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The Effect of a Patient and Provider Education Program on Antibiotic Overuse in Respiratory Tract Infections in a Rural Primary Care Population

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Final DNP Project Report

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Abstract

Objective: In the “walk-in” portion of the Jessamine Medical and Diagnostic Center (JMC) primary care (PC) practice in Jessamine County, Kentucky, a combination patient and provider education program was implemented to assess its effects on antibiotic prescribing in respiratory tract infections (RTIs). The goal was to conduct an evaluation of the patient and provider education program at JMC, by specifically examining changes in immediate antibiotic prescribing in RTI (i.e., prescription given during visit to start taking immediately) one-year after implementation of the education program (March 1, 2015- February 28, 2016).

Methods: Utilizing a quasi-experimental pretest-posttest design, a retrospective electronic medical record review was conducted to determine if an antibiotic (immediate or delayed) was prescribed during the visit for RTI for 207 randomly selected patients who were evaluated by a full-time “walk-in” care provider during the established evaluation time periods.

Results: A total of 1,943 patients met initial inclusion and exclusion criteria. Through a random selection process, 207 patients (103 in the pre-intervention group and 104 in the post-intervention group) were included in the study. In the pre-intervention group, 58 were prescribed antibiotics, for an antibiotic prescription rate of 56.3%. Immediate antibiotics were prescribed in 32 of the encounters, for an immediate antibiotic prescribing rate of 31.1%. In the post-intervention group, antibiotics were prescribed in 30 of the 104 encounters, for a prescription rate of 28.8%. Immediate antibiotics were prescribed in only 14 of the 104 encounters, for a prescription rate of 13.5%. After the implementation of the intervention, there was a significant decrease in the number of antibiotics prescribed overall, Chi-square = 15.97 (DF = 1), $p < .001$, as well as in the number of immediate antibiotics prescribed, Chi-square = 9.28 (DF = 1), $p < .05$.

Conclusions: The number of immediate and total antibiotic prescriptions for RTI decreased significantly in the year following implementation of the education program. Further evaluation is needed to determine if long-term sustainability, further reduction in antibiotic prescribing, and dissemination to the entire clinic can be achieved. The results of this study demonstrate to practitioners that education interventions can be effective in rural settings and that changes in antibiotic prescribing are possible.

The Effect of a Patient and Provider Education Program on Antibiotic Overuse in Respiratory Tract Infections in a Rural Primary Care Population

Background and Significance

Antibiotic resistance is a serious health threat, and antibiotic overuse is the single largest contributor to the problem of antibiotic resistance (Centers for Disease Control and Prevention [CDC], 2013). Each year, over 2 million people in the United States get antibiotic resistant infections and 23,000 people die from them (CDC, 2015b). Antibiotic resistance is being reported at high rates worldwide, in common infections that were once easy to treat. If antibiotic prescribing does not decrease, many illnesses may soon become untreatable (World Health Organization [WHO], 2015). Moreover, Kentucky has one of the highest antibiotic prescribing rates in the country (CDC, 2016).

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 primary care” (2008, p. 4). The most common ailment treated in primary care (PC) is a respiratory tract infection (Little et al., 2005). Although an estimated 90% of respiratory tract infections (RTIs) are caused by viruses, antibiotics are still prescribed for over 60% of cases (Dempsey, Businger, Whaley, Gagne, & Linder, 2014). The Joint Commission estimates that one billion dollars is spent annually in the U.S. on unnecessary antibiotics for RTIs (Joint Commission, 2016).

Antibiotics are not indicated in RTI, as research shows that they have not resulted in a cure or resolution of symptoms compared to a placebo (Kenealy & Arroll, 2013). Antibiotics are also associated with a significantly higher risk of adverse reactions (Arnold & Straus, 2005; Kenealy & Arroll, 2013; Llor & Bjerrum, 2014). Why, then, are they still used so often in the treatment of RTIs?

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 (Lopez-Vazquez, Vazquez-Lago, & Figueiras, 2012; Tonkin-Crine, Yardley, & Little, 2011; Wong, Blumberg, & Lowe, 2006). 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 (Matthys, 2013). An estimated 60-70% of patients with RTIs believe they need antibiotics (Filipetto, Modi, Weiss, & Ciervo, 2008). Thus, patient knowledge about appropriate antibiotic use is one factor that must be addressed for this issue to improve.

Despite believing 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 (Linder, Singer, & Stafford, 2003; Lopez-Vazquez et al., 2012). This indicates that many PCPs lack knowledge of and comfort with effective strategies to reduce 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 (Altiner et al., 2007; Bont, Alink, Falkenberg, Dinant, & Cals, 2015; Ranji, Steinman, Shojania, & Gonzales, 2008), while PCP educational interventions alone do not (Arnold & Straus, 2005; Gonzales, Steiner, Lum, & Barrett, 1999; Vodicka et al., 2013). 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 re-consultation rates, for the same illness as well as for similar illnesses in the future (Bont et al., 2015). In contrast, antibiotic prescriptions were associated with increased re-consultation rates (Bont et al., 2015). Printed patient education materials are effective in reducing antibiotic prescribing in RTI, even when they are used passively (Altiner et al., 2007; Arnold & Straus, 2005; Bont et al., 2015; Ranji et al., 2008; Vodicka et al., 2013). However, education is much more effective when actively used by the PCP during the patient consultation (Bont et al., 2015; Vodicka et al., 2013). Indeed, the most effective educational intervention for reducing antibiotic prescribing for RTIs in PC is a combination of patient and PCP education (Arnold & Straus, 2005; Bont et al., 2015; Meeker et al., 2014; NICE, 2008; Ranji et al., 2008; Regev-Yochay et al., 2011; Spurling, Del Mar, Dooley, Foxlee, & Farley, 2013; Vodicka et al., 2013).

The clinical practice guidelines (CPGs) on RTI management recommend a combined approach of prescribing strategy and actively administered patient education during the visit (NGC, 2008). 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 (NGC, 2008). 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 (NGC, 2008). 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 (NICE, 2008). 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 (Arnold & Straus, 2005; Kenealy & Arroll, 2013). However, no antibiotic prescribing results in fewer antibiotics taken than delayed antibiotic prescribing (Spurling et al., 2013).

CPGs recommend that the patient education accompanying delayed or no antibiotic prescribing contain a few key components. PCPs 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. PCPs also need to provide education on worsening or prolonged symptoms and when to return for re-evaluation. 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 (NGC, 2008).

National media campaigns and some state initiatives have been in place for several years to try to increase the public's knowledge of appropriate antibiotic use (CDC, 2015a). In 2015, the Obama Administration made a commitment to decrease antibiotic overprescribing by 50% in outpatient settings by 2020 (The White House, 2015). Although some small improvements in public knowledge have been reported nationally, improvements in knowledge have not been found among those with low socioeconomic status (Hwang, 2015; The White House, 2015). Some rural counties, like Jessamine County, Kentucky, where a large proportion of the population has low socioeconomic status, are likely to still fall in the lower category of patient knowledge of appropriate antibiotic use (Hwang, 2015; University of Wisconsin Public Health, 2015). Recent studies have shown that counties with low income and low education, like Jessamine County, tend to have the highest rates of antibiotic prescribing (Hicks et al., 2015; University of Wisconsin Public Health, 2015). Rural communities are also less likely to be effectively influenced by national campaigns, which are typically not designed specifically with rural cultural considerations in mind (Campo et al., 2008). 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 (Campo et al., 2008; Morgan & Hart, 2009).

National media campaign efforts have failed to make a difference in antibiotic knowledge and use in rural areas (Hwang, 2015). Local implementation of a program designed with cultural considerations may be the only way to improve the problem. In a rural community, an education program must be specifically designed to reach that specific population and address changing their social norms (Campo et al., 2008). The patient and provider education intervention in this program was designed around the Jessamine County patient populations' needs and culture, utilizing Rogers' diffusion of innovation theory as a framework (Rogers, 2010). This framework describes the process by which new information spreads and becomes accepted through a population (Rogers, 2010; Zhang, Yu, Yan, & Ton, 2015). The theory asserts that some people in a population are more likely to accept a new idea before it gains momentum and most of the population accepts it. Certain attributes of the new idea or information make it more likely to be adopted. The patient education portion of the program included content specifically 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. This intervention had both trial ability and observability. 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. According to Rogers (2010), an innovation is much more likely to be adopted by a population if it has trialability and observability.

Without an effective program to improve antibiotic prescribing in RTI, the cycle of inappropriate antibiotic demand, prescribing, and use is likely to continue perpetuating itself, leading to a worsening in antibiotic resistance. Thus, it was imperative that a program to reduce antibiotic prescribing be implemented in a PC in the rural community of Jessamine County. The antibiotic education program was implemented on March 1, 2014 and completed on February 28, 2015. The purpose of this study was to evaluate the effects of a combined patient and provider education program on reducing immediate antibiotic prescribing in RTIs during the year following completion of the program (March 1, 2015- February 28, 2016) compared to the year prior to the program (March 1, 2013- February 28, 2014).

Research Questions and Objectives

This study was conducted to evaluate the effectiveness of the education program at JMC on decreasing immediate antibiotic prescribing. The research questions to be answered were:

- Was there a difference in immediate antibiotic prescriptions in RTI, and, if so, what was the difference?
- Was there any association between participant demographics (age and gender) and antibiotic prescribing?

Methods

Setting

The study was conducted at a primary care practice (PCP), the Jessamine Medical and Diagnostic Center (JMC), in Nicholasville, Kentucky. JMC provides primary care by appointment, as well as acute care in a “walk-in” area of the clinic. JMC is part of the Lexington Clinic health system. JMC provides care for patients of all ages and has served the communities of Nicholasville, Jessamine County, and a few surrounding counties for the past 25 years. Nicholasville is a small rural city of just over 28,000 people, within Jessamine County, which has a population of around 50,000. This rural population has risk factors for health issues, such as high tobacco use and low socioeconomic status (University of Wisconsin Public Health, 2015).

Sample

The population for this study consisted of “walk-in” patients, who met all study inclusion and exclusion criteria. Inclusion criteria consisted of the following: age 2-65, evaluated by participating provider and diagnosed with RTI during the established evaluation time periods. Participating providers were defined as the two full-time providers of JMC's "walk-in" care area, as this is where most RTI patients are seen at JMC. The other PCPs at JMC, who perform primary care by appointment and focus more on preventative care and chronic disease management, do not see many patients with RTI and were therefore excluded from the record review. Additionally, part-time or per diem providers were excluded, as this patient population is not their full-time focus. Additional exclusion criteria were: additional diagnosis of bacterial illness in the same visit (such as pneumonia or sinusitis); duration of illness for ten or more days; co-morbidities of COPD, asthma, or immunosuppression. These exclusion criteria were based on the NICE (2008) CPG indicators for patients at higher risk for complications and an immediate antibiotic regimen is considered appropriate for these patients.

Intervention

The program was implemented over one year, March 1, 2014-February 28, 2015. A printed patient education handout was created as part of the patient education intervention. The handout was created in accordance with the CPG recommendations (NICE, 2008) regarding the education that all RTI patients should receive and was tailored to the specific needs of the PC patients in Jessamine County, KY. Posters from the CDC's "Get Smart: Know When Antibiotics Work" campaign (2015c) were obtained and displayed in all three participating patient rooms at the PC practice. 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, according to CPG (NICE, 2008).

Procedures

Utilizing a quasi-experimental pretest-posttest design, data were obtained via a retrospective electronic medical record review, using data of patients who were evaluated by a full-time "walk-in" care provider for the following time periods: one year prior to program implementation (March 1, 2013- February 28, 2014) and one year after the program implementation (March 1, 2015- February 28, 2016). Data were obtained at JMC, after obtaining permission from the compliance office for the Lexington Clinic and the Institutional Review Board of the University of Kentucky. Records meeting the inclusion and exclusion criteria were assessed to determine if an antibiotic was prescribed, and if so, whether it was immediate versus delayed.

Measures

The following measures were used in the study:

1) Antibiotics prescribed: This information was coded as (1) if an antibiotic was prescribed during the visit and (0) if no antibiotic was prescribed.
2) Immediate antibiotics prescribed:
   a. This information was coded as (1) if an immediate antibiotic was prescribed during the visit. Immediate antibiotic prescription- the patient was given a prescription for antibiotics to start immediately. This measure was based on a chart record that indicated that an antibiotic was prescribed during a visit, without the presence of any documentation of instructions to delay the start of the antibiotic. This information was coded as (1).
   b. This information was coded as (0) if an immediate antibiotic was not prescribed during the visit. No antibiotic prescriptions and delayed antibiotic prescriptions were coded as (0). Delayed antibiotic prescription- the patient was given a prescription for antibiotics and was advised not to take the antibiotic that day, but only at a later time period, if the patient's symptoms worsened or did not improve. An antibiotic prescription was counted as delayed if the medical record contained any of the following documentation: patient instructions to take the antibiotic at a later time period if symptoms worsened or did not improve; antibiotic prescription given with a fill date later than the day prescribed; or the terms "Prescription / hold" or "Prescription & Hold". This information was coded as (0).
3) Demographics: This included gender with males coded as (1) and females coded as (0); and age group with children (age 2-11 years old) coded as (0), adolescents (age 12-17 years old) coded as (1), and adults (age 18-65 years old) coded as (2).

Sampling procedures. There were 1,943 patients who met the initial inclusion criteria, 1,075 in the pre-intervention group and 868 in the post-intervention 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 1943 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 reviewed records were 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, per NICE (2008) CPG. Data were collected on a total of 207 participants, 103 in the pre- and 104 in the post- intervention groups.

Data analysis. Data were analyzed using IBM SPSS Statistics for Windows, version 23. Descriptive statistics were utilized to examine the demographics of the participants. A chi-square test was used to determine if there were significant changes in immediate and total antibiotic prescribing, over time, between the pre-intervention and post-intervention group. A chi-square test was also used to determine whether there was an association between participant gender and antibiotic prescribing. The Mann-Whitney U test was used to determine if there was an association between age and whether an antibiotic was prescribed, in the total sample and within each group. An alpha level of .05 was used for all statistical tests.

Results

Participant Demographics

The 207 participants were comprised of 138 females and 69 males (see Figure 1). Of the participants, 79% (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 was no difference in age ($p = .24$) or gender ($p = .92$) between the two groups (see Figure 2). A chi-square test was used to determine if 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 pre-intervention group ($p = .95$), post-intervention group ($p = .38$), or overall ($p = .62$). A Mann-Whitney U test was used to determine if there was an association between antibiotic prescribing and age. There was a significant difference in antibiotic prescribing between age groups in the pre-intervention group; patients in the oldest age group, age 18-65, were significantly more likely to be prescribed an antibiotic ($p = 0.012$). However, there was no significant difference in antibiotic prescribing between age groups in the post intervention group ($p = 0.29$).

Antibiotics Prescribed

In the pre-intervention group, 58 individuals were prescribed antibiotics, for an antibiotic prescription rate in RTI of 56.3% (58/103). In the post-intervention group, antibiotics were prescribed in 30 encounters, for an antibiotic prescription rate of 28.8% (30/104). A chi-square test of association was used to analyze the relationship between the number of antibiotics prescribed in the pre- and post- intervention groups. There was a significant decrease in the number of antibiotics prescribed in the post-intervention group in comparison to the pre-intervention group ($p < .001$).

Immediate and Delayed Antibiotics Prescribed

In 32 of the pre-intervention encounters, the antibiotic prescriptions given were immediate, for an immediate antibiotic prescribing rate of 31.1% (32/103). In the 104 post-intervention group encounters, only 14 were given immediate antibiotic prescriptions, for an immediate antibiotic prescription rate of 13.5% (see Figure 3). A chi-square test of association was used to analyze the association between the number of immediate antibiotic prescriptions in the pre- and post- intervention groups. The number of immediate antibiotic prescriptions decreased significantly in the post-intervention group in comparison to the pre-intervention group ($p < .05$). However, there was not a significant change in the number of delayed antibiotic prescriptions after implementation of the intervention ($p = .08$).

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. While delayed antibiotic prescriptions result in less antibiotic use than immediate prescriptions, not prescribing an antibiotic at all results in less antibiotic use than delayed prescriptions (Spurling et al., 2013). 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 used as a substitution for immediate antibiotics in the post-intervention period. This was an unexpected finding. Although immediate antibiotic prescriptions decreased significantly, there is still room for improvement. Much of the literature focuses on the impact of interventions on improving antibiotic prescribing 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 (Arnold & Straus, 2005; Kenealy & Arroll, 2013).

Rural populations, particularly those with low socioeconomic status, tend to have low antibiotic knowledge and high antibiotic use (Hwang, 2015). 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 (Campo et al., 2008), implementing educational programs in other rural settings may not result in generalizable findings. However, 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. Yet, the results of this study support those of others (Bont et al., 2015; Meeker et al., 2014; Regev-Yochay et al., 2011; Spurling et al., 2013; Vodicka et al., 2013), that educational interventions with providers and patients can result in change, and reductions in antibiotic prescribing for RTIs can be achieved.

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 were limited. Moreover, by measuring only two time-points, the sustainability of the effect of the program cannot be demonstrated. There may have been unforeseen factors occurring in the clinic setting or in the community that could have impacted the outcome of this study. Additionally, the intervention was not implemented in the PC portion of the clinic, which may limit the transferability of the intervention to be successful only in similar "walk-in" type settings. Only two providers were involved, which is a very small sample. The providers who participated did so voluntarily, as 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.

Recommendations for Clinical Practice and Future Study

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. Hanging posters from the CDC's "Get Smart: Know When Antibiotics Work" campaign 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 both 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 using delayed antibiotic prescriptions 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 if the improvements in antibiotic prescribing are sustained, and if continued replication results in successful dissemination throughout the entire office. Additionally, further exploration of whether this project had any impact on re-consultation rates, or the frequency with which patients returned for additional visits for the same or similar illnesses, and patient satisfaction scores would be beneficial.

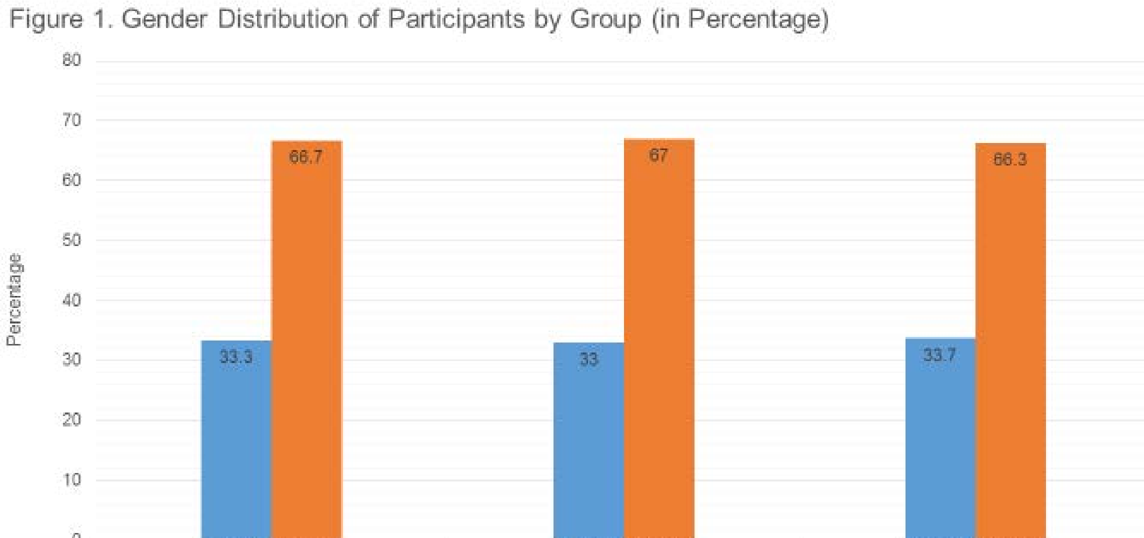
After finding that the results of our study support the findings of other studies, a new question has moved to the forefront. If we know what works, why are we not implementing this in practice? The question is, with the knowledge that patient and provider educational programs are successful in improving the problem of antibiotic overprescribing, why are these educational programs not 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.

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. Statistically significant reductions in immediate antibiotic and overall antibiotic prescriptions were observed. Changing antibiotic prescribing involves altering 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.

Appendix A

Figure 1. Gender Distribution of Participants by Group (in Percentage)



	All Participants	Pre Program Group	Post Program Group
Males	33.3	33	33.7
Females	66.7	67	66.3

Figure 1. Gender distribution of participants by group (in percentage).

Appendix B

Figure 2. Participant Age Breakdown by Group (in Percentage)

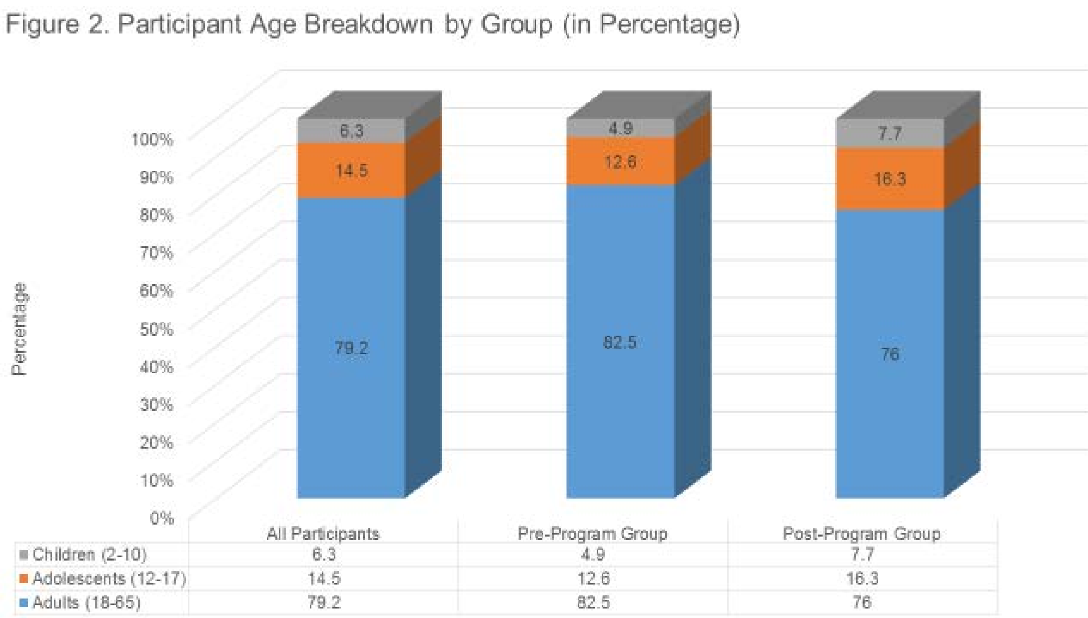


Figure 2. Participant age breakdown by group (in percentage)

Appendix C

Figure 3. Antibiotic Prescriptions by Type per Group

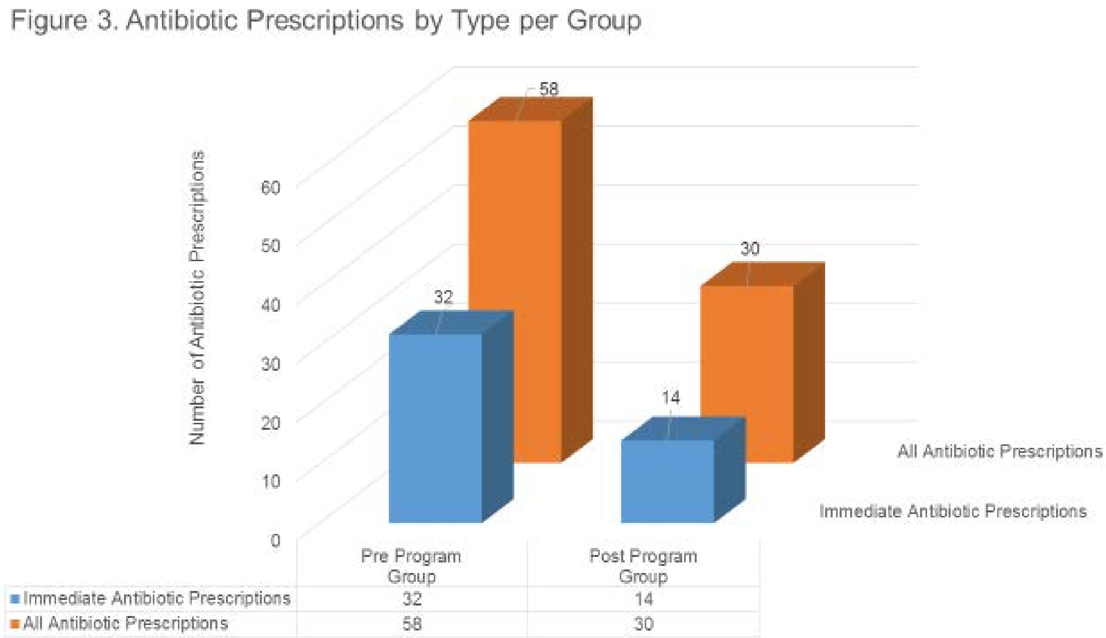


Figure 3. Antibiotic prescriptions by type per group.

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