Original Article

# Effect of Patient and Provider Education on Antibiotic Overuse for Respiratory Tract Infections

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**ABSTRACT**

Antibiotic overuse for respiratory tract infections (RTIs) in primary care (PC) is a known important contributor to the serious health threat of antibiotic resistance, yet remains a difficult problem to improve. The purpose of the study was to assess the effects of a combination patient and provider education program on antibiotic prescribing in RTIs in a rural primary care clinic. Utilizing a quasi-experimental pretest-posttest design, a retrospective electronic medical record review was conducted to determine if a patient and provider education program changed the rates of antibiotics being prescribed (immediate or delayed) during a visit for RTI for 207 randomly selected patients during the established evaluation time periods. The antibiotic prescription rate for the preintervention group was 56.3% compared to 28.8% for the postintervention group ($p < .01$). Immediate antibiotics were ordered in the preintervention group 31.1% of the time compared to 13.5% for the postintervention group ($p < .05$). The results of this study demonstrate that educational interventions can be effective in rural settings and that changes in antibiotic prescribing are possible.

**Keywords:** antibiotic stewardship, respiratory tract infections

## Introduction

### Background

Antibiotic resistance is a serious health threat, and antibiotic overuse is the single largest contributor to the problem of antibiotic resistance.[1] Each year, over two million people in the United States get antibiotic resistant infections and 23,000 people die from them.[2] Antibiotic resistance in common infections that were once easy to treat is being reported at high rates worldwide. If inappropriate antibiotic prescribing does not decrease, many illnesses may soon become untreatable.[3]

The most common ailment treated in primary care (PC) is a respiratory tract infection (RTI).[4] Although only approximately 10% of RTIs are caused by bacteria, providers prescribe antibiotics for over 60% of cases.[5] According to the United Kingdom National Institute for Health and Clinical Excellence (NICE), "international comparisons make it clear that antibiotic resistance rates are strongly related to antibiotic use in PC."[6] The Joint Commission estimates that one billion dollars is spent annually in the United States on unnecessary antibiotics for RTIs.[7]

Antibiotics are not indicated in RTI because research shows that they have not resulted in a cure or resolution of symptoms compared to a placebo.[8] Antibiotics are also associated with a significantly higher risk of adverse reactions.[8–10] There are several factors contributing to the problem of antibiotic overuse in RTI. Primary care providers (PCPs) indicate that patient demand is a main reason for prescribing antibiotics for RTIs.[11–13] This demand stems from patients' lack of knowledge about the appropriate use of antibiotics, the appropriate treatment for viral illness, the effective self-care regimen in RTI, and the potential dangers of inappropriate antibiotic overuse.[14] An estimated 60%–70% of patients with RTIs believe they need antibiotics.[15] Thus, patient knowledge about appropriate antibiotic use is one factor that must be addressed for this issue to improve.

Despite believing that they are not indicated, PCPs report prescribing antibiotics for RTIs for the following reasons: satisfying the patient, keeping the patient in the practice, wanting to avoid being perceived as doing nothing for the patient, lacking the energy to resist the demand, shortening the visit duration, and believing that patients who really want antibiotics will obtain them anyway.[13,16] This indicates that many PCPs lack knowledge of and comfort

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with effective strategies for reducing antibiotic prescribing, particularly regarding patient education on the topic. When PCPs inappropriately prescribe antibiotics for RTIs, the cycle is perpetuated and antibiotics become the expected treatment.

Research on approaches to decrease antibiotic use in RTI focuses on three interventions: patient education, PCP education, and a combination of the two. Patient education decreases antibiotic prescribing in PC patients with RTIs,[17–19] whereas PCP educational interventions alone do not.[9,20,21] Although patient education can come in many forms, printed education materials have been evaluated more than any other type. A systematic review on the use of printed patient education materials to reduce antibiotic prescriptions showed that educational materials may improve patient satisfaction and decrease reconsultation rates for the same illness as well as for similar illnesses in the future.[18] In contrast, antibiotic prescriptions were associated with increased reconsultation rates.[18] Printed patient education materials are effective in reducing antibiotic prescribing in RTI, even when they are used passively.[9,17–20] However, education is much more effective when actively used by the PCP during the patient consultation.[18,20] Systematic reviews demonstrate that the most effective educational intervention for reducing antibiotic prescribing for RTIs in PC is a combination of patient and PCP education.[6,9,18–20,22–24]

The clinical practice guidelines (CPGs) from NICE[25] were selected as the evidence-based foundation for this study because this CPG and the summary of it[26] were the only current CPGs specifically directing evidence-based management of RTI in PC. The CPGs recommend a combined approach of prescribing strategy and actively administered patient education during the visit.[25] For patients who are not at high risk of developing complications, it is recommended that patient education be implemented by the PCP and that either no antibiotics or delayed antibiotics be prescribed.[25] Delayed antibiotic prescribing is the practice of recommending no antibiotics but offering a prescription for antibiotics that a patient may take or pick up in a few days if symptoms worsen.[25] Delayed antibiotic prescribing is used as an alternative to immediate antibiotic prescribing, in which the patient is given an antibiotic prescription to start taking immediately.[6] A combination of delayed antibiotic prescribing and patient education successfully reduces antibiotic use in RTIs, as well as future visits for RTIs, without decreasing patient satisfaction.[8,9] However, no antibiotic prescribing results in fewer antibiotics taken than delayed antibiotic prescribing.[24]

Clinical practice guidelines recommend that the patient education accompanying delayed or no antibiotic prescribing contains a few key components. Primary care providers should discuss the natural history of the illness with the patient, including how long the illness is likely to last. Symptomatic treatment needs to be addressed. Patients should be advised that antibiotics are not needed, are not likely to help, and may cause potential side effects. Primary care providers also need to provide education on worsening or prolonged symptoms and when to return for reevaluation. In addition, patients who are given delayed antibiotic prescriptions should be instructed to take the antibiotic only if the symptoms worsen or do not follow the expected natural course of illness.[25]

## Purpose

Recent studies have shown that areas with low income and low education tend to have the highest rates of antibiotic prescribing.[26,27] Rural communities are also less likely to be effectively influenced by national prevention campaigns, which are typically not designed specifically with rural cultural considerations in mind.[28] Patients in rural communities tend to have health beliefs and values that arise from their community social norms. They value their family members' or their own knowledge of health, illness, and treatment based on experience. They also see people in their community as their family. This must be considered when designing a program to change health beliefs and knowledge in such a location.[28,29]

National media campaign efforts have failed to make a difference in antibiotic knowledge and use in rural areas.[30] Local implementation of a program designed with cultural considerations may be the only way to improve the problem. Without an effective program to improve antibiotic prescribing in RTI, the cycle of inappropriate antibiotic demand, prescribing, and use was likely to continue perpetuating itself, leading to a worsening in antibiotic resistance. In a rural community, an education program must be specifically designed to reach that specific population and address changing their social norms.[28] The purpose of this study was to evaluate the effect of a combination patient and provider education program on reducing immediate antibiotic prescribing in RTIs in a rural setting PC clinic.

## Methods

### Design, Data Collection, and Ethical Approvals

Using a quasiexperimental pretest–posttest design, antibiotic prescription data were obtained via a retrospective electronic medical record review of patient records that were evaluated by a full-time "walk-in" care provider 1 year prior to and 1 year after program implementation. No additional balancing measures were specifically examined. Provider education was done after all preintervention group patients had been seen in the clinic and before data collection occurred for the postintervention group; all providers were educated during the same 1-month time period. The Institutional Review Board, Protocol Number 16-0609-X3B, approved the study.

### Setting and Sample

The study was conducted at a rural PC practice setting in the south central part of the United States that provides care for patients of all ages. The population for this study consisted of "walk-in" patients, age 2–65, evaluated by the participating providers and diagnosed with RTI. Exclusion criteria included the following: additional diagnosis of bacterial illness in the same visit (such as pneumonia or sinusitis); duration of illness: 10 or more days; comorbidities of: COPD, asthma, or immunosuppression. These exclusion criteria were based on the CPG indicators for patients at higher risk for complications and an immediate antibiotic regimen could be considered appropriate for these patients.[6] There were 1,943 patients who met the initial inclusion criteria, 1,075 in the preintervention group and 868 in the postintervention group. A power analysis was done to determine the number of participants needed in each group to obtain a statistically significant change; the analysis demonstrated that at least 103 needed to be in each group. Through a random selection process using the 1,943 patient records, the first participants on the list in each sample group to meet all inclusion and exclusion criteria were selected as the sample. Fifty-one of the records reviewed for inclusion had to be excluded, primarily due to comorbidities and duration of illness of 10 days or longer, making them potentially at higher risk for complications and appropriate candidates for possible antibiotic treatment. Data were collected on a total of 207 participants, 103 in the preintervention group and 104 in the postintervention groups.

### Interventions

The patient education intervention program, as shown in Table 1, was implemented over 1 year in accordance with the CPG recommendations[6] regarding the education that all RTI patients should receive. Patient education included content designed to address the values and beliefs of this population, enabling this new health information to have high compatibility with the needs of this community. Patients were given repeated exposure to health information in the form of posters and handouts. Some patients were given prescriptions for delayed antibiotics, which allowed them to still receive an antibiotic prescription and determine for themselves if they needed to take it, allowing them to trial the intervention.

During the visit, providers educated patients about RTIs, natural history of illness, expected duration and symptoms, symptomatic treatment, and abnormal symptoms for which they should return. Providers also discussed that antibiotics would not help and would potentially harm. They provided this education using plain language, which was reinforced with a handout, as shown in Table 1.

Posters were obtained and displayed in the clinic from the Centers for Disease Control and Prevention's "Get Smart: Know When Antibiotics Work" campaign[31] (recently renamed "Be Antibiotics Aware: Smart Use, Best Care"[32] with updated posters that contain similar messaging), as shown in Table 2. According to CPG, the participating "walk-in" care providers were educated on actively teaching patients about RTIs and appropriate antibiotic use during the patient visit, as well as on the use of no or delayed antibiotic prescriptions.[6]

## Results

### Demographics

The 207 participants were comprised of 138 females and 69 males, as shown in Table 3. Of the participants, 79.2% (n = 164) were adults, age 18–65. Adolescents, age 11–17, comprised 14.5% (n = 30) of the participants, and children, age 2–11, comprised the remaining 6.3% (n = 13). There were 103 participants in the preintervention group and 104 in the postintervention implementation group. There was no difference in age ($p = .24$) or gender ($p = .92$) between the two groups.

### Data Analysis and Findings

In the preintervention group, 103 participants were evaluated for RTI. Fifty-eight of them were prescribed antibiotics for an antibiotic prescription rate

**Table 1. Translating Important Information Into Effective Patient Education**

| |
|---|
| Provider Education to Patient During Visit: |
| • A respiratory tract infection, or "the common cold," is usually caused by a virus. |
| • Antibiotics do not treat viruses; they treat bacteria. |
| • Viruses have to go away on their own. |
| • Taking antibiotics for viral illnesses can cause dangerous problems, like serious side effects or reactions and put you at risk for an infection that is resistant to treatment. |
| • Symptoms (like cough and congestion) usually last 1 to 2 weeks. |
| • Symptomatic treatment encouraged; specific recommendations made as appropriate to the patient. |
| • High fevers, shortness of breath or worsening after a period of improvement are not a normal part of this illness and if you experience these, you should be reexamined. |
| Reinforced with handout: |
| • Written in plain, lay language using terms that patient population understands. |
| • Addressing main points contained in provider education. |
| • Recommending symptomatic treatments according to symptom, age, and comorbidity (such as hypertension). |
| • Addressing frequently asked questions and commonly held beliefs from our patient population, such as why they should not to take an antibiotic now and why yellow or green nasal drainage does not always mean an antibiotic is needed. |

in RTI of 56.3%. In 32 of those 103 encounters, the antibiotic prescriptions given were immediate for an immediate antibiotic prescribing rate of 31.1%. In the postintervention group, 104 participants were evaluated for RTI. Antibiotics were prescribed in 30 of the 104 encounters for an antibiotic prescription rate of 28.8%. There was a significant decrease in the number of antibiotics prescribed in the postintervention group in comparison with the preintervention group ($\chi^2 = 15.97$, $p < .001$). In the 104 postintervention group encounters, only 14 were given immediate antibiotic prescriptions for an immediate antibiotic prescription rate of 13.5%. The number of immediate antibiotic prescriptions

**Table 2. Simply Getting the Message Across[31]**

| |
|---|
| CDC's "Get Smart: Know When Antibiotics Work" Campaign Posters[a] displayed containing these points: |
| • Taking antibiotics when you have a virus (like a cold or the flu) will NOT: |
| ○ Cure the infection |
| ○ Help you feel better |
| ○ Keep you from spreading the infection to others |
| ○ Help you get back to work faster |
| • Antibiotics are only needed for treating certain infections caused by bacteria; antibiotics do not treat infections caused by viruses. |
| • Taking antibiotics for a virus puts you at risk for a bacterial infection that is resistant to antibiotic treatment. |
| [a] This campaign from the CDC has recently been renamed "Be Antibiotics Aware: Smart Use, Best Care"[32] with updated posters that contain similar messaging. |

**Table 3. Characteristics of Participants by Group[a]**

| Characteristics | Preintervention group (%) | Postintervention group (%) |
|---|---|---|
| Gender | | |
| Male | 33 | 33.7 |
| Female | 67 | 66.3 |
| Age | | |
| Child (2–10) | 4.9 | 7.7 |
| Adolescents (12–17) | 12.6 | 16.3 |
| Adults (18–65) | 82.5 | 76 |

[a] Additional information was not collected due to the homogeneity of the patient population.

decreased significantly in the postintervention group in comparison with the preintervention group ($\chi^2 = 9.28$, $p < .05$). There was no significant change in the number of delayed antibiotic prescriptions after implementation of the intervention ($p = .08$).

A chi-square test was used to determine whether there was an association between antibiotic prescribing and gender. No difference was found in relation to the gender of participants and antibiotic prescribing rate in the preintervention group ($p = .95$), postintervention group ($p = .38$), or overall ($p = .62$). A Mann–Whitney $U$ test was used to determine whether there was an association between antibiotic prescribing and age. There was a significant difference in antibiotic prescribing between age groups in the preintervention group; adults, age 18–65, were significantly more likely to be prescribed an antibiotic ($p = .012$). However, there was no significant difference in antibiotic prescribing between age groups in the postintervention group ($p = .29$).

## Limitations

This intervention was conducted in only one clinic. Furthermore, only the "walk-in" area of that clinic was involved, not the entire clinic. Because of the retrospective design of the study based on existing medical records, the number of variables for analysis was limited. Moreover, by measuring only two timepoints, the sustainability of the effect of the program cannot be demonstrated.

Only full-time providers that saw patients in the walk-in portion of the clinic were participants for this study; part-time and per diem providers and full-time providers who saw patients by appointment and focused more on preventative care and chronic disease management do not see many patients with RTI and were therefore excluded. The providers who participated did so voluntarily because they had noticed a problem and wanted a change. Providers who voluntarily opt to become involved in a study of this nature may be those who are willing to attempt changes in prescribing habits more readily than other providers. This may also limit the generalizability of the study findings.

## Discussion

The number of immediate and total antibiotic prescriptions for RTIs decreased significantly after the implementation of the combination education initiative. Reduced use of antibiotics when not indicated is the ultimate goal. Although delayed antibiotic prescriptions resulted in less antibiotic use than immediate prescriptions, not prescribing an antibiotic at all has been demonstrated to result in less antibiotic use than delayed prescriptions.[24] Since the overall goal for implementing the program was to reduce antibiotic use in patients with RTI, decreasing antibiotics overall is a step toward that overall goal. Immediate antibiotic prescription change was chosen at the outset of the program as the outcome measure, rather than overall antibiotics, because it was considered a more achievable goal in this patient population. Delayed antibiotic prescriptions was selected as a substitution while the patients became exposed to new knowledge and PCPs became more comfortable educating patients, until patients and PCPs became comfortable enough to utilize the no antibiotic strategy.

The number of delayed antibiotic prescriptions did not change significantly which indicates that delayed antibiotic prescriptions were not frequently utilized as a substitution for immediate antibiotics in the postintervention period. Much of the literature focuses on interventions and their impact on improving antibiotic prescribing overall and/or guideline adherence. There is minimal information in the literature about the impact of an educational program on the outcome of immediate or delayed antibiotic prescription. Delayed antibiotic prescriptions have been utilized as a method to decrease antibiotic prescriptions and have been included in studies as actions of guideline adherence. More

studies are needed to further understand the educational approaches that may enhance delayed antibiotic prescribing.

Rural populations, particularly those with low socioeconomic status, tend to have low antibiotic knowledge and high antibiotic use.[30] Educational programs have been shown to decrease antibiotic use in RTI; however, there is a gap in the literature regarding implementation of these programs in rural populations. Knowing that rural populations have specific cultural and community needs related to health beliefs,[28] implementing educational programs in other rural settings may not result in generalizable findings. This study demonstrates that a combined patient and provider education program, tailored to the needs of the rural population, can produce improvements in antibiotic prescribing like those demonstrated in other populations.

As noted earlier, PCPs listed concerns about patient satisfaction and retention as reasons for prescribing antibiotics for RTIs. Additionally, with the implementation of value-based purchasing, PCPs and organizations may resist antibiotic stewardship initiatives out of concern that they may decrease patient satisfaction. The findings of this study may help overcome some of the initial resistance to antibiotic stewardship initiatives and increase support for them.

The overuse of antibiotics in RTI, perpetuated by the cycle of patient demand and PCP prescribing, may seem challenging to change. Yet, the results of this study support to those of others[18,20,22–24] that educational interventions with providers and patients can result in change and reductions in antibiotic prescribing for RTIs can be achieved.

## Conclusion

Although information on the dangers of antibiotics is widely published and prescribers are continually urged to prescribe antibiotics judiciously, this study illustrates the complexity of the issue and the continued need for improvement. Significant reductions in immediate antibiotic and overall antibiotic prescriptions were observed. Changing antibiotic prescribing involves changing the beliefs and behavior of patients and providers, which can seem daunting and unachievable. The importance of these study results is that they demonstrate to practitioners that changes in antibiotic prescribing are possible, through educational interventions, even in settings that may seem challenging due to patient knowledge and established provider prescribing patterns. Simple, educational interventions, such as posters, patient handouts, and delayed antibiotic prescriptions can make a difference. For practitioners, the key is to be reminded that antibiotic stewardship is possible and to take that first step toward making a change. Hence, this study's findings can be used as a source to change PCP practice and to develop interventions to further promote antibiotic stewardship.

## Implications

Antibiotic prescribing can be changed through very simple interventions, even in settings and populations where the cycle of antibiotic overuse, patient demand, and provider prescribing seems impossible to break. Educational interventions, when tailored to the needs of the population, can produce positive changes in rural settings. Small, low-cost, simple to implement educational interventions do work. Displaying posters from the CDC's "Be Antibiotics Aware" campaign[32] in patient exam rooms can be the simple step that begins this change by passively exposing patients to this knowledge. Patient handouts that are specific to the patient population can be very effective in providing education, giving reassurance, answering frequently asked questions, guiding supportive care, and advising about return visits. Delayed antibiotic prescribing can be used as a progressive step toward decreasing antibiotic prescriptions until providers and patients are more comfortable with no antibiotic prescriptions.

Further research on the impact of an educational program on these outcomes may be beneficial, as well as on factors associated with uptake of or resistance to utilization of delayed antibiotic prescriptions used in substitution for immediate antibiotic prescriptions. In practices such as this one, where educational programs have shown some improvement, it could be beneficial to explore the reasons why delayed antibiotic prescriptions did not change significantly. Knowing the influential factors that persist after the implementation of evidence-based practice educational programs could help target more successful interventions for future programs.

Follow-up studies would be beneficial to determine whether the improvements in antibiotic prescribing are sustained and whether continued replication results in successful dissemination throughout the entire office. Additionally, further exploration of whether this project had any impact on reconsultation rates, or the frequency with which patients returned for additional visits for the same

or similar illnesses and patient satisfaction scores, would be beneficial.

After conducting this study and finding that the results support the findings of other studies, a new question has moved to the forefront. If we know what works, why are not we implementing this in practice? The question is, with the knowledge that patient and provider educational programs are successful in improving the problem of antibiotic overprescribing, why are not these educational programs more widely implemented? What are the barriers to implementation and how can they be overcome? Further research in this direction would be beneficial to achieve more implementation; now that success is fairly established but provider buy-in remains limited.

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