and clinicians’ diagnoses definitive. Fourth, a single reviewer determined visit necessity and the HPI diagnosis for most visits. However, a duplicate review of 10% of visits showed 84% concordance in determining visit necessity. Despite these limitations, our study shows that a majority of ARI may not require office visit for diagnosis and management.
Conclusion

In conclusion, we found that approximately 63% of primary care visits for ARI are unnecessary for appropriate management. A robust system of pre-visit triage and management, by telephone, internet, or some other modality, could help determine which patients could be managed without office visit and ensure appropriate follow-up. Interventions to reduce ARI visits have the potential to decrease inappropriate antibiotic prescribing, reduce the burden of ARI office visits on the health care system, and offer more convenience for patients.
References


Legends for Figures

Figure 1: Visit Flow

Figure 2: Visit Classification

*The most common diagnoses for the 316 visits that did not require an office visit based on non-visit-required information were NS URI (122; 39%), sinusitis (76; 24%), and bronchitis (70; 22%).

**The most common diagnoses for the 123 visits that required office visit based on non-visit-required information were otitis media (39; 32%), pneumonia (39; 32%), and pharyngitis (35; 28%).

Dx = diagnosis
Table 1: Discrepancies between HPI Diagnoses and Clinician Diagnoses for Unnecessary Visits based on Non-visit-required Information with Changes in Antibiotic Management (n = 40)

<table>
<thead>
<tr>
<th>Primary HPI diagnosis</th>
<th>Clinician Diagnosis</th>
<th>Antibiotics Prescribed by Treating Clinician</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 NS URI</td>
<td>8 Bronchitis</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>6 Sinusitis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 Otitis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 Pharyngitis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Pneumonia</td>
<td></td>
</tr>
<tr>
<td>11 Bronchitis</td>
<td>5 Sinusitis</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>3 Pneumonia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 NS URI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Otitis</td>
<td></td>
</tr>
<tr>
<td>4 Non-streptococcal pharyngitis</td>
<td>3 Pharyngitis</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>1 Sinusitis</td>
<td></td>
</tr>
<tr>
<td>4 Sinusitis</td>
<td>4 NS URI</td>
<td>No</td>
</tr>
<tr>
<td>1 Influenza</td>
<td>1 Otitis</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Table 2: Discrepancies between HPI Diagnoses and Clinician Diagnoses for Necessary Visits based on Non-visit-required Information (n = 28)

<table>
<thead>
<tr>
<th>Primary HPI Diagnosis and Secondary Diagnoses</th>
<th>Clinician Diagnosis</th>
<th>Antibiotics Prescribed by Treating Clinician</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Otitis</td>
<td>4 NS URI</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>2 Pharyngitis</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>1 Pharyngitis</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>1 Sinusitis</td>
<td>Yes</td>
</tr>
<tr>
<td>6 Sinusitis</td>
<td>6 NS URI</td>
<td>No</td>
</tr>
<tr>
<td>Secondary diagnoses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Otitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Pneumonia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Asthma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Pneumonia</td>
<td>2 Bronchitis</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>1 NS URI</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>1 Pharyngitis</td>
<td>No</td>
</tr>
<tr>
<td>4 NS URI</td>
<td>2 Bronchitis</td>
<td>Yes</td>
</tr>
<tr>
<td>Secondary diagnoses</td>
<td>1 Sinusitis</td>
<td>Yes</td>
</tr>
<tr>
<td>1 Pneumonia</td>
<td>1 Pharyngitis</td>
<td>No</td>
</tr>
<tr>
<td>1 Otitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Symptoms for 30 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Immunosuppressive medications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Bronchitis</td>
<td>2 NS URI</td>
<td>Yes</td>
</tr>
<tr>
<td>Secondary diagnoses</td>
<td>1 NS URI</td>
<td>No</td>
</tr>
<tr>
<td>3 Pneumonia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Influenza</td>
<td>1 Sinusitis</td>
<td>Yes</td>
</tr>
<tr>
<td>Secondary diagnoses</td>
<td>1 Bronchitis</td>
<td>No</td>
</tr>
<tr>
<td>2 Pneumonia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Possible streptococcal pharyngitis</td>
<td>1 NS URI</td>
<td>No</td>
</tr>
</tbody>
</table>
Figure 1:

58,398 ARI visits

500 randomly selected visits

13 insufficient documentation

10 no ARI symptoms

24 follow-up visits for ARI

14 symptoms > 30 days

439 ARI visits analyzed
Figure 2:

439 ARI visits analyzed

316 (72%) did not require office visit based on non-visit-required information*

123 (28%) required office visit based on non-visit-required information**

213 (49%): HPI dx = clinician’s dx

103 (23%): HPI dx ≠ clinician’s dx

95 (22%): HPI dx = clinician’s dx

28 (6%): HPI dx ≠ clinician’s dx

63 (14%) no change in antibiotic management

40 (9%) change in antibiotic management